William F. Martin
Mayor

City known as the Town of
GREENFIELD, MASSACHUSETTS

Purchasing and Procurement

Town Hall ● 14 Court Square ● Greenfield, MA 01301
Phone: 413-772-1569
purchasing@greenfield-ma.gov

Audrey LaBonte'
Chief Procurement Officer

Phil Wartel
Procurement Officer

18-03 Olive Street Parking Garage – Trades Bidders

Addendum #1

September 13, 2017

- Exhibit E remains as previously published/ issued.
- Exhibit J is deleted in its entirety and should be disregarded. (Please note that Daniel O'Connell's Sons, Inc. special instructions to bidders do include an Exhibit "J".)
- The project Specifications have been re-issued in their entirety via Addendum 1#. The specifications included in this Addendum #1 are what all Bids should be based on.
- The Drawings as currently included on the web site stand as published / listed.
- The Prevailing Wages included on the Web site govern and supersede any wage sheets included in DOC instructions.
- Trade Bid Form Part 2 Olive Street pdf is replaced in its entirety with; The Town of Greenfield Instructions to Bidders and Bid Form as included in Addendum #1
- All bid dates associated with the bid remain in force and are re-stated in the Town of Greenfield instructions to bidders.

Town of Greenfield Massachusetts

Olive Street Parking Garage

INSTRUCTIONS TO BIDDERS for Prequalified Trade Contractors

Construction Manager at Risk Project – M.G.L. c.149A, §8

TRADE BIDS REQUESTED AT THIS TIME:

- MASONRY WORK
- MISCELLANEOUS & ORNAMENTAL IRON
- WATER/DAMP-PROOFING & CAULKING
- ROOFING & FLASHING
- PAINTING
- PLUMBING
- HVAC
- ELECTRICAL

Town of Greenfield Project # PG 18-03

Bid Submission Deadline: **Thursday – September 27, 2017 at 2:00 PM**

Deadline for Submitting Questions: Tuesday September 19th, 2017

Submit Bids to: Procurement Office
ATTN: Audrey LaBonte
14 Court Square
Greenfield, MA 01301

Issued: September 6, 2017

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Part Two: Prequalified Trade Contractor Bid Form and Attachments

(Documents to be completed and submitted by Trade Contractor with Bid)

✷✷	TRADE CONTRACTOR BID FORM
Attachment A:	Bid Bond (Inserted by Trade Contractor)
Attachment B:	DCAM Sub-Bidder Certificate of Eligibility (Inserted by Trade Contractor)
Attachment C:	DCAM Sub-Bidder Update Statement (Inserted by Trade Contractor)

REFERENCES

- **CONTRACT DOCUMENTS:**
  Drawings & Specifications as issued by Desman Design Management.

- **DOC SUMMARY INSTRUCTIONS TO TRADE BIDDER (Exhibit J) (with exhibits)**
  - DOC Exhibit "A" – Insurance
  - DOC Exhibit "B" – Requirements for Requisition
  - DOC Exhibit "C" – Certification and Partial Wavier of Lien
  - DOC Exhibit "D" – Equal Opportunity
  - DOC Exhibit "E" – Scope of Work Clarifications
  - DOC Exhibit "F" – Purchase & Delivery Schedule/Material Status Report
  - DOC Exhibit "G" – List of Contract Documents
  - DOC Exhibit "H" – Affidavit of Final Payment & Release of Lien
  - DOC Exhibit "I" – Tax Exempt Form
  - DOC Exhibit "J" – DOC Summary Instructions to Trade Bidders
  - DOC Exhibit "K" – DOC Site Logistics Plan
  - DOC Exhibit "L" – Schedule of Wage Rates Breakdown
  - DOC Exhibit "M" – Subcontractor's Guarantee/Warranty Form-One Year
  - DOC Exhibit "N" – Project Schedule
  - DOC Exhibit "O" – Project Site Specific Safety Plan (SSSP)
  - DOC Exhibit "P" – Rider "A" – Chapter 149 Section 29E
  - DOC Exhibit "Q" – Rider "B" – Chapter 149 Section 29F
  - DOC Exhibit "R" – Prevailing Wage Rates
  - DOC Exhibit "S" – Owner's General Conditions

PART ONE
INSTRUCTIONS FOR PREQUALIFIED TRADE CONTRACTOR BIDDERS

SECTION 1 – PROJECT INFORMATION

1.1 Project Specific Information and Dates

Awarding Authority: Town of Greenfield
14 Court Square
Greenfield, MA 01301
(413) 772-1562

Greenfield Project #: PG 18-03

Project Name: Olive Street Parking Garage

Project Location: Olive Street Greenfield, MA

Project Description:

Construction of new 4 level precast parking garage on a site owned by the Town of Greenfield.

Trade Contractor Pre-Bid Meeting/Site Visit: September 19, 2017
Daniel O'Connell's Son's Job Office
40 Bank Row, Greenfield MA 01301

Submission Deadline:
(For submission of Bid Packets in response to this Request for Bids)

Date: Wednesday -September 27, 2017
Time: 2:00 PM

Submission Address: Town of Greenfield Procurement
ATTN: Audrey LaBonte
14 Court Square
Greenfield, MA 01301

Estimated Total Project Construction Cost: $8,000,000 (Excluding Alternates)

Estimated Project Duration for Overall Project: 12 Months

Construction Manager at Risk	Owners Project Manager	Project Architect
Daniel O'Connell's Sons, Inc. 480 Hampden Street Holyoke, MA 01040	Skanska USA Building, Inc. 101 Seaport Blvd. Boston, MA 02210	Desman Design Management 18 Tremont Street Boston, MA 02108

✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳ **IMPORTANT NOTICE** ✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳

Participation in the RFB Bidding Phase of this Project is limited to ONLY those Trade Contractor firms that submitted a SOQ (and required supporting documentation) in response to a previously issued RFQ for this project AND that have been deemed prequalified by the Town of Greenfield.

Trade Contractors that failed to respond to the prior RFQ and submit a SOQ with the required supporting documentation by the Submission Deadline and Trade Contractors that have not been deemed prequalified by The Town of Greenfield are not eligible to bid on this Project and bids will not be solicited from or accepted from such firms at this time.

✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳ **IMPORTANT NOTICE** ✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳✳

1.2 Introduction

The project delivery method for construction of this project will be public CM at Risk with a Guaranteed Maximum Price ("GMP") under M.G.L. Chapter 149A. This Request for Bids ("RFB") is the second phase of a two-phase procurement process as set forth in MGL Chapter 149A. In the first phase of this procurement the Town of Greenfield, through its Trade Contractor Prequalification Committee, prequalified firms interested in providing public Trade Contractor services on this Public Construction Manager at Risk ("CM" or "CM at Risk") project through a prior Request for Qualifications ("RFQ") process. As part of the prior RFQ process The Town of Greenfield evaluated submitted Statements of Qualifications ("SOQs") and only those firms obtaining the required minimum points were deemed prequalified. Only those respondents deemed prequalified in phase one are now permitted to submit a bid in response to this Request for Bids ("RFB"). A list of those firms that, as of the date of this Request for Bids, have been determined to be prequalified for the trades listed and are therefore permitted to submit bids on this Project is attached as Exhibit A in this Instructions to Bidders.

1.3 Detailed Project Description

Construction of a 4 level 272 spot precast parking garage on Olive Street in downtown Greenfield MA. The project is funded via a grant from MASS Works and a bond issuance from the Town of Greenfield. The project is utilizing a Chapter 149A approach and Daniel O'Connell's Sons, Inc. of Holyoke MA has been engaged by the Town of as the Construction Manager, Skanska USA Inc. is acting as the Owner Project Manager.

1.4 Categories of Trade Bids Requested

This RFB requests that prequalified Trade Contractor firms in the categories of work listed on the cover page and in the below table submit bids on the Project at this time.

The selected Trade Contractors on this CM at Risk project are required by law to provide payment and performance bonds for the full value of their subcontracts and Trade Contractors must include the cost of the required payment and performance bonds in their bid price.

See "X" Below For ALL Trades Being Bid (at this time)	Section #	Trade Category	Estimated Budget for Trades Bid (Including Alternates)
☒	04 00 01	MASONRY WORK	$ 122,000
☒	05 00 01	MISCELLANEOUS & ORNAMENTAL IRON	$ 635,000
☒	07 00 01	WATERPROOFING, DAMPPROOFING & CAULKING	$ 135,000
☒	07 00 02	ROOFING & FLASHING	$ 30,000
☒	09 00 07	PAINTING	$ 25,000
☒	22 00 01	PLUMBING	$ 133,800
☒	23 00 01	HVAC	$ 25,000
☒	26 00 01	ELECTRICAL	$ 294,000

The Construction Managers' Outline Schedule indicating the planned sequence and duration of the Trade Category scopes of work for which Bids are requested at this time can be found in Exhibit "N" of the DOC Summary Instructions to Trade Bidders (Exhibit "J").

Contract Documents will be available following September 6, 2017. All documents will be available on the Town of Greenfield purchasing website: at www.greenfield-ma.gov under "Departments", "Purchasing", and "Active Bids/RFQ/RFP".

1.5 Certain Project Requirements

Minimum Wage Rates as determined by the Director under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 to 27H, as amended, apply to this project. **The current minimum wage rate requirements for this Contract are located in Exhibit R of the DOC Summary Instructions to Trade Bidders (Exhibit "J"). It is the contractor's responsibility to obtain and comply with any wage rate increases in accordance with state and federal laws.**

The Minority Business Enterprise ("MBE") and Women Business Enterprise ("WBE") participation goals for the overall Project are as follows:

The MBE Utilization goal is: 7.4%
The WBE Utilization goal is: 4.0%

The time for completion of the work is specified in Article VI of the Town of Greenfield's General Conditions of the Contract (Exhibit "S"). Liquidated damages for failure to complete work on time are as stated in Article VI of the Greenfield's General Conditions of the Contract (Exhibit "S"). (Also see DOC Exhibit "N" for the Construction Manager Outline Schedule).

As stated above, Trade Contractors on this CM at Risk Project are required by law to provide payment and performance bonds for the full value of their Trade Contracts and Trade Contractors must include the full cost of the required payment and performance bonds in the bid price they submit in response to this RFB.

Pursuant to M.G.L. c. 30, §39S(a)(2) all employees to be employed on the Project must have successfully completed a course in construction safety and health approved by OSHA and of at least 10 hours in duration. All contractors, subcontractors and sub-subcontractors are required by law to submit evidence of completion of such training for each employee working on the Project as part of their regular certified payroll submissions. Please refer to the DOC Summary Instructions to Trade Bidders (Exhibit "J") - Section 38 for more information.

All Trade Contractors on the Project and their sub-subcontractors will also be required to provide written verification of compliance with Federal Department of Homeland Security Requirements, including but not limited to the Employment Eligibility Verification (Form I-9) Process.

SECTION 2 – BIDDER'S REPRESENTATION

2.1 Each Trade Contractor (hereinafter sometimes referred to as "Trade Contractor" or "Bidder") by making or submitting a bid (hereinafter sometimes referred to as "Bid") represents and warrants that Bidder has visited and examined the Site and the Contract Documents, that Bidder is familiar with the local conditions under which the Work is to be performed, that Bidder has correlated personal observations with the requirements of the Contract Documents, and that where the Contract Documents require, in any part of the Work, a given result to be produced, the Contract Documents are adequate and that Bidder will produce the required result within the Bid price and that the Bid is made in accordance therewith.

2.2 Failure to so examine the Contract Documents and the Site will not relieve any Bidder from any obligation under the Bid as submitted. Neither The Town of Greenfield nor the Designer will be responsible for errors, omissions and/or charges for extra work arising from Bidder's failure to familiarize itself with the Contract Documents or existing conditions.

SECTION 3 – TRADE CONTRACTORS CERTIFICATE OF ELIGIBILITY AND SUB-BIDDER UPDATE STATEMENT

3.1 Every Trade Contractor must submit the following with each bid:

A. A Certificate of Eligibility issued by the Division of Capital Asset Management and Maintenance ("DCAM") showing that the Trade Contractor is currently certified in that trade and is eligible to bid on projects in the category of work in which the Bid is being submitted.

B. A fully completed Sub-Bidder Update Statement on DCAM's current Sub-Bidder Update Statement form.

3.2 It is the Trade Contractor's responsibility to obtain the necessary forms from DCAM and to submit its Application for Sub-bidder Certificate of Eligibility so as to allow sufficient time for DCAM's evaluation of the application and issuance of a Sub-Bidder Certificate of Eligibility prior to the deadline for bidding.

3.3 Certification

Respondent Trade Contractors must be certified by DCAM as a trade sub-bidder in the trade for which they were prequalified and for which they seek to submit a bid. Each Trade Contractor must submit a copy of the firm's currently valid DCAM Sub-bidder Certificate of Eligibility with its Bid. Note, however, that a joint venture team must be certified in the specific trade(s) that it is seeking to Bid for this Project in the name of the joint venture and must submit a Sub-bidder Certificate of Eligibility in the name of the joint venture for each such Trade with its Bid.

For certification forms and additional information see DCAM's web site:
http://www.mass.gov/anf/property-mgmt-and-construction/design-and-construction-of-public-bldgs/contractor-certification/

Or contact the Certification Office at:

DCAM Contractor Certification Office
One Ashburton Place
Boston, MA 02108
TEL: (617) 727-4050 ext. 31305

3.4 Update Statement

Interested Trade Contractors must provide a current and completed Sub-bidder Update Statement prepared by the interested Trade Contractor. If a respondent to the RFB is a joint venture then: i) each party to the joint venture must be certified by DCAM and each must submit its own signed update statement (Form CQ3) as part of its Bid, and; ii) the joint venture must be certified by DCAM in the Trade category of for which it is submitting a Bid.

For the Sub-bidder Update Statement Form and additional information see DCAM's web site: http://www.mass.gov/anf/property-mgmt-and-construction/design-and-construction-of-public-bldgs/contractor-certification/update-statements.html

3.5 The Sub-Bidder Update Statement is not a public record as defined in M.G.L. c. 4, §7 and will not be open to public inspection.

SECTION 4 – REQUESTS FOR INTERPRETATION

4.1 Any questions by prospective Bidders concerning interpretation of the Contract Documents must be submitted in writing to Ms. Audrey LaBonte at purchasing@greenfield-ma.gov . Questions are due by 5PM September 19th and answers will be provided no later than 5PM September 22, 2017. The Awarding Authority and Architect will issue any addenda or written interpretations that it deems necessary. Bidders may not rely upon oral communications or interpretations from the Awarding Authority or the Designer and the Awarding Authority shall not be bound by them.

4.2 It is the sole responsibility of the Bidder to ascertain the existence of any addenda issued by the Awarding Authority, whether or not the same are received by, Bidder. Copies of addenda will be made available for inspection at the locations listed in the Advertisement where the Contract Documents are on file.

4.3 Wherever in the Contract Documents reference is made to Massachusetts General Laws or Federal Laws, it shall be construed to include all amendments thereto effective as of the date of the issuance of the Request for Bids on the proposed work.

SECTION 5 – PREPARATION OF BIDS; ALTERNATES

5.1 Trade Contractor Bids shall be submitted on the Trade Contractor Bid Form included as Part Two of this Instructions to Bidders for Prequalified Trade Contractors.

5.2 All entries on the Bid form shall be typewritten or in ink.

5.3 All Trade Contractors must include in their Bid price the cost of providing payment and performance bonds in the full amount of their Bid; alternates shall include the cost of such bonds for the alternate work. All Trade Contractors awarded contracts on this Project are required by law to provide full payment and performance bonds at their own expense prior to the execution of their contract with the CM at Risk. Bonds must be issued by a surety company licensed to do business in the Commonwealth and whose name appears on United States Treasury Department Circular 570.

5.4 Where so indicated on the Bid form, sums shall be expressed in both words and numerals. Where there is a discrepancy between the Bid sum expressed in words and the Bid sum expressed in figures, the Bid sum expressed in words shall control unless the intention of the Bidder clearly is otherwise as determined by the Awarding Authority in its sole discretion.

5.5 Each Bidder shall acknowledge all required alternates in Section B on the Trade Contractor Bid Form by **entering the dollar amount of addition or subtraction necessitated**. If an alternate does not involve a change in the cost of the Bid, the Bidder shall so indicate by writing "$0" in the space provided for that alternate. **A blank space or Not Applicable "NA" will NOT be accepted.**

5.6 The lowest Bidder will be determined on the basis of the sum of the base Bid and the accepted alternates. The bidder shall be required to hold the alternate price for 90 days.

5.7 Trade Contractors shall not list Paragraph E sub-subcontractors (on the attached form of bid) unless expressly requested to do so by the Awarding Authority in the Contract Documents.

5.8 Each and every Bid of a Trade Contractor must be accompanied by a bid bond. The bid bond shall be with a surety company qualified to do business in the Commonwealth and listed on U.S. Treasury Department Circular 570, and conditioned upon the faithful performance by the principal of the agreements contained in the Bid. The bid bond shall be drawn in favor of The Town of Greenfield.

5.9 The amount of such bid bond shall be **5% five percent** of the value of the Bid including all alternates. The bid bond shall be returned to the bidder if the bidder is not selected as the trade contractor.

SECTION 6 – SUBMISSION OF BIDS

6.1 Each Trade Contractor Bid, **including the bid bond**, **Sub-Bidder Certificate of Eligibility and Sub-Bidder Update Statement** shall be enclosed in a sealed envelope with the following plainly marked on the outside. **A separate individual bid must be submitted for each and every other trade in which it was prequalified and submits a bid for this Project.**

> **Trade Contractor Bid for:**
>
> Town of Greenfield Bid #PG 18-03
> Olive Street Parking Garage
> *[Insert Section #]*
> *[Insert Trade]*
> *[Insert Trade Contractors Name, Business Address and Telephone Number]*

6.2 All Bids must be received by the Awarding Authority at the address specified on page 3 of these Instructions to Bidders no later than the applicable date and time specified on page 3 of these Instructions to Bidders. Any Bid not received by the applicable deadline will not be accepted.

6.3 The location of the Public Bid Opening will be at The Greenfield Town Hall, 14 Court Square, Greenfield MA at 11:00 AM, immediately following the submission deadline. Bidding results will not be given out over the telephone.

SECTION 7 – WITHDRAWAL OF BIDS; REJECTION OF BIDS

7.1 Any Bid may be withdrawn prior to the specified deadline for the receipt of Bids, provided that the withdrawal shall be made by a written request signed by a person having the authority to bind the Bidder. The written request must be hand delivered or otherwise delivered to the Town of Greenfield Procurement Office, 14 Court Square Greenfield, MA addressed to the attention of Audrey LeBonte and must be received on or before the date and time appointed as the deadline for the receipt of Bids.

7.2 A Bidder may withdraw its Bid without penalty at any time up to the time of Award as defined below in subsection 9.1 only upon demonstrating to the satisfaction of the Awarding Authority that a death or disability has occurred or a bona fide clerical or mechanical error of a substantial nature was made during the preparation of the bid. Failure to demonstrate conclusively that a bona fide clerical or mechanical error of a substantial nature was made will result in forfeiture of the Bid deposit.

7.3 The awarding Authority reserves the right to waive any informality in or to reject any and all Bids if it is in the public interest to do so. Without limiting the foregoing, the Awarding Authority reserves the right to reject unit prices which it deems unduly high or unduly low as unbalanced.

SECTION 8 – MBE/WBE PARTICIPATION

8.1 The Town of Greenfield is committed to the utilization of women (WBE) and minority (MBE) business enterprises as vendors, suppliers, and contractors in all aspects of procurement and contracting to the maximum extent feasible. In furtherance of this commitment and in compliance with federal and state funding requirements, the Town of Greenfield has set MBE/WBE participation goals for the overall Project as set forth in section 1.5 of these Instructions to Bidders.

SECTION 9 – CONTRACT AWARD

9.1 "Award" means the determination, selection, and notification of the lowest, responsible and eligible Bidder by the Awarding Authority and/or the CM at Risk.

9.2 The Awarding Authority reserves the right to reject any Trade Contractor Bid if it determines that such Bid does not represent the Bid of a person competent to perform the work as specified, or if fewer than three Bids are received for a sub-trade, and the Bid prices are not reasonable for acceptance without further competition.

9.3 The lowest Bidder will be determined on the basis of the sum of the base Bid and the accepted alternates. The bidder shall be required to hold the alternate price for 90 days.

SECTION 10 – EXECUTION OF CONTRACTS

10.1 If a selected Trade Contractor Bidder fails, within ten days, Saturdays, Sundays and legal holidays excluded, after presentation of a Subcontract by the CM at Risk, to perform its agreement to execute a Subcontract in the form provided by the Awarding Authority with such CM at Risk and/ or fails to furnish performance and payment bonds as required by law, such CM at Risk and the Awarding Authority shall select from the other Trade Contractor Bids duly filed with the Awarding Authority for such sub-trade and not rejected the next lowest responsible and eligible Trade Contractor Bidder at the amount named in its Bid as so filed against whose standing and ability the Awarding Authority and CM at Risk make no objection.

10.2 Upon receipt of the Award, the Bidder awarded the Contract shall submit three (3) properly executed originals of each of the following documents prior to execution of the Contract by the CM at Risk. All such documents shall be in the form prescribed by the Awarding Authority.

- Trade Contractor Agreement with attachments
- Performance and Payment Bonds with power of attorney attached
- Certificate of Insurance evidencing coverage in amounts required by the Contract Documents
- Any other documents that the Awarding Authority or CM at Risk may reasonably require in connection with the Trade Contractor's execution of the Contract.

10.3 Please note that **no part of the Trade Contractor's work, other than work specifically identified as Paragraph E work in the Contract Documents or on the Bid Form may be subcontracted and must be self-performed by the Trade Contractor.** Approved subcontractors are eligible for direct payments under M.GL. 30, § 39F, as amended. Material suppliers not involved in site labor need not be submitted for approval.

EXHIBIT A: LIST OF PREQUALIFIED TRADE CONTRACTORS FOR TRADES CURRENTLY BEING BID

04 00 01 **MASONRY WORK**

Sullivan & Narey Construction Company
Cantarella & Son, Inc.
Marmelo Brothers Construction
Fernandes Masonry
The Waterproofing Company Inc.
Chabot & Burnett Construction
L&L Masonry & Construction

05 00 01 **MISCELLANEOUS & ORNAMENTAL IRON**

United Steel, Inc.
EDM Construction, Inc.

07 00 01 **Water/Damp-Proofing & Caulking**

Armani Restoration, Inc.
Chapman Waterproofing Company
East Coast Air Barrier
Superior Caulking & Waterproofing
PJ Spillane Co., Inc.

07 00 02 **ROOFING & FLASHING**

JD Rivet and Company, Inc.
Rockwell Roofing, Inc.
Greenwood Industries, Inc.

09 00 07 **PAINTING**

Northeast Painting Associates, Inc.
Keltic Painting LLC.
John W. Egan Co., Inc.
King Painting, Inc.

22 00 01 **PLUMBING**

B-G Mechanical Contractors, Inc.
Boulanger's Plumbing
Dobbert Heating & Air Conditioning
Edward F. Corcoran Plumbing & Heating
Harold Brothers Mechanical
Adams Plumbing & Heating, Inc.
Araujo Bros. Plumbing Inc.

23 00 01 **HVAC**

Boulanger's Plumbing
Edward F. Corcoran Plumbing & Heating
B-G Mechanical Contractors, Inc.
Adams Plumbing & Heating, Inc.
General Mechanical Contractors
Dobbert Heating & Air Conditioning
Harold Brothers Mechanical

26 00 01 **ELECTRICAL**

Amp Electrical Inc.
Comalli Group Inc..
Wayne J. Griffin Electric, Inc.
Gable Electric Co. Inc.
Universal Electric

EXHIBIT B: TRADE CONTRACTOR BID CHECKLIST

THIS DOCUMENT IS NOT REQUIRED TO BE SUBMITTED WITH BID.

PLEASE NOTE THAT INCOMPLETE OR LATE BIDS WILL NOT BE CONSIDERED. THEREFORE, BEFORE SUBMITTING A BID, PLEASE REVIEW THE FOLLOWING. This is not a contract document; it is provided for your convenience to help avoid common mistakes that can result in the rejection of bids.

☐ 1. Have you used the correct bid form that immediately follows this Instructions to Bidders?

☐ 2. Are your bid amounts, as expressed in figures and words, consistent? (The amount expressed in words will control)

☐ 3. Have you acknowledged all addenda issued, and followed the instructions contained in each one?

☐ 4. Have you responded to all of those alternates identified as applying to the Trade Contractor section you are bidding on?

☐ 5. If your scope of work is affected by an alternate and an alternate price is requested and you estimate that there is no change in price, did you indicate by writing **"$0"?** Failure to provide a price or $0 for an alternate when identified as part of a Trade Contractors' scope of work will result in rejection of your bid. **A blank space or Not Applicable "NA" will NOT be accepted.**

☐ 6. If you are a Trade Contractor and the alternate does not affect your category of work, have you written **"$0"**? **A blank space or Not Applicable "NA" will NOT be accepted.**

☐ 7. If you are a Trade Contractor and the bid documents request that you supply the name of the firm(s) that will do certain work identified as sub-subcontract Paragraph E work, have you completed the Paragraph E section?

☐ 8. Have you added any information not called for, acknowledged an addendum that does not exist, or provided a price for an alternate not identified as part of your scope of work which can result in rejection of your bid?

☐ 9. Is your Bid Form **SIGNED** and **DATED**?

10. Bid Bond:

☐ a. Is your bid bond issued by a bonding company licensed to do business in the Commonwealth of Massachusetts? **Is it signed by the contractor and the bonding company?**

☐ b. Is your bid bond of the highest possible bid amount, inclusive of all alternates?

☐ c. Is your bid bond drawn in favor of The Springfield Redevelopment Authority (SRA)?

☐ 11. Have you included your current DCAM Sub-Bidder Certificate of Eligibility and a completed, signed DCAM Sub-Bidder Update Statement?

☐ 12. Are all of your bid materials enclosed in a sealed envelope and labeled with the project information exactly as provided in the Instructions to Bidders?

☐ 13. Your bid MUST be received by the Awarding Authority prior to the deadline!

☐ 14. Is the person who signed the Bid Form authorized to do so and did they provide contact information?

PART TWO

PREQUALIFIED TRADE CONTRACTOR BID FORM AND ATTACHMENTS

TO BE COMPLETED AND SUBMITTED BY TRADE CONTRACTOR WITH BID

The following must be attached to or inserted into this Trade Contractor Bid:

✷✷ **TRADE CONTRACTOR FORM OF BID**

ATTACHMENT A: **BID BOND:** Trade Contractors **MUST ATTACH** to this Trade Contractor Form of Bid at Attachment A, a valid Bid Bond equal to 5% of the total bid price including all alternates. Failure to submit such Bid Bond will result in rejection of the bid.

ATTACHMENT B: **DCAM SUB-BIDDER CERTIFICATE OF ELIGIBILITY:** Trade Contractors **MUST ATTACH** to this Trade Contractor Form of Bid at Attachment B a valid Sub-bidder Certificate of Eligibility (issued by DCAM) for each Trade in which it submits a bid. Failure to attach a valid Certificate of Eligibility will result in rejection of the bid.

ATTACHMENT C: **DCAM SUB-BIDDER UPDATE STATEMENT:** Trade Contractors **MUST ATTACH** to this Trade Contractor Form of Bid a current and completed Sub-bidder Update Statement for each Trade in which they submit a bid. Failure to submit such Update Statement will result in rejection of the bid.

Town of Greenfield MA
14 Court Square
Greenfield MA 01301

Phone: (413) 772-1567
Fax: (413) 772-1519

TRADE CONTRACTOR FORM OF BID – M.G.L.c.149A as amended

Town of Greenfield: PG 18-03

Project Name: Olive Street Parking Garage

Trade Contractor Category of Work: _____

Trade Contractor Name: _____

Trade Contractor Mailing Address: _____

_____

Trade Contractor Street Address: _____

_____

Contact Person/Title: _____

Email Address: _____

Telephone Number: _____

Facsimile Number: _____

Federal Tax ID #: _____

Trade Contractor Acknowledges
Addenda Nos. (insert all numbers): _____

Utilization of M/W/DBE Contractors and Suppliers

The Bidder is highly encouraged to obtain participation of Minority/Women/Disadvantaged business subcontractors and/or suppliers certified by the Commonwealth of Massachusetts Supplier Diversity Office (SDO).

Note: If Respondent Trade Contractor is "SDO Certified" as a M/W/DBE, please indicate which below and attach letter from the Supplier Diversity Office evidencing such certification.

☐ MBE ☐ WBE ☐ DBE

Indicate here the utilization of certified M/W/DBE's included in the base bid. IF NO INDICATION IS GIVEN, IT SHALL BE INTERPRETED THAT ZERO M/W/DBE PARTICIPATION IS INCLUDED.

This proposal includes ____% certified MBE and ____% certified WBE and ____% certified DBE participation.

✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶ **IMPORTANT NOTICE** ✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶

Interested Prequalified TRADE CONTRACTORS <u>must</u> indicate in the table below the trade for which it is submitting THIS bid and MUST submit SEPARATE individual bids for each and every other trade in which it was prequalified and submits a bid for this Project.

✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶ **IMPORTANT NOTICE** ✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶✶

See "X" Below For ALL Trades Being Bid (at this time)	Section #	Trade Category
☐	04 00 01	MASONRY WORK
☐	05 00 01	MISCELLANEOUS & ORNAMENTAL IRON
☐	07 00 01	WATERPROOFING, DAMPPROOFING & CAULKING
☐	07 00 02	ROOFING & FLASHING
☐	09 00 07	PAINTING
☐	22 00 01	PLUMBING
☐	23 00 01	HVAC
☐	26 00 01	ELECTRICAL

To the Construction Manager on this CM at Risk Project:

The undersigned prequalified Trade Contractor (also referred to as a sub-bidder) proposes to furnish all labor and materials required for completing, in accordance with the hereinafter described Plans, Specifications and addenda, all the work specified in Section No. _____ of the Specifications and in any Plans specified in such section, prepared by
(section #)

Desman Design Management for **PG 18-03**,
(designer) *(Greenfield bid number)*

Olive Street Parking Garage
(project name)

In **Greenfield**, Massachusetts, for the Contract sum of
(city/town)

_____
(written amount)

_____ dollars ($_____).
(numerical value)

B. The lowest Bidder will be determined on the basis of the sum of the base Bid and the accepted alternates. Alternate pricing will be a considered factor for contract award. The bidder shall be required to hold the alternate price for 90 days.
NOTE: A blank space or Not Applicable "NA" will NOT be accepted.

For Alternate No. 1: Add $_____ Subtract $_____

4X4 Tubes at Perimeter

For Alternate No. 2: Add $_____ Subtract $_____

Woven Mesh at Facade

For Alternate No. 3: Add $_____ Subtract $_____

Up Lighting of the Woven Mesh

For Alternate No. 4: Add $_____ Subtract $_____

Metal Railings at Spandrels in Lieu of Precast

C. **IMPORTANT INFORMATION:** Because this is a CM at Risk Project **All Trade Contractors must include in their Bid price the cost of their providing payment and performance bonds in the full amount of their Bid, including all alternates.** All Trade Contractors awarded contracts on this Project are required by law to provide full payment and performance bonds at their own expense.

D. The undersigned agrees that, if it is selected as a Trade Contractor, it will, within ten days, Saturdays, Sundays, and legal holidays excluded, after presentation of a subcontract by the Construction Manager selected as the CM at Risk, execute with such Construction Manager a subcontract in accordance with the terms of this Trade Contractor Bid Packet, and contingent upon the execution of the general contract, and recognizes that it, the Trade Contractor, is required to furnish a performance and payment bond and the Trade Contractor is required to pay the premiums therefore. Payment and Performance Bonds must be issued by a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority in the full sum of the subcontract price.

E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the section of the Specifications for this sub-trade require a listing in this paragraph, including the undersigned if customarily furnished by persons on his own payroll, and in the absence of a contrary provision in the Specifications, the name of each such class of work or part thereto and the bid price for such class of work or part thereof are:

NAME	CLASS OF WORK	BID PRICE ($)
_____	_____	
_____	_____	
_____	_____	
_____	_____	

(Do not give bid price for any class or part thereof furnished by the undersigned)

By submission of this Bid the Trade Contractor certifies that it has prequalified each of the sub-trade subcontractors listed above using criteria similar to the criteria for the prequalification of the Trade Contractors.

F. The undersigned agrees that the above list of bids to the undersigned represents bona fide bids based on the hereinbefore described Plans, Specifications and addenda and that, if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the awarding authority.

G. The undersigned further agrees to be bound to the Construction Manager, Daniel O'Connell's Sons, Inc. by the terms of the hereinbefore describe Plans, Specifications, including all general conditions stated therein, and addenda, and to assume toward the Construction Manager all the obligations and responsibilities that the Construction Manager, by those documents, assumes toward the Town of Greenfield.

CERTIFICATIONS

The undersigned hereby certifies that the Trade Contractor will perform the complete trade contract work with employees on its own payroll, except for work listed and identified in Paragraph E above.

The undersigned further certifies that it shall comply with the prevailing wage law set forth in M.G.L. c. 149, §§26 & 27 and pay wages no less than those set forth in the wage rate tables for the Project. The undersigned further certifies that it is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work; that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that it will comply fully with all laws and regulations applicable to awards of subcontracts subject to Chapter 149A of the General Laws.

The undersigned further certifies under penalties of perjury that this Trade Bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the work "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned also certifies that he or she (or, if he or she is the authorized representative of a company, the company) is the only person interested in this Bid; that it is made without any connection with any other person making any submission for the same work; that no person acting for, or employed by, the Commonwealth of Massachusetts is directly or indirectly interested in this Bid or any subsequent proposal, or in any contract which may be made under it, or in expected profits to arise therefrom; that the undersigned Bidder has not influenced or attempted to influence any other person or corporation to file a Bid or subsequent proposal or to refrain from doing so or to influence the terms of the Bid or any subsequent proposal of any other person or corporation; and that this submission is made in good faith without collusion or connection with any other person applying for the same work.

The undersigned certifies that if awarded this work it shall comply with all federal and state laws, rules and regulations promoting fair employment practices or prohibiting employment discrimination and unfair labor practices and shall not discriminate in the hiring of any applicant for employment nor shall any qualified employee be demoted, discharged or otherwise subject to discrimination in the tenure, position, promotional opportunities, wages, benefits or terms and conditions of their employment because of race, color, national origin, ancestry, age, sex, religion, disability, handicap, sexual orientation or for exercising any rights afforded by law.

The undersigned certifies that if awarded this work it shall not knowingly use undocumented workers in connection with the performance of Contracts; that, pursuant to federal requirements, they shall verify the immigration status of all workers assigned to Contract without engaging in unlawful discrimination; and that they shall not knowingly or recklessly alter, falsify, or accept altered or falsified documents from any such worker. The Contractor understands and agrees that it must submit documentation of compliance with this requirement as required by The Town of Greenfield and that any breach of any of these terms during the

period of a Contract may be regarded as a material breach, subjecting Contractor to sanctions, including but not limited to monetary penalties, withholding of payments, contract suspension or termination.

The undersigned further certifies pursuant to M.G.L. c. 62C, §49A, M.G.L. c. 149A, §8(g) 10, and M.G.L. c. 151A, § 19A, I, that Bidder has filed all state tax returns and paid all taxes as required by law and has complied with all state laws pertaining to contributions to the unemployment compensation fund and to payments in lieu of contributions.

The undersigned further certifies under penalties 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 twenty-nine F of chapter twenty-nine or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder. The undersigned further certifies under pain and penalties of perjury that it is not presently debarred by the federal government from doing public work under any applicable federal law.

a. **Authorized Signature:** This form must be signed by an officer of the firm or an individual so authorized by an officer of the firm who has personal knowledge regarding the information contained herein.

Signed under the pains and penalty of perjury this _____ day of _____2017.

By: _____

Print Full Name/Title: _____

Legal Firm Name: _____

This bidder is a (an): _____ (Individual, Partnership, Corporation)

NOTE: This Bid Proposal must bear the written signature of the Bidder.

a. If the Bidder is an Individual doing business under a name other than his own name, the Proposal must so state, giving the address of the Individual.
b. If the Bidder is a Partnership, the Bid Proposal must so state, setting forth the names and addresses of all Partners, and must be signed by a Partner so designated as such.
c. If the Bidder is a Corporation, the Bid Proposal must be signed by a duly authorized officer or agent of such Corporation.

Attachment A – TRADE CONTRACTOR BID BOND

Trade Contractor MUST Attach a Valid Bid Bond meeting the requirement of this Trade Contractor Bid Package here.

Attachment B – TRADE CONTRACTOR DCAM CERTIFICATE OF ELIGIBILITY

Trade Contractor MUST Attach a Valid Sub-Bidder Certificate of Eligibility issued by the Massachusetts Division of Capital Asset Management meeting the requirements of this Trade Contractor Bid Package here.

Note: Trade Contractors submitting a bid for more than one Trade must submit a DCAM Sub-bidder Certificate of Eligibility and Update Statement for each Trade.

Attachment C – TRADE CONTRACTOR DCAM UPDATE STATEMENT

Trade Contractor MUST Attach a Completed Sub-Bidder Update Statement on the form issued by the Massachusetts Division of Capital Asset Management meeting the requirements of this Trade Contractor Bid Package here.

Note: Trade Contractors submitting a bid for more than one Trade must submit a DCAM Sub-bidder Certificate of Eligibility and Update Statement for each Trade.

Olive Street Parking Facility
Greenfield, Massachusetts

PROJECT SPECIFICATIONS

CONSTRUCTION DOCUMENTS – BID SET
September 6, 2017

DESMAN PROJECT NO. 20-16105.01-1

Owner:	Town of Greenfield 14 Court Square Greenfield, MA 01301
Engineer of Record:	DESMAN, Inc. 18 Tremont Street, Suite 300 Boston, MA 02108
Architect of Record:	Jones Whitsett Architects 308 Main Street Greenfield, MA 01301
MEP/HVAC Consultant:	edm Engineering 166 East Street Pittsfield, MA 01201
Site/Civil Consultant:	SVE Associates 439 West River Road Brattleboro, VT 05302

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There is no Division 1 included in these specifications.

DIVISION 2 – SITEWORK

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02300 EARTHWORK
02400 RIGID INCLUSIONS

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031000 CONCRETE FORMWORK
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033000 CAST-IN-PLACE CONCRETE
034100 STRUCTURAL PRECAST CONCRETE

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*04200 UNIT MASONRY

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*07541 POLYVINYL CHLORIDE (PVC) MEMBRANE ROOFING
*07620 FLASHING AND SHEET METAL
*07710 ROOF SPECIALTIES
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*Filed Sub-Bids Required

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10140 SIGNAGE
10606 CHAIN LINK SCREEN & GATE
10820 GRILLES & SCREENS

DIVISION 14 – CONVEYING SYSTEMS

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*Filed Sub-Bids Required

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*16140 WIRING DEVICES
*16410 ENCLOSED SWITCHES AND CIRCUIT BREAKERS
*16442 PANELBOARDS
*16511 INTERIOR LIGHTING
*16521 EXTERIOR LIGHTING

*Filed Sub-Bids Required

DIVISION 0

EXHIBIT "J"

DOC SUMMARY INSTRUCTIONS TO TRADE BIDDERS

OLIVE STREET PARKING FACILITY
GREENFIELD, MASSACHUSTEES

Re: Town of Greenfield
Olive Street Parking Facility
Olive Street
Greenfield, MA 01301

September 6, 2017
DOC Project No. 2017-107

The Town of Greenfield has seen a rebirth in its downtown area and parking demand exceeds available parking. Further exacerbating this situation is the opening of the new Court House in the downtown area. To alleviate the parking problem, the Town of Greenfield is constructing a new 272 space parking structure on Olive Street. The new structure is designed as a precast single threaded helix. The CM at Risk delivery method has been selected for this project and Daniel O'Connell's Sons (DOC) was selected to provide these services. Daniel O'Connell's Sons is soliciting bids for the construction that will include Masonry, Miscellaneous Metals, Waterproofing, Dampproofing and Caulking, Roofing and Flashing, Painting, Plumbing, HVAC, and Electrical as designed by DESMAN, Inc., Boston, MA.

Contract Documents will be available following September 6, 2017. All documents will be available on the Town of Greenfield Purchasing Web site at www.greenfield-ma.gov under "Departments","Purchasing", "Active Bids/RFQ/RFP".

PRE-BID MEETING: Tuesday, September 19, 2017 at 2:30PM Pre-bid Conference will be held at DOC's Field Office at 20 Bank Row, Greenfield MA.

Deadline for Submitting Questions: Tuesday – September 19, 2017 by 5PM. All questions should be submitted in writing to Ms. Audrey LaBonte at purchasing@greenfield-ma.gov. Answers will be provided no later than **5PM Friday, September 22, 2017.**

In accordance with the Bidding Requirements and
Contract Documents prepared by the Architect / Engineer:

Awarding Authority – Town of Greenfield Massachusetts

Owners Project Manager – Skanska USA,
Mr. John Benzinger john.benzinger@skanska.com

Construction Manager – Daniel O'Connell's Sons,
Mr. Robert Aquadro – baquadro@oconnells.com

Trade Bids will be received at the Office of the Mayor:

Ms. Audrey LaBonte
Town of Greenfield
14 Court Square
Greenfield, MA 01301
PHONE: (413) 772-1560

TRADE Subcontractor Bids are due to the Town of Greenfield by 2:00PM on Wednesday September 27, 2017

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BIDDING REQUIREMENTS

1. SCHEDULE

All bidders shall review the attached schedules and incorporate the information and deadlines into their proposals. **Bidders shall concur and comply with the Schedule's requirements.** The attached Project Schedule (**Exhibit N**) should be used as a reference guide for the bidding phase. A detailed Project Schedule will be developed with input from subcontractors and issued after contract award.

Please note that there are liquidated damages on this project. Subcontractors need to provide adequate update on activities and material delivery lead times and to work wroth the other trades to eliminate the possibility of a late project delivery.

2. INTERPRETATION OF DOCUMENTS

Requests for interpretation of the Bidding Requirements and the Contract Documents shall be in written form and submitted to Ms. Audrey LaBonte at purchasing@greenfield-ma.gov. The Architect will respond to questions in the form of an addendum and will be available to all persons / firms to whom the Contract Documents have been issued. All such addenda shall become part of the Bid Documents and upon execution of the Contract they shall become part of the Contract Documents.

3. INTENT OF DRAWINGS

It is understood that the contract drawings delineate the general intent of the work and that each Subcontractor \ Supplier shall provide whatever incidental material and labor necessary to translate the intent of the documents into a finished and usable structure, notwithstanding the same may have been inferred and \ or omitted from the plans and specifications.

4. SUBSTITUTIONS

Substitutions as allowed by the Contract Documents for specified materials, equipment, or systems proposed by or through the Construction Manager shall be effected only by the evaluation and recommendation of the Architect and acceptance and authorization by the Owner through the issuance of an Addendum, if prior to award of a Contract, or by Change Order after award of a Contract. An approved substitution shall become part of the Contract Documents as if originally incorporated therein.

5. SITE VISIT

With submission of a proposal, the bidder acknowledges that they have inspected the site and have verified to their satisfaction the nature and quantity of the work involved, and that they are familiar with all conditions to be encountered and they will complete all work herein undertaken for the sum set out in their subcontract(s).

6. BONDS

All Trade and Non-Trade Contractors shall provide payment and performance bonds to the CM each in the amount of 100% of the Contract Price.

All trade contracts entered into in accordance with M.G.L. c.149A, §8 shall be secured by performance and payment bonds in the full amount of the trade contract amount from a surety company licensed to do business in the commonwealth and whose name appears on United States Treasury Department Circular 570; provided that the bonds are subject to subsection (3) of section 44F of chapter 149. The Surety Company's underwriting limitation, as further set forth on "Treasury Department Circular 570", must not be less than the full amount required by the bond itself.

Section 44F of chapter 149, states "A performance and payment bond furnished by the subcontractor, either pursuant to the requirements of the prequalification process as established in section 44D3/4 or at the request of a general contractor set forth

in the general bid form, shall be for the benefit of the general contractor; shall secure the performance of the subcontract by the subcontractor; and shall indemnify and hold harmless the general contractor and the surety or sureties under the labor and materials or payment bond furnished by the general contractor to the awarding authority against (i) any and all loss and expense arising out of any and all claims in connection with the performance of the subcontract which would be required to be paid under the labor and materials or payment bond furnished by the general contractor to the awarding authority and (ii) attorneys' fees in the event that the subcontractor, after notice, fails to assume the defense of and defend such claims."

Actual bonding cost associated with the value of the Contract Sum shall be supported by written documentation from the bonding company. No mark up shall be added to the Contract Sum for premiums on bonds and insurance.

If you are an Out Of State Subcontractor you may be required to provide a sales and use tax guarantee bond to the State Department of Revenue in order to secure payment of any sales/use tax on construction materials used in carrying out the contract. The nonresident subcontractor must provide a copy of the certificate to the Construction Manager. The nonresident subcontractor is required to register with the Department Of Revenue even when contracting with a tax exempt entity. The Department will determine if the project qualifies for the exception.

GENERAL REQUIREMENTS

The following is a list of some general requirements for which all Subcontractors \ Suppliers will be responsible to comply with. Please note that this memo in no way releases the Subcontractors \ Suppliers from the requirement established by the Contract Documents. The Subcontractor / Supplier, to the extent that the work to be performed by them, is bound to the Construction Manager by the terms of the Contract Documents, and assumes toward the Construction Manager all the obligations and responsibilities which the Construction Manager assumes toward the Owner.

7. COMMENCEMENT AND COMPLETION WORK

(A) Work at the project site shall begin as soon as possible after signing of the Subcontract Agreement or Letter of Intent and progress with proper and sufficient workforce and ample supply of materials to satisfy the Construction Manager and to assure overall completion of the work by the dates shown on the preliminary project schedule.

(B) **Working hours** shall exist between **7:00 AM and 3:30 PM**, Monday through Friday (this does not include shift work). Work beyond these hours, as well as, work on weekends and holidays must be reviewed and approved by Owner at least 24-hours in advance.

(C) Any manufacturer or supplier upcharges required to meet the schedule shall be included in the bid.

Subcontractor agrees to commence work on the Project within four (4) calendar days after the award of the Contract or Letter of Intent and to substantially complete the work in coordination with the Job Progress Schedule.

8. TAXES

Tax Exempt Certificate to be provided upon execution of subcontract.

The Subcontractor agrees, in the performance of this Subcontract, to comply with all federal, state, county, municipal, and local laws, ordinances, codes and governing regulations; to pay all costs and expenses required thereby; to pay all fees and taxes, including sales and use taxes; and to pay all taxes imposed by any federal, state, county, municipal or local law for employment insurance, pensions, old age benefits, union benefits, or for such other like or comparable purpose.

STATE OF MASSACHUSETTS PROJECTS (SALES TAX)
Nonresident Subcontractors / Suppliers are required to deposit with the Commissioner of Corporations and Taxation (the "Commissioner") a sum equivalent to six and a quarter percent (6.25%) of the total amount to be paid under the Subcontract, or furnish the Commissioner with a guarantee bond satisfactory to the Commissioner in a sum equivalent to six and a quarter percent (6.25%) of such total amount, to secure payment of the tax payable relative to tangible personal property consumed or used pursuant to or in carrying out the subcontract and shall obtain a certificate in duplicate from the Commissioner stating that the requirements of M.G.L.A. Chapter 64h, Section 30A, and Chapter 641, Section 31A have been met. If no certificate is provided by the Commissioner the Construction Manager / Contractor shall retain six and a quarter percent (6.25%) of the total amount of the Subcontract and pay it to the Commissioner on behalf of the nonresident Subcontractor / Supplier.

OTHER STATES – AS REQUIRED BY STATUTE (TAXES)

9. INSURANCE AND INDEMNITY

Subcontractors \ Suppliers shall purchase and maintain appropriate insurance coverages per the Construction Manager's Insurance Requirements (as outlined in Exhibit "A" issued in an addenda and per general conditions per Exhibit "S") and per General Conditions. All Subcontractors \ Suppliers shall comply with the limits stated or indicate what the added cost would be to comply. Sub-Subcontractors shall also obtain and maintain appropriate insurance coverages. All insurance certificates shall name **"The Town of Greenfield", "Skanska USA", "DESMAN Design Management", Jones Whitsett Architects, and "Daniel O'Connell's Sons, Inc." their directors, officers, representatives, agents, employees, and heirs as Additional Insureds.**

10. PERMITS AND FEES

The Construction Manager and Owner will apply and pay for the basic Building Permit. All Subcontractors are to apply and pay for their required permits for the execution of their work. Subcontractors will submit copies of all permits, licenses, certifications, inspection reports, releases, notices, judgments and communications from Authorities having jurisdiction to the Construction Manager. Prior to commencing work, Construction Manager shall submit copies of the required permits to the Owner.

11. RETAINAGE

A **5% percent retainage** shall be withheld from progress payments to all Subcontractors and Major Suppliers or as regulated by State statue.

12. WAGE RATE BREAKDOWN

In reference to Owner's Contract with Daniel O'Connell's Sons all Subcontractors will supply a complete trade hourly wage rate breakdown (Exhibit "L" - Schedule of Wage Rates) as determined for this project to DOC. This wage rate breakdown information, along with the back-up documentation, is required to be presented for each scheduled and/or estimated increase must be provided and negotiated prior to finalizing the Subcontract with each Subcontractor. Wage Rate Breakdowns should be provided for all people who will be associated with the project and should include the breakdown per Exhibit L and needs to also include other miscellaneous items (Safety Equipment, Lodging, Travel, Vehicles, etc.) allowed by the General Conditions, Article 29 Changes in the Work.

13. MARKUP ON CHANGES

Subcontractor or Sub-subcontractor (trade executing the Work) may only markup changes in the Work for overhead and profit by ten percent (10%). All levels above may only markup changes in the Work for overhead and profit by five percent (5%) to a total of 15% maximum. In the event the Contract Documents set forth provisions different than noted above, the allowable markup in the Contract Documents shall prevail.

ALLOWABLE EQUIPMENT RATES FOR CHANGES IN THE WORK

Equipment rate costs for equipment are as follows:

a. Work less than 40 hours – standard daily bluebook rate divided by 8
b. Work equal to or greater than 40 hours – standard weekly bluebook rate divided by 40

14. EQUAL OPPORTUNITY

All Subcontractors are to comply with the Owner's Affirmative Action Programs. The Owner encourages the use of businesses and contractors.

15. CERTIFED PAYROLLS REPORTING

All Subcontractors are required to submit weekly certified payrolls as required in the Contract Documents.
Construction Manager and all Subcontractors are responsible for submitting all required documentation which includes, but is not limited to: Weekly Certified Payrolls, Contractor's Weekly Workforce Report, Weekly Payroll Report & Statement of Compliance, etc. See DOC Exhibit "R" for form required to be submitted.

Please Note: **One Copy** of the weekly Certified Payroll Reports must be provided every week (whether the subcontractor is on site or not) for the duration of their presence on this project. If the subcontractor is not on site during a week or more they are still responsible to submit reports indicating 'no work' on site that week until their work is completed. **Failure to submit will be grounds for withholding payment.** The weekly Certified Payrolls must be emailed to Laura Treso with Daniel O'Connell's Sons at LTereso@oconnells.com and an original hard copy mailed to the attention of Laura Tereso at 80 Kelly Way, Holyoke, MA 01040.

16. CODE COMPLIANCE

The Subcontractor and its Sub-subcontractors \ Suppliers shall comply with all applicable codes, ordinances, regulations and requirements of all authorities having jurisdiction.

17. HARASSMENT

Courteous behavior shall be enforced. Working personnel will refrain from harassing any student, faculty, staff member, and visitor or fellow worker. Occurrence will require immediate termination of the responsible person(s).

18. CONDUCT

(A) No smoking within or adjacent to existing buildings at project site.
(B) No entering buildings or areas other than that which is within your Scope of Work.
(C) No calling, shouting or use of profanity.
(D) No radios, no Walkman radios.

19. PARKING AND DELIVERIES

No parking is available on site or on property. Delivery of material shall be coordinated through the Construction Manager.

20. SITE LOGISTICS

Site Logistics and all activities and or areas to be used need to be approved by the CM and Owner.

Lay-down areas are minimal. Please include off-site storage for large quantity items. All lay-down areas shall be approved by the CM.

The surrounding area will be an operating facility during construction. There are some areas where work will be occurring in close proximity to on-going classes, etc. Subcontractors will be expected to schedule work in these affected areas with the CM. See Exhibit "K" for Site Logistics.

21. NOISE CONTROL

Noise generated by the Subcontractors \ Supplier must be controlled to a maximum level of 80dB. Noise is defined as raised voices, idling and \ or running of gasoline, diesel and electric motors and pneumatic equipment, use of hand tools and contact of two or more similar or dissimilar materials.

22. DAILY CLEANUP AND BACKCHARGE RATES

TRADE AND NON-TRADE SPECIFIC CLEANUP SHALL BE DONE BY THE SUBCONTRACTORS ON A DAILY BASIS TO THE DUMPSTERS PROVIDED ON SITE. If after being given a 24-hour notice to thoroughly clean the premises of debris generated by your trade, DOC will assume these obligations and back-charge your account for all costs associated with these cleaning operations. The subcontractor will be back-charged by the CM at a labor rate of $100/hour (excludes small tools and equipment which will be added as appropriate), including overhead and profit, to perform this service.

The DOC back-charge rate for all work performed on behalf of a trade or non-trade subcontractor or its sub-subs, other than that of general cleaning, will be billed at DOC's cost plus 15% Markup.

23. SUPERVISION AND WORKFORCE

Subcontractors are required to employ competent supervisory and field personnel and shall coordinate their work with the work of all other trades. The Foreman in charge of the work shall be on-site at all times during the performance of their work. Subcontractors agree to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the Project. Any required shift work needed to support the project schedule shall be included in the Subcontractor's bid proposal. Refer to individual specifications for other requirements.

24. COMMUNICATION

All major Subcontractors (contracts valued over $100,000.00) on the project will be required to have cellular phones as a means of communication with the CM and other trades. All project managers, superintendents, foremen and other key personnel will be required to have cellular phones tied into the business network.

25. TEMPORARY TELEPHONE SERVICE

Subcontractors shall be responsible for their own telephone service.

26. TEMPORARY POWER

The Electrical Trade Subcontractor shall make arrangements for and provide equipment, poles, meter, wiring, switches, outlets, etc. required as necessary to provide for all lighting and power requirements for construction purposes. The Electrical Trade Subcontractor shall be responsible for all negotiations and coordination with the electrical utility company, and shall pay for all electrical company charges associated with the temporary service. Provide and maintain adequate lighting, including lamp replacement, in accordance with all State and Federal laws, with local switching for safe access and egress, security, and for providing adequate illumination for construction operations. Provide a 200 amp temporary service. Remove all temporary equipment when no longer needed. The Construction Manager will pay for the cost of the power consumed.

All Subcontractors are to submit their Assured Grounding Program to the CM for review and each Subcontractor is responsible for its implement and enforcement.

Electric welders are not allowed to be connected to the project's temporary electric system.

27. TEMPORARY HEAT

Temporary heat if required will be provided by the Construction Manager requiring its use.

28. TEMPORARY WATER

All temporary water will be provided by the Construction Manager through a local hydrant. All distribution of water from the hydrant will be by the Subcontractor.

29. TEMPORARY TOILETS

The Construction Manager will provide the necessary portable toilets.

30. TEMPORARY STANDPIPE AND FIRE PROTECTION

The Fire Protection Subcontractor shall supply the temporary fire protection system that is required by the local Fire Authority during the construction process. Any fire protection system, which services adjacent spaces, **shall remain active throughout the Project with no shutdowns.**

31. TEMPORARY PROTECTION

Temporary protection shall be the Trade's responsibility.

32. OWNER'S UTILITY CONNECTIONS

Subcontractors shall notify The Construction Manager (CM) at least 48 hours in advance of the desire to connect, disconnect, turn on, or turn off any utility service from the Owner's supply systems. The CM in turn will notify the Owner's Representative and the actual operation shall be performed by technicians from the Owner's staff.

33. HOISTING AND SCAFFOLDING

Subcontractors shall provide all their own ladders, scaffolding, staging, planking services, hoisting equipment, and all other necessary tools and equipment for the completion of their Subcontract Work. Upon direction of the Construction Manager / Contractor, the Subcontractor shall permit other trades to utilize the Subcontractor's scaffolding, staging, planking services and hoisting equipment when said utilization is consistent with industry standards in a manner not to interfere with Subcontractor's work. In the event that Construction Manager / Contractor provides any hoisting equipment for the Subcontractor, the Subcontractor shall properly secure, rig and guide material or equipment and all risk associated with Subcontractor's use of such hoisting equipment shall be the responsibility of the Subcontractor. Furthermore, in the event that Construction Manager / Contractor provides materials / equipment for multi-trade use, such as but not limited to scaffolding, man-lifts, scissor lifts, etc., the Subcontractor utilizing such equipment shall ensure their employees / subcontractors are properly trained / certified in the safe operation / use of subject matter to recognize the hazards associated with the type of scaffolding, man-lift, scissor lift and to control or minimize those hazards as required by the manufacturer, local safety rules (SSSP) and Federal Occupational Safety and Health Standards. In all cases where equipment is provided by Construction Manager / Contractor for the Subcontractor copies of proper training / licenses shall be submitted by the Subcontractor to Construction Manager / Contractor. The Subcontractor agrees to defend, indemnify and hold harmless the Construction Manager / Contractor as noted in Article 5 of this Contract.

34. GAS-POWERED EQUIPMENT

No gas-powered equipment will be allowed to operate within the confined spaces on the project until it has been cleared for use by the Owner and DOC. Certificates of clearance must be filed with the Project Manager prior to the start of work.

35. STRUCTURAL SHORING

If shoring is required for the completion of any Subcontractor's work, the Subcontractor shall provide labor and material for all structural shoring to include engineered drawings prepared and stamped by a licensed professional engineer in the State which the project is located. The drawings shall be submitted to the Construction Manager for approval prior to any work being done. The engineered drawings are the responsibility of the Subcontractor.

This shoring requirement includes shoring required for demolition by the demolition Subcontractor which will remain in place until the structure is safely supported by new construction.

36. ENGINEERING & FIELD LAYOUT

Subcontractors shall coordinate their work with the work of other trades and shall be responsible for their own field dimensioning and layout from control lines established by the Construction Manager.

37. CUTTING AND PATCHING

Subcontractors shall include all cutting, coring, drilling, punching, patching, firesafing, and reinforcing of holes required for the coordination of work, and shall coordinate the above with the Construction Manager**.** "Do not cut and patch structural work in a manner that would result in a reduction of load-carrying capacity or of load-deflection ratio. Prior to the performance of any such work, the Subcontractor shall submit a written request to the Construction Manager. This request will be forwarded to the Architect for approval. (Request for Information Form "RFI")

38. SAFETY

The Subcontractor in its performance of the Work shall comply with all statutory regulations and requirements including, but not limited to (most stringent shall apply):

(A) Occupational Safety and Health Act of 1970 as amended.

(B) State Department of Labor and Industries, "Rules and Regulations for the Prevention of Accidents in Construction Operations."

C) Follow all safety initiatives directed by DOC representatives and DOC's Insurance Carrier's Loss Control Representative during or following an on-site safety inspection/audit, providing the initiatives fall within the boundary and intent of local, state or federal (OSHA) rules and regulations including Exhibit "O", Project Site Specific Safety Plan (SSSP).

(D) Subcontractor's site specific safety plan written safety program and Exhibit "O", Project Site Specific Safety Plan (SSSP), which shall be available at the job site for review.

(E) Local municipal / Owner / Client safety regulations.

(F) Hard hats and appropriate personal protection equipment (PPE), such as safety glasses, safety shoes and hi-visibility upper body outerwear shall be worn at all times while in the designated construction area. Determining additional PPE requirements, such as use of a face shield while cutting/grinding is the responsibility of the subcontractor. Failure to comply will result in the offender receiving a Notice of Unsafe Practice (1st notice is a documented warning), a second Notice of Unsafe Practice may result in the offender being removed from the Project permanently.

(G) In the event the Subcontractor receives correspondence or other communication from OSHA due to Subcontractor's employee complaints, Subcontractor must immediately notify and provide copies of alleged documents and communications to Construction Manager / Contractor. In the event OSHA fines are assessed to the Owner, Construction Manager / Contractor or Project, the offending Subcontractor / Supplier agrees to promptly notify Construction Manager / Contractor and pay that portion of such fines assessed that are directly attributable in whole or in part to the actions of Subcontractor or its employees or Sub-subcontractors or Subcontractor's Work.

(H) Should the Construction Manager / Contractor choose to form a Safety Committee on the project, the Subcontractor may be required to have its Project foreman serve on the Safety Committee, if requested to do so by the Construction Manager / Contractor. The purpose of the Safety Committee will be to monitor overall project safety and suggest methods to improve safety for all on site personnel, visitors to the Property and individuals working adjacent to the Property.-

(I) Exhibit "O", Project Site Specific Safety Plan (SSSP) will be provided to the Subcontractor / Supplier through the Contract and upon arrival at the Project.

(J) All employees to be employed at the work site shall have successfully completed an OSHA Ten-Hour (or Thirty-Hour) Construction Certification Program at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee. Any employee found on the work site without documentation of successful completion of a course in construction safety and health approved by OSHA that is at least ten hours in duration, shall be subject to immediate removal.

(K) The Subcontractor Foreman shall attend the Construction Manager / Contractor's Monthly Safety Meetings.

(L) Subcontractor shall prior to commencing work, furnish to the Construction Manager / Contractor a copy of its company's own Site Specific Safety Plan, which is in addition to their Safety Manual for Construction Manager / Contractor review demonstrating that the Work will be performed in accordance with all applicable safety regulations, including the DOC Project Site Specific Safety Plan (SSSP).

(M) Prior to commencing work on site, Subcontractor's on-site Supervision will acknowledge, through signature, their review, understanding and agreement of Exhibit "O" confirming they will review the contents of Exhibit "O" with employees assigned to and working on project site. Further, all of the Subcontractor's employees on site shall participate in Project Safety Orientation, acknowledge participation, understanding and agreement and apply Project Specific Hardhat Sticker to hardhats before commencing work.

(N) Subcontractor shall, upon request by Construction Manager / Contractor, have their Safety Director, Loss Control representative come to the project to audit Subcontractor's safety program, assist with Job Hazard Analyses, and other safety related initiatives and requirements. Subcontractor shall provide Construction Manager / Contractor a written report of each such visit.

In the event the Subcontractor fails within twenty four (24) hours after receiving written notice from the Construction Manager / Contractor to take corrective action to insure compliance with said project safety requirements and/or the removal of rubbish and debris resulting from its Work, the Construction Manager / Contractor shall subcontract to others these obligations and charge the cost of same to the Subcontractor's account without further notice to the Subcontractor. The Subcontractor shall reimburse the Construction Manager / Contractor for all monetary penalties or fines assessed to the Construction Manager / Contractor, for any citations which arise out of or are levied against the Owner or Construction Manager / Contractor as a result of the Subcontractor's failure to take said corrective measures in a timely manner.

The Subcontractor agrees to immediately notify the Construction Manager / Contractor of all accidents/incidents which may occur on the jobsite to persons or property and the Subcontractor shall, within 24 hours of occurrence of the accident/incident, complete a comprehensive accident report (which shall include the statement of all witnesses) and provide the Construction Manager / Contractor with a complete copy of such accident report.

BE CAREFUL TODAY! This is Daniel O'Connell's Sons' motto. We insist on safe practices and will do everything in our power to insure a safe jobsite for everyone. All Subcontractors and Suppliers will be expected to participate actively and rigorously in our goal.

Substance abuse of any kind will not be tolerated and shall evoke immediate termination of employment.

In the event of OSHA fines being charged to the project, the offending Subcontractor agrees to promptly pay that portion assessed against the Construction Manager, directly attributable to his work.

SPECIAL REQUIREMENT: All personnel who arrive on site to perform physical work for which they are contractually obligated are required to attend the Construction Safety Orientation (Orientation). Requirements pertaining but not limited to Safety, Hazardous Materials/Conditions, Environmental, Noise, Dust, Incident Reporting, Emergency Action Plan, etc., are covered. Upon completing Orientation personnel will acknowledge that they have received, understood and will abide by the elements of the Orientation. Once the acknowledgement is signed personnel will receive a hardhat sticker specific to the Project which is to be affixed to the hardhat indicating they have completed the Orientation

39. ASBESTOS OSHA TRAINING – IF APPLICABLE

Please refer to hazardous material investigations and testing specification section and other Contract Documents. Any trade disturbing these areas must be trained in accordance with
OSHA standards.

40. HAZARDOUS MATERIALS

When the use or storage or handling of hazardous materials are required for the Work, provide Material Safety Data Sheets (Dept. of Labor Form OSHA-20). The Owner's rights to duplicate and disclose any data furnished under this article is used to (1) apprise personnel of the hazards to which they may be exposed…; and (2) obtain medical treatment for those affected by the material

41. BOXOUTS, SLEEVES, AND ACCESS PANELS

All Subcontractors are responsible to furnish and install their own boxouts and sleeves in the basic structure (slabs, walls, etc.). Access panels in finished surfaces will be supplied and coordinated by the Subcontractor requiring access. They will be installed by the Subcontractor doing the finishes.

42. COORDINATION OF WORK

The Subcontractor \ Supplier shall coordinate its work and deliveries with that of other trades and to follow the scheduling directives of Daniel O'Connell's Sons.

43. PRECONSTRUCTION MEETING

A mandatory Preconstruction Meeting will be held on the jobsite after the award of all major subcontracts. Many general and operational issues will be discussed.

44. PROGRESS MEETINGS

There will be on-site meetings every week. Subcontractors, Suppliers, and Major Sub-sub-contractors will be required to attend the meetings when they are determined to be an active participant within the project's progress or as otherwise required by the Construction Manager. The attendee shall be an assigned Project Manager or other employee approved by the Construction Manager. Failure to attend may result in the offending Subcontractor being directly assessed a fine of $100 per incident.

45. FOREMEN'S MEETING

Foremen's Meeting shall be held weekly. Jobsite foremen are required to attend and participate.

46. MEP COORDINATION

Coordination meetings will be held as needed via GoToMeeting and on site. All applicable subcontractors are required to attend and shall have a representative present who has authority to make coordination decisions in the meeting. Coordination drawings will be generated from these meetings by all mechanical and electrical trades.

47. CONSTRUCTION MANAGEMENT SOFTWARE PROGRAM

DOC will be using Newforma, a web-based construction management software program and e-mail. All Subcontractors and Major Suppliers will be required to use this software in combination with e-mail. Access to the website will be awarded to successful bidders.

48. SHOP DRAWINGS AND SUBMITTALS

Submittals are to be electronically transmitted via DOC web based project management software, Newforma. Access to the software is free. Submittals are to include the following:

(A) Submittal transmittal
(B) All materials subject to approval by the Architect
(C) Brochures and/or literature packets from the manufacturer
(D) Samples as required by specifications (minimum of 3) – coordinate distribution with DOC PM
(E) Certificates of product data as required by specifications

The Subcontractor shall not be relieved of responsibility for any deviations from the requirements of the Contract Documents by the Architect's approval of the shop drawings, product data, or samples unless the Subcontractor has specifically informed the Architect, in writing, of such deviation at the time of submission and the Architect has given written approval to said deviation.

49. PROGRESS RECORD DRAWINGS

The Construction Manager and Subcontractors shall maintain, at the Construction Manager's field office, a record copy of the Construction Documents. All Trades shall record changes and progress made during construction on a weekly basis. Monthly progress payment by the Owner will only be contingent upon these documents being correct and current.

50. RECORD DRAWINGS AND O&M MANUALS

All Subcontractors \ Suppliers are responsible for their record drawings (as-builts), O&M Manuals, guarantees, etc., and other closeout items required by the Contract Documents. These items should be collected and submitted via Newforma as the project nears completion (28 days prior to completion). **There will be no retainage reduction until these items are submitted and approved.**

51. STARTING SYSTEMS

The start-up and testing of systems or equipment will be coordinated with the Construction Manager, Owner, Architect, and the Commissioning Agent. A seven-day written notice is required prior to the start-up of each item.

52. COORDINATION OF WORK WITH OWNER'S ACTIVITIES

The Owner reserves the right to limit and/or cease work of the Subcontractors in the event of special functions located on their property. Such functions may be commencement activities, convocations, reunions, reading week, etc. All Subcontractors will be expected to work together with Construction Manager to accommodate the Owner.

53. DANIEL O'CONNELL'S SONS' CONTRACT EXHIBITS

Exhibit "A"	-	Insurance
Exhibit "B"	-	Requirements for Requisitioning
Exhibit "C"	-	Certification and Partial Waiver of Lien
Exhibit "D"	-	Equal Opportunity
Exhibit "E"	-	Scope of Work Clarifications
Exhibit "F"	-	Purchase and Delivery Schedule/Material Status Report
Exhibit "G"	-	List of Contract Documents
Exhibit "H"	-	Affidavit of Final Payment & Release of Lien
Exhibit "I"	-	Tax Exempt Certificate
Exhibit "J"	-	DOC Summary Instructions to Trade Bidders
Exhibit "K"	-	DOC Site Logistics Plan
Exhibit "L"	-	Schedule of Wage Rates Breakdown
Exhibit "M"	-	Subcontractor's Guarantee/Warranty Form – One Year
Exhibit "N"	-	Project Schedule
Exhibit "O"	-	Project Site Specific Safety Plan (SSSP)
Exhibit "P"	-	Rider "A" – Chapter 149 Section 29E
Exhibit "Q"	-	Rider "B" – Chapter 149 Section 29F
Exhibit "R"	-	Prevailing Wage Rates
Exhibit "S"	-	Owner's General Conditions

- END OF DOC SUMMARY INSTRUCTIONS TO TRADE BIDDERS -

ESTABLISHED 1879

Daniel O'Connell's Sons

Construction Managers and
General Contractors

480 Hampden Street
Holyoke, MA 01040
(413) 534-5667
FAX (413) 534-2902

TRADE LIST OF EXHIBITS

EXHIBIT "A" IS INSURANCE

EXHIBIT "B" IS REQUIREMENTS FOR REQUISITIONING

EXHIBIT "C" IS CERTIFICATION AND PARTIAL WAIVER OF LIEN

EXHIBIT "D" IS EQUAL OPPORTUNITY

EXHIBIT "E" IS SCOPE OF WORK CLARIFICATIONS

EXHIBIT "F" IS PURCHASE AND DELIVERY SCHEDULE/MATERIAL STATUS REPORT

EXHIBIT "G" IS LIST OF CONTRACT DOCUMENTS

EXHIBIT "H" IS AFFIDAVIT OF FINALPAYMENT & RELEASE OF LIEN

EXHIBIT “I” IS THE TAX EXEMPT CERTIFICATE

EXHIBIT “J” IS THE DOC SUMMARY INSTRUCTIONS

EXHIBIT “K” IS THE DOC SITE LOGISTICS PLAN

EXHIBIT “L” IS THE SCHEDULE OF WAGE RATES BREAKDOWN

EXHIBIT “M” IS THE SUBCONTRACTOR GUARANTEE / WARRANTY FORM

EXHIBIT “N” IS THE PROJECT SCHEDULE

EXHIBIT “O” IS PROJECT SITE SPECIFIC SAFETY PLAN (SSSP)

EXHIBIT “P” IS SUBCONTRACT RIDER “A” – CHAPTER 149 SECTION 29E

EXHIBIT “Q” IS SUBCONTRACTOR RIDER “B” – CHAPTER 149 SECTION 29F

EXHIBIT “R” IS THE PREVAILING WAGE RATES

EXHIBIT “S” IS THE OWNER’S GENERAL CONDITIONS

Exhibit "A"

DOC INSURANCE REQUIREMENTS

I. Subcontractor's Liability Insurance

A. The Subcontractor shall purchase and maintain, in a company or companies licensed to do business in the state in which the Project is located, insurance as will protect Subcontractor, Owner, Owner's Lender(s), Owner's Representative (if any), the Architect, and Construction Manager from claims set forth below which may arise out of or result from the Subcontractor's operations under the Subcontract, whether such operations be by Subcontractor, or by any Sub-subcontractor of Subcontractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

1. Claims under workers' compensation, disability benefit and other similar employee benefit acts;

2. Claims for damages because of bodily injury, occupational sickness or disease, or death of an employee or employees of Subcontractor and any Sub-subcontractor;

3. Claims for damages because of bodily injury, sickness or disease, or death of any person other than an employee or employees of Subcontractor or any Sub-subcontractor;

4. Claims for damages insured by usual personal injury liability coverage which are sustained (i) by any person as a result of an offense directly or indirectly related to the employment of such person by the Subcontractor, or (ii) by any other person;

5. Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom; and

6. Claims for damages because of bodily injury or death of any person; personal injury or property damage arising out of the ownership, maintenance or use of any vehicle.

II. The insurance required by subparagraph (1), above, shall be written for liability specified herein or required by law, whichever is greater, and shall include contractual liability insurance as applicable to the Subcontractor's obligations under the Subcontract.

III. Certificates of insurance acceptable to the Construction Manager and Owner shall be filed with the Construction Manager, containing the requirements that follow. Attached to each Certificate of insurance shall be a copy of the Additional Insured Endorsement that is a part of the Subcontractor's Commercial General Liability Policy.

A. Subcontractor and, unless otherwise specified, each of Subcontractor's Sub-subcontractors, shall obtain and maintain insurance coverage set forth herein in companies satisfactory to the Owner and shall name the Owner, Owner's Lender(s), Owner's representative (if any), the Architect, and the Construction Manager, Daniel O'Connell's Sons, Inc., and their respective officers, directors, agents, employees, heirs, partners, members, legal representatives, successors and assigns, and such other parties as the Construction Manager may identify by notice to the Subcontractor, as **additional insureds**, using ISO Additional Insured Endorsement CG 2010 (10/01) and CG 2037 (10/01) or CG 2033 (10/01) and CG 2037 (10 01), or an endorsement acceptable to the Owner providing equivalent coverage to the additional insureds. Such additional insurance shall be as broad as the coverage provided for the named insured Subcontractor and shall apply as primary and non-contributing insurance before any other insurance or self-insurance, including but not limited to, any deductible maintained by, or provided to, the additional insureds. Subcontractor shall not commence Work under the Subcontract, nor shall Subcontractor allow any Sub-Subcontractor to commence work, until true copies or certificates evidencing such insurance have been submitted to and approved in form and in content by Construction Manager and the Owner.

The Subcontractor shall maintain completed operations coverage for not less than three (3) years after final completion of the Work.

Each policy shall provide that it will not be canceled or materially altered except after thirty (30) days' advance written notice to Construction Manager mailed to the address indicated in the Subcontract, and the certificates of insurance shall so state. Upon receipt of any notice of cancellation or alteration, Subcontractor shall, within ten (10) days, procure other policies, about to be canceled or altered, and, if Subcontractor fails to provide, procure, and deliver acceptable policies of insurance, or satisfactory evidence thereof, in accordance with the terms hereof then at Construction Manager's option, Construction Manager may obtain such insurance at the cost and expense of Subcontractor, without the need of any notice to Subcontractor.

If the Subcontractor shall fail to certify required insurance coverage to the Construction Manager as set forth herein, before commencing Work under the Subcontract, the Construction Manager may, at its option, place insurance of the character, nature, and limits described herein to cover the operations of the Subcontractor, paying the premiums for the same and charging same to the Subcontractor.

The Construction Manager may, at its option, require the Subcontractor to furnish originals or certified copies of the policy or policies including all endorsements required to provide stated coverages.

The Construction Manager may, at its option, terminate the Subcontract in the event the Subcontractor fails to procure and maintain the insurance coverage and limits described herein upon thirty (30) days written notice to the Subcontractor. The Subcontractor shall be entitled to payment for all Work executed prior to said termination and for any direct loss (but excluding any indirect, incidental or consequential loss) sustained by the Subcontractor who furnishes satisfactory proof of such loss, and including an allowance for profit on the Work executed prior to termination, all as determined by the Architect, but excluding any and all claims or payment for loss of profit on that portion of the work not executed.

B. The insurance required under this Exhibit "A" shall, at a minimum, include the following coverage and limits, or such greater coverage or larger limits as may be required by law, in the following categories, amounts and detail:

1. Worker's Compensation and Employer's Liability Coverage

   a. If applicable, coverage required for United States Longshore and Harborworkers Act, Maritime Coverage, and the Jones Act.

   b. Endorsements required:

      (1) Broad form all states endorsement
      (2) Voluntary compensation endorsement

   c. Policy limits:

      (1) Coverage A. (Worker's Compensation) = statutory

      (2) Coverage B. (Employer's Liability)

      - Bodily Injury By Accident $500,000 Each Accident
      - Bodily Injury by Disease $500,000 Each Employee

2. Comprehensive General Liability

   a. Endorsements required:

      (1) Premises - operations liability
      (2) Independent contractor's liability
      (3) Completed operations and products liability
      (4) Broad form contractual liability
      (5) Personal and advertising injury liability
      (6) Broad form property damage liability including completed operations
      (7) Blanket "XCU" coverage (if applicable)
      (8) Employees as additional insureds

   b. Policy limits:

      (1) Bodily injury: $1,000,000 per occurrence
      $2,000,000 annual aggregate

      (2) Property damage: $1,000,000 per occurrence
      $2,000,000 annual aggregate

      (3) Contractual bodily injury: $1,000,000 per occurrence
      $2,000,000 annual aggregate

      (4) Contractual property damage: $1,000,000 per occurrence
      $2,000,000 annual aggregate

      (5) Personal injury: $1,000,000 per occurrence
      $2,000,000 annual aggregate

      (6) Products and completed operations: $1,000,000 annual aggregate

      (7) Medical expenses: $5,000

3. Comprehensive Automobile Liability

a Including coverage for owned, non-owned and hired vehicles; including the loading or unloading thereof.

b. Policy limits:
(1) Bodily injury = $1,000,000 per occurrence
(2) Property damage = $1,000,000 per occurrence
or
(3) Bodily Injury/Property damage = $1,000,000 Combined Single Limit

4. Pollution Control Liability Include coverage for liability arising out of pollution related exposure:
(1) Bodily injury: $1,000,000 per occurrence
$2,000,000 annual aggregate

(2) Property damage $1,000,000 per occurrence
$2,000,000 annual aggregate

5. Commercial Excess Liability (Umbrella) Coverage

a. The umbrella policy shall contain a minimum total occurrence and aggregate limit of

$2,000,000 if the subcontract amount is $1,000,000 or under;
$5,000,000 if the subcontract amount is between $1,000,000.01 and $5,000,000; and
$10,000,000 if the subcontract amount if between $5,000,000.01 and $10,000,000.

The policy(ies) shall contain coverage no less restrictive than that required under Paragraph III B.2a, 2b and III B.3a, 3b above.

6. Any combination of Comprehensive General Liability and Excess Liability (Umbrella) insurance with limits totaling at least

$4,000,000 if the Subcontract amount is $1,000,000 or under;
$7,000,000 if the Subcontract amount is between $1,000,000 and $5,000,000; and
$12,000,000 if the Subcontract amount if between $5,000,000 and $10,000,000.

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6. Watercraft Hull and Protection and Indemnity Liability (if applicable)

a. Including coverage for owned, non-owned, and hired crafts; including the loading or unloading thereof.

b. Policy limits: Value of hull and N/A (protection and indemnity) bodily injury and property damage.

7. Aircraft Hull and Liability (if applicable)

a. Including coverage for owned, non-owned, and hired crafts; including loading and unloading thereof.

b. Policy limits: Combined single limit bodily injury and property damage = N/A to include passenger liability without any seat limitations.

8. Professional Liability Insurance (if applicable)

a. In the amount of $2,000,000, each claim. Coverage shall remain in force and in effect for a minimum of one year following the Owner's acceptance and occupancy of the project.

C. The insurance policies required under this Exhibit "A" shall include the following waiver of subrogation:

To the fullest extent permitted by law, Subcontractor waives all rights against Owner, Owner's lender(s), Owner's Representative (if any), the Architect, and Construction Manager, and their respective officers, directors, partners, members, agents, employees, heirs, legal representatives, successors and assigns, for recovery of damages to the extent said damages are covered by any of the insurance required to be procured and maintained by the Subcontractor hereunder.

EXHIBIT B

Requirements for Requistioning

1. Subcontractor shall provide a draft of its Application for Payment covering work performed and to be performed in each monthly payment period (the "Pencil Requisition") via an attachment to an electronic mail message in portable document format (PDF) to the Construction Manager / Contractor's Project Manager (or such other designee as such is set forth in writing by Construction Manager / Contractor's Project Manager) no earlier than the **20th day** and no later than the **22nd day** of the month. In the event that the aforementioned date(s) fall on a weekend, holiday or other non-work day for the Construction Manager / Contractor, such dates shall be adjusted without notice to the last business day prior to such date(s). Furthermore, Construction Manager / Contractor shall have the right, in its sole discretion, to modify the aforementioned date(s) on a month-by-month or permanent basis upon notice to Subcontractor.

2. The cover page of the Pencil Requisition must be marked, "DRAFT", and be completed using an AIA G702 / G703 format with both front sheet and continuation forms completed.

3. The Pencil Requisition must contain all supporting documentation required by the Contract Documents, the Construction Manager / Contractor and the Owner, including, without limitation an updated certificate of insurance as outlined in Exhibit A, and, to the extent applicable and required by Construction Manager / Contractor, photographs and affidavits relating to materials stored off-site with Construction Manager / Contractor's consent, transfers of title and required MBE, WBE and DBE documentation. In the event that the referenced exhibits are not part of the Subcontract or Purchase Order, the forms of such required documents shall conform to those required by Construction Manager / Contractor in Construction Manager / Contractor's sole discretion.

4. Submission of the Pencil Requisition shall not be considered submission of an Application for Payment for the purposes of M.G.L. Chapter 149, Section 29E.

5. Subcontractor shall use best efforts to timely cooperate, coordinate and meet with Construction Manager / Contractor regarding Subcontractor's Pencil Requisition upon Construction Manager / Contractor's request. Subcontractor shall revise the Pencil Requisition prior to submission of its Application for Payment in accordance with Construction Manager / Contractor's direction and include all such revisions in Subcontractor's Application for Payment.

6. Construction Manager / Contractor reserves the right to reject Subcontractor's Application for Payment in the event that Subcontractor's Pencil Requisition is not submitted, prepared or revised in strict accordance with the terms and conditions of this Rider.

7. Subcontractor shall submit its Application for Payment covering work performed and to be performed in each monthly payment period in either a hard copy original form to 480 Hampden Street, Holyoke, MA 01040, Attn.: Accounts Payable or via an attachment to an electronic mail message in PDF format to invoices@oconnells.com no later than 5 days after final approval by Construction Manager / Contractor's Project Manager (or such other designee as such is set forth in writing by Construction Manager / Contractor's Project Manager). Such hard copies must be complete in original form with original signatures and notary stamps and seals. Copies will not be accepted. In the event that the aforementioned date(s) fall on a weekend, holiday or other non-work day for the Construction Manager / Contractor, such dates shall be adjusted without notice to the last business day prior to such date(s). Furthermore, Construction Manager / Contractor shall have the right, in its sole discretion, to modify the aforementioned date(s) on a month-by-month or permanent basis upon notice to Subcontractor. Construction Manager / Contractor shall review and make payment to Subcontractor of an Application for Payment, only to the extent of approval thereof, not later than the maximum time periods permitted by law.

8 The Application for Payment must include all necessary signatures and notary stamps and seals, all revisions to the Pencil Requisition directed by Construction Manager / Contractor, a Subcontractor Waiver of Lien in the form attached as Exhibit C and all other supporting documentation required by the Contract Documents, Construction Manager / Contractor and Owner. In the event that the referenced exhibit is not part of the Subcontract or Purchase Order, the forms of such required documents shall conform to those required by Construction Manager / Contractor in Construction Manager / Contractor's sole discretion. Application for final payment may require additional or revised documentation upon Construction Manager / Contractor's direction at Construction Manager / Contractor's sole discretion.

9 Any verbal, written or implied statement by Construction Manager / Contractor or any of its employees or agents shall not be deemed to be an approval of Subcontractor's Application for Payment. Construction Manager / Contractor's inclusion and submission of Subcontractor's Application for Payment in Construction Manager / Contractor's Application for Payment to the Owner shall not be deemed or construed to mean that Construction Manager / Contractor has approved, in whole or in part, Subcontractor's Application for Payment.

10 Construction Manager / Contractor may reject an Application for Payment in whole or in part due to any inaccuracies or omissions in such Application for Payment or for Subcontractor's failure to fulfill any obligation set forth in the Subcontract, including, without limitation, (i) defective Work not remedied; (ii) third party claims filed or probable filing of such claims; (iii) failure of Subcontractor to make payments properly to union benefit funds or for labor, materials or equipment; (iv) reasonable evidence that the Work cannot be completed for the unpaid balance of the Subcontract Price or the Subcontract Time: (v) damage to Construction Manager / Contractor, Owner or a separate contractor; (vi) failure to carry out the Work in accordance with the Subcontract or Contract Documents; (vii) failure of Subcontractor's Pencil Requisition or Application for Payment to comply with all applicable provisions of the Subcontract, including this Exhibit B; (viii) Owner's rejection, in whole or in part, of Subcontractor's Application for Payment; (ix) Owner's rejection, in whole or in part, of Construction Manager / Contractor's application for payment in which Subcontractor's Application for Payment is included; (x) failure to fulfill any and all insurance requirements set forth in this Subcontract; or (xi) any other breach of any term or condition of the Subcontract.

11 In the event that Construction Manager / Contractor rejects an Application for Payment, Subcontractor shall not be entitled to submit an Application for Payment covering the period set forth in the rejected Application for Payment until the following application for payment is due to be submitted.

12 Construction Manager / Contractor may, in its sole discretion, issue joint checks to Subcontractor and to any union benefit fund or lower tier subcontractor, supplier, vendor and require Subcontractor to furnish any and all lien and claim waivers and releases in forms acceptable to Construction Manager / Contractor in Construction Manager / Contractor's sole discretion from any such joint payees as a condition precedent to Construction Manager / Contractor making any payment to Subcontractor**.**

13 <u>All major subcontractors, especially the MEP subs, shall have a line item in their Schedule of Values breakdown for monthly requisitioning that allows up to 5% of their Contract Value to cover the cost to track, collect, organize and submit for approval all required close-out items (record drawings/as-built documents, O&M Manuals, warranties, stock/spare materials, punch lists and final release of lien.)</u>

EXHIBIT "C"
CERTIFICATION AND PARTIAL WAIVER OF LIEN – SUBCONTRACTOR OR SUPPLIER
(To be Submitted with Each Application for Payment)

OWNER:

CONSTRUCTION MANAGER / CONTRACTOR:

PROJECT:

SUBCONTRACTOR OR SUPPLIER:

Current Contract Amount: $_____

Total Amount Previously Paid $_____

Total Amount Invoiced and Outstanding $_____ Invoice Date(s):_____

Retainage Held to Date: $_____

In consideration of all past payments received in connection with the Project, and upon receipt of the amount set forth above the Subcontractor or Supplier acknowledges and agrees that except for the retainage listed above, it has been paid in full for all labor, materials and/or equipment furnished by the Subcontractor or Supplier and by its Sub-subcontractors or Sub-suppliers in connection with the Project, including work required by the Contract Documents and any work claimed to be additional work thereunder.

Except to any extent prohibited by law, in which case the provisions of this paragraph shall be severed herefrom and all other terms, conditions, covenants, warranties and representations herein shall be otherwise remain in full force and effect, the Subcontractor or Supplier hereby releases, discharges, relinquishes and waives any and all liens, claims or rights to lien with respect to the Owner, the Project and/or Construction Manager / Contractor on account of any labor, materials and/or equipment previously furnished and paid for as shown above.

The undersigned warrants that all potential lien or bond claimants whose claims arise from the undersigned's work, including but not limited to laborers, trustees of employee benefit groups, materialmen**,** suppliers, subcontractors, and any other service providers engaged or employed by the undersigned in connection with the Project, (collectively the "CLAIMANTS"), have been paid in full and that none of such CLAIMANTS has any claim, demand or lien against the Project on account of any labor, materials and/or equipment previously furnished and paid for as shown above. The undersigned further warrants that all applicable taxes, fees and benefits relating directly or indirectly to the undersigned's work have been paid in full on account of any labor, materials and/or equipment previously furnished and paid for as shown above.

The undersigned individual represents and warrants that he/she is the duly authorized representative of the Subcontractor or Supplier, empowered and authorized to execute and deliver this document on behalf of the Subcontractor or Supplier and that this document shall be binding upon the Subcontractor or Supplier.

Signed under the penalties of perjury as of this _____ date of _____ , 20_____

_____
Name of Subcontractor or Supplier Releasing Lien

_____
Signature of Individual Signing this Lien Waiver

_____
Printed Name and Title of Above Individual

Submitted with Construction Manager's Payment Application No. _____

Exhibit "D"

15.3 Equal Opportunity

A. During the performance of this contract the Subcontractor agrees as follows:

1. The Subcontractor will not discriminate against any employee or applicant for employment because of race, color, sex, religion, national origin, handicap, or age. The Subcontractor will take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to their race, color, sex, religion, national origin, handicap or age. Such action shall include but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Subcontractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by an appropriate agency or the federal government setting forth the requirements of these nondiscrimination provisions.

2. The Subcontractor will state, in all solicitations or advertisements for employees placed by or on behalf of the Subcontractor, that all qualified applicants will receive consideration for employment without regard to race, color, sex, religion, national origin, handicap, or age.

3. The Subcontractor will send to each representative of workers with which the Subcontractor has a collective bargaining agreement or other contract or understanding a notice to be provided by the Owner, advising the workers' representative of the Subcontractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965 as amended, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. The Subcontractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and the rules, regulations and relevant orders of the Secretary of Labor.

5. The Subcontractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965 as amended, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and shall permit access to his books, records and accounts by an appropriate agency of the federal government and by the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

6. In the event of the Subcontractor's noncompliance with the equal opportunity conditions of this contract or with any of such rules, regulations or orders, this contract may be canceled, terminated or suspended in whole or in part, and the Subcontractor may be declared ineligible for further government contracts or federally assisted contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions may be imposed and remedies invoked as provided in said Executive Order, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

7. The Subcontractor will include this exhibit in every subcontract or purchase order unless exempted by rules, regulations or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each Sub-Subcontractor or Vendor. The Subcontractor will take such action with respect to any Sub-Subcontractor or Vendor as the appropriate agency of the federal government may direct as a means of enforcing such provisions, including sanctions for noncompliance, provided, however, that in the event the Subcontractor becomes involved in, or is threatened with, litigation with a Sub-Subcontractor or Vendor as a result of such direction by the appropriate agency of the federal government, the Subcontractor may request the United States to enter into such litigation to protect the interests of the United States.

ESTABLISHED 1879

Daniel O'Connell's Sons
Construction Managers and
General Contractors

480 Hampden Street
Holyoke, MA 01040
(413) 534-5667
FAX (413) 534-2902

Exhibit "E"

Scope of Work Clarifications for Trade Bidders

Olive Street Parking Facility
Greenfield, MA

Bid Documents included in Package

1. DESMAN, Inc. Bid Documents: Olive Street Parking Facility, Greenfield, Massachusetts: Construction Documents – Bid Set: Drawings and Specifications dated September 6, 2017.
2. DOC Summary Instructions To Trade Bidders (Exhibit J) and Exhibits A, B, C, D, E, F, G, H, I, K, L, M, N, O, P, Q, R. and S.
3. Exhibit "E" - Scope of Work Clarifications for Trade Bidders

Scope of the Work Clarifications:

This scope clarification exhibit is to be used in conjunction with the Olive Street Parking Facility, Greenfield Massachusetts, Construction Documents – Bid Set: Drawings and Specifications dated September 6, 2017. It is not, in any way, intended to limit the scope of the work as defined by the contract drawings and specifications issued by DESMAN, Inc. dated August 23, 2017 and addenda. Therefore, the work is inclusive of **but not limited to** the following:

General Item Clarifications: Applies to all Trade Bidder Divisions

1. Police details will be furnished by the Construction Manager.
2. Responsible for adhering to the project issued Storm Water Pollution Prevention Plan.
3. The Trade subcontractors are responsible for coring of all holes in the precast structure and foundations required to complete their installations that are not being provided by the precast subcontractor as detailed on the contract drawings.
4. Staging. Planking and Scaffolding: All Trade subcontractors shall furnish, install and maintain in a safe and adequate condition, all staging, planking, scaffolding, man-lifts and platform lifts, stationary or moveable, and regardless of height, that is necessary for the proper execution of the Work of this Section.
5. Hoisting: All Trade subcontractors shall furnish, install and maintain in a safe and adequate condition all mechanical hoisting equipment, operating personnel and rigging that is necessary for the proper execution of the Work of this Section.

Masonry
Division 04200 – Unit Masonry - Clarifications

The following clarification items are to be included in the Masonry Trade Bid and are only provided as a guide. This list is not, in any way, intended to limit the scope of the work as defined by the contract drawings and specifications issued by DESMAN, Inc. dated September 6, 2017 and addenda. Therefore, the work is inclusive of **but not limited to** the following:

1. Interior CMU walls located on Level 1 including all masonry lintels, setting and building in door frames, grout, and masonry reinforcing.
2. Blocking in/Building in of Elevator door frames as shown in Details 1 and 2 on A502. Infill can be installed off operating elevator car.

Miscellaneous and Ornamental Iron
Division 05500 - Miscellaneous Metals – Clarifications

The following clarification items are to be included in the Miscellaneous Metals Trade Bid and are only provided as a guide. This list is not, in any way, intended to limit the scope of the work as defined by the contract drawings and specifications issued by DESMAN, Inc. dated September 6, 2017 and addenda. Therefore, the work is inclusive of **but not limited to** the following:

1. Furnish and install support angles for elevator door sills.
2. Furnish and install cants in elevator hoistway.
3. Furnish and install North Entry Canopy complete.
4. Furnish and install aluminum tube columns located on the exterior of the building (note that some are base bid and most are an alternate).
5. Furnish and install seismic clips at masonry walls.
6. Furnish and install concrete filled bollards with specified plastic sleeves. Include grouting base plate.
7. Furnish and install all pipe guards protecting MEP piping and conduit as detailed.
8. Furnish and install exterior railing at handicapped ramp. Hot dipped galvanized.
9. Furnish and install all stair railings and guard railings. Hot dipped galvanized.
10. Snow gate. Hot dipped galvanized. Items cast into precast will be provided by precast subcontractor.
11. Furnish elevator sump pit frame and furnish and install elevator sump pit grate.
12. Furnish and install exterior spandrel railings. Hot dipped galvanized and factory finished per specifications (note this is an Alternate).

Roofing and Flashing
Division 07000 – Roofing and Flashing – Clarifications
Division 07541 – Polyvinyl Chloride (PVC) Membrane Roofing – Clarifications
Division 07620 – Flashing and Sheet Metal – Clarifications
Division 07710 – Roof Specialties – Clarifications

The following clarification items are to be included in the Roofing and Flashing Trade Bid and are only provided as a guide. This list is not, in any way, intended to limit the scope of the work as defined by the contract drawings and specifications issued by DESMAN, Inc. dated September 6, 2017 and addenda. Therefore, the work is inclusive of **but not limited to** the following:

1. Furnish all roofing and flashing for the South Stair roof, North Stair roof and Elevator roof.
2. Cutting of reglets into precast required to install counter flashing, Detail 9 on A207 typical, is the work of the Roofing Trade subcontractor.

Joint Sealants
Division 07920 – Joint Sealants – Clarifications
Division 07950 – Expansion Control – Clarifications

The following clarification items are to be included in the Joint Sealants Trade Bid and are only provided as a guide. This list is not, in any way, intended to limit the scope of the work as defined by the contract drawings and specifications issued by DESMAN, Inc. dated September 6, 2017 and addenda. Therefore, the work is inclusive of **but not limited to** the following:

1. This trade subcontract does not include exterior sidewalk sealants.
2. Caulking subcontractor to inspect and accept work prior to installation of materials.
3. Caulking subcontractor to grind and remove laitance from all joints prior to caulking.
4. Caulking subcontractor to provide blow down prior to sealing.

5. Caulking subcontractor will grind and prime all joints prior to caulking.
6. Bond breaker tape or backer rod must be used at bottom of joint to prevent bond.
7. Caulk double tee to double tee flange joints. Joints will vary +/- ¾".
8. Caulk double tee perimeter joints to spandrels, column, beams and walls. Joints will vary +/- 1".
9. Caulk interior spandrel to column joints including top and bottom of spandrel. Joints will vary +/- ½".
10. Grouted precast to cast in place joints will range from 1"-3" as identified on the drawings and can vary +/- ½".
11. Grouted precast joints will range from 1"-3" as identified on the drawings and can vary +/- ½".
12. Caulk around all embedded floor/roof drain frames located in cast in place concrete or precast floors.
13. Caulk stair risers and stair landings.
14. Architectural caulk all exterior precast to precast joints.
15. Caulk lift pockets in all precast products including spandrels, beams and tees.
16. Caulk all weld pockets.
17. Caulk all vee joints in cast in place topping concrete on precast.
18. Caulk cast in place concrete topping to precast.
19. Elevator Tower and adjacent MEP shaft requires 2 hour fire rated sealant system per documents.
20. A portion of the West wall of the garage adjacent to the Dance Studio is required to be 2 hour rated. See notes on Drawing A001. Provide a 2 hour rated sealant system per documents.
21. Masonry to precast joints will range from 1"-2".
22. Caulk all hollow metal door frames.
23. Caulk all stainless steel elevator entrance frames.
24. Caulk elevator louver and elevator machine room vent.
25. Caulk all storefront/curtainwall abutting dissimilar materials.
26. Expansion Joint including all required preparation of the precast and cast-in-place concrete required for proper installation.
27. Caulking subcontractor to survey and repair any leaks during warranty period.

Painting
Division 09900 – Painting – Clarifications

The following clarification items are to be included in the Joint Sealants Trade Bid and are only provided as a guide. This list is not, in any way, intended to limit the scope of the work as defined by the contract drawings and specifications issued by DESMAN, Inc. dated September 6, 2017 and addenda. Therefore, the work is inclusive of **but not limited to** the following:

No specific clarifications issued**.**

Plumbing
Division 15316 – Sanitary Waste and Vent Piping – Clarifications
Division 15319 – Sanitary Waste Piping and Specialties – Clarifications
Division 15323 – Sanitary Waste Interceptors – Clarifications
Division 15413 – Facility Storm Drainage Piping – Clarifications
Division 15529 – Hangers and Supports for Plumbing Piping – Clarifications
Division 15719 – Piping Insulation – Clarifications

The following clarification items are to be included in the Joint Sealants Trade Bid and are only provided as a guide. This list is not, in any way, intended to limit the scope of the work as defined by the contract drawings and specifications issued by DESMAN, Inc. dated September 6, 2017 and addenda. Therefore, the work is inclusive of **but not limited to** the following:

1. Floor drain bodies that are required to be cast into the precast double tees are to be shipped to the precast subcontractor's factory located in Shaftsbury, Vermont.

HVAC
Division 15126 – Split System Air Conditioners – Clarifications
Division 15239 – Propeller Unit Heaters – Clarifications
Division 15126 – Refrigerant Piping – Clarifications

The following clarification items are to be included in the Joint Sealants Trade Bid and are only provided as a guide. This list is not, in any way, intended to limit the scope of the work as defined by the contract drawings and specifications issued by DESMAN, Inc. dated September 6, 2017 and addenda. Therefore, the work is inclusive of **but not limited to** the following:

No specific clarifications issued**.**

Electrical
Division 16050 – Basic Electrical Materials and Methods – Clarifications
Division 16060 – Grounding and Bonding – Clarifications
Division 16073 – Hangers and Supports for Electrical Systems – Clarifications

The following clarification items are to be included in the Joint Sealants Trade Bid and are only provided as a guide. This list is not, in any way, intended to limit the scope of the work as defined by the contract drawings and specifications issued by DESMAN, Inc. dated September 6, 2017 and addenda. Therefore, the work is inclusive of **but not limited to** the following:

1. Temporary Electricity and Lighting: The Electrical Trade Subcontractor shall make arrangements for and provide equipment, poles, meter, wiring, switches, outlets, etc. required as necessary to provide for all lighting and power requirements for construction purposes. The Electrical Trade Subcontractor shall be responsible for all negotiations and coordination with the electrical utility company, and shall pay for all electrical company charges associated with the temporary service. Provide and maintain adequate lighting, in accordance with all State and Federal laws, with local switching for safe access and egress, security, and for providing adequate illumination for construction operations. Provide a 200 amp temporary service. Remove all temporary equipment when no longer needed.

Exhibit "F"

Purchase and Delivery Schedule

Daniel O'Connell's Sons, Inc.

Job Name:

Location:

Client:

Class of Work: _____

Subcontractor/Supplier:_____

Report No. _____

Report Date: _____

Sheet _____ **of** _____

Project No.:

				Purchase Order		Submittals				Delivery				
Spec Ref	Description	Manufacturer	Supplier	No.	Date	From Manuf.	To DO'C	Rec'd App	To Manuf.	Required at Job	Sched. Shipment	Released Shipment	Received at Job	Remarks

Exhibit "F"

Exhibit G

List of Contract Documents
Greenfield Olive Street Garage

Documents	Permit Set Dated 8/23/2017
Drawings	
Informational	
G000 - Title Sheet	9/6/2017
G001 - Drawings List	9/6/2017
Civil	
C1 - Standard Notes, Legend & Table of Contents	9/6/2017
C2 - Existing Condition Plan	9/6/2017
C3 - Site Plan	9/6/2017
C4 - Grading Plan	9/6/2017
C5 - Utility Plan	9/6/2017
C6 - Improvement Plan - Olive Street	9/6/2017
C7 - Improvement Plan - Proposed Drive	9/6/2017
C8 - Improvement Plan - Alley	9/6/2017
C9 - Erosion Control Plan	9/6/2017
C10 - Detail Sheet	9/6/2017
C11 - Detail Sheet	9/6/2017
C12 - Dry Utility Plan	9/6/2017
L1 - Landscape Plan - Sheet 1	9/6/2017
L2 - Landscape Plan - Sheet 2	9/6/2017
Architectural	
A001 - Code Summary	9/6/2017
A002 - Mock-Up Details	9/6/2017
A101 - Grade Level Floor Plan	9/6/2017
A102 - Second Level Floor Plan	9/6/2017
A103 - Third Level Floor Plan	9/6/2017
A104 - Roof Level Floor Plan	9/6/2017
A201 - Exterior Elevations	9/6/2017
A202 - Exterior Elevations	9/6/2017
A203 - Isometric Views	9/6/2017
A204 - Elevation Details	9/6/2017
A205 - Elevation Details	9/6/2017
A206 - Bas-Relief Details	9/6/2017
A207 - Roof & Canopy Details	9/6/2017
A208 - Signage Details	9/6/2017
A301 - Interior Sections	9/6/2017
A302 - Exterior Sections	9/6/2017
A401 - Enlarged Stair Plans	9/6/2017
A402 - Stair Details	9/6/2017

Exhibit G

List of Contract Documents
Greenfield Olive Street Garage

A501 - Curtain Wall & Storefront Details	9/6/2017
A502 - Door Schedule & Misc. Details	9/6/2017
A701 - Typical Details	9/6/2017
A800 - Signage Details	9/6/2017
A801 - Grade Signage Plans and Mounting Details	9/6/2017
A802 - Typical & Roof Level Signage Plan	9/6/2017
Structural	
S001 - General Notes	9/6/2017
S002 - Column Loads & Base Shear Diagram	9/6/2017
S003 - Typical Foundation Details	9/6/2017
S004 - Typical Foundation Details	9/6/2017
S005 - Typical Masonry Details	9/6/2017
S101 - Foundation Plan	9/6/2017
S102 - Foundation Sections	9/6/2017
S103 - Foundation Sections	9/6/2017
S104 - Foundation Sections	9/6/2017
S105 - Foundation Elevations	9/6/2017
S106 - Foundation Elevations	9/6/2017
S121 - Jump Wall Details	9/6/2017
S131 - Shear Wall Sections and Details	9/6/2017
S140 - South Stair Details	9/6/2017
S201 - Slab-on-Grade Plan	9/6/2017
S202 - Typical Level Framing Plan	9/6/2017
S203 - Roof Level Framing Plan	9/6/2017
S301 - Typical Precast Details	9/6/2017
S302 - Typical Precast Details	9/6/2017
S303 - Typical Precast Details	9/6/2017
S401 - Snow Gate Details	9/6/2017
S402 - Roof Steel Details	9/6/2017
S403 - Roof Steel Details	9/6/2017
S404 - Typical Barrier Cable Details	9/6/2017
Electrical	
E-001 - Electrical Symbols, Notes and Legends	9/6/2017
E-002 - Electrical Schedules and Risers	9/6/2017
E-003 - Electrical Site Plan	9/6/2017
E-111 - Electrical Ground Level Plan	9/6/2017
E-121 - Electrical Second Level Plan	9/6/2017
E-131 - Electrical Third Level Plan	9/6/2017
E-141 - Electrical Roof Level Plan	9/6/2017

Exhibit G

List of Contract Documents
Greenfield Olive Street Garage

Fire Protection	
FP001 - Fire Protection Notes, Symbols, and Details	9/6/2017
FP101 - Grade and Second Floor Fire Protection Plans	9/6/2017
FP102 - Third Floor and Roof Fire Protection Plans	9/6/2017
H001 - Mechanical Legends, Schedules and Details	9/6/2017
H100 - Mechanical Grade Level Plan	9/6/2017
H101 - Mechanical Roof Level Plan	9/6/2017
Plumbing	
P-001 - Plumbing Legends, Schedules, and Details	9/6/2017
P-100 - Plumbing Under Ground Plan	9/6/2017
P-101 - Plumbing Grade Level Plan	9/6/2017
P-102 - Plumbing Second Level Plan	9/6/2017
P-103 - Plumbing Third Level Plan	9/6/2017
P-104 - Plumbing Roof Level Plan	9/6/2017
Technical Specifications	
Project Specifications: Permit Set	9/6/2017
Fire Protection System Narrative Report	9/6/2017
Fire Protection Hydraulic Calculations	2/25/2017

Exhibit "H"

AFFIDAVIT OF FINAL PAYMENT & RELEASE

The sum of _____ represents the final payment due the undersigned under its contract with DANIEL O'CONNELL'S SONS, INC. ("DOC") for the furnishing of _____ (Trade/Scope of Work) for the _____ (Project Name) located at _____ (Project Address).

1. In consideration of the above described final payment and upon receipt of that final payment, the undersigned will have received payment in full for all services, labor, materials and equipment provided and/or for all work performed in connection with the construction of the Project. Except for the above stated final payment, and as an inducement to DOC to make said final payment, the undersigned hereby affirms that there are no outstanding claims against DOC, or against the owner of the Project (the "Owner"), or against either of its/their sureties or guarantors in connection with this Project.

2. In consideration of the above described final payment and upon receipt of that final payment, the undersigned does hereby forever release, waive, and discharge DOC, the Owner, their sureties, and any and all other guarantors or obligors on any Bond or other undertaking, along with their insurers, partners, officers, directors, agents, employees, attorneys, successors, administrators, executors, heirs and assigns (collectively hereinafter referred to as "RELEASEES") from any and all claims or demands for additional payment in connection with the Project and from any and all manner of actions, causes of action, suits, debts, accounts, claims, contracts, demands, agreements, encumbrances, liens, controversies, judgments, obligations, damages and liabilities of any kind, nature and description whatsoever, in law or equity, whether or not now known, suspected or claimed which the undersigned ever had, now has or hereafter may have or claim to have against said RELEASEES by reason of any act, transaction, practice, conduct or omission of RELEASEES or any matter, cause, effect, or thing of any kind whatsoever that arose or occurred prior to the date of this RELEASE, including, without limiting the generality of this RELEASE, any claim that arose out of, relates to or is based upon, in whole or in part, any act, transaction, practice, conduct, omission, matter, cause, effect or thing which was, or which could have been alleged or asserted against DOC and/or any of the other Releasees on account of any labor, materials and/or equipment previously furnished in connection with the Project.

3. The undersigned warrants that all potential lien or bond claimants whose claims arise from the undersigned's work, including but not limited to laborers, trustees of employee benefit groups, materialmen**,** suppliers, subcontractors, and any other service providers engaged or employed by the undersigned in connection with the Project, (collectively the "CLAIMANTS"), have been paid in full and that none of such CLAIMANTS has any claim, demand or lien against the Project. The undersigned further warrants that all applicable taxes, fees and benefits relating directly or indirectly to the undersigned's work have been paid in full.

4. The undersigned hereby agrees to indemnify and hold harmless DOC and the other RELEASEES from any and all damages, costs, expenses, demands, causes of action, suits, debts, accounts, encumbrances, judgments, claims, demands and legal fees, directly or indirectly arising from any claim or lien by any CLAIMANT or other party which provided labor, services, equipment or materials to or on behalf of the undersigned in connection with the Project.

5. The undersigned has not and will not assign any claim against DOC, its sureties, and other guarantors on the Bond or other undertaking, nor any lien or right to perfect a lien against the Project. The undersigned warrants that no security interest has been given or executed by the undersigned for or in connection with any materials, appliances, machinery, fixtures, or furnishings placed upon or installed in the Project.

6. This AFFIDAVIT OF FINAL PAYMENT & RELEASE shall be an independent covenant and shall operate and be effective with respect to all work, services, labor, equipment or materials furnished in connection with the Project under any contract or supplemental contract, whether oral or written, and shall be applicable to any and all contract, extra or additional work performed or costs incurred at any time by the undersigned with respect to the Project.

IN WITNESS WHEREOF, with all right, power, and authority required to execute this document, this AFFIDAVIT OF PAYMENT & RELEASE has been executed on the _____day of _____, 20_____.

WITNESS: [SUBCONTRACTOR]

BY:_____ TITLE: _____

Duly Authorized

Subscribed, sworn to, and acknowledged before me this _____ day of _____ , 20 _____.

_____

My Commission Expires:_____ Notary Public

Exhibit I

Rev. 11/10

Massachusetts Department of Revenue

Form ST-5C
Contractor's Sales Tax Exempt Purchase Certificate

Part A. To be completed by governmental body, agency or IRC Section 501(c)(3) certified exempt organization

Exempt number: E 046 - 001 - 163

Contract number:

Name of exempt organization: Town of Greenfield

Authorizing signature: Edith J Benoit

Date: 8/15/17

Part B. To be completed by purchasing contractor or subcontractor claiming exemption under MGL Ch. 64H, sec. 6(d), (e), (f) or (tt)

Purchaser (☒ contractor ☐ subcontractor)

Daniel O'Connell's Sons, Inc.

Address

480 Hampden St PO Box 267 Holyoke Ma 01040

Date: 08/16/2017

Vendor registration number (if applicable): 04-1685580

Contract/subcontract number: 2017-107

Contract/subcontract date:

Estimated date of completion: October , 2018

Part C. To be completed by purchasing contractor or subcontractor claiming exemption. See instructions. I claim the exemption corresponding to the box checked below, and certify as follows (check appropriate box below):

1. ☐ *Exemption under MGL Ch. 64H, sec. 6(d) or (e): Contractor as Agent of Exempt Entity.* I certify that the purchaser is a contractor or subcontractor engaged in the performance of the above described contract and that the purchaser is acting as an agent of one the entities described below (check appropriate box) in purchasing tangible personal property (other than building materials and supplies described in MGL Ch. 64H, sec. 6(f)):

   ☐ Governmental body or agency described in MGL Ch. 64H, sec. 6(d) (local public school, city/town government, state agency, etc.). Attach Form ST-2, Certificate of Exemption. If Form ST-2 is not available, enter agency's exemption number.

   ☐ Tax exempt organization (under IRC Section 501(c)(3)) as described in MGL Ch. 64H, sec. 6(e) (parochial school, Scout troop, PTO, etc.). Attach Form ST-2, Certificate of Exemption.

To the best of my knowledge and belief, the quantities of tangible personal property noted on the reverse side are exempt from the sales/use tax under the provisions of MGL Ch. 64 H, sec. 6(d) or (e) as they are purchased by a purchaser acting as an agent for either a Massachusetts governmental body or for a tax-exempt organization under IRC section 501(c)(3).

2. ☒ *Exemption under MGL Ch. 64H, sec. 6(f): Building Materials and Supplies.* I certify that the purchaser is a contractor or subcontractor engaged in the performance of a contract for the construction, reconstruction, alteration, remodeling or repair of a building or structure for a governmental body or agency or for a certified IRC Section 501(c)(3) exempt organization or other project described in MGL Ch. 64H, sec. 6(f). To the best of my knowledge and belief, the described quantities of building materials and supplies noted on the reverse side are exempt from sales/use tax under the provisions of MGL Ch. 64H, sec. 6(f), and the described quantities of these materials and supplies are being purchased for use exclusively in the above contract.

3. ☐ *Exemption under MGL Ch. 64H, sec. 6(tt): Consulting/Operating Contractor as Agent of Governmental Entity.* I certify that the purchaser is a consulting or operating contractor or subcontractor as defined in MGL Ch. 64H, sec. 6(tt) and that the purchaser is authorized and acting as an agent of, and providing "qualified services," as defined in MGL Ch. 64H, sec. 6(tt), to a governmental body or agency described in MGL Ch. 64H, sec. 6(d). Attach Form ST-2. If Form ST-2 is not available, enter agency's exemption number. To the best of my knowledge and belief, the quantities of tangible personal property noted on the reverse side are exempt from the sales/use tax under the provisions of MGL Ch. 64 H, sec. 6(tt). The purchaser has been authorized under the above contract by a governmental body.

Regardless of the exemption claimed, I will maintain adequate records to show the disposition of all property purchased under this certificate. I understand that I am fully liable for the payment of any sales/use tax due in the event that the property purchased under this certificate is used in a non-exempt manner.

Signed under the penalties of perjury.

Signature: Kathleen Collins

Title: Controller

Location and description of project and description of kind and quantity of property or receipts/invoices must be attached or noted on the back of this form. This form is approved by the Commissioner of Revenue and may be reproduced.

Rev. 5/92

Massachusetts Department of Revenue

Form ST-5
Sales Tax Exempt Purchaser Certificate

To Be Completed by Exempt Organization

Name: TOWN OF GREENFIELD

Address: TOWN HALL 14 COURT SQUARE

City: GREENFIELD State: MA Zip: 01301

Exemption Number: 046-001-163 Certificate expires on: NONE

Issue Date: JANUARY 4, 1989

Certification is hereby made that the organization named above is an exempt purchaser under Massachusetts General Laws, Chapter 64H, sections 6(d) or 6(e). All purchases of tangible personal property or services by this organization are exempt from taxation under said chapter to the extent that such property or services are used in the conduct of the business of the purchaser. Any abuse or misuse of this certificate by any tax-exempt organization or any unauthorized use of this certificate by any individual constitutes a serious violation and will lead to revocation.

Signed under the penalties of perjury.

Signature: Elizabeth J Bernasconi Title: Town Accountant Date: 5/3/2011

Warning: Willful misuse of this certificate may result in criminal tax evasion sanctions of up to one year in prison and $10,000 ($50,000 for corporations) in fines.

To Be Completed by Vendor

Vendor's name

Check applicable box: ☐ Single Purchase Certificate ☐ Blanket Certificate

Attach detailed receipts/invoices or describe property on the back of this form.

General Instructions

The organization or agency must have obtained a Certificate of Exemption (Form ST-2) from the Commissioner of Revenue, certifying that it is entitled to exemption and must attach a photocopy of Form ST-2 to this certificate. The vendor must retain a completed Form ST-5 accompanied by a copy of Form ST-2 in the same manner as other sales tax records. For further information regarding the requirements for retaining records, see Massachusetts Regulation 830 CMR 62C.25.1.

Notice to Vendors

Vendors must obtain a copy of the Certificate of Exemption (Form ST-2) at the time of any sale to an exempt organization. Vendors should verify the validity of the certificate presented to them by checking the expiration date on the certificate. Vendors must **not** honor a Certificate of Exemption that has expired. Staple a copy of Form ST-2 to this form. **NOTE:** Governmental agencies maintain ST-2 Certificates of Exemption that have an expiration date of "NONE."

Vendors should call the Taxpayer Assistance Bureau at (617) 621-5251 if they have any questions regarding a Certificate of Exemption which is presented to them.

If you have any questions about completing this certificate, please contact:
Massachusetts Department of Revenue
Taxpayer Assistance Bureau
215 First Street
Cambridge, MA 02142
(617) 621-5251

ST-2

MASSACHUSETTS DEPARTMENT OF REVENUE

CERTIFICATE OF EXEMPTION

Certification is hereby made that the organization herein named is an exempt purchaser under General Laws, Chapter 64H, Sections 6(d) and (e). All purchases of tangible personal property by this organization are exempt from taxation under said chapter to the extent that such property is used in the conduct of the business of the purchaser. Any abuse or misuse of this certificate by any tax-exempt organization or any unauthorized use of this certificate by any individual constitutes a serious violation and will lead to revocation. Willful misuse of this Certificate of Exemption is subject to criminal sanctions of up to 1 year in prison and $10,000 ($50,000 for corporations) in fines. (See reverse side).

TOWN OF GREENFIELD
TOWN HALL 14 COURT SQUARE
GREENFIELD MA 01301

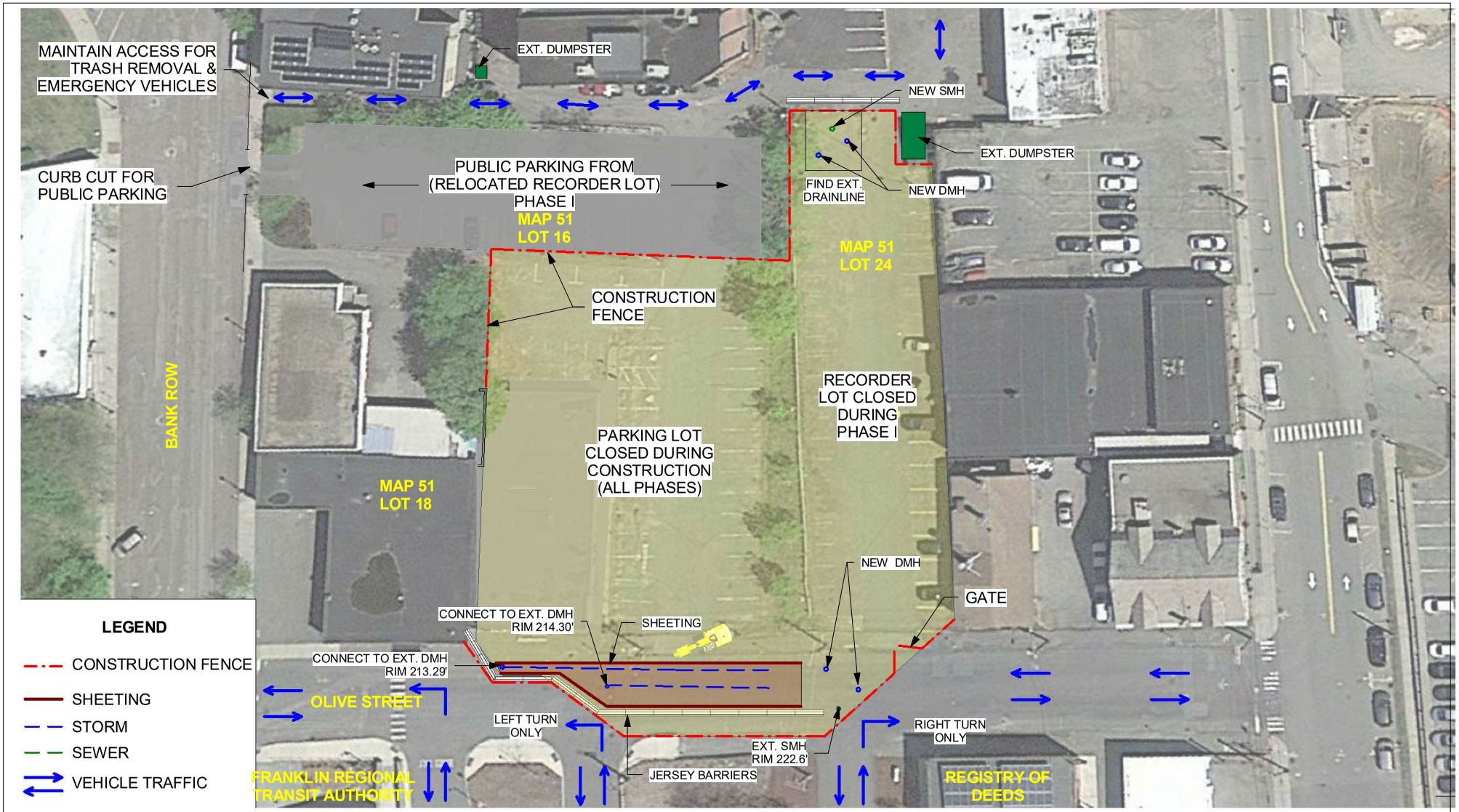
EXEMPTION NUMBER E
046-001-163

ISSUE DATE
01/04/89

CERTIFICATE EXPIRES ON
NONE

NOT ASSIGNABLE OR TRANSFERABLE

COMMISSIONER OF REVENUE
STEPHEN W. KIDDER



Daniel O'Connell's Sons
480 Hampden Street
Holyoke, MA 01040

www.oconnells.com

Greenfield, MA

EXHIBIT K

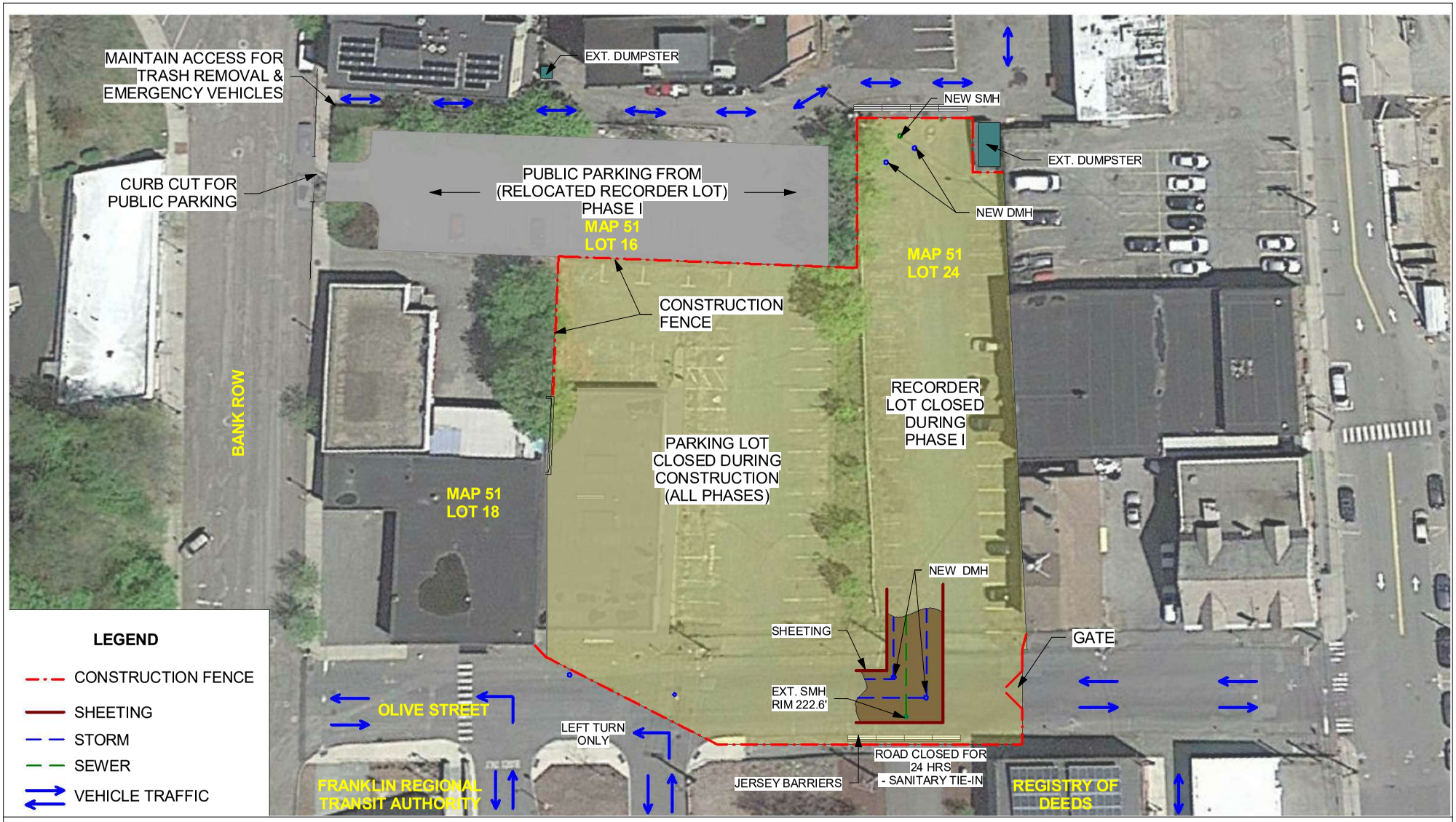
Olive Street Parking Facility

No.	Description	Date

Site Logistics Plan - Phase I

Project number	.	SL-01
Date	5/8/17	
Drawn by	EA	
Checked by	JW	Scale 1" = 40'-0"

5/8/2017 1:41:27 PM



Daniel O'Connell's Sons
480 Hampden Street
Holyoke, MA 01040

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Greenfield, MA
EXHIBIT K
Olive Street Parking Facility

No.	Description	Date

Site Logistics - Phase IA

Project number	.	SL-01A
Date	5/8/17	
Drawn by	EA	
Checked by	JW	Scale 1" = 40'-0"

5/8/2017 1:41:28 PM

Daniel O'Connell's Sons
480 Hampden Street
Holyoke, MA 01040

www.oconnells.com

Greenfield, MA

EXHIBIT K

Olive Street Parking Facility

No.	Description	Date

Site Logistics - Phase II

Project number	.	SL-02
Date	5/8/17	
Drawn by	EA	
Checked by	JW	Scale 1" = 40'-0"

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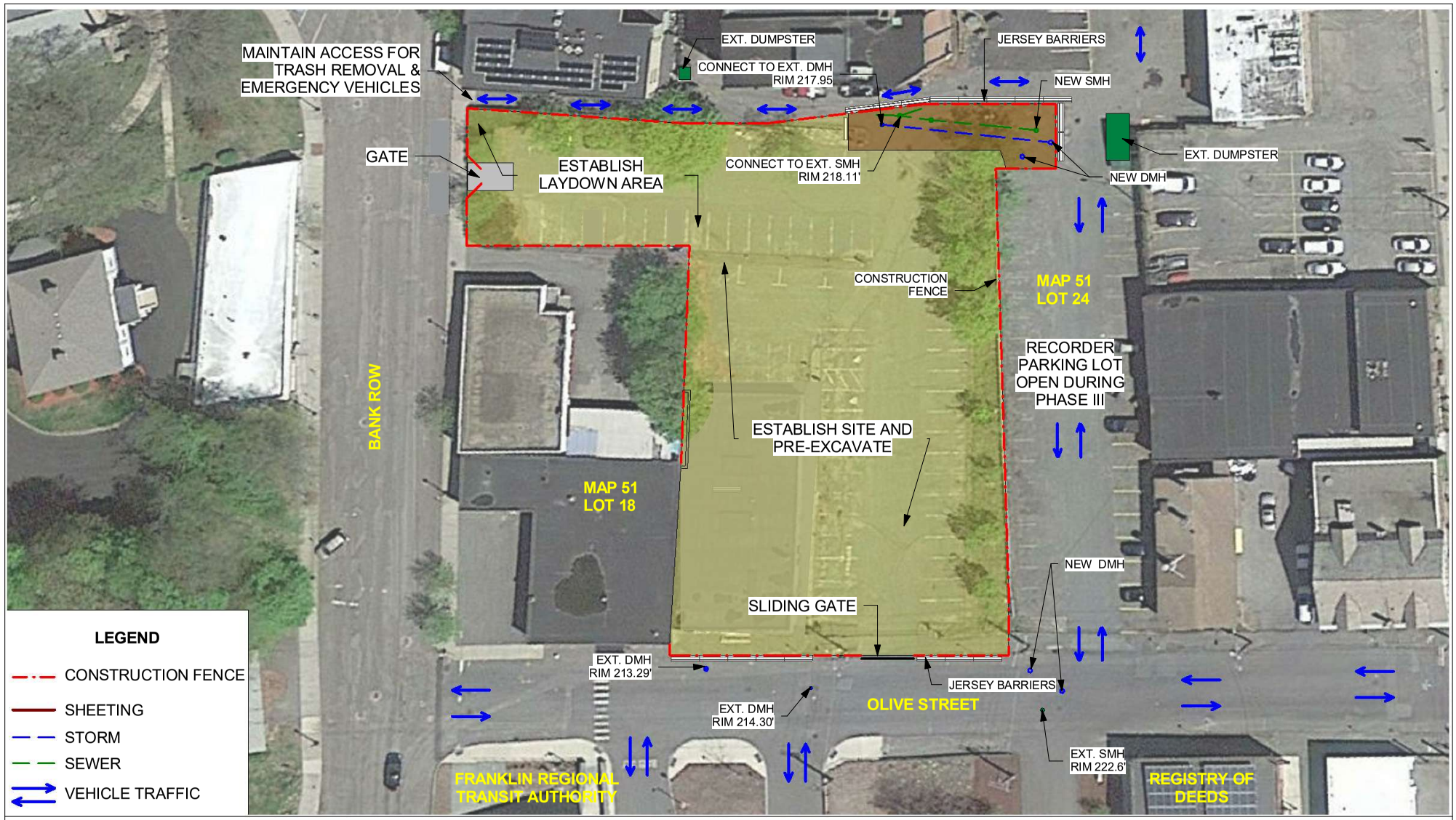

Daniel O'Connell's Sons
480 Hampden Street
Holyoke, MA 01040

www.oconnells.com

Greenfield, MA

EXHIBIT K

Olive Street Parking Facility

No.	Description	Date

Site Logistics - Phase III

Project number	.	SL-03
Date	5/8/17	
Drawn by	EA	
Checked by	JW	Scale 1" = 40'-0"

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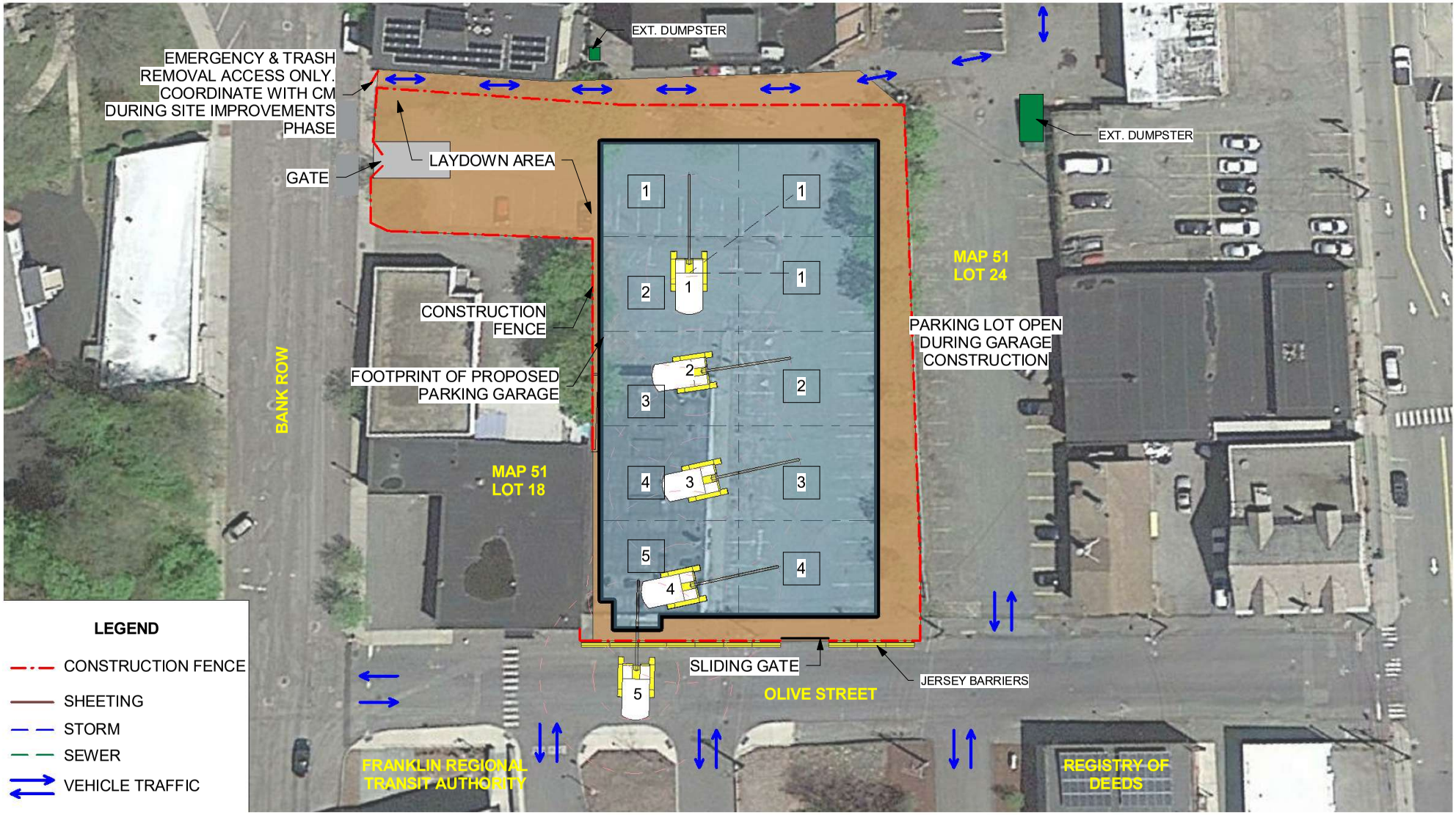


Daniel O'Connell's Sons
480 Hampden Street
Holyoke, MA 01040
www.oconnells.com

Greenfield, MA
EXHIBIT K
Olive Street Parking Facility

No.	Description	Date

Site Logistics - Parking Garage

Project number	.	SL-04
Date	7/13/17	
Drawn by	EA	
Checked by	JW	Scale 1" = 40'-0"

7/13/2017 10:10:18 AM

PROJECT: Subcontractor Change Order Hourly Rate Form **EXHIBIT L**

Hourly Rates for Change Order work include only the Base Rate & Fringe for each
Trade, and the other (5) categories listed. (FICA, SUTA, FUTA, WC & GL)
The rate designated below shall apply to all Change Order work throughout the project for that Subcontractor
These Subcontractor Hourly Rates are confirmed at final scope review, and are included in their contract with
Various percentage charges for safety, small tools, and other misc. items associated with Change Order
hours is not accepted at DOC and will not be reimbursed.
Subcontractor shall include relevant supporting information to validate these additional costs not included in t

COMPANY: _____

BID PACKAGE: _____

TRADE:

Journeyman

Item	%	Standard Time	Overtime	Double Time
Base Rate		0.00	0.00	0.00
Fringe		0.00	0.00	0.00
FICA	7.65%	0.00	0.00	0.00
FUTA - see below		0.03	0.03	0.03
SUTA - see below		0.00	0.00	0.00
WC	0.00%	0.00	0.00	0.00
GL	0.00%	0.00	0.00	0.00
Other Insurance			0.00	0.00
Total:		**0.03**	**0.03**	**0.03**

Foreman

Item	%	Standard Time	Overtime	Double Time
Base Rate		0.00	0.00	0.00
Fringe		0.00	0.00	0.00
FICA	7.65%	0.00	0.00	0.00
FUTA - see below		0.02	0.02	0.02
SUTA - see below		0.00	0.00	0.00
WC	0.00%	0.00	0.00	0.00
GL	0.00%	0.00	0.00	0.00
Other Insurance			0.00	0.00
Total:		**0.02**	**0.02**	**0.02**

General Foreman

Item	%	Standard Time	Overtime	Double Time
Base Rate		0.00	0.00	0.00
Fringe		0.00	0.00	0.00
FICA	7.65%	0.00	0.00	0.00
FUTA - see below		0.02	0.02	0.02
SUTA - see below		0.00	0.00	0.00
WC	0.00%	0.00	0.00	0.00
GL	0.00%	0.00	0.00	0.00
Other Insurance			0.00	0.00
Total:		**0.02**	**0.02**	**0.02**

Notes:
1. Workman's Compensation shall be a fixed amount since cost are based on hours and not hourly rate.
2. Allowable deductins per state:

State		Journeyman	Foreman			
		Hrs/Yr	Hrs/Yr			
		1500	1900			
				%	Payroll Limit	Total per Year
	FICA			7.650%	$ 118,500.00	$ 9,065.25
	FUTA	$ 0.03	$ 0.02	0.600%	$ 7,000.00	$ 42.00
MA	SUTA	$ 0.92	$ 0.72	9.156%	$ 15,000.00	$ 1,373.40
CT	SUTA	$ 0.68	$ 0.54	6.800%	$ 15,000.00	$ 1,020.00
RI	SUTA	$ 1.57	$ 1.24	10.000%	$ 23,500.00	$ 2,350.00
NY	SUTA	$ 0.15	$ 0.12	2.100%	$ 10,700.00	$ 224.70
NH	SUTA	$ 0.15	$ 0.12	1.600%	$ 14,000.00	$ 224.00

Exhibit "M"

SUBCONTRACTOR'S GUARANTEE / WARRANTY FORM - ONE YEAR

Project:_____ **DOC Project #** _____
_____ **Date:** _____

TO: _____ **TO**:_____
_____ **Daniel O'Connell's Sons, Inc.**
_____ P. O. Box 267
_____ Holyoke, MA 01041-0267

In consideration of the sum of One Dollar ($1.00) and other good and valuable considerations, the receipt of which is hereby acknowledged, we (I) guarantee/warranty the _____ Work, Specification Section(s) _____, including materials and equipment installed by us in the above-named building under our Agreement, Contract, C-_____ , dated _____, with Daniel O'Connell's Sons, and change orders thereto, to be free from imperfect workmanship, and/or materials and equipment, and to be in accordance with all Contract Documents including Drawings and Specifications, revisions and written modifications made by the Architect. We agree to repair and/or replace and make adjustments necessary to meet specified performance results at our own cost and expense for a period of one (1) year from approved date of Substantial Completion, as hereinafter noted, all of the Work covered under said contract and change orders that may prove defective, including materials or equipment partially or completely covered by manufacturer's guarantee/warranty or which were not installed in accordance with Contract Documents at any time during the period of guarantee/warranty.

We also agree to pay the cost of all repairing all damage to other work resulting from defects in our own work and to pay the cost of replacing other work which we may disturb in making good the defects in our work.

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

Any materials or equipment which in the opinion of the Architect requires excessive service at any time during the first year of operation shall be considered defective and shall be replaced under this guarantee/warranty at no expense to the Owner. As to equipment or parts thereof which are replaced under this guarantee/warranty, or longer, per guarantee/warranty provisions, shall run from the approved date of Substantial Completion of the replaced installation or parts thereof.

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

It is understood that the Owner shall give notice of observed defects with reasonable promptness and all questions arising under this guarantee/warranty shall be decided by the Architect.

Approved date of Substantial Completion of work: _____

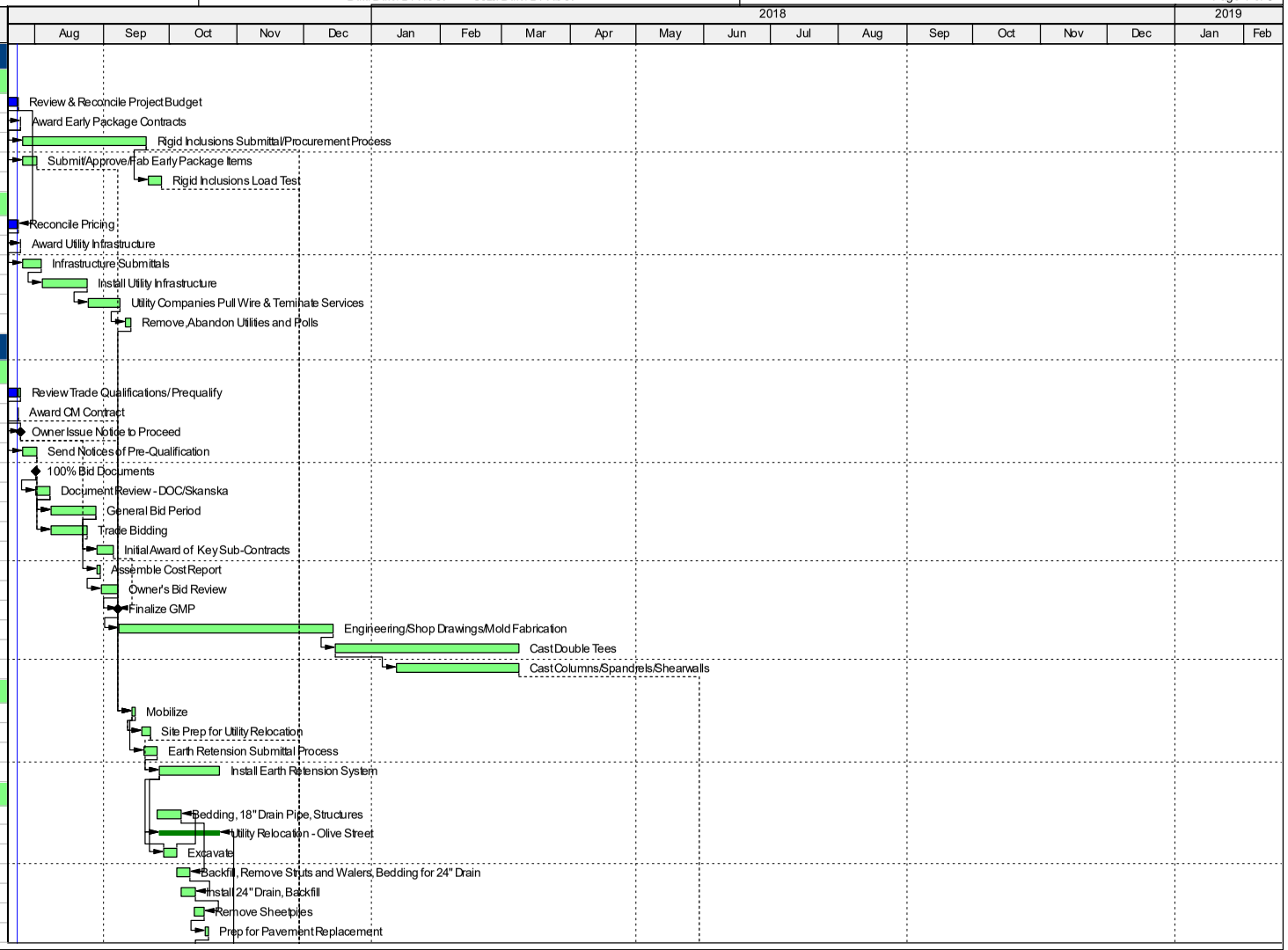
Date of expiration of this guarantee/warranty: _____
Subcontractor/Supplier

From:_____ To: _____
date date By: _____
(Authorized Signature)

Proposal

Data Date: 24-Jul-17 Print Date: 24-Jul-17

Activity ID	Original Duration	Start	Finish
Pre-Construction			
EP Procurement - Garage			
Gar1505	5	12-Jun-17 A	24-Jul-17
Gar1515	1	25-Jul-17	25-Jul-17
Gar220	40	26-Jul-17	20-Sep-17
Gar1575	5	26-Jul-17	01-Aug-17
Gar1625	5	21-Sep-17	27-Sep-17
EP Procurement - Olive St. Utilities			
Gar1605	5	12-Jun-17 A	24-Jul-17
Gar1615	1	25-Jul-17	25-Jul-17
Gar1675	7	26-Jul-17	03-Aug-17
Gar1645	15	04-Aug-17	24-Aug-17
Gar1655	10	25-Aug-17	08-Sep-17
Gar1665	3	11-Sep-17	13-Sep-17
Parking Garage			
Preconstruction			
Gar180	10	26-Jun-17 A	25-Jul-17
Gar270	1	24-Jul-17*	24-Jul-17
Gar250	0	25-Jul-17	
Gar190	5	26-Jul-17	01-Aug-17
Gar100	0	01-Aug-17*	
Gar210	5	01-Aug-17	07-Aug-17
Gar110	15	08-Aug-17*	28-Aug-17
Gar200	13	08-Aug-17	24-Aug-17
Gar120	5	29-Aug-17	05-Sep-17
Gar230	2	29-Aug-17	30-Aug-17
Gar240	5	31-Aug-17	07-Sep-17
Gar260	0		07-Sep-17*
Gar130	70	08-Sep-17	14-Dec-17
Gar140	60	15-Dec-17	08-Mar-18
Gar150	40	12-Jan-18	08-Mar-18
Utility Relocation-Start Up			
Gar1305	2	14-Sep-17	15-Sep-17
Gar1310	5	18-Sep-17	22-Sep-17
Gar1410	5	19-Sep-17	25-Sep-17
Gar1440	20	26-Sep-17	23-Oct-17
Utility Relocation - Olive Street			
Gara2010	10	25-Sep-17	06-Oct-17
Gar1630	20	26-Sep-17	23-Oct-17
Gara2000	5	28-Sep-17	04-Oct-17
Gara2020	5	04-Oct-17	10-Oct-17
Gara2040	5	06-Oct-17	12-Oct-17
Gara2050	3	12-Oct-17	16-Oct-17
Gara2060	2	17-Oct-17	18-Oct-17



Remaining Level of Effort
Critical Remaining Work
Actual Work
Milestone
Remaining Work

Greenfield, Massachusetts
Olive St Parking Facility

Daniel O'Connell's Sons
480 Hampden St.
Holyoke, Ma. 01040

EXHIBIT "N"

EXHIBIT "N"

Proposal

Data Date: 24-Jul-17 Print Date: 24-Jul-17

Activity ID	Original Duration	Start	Finish
Gara2070	2	19-Oct-17	20-Oct-17
Gara2080	1	23-Oct-17	23-Oct-17
Gara2090	0		23-Oct-17*
Utility Relocation- Recorder Lot			
Gar1450	3	24-Oct-17	26-Oct-17
Gar1640	21	24-Oct-17	21-Nov-17
Gar1490	5	25-Oct-17	31-Oct-17
Gar1500	4	30-Oct-17	02-Nov-17
Gar1520	3	02-Nov-17	06-Nov-17
Gar1530	4	06-Nov-17	09-Nov-17
Gar1550	4	10-Nov-17	15-Nov-17
Gar1560	3	16-Nov-17	20-Nov-17
Gar1570	1	21-Nov-17	21-Nov-17
Gar1580	0		21-Nov-17
Utility Relocation - Back of Lot			
Gara3000	1	22-Nov-17	22-Nov-17
Gar1650	11	22-Nov-17	06-Dec-17
Gara3030	2	23-Nov-17	24-Nov-17
Gara3040	2	01-Dec-17	04-Dec-17
Gara3050	2	05-Dec-17	06-Dec-17
Foundations			
Gar1315	20	05-Dec-17	01-Jan-18
Gar1355	24	20-Mar-18*	20-Apr-18
Gar1320	25	05-Apr-18*	09-May-18
Gar1325	5	23-Apr-18	27-Apr-18
Gar1525	10	30-Apr-18	11-May-18
Gar1535	12	14-May-18	29-May-18
Gar1545	5	30-May-18	05-Jun-18
Gar1555	4	30-May-18	04-Jun-18
Gar1335	8	11-Jul-18	20-Jul-18
Gar1565	5	18-Jul-18	24-Jul-18
Superstructure			
Gar1340	14	05-Jun-18	22-Jun-18
Gar1350	10	25-Jun-18	06-Jul-18
Gar1345	12	25-Jun-18	10-Jul-18
Gar1510	15	11-Jul-18	31-Jul-18
Gar1360	10	01-Aug-18	14-Aug-18
Gar1390	8	01-Aug-18	10-Aug-18
Gar1380	7	01-Aug-18	09-Aug-18
Gar1365	15	08-Aug-18	28-Aug-18
Gar1385	10	10-Aug-18	23-Aug-18
Rough Interiors			
Gar1405	10	01-Aug-18	14-Aug-18
Gar1370	6	01-Aug-18	08-Aug-18
Gar1420	10	08-Aug-18	21-Aug-18
Gar1375	30	09-Aug-18	19-Sep-18
Gar1430	5	13-Aug-18	17-Aug-18
Gar1400	35	17-Aug-18	04-Oct-18

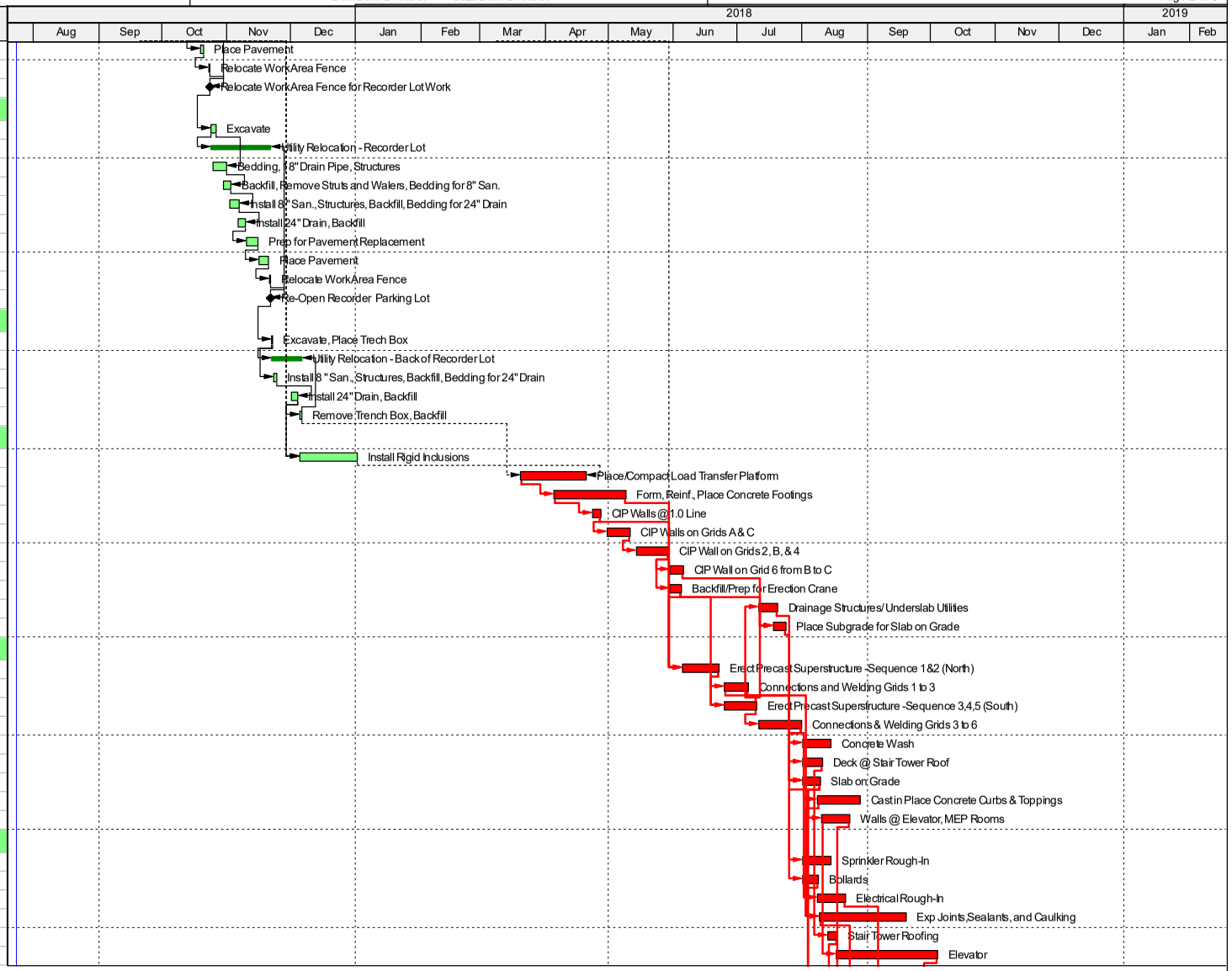


EXHIBIT "N"

EXHIBIT "N"

Proposal

Data Date: 24-Jul-17 Print Date: 24-Jul-17

Activity ID	Original Duration	Start	Finish
Gar1435	20	20-Aug-18	14-Sep-18
Gar1395	12	24-Aug-18	10-Sep-18
Finishes			
Gar1460	20	03-Aug-18	30-Aug-18
Gar1590	15	10-Aug-18	30-Aug-18
Gar1610	20	10-Aug-18	06-Sep-18
Gar1620	25	10-Aug-18	13-Sep-18
Gar1425	5	30-Aug-18	05-Sep-18
Gar1600	20	31-Aug-18	27-Sep-18
Gar1455	4	06-Sep-18	11-Sep-18
Gar1465	7	12-Sep-18	20-Sep-18
Gar1470	8	21-Sep-18	02-Oct-18
Gar1475	0		04-Oct-18*
Gar1480	10	05-Oct-18	18-Oct-18
Gar1485	0		18-Oct-18

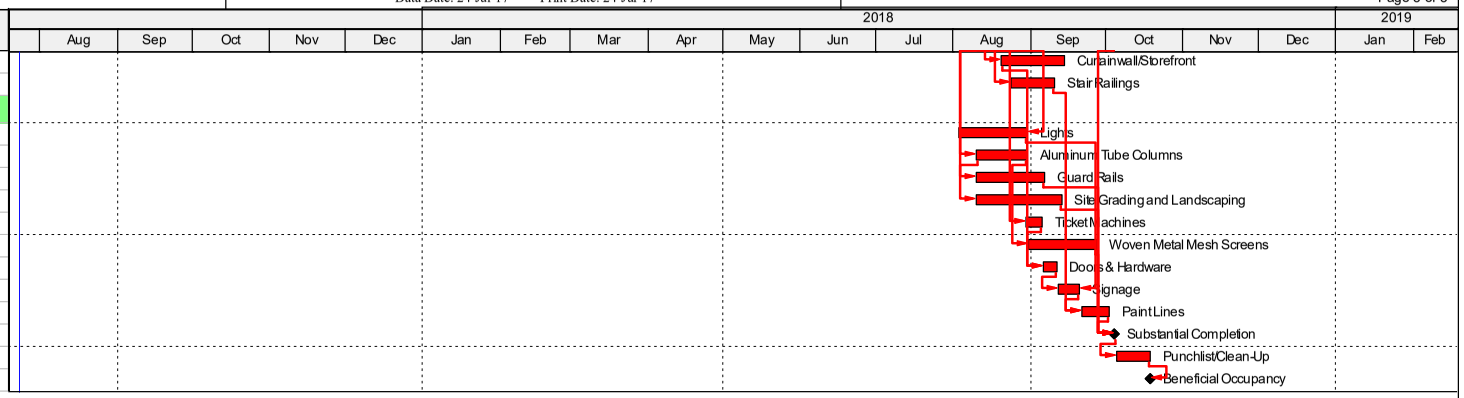


EXHIBIT "N"

EXHIBIT "N"

EXHIBIT "O"

ESTABLISHED 1879

Daniel O'Connell's Sons

Site Specific Safety Plan

For

Olive Street Parking Garage

Greenfield Parking Garage Project

Olive Street

Greenfield, MA 01301

Daniel O'Connell's Sons Project Number 2017-107

Revisions			
Revision Number		Description	Date
	1	Minor edits	5/15/17
	2	Edited address of DOC Field Office, new PM	8/2/17

PART 1 - Emergency Services Contact List

EMERGENCY SERVICES		
POLICE & FIRE EMERGENCY: LOCAL EMERGENCY SERVICES		**911 or**
	Police Department	413-773-5411
	Fire Department	413-774-4737
	US Poison Control	1-800-222-1222

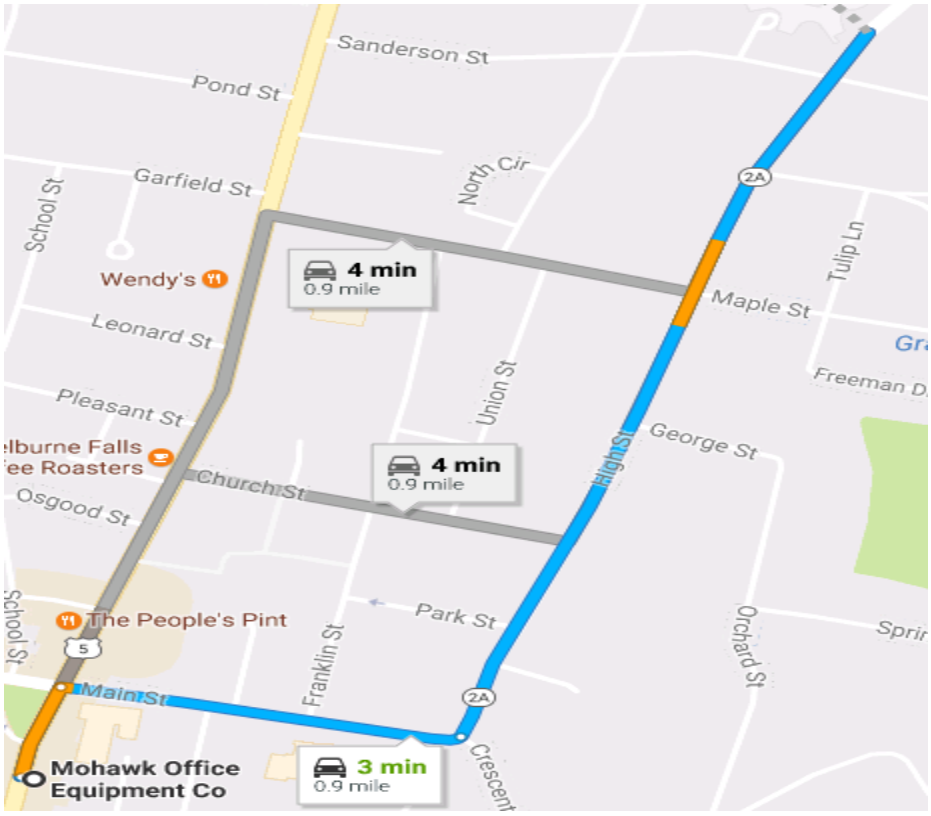
LOCAL AREA HOSPITALS		
NAME	**ADDRESS**	**TELEPHONE NUMBER**
Bay State/Franklin Medical Center	164 High Street Greenfield, MA. 01301	413-773-0211
Services Provided:	All Major Medical Emergencies	

LOCAL NON-EMERGENCY HEALTH CLINIC		
NAME	**ADDRESS**	**TELEPHONE NUMBER**
AEIOU Urgent Care	489 Bernardston Road Greenfield, MA 03101	413-773-1394
Services Provided:	Minor Medical Issues	

PART 2 - Hospital Maps & Directions

Hospital Name	Bay State/Franklin Medical Center
Physical Address	164 High Street Greenfield, MA. 01301
Main Phone Number	413-773-0211

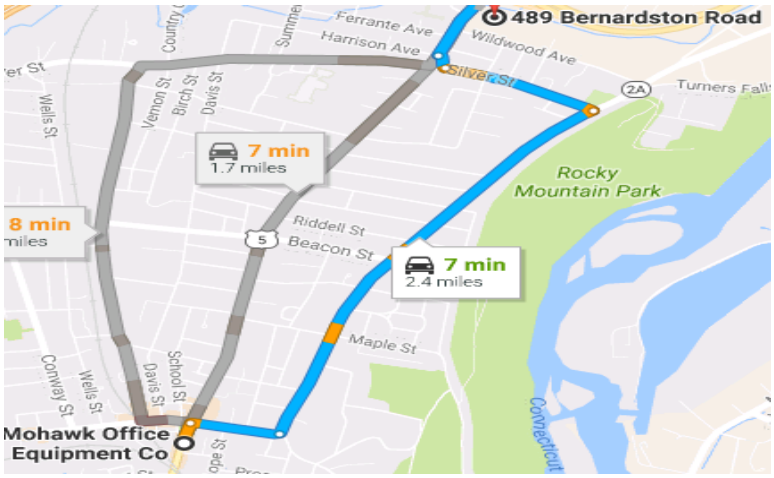
Directions



1.	Head North on Bank Row towards Court Square	6.	
2.	Turn R onto Main Street	7.	
3.	Continue to High Street	8.	
4.	Hospital will be on the left	9.	
5.		10.	

Directions

Clinic Name	**AEIOU Urgent Care**
Physical Address	489 Bernardston Road Greenfield, MA 01301
Main Phone Number	413-773-1394



1.	Head North on Bank Row towards Court Square	6.	Turn R onto US-5 / RT 10 Bernardston
2.	Turn R onto Main Street	7.	AEIOU Urgent Care will be on your R
3.	Continue to High Street	8.	
4.	Turn L onto Silver Street	9.	
5.	Turn R onto Long Farm Terrace	10.	

PART 3 - Site Evacuation Plan

Olive Street Parking Garage Project- 33 Bank Row, Greenfield, MA. 01301

- In the case of Fire or Emergency call 911 for assistance;
- All workers will exit the project area and assemble at the specified Muster Point (A or B). The General Foreman will take a roll call to account for all personnel;
- Notify the DOC Superintendent of any fire or emergency;
- All workers must receive training on this evacuation plan;
- Visitors to the job site must be made aware of the evacuation plan.

Site Logistics Plan

PART 4 - Project Contact List

DOC Onsite Contacts

Title	Name	Phone	Email
Project Manager	Joe Imelio	413-326-0023	jimelio@oconnells.com
Superintendent	Pete Sickler	413-326-1582	psickler@oconnells.com
Field Engineer	TBD		
Safety Engineer	Scott Sattler	413-351-5842	ssattler@oconnells.com

DOC Core Team Support

Title	Name	Phone	Email
DOC Project Executive	Joe Imelio	413-326-0023	jimelio@oconnells.com
VP Corporate Safety	Nate Clinard	603-770-7221	nclinard@oconnells.com

Owners Project Manager

Title	Name	Phone	Email
Sr. Project Manager, Skanska USA	John Benzinger	413-281-8934	

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This Site Specific Safety Plan (SSSP) must be reviewed, understood and signed by each Contractor's Supervisor (authorized representative) responsible for the on-site performance of the work for which they are contractually responsible **(see the last page of this document, sign and provide copy to DOC prior to starting any work)**. Furthermore, it is the responsibility of the Contractor's Supervisor, through their signature on the acknowledgement page, to ensure these rules, (including those of the Contractor and their own SSSP) are reviewed as part of their New Hire Orientation for this project, understood and followed by all Contract Supervisor's employees or sub-contractors for which they hire in order to meet their contractual obligations.

Contractors/subcontractors are required to employ competent supervisory and field personnel who are qualified and trained for the type of work they will perform, providing all applicable training and safety instructions, and assuring that safe practices are followed. This includes verifying that employees reporting to work are physically able to do all the aspects of their jobs. Contractor/subcontractor employees reporting for work shall have successfully completed an OSHA Ten-Hour or Thirty-Hour Construction Training Program. At least one English Speaking Forman must be on site at all times.

I. Introduction

1. This Site Specific Safety Plan (SSSP) will govern the safety aspects of the way that contractors and their subcontractors and agents perform work at the **Olive Street Parking Garage Project**. These rules are meant to convey Daniel O'Connell's Sons, Inc. (DOC) minimum expectations regarding safe work practices, which does, in some instances, exceed the requirements of OSHA and other regulatory agencies. These work rules are to be considered as an addition to any safety rules or regulations of the contractor, including their own SSSP.

2. If applicable, contractors must provide their employees with appropriate training concerning bloodborne pathogens. This training and awareness shall meet and/or exceed OSHA CFR1910.1030 and all applicable appendices.

3. Contractors and their employees are responsible for safety. This includes following all safety, health, and environmental rules and regulations, including but not limited to the latest versions of Federal Regulations (OSHA, EPA, DOT, etc.) that are pertinent to the work they are performing, and in effect or that may take effect during the work. Further, any DOC rules and procedures, Owner/Client/Owners Representative rules, and safe work practices must be followed in the performance of their work. Failure to comply will not be tolerated and is just cause for expulsion from the Project. DOC has a strict policy to document and address unsafe work practices. Documented warnings shall be used for observed unsafe work practices. If a person is observed working in an unsafe manner a second time, DOC will, at our discretion, remove them from site or suspend them from working for a period of time. DOC takes the Safety of workers and those on the project seriously.

   Further, each contractor shall monitor safety compliance for their employees. It is expected that non-conformance with this SSSP, contractor's safety rules/policies/procedures/SSSP or owner/client/owners representative safety rules shall be immediately corrected and a record of the non-conformance and corrective action (disciplinary action) be provided to DOC immediately. DOC Field Safety Engineers will perform periodic Safety Audits in the presence of DOC Field

Leadership. Positive observations, as well as any non-conformances, will be documented along with the corrective action. These audits will be shared with all appropriate subcontractors.

4. Each contractor is and shall remain an independent contractor as to all work performed under the contract. Nothing herein shall relieve a contractor of its responsibility for safety. Contractors remain solely responsible for the safety of their employees and the work they perform. As such, DOC expects them to take appropriate action to ensure the safety of their employees and others who may be affected by their work and activities. Unsafe conditions shall be addressed immediately.

5. Neither compliance with this SSSP nor DOC's approval of any actions or procedures of the contractor shall relieve the contractor of its obligation to always use due care in performing work and to take any additional precautions necessary or proper under the circumstances to prevent injury or property damage.

II. General Safety Rules

1. Planning and Forethought

Contractor's shall exercise planning and forethought regarding all work. As a minimum, this requires the contractor to apply the same planning and management skills to the safety and environmental aspects of the job as to the bid preparation, work assignment, job scheduling, and other productivity and quality aspects. **Contractor's shall develop a Site Specific Safety Plan (SSSP) for the work and assign a person with full-time or collateral safety oversight responsibilities. <u>The SSSP must be provided to DOC prior to the start of any work.</u>**

2. Emergency Response

Prior to the start of work, contractors must coordinate emergency response with DOC. This may include preferred means of reporting and responding to emergencies, evacuation alarms and routes, medical treatment facilities available, etc. After this is coordinated, DOC will develop list of contact numbers and distribute to each contractor. These numbers and reporting requirements are to be posted in conspicuous locations for immediate use. At a minimum, when reporting an emergency, contractors must clearly state what the emergency is, where they are located, and any other information to allow the appropriate response action. This includes requesting fire or ambulance equipment if needed. A draft Emergency Action Plan (EAP) is attached to this SSSP. (Attachment I)

3. Medical Treatment

Contractors shall be equipped with their own first aid kits. Contractors are responsible for arranging transportation for employees to receive medical attention for minor injuries not requiring 911 emergency responses. DOC has already established the following as the local medical facility:

NON-911 INIJURIES:	**911 INJURIES:**
AEIOU Urgent Care 489 Bernardston Rd. Greenfield, MA 01301 413-733-1394	Bay State/Franklin Medical Center 164 High St. Greenfield, MA 01301 413-773-0211

Please call the number above to advise the Medical Staff that an employee is being transported to the facility so they may check them in to reduce any wait times. ***Distance from the project to AEIOU Urgent Care is approximately 2 miles. Distance from the project to Bay State/Franklin Medical Center is approximately 2.4 miles. Maps and directions are attached to this document.***

4. Pre-job Safety Briefings

Contractors must conduct pre-job safety briefings (commonly known as toolbox discussions, tailboard discussions, etc.) with all workers that will be involved in the job at the start of each shift, when the scope of work changes, and before new work assignments. These discussions must cover the actual and potential hazards of the job, the specific PPE requirements, and all other precautions required to prevent injury or property damage. Copies of completed pre-job safety briefings must be made available upon request. **A sample Pre-Job Brief is attached to this document for your use if you do not have one developed. (Attachment II)**

5. Training Records

Contractors shall have training and certification records and other such documentation for its employees that are pertinent to the work to be performed available on site or immediately available for review by DOC upon request. One employee for each contractor shall be certified in 1st Aid/CPR.

6. Alcohol, Drugs, and Firearms

Alcoholic beverages, beverages labeled as "non-alcoholic," controlled drugs (other than prescribed drugs), or firearms are not allowed on the Jobsite (including parking lots) nor shall any worker under the influence of alcohol and/or drugs be allowed on the Jobsite. The sale or use of alcohol and/or drugs on the Jobsite is strictly prohibited.

7. Reporting Injuries and Other Incidents

Contractors are required to immediately report to DOC all injuries, illnesses, property damage and near misses to their personnel. **Complete and thorough investigations listing contributing cause(s) and root cause, including a list of corrective actions taken or planned, shall be provided to DOC within 24 hours of the incident. The contractor is responsible for all OSHA and State Reporting/Recordkeeping requirements and shall complete these tasks within 24 hours with copies to DOC.**

8. Inspection and Maintenance Records

Inspection and maintenance records (daily, weekly, monthly, annual, etc.) of cranes, hoists, personnel lifts, scaffolds, excavations, PPE, etc., are subject to DOC review and must be readily available.

III. Specific Safety Rules

1. Fall Protection

100% fall protection is required whenever the fall hazard is six (6) feet or greater, regardless of the type of work being performed. Contractors are responsible for determining the suitability of potential anchorage points. In many instances, the use of shock absorbing lanyards will not provide the required fall distance. Therefore, each contractor shall have an adequate supply of retractable lanyards on hand in an effort to prevent unnecessary delay and afford the appropriate protection. **If an unguarded fall hazard is identified by a contractor, it must be reported to DOC immediately**.

2. Trenching and Excavating

No trenching or excavation work may begin until the contractor has designated a competent person to oversee the work and has informed DOC of the name(s) of the competent person(s) and the basis for such determination. **Contractors are to assume all soil is Type C unless they prove otherwise with appropriate engineering tests**. Contractor is responsible for contacting the appropriate "Call Before You Dig" or "Dig Safe" agency a minimum of three (3) working days prior to the planned start of any excavation. All trenches and excavations shall be securely guarded to prevent inadvertent entry/falls while open. All trenching and excavation activity shall meet and/or exceed OSHA CFR1926.500 and CFR1926.650-652 and all applicable appendices, as well as State Law. **Pre-use inspection documentation must be performed with documentation available for review upon request**.

3. Scaffolding

No scaffolding work may begin until the contractor has designated a competent person to oversee the work and has informed DOC of the name(s) of the competent person(s) and the basis for such determination. **100% fall protection is required at all times during erection, maintenance, and dismantling of the scaffold whenever the fall hazard is six (6) feet or greater.** Scaffold posts and other members may not be used for fall protection anchorage unless contractor provides written certification acceptable to DOC. All scaffolding activity shall meet and/or exceed OSHA CFR1926.450-454 and all applicable appendices. **Pre-use inspection documentation must be performed with documentation available for review upon request.**

4. Housekeeping

Contractors shall keep the job site neat, clean, and free of debris, trash, and hazards. Contractor shall store all materials in a neat and orderly fashion. As a minimum, contractors shall perform housekeeping activities in their delineated work areas.

5. Hot Work

Charged and inspected Fire Extinguishers shall be placed in various locations throughout the facility. Hot work is any work that involves the use of burning or welding equipment, brazing equipment, explosives, open flames, grinders, powder actuated tools, and any other activity that produces a flame, spark, or excessive heat. Hot work requires the contractor to conduct a hazard assessment and take appropriate actions to prevent the ignition of combustible and flammable materials, including but not limited to the use of welding tarps, fire watches, and the immediate

availability of fire extinguishers (within 35' of the activity). The contractor shall comply with all applicable safety regulations (Federal, State, etc.) that are in effect, or may come in to effect, at all times when performing hot work activities. If applicable, contractor shall work with DOC and the owner to place the fire detection system in local mode.

6. Smoking

Smoking (including e-cigarettes) is prohibited within the parking garage and within 25' of the structure.

7. Lifting and Hoisting

Contractor shall not move loads suspended from mobile equipment without the load being secured (tag lines) to prevent swinging. All chains, cables, rope, etc., suspended from mobile equipment shall be properly fastened. Tag lines shall be used on all loads handled by lifting equipment, except when there is a danger of the equipment, load, or tag line making contact with energized parts. Swing load radius must be barricaded during moving of suspended loads. Rigging equipment shall be inspected as applicable with documentation made available upon request.

8. Guarding of Holes and Openings

Contractor shall guard or place appropriate barricades around temporary openings in floors, handrails, excavations, etc., to prevent inadvertent entry. Covers over excavations or floor holes shall be secured, conspicuously marked (Danger, Open Hole. Do Not Remove) to indicate the hazard and the danger of removal.

9. Ladders

Only ladders constructed of fiberglass may be used in and around electrical equipment. Ladders are to be properly positioned, extending at least 3 feet at the exit level. **Straight and extension ladders are to be secured at all times when in use**. Step ladders may not be used in the closed position and no person may stand or sit on the steps or platforms on which standing or sitting is prohibited. Job-built ladders will be built to industry (ANSI/OSHA) standards, meet the above tie-off requirements and be inspected by the contractor daily. **Aluminum ladders may be allowed, in very limited circumstances, with the approval of the DOC Superintendent**.

10. Tools and Equipment

Contractors are responsible for providing the proper tools and equipment. Except in rare or emergency situations, DOC will not provide or lend tools or equipment, including personal protective equipment.

11. Walks and Roadways

When working on the project, contractors shall not hinder or obstruct the normal flow of vehicular or pedestrian traffic without prior coordination with DOC. In such cases, appropriate actions must be taken to alert traffic of the hazard and/or control the flow of traffic to ensure safety. Contractor shall provide approved lights, barriers, signs, warning devices, signal persons, and/or other precautions appropriate to the situation.

12. Lock out/Tag out

Contractor is to coordinate lock out/tag out with DOC as needed. Contractor will be required to comply with Cogentrix lock out/tag out requirements.

13. Confined Space Entry

All confined spaces are considered to be permit-required confined spaces unless the contractor conducts a written hazard assessment that documents otherwise. Before any confined space entry activities are made, DOC will be notified to ensure there is no operational impact to the client. Copies of all documents used in the entry process will be made available to DOC upon request. All confined space entry activities shall meet and/or exceed OSHA CFR1926.1200-1213 and all applicable appendices.

14. Personal Protective Equipment (PPE)

As a minimum, work performed on this project requires the use of safety glasses, safety shoes, hard hats and hi-visibility vests, shirts, jackets, etc. Determining additional PPE requirements, such as the use of face shield while cutting/grinding, is the responsibility of the contractor. Contractor's PPE hazard assessment certifications are subject to review by DOC. Cut off shorts are not allowed. **The pre-job briefing shall be referenced to assist in determining PPE requirements.** (See Attachment II)

15. Barriers, Signs, and Signage Credibility

Work areas, whether indoors or outdoors, restricted to entry by unauthorized persons shall be clearly marked and delineated. Unless otherwise permitted, such marking shall consist of a conspicuous rope or caution tape with appropriate DANGER, CAUTION, or other appropriate signs that note the nature of the hazard and provide guidance to the reader. The placement of orange cones or signs alone may not be adequate. Detours, whether for vehicular or pedestrian traffic, shall be clearly marked along the entire route. Signs, barriers, and similar markings shall be checked and maintained throughout the period of need and shall be removed promptly when the need has ended.

16. Communications with DOC Personnel

Planned work activities, which may affect or disrupt work of the owner, shall be communicated to DOC far enough in advance (no later than 72 hours) to allow for coordination, accommodations, or resolution of conflicts.

17. Demolition Activities

Demolition activities shall be coordinated with DOC and shall follow OSHA CFR1926.850 et al. A demolition plan shall be provided far enough in advance of demolition activities in order to not delay any other activities.

18. Asbestos, Lead, and Other Hazardous Substances or Contaminates

The contractor is responsible for ascertaining the presence of asbestos, lead or other hazardous substances that may impact in the performance of their work. Upon identification, contractors are

to inform their employees and ensure appropriate precautions are taken along with required training. Air monitoring will be performed, as necessary, by the contractor performing work that impacts these materials, in order to assist in the determination of appropriate level of PPE required. Dust control will be emphasized throughout the project.

19. Nail guns and Powder-Actuated Tools

Nail guns, Hilti Guns, and similar tools shall be used in such a manner to ensure the projected fastener cannot miss or penetrate the intended surface and strike an unintended person or object, including but not limited to the fastener becoming an airborne projectile. Precautions include, but are not limited to directing the line of fire away from other persons, including passersby, preventing access to the opposite sides of nailing surfaces (e.g., walls), and preventing access closer than 20 feet to Hilti gun use.

20. Fire Retardant (FR) Clothing

Certain electrical activities require the use of fire retardant (FR) clothing. Contractor is to coordinate with DOC to determine administrative "When-to-wear" owner/client/owner representative requirements that may exceed OSHA requirements.

21. Electrical Awareness

High voltage electrical lines and equipment exist throughout the property. Contractor must provide, or ensure that all persons working under a contract have received, electrical awareness training appropriate to the work they will be performing. The intent of the training is to ensure persons understand the hazards of electricity and the actions they must take to prevent inadvertent contact. At no time will contractors disturb/manipulate lockout tags on the property.

22. Hazard Communication/GHS

All contractor-supplied hazardous materials and chemicals must be reviewed by DOC prior to entry on the project and its use. All MSDS or SDS's and associated instruction/warning sheets must be provided to DOC far enough in advance of the time of intended use. Contractor must also have a copy of its Hazard Communication/GHS program available for review upon request. All containers used to handle chemicals, fluids, or hazardous material must be labeled according to OSHA CFR1910.1200 and all applicable appendices.

23. Chemical Use and Disposal

Contractor is responsible for ensuring safe and proper use of all chemicals and hazardous materials, and to take precautions necessary to prevent exposure to other persons. Chemicals, fluids, and hazardous materials transferred from their original containers must be placed in containers approved for their use. Unless otherwise directed, disposal and removal of all such chemicals and materials is the responsibility of the contractor. However, temporary storage locations and removal shall be coordinated with DOC and the owner.

24. Environmental

Contractor is responsible for immediately containing, reporting to DOC and the appropriate regulatory agencies, and remediating all chemical discharges of any quantity to the environment. Remediating discharge of DOC furnished chemicals will be performed by DOC or its designated

licensed contractor and billed to the responsible contractor. **All spills shall be reported to DOC immediately.**

25. Daily Site Walk-throughs

Contractors shall perform daily site walkthroughs to field verify that their employees/ representatives are working safely and following all applicable safety requirements. Each contractor should document to DOC, at the end of each day, that there were no injuries to their employees/representatives and that they have left no un-controlled hazards in their work areas.

End

Site Specific Safety Plan Acknowledgement Form

Instructions:

Senior Management: Sign and return with executed contract.

Field Supervision: Sign and date where indicated in the presence of DOC.

DOC Field Management: Sign and date where indicated below and file on Project.

As an authorized representative of my company, I have reviewed the SSSP for this project and agree to work in conformance with them, as well as those of OSHA, along with our internal safety rules/policies/procedures and our own SSSP for the project. Furthermore, I agree to review these rules and requirements with all of my employees and representatives prior to them beginning work on this project. Any questions I had pertaining to these rules and requirements have been answered by DOC.

_____

Contract Company or Organization Represented

_____ _____

Print Name *Signature*

_____

Date

_____

_____ _____

DOC Rep (print name) *DOC Rep Signature*

_____

Date

Employee Orientation Acknowledgement Form

(To be signed by all employees onsite.)

Project: Olive Street Parking Garage Project
Olive Street
Greenfield, MA. 01301

I have read, been instructed, and understand all the job site requirements regarding safety and environmental concerns while working at the Olive Street Parking Garage Project.

_____
Company Name

_____
Name/Title

_____
Signature

_____
Date

Appendix I ~ Emergency Action Plan

DANIEL O'CONNELL'S SONS, INC
Olive Street Parking Garage Project
40 Bank Row
Greenfield, MA. 01301

EMERGENCY ACTION PLAN

The *Emergency Response Team* shall consist of:

Joe Imelio – Project Manager
Pete Sickler – Superintendent
TBD – Field Engineer
Scott Sattler – Field Safety Engineer

In case of Emergency, including accident, fire, hazardous materials incident, medical emergencies and suspicious activities/person(s), call 911.

1. All incidents, including near misses, personal injury and Property Damage shall be reported to DOC immediately. A draft report, including pictures and supporting documentation must be submitted to DOC within 24 hours of the occurrence.

2. In case of Fire Alarm or the sound of the Project Air Horn, all persons are required to evacuate the building, and report to a designated "MUSTER POINT" (A or B).

3. An Emergency Response Team Member, or their designee, shall meet the Ambulance, Fire and/or Police Department(s) to assist with information and to provide the necessary assistance, as requested.

4. Fire Extinguishers can only be used, for incipient fires, by persons that have been trained in their use, after

   a) Fire Alarm has been activated, and,
   b) 911 has been called.

5. To ensure this information is shared with each project worker, it will be part of the DOC Site Specific Safety Plan (SSSP) and acknowledged by each subcontractor's superintendent/foremen.

Note: DOC personnel will be the designated spokesperson(s) when dealing with any press related to the emergency.

Appendix I ~ Emergency Action Plan (continued)

EMERGENCY CONTACT NUMBERS

POLICE/FIRE/EMT 911

Bay State/Franklin Medical Center
413-773-0211

AEIOU Urgent Care
413-773-1394

BUILDING EVACUATION PLAN

In the event of a FIRE or BUILDING EMERGENCY, the procedure below is to be followed:

1. Any person that witnesses a fire or an evacuation situation is to activate the building fire alarm. This will enact the Building Evacuation Plan.

2. All foremen are to demand that work cease immediately and direct his/her employees to report outside to the front of the building. The foreman will take a head count of his/her employees and report any missing employee(s) to DOC personnel.

3. Everyone is to remain in the "Muster Point/Accountability Area", or an area designated during the emergency, until the Outside Emergency Responders (Fire Department, Police, etc.) indicate that it is safe to return to work.

BE CAREFUL TODAY!!

Appendix I ~ Emergency Action Plan (continued)

Project Contact Information

Main Office

Daniel O'Connell's Sons
480 Hampden Street
Holyoke, MA 01040
413-534-5667
Fax 413-534-2902

VP - Corporate Safety:	Nate Clinard	
	Direct:	413-540-1449
	Mobile:	603-770-7221

DOC Greenfield Parking Garage Field Office:

Daniel O'Connell's Sons
40 Bank Row
Greenfield, MA. 01301

			Emergency Call Sequence
Project Superintendent	Pete Sickler		1
	Mobile:	413-326-1582	
Field Engineer	TBD		2
	Mobile:		
Field Safety Engineer	Scott Sattler		3
	Mobile:	413-351-5842	

Appendix I ~ Emergency Action Plan (continued)

Emergency Phone Numbers

Ambulance:	911
Fire:	911
Police:	911
Hospital:	Bay State/Franklin Medical Center 164 High Street Greenfield, MA. 01301 413-773-0211
Medical Center:	AEIOU Urgent Care 489 Bernardston Road Greenfield, MA 413-773-1394
Dig Safe:	811
State Police:	911
Police:	911
Fire Department:	911
EMS:	911

Note: Additional Emergency Phone Numbers will be posted in various locations.

Appendix II ~ Hazard Assessment (STAR Card)

YES	NO	GENERAL SAFETY
☐	☐	Access / Egress
☐	☐	Adequate Lighting
☐	☐	Air Hose Fasteners Secure
☐	☐	Driving Conditions
☐	☐	Equipment Inspection
☐	☐	Evacuation
☐	☐	First Aid
☐	☐	Warm-up Stretching
☐	☐	Hazcom (Labels)
☐	☐	Material / Flammable Storage
☐	☐	Nearest Fire Extinguisher
☐	☐	Nearest Safe Area
☐	☐	Open Holes Protected And Marked
☐	☐	Shower / Eyewash
☐	☐	Signals / Barricades
☐	☐	Signs
☐	☐	Spills & Leaks

Checking No is similar to N/A

YES	NO	MATERIAL HANDLING
☐	☐	Moving / Shifting Loads
☐	☐	Cargo Securement
☐	☐	Proper Body Position
☐	☐	Proper Lifting Methods
☐	☐	Rated Lifting Devices

Checking No is similar to N/A

YES	NO	HAZARDS IDENTIFIED
☐	☐	Abrasive / Sharp Objects
☐	☐	Access / Egress
☐	☐	Asbestos
☐	☐	Arial Lifts
☐	☐	Chemical Burns
☐	☐	Confined Space
☐	☐	Multi Gas Meter
☐	☐	Fire Hazard
☐	☐	Heat / Cold Stress
☐	☐	Inhalation Hazard
☐	☐	Insects
☐	☐	Poison Ivy/Oak
☐	☐	Lead
☐	☐	Lockout/Tagout
☐	☐	Moving / Rotating Parts
☐	☐	Particles In Eyes
☐	☐	Slips, Trips, Falls
☐	☐	Spill Potential
☐	☐	Stored Energy Released (spring/gravity, etc.)
☐	☐	Terrain
☐	☐	Thermal Burns
☐	☐	Vehicle / Locomotive Traffic
☐	☐	Weather Conditions
☐	☐	Work Overhead
☐	☐	Other:

_____

_____

_____

Hazard Assessment

STAR (Stop Think Act Review)

DATE: _____

TIME: _____

JOB LOCATION: _____

JOB DESCRIPTION: _____

EMPLOYEES ON JOB: _____

_____

_____

_____

_____

Be safe in all that you do.

If you have any questions or doubts, STOP THE TASK, and contact your Supervisor or the Safety Administrator

Appendix II ~ Hazard Assessment (STAR Card) – continued

YES	NO	PPE REQUIRED
☐	☐	Chain Saw Chaps
☐	☐	Chemical Goggles
☐	☐	Chemical Suit
☐	☐	Face Shield
☐	☐	Fall Distance Calculated
☐	☐	Hearing Protection
☐	☐	Leather Gloves
☐	☐	PPE Inspected
☐	☐	Respirator Protection
☐	☐	Rubber Gloves / Boots
☐	☐	Traffic Vests
☐	☐	Tyvek Suits
☐	☐	Other:

Checking No is similar to N/A

YES	NO	POST JOB TASKING
☐	☐	Housekeeping Completed
☐	☐	Tools / Equipment Stored
☐	☐	Other - List Below

Checking No is similar to N/A

_____

_____

_____

_____

_____

_____

YES	NO	RIGGING / HOISTING
☐	☐	Communication
☐	☐	Cable Length
☐	☐	Inspection
☐	☐	Load Angle
☐	☐	Load Weight / Rating
☐	☐	Overhead Clearances
☐	☐	Outrigger Footing
☐	☐	Tag Lines

Checking No is similar to N/A

YES	NO	WELDING / BURNING
☐	☐	Bottle Storage / Transport
☐	☐	Flashback Arrestors
☐	☐	Fire Extinguisher
☐	☐	Fire Watch
☐	☐	Systems Drained
☐	☐	Welding Lead (s) Condition
☐	☐	Welding Screens In Place

Checking No is similar to N/A

YES	NO	ELECTRICAL
☐	☐	Check For Potential
☐	☐	Exposed Conductors
☐	☐	Fire Retardant Clothing
☐	☐	GFI Protection
☐	☐	Safe Working Distances
☐	☐	Vehicle Grounds
☐	☐	Cords Inspected
☐	☐	Ground Prong In Place

Checking No is similar to N/A

YES	NO	TRENCHING/EXCAVATION
☐	☐	Dig Safe
☐	☐	Soil Classification
☐	☐	Competent Person Identified
☐	☐	Depth Identified
☐	☐	Cave-In Protection In Place
☐	☐	Access/Egress Every 25 Feet
☐	☐	Air Tested
☐	☐	Fall Protection
☐	☐	Barrier Protection
☐	☐	Exposure to Traffic
☐	☐	Daily Excavation Inspection Report Completed

Checking No is similar to N/A

YES	NO	LADDERS / SCAFFOLDS
☐	☐	Fall Protection—retractable / beam runner / lanyard
☐	☐	Handrails & Midrails
☐	☐	Material Hoist Rope
☐	☐	Proper Footing
☐	☐	Scaffold Tags Current
☐	☐	Toe Boards
☐	☐	Tied Off
☐	☐	Work Positioning

Checking No is similar to N/A

EXHIBIT "P"
SUBCONTRACT RIDER "A"

MGL c. 149, §29E

Notwithstanding anything to the contrary set forth in the Subcontract to which this Rider is attached, the terms of this Rider and MGL c. 149, §29E shall apply to and govern the terms of periodic progress payments covered herein, and shall supersede any conflicting terms in the Subcontract with respect to such payment terms, which are stated below:

1. Subcontractor's Applications for Payment: Processing and Payment of Periodic Progress Payments

a. Subcontractor's Application for Payment for a periodic progress payment shall be submitted not sooner that the 28th day of the month within which the work was completed; provided that the first Application for Payment shall be for a period that is up to forty-four (44) days in the event that the Subcontractor Work commenced within the fourteen (14) days preceding the start of the first full calendar month after commencement of the Subcontract Work. Any Application for Payment not received within the time period set forth herein shall be rejected as untimely and Subcontractor shall not be entitled to submit an Application for Payment until the following month. Application for Payment shall be delivered via US Mail or hand delivered to the Construction Manager's / Contractor's Project Manager (or such other designee as such is set forth in writing by Construction Manager / Contractor's Project Manager). Application for Payment must be in AIA G702 / G703 format with both front sheet and continuation forms completed. An original copy of the requisition must be submitted to the Holyoke office, with a copy emailed or faxed to the DOC Project Manager.

b. Subcontractor may not submit more than one Application for Payment in any thirty (30) day period. Any extra Application for Payment submitted within such thirty (30) day period shall be deemed null and void and Construction Manager / Contractor shall have no obligation with respect to such extra Application for Payment.

c. Provided that an Application for Payment for a periodic progress payment is received by the Construction Manager / Contractor not later than the 28th day of a month, Construction Manager / Contractor shall have twenty-two (22) days from receipt to approve, reject, or approve in part and reject in part such Application for Payment. Any rejection or rejection in part shall be made in writing by Construction Manager / Contractor and / or Architect and / or Owner or other party as allowed by the Contract Documents, and shall include an explanation of the factual and contractual basis for the rejection or rejection in part and shall be certified as made in good faith. A rejection or rejection in part of an Application for Payment shall be subject to the dispute resolution procedure of this Subcontract and / or the Contract Documents as applicable. An Application for Payment that is neither approved nor rejected, or approved in part and rejected in part, shall be deemed to be approved unless it is rejected before payment is due under subparagraph d. below, in which case any prior deemed acceptance due to the passage of time shall be null and void. Neither Construction Manager / Contractor's submission of Subcontractor's Application for Payment to Owner nor the inclusion by Construction Manager / Contractor of amounts claimed due by Subcontractor in any Application for Payment submitted by Construction Manager / Contractor to Owner shall constitute or be deemed acceptance of Subcontractor's Application for Payment, either in whole or in part.

d. Construction Manager / Contractor will include Subcontractor's Work covered by Subcontractor's Application for Payment for a periodic progress payment in the next Application for Payment that Construction Manager / Contractor is entitled to submit to Architect and / or Owner or as otherwise provided in the Contract Documents. Construction Manager / Contractor shall pay Subcontractor each progress payment, less retainage as provided in the Subcontract and / or the Contract Documents, no later than forty-five (45) days after approval of Subcontractor's Application for Payment, subject to the condition precedent set forth in paragraph 3 below, when applicable.

e. Construction Manager / Contractor may withhold approval of an Application for Payment in whole or in part, to the extent reasonably necessary to protect the interests of Construction Manager / Contractor and / or Owner and / or Architect or as otherwise allowed by the Subcontract and / or the Contract Documents. Construction Manager / Contractor may also withhold its approval or, because of subsequently discovered evidence, may nullify in whole or in part a previously approved Application for Payment, to the extent reasonably necessary to protect the interests of Construction Manager / Contractor and / or Owner and / or Architect, from loss for which Subcontractor may be responsible, including but not limited to, loss that may result from:

i. defective Subcontract Work not remedied;
ii. third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Construction Manager / Contractor is provided by Subcontractor;
iii. failure of Subcontractor to make payments properly to sub-subcontractors or suppliers or otherwise for labor, materials or equipment;
iv. reasonable evidence that the Subcontract Work cannot be completed for the unpaid balance of the Subcontract Price;
v. damage to Construction Manager / Contractor, Owner or a separate Construction Manager / Contractor;
vi. reasonable evidence that the Subcontract Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
vii. failure to carry out the Subcontract Work in accordance with the Contract Documents; or
viii. any other breach of any term of the Subcontract.

f. When the above reasons for withholding approval are removed, approval will be made for amounts previously withheld. If Construction Manager / Contractor withholds approval for payment for the reason set forth in subparagraph e, (iii) above, the Construction Manager / Contractor may, at its sole option, issue joint checks to the Subcontractor and to any sub-subcontractor or material or equipment supplier or union benefit fund to whom the Subcontractor failed to make payment for Subcontract Work properly performed or material or equipment suitably delivered. If the Construction Manager / Contractor makes payments by joint checks, the Subcontractor shall reflect such payment on its next Application for Payment.

2. Processing and Payment of Change Order Requests

a. Any request for changes to Subcontract Price must be made in writing to Construction Manager / Contractor's Project Manager (or such other designee as such is set forth in writing by Construction Manager / Contractor's Project Manager). A request for change that does not include any and all supporting documentation required by the Subcontract or the Contract Documents shall be rejected.

b. With respect to a written request by the Subcontractor seeking an increase in the Subcontract Price, the Construction Manager / Contractor shall provide a written response to such request not more than thirty-seven (37) days after the later of (i) the commencement of the performance of the work on which the request is based or (ii) the submission of such written request. In the event that Construction Manager / Contractor neither approves nor rejects such written request within such thirty-seven (37) day period, then such request shall be deemed approved and may be submitted for payment within the next Application for Payment (on a percentage of completion basis), unless it is rejected by Construction Manager / Contractor before the date payment is due on such Application for Payment, in which case any prior deemed acceptance due to the passage of time shall be null and void. A rejection of such a request, whether in whole or in part, shall be made by the Construction Manager / Contractor in writing, shall include an explanation of the factual and contractual basis for the rejection and shall be certified as made in good faith. A rejection in whole or in part shall be subject to the dispute resolution procedure set forth in this Subcontract.

c. Pending final resolution of a request seeking an increase in the Subcontract Price, the Subcontractor shall proceed diligently with performance of the Subcontract and the Construction Manager / Contractor shall continue to make payments of amounts undisputedly due in accordance with the Subcontract. Notwithstanding the foregoing, nothing in this paragraph shall be deemed to require Subcontractor to continue its performance if Subcontractor's claim is for payment of an approved Application for Payment and more than thirty (30) days have elapsed since the date payment was due, unless there shall be (i) a dispute regarding the quality or quantity of the work furnished by Subcontractor or others for whom it is responsible; or, (ii) a default by Subcontractor under the Subcontract after approval of the Application for Payment that is the subject of the written claim and Subcontractor has received (a) prior written notice of such dispute or default certified as made in good faith and (b) payment of all sums due less any amounts attributable to the dispute or default.

3. Condition Precedent to Payment

To the fullest extent allowed by MGL c. 149 §29E (e), with respect to periodic progress payments, release of retainage and / or final payment, receipt of payment form Owner to Construction Manager / Contractor shall be, in each instance, an express condition precedent to Construction Manager / Contractor's obligation to pay Subcontractor and Subcontractor's right to receive payment from Construction Manager / Contractor, but only: (i) to the extent of amounts not received by Construction Manager / Contractor from Owner because Subcontractor failed to perform in accordance with its obligations under this Subcontract and failed to cure such non-performance within the time required by this Subcontract or by law after receipt of written notice, or (ii) to the extent of amounts not received by Construction Manager / Contractor from Owner because Owner is or becomes insolvent within ninety (90) days after the date of submission of Subcontractor's Application for

Payment for which payment is sought, provided that Construction Manager / Contractor complies with all requirements of MGL c. 149, §29E (e) relating to the filing of a mechanics lien and efforts to collect such payment from the Owner.

4. Dispute Resolution

In the event that the dispute resolution procedure set forth in the Subcontract and / or the Contract Documents contains a provision requiring Subcontractor to wait until the Subcontract Work or the Project is substantially complete before commencing formal proceedings under such dispute resolution procedure, or otherwise imposes a delay or waiting period before Subcontractor may commence formal proceedings under such dispute resolution procedure, then, solely with respect to the applicability of such dispute resolution procedure to Construction Manager / Contractor's rejection in whole or in part of an Application for Payment or a written request for an increase in the Subcontract Price, such provision shall be modified or interpreted to mean that with respect to each such rejection or partial rejection of an Application for Payment or written request for an increase in the Subcontract Price, Subcontractor may commence formal proceedings under the dispute resolution procedure of the Subcontract and / or the Contract Documents, as applicable, not earlier than sixty (60) days after (i) the rejection or partial rejection of an Application for Payment or (ii) the rejection of a written request for an increase in the Subcontract Price.

5. Saving Clause

Notwithstanding anything stated herein or in the Subcontract and / or Contract Documents, the payment and other terms of this Subcontract shall be interpreted in a matter consistent with MGL c. 149, §29E, which is deemed incorporated herein by reference. To the extent any term of this Subcontract or Rider violates the requirements of MGL c. 149, §29E, the statue shall govern and such term shall be reformed to the extent required to conform to the law.

-END OF RIDER A-

EXHIBIT "Q"
SUBCONTRACT RIDER "B"

MGL c. 149, §29F

Notwithstanding anything to the contrary set forth in the Subcontract to which this Rider is attached, the terms of this Rider and M.G.L. c. 149, §29F shall apply to and govern the amount of retainage withheld from progress payments, the definition of substantial completion, the application for and payment of retainage, and all other matters set forth in M.G.L. c. 149, §29F, and shall supersede any conflicting terms in the Subcontract with respect to these terms which are stated below:

1. Retainage shall be 5% of each progress payment.
2. Subcontractor shall provide the Contractor with a Schedule of Values for the Subcontractor's work in such detail and at such time as required by Contractor.
3. When the Subcontractor believes it has achieved substantial completion of its work, the Subcontractor shall provide written notice of same to Contractor. Contemporaneous with this notice, the Subcontractor shall also provide to the Contractor a written list describing all incomplete or defective work items and outstanding deliverables required under the Subcontract (the "Subcontractor's Preliminary Punch List"). The Subcontractor's Preliminary Punch List shall be certified by the Subcontractor as made in good faith. Immediately upon submission of the Subcontractor's Preliminary Punch List, the Subcontractor shall proceed expeditiously and without delay to complete, correct, and provide all items on such list, except items which, due to seasonal weather conditions, cannot be completed until such seasonal weather conditions allow.
4. Not later than 21 days after the express or deemed acceptance by the Owner of substantial completion in accordance with M.G.L. c. 149, §29F(e), the Contractor shall submit to the Subcontractor a written list describing all incomplete or defective work items and deliverables required of the Subcontractor under the Subcontract (the "Incomplete Work List"). The Subcontractor shall complete the work on the Incomplete Work List within thirty (30) days of receipt of that List, except items which, due to seasonal weather conditions, cannot be completed until such seasonal weather conditions allow. The Contractor may supplement the Incomplete Work List upon notice from the Owner of subsequent discovery of additional items of incomplete or defective work items and deliverables required under the Subcontract.
5. Application by the Subcontractor for payment of retainage and payment of retainage including establishing the value to complete or correct incomplete or defective work items shall proceed in accordance with the applicable provisions of Chapter 149, §29F, except where the Contract between the Owner and Contractor provides for an earlier submission or payment.
6. Substantial completion of the Subcontract shall be determined in accordance with the applicable provisions of Chapter 149, §29F.

-END OF RIDER B -

EXHIBIT "R"

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

Prevailing Wage Rates

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

CHARLES D. BAKER
Governor

KARYN E. POLITO
Lt. Governor

ROSALIN ACOSTA
Secretary

WILLIAM D MCKINNEY
Director

Awarding Authority: Town of Greenfield

Contract Number: 18-01 **City/Town:** GREENFIELD

Description of Work: Construction testing/inspection Services for the Olive Street Parking Garage; to include soil compaction and gradation, cast in place concrete, precast welds and caulking

Job Location: Olive Street, Greenfield, MA

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 B*	12/01/2016	$32.15	$10.91	$10.89	$0.00	$53.95
(3 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2016	$32.22	$10.91	$10.89	$0.00	$54.02
(4 & 5 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2016	$32.34	$10.91	$10.89	$0.00	$54.14
ADS/SUBMERSIBLE PILOT *PILE DRIVER LOCAL 56 (ZONE 3)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2015	$90.51	$9.80	$18.17	$0.00	$118.48
AIR TRACK OPERATOR *LABORERS - ZONE 3 (BUILDING & SITE)* For apprentice rates see "Apprentice- LABORER"	12/05/2016	$30.33	$7.60	$12.50	$0.00	$50.43
AIR TRACK OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)* For apprentice rates see "Apprentice- LABORER (Heavy and Highway)	12/01/2016	$30.25	$7.60	$10.62	$0.00	$48.47
ASBESTOS WORKER (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (SPRINGFIELD)*	06/01/2017	$31.41	$11.50	$6.60	$0.00	$49.51
	12/01/2017	$32.31	$11.50	$6.60	$0.00	$50.41
	06/01/2018	$33.21	$11.50	$6.60	$0.00	$51.31
	12/01/2018	$34.11	$11.50	$6.60	$0.00	$52.21
	06/01/2019	$35.01	$11.50	$6.60	$0.00	$53.11
	12/01/2019	$35.91	$11.50	$6.60	$0.00	$54.01
	06/01/2020	$36.81	$11.50	$6.60	$0.00	$54.91
	12/01/2020	$37.71	$11.50	$6.60	$0.00	$55.81
ASPHALT RAKER *LABORERS - ZONE 3 (BUILDING & SITE)* For apprentice rates see "Apprentice- LABORER"	12/05/2016	$29.83	$7.60	$12.50	$0.00	$49.93
ASPHALT RAKER (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)* For apprentice rates see "Apprentice- LABORER (Heavy and Highway)	12/01/2016	$29.75	$7.60	$10.62	$0.00	$47.97
AUTOMATIC GRADER-EXCAVATOR (RECLAIMER) *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.88	$10.79	$12.75	$0.00	$57.42
	12/01/2017	$34.48	$10.79	$13.02	$0.00	$58.29
	06/01/2018	$35.09	$10.79	$13.29	$0.00	$59.17
	12/01/2018	$35.69	$10.79	$13.56	$0.00	$60.04
	06/01/2019	$36.20	$10.79	$13.83	$0.00	$60.82
	12/01/2019	$36.80	$10.79	$14.10	$0.00	$61.69
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER OPERATOR *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.88	$10.79	$12.75	$0.00	$57.42
	12/01/2017	$34.48	$10.79	$13.02	$0.00	$58.29
	06/01/2018	$35.09	$10.79	$13.29	$0.00	$59.17
	12/01/2018	$35.69	$10.79	$13.56	$0.00	$60.04
	06/01/2019	$36.20	$10.79	$13.83	$0.00	$60.82
	12/01/2019	$36.80	$10.79	$14.10	$0.00	$61.69
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER *LABORERS - ZONE 3 (BUILDING & SITE)* For apprentice rates see "Apprentice- LABORER"	12/05/2016	$29.83	$7.60	$12.50	$0.00	$49.93

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
BATCH/CEMENT PLANT - ON SITE *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.35	$10.79	$12.75	$0.00	$56.89
	12/01/2017	$33.95	$10.79	$13.02	$0.00	$57.76
	06/01/2018	$34.56	$10.79	$13.29	$0.00	$58.64
	12/01/2018	$35.16	$10.79	$13.56	$0.00	$59.51
	06/01/2019	$35.67	$10.79	$13.83	$0.00	$60.29
	12/01/2019	$36.27	$10.79	$14.10	$0.00	$61.16
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BLOCK PAVER, RAMMER / CURB SETTER *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$30.33	$7.60	$12.50	$0.00	$50.43
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$30.25	$7.60	$10.62	$0.00	$48.47
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						
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 (SPRINGFIELD/PITTSFIELD)*	02/27/2017	$39.26	$10.75	$17.38	$0.00	$67.39

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BRICK/PLASTER/CEMENT MASON - Local 3 Springfield/Pittsfield*

Effective Date - 02/27/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.63	$10.75	$17.38	$0.00	$47.76
2	60	$23.56	$10.75	$17.38	$0.00	$51.69
3	70	$27.48	$10.75	$17.38	$0.00	$55.61
4	80	$31.41	$10.75	$17.38	$0.00	$59.54
5	90	$35.33	$10.75	$17.38	$0.00	$63.46

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/POWER SHOVEL/TREE SHREDDER /CLAM SHELL *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.88	$10.79	$12.75	$0.00	$57.42
	12/01/2017	$34.48	$10.79	$13.02	$0.00	$58.29
	06/01/2018	$35.09	$10.79	$13.29	$0.00	$59.17
	12/01/2018	$35.69	$10.79	$13.56	$0.00	$60.04
	06/01/2019	$36.20	$10.79	$13.83	$0.00	$60.82
	12/01/2019	$36.80	$10.79	$14.10	$0.00	$61.69
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 3 (BUILDING & SITE)*	12/05/2016	$29.83	$7.60	$12.50	$0.00	$49.93
For apprentice rates see "Apprentice- LABORER"						
CARPENTER *CARPENTERS LOCAL 108 - HAMPDEN HAMPSHIRE FRANKLIN*	02/27/2017	$34.56	$8.26	$15.00	$0.00	$57.82
	09/04/2017	$35.56	$8.26	$15.00	$0.00	$58.82
	03/05/2018	$36.56	$8.26	$15.00	$0.00	$59.82
	09/05/2018	$37.60	$8.26	$15.00	$0.00	$60.86
	03/04/2019	$38.64	$8.26	$15.00	$0.00	$61.90

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CARPENTER - Local 108 Hampden Hampshire Franklin*

Effective Date - 02/27/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.28	$8.26	$1.22	$0.00	$26.76
2	60	$20.74	$8.26	$1.22	$0.00	$30.22
3	70	$24.19	$8.26	$11.34	$0.00	$43.79
4	75	$25.92	$8.26	$11.34	$0.00	$45.52
5	80	$27.65	$8.26	$12.56	$0.00	$48.47
6	80	$27.65	$8.26	$12.56	$0.00	$48.47
7	90	$31.10	$8.26	$13.78	$0.00	$53.14
8	90	$31.10	$8.26	$13.78	$0.00	$53.14

Effective Date - 09/04/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.78	$8.26	$1.22	$0.00	$27.26
2	60	$21.34	$8.26	$1.22	$0.00	$30.82
3	70	$24.89	$8.26	$11.34	$0.00	$44.49
4	75	$26.67	$8.26	$11.34	$0.00	$46.27
5	80	$28.45	$8.26	$12.56	$0.00	$49.27
6	80	$28.45	$8.26	$12.56	$0.00	$49.27
7	90	$32.00	$8.26	$13.78	$0.00	$54.04
8	90	$32.00	$8.26	$13.78	$0.00	$54.04

Notes:

** 1: 1-5/2: 6-8/3:9-11/Steps: 6 mos (600 hrs)/rates by step

Apprentice to Journeyworker Ratio:**

CEMENT MASONRY/PLASTERING *BRICKLAYERS LOCAL 3 (SPRINGFIELD/PITTSFIELD)*	07/01/2017	$39.31	$12.15	$14.56	$1.30	$67.32
	01/01/2018	$39.34	$12.15	$14.56	$1.30	$67.35
	07/01/2018	$39.37	$12.15	$14.56	$1.30	$67.38
	01/01/2019	$39.41	$12.15	$14.56	$1.30	$67.42
	07/01/2019	$39.44	$12.15	$14.56	$1.30	$67.45
	01/01/2020	$39.48	$12.15	$14.56	$1.30	$67.49

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CEMENT MASONRY/PLASTERING - Springfield/Pittsfield*

Effective Date - 07/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.66	$12.15	$12.33	$0.00	$44.14
2	60	$23.59	$12.15	$14.56	$1.30	$51.60
3	65	$25.55	$12.15	$14.56	$1.30	$53.56
4	70	$27.52	$12.15	$14.56	$1.30	$55.53
5	75	$29.48	$12.15	$14.56	$1.30	$57.49
6	80	$31.45	$12.15	$14.56	$1.30	$59.46
7	90	$35.38	$12.15	$14.56	$1.30	$63.39

Effective Date - 01/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.67	$12.15	$12.33	$0.00	$44.15
2	60	$23.60	$12.15	$14.56	$1.30	$51.61
3	65	$25.57	$12.15	$14.56	$1.30	$53.58
4	70	$27.54	$12.15	$14.56	$1.30	$55.55
5	75	$29.51	$12.15	$14.56	$1.30	$57.52
6	80	$31.47	$12.15	$14.56	$1.30	$59.48
7	90	$35.41	$12.15	$14.56	$1.30	$63.42

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 3 (BUILDING & SITE)*	12/05/2016	$29.83	$7.60	$12.50	$0.00	$49.93
For apprentice rates see "Apprentice- LABORER"						
COMPRESSOR OPERATOR *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.35	$10.79	$12.75	$0.00	$56.89
	12/01/2017	$33.95	$10.79	$13.02	$0.00	$57.76
	06/01/2018	$34.56	$10.79	$13.29	$0.00	$58.64
	12/01/2018	$35.16	$10.79	$13.56	$0.00	$59.51
	06/01/2019	$35.67	$10.79	$13.83	$0.00	$60.29
	12/01/2019	$36.27	$10.79	$14.10	$0.00	$61.16
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
CRANE OPERATOR *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$37.38	$10.79	$12.75	$0.00	$60.92
	12/01/2017	$37.98	$10.79	$13.02	$0.00	$61.79
	06/01/2018	$38.59	$10.79	$13.29	$0.00	$62.67
	12/01/2018	$39.19	$10.79	$13.56	$0.00	$63.54
	06/01/2019	$39.70	$10.79	$13.83	$0.00	$64.32
	12/01/2019	$40.30	$10.79	$14.10	$0.00	$65.19
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DELEADER (BRIDGE) *PAINTERS LOCAL 35 - ZONE 3*	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 3 (BUILDING & SITE)*	06/01/2017	$37.00	$7.60	$14.65	$0.00	$59.25
	12/01/2017	$37.85	$7.60	$14.65	$0.00	$60.10
	06/01/2018	$38.80	$7.60	$14.65	$0.00	$61.05
	12/01/2018	$39.75	$7.60	$14.65	$0.00	$62.00
	06/01/2019	$40.75	$7.60	$14.65	$0.00	$63.00
	12/01/2019	$41.75	$7.60	$14.65	$0.00	$64.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: BACKHOE/LOADER/HAMMER OPERATOR *LABORERS - ZONE 3 (BUILDING & SITE)*	06/01/2017	$38.00	$7.60	$14.65	$0.00	$60.25
	12/01/2017	$38.85	$7.60	$14.65	$0.00	$61.10
	06/01/2018	$39.80	$7.60	$14.65	$0.00	$62.05
	12/01/2018	$40.75	$7.60	$14.65	$0.00	$63.00
	06/01/2019	$41.75	$7.60	$14.65	$0.00	$64.00
	12/01/2019	$42.75	$7.60	$14.65	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: BURNERS *LABORERS - ZONE 3 (BUILDING & SITE)*	06/01/2017	$37.75	$7.60	$14.65	$0.00	$60.00
	12/01/2017	$38.60	$7.60	$14.65	$0.00	$60.85
	06/01/2018	$39.55	$7.60	$14.65	$0.00	$61.80
	12/01/2018	$40.50	$7.60	$14.65	$0.00	$62.75
	06/01/2019	$41.50	$7.60	$14.65	$0.00	$63.75
	12/01/2019	$42.50	$7.60	$14.65	$0.00	$64.75
For apprentice rates see "Apprentice- LABORER"						
DEMO: CONCRETE CUTTER/SAWYER *LABORERS - ZONE 3 (BUILDING & SITE)*	06/01/2017	$38.00	$7.60	$14.65	$0.00	$60.25
	12/01/2017	$38.85	$7.60	$14.65	$0.00	$61.10
	06/01/2018	$39.80	$7.60	$14.65	$0.00	$62.05
	12/01/2018	$40.75	$7.60	$14.65	$0.00	$63.00
	06/01/2019	$41.75	$7.60	$14.65	$0.00	$64.00
	12/01/2019	$42.75	$7.60	$14.65	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: JACKHAMMER OPERATOR *LABORERS - ZONE 3 (BUILDING & SITE)*	06/01/2017	$37.75	$7.60	$14.65	$0.00	$60.00
	12/01/2017	$38.60	$7.60	$14.65	$0.00	$60.85
	06/01/2018	$39.55	$7.60	$14.65	$0.00	$61.80
	12/01/2018	$40.50	$7.60	$14.65	$0.00	$62.75
	06/01/2019	$41.50	$7.60	$14.65	$0.00	$63.75
	12/01/2019	$42.50	$7.60	$14.65	$0.00	$64.75
For apprentice rates see "Apprentice- LABORER"						
DEMO: WRECKING LABORER *LABORERS - ZONE 3 (BUILDING & SITE)*	06/01/2017	$37.00	$7.60	$14.65	$0.00	$59.25
	12/01/2017	$37.85	$7.60	$14.65	$0.00	$60.10
	06/01/2018	$38.80	$7.60	$14.65	$0.00	$61.05
	12/01/2018	$39.75	$7.60	$14.65	$0.00	$62.00
	06/01/2019	$40.75	$7.60	$14.65	$0.00	$63.00
	12/01/2019	$41.75	$7.60	$14.65	$0.00	$64.00
For apprentice rates see "Apprentice- LABORER"						
DIVER *PILE DRIVER LOCAL 56 (ZONE 3)*	08/01/2015	$60.34	$9.80	$18.17	$0.00	$88.31
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER *PILE DRIVER LOCAL 56 (ZONE 3)*	08/01/2015	$43.10	$9.80	$18.17	$0.00	$71.07
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 3)*	08/01/2015	$64.65	$9.80	$18.17	$0.00	$92.62
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER/SLURRY (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 3)*	08/01/2015	$90.51	$9.80	$18.17	$0.00	$118.48
For apprentice rates see "Apprentice- PILE DRIVER"						
ELECTRICIAN (Including Core Drilling) *ELECTRICIANS LOCAL 7*	07/02/2017	$40.01	$9.60	$11.20	$0.00	$60.81
	12/31/2017	$40.51	$10.00	$11.42	$0.00	$61.93
	07/01/2018	$41.21	$10.25	$11.74	$0.00	$63.20
	12/30/2018	$41.91	$10.50	$12.06	$0.00	$64.47
	06/30/2019	$42.66	$10.75	$12.33	$0.00	$65.74
	12/29/2019	$43.41	$11.00	$12.60	$0.00	$67.01

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELECTRICIAN - Local 7*

Effective Date - 07/02/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$16.00	$5.25	$0.48	$0.00	$21.73
2	45	$18.00	$5.25	$0.54	$0.00	$23.79
3	50	$20.01	$9.60	$6.90	$0.00	$36.51
4	55	$22.01	$9.60	$6.96	$0.00	$38.57
5	65	$26.01	$9.60	$8.08	$0.00	$43.69
6	70	$28.01	$9.60	$9.14	$0.00	$46.75

Effective Date - 12/31/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$16.20	$5.40	$0.49	$0.00	$22.09
2	45	$18.23	$5.40	$0.55	$0.00	$24.18
3	50	$20.26	$10.00	$6.91	$0.00	$37.17
4	55	$22.28	$10.00	$6.97	$0.00	$39.25
5	65	$26.33	$10.00	$8.09	$0.00	$44.42
6	70	$28.36	$10.00	$9.15	$0.00	$47.51

Notes:

Steps 1-2 are 1000 hrs; Steps 3-6 are 1500 hrs.

Apprentice to Journeyworker Ratio:2:3**

ELEVATOR CONSTRUCTOR *ELEVATOR CONSTRUCTORS LOCAL 41*	01/01/2017	$49.90	$15.28	$15.71	$0.00	$80.89

Apprentice - *ELEVATOR CONSTRUCTOR - Local 41*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.95	$15.28	$15.71	$0.00	$55.94
2	55	$27.45	$15.28	$15.71	$0.00	$58.44
3	65	$32.44	$15.28	$15.71	$0.00	$63.43
4	70	$34.93	$15.28	$15.71	$0.00	$65.92
5	80	$39.92	$15.28	$15.71	$0.00	$70.91

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 41*	01/01/2017	$34.93	$15.28	$15.71	$0.00	$65.92

For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"

FENCE & GUARD RAIL ERECTOR (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$29.75	$7.60	$10.62	$0.00	$47.97

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIELD ENG.INST/ROD-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 98*	06/01/1999	$18.84	$4.80	$4.10	$0.00	$27.74
FIELD ENG.PARTY CHIEF:BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 98*	06/01/1999	$21.33	$4.80	$4.10	$0.00	$30.23
FIELD ENG.SURVEY CHIEF-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 98*	06/01/1999	$22.33	$4.80	$4.10	$0.00	$31.23
FIRE ALARM INSTALLER *ELECTRICIANS LOCAL 7*	07/02/2017	$40.01	$9.60	$11.20	$0.00	$60.81
	12/31/2017	$40.51	$10.00	$11.42	$0.00	$61.93
	07/01/2018	$41.21	$10.25	$11.74	$0.00	$63.20
	12/30/2018	$41.91	$10.50	$12.06	$0.00	$64.47
	06/30/2019	$42.66	$10.75	$12.33	$0.00	$65.74
	12/29/2019	$43.41	$11.00	$12.60	$0.00	$67.01
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING *ELECTRICIANS LOCAL 7*	07/02/2017	$40.01	$9.60	$11.20	$0.00	$60.81
	12/31/2017	$40.51	$10.00	$11.42	$0.00	$61.93
	07/01/2018	$41.21	$10.25	$11.74	$0.00	$63.20
	12/30/2018	$41.91	$10.50	$12.06	$0.00	$64.47
	06/30/2019	$42.66	$10.75	$12.33	$0.00	$65.74
	12/29/2019	$43.41	$11.00	$12.60	$0.00	$67.01
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"						
FIREMAN *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.35	$10.79	$12.75	$0.00	$56.89
	12/01/2017	$33.95	$10.79	$13.02	$0.00	$57.76
	06/01/2018	$34.56	$10.79	$13.29	$0.00	$58.64
	12/01/2018	$35.16	$10.79	$13.56	$0.00	$59.51
	06/01/2019	$35.67	$10.79	$13.83	$0.00	$60.29
	12/01/2019	$36.27	$10.79	$14.10	$0.00	$61.16

Apprentice - *OPERATING ENGINEERS - Local 98 Class 3*

Effective Date - 06/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$20.01	$10.79	$12.75	$0.00	$43.55
2	70	$23.35	$10.79	$12.75	$0.00	$46.89
3	80	$26.68	$10.79	$12.75	$0.00	$50.22
4	90	$30.02	$10.79	$12.75	$0.00	$53.56

Effective Date - 12/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$20.37	$10.79	$13.02	$0.00	$44.18
2	70	$23.77	$10.79	$13.02	$0.00	$47.58
3	80	$27.16	$10.79	$13.02	$0.00	$50.97
4	90	$30.56	$10.79	$13.02	$0.00	$54.37

Notes:

Steps 1-2 are 1000 hrs.; Steps 3-4 are 2000 hrs.

Apprentice to Journeyworker Ratio:1:6

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FLAGGER & SIGNALER (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$20.50	$7.60	$10.62	$0.00	$38.72
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						
FLOORCOVERER *FLOORCOVERERS LOCAL 2168 ZONE III*	03/01/2016	$32.60	$8.55	$14.42	$0.00	$55.57

Apprentice - *FLOORCOVERER - Local 2168 Zone III*

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$16.30	$8.55	$1.20	$0.00	$26.05
2	55	$17.93	$8.55	$1.20	$0.00	$27.68
3	60	$19.56	$8.55	$10.82	$0.00	$38.93
4	65	$21.19	$8.55	$10.82	$0.00	$40.56
5	70	$22.82	$8.55	$12.02	$0.00	$43.39
6	75	$24.45	$8.55	$12.02	$0.00	$45.02
7	80	$26.08	$8.55	$13.22	$0.00	$47.85
8	85	$27.71	$8.55	$13.22	$0.00	$49.48

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

FORK LIFT *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.57	$10.79	$12.75	$0.00	$57.11
	12/01/2017	$34.17	$10.79	$13.02	$0.00	$57.98
	06/01/2018	$34.78	$10.79	$13.29	$0.00	$58.86
	12/01/2018	$35.38	$10.79	$13.56	$0.00	$59.73
	06/01/2019	$35.89	$10.79	$13.83	$0.00	$60.51
	12/01/2019	$36.49	$10.79	$14.10	$0.00	$61.38
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GENERATORS/LIGHTING PLANTS *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$30.12	$10.79	$12.75	$0.00	$53.66
	12/01/2017	$30.72	$10.79	$13.02	$0.00	$54.53
	06/01/2018	$31.33	$10.79	$13.29	$0.00	$55.41
	12/01/2018	$31.93	$10.79	$13.56	$0.00	$56.28
	06/01/2019	$32.44	$10.79	$13.83	$0.00	$57.06
	12/01/2019	$33.04	$10.79	$14.10	$0.00	$57.93
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) *GLAZIERS LOCAL 1333*	06/01/2016	$35.58	$10.70	$8.25	$0.00	$54.53

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *GLAZIER - Local 1333*

Effective Date - 06/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.79	$10.70	$1.00	$0.00	$29.49
2	56	$20.01	$10.70	$1.00	$0.00	$31.71
3	63	$22.24	$10.70	$1.50	$0.00	$34.44
4	69	$24.46	$10.70	$1.50	$0.00	$36.66
5	75	$26.69	$10.70	$2.00	$0.00	$39.39
6	81	$28.91	$10.70	$2.00	$0.00	$41.61
7	88	$31.13	$10.70	$8.00	$0.00	$49.83
8	94	$33.36	$10.70	$8.00	$0.00	$52.06

Notes:

Apprentice to Journeyworker Ratio:1:3

GRADER/TRENCHING MACHINE/DERRICK *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.88	$10.79	$12.75	$0.00	$57.42
	12/01/2017	$34.48	$10.79	$13.02	$0.00	$58.29
	06/01/2018	$35.09	$10.79	$13.29	$0.00	$59.17
	12/01/2018	$35.69	$10.79	$13.56	$0.00	$60.04
	06/01/2019	$36.20	$10.79	$13.83	$0.00	$60.82
	12/01/2019	$36.80	$10.79	$14.10	$0.00	$61.69
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
HVAC (DUCTWORK) *SHEETMETAL WORKERS LOCAL 63*	01/01/2017	$32.24	$10.64	$15.49	$1.75	$60.12
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (ELECTRICAL CONTROLS) *ELECTRICIANS LOCAL 7*	07/02/2017	$40.01	$9.60	$11.20	$0.00	$60.81
	12/31/2017	$40.51	$10.00	$11.42	$0.00	$61.93
	07/01/2018	$41.21	$10.25	$11.74	$0.00	$63.20
	12/30/2018	$41.91	$10.50	$12.06	$0.00	$64.47
	06/30/2019	$42.66	$10.75	$12.33	$0.00	$65.74
	12/29/2019	$43.41	$11.00	$12.60	$0.00	$67.01
For apprentice rates see "Apprentice- ELECTRICIAN"						
HVAC (TESTING AND BALANCING - AIR) *SHEETMETAL WORKERS LOCAL 63*	01/01/2017	$32.24	$10.64	$15.49	$1.75	$60.12
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) *PLUMBERS & PIPEFITTERS LOCAL 104*	03/17/2017	$39.26	$8.50	$15.30	$0.00	$63.06
	09/17/2017	$40.01	$8.50	$15.30	$0.00	$63.81
	03/17/2018	$40.76	$8.50	$15.30	$0.00	$64.56
	09/17/2018	$41.51	$8.50	$15.30	$0.00	$65.31
	03/17/2019	$42.26	$8.50	$15.30	$0.00	$66.06
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC MECHANIC *PLUMBERS & PIPEFITTERS LOCAL 104*	03/17/2017	$39.26	$8.50	$15.30	$0.00	$63.06
	09/17/2017	$40.01	$8.50	$15.30	$0.00	$63.81
	03/17/2018	$40.76	$8.50	$15.30	$0.00	$64.56
	09/17/2018	$41.51	$8.50	$15.30	$0.00	$65.31
	03/17/2019	$42.26	$8.50	$15.30	$0.00	$66.06
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HYDRAULIC DRILLS (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$30.25	$7.60	$10.62	$0.00	$48.47
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						
INSULATOR (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (SPRINGFIELD)*	09/01/2016	$36.07	$11.75	$14.20	$0.00	$62.02
	09/01/2017	$37.67	$11.75	$14.20	$0.00	$63.62
	09/01/2018	$39.47	$11.75	$14.20	$0.00	$65.42
	09/01/2019	$41.47	$11.75	$14.20	$0.00	$67.42

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

Effective Date - 09/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.04	$11.75	$10.45	$0.00	$40.24
2	60	$21.64	$11.75	$11.20	$0.00	$44.59
3	70	$25.25	$11.75	$11.95	$0.00	$48.95
4	80	$28.86	$11.75	$12.70	$0.00	$53.31

Effective Date - 09/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.84	$11.75	$10.45	$0.00	$41.04
2	60	$22.60	$11.75	$11.20	$0.00	$45.55
3	70	$26.37	$11.75	$11.95	$0.00	$50.07
4	80	$30.14	$11.75	$12.70	$0.00	$54.59

Notes:

Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER *IRONWORKERS LOCAL 7 (SPRINGFIELD AREA)*	03/16/2017	$32.39	$7.80	$19.60	$0.00	$59.79

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *IRONWORKER - Local 7 Springfield*

Effective Date - 03/16/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$19.43	$7.80	$19.60	$0.00	$46.83
2	70	$22.67	$7.80	$19.60	$0.00	$50.07
3	75	$24.29	$7.80	$19.60	$0.00	$51.69
4	80	$25.91	$7.80	$19.60	$0.00	$53.31
5	85	$27.53	$7.80	$19.60	$0.00	$54.93
6	90	$29.15	$7.80	$19.60	$0.00	$56.55

Notes:

Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:

JACKHAMMER & PAVING BREAKER OPERATOR *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$29.83	$7.60	$12.50	$0.00	$49.93

For apprentice rates see "Apprentice- LABORER"

LABORER *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$29.58	$7.60	$12.50	$0.00	$49.68

Apprentice - *LABORER - Zone 3 Building & Site*

Effective Date - 12/05/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$17.75	$7.60	$12.50	$0.00	$37.85
2	70	$20.71	$7.60	$12.50	$0.00	$40.81
3	80	$23.66	$7.60	$12.50	$0.00	$43.76
4	90	$26.62	$7.60	$12.50	$0.00	$46.72

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$29.50	$7.60	$10.62	$0.00	$47.72

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LABORER (Heavy & Highway) - Zone 3*

Effective Date - 12/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$17.70	$7.60	$10.62	$0.00	$35.92
2	70	$20.65	$7.60	$10.62	$0.00	$38.87
3	80	$23.60	$7.60	$10.62	$0.00	$41.82
4	90	$26.55	$7.60	$10.62	$0.00	$44.77

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER: CARPENTER TENDER *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$29.58	$7.60	$12.50	$0.00	$49.68
For apprentice rates see "Apprentice- LABORER"						
LABORER: CEMENT FINISHER TENDER *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$29.83	$7.60	$12.50	$0.00	$49.93
For apprentice rates see "Apprentice- LABORER"						
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER *LABORERS - ZONE 3 (BUILDING & SITE)*	06/01/2017	$30.18	$7.60	$12.77	$0.00	$50.55
	12/01/2017	$30.94	$7.60	$12.77	$0.00	$51.31
	06/01/2018	$31.72	$7.60	$12.77	$0.00	$52.09
	12/01/2018	$32.49	$7.60	$12.77	$0.00	$52.86
	06/01/2019	$33.30	$7.60	$12.77	$0.00	$53.67
	12/01/2019	$34.11	$7.60	$12.77	$0.00	$54.48
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$30.58	$7.60	$12.50	$0.00	$50.68
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$29.75	$7.60	$10.62	$0.00	$47.97
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						
LABORER: MULTI-TRADE TENDER *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$29.58	$7.60	$12.50	$0.00	$49.68
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$29.58	$7.60	$12.50	$0.00	$49.68
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 3 (BUILDING & SITE)*	12/05/2016	$29.83	$7.60	$12.50	$0.00	$49.93
For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$29.75	$7.60	$10.62	$0.00	$47.97
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						
MARBLE & TILE FINISHERS *BRICKLAYERS LOCAL 3 (SPR/PITT) - MARBLE & TILE*	02/27/2017	$32.67	$10.75	$17.05	$0.00	$60.47

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MARBLE-TILE-TERRAZZO FINISHER-Local 3 Marble/Tile (Spr/Pitt)*
Effective Date - 02/27/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$16.34	$10.75	$17.05	$0.00	$44.14
2	60	$19.60	$10.75	$17.05	$0.00	$47.40
3	70	$22.87	$10.75	$17.05	$0.00	$50.67
4	80	$26.14	$10.75	$17.05	$0.00	$53.94
5	90	$29.40	$10.75	$17.05	$0.00	$57.20

Notes:

Apprentice to Journeyworker Ratio:1:5

MARBLE MASONS,TILELAYERS & TERRAZZO MECH *BRICKLAYERS LOCAL 3 (SPR/PITT) - MARBLE & TILE*	02/27/2017	$39.26	$10.75	$17.38	$0.00	$67.39

Apprentice - *MARBLE-TILE-TERRAZZO MECH - Local 3 Marble/Tile (Spr/Pitt)*
Effective Date - 02/27/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.63	$10.75	$17.38	$0.00	$47.76
2	60	$23.56	$10.75	$17.38	$0.00	$51.69
3	70	$27.48	$10.75	$17.38	$0.00	$55.61
4	80	$31.41	$10.75	$17.38	$0.00	$59.54
5	90	$35.33	$10.75	$17.38	$0.00	$63.46

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.88	$10.79	$12.75	$0.00	$57.42
	12/01/2017	$34.48	$10.79	$13.02	$0.00	$58.29
	06/01/2018	$35.09	$10.79	$13.29	$0.00	$59.17
	12/01/2018	$35.69	$10.79	$13.56	$0.00	$60.04
	06/01/2019	$36.20	$10.79	$13.83	$0.00	$60.82
	12/01/2019	$36.80	$10.79	$14.10	$0.00	$61.69

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MECHANIC/WELDER/BOOM TRUCK *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.35	$10.79	$12.75	$0.00	$56.89
	12/01/2017	$33.95	$10.79	$13.02	$0.00	$57.76
	06/01/2018	$34.56	$10.79	$13.29	$0.00	$58.64
	12/01/2018	$35.16	$10.79	$13.56	$0.00	$59.51
	06/01/2019	$35.67	$10.79	$13.83	$0.00	$60.29
	12/01/2019	$36.27	$10.79	$14.10	$0.00	$61.16

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
MILLWRIGHT (Zone 3) *MILLWRIGHTS LOCAL 1121 - Zone 3*	04/01/2017	$33.81	$9.90	$18.50	$0.00	$62.21
	10/01/2017	$34.64	$9.90	$18.50	$0.00	$63.04
	04/01/2018	$35.46	$9.90	$18.50	$0.00	$63.86
	10/01/2018	$36.29	$9.90	$18.50	$0.00	$64.69
	04/01/2019	$37.11	$9.90	$18.50	$0.00	$65.51

Apprentice - *MILLWRIGHT - Local 1121 Zone 3*

Effective Date - 04/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$18.60	$9.90	$5.31	$0.00	$33.81
2	65	$21.98	$9.90	$15.13	$0.00	$47.01
3	75	$25.36	$9.90	$16.10	$0.00	$51.36
4	85	$28.74	$9.90	$17.06	$0.00	$55.70

Effective Date - 10/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$19.05	$9.90	$5.31	$0.00	$34.26
2	65	$22.52	$9.90	$15.13	$0.00	$47.55
3	75	$25.98	$9.90	$16.10	$0.00	$51.98
4	85	$29.44	$9.90	$17.06	$0.00	$56.40

Notes:

Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$29.83	$7.60	$12.50	$0.00	$49.93

For apprentice rates see "Apprentice- LABORER"

OILER *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$29.04	$10.79	$12.75	$0.00	$52.58
	12/01/2017	$29.64	$10.79	$13.02	$0.00	$53.45
	06/01/2018	$30.25	$10.79	$13.29	$0.00	$54.33
	12/01/2018	$30.85	$10.79	$13.56	$0.00	$55.20
	06/01/2019	$31.36	$10.79	$13.83	$0.00	$55.98
	12/01/2019	$31.96	$10.79	$14.10	$0.00	$56.85

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

OTHER POWER DRIVEN EQUIPMENT - CLASS VI *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$27.06	$10.79	$12.75	$0.00	$50.60
	12/01/2017	$27.66	$10.79	$13.02	$0.00	$51.47
	06/01/2018	$28.27	$10.79	$13.29	$0.00	$52.35
	12/01/2018	$28.87	$10.79	$13.56	$0.00	$53.22
	06/01/2019	$29.38	$10.79	$13.83	$0.00	$54.00
	12/01/2019	$29.98	$10.79	$14.10	$0.00	$54.87

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

PAINTER (BRIDGES/TANKS) *PAINTERS LOCAL 35 - ZONE 3*	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	$34.68	$7.85	$12.30	$0.00	$54.83

* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 3*

Apprentice - *PAINTER Local 35 Zone 3 - Spray/Sandblast - New*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.34	$7.85	$0.00	$0.00	$25.19
2	55	$19.07	$7.85	$1.57	$0.00	$28.49
3	60	$20.81	$7.85	$1.71	$0.00	$30.37
4	65	$22.54	$7.85	$1.85	$0.00	$32.24
5	70	$24.28	$7.85	$11.45	$0.00	$43.58
6	75	$26.01	$7.85	$11.59	$0.00	$45.45
7	80	$27.74	$7.85	$11.73	$0.00	$47.32
8	90	$31.21	$7.85	$12.02	$0.00	$51.08

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT)	01/01/2017	$32.00	$7.85	$12.30	$0.00	$52.15

PAINTERS LOCAL 35 - ZONE 3

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 3 - Spray/Sandblast - Repaint*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$16.00	$7.85	$0.00	$0.00	$23.85
2	55	$17.60	$7.85	$1.57	$0.00	$27.02
3	60	$19.20	$7.85	$1.71	$0.00	$28.76
4	65	$20.80	$7.85	$1.85	$0.00	$30.50
5	70	$22.40	$7.85	$11.45	$0.00	$41.70
6	75	$24.00	$7.85	$11.59	$0.00	$43.44
7	80	$25.60	$7.85	$11.73	$0.00	$45.18
8	90	$28.80	$7.85	$12.02	$0.00	$48.67

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, NEW) *	01/01/2017	$33.28	$7.85	$12.30	$0.00	$53.43

* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 3*

Apprentice - *PAINTER - Local 35 Zone 3 - BRUSH NEW*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$16.64	$7.85	$0.00	$0.00	$24.49
2	55	$18.30	$7.85	$1.57	$0.00	$27.72
3	60	$19.97	$7.85	$1.71	$0.00	$29.53
4	65	$21.63	$7.85	$1.85	$0.00	$31.33
5	70	$23.30	$7.85	$11.45	$0.00	$42.60
6	75	$24.96	$7.85	$11.59	$0.00	$44.40
7	80	$26.62	$7.85	$11.73	$0.00	$46.20
8	90	$29.95	$7.85	$12.02	$0.00	$49.82

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT) *PAINTERS LOCAL 35 - ZONE 3*	01/01/2017	$30.60	$7.85	$12.30	$0.00	$50.75

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 3 - BRUSH REPAINT*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$15.30	$7.85	$0.00	$0.00	$23.15
2	55	$16.83	$7.85	$1.57	$0.00	$26.25
3	60	$18.36	$7.85	$1.71	$0.00	$27.92
4	65	$19.89	$7.85	$1.85	$0.00	$29.59
5	70	$21.42	$7.85	$11.45	$0.00	$40.72
6	75	$22.95	$7.85	$11.59	$0.00	$42.39
7	80	$24.48	$7.85	$11.73	$0.00	$44.06
8	90	$27.54	$7.85	$12.02	$0.00	$47.41

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER TRAFFIC MARKINGS (HEAVY/HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$29.50	$7.60	$10.62	$0.00	$47.72
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						
PANEL & PICKUP TRUCKS DRIVER *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2012	$30.28	$9.07	$8.00	$0.00	$47.35
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) *PILE DRIVER LOCAL 56 (ZONE 3)*	08/31/2015	$39.00	$9.80	$18.17	$0.00	$66.97
For apprentice rates see "Apprentice- PILE DRIVER"						
PILE DRIVER *PILE DRIVER LOCAL 56 (ZONE 3)*	08/31/2015	$39.00	$9.80	$18.17	$0.00	$66.97

Apprentice - *PILE DRIVER - Local 56 Zone 3*

Effective Date - 08/31/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	0	$0.00	$0.00	$0.00	$0.00	$0.00

Notes: Apprentice wages shall be no less than the following Steps;
(Same as set in Zone 1)
1$50.05/2$54.25/3$58.46/4$60.56/5$62.66/6$62.66/7$66.87/8$66.87

Apprentice to Journeyworker Ratio:1:3

PIPELAYER *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$29.83	$7.60	$12.50	$0.00	$49.93
For apprentice rates see "Apprentice- LABORER"						
PIPELAYER (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$29.75	$7.60	$10.62	$0.00	$47.97
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PLUMBER & PIPEFITTER *PLUMBERS & PIPEFITTERS LOCAL 104*	03/17/2017	$39.26	$8.50	$15.30	$0.00	$63.06
	09/17/2017	$40.01	$8.50	$15.30	$0.00	$63.81
	03/17/2018	$40.76	$8.50	$15.30	$0.00	$64.56
	09/17/2018	$41.51	$8.50	$15.30	$0.00	$65.31
	03/17/2019	$42.26	$8.50	$15.30	$0.00	$66.06

Apprentice - *PLUMBER/PIPEFITTER - Local 104*

Effective Date - 03/17/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$17.67	$8.50	$9.05	$0.00	$35.22
2	50	$19.63	$8.50	$9.05	$0.00	$37.18
3	55	$21.59	$8.50	$9.05	$0.00	$39.14
4	60	$23.56	$8.50	$9.05	$0.00	$41.11
5	65	$25.52	$8.50	$9.05	$0.00	$43.07
6	70	$27.48	$8.50	$9.05	$0.00	$45.03
7	75	$29.45	$8.50	$9.05	$0.00	$47.00
8	80	$31.41	$8.50	$9.05	$0.00	$48.96
9	80	$31.41	$8.50	$15.30	$0.00	$55.21
10	80	$31.41	$8.50	$15.30	$0.00	$55.21

Effective Date - 09/17/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$18.00	$8.50	$9.05	$0.00	$35.55
2	50	$20.01	$8.50	$9.05	$0.00	$37.56
3	55	$22.01	$8.50	$9.05	$0.00	$39.56
4	60	$24.01	$8.50	$9.05	$0.00	$41.56
5	65	$26.01	$8.50	$9.05	$0.00	$43.56
6	70	$28.01	$8.50	$9.05	$0.00	$45.56
7	75	$30.01	$8.50	$9.05	$0.00	$47.56
8	80	$32.01	$8.50	$9.05	$0.00	$49.56
9	80	$32.01	$8.50	$15.30	$0.00	$55.81
10	80	$32.01	$8.50	$15.30	$0.00	$55.81

Notes: **1:1,2:5,3:9,4:12

Apprentice to Journeyworker Ratio:**

PNEUMATIC CONTROLS (TEMP.) *PLUMBERS & PIPEFITTERS LOCAL 104*	03/17/2017	$39.26	$8.50	$15.30	$0.00	$63.06
	09/17/2017	$40.01	$8.50	$15.30	$0.00	$63.81
	03/17/2018	$40.76	$8.50	$15.30	$0.00	$64.56
	09/17/2018	$41.51	$8.50	$15.30	$0.00	$65.31
	03/17/2019	$42.26	$8.50	$15.30	$0.00	$66.06

For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"

PNEUMATIC DRILL/TOOL OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$29.75	$7.60	$10.62	$0.00	$47.97

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
POWDERMAN & BLASTER *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$30.58	$7.60	$12.50	$0.00	$50.68
For apprentice rates see "Apprentice- LABORER"						
POWDERMAN & BLASTER (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$30.50	$7.60	$10.62	$0.00	$48.72
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						
PUMP OPERATOR (CONCRETE) *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.88	$10.79	$12.75	$0.00	$57.42
	12/01/2017	$34.48	$10.79	$13.02	$0.00	$58.29
	06/01/2018	$35.09	$10.79	$13.29	$0.00	$59.17
	12/01/2018	$35.69	$10.79	$13.56	$0.00	$60.04
	06/01/2019	$36.20	$10.79	$13.83	$0.00	$60.82
	12/01/2019	$36.80	$10.79	$14.10	$0.00	$61.69
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.35	$10.79	$12.75	$0.00	$56.89
	12/01/2017	$33.95	$10.79	$13.02	$0.00	$57.76
	06/01/2018	$34.56	$10.79	$13.29	$0.00	$58.64
	12/01/2018	$35.16	$10.79	$13.56	$0.00	$59.51
	06/01/2019	$35.67	$10.79	$13.83	$0.00	$60.29
	12/01/2019	$36.27	$10.79	$14.10	$0.00	$61.16
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY-MIX CONCRETE DRIVER *TEAMSTERS LOCAL 404*	05/01/2016	$21.01	$10.23	$9.40	$0.00	$40.64
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 LOCAL 108 - HAMPDEN HAMPSHIRE FRANKLIN*	04/01/2017	$22.08	$7.07	$7.18	$0.00	$36.33
	10/01/2017	$22.63	$7.07	$7.18	$0.00	$36.88
	04/01/2018	$23.01	$7.07	$7.18	$0.00	$37.26
	10/01/2018	$23.39	$7.07	$7.18	$0.00	$37.64
	04/01/2019	$23.78	$7.07	$7.18	$0.00	$38.03
	10/01/2019	$24.17	$7.07	$7.18	$0.00	$38.42

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) - 108 Hampden Hampshire*

Effective Date - 04/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$13.25	$7.07	$0.00	$0.00	$20.32
2	60	$13.25	$7.07	$7.18	$0.00	$27.50
3	65	$14.35	$7.07	$7.18	$0.00	$28.60
4	70	$15.46	$7.07	$7.18	$0.00	$29.71
5	75	$16.56	$7.07	$7.18	$0.00	$30.81
6	80	$17.66	$7.07	$7.18	$0.00	$31.91
7	85	$18.77	$7.07	$7.18	$0.00	$33.02
8	90	$19.87	$7.07	$7.18	$0.00	$34.12

Effective Date - 10/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$13.58	$7.07	$0.00	$0.00	$20.65
2	60	$13.58	$7.07	$7.18	$0.00	$27.83
3	65	$14.71	$7.07	$7.18	$0.00	$28.96
4	70	$15.84	$7.07	$7.18	$0.00	$30.09
5	75	$16.97	$7.07	$7.18	$0.00	$31.22
6	80	$18.10	$7.07	$7.18	$0.00	$32.35
7	85	$19.24	$7.07	$7.18	$0.00	$33.49
8	90	$20.37	$7.07	$7.18	$0.00	$34.62

Notes:

** 1: 1-5, 2: 6-8, 3: 9-11

Apprentice to Journeyworker Ratio:**

RIDE-ON MOTORIZED BUGGY OPERATOR *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$29.83	$7.60	$12.50	$0.00	$49.93
For apprentice rates see "Apprentice- LABORER"						
ROLLER OPERATOR *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$32.74	$10.79	$12.75	$0.00	$56.28
	12/01/2017	$33.34	$10.79	$13.02	$0.00	$57.15
	06/01/2018	$33.95	$10.79	$13.29	$0.00	$58.03
	12/01/2018	$34.55	$10.79	$13.56	$0.00	$58.90
	06/01/2019	$35.06	$10.79	$13.83	$0.00	$59.68
	12/01/2019	$35.66	$10.79	$14.10	$0.00	$60.55
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Coal tar pitch) *ROOFERS LOCAL 248*	07/16/2017	$32.25	$10.00	$13.91	$0.00	$56.16
	07/16/2018	$33.65	$10.00	$14.01	$0.00	$57.66
	07/16/2019	$35.30	$10.00	$14.11	$0.00	$59.41
For apprentice rates see "Apprentice- ROOFER"						
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg) *ROOFERS LOCAL 248*	07/16/2017	$31.75	$10.00	$13.41	$0.00	$55.16
	07/16/2018	$33.15	$10.00	$13.51	$0.00	$56.66
	07/16/2019	$34.80	$10.00	$13.61	$0.00	$58.41

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ROOFER - Local 248*

Effective Date - 07/16/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$19.05	$10.00	$0.00	$0.00	$29.05
2	65	$20.64	$10.00	$13.41	$0.00	$44.05
3	70	$22.23	$10.00	$13.41	$0.00	$45.64
4	75	$23.81	$10.00	$13.41	$0.00	$47.22
5	80	$25.40	$10.00	$13.41	$0.00	$48.81
6	85	$26.99	$10.00	$13.41	$0.00	$50.40
7	90	$28.58	$10.00	$13.41	$0.00	$51.99
8	95	$30.16	$10.00	$13.41	$0.00	$53.57

Effective Date - 07/16/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$19.89	$10.00	$0.00	$0.00	$29.89
2	65	$21.55	$10.00	$13.51	$0.00	$45.06
3	70	$23.21	$10.00	$13.51	$0.00	$46.72
4	75	$24.86	$10.00	$13.51	$0.00	$48.37
5	80	$26.52	$10.00	$13.51	$0.00	$50.03
6	85	$28.18	$10.00	$13.51	$0.00	$51.69
7	90	$29.84	$10.00	$13.51	$0.00	$53.35
8	95	$31.49	$10.00	$13.51	$0.00	$55.00

Notes:

Steps are 750 hrs.Roofer(Tear Off)1:1; Same as above

Apprentice to Journeyworker Ratio:1:3

ROOFER SLATE / TILE / PRECAST CONCRETE *ROOFERS LOCAL 248*	07/16/2017	$32.25	$10.00	$13.91	$0.00	$56.16
	07/16/2018	$33.65	$10.00	$14.01	$0.00	$57.66
	07/16/2019	$35.30	$10.00	$14.11	$0.00	$59.41
For apprentice rates see "Apprentice- ROOFER"						
SCRAPER *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$33.35	$10.79	$12.75	$0.00	$56.89
	12/01/2017	$33.95	$10.79	$13.02	$0.00	$57.76
	06/01/2018	$34.56	$10.79	$13.29	$0.00	$58.64
	12/01/2018	$35.16	$10.79	$13.56	$0.00	$59.51
	06/01/2019	$35.67	$10.79	$13.83	$0.00	$60.29
	12/01/2019	$36.27	$10.79	$14.10	$0.00	$61.16
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
SELF-POWERED ROLLERS AND COMPACTORS (TAMPERS) *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$32.74	$10.79	$12.75	$0.00	$56.28
	12/01/2017	$33.34	$10.79	$13.02	$0.00	$57.15
	06/01/2018	$33.95	$10.79	$13.29	$0.00	$58.03
	12/01/2018	$34.55	$10.79	$13.56	$0.00	$58.90
	06/01/2019	$35.06	$10.79	$13.83	$0.00	$59.68
	12/01/2019	$35.66	$10.79	$14.10	$0.00	$60.55
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
SELF-PROPELLED POWER BROOM *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$30.12	$10.79	$12.75	$0.00	$53.66
	12/01/2017	$30.72	$10.79	$13.02	$0.00	$54.53
	06/01/2018	$31.33	$10.79	$13.29	$0.00	$55.41
	12/01/2018	$31.93	$10.79	$13.56	$0.00	$56.28
	06/01/2019	$32.44	$10.79	$13.83	$0.00	$57.06
	12/01/2019	$33.04	$10.79	$14.10	$0.00	$57.93
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
SHEETMETAL WORKER *SHEETMETAL WORKERS LOCAL 63*	01/01/2017	$32.24	$10.64	$15.49	$1.75	$60.12

Apprentice - *SHEET METAL WORKER - Local 63*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$14.51	$6.21	$4.36	$0.00	$25.08
2	50	$16.12	$6.55	$4.85	$0.00	$27.52
3	55	$17.73	$6.88	$8.72	$0.98	$34.31
4	60	$19.34	$7.22	$8.72	$1.06	$36.34
5	65	$20.96	$7.55	$8.72	$1.12	$38.35
6	70	$22.57	$7.88	$8.72	$1.18	$40.35
7	75	$24.18	$8.22	$8.72	$1.23	$42.35
8	80	$25.79	$9.30	$14.52	$1.43	$51.04
9	85	$27.40	$9.64	$14.52	$1.49	$53.05
10	90	$29.02	$9.98	$14.52	$1.55	$55.07

Notes:

Apprentice to Journeyworker Ratio:1:3

SIGN ERECTOR *PAINTERS LOCAL 35 - ZONE 3*	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 3*

Effective Date - 06/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$12.91	$7.07	$0.00	$0.00	$19.98
2	55	$14.20	$7.07	$2.45	$0.00	$23.72
3	60	$15.49	$7.07	$2.45	$0.00	$25.01
4	65	$16.78	$7.07	$2.45	$0.00	$26.30
5	70	$18.07	$7.07	$7.05	$0.00	$32.19
6	75	$19.36	$7.07	$7.05	$0.00	$33.48
7	80	$20.65	$7.07	$7.05	$0.00	$34.77
8	85	$21.94	$7.07	$7.05	$0.00	$36.06
9	90	$23.23	$7.07	$7.05	$0.00	$37.35

Notes:

Steps are 4 mos.

Apprentice to Journeyworker Ratio:1:1

SPECIALIZED EARTH MOVING EQUIP < 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2016	$32.44	$10.91	$10.89	$0.00	$54.24
SPECIALIZED EARTH MOVING EQUIP > 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2016	$32.73	$10.91	$10.89	$0.00	$54.53
SPRINKLER FITTER *SPRINKLER FITTERS LOCAL 669*	04/01/2017	$40.26	$9.17	$12.43	$0.00	$61.86
	01/01/2018	$40.26	$9.67	$12.63	$0.00	$62.56
	04/01/2018	$41.51	$9.67	$12.88	$0.00	$64.06
	01/01/2019	$41.51	$10.02	$13.08	$0.00	$64.61

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SPRINKLER FITTER - Local 669*

Effective Date - 04/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$18.12	$7.60	$0.00	$0.00	$25.72
2	50	$20.13	$7.60	$0.00	$0.00	$27.73
3	55	$22.14	$9.17	$6.60	$0.00	$37.91
4	60	$24.16	$9.17	$6.60	$0.00	$39.93
5	65	$26.17	$9.17	$6.85	$0.00	$42.19
6	70	$28.18	$9.17	$6.85	$0.00	$44.20
7	75	$30.20	$9.17	$6.85	$0.00	$46.22
8	80	$32.21	$9.17	$6.85	$0.00	$48.23
9	85	$34.22	$9.17	$6.85	$0.00	$50.24
10	90	$36.23	$9.17	$6.85	$0.00	$52.25

Effective Date - 01/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$18.12	$7.75	$0.00	$0.00	$25.87
2	50	$20.13	$7.75	$0.00	$0.00	$27.88
3	55	$22.14	$9.67	$6.80	$0.00	$38.61
4	60	$24.16	$9.67	$6.80	$0.00	$40.63
5	65	$26.17	$9.67	$7.05	$0.00	$42.89
6	70	$28.18	$9.67	$7.05	$0.00	$44.90
7	75	$30.20	$9.67	$7.05	$0.00	$46.92
8	80	$32.21	$9.67	$7.05	$0.00	$48.93
9	85	$34.22	$9.67	$7.05	$0.00	$50.94
10	90	$36.23	$9.67	$7.05	$0.00	$52.95

Notes:

Apprentice to Journeyworker Ratio:1:1

TELECOMMUNICATION TECHNICIAN *ELECTRICIANS LOCAL 7*	07/02/2017	$40.01	$9.60	$11.20	$0.00	$60.81
	12/31/2017	$40.51	$10.00	$11.42	$0.00	$61.93
	07/01/2018	$41.21	$10.25	$11.74	$0.00	$63.20
	12/30/2018	$41.91	$10.50	$12.06	$0.00	$64.47
	06/30/2019	$42.66	$10.75	$12.33	$0.00	$65.74
	12/29/2019	$43.41	$1.00	$12.60	$0.00	$57.01

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *TELECOMMUNICATION TECHNICIAN - Local 7*

Effective Date - 07/02/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$16.00	$5.25	$0.48	$0.00	$21.73
2	45	$18.00	$5.25	$0.54	$0.00	$23.79
3	50	$20.01	$9.60	$6.90	$0.00	$36.51
4	55	$22.01	$9.60	$6.96	$0.00	$38.57
5	65	$26.01	$9.60	$8.08	$0.00	$43.69
6	70	$28.01	$9.60	$9.14	$0.00	$46.75

Effective Date - 12/31/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$16.20	$5.40	$0.49	$0.00	$22.09
2	45	$18.23	$5.40	$0.55	$0.00	$24.18
3	50	$20.26	$10.00	$6.91	$0.00	$37.17
4	55	$22.28	$10.00	$6.97	$0.00	$39.25
5	65	$26.33	$10.00	$8.09	$0.00	$44.42
6	70	$28.36	$10.00	$9.15	$0.00	$47.51

Notes:

Steps are 800 hours

Apprentice to Journeyworker Ratio:1:1

TERRAZZO FINISHERS *BRICKLAYERS LOCAL 3 (SPR/PITT) - MARBLE & TILE*	02/27/2017	$32.67	$10.75	$17.05	$0.00	$60.47

Apprentice - *MARBLE-TILE-TERRAZZO FINISHER-Local 3 Marble/Tile (Spr/Pitt)*

Effective Date - 02/27/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$16.34	$10.75	$17.05	$0.00	$44.14
2	60	$19.60	$10.75	$17.05	$0.00	$47.40
3	70	$22.87	$10.75	$17.05	$0.00	$50.67
4	80	$26.14	$10.75	$17.05	$0.00	$53.94
5	90	$29.40	$10.75	$17.05	$0.00	$57.20

Notes:

Apprentice to Journeyworker Ratio:1:5

TEST BORING DRILLER *LABORERS - FOUNDATION AND MARINE*	12/01/2016	$37.70	$7.60	$14.35	$0.00	$59.65

For apprentice rates see "Apprentice- LABORER"

TEST BORING DRILLER HELPER *LABORERS - FOUNDATION AND MARINE*	12/01/2016	$36.42	$7.60	$14.35	$0.00	$58.37

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TEST BORING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2016	$36.30	$7.60	$14.35	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						
TRACTORS *OPERATING ENGINEERS LOCAL 98*	06/01/2017	$32.74	$10.79	$12.75	$0.00	$56.28
	12/01/2017	$33.34	$10.79	$13.02	$0.00	$57.15
	06/01/2018	$33.95	$10.79	$13.29	$0.00	$58.03
	12/01/2018	$34.55	$10.79	$13.56	$0.00	$58.90
	06/01/2019	$35.06	$10.79	$13.83	$0.00	$59.68
	12/01/2019	$35.66	$10.79	$14.10	$0.00	$60.55
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2016	$33.02	$10.91	$10.89	$0.00	$54.82
TUNNEL WORK - COMPRESSED AIR *LABORERS (COMPRESSED AIR)*	12/01/2016	$48.58	$7.60	$14.75	$0.00	$70.93
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) *LABORERS (COMPRESSED AIR)*	12/01/2016	$50.58	$7.60	$14.75	$0.00	$72.93
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR *LABORERS (FREE AIR TUNNEL)*	12/01/2016	$40.65	$7.60	$14.75	$0.00	$63.00
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR (HAZ. WASTE) *LABORERS (FREE AIR TUNNEL)*	12/01/2016	$42.65	$7.60	$14.75	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2016	$32.44	$10.91	$10.89	$0.00	$54.24
WAGON DRILL OPERATOR *LABORERS - ZONE 3 (BUILDING & SITE)*	12/05/2016	$29.83	$7.60	$12.50	$0.00	$49.93
For apprentice rates see "Apprentice- LABORER"						
WAGON DRILL OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 3 (HEAVY & HIGHWAY)*	12/01/2016	$29.75	$7.60	$10.62	$0.00	$47.97
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
WATER METER INSTALLER *PLUMBERS & PIPEFITTERS LOCAL 104*	03/17/2017	$39.26	$8.50	$15.30	$0.00	$63.06
	09/17/2017	$40.01	$8.50	$15.30	$0.00	$63.81
	03/17/2018	$40.76	$8.50	$15.30	$0.00	$64.56
	09/17/2018	$41.51	$8.50	$15.30	$0.00	$65.31
	03/17/2019	$42.26	$8.50	$15.30	$0.00	$66.06
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - West						
EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - WEST LOCAL 42*	08/30/2015	$42.16	$8.20	$9.26	$0.00	$59.62
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - WEST LOCAL 42*	08/30/2015	$28.87	$8.20	$8.87	$0.00	$45.94
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN / TRUCK DRIVER *OUTSIDE ELECTRICAL WORKERS - WEST LOCAL 42*	08/30/2015	$37.73	$8.20	$9.13	$0.00	$55.06
For apprentice rates see "Apprentice- LINEMAN"						
HEAVY EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - WEST LOCAL 42*	08/30/2015	$44.37	$8.20	$9.33	$0.00	$61.90
For apprentice rates see "Apprentice- LINEMAN"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
JOURNEYMAN LINEMAN *OUTSIDE ELECTRICAL WORKERS - WEST LOCAL 42*	08/30/2015	$48.80	$8.20	$9.46	$0.00	$66.46

Apprentice - *LINEMAN (Outside Electrical) - West Local 42*

Effective Date - 08/30/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$29.28	$8.20	$0.88	$0.00	$38.36
2	65	$31.72	$8.20	$0.95	$0.00	$40.87
3	70	$34.16	$8.20	$9.02	$0.00	$51.38
4	75	$36.60	$8.20	$9.10	$0.00	$53.90
5	80	$39.04	$8.20	$9.17	$0.00	$56.41
6	85	$41.48	$8.20	$9.24	$0.00	$58.92
7	90	$43.92	$8.20	$9.32	$0.00	$61.44

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER *OUTSIDE ELECTRICAL WORKERS - WEST LOCAL 42*	01/01/2016	$28.98	$4.25	$3.12	$0.00	$36.35
TELEDATA LINEMAN/EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - WEST LOCAL 42*	01/01/2016	$27.31	$4.25	$3.07	$0.00	$34.63
TELEDATA WIREMAN/INSTALLER/TECHNICIAN *OUTSIDE ELECTRICAL WORKERS - WEST LOCAL 42*	01/01/2016	$27.31	$4.25	$3.07	$0.00	$34.63
TRACTOR-TRAILER DRIVER *OUTSIDE ELECTRICAL WORKERS - WEST LOCAL 42*	08/30/2015	$42.16	$8.20	$9.26	$0.00	$59.62
TREE TRIMMER *OUTSIDE ELECTRICAL WORKERS - WEST LOCAL 42*	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 - WEST LOCAL 42*	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.

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.

CM / SUBCONTRACTOR'S WEEKLY WORKFORCE REPORT
MAIL ORIGINAL TO ADDRESS BELOW AS WELL AS EMAIL REPORT TO: ltereso@oconnells.com

Project No. Project Name: Greenfield Olive Street Garage Project Location: **Greenfield, MA**

Name of Construction Manager: **Daniel O'Connell's Sons, Holyoke MA 01040** Minority: Women: Apprentice:

Name of Contractor Filing Report _____Address: _____

Week Ending:_____ **Report No. _____** Date Work Began _____

NOTE: **Min. = Minority** **Wom. = Women** ☐ Check here if this is a final report Date Work Completed_____

Job Category	Number of Employees	Number of Employees Who Are		Total Weekly Workforce Hours	Total Weekly Workforce Hours				Total Workforce Hours To Date	Total Workforce Hours To Date		% of Workforce Hours To Date	
	Total	Min.	Wom.		Min.	Wom.	Min.	Wom.		Min.	Wom.	Min.	Wom.
							#DIV/0!	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
TOTALS:	**0**	0	0	**0**	0	0	#DIV/0!	#DIV/0!	**0**	**0**	**0**	**#DIV/0!**	**#DIV/0!**

The undersigned hereby certifies that the company submitting this report has followed the following listed legal requirements for each and every employee listed on the Certified Payroll report submitted with this Weekly Workforce Report: 1) faithfully completed the Federal Form I-9 process; 2) proper classification; 3) workers' compensation insurance coverage, unemployment insurance, social security taxes, and income taxes; and 4) all laws governing hospitalization and medical benefits that meet the minimum requirements of G.L. c. 176.

The undersigned hereby certifies under pains and penalties of perjury that the above information is true and accurate.

Mail to: Daniel O'Connell's Sons
Attn: Laura Tereso
480 Hampden Street
PO Box 267
Holyoke MA 01040

Authorized Signature_____

Print Name_____

Title_____

WEEKLY PAYROLL RECORDS REPORT
& STATEMENT OF COMPLIANCE

In accordance with Massachusetts General Law c. 149, $ 27B, a true and accurate record must be kept of all persons employed on the public works project for which the enclosed rates have been provided. A Payroll Form is available from the Department of Labor Standards (DLS) at www.mass.gov/dols/pw and includes all the information required to be kept by law. Every contractor or subcontractor is required to keep these records and preserve them for a period of three years from the date of completion of the contract.

On a weekly basis, every contractor and subcontractor is required to submit a certified copy of their weekly payroll records to the awarding authority; this includes the payroll forms and the Statement of Compliance form. The certified payroll records must be submitted either by regular mail or by e-mail to the awarding authority. Once collected, the awarding authority is required to preserve those records for three years from the date of completion of the project.

Each such contractor and subcontractor shall furnish weekly **and** within 15 days after completion of its portion of the work, to the awarding authority directly by first-class mail or e-mail, a statement, executed by the contractor, subcontractor or by any authorized officer thereof who supervised the payment of wages, this form, accompanied by their payroll:

STATEMENT OF COMPLIANCE

_____, 20 _____

I, _____ _____ , _____
(Name of signatory party) (Title)

do hereby state:

That I pay or supervise the payment of the persons employed by

_____ _____ on the _____
(Contractor, subcontractor or public body) (Building or project)

and that all mechanics and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty-nine of the General Laws.

Signature _____

Title _____ _____

CM / SUBCONTRACTOR'S WEEKLY WORKFORCE REPORT

Project No. Project Name: **Greenfield Olive Street Garage** Project Location: **Greenfield, MA**
Name of Construction Manager: **Daniel O'Connell's Sons, Holyoke MA 01040**
Name of Contractor Filing Report: _____
Week Ending _____ **Report No.** _____ Date Work Began _____

NOTE: **App.= Apprentice Min. = Minority Wom. = Women** ☐ Check here if this is a final report Date Work Completed_____

JOB CATEGORY	NAME OF EMPLOYEE	ADDRESS	MINORITY GROUP	GENDER

The undersigned hereby certifies that the company submitting this report has followed the following listed legal requirements for each and every employee listed on the Certified Payroll report submitted with this Weekly Workforce Report: 1) faithfully completed the Federal Form I-9 process; 2) proper classification; 3) workers' compensation insurance coverage, unemployment insurance, social security taxes, and income taxes; and 4) all laws governing hospitalization and medical benefits that meet the minimum requirements of G.L. c. 176.
The undersigned hereby certifies under pains and penalties of perjury that the above information is true and accurate.

Mail to:

Daniel O'Connell's Sons
Attn: Laura Tereso
480 Hampden Street
PO Box 267
Holyoke MA 01040

Authorized Signature_____
Print Name_____
Title_____
Date _____

Telephone No. _____

EXHIBIT S

TOWN OF GREENFIELD

CONSTRUCTION MANAGER AT RISK CONTRACT

GENERAL CONDITIONS OF THE CONTRACT

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_____ CM Initials _____ Owner Initials

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CM Initials _____ Owner Initials _____

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ARTICLE I: DEFINITION OF TERMS

The following words shall have the following meanings as used in this Contract:

Approval: (or Approved): An approval in writing signed by the authorized signatory of THE OWNER. Depending upon the nature of the approval, the Designer or the Project Manager may, when authorized by the Owner, issue approvals on the Owner's behalf.
Architect: The architect identified in the Owner-CM Agreement, also referred to as the Designer.
As directed, as permitted, as required, as determined or words of like effect: The direction, permission, requirement or determination of the Owner unless otherwise stated in the Contract Documents. Similarly, *approved*, *acceptable*, *satisfactory* or words of like import shall mean approved by or acceptable or satisfactory to the Designer and THE OWNER.
Certificate of Use and Occupancy: A certificate signed by the Designer pursuant to the requirements of Article VI of these General Conditions of the Contract, indicating that (1) the Work has been completed in accordance with the Contract Documents, except for Punch List items, (2) certificates of inspection, testing and/or approval (including a certificate of occupancy under the Building Code), operating permits for any mechanical apparatus which may be required to permit full use and occupancy of the Work by its intended users have been delivered to THE OWNER, (3) any applicable written warranties, operating instructions and related materials have been delivered to THE OWNER, and (4) the Work may be used for its intended purpose without substantial inconvenience or interference.
Change Order: (1) A written order not requiring the consent of the CM, approved by the Owner and signed by the Project Manager and designated as a Change Order, directing the CM to make changes in the Work within the general scope of the Contract.
Construction Manager, Contractor, CM and General Contractor These words are used interchangeably and mean the person, corporation or other entity with whom THE OWNER has executed the CM Contract. -
Construction Manager's Key Personnel: The personnel listed in the Construction Manager's Proposal and the Owner-CM Agreement, all of whom shall be dedicated to the Project on a full time basis, unless otherwise agreed to.
Contract Documents: The documents listed in Article 2 of the Owner-CM Agreement.
Day: calendar day.
Designer: The architect or engineer identified as the Designer in the Owner-CM Agreement.
Drawings: The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including Plans, elevations, sections, details, schedules, and diagrams.
Final Acceptance: The written determination by THE OWNER upon recommendation of the Designer, that the Work has been 100% completed, except for the CM's indemnification obligations, warranty obligations, obligations to continue to maintain insurance coverage for the time periods provided in the Contract Documents, and any other obligations which are intended to survive Final Acceptance and/or the termination of the Contract.
Laws: All applicable statutes, regulations, ordinances, codes, laws, orders, decrees, approvals, certificates and requirements of governmental and quasi-governmental authorities.
~~**MSBA**: The Massachusetts School Building Authority which has agreed to finance a portion of the costs for the Project, which procedures require the Owner and CM to submit payment related information in a format acceptable to the MSBA.~~
Notice to Proceed (NTP): The written notice provided by THE OWNER to the CM which authorizes the CM to commence the Work as of a date specified therein, from which date the

times specified in Article 4 of the Owner-CM Agreement are measured. THE OWNER may issue more than one NTP, for Preconstruction and Construction Services, in which case the date from which the time for completion of construction is measured shall be as stated in the appropriate NTP.
Or equal (or words of like import): Equal in the opinion of THE OWNER determined pursuant to the provisions of M.G.L. c.30, s. 39M and the provisions of the Contract.
Owner: The Town of Greenfield acting through authorized officials.
Owner-CM Agreement: The Owner-Construction Manager Agreement between the Owner and the CM for the Project, which is incorporated into the Contract Documents.
Plan(s): Drawing(s).
Progress Schedule: The progress schedule submitted by the CM and approved by THE OWNER in accordance with the Contract Documents.
Project: The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by separate contractors.
Project Manager: The Owner's Project Manager identified in the Owner-CM Agreement.
Punch List: A list of items determined by THE OWNER upon the recommendation of the Designer, to be minor, incomplete or unsatisfactory work items that do not materially impair the use of the Work by THE OWNER for its intended purpose.
Clerk of Works or Owner's Representative: The on-Site representative of THE OWNER, who may be an employee of the Project Manager or may work directly for the Owner. The Clerk of Works or Owner's Representative has no authority to make changes in the work, interpret provisions of the Contract, approve or disapprove payment requests from the CM, or otherwise provide direction to the CM.
Samples: Samples are physical examples, that illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.
Schedule of Values: The schedule prepared by the CM and approved by THE OWNER pursuant to Article VIII of these General Conditions of the Contract which allocates the Contract Price to the various portions of the Work and is used as a basis for determining payments due to the CM.
Shop Drawings: Drawings, diagrams, details, schedules, and other data specially prepared for the Work by the CM or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate a portion of the Work.
Site: The land and, if any, building(s) or space within any such building(s) on which or in which the CM is to perform the Work.
Specifications: The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, and workmanship for the Work and performance of related services.
Subcontractor: Person or entity with whom the CM or a subcontractor contracts in order to perform the Work, except as otherwise specifically provided or required herein or by Law. "Subcontractor" also means "Trade Contractor" except when otherwise specified.
Substantial Completion: The term "substantial completion " shall mean the point at which . as certified in writing by the Design er. the new Olive Street Parking Garage (" School ") is at a level of completion in strict compliance with the contract and the contract documents such that the Town can enjoy beneficial use or occupancy and can use or operate it in all respects, for its intended purpose. Partial use or occupancy shall not be deemed substantially complete. and such partial use or occupancy shall not be evidence of substantial completion.
Superintendent: The licensed construction supervisor who is an employee of the CM designated to be in full time attendance at the Site throughout the prosecution and progress of the Work and who shall have complete authority to act for the CM.

Trade Contractor: Subcontractors under Contract with the CM to perform the work of the trades listed in paragraph 1.1 of the Procedures for Award of Subcontracts at Appendix C, and selected under the process authorized in M.G.L. c. 149A and Section I of the aforementioned Procedures by the CM. Sometimes referred to as "Filed Subcontractor" or "Filed Subbidder".
User Agency: The Town Of Greenfield. Other terms, abbreviations and references are defined as they appear herein.

ARTICLE II: EXECUTION OF THE CONTRACT, SCOPE OF WORK, INTERPRETATION OF CONTRACT DOCUMENTS, DISTRIBUTION OF WORK, SUBCONTRACTS

1. Execution.
The execution of the Owner – CM Agreement by the CM is a representation that the CM has visited the Site, has become familiar with local conditions under which the Work is to be performed, has correlated observations at the site with requirements of the Contract Documents and is aware of requirements contained in the permits that have issued that apply to the construction of the work as well as the requirements of the Mass Works, as stated in the Project Funding Agreement between the Mass Works and the Owner.

2. Scope of Work.
The Work consists of all the work identified in the Contract Documents. The Work includes Pre-Construction Services the CM has agreed to provide as well as the completed construction required by the Contract Documents and includes all labor, tools, materials, supplies, equipment, permits, approvals, paperwork, calculations, submittals, and certificates necessary to develop, construct and complete the Work in accordance with all Laws, and all construction and other services required to be supervised, overseen, performed or furnished by CM or that the Contract Documents require the CM to cause to be supervised, overseen, performed or furnished. The CM shall provide and perform all of the Work, duties and obligations set forth in the Contract Documents.

3. Interpretation.

A. The Plans and Specifications and other Contract Documents are to be considered together and are intended to be mutually complementary, so that any work shown on the Plans though not specified in the Specifications, and any work specified in the Specifications though not shown on the Plans, is to be executed by the CM as a part of this Contract. Should a conflict occur in or between or among any parts of the Contract Documents that are entitled to equal preference, the better quality or greater quantity shall govern, unless THE OWNER directs otherwise. Figured dimensions shall take precedence over scaled dimensions.

B. All things that in the opinion of THE OWNER may be reasonably inferred from the Plans, Specifications and other Contract Documents are to be executed by the CM. The Designer shall determine whether the detail Plans conform to the general Plans and Contract Documents, except as may be otherwise determined by THE OWNER.

C. The tables of contents, titles, headings and marginal notes or sub-scripts contained herein are solely to facilitate references, are not intended to be construed as provisions of the Contract, and in no way affect the interpretation of the provisions to which they refer.

D. Where reference is made in the Contract Documents to publications, standards, or codes issued by associations or societies, such reference shall be interpreted to mean the current edition of such publications, standards, or codes, including revisions in effect on the date of the issuance of the RFP for the contract notwithstanding any reference to a particular date. The foregoing sentence shall not apply to the dates, if any, specified with respect to insurance policy endorsement forms.

E. In case of any conflict among the Contract Documents, unless the context clearly otherwise requires, the Contract Documents shall be construed according to the following priorities:

First Priority: Contract Modifications and Change Orders
Second Priority: Owner-CM Agreement, the General Conditions of the Contract Specifications and Drawings, as amended.
Third Priority: CM's Proposal, as accepted by OWNER
Fourth Priority: Owner's Request for Proposals.
Fifth Priority: Owner's Request for Qualifications

F. All plans, general and detailed, are to be deemed a part of the Contract, and the plans and specifications and Contract are to be considered together, and are intended to be mutually complementary, so that any work shown on the plans, though not specified in the specifications, and any work specified in the specifications, though not shown on the plans, is to be executed by the CM as part of the Contract. All things which in the opinion of the Designer may reasonably be inferred from the Contract Documents are to be executed by the CM in accordance with the terms of the Contract. In the event of a conflict, CM is to assume that the Contract requires the greater quantity or quality of work, and the CM shall immediately bring to the attention of the Designer said purported conflict.

G. The CM shall refer to all of the Drawings, and to all of the sections of the Specifications, and shall perform all work reasonably inferable therefrom as being necessary to produce the indicated results. Neither THE OWNER nor the Designer assume any liability arising out of jurisdictional issues raised or claims advanced by Subcontractors, trade organizations or other interested parties based on the arrangement or manner of subdivision of the content of the Specifications and Drawings. In the event of any claim arising out of any duplication, conflict, inconsistency or discrepancy within the Specifications or on the Drawings as to the allocation of the Work among the Subcontractor the CM shall be solely responsible for resolving the claim and shall be responsible for ensuring that all of the Work is completed, regardless of where it appears in the Specifications or on the Drawings.

4. Distribution of Work.

Other than as required by M.G.L. c. 149A and any other applicable provisions of the Massachusetts General Laws and these Contract Documents, the CM shall be responsible for distributing the Work in the best interests of the Project.

5. Subcontracts

Procedures for the procurement and the award of contracts by the CM for the furnishing of labor, materials and equipment in the performance of the Work ("Subcontracts") shall be as specified in the procedures attached hereto as Appendix "C". The CM shall not replace any Subcontractor previously selected without the prior written approval of THE OWNER. The CM shall maintain and periodically update and distribute to THE OWNER, the Project

Manager and the Designer a Project Directory listing the names, addresses and telephone numbers of the principal members of the staff of each Subcontractor. The principal contact and a back-up for each Subcontractor and each of their office telephone numbers, mobile telephone numbers and pager numbers, if available, shall be indicated in the Project Directory so that such persons can be reached in emergency situations occurring beyond regular business hours.

All work shall be performed pursuant to written subcontracts. When subcontracting with Trade Contractors the CM shall use the Form for Trade Contract attached hereto. All subcontracts shall require the Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the CM by the terms of the Contract Documents, and to assume toward the CM all the obligations and responsibilities which the CM, by the Contract Documents, assumes toward THE OWNER. Each Subcontract shall preserve and protect the rights of THE OWNER under the Contract Documents with respect to the Work to be performed by the Subcontractor so that the subcontracting thereof will not prejudice such rights. The CM shall require each Subcontractor to enter into similar agreements with its Subcontractors. The CM shall provide to each proposed Subcontractor, prior to the execution of a Subcontract with such Subcontractor, copies of the Contract Documents to which the Subcontractor will be bound by this Paragraph.

In the event of termination of the Contract due to the default of the CM or for any other reason, THE OWNER shall have the right (but shall have no obligation) to assume, and/or accept assignment of and further assign to a general contractor or construction manager or other third party who is qualified and has sufficient resources to complete the Work, the rights of the CM under the Subcontract with such Subcontractor. In the event of such assumption or assignment by THE OWNER, the Subcontractor shall have no claim against THE OWNER or such third party for work performed by such Subcontractor or other matters arising prior to termination of the Contract, and THE OWNER or such third party, as the case may be, shall be liable only for obligations to the Subcontractor arising after such assumption or assignment.

No Subcontract, and nothing contained herein or in any Subcontract, shall be construed to create any contractual relationship between any Subcontractor and THE OWNER.

6. Contract Price.
The Contract Price constitutes the amount of compensation authorized to be paid to the CM for everything to be performed and furnished by the CM in connection with the Work, as provided in the Owner CM Agreement.

ARTICLE III: CONTROL OF WORK / ADMINISTRATION OF THE CONTRACT

1. Designer.
Notwithstanding anything to the contrary expressed or implied in this Contract, any of the powers, rights, and duties of the Designer may be exercised by THE OWNER, provided that THE OWNER shall be under no obligation to do so. THE OWNER may rely on the Designer for the performance and exercise of certain rights and obligations of the Owner hereunder. Except as otherwise authorized by the Owner, any Approval required to be obtained from THE OWNER hereunder shall not be valid without the signature of THE

OWNER. THE OWNER may explicitly overrule in writing any action, determination or decision of the Designer should THE OWNER choose to do so, except to the extent that the same would violate applicable law. Subject to the foregoing, the Designer shall be responsible for the general administration of the Contract and shall perform the duties and exercise the rights herein conferred on the Designer. Except as otherwise specifically provided herein, the Designer shall decide all questions which may arise as to the conduct, quantity, quality, equality, acceptability, fitness, and rate of progress of the several kinds of work and materials to be performed and furnished under this Contract, and shall decide all questions which may arise as to the interpretation of the Plans and Specifications. In the case of the death, resignation, inability or refusal of the Designer to act, or the termination of his or her or its employment, THE OWNER may appoint another person to act as Designer for the purposes of this Contract. THE OWNER shall give written notice to the CM of any such appointment.

2. Right of Access to Work.
THE OWNER, the Project Manager, and the Designer (and persons designated by them) may for any purpose enter upon the Work, the Site, and premises used by the CM, and the CM shall provide safe facilities therefore Other contractors of THE OWNER may also enter upon the same for the purposes which may be required by their contracts or work. Any differences or conflicts which may arise between the CM and other contractors of THE OWNER with respect to their work shall be initially resolved by the Project Manager.

3. Inspection No Waiver.
No inspection by THE OWNER, the Designer, the Project Manager, or employees or agents of either of them, and no order, measurement, certificate, approval, payment order, payment, acceptance or any other action or inaction of any of them, shall operate as a waiver by THE OWNER of any provision of this Contract.

ARTICLE IV: GENERAL PERFORMANCE OBLIGATIONS OF THE CM

The CM shall complete for the Contract Price all of the Work in a proper, thorough, and workmanlike manner in accordance with the Contract Documents. Without limiting the foregoing and without limiting the CM's obligations under any other provision of the Contract Documents, the CM shall for the Contract Price perform the following general obligations:

1. Review of Contract Documents and Field Conditions.
A. Before commencing the Work, the CM shall carefully study the Contract Documents and carefully compare all Specifications, Plans, Drawings, figures, dimensions, lines, marks, scales, directions of the Designer, and any other information provided by THE OWNER and shall at once report to the Designer any questions, errors, inconsistencies, or omissions which the CM may discover.
B. Before commencing the Work, the CM shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the CM with the Contract Documents and shall at once report to the Designer any questions, errors, inconsistencies, or omissions.

2. Supervision and Construction Procedures; Coordination; Cutting, and Patching.
A. The CM shall supervise and direct the Work, using the CM's best skill and attention. The CM shall be solely responsible for, and shall have control over, construction means, methods,

techniques, sequences and procedures, and shall be responsible for coordinating all portions of the Work under the Contract.

B. The CM shall be responsible for the proper fitting of all Work and the coordination of the operations of all trades, Subcontractors, and materialmen engaged upon the Work.

C. All necessary cutting, coring, drilling, grouting, and patching required to fit together the several parts of the Work shall be coordinated by the CM.

D. The CM shall be responsible to THE OWNER for the acts and omissions of the CM's employees, agents and Subcontractors of all tiers, and their agents and respective contractors employees, and other persons performing portions of the Work or supplying materials therefor.

E. The CM shall be responsible for the inspection of portions of the Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work.

F. The Designer shall establish baselines and benchmarks on the Drawings for the location of the Work but all other lines and grades shall be determined by the CM. The Owner shall employ a registered land surveyor to perform any engineering required for establishing grades, lines, levels, dimensions, layouts, and reference points for the trades. The CM shall be responsible for maintaining benchmarks and other survey marks and shall replace any benchmarks or survey marks that may have become disturbed or destroyed. The CM shall verify the materials shown on the Drawings before laying out the Work and shall be responsible for any error resulting from its failure to exercise this precaution.

G. Work shall be performed during regular Working Hours which, unless otherwise approved by the Owner shall be 7:00 a.m. to 5:00 p.m. However, if the CM desires to carry on the Work outside of regular working hours or on Saturdays, Sundays, or Massachusetts or federal holidays, the CM shall provide the Owner's on site representative with 48 hours notice to allow satisfactory arrangements to be made for inspecting Work in progress. Any work performed during regular Working Hours or at any other time shall comply with the Town of Greenfield's Noise Ordinance. The additional costs incurred by the Designer, the Project Manager or the Clerk of Works to monitor work during extended hours, shall be paid by the CM out of an allowance which shall be included in the GMP for such purposes.

H. Work performed outside of regular Working Hours without prior notice to the Designer and/or THE OWNER shall be subject to additional inspection and testing as directed by the Designer. The Owner's costs for this inspection and testing shall be borne by the CM whether the Work is found to be acceptable or not. THE OWNER shall be entitled to issue the CM a credit to cover such cost from payments due the CM.

3.<u>Key Personnel.</u>

The CM shall employ the Key Personnel as defined in Article I of the General Conditions unless otherwise agreed to by THE OWNER. The Project Executive shall be the CM's senior person on Site and shall have full authority to accept communications to, make decisions for, and otherwise fully represent the CM in connection with all matters relevant to the Project. The CM's Project Manager(s) shall be responsible for one or more portions of the Work as assigned by the Project Executive. CM's Project Manager may be the designee

of the Project Executive to exercise the Project Executive's responsibilities in the CM's Project Executive's absence. The Superintendent shall be properly licensed in accordance with the Building Code.

4. Labor.

A.. The CM shall employ only competent workers. The CM shall enforce and shall require all its Subcontractors to enforce strict discipline and good order among their respective employees and other persons carrying out the Work. The CM shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. Whenever the Designer or THE OWNER shall notify the CM in writing that any worker is, in the Owner's opinion, incompetent, unfaithful, disorderly, or otherwise unsatisfactory, such employee shall be discharged from the Work and shall not again be employed on the Project except with the consent of THE OWNER. See Paragraph 9 of this Article.

B. The CM shall ensure that all its Subcontractors employ a sufficient number of workers to carry on the Work with all proper speed in accordance with Laws, the requirements of the Contract Documents, and the Progress Schedule.

C. The CM shall procure materials from such sources and shall manage its own forces and the forces of its Subcontractors in such a manner as will result in harmonious labor relations on the Project Site. The CM shall cause persons to be employed in the Work who will work in harmony with others so employed.

5. Notices and Permits.

A. The CM shall take out and pay for all approvals, permits, user fees, certificates and licenses required by Laws, pay all charges and fees, and pay for or cause the appropriate Subcontractor to pay for all utilities required for the proper execution of the Work. The costs of any required permits shall be considered Cost of the Work. The CM shall perform the work in strict accordance with all permit requirements that have issued for the Project.

B. The CM shall comply with all Laws and shall give all notices required thereby.

C. Except as otherwise specified in this Contract, it is not the CM's responsibility to ascertain that the Contract Documents are in accordance with applicable Laws. However, if the CM observes that portions of the Contract Documents are at variance with the requirements of Laws, the CM shall promptly notify the Designer and THE OWNER in writing, and necessary changes shall be accomplished by an appropriate Contract Modification.

D. If the CM performs Work knowing it to be contrary to Laws without giving such notice to the Designer and THE OWNER, the CM shall bear full responsibility for such Work and all costs attributable thereto, including, without limitation, corrections to the Work.

6. Excavation.

The CM shall prevent by sheeting and shoring or bracing, if necessary, any caving or bulging of the sides of any excavation made by the CM, leaving sheeting and shoring in place, or if any is removed, filling solid the spaces left thereby.

7. Corrections to the Work; Inspection No Bar to Subsequent Corrections.

The review of the Work by the Designer, THE OWNER or its consultants shall not relieve the CM of its responsibilities to fulfill the Contract obligations. Defective work may be rejected by the Designer, THE OWNER or its consultants whether or not such work and/or materials have been previously overlooked or misjudged by the Designer, THE OWNER or its consultants and accepted for payment. If the Work or any part thereof shall be found defective at any time

before the Final Acceptance of the whole Work, or during the Warranty Period, the CM shall forthwith correct such defect in a manner satisfactory to the Designer, THE OWNER or its consultants. If any material brought upon the Site for use in the Work, or selected for the same, shall be rejected by the Designer, THE OWNER or its consultants as unsuitable or not in conformity with the Contract Documents, or as damaged by casualty or deteriorated due to improper storage at the Site or to any other factor, the CM shall forthwith remove such materials from the Site. The CM shall pay for the cost of making good all work or property of other contractors or of the Owner destroyed or damaged by such removal or replacement; repair any injury, defect, omission or mistake in the Work as soon as it is discovered, finish and immediately make good any defect, omission or mistake in the Work and complete and leave the Work in perfect condition. The costs of correcting such defects or mistakes shall not be considered Cost of the Work, unless the Owner approves funding such cost as a Construction Contingency Item, as provided in Section 7.2 of the Agreement for Construction Services.

9. Sanitary Facilities.
The CM shall provide and maintain sanitary facilities for all persons employed on the Work, beginning with the first worker at the Site. Said facilities shall meet the following minimum requirements unless otherwise specified in Division 1 of the Specifications.

A. There shall be no fewer facilities than the number required by applicable Laws;

B. Facilities shall be kept in a clean sanitary condition at all times and shall be adequately screened to be inaccessible to flies.

10. Temporary Offices. See Division 1 of the Specifications.

11. Contract Documents and Samples at the Site.
An Electronic set of Contract Documents will be furnished to the CM by THE OWNER immediately after signing of the Contract, one of which shall be maintained at the Site for reference by authorized representatives of THE OWNER. The CM shall maintain at the Site for the use and information of THE OWNER one record copy of the Drawings, Specifications, Addenda, Change Orders, Approved Shop Drawings, Product Data, Samples, updated Progress Schedule, and all other submittals, all in good order and marked currently to record changes and selections made during construction. These shall be available to the Designer and Project Manager and shall be delivered to the Designer for submittal to THE OWNER upon completion of the Work. The Drawings, Specifications and other documents prepared by the Designer, and copies thereof furnished to the CM, are for use solely with respect to this Project. The CM shall not permit their release to other parties except as may be necessary in dealing with governmental authorities in the ordinary course of permitting and constructing the Project. Further, they are not to be used by the CM or any Subcontractor or Supplier on other projects without the specific written consent of THE OWNER and the Designer.

12. Telephones. See Division 1 of the Specifications.

13. Safety Laws, Regulations, and Practices.

A. The CM shall comply with all health and safety Laws applicable to the Work. Without limitation,

(1) If the CM uses or stores toxic or hazardous substances it shall comply with M.G.L. c. 111F, s. 2, the "Right to Know" law and regulations promulgated by the Department of Public Health,

105 CMR 670, the Department of Environmental Protection, 310 CMR 33, and the Department of Labor and Workforce Development, 441 CMR 21; and shall post a Workplace Notice obtainable from the Department of Labor and Workforce Development.
(2) The CM shall comply with the Federal Resource Conservation and Recovery Act, the Federal Comprehensive Environmental Response, Compensation and Liability Act, M.G.L. c. 21C, M.G. L. c. 21E, and any other Laws affecting toxic or hazardous materials, solid, special or hazardous waste (collectively "Hazardous Materials Laws). Should the CM discover unforeseen materials subject to Hazardous Materials Laws at the Site, the CM shall immediately notify THE OWNER of such discovery.
(3) The CM shall be responsible for the location of all utilities in connection with the Work. Without limiting the foregoing, the CM shall comply with Dig-Safe Laws. Dig-Safe is the Utility Underground Plant Damage Prevention System, 111 South Bedford Road, Burlington, MA 01803, 1-800-322-4844. The CM shall notify Dig-Safe of contemplated excavation, demolition, or explosive work in public or private ways, and in any utility company right of way or easement, by certified mail, with a copy to Department of Environmental Protection (DEP). This notice shall be given at least 72 hours prior to the work, but not more than sixty days before the work is to be done. Such notice shall state the name of the street or the route number of the way and shall include an accurate description of the location and nature of the proposed work. Dig-Safe is required to respond to the notice within 72 hours of receipt by designating the location of pipes, mains, wires or conduits at the Site. The CM shall not commence work until Dig-Safe has responded. The work shall be performed in such manner and with reasonable precautions taken to avoid damage to utilities under the surface at the work location. The CM shall provide the Superintendent with current Dig-Safe regulations, and a copy of M.G.L. c. 82, s. 40. Any costs related to the services performed by Dig-Safe shall be borne by the CM.
(4) The CM shall comply with Public Law 92-596, "Occupational Safety and Health Act of 1970" (OSHA), with respect to all rules and regulations pertaining to construction, U.S. Code Title 29, sections 651 et seq. including Volume 36, numbers 75 and 105, of the Federal Register as amended, and as published by the U.S. Department of Labor.
(5) The CM shall comply with M.G.L. c. 149, s. 129A, relative to shoring and bracing of trenches.

B. The CM shall take reasonable precautions to prevent damage, injury or loss to persons or property. Nothing herein shall relieve Subcontractors of their responsibility for the safety of persons and property, and for compliance with all Laws applicable to the Work and their activities in connection therewith. Without limitation, the CM shall take all reasonable precautions for the safety of, and the prevention of injury or damage to (1) all agents and employees and contractors on the Work and all other persons who may be affected thereby including the general public, (2) all the Work and all materials and equipment to be incorporated therein, whether in storage on or off the Site, under the care custody or control of the CM or any of its Subcontractors or any contractors directly or indirectly contracting through any of them, and (3) other property at the Site or adjacent thereto, including but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of the Work. The CM shall promptly remedy all damage or loss to any such property caused in whole or in part by the CM, any Subcontractor, or anyone directly or indirectly contracted or employed by any of them or by anyone for whose acts any of them may be liable. Without limiting the foregoing, the CM shall:
(1) post and maintain adequate danger signs and other warnings against hazards;
(2) promulgate safety regulations and give appropriate notices to THE OWNER and users of adjacent utilities and property;

(3) insure the adequate strength and safety of all scaffolding, staging and hoisting equipment, temporary shoring, bracing and tying;
(4) protect adjoining private or public property;
(5) provide barricades, temporary fences, and covered walkways required by prudent construction practices, Laws and/or the Contract Documents;
(6) furnish approved hard hats and other personal protective equipment, furnish approved first aid supplies, furnish the name of the first aid attendant, and maintain a posted list of emergency facilities;
(7) provide proper means of access to property where the existing access is cut off by the CM;
(8) maintain from the beginning of any darkness or twilight through the whole of every night sufficient lights on or near any obstruction so as to guard to protect travelers from injury from such obstruction;
(9) maintain reasonable security at the Site so as not to expose the Work and surrounding property to vandalism or malicious mischief;
(10) provide adequate fire protection procedures during the use of cutting torches, welding equipment, plumbers' torches and other flame and spark producing apparatus;
(11) take prompt action to correct any dangerous or hazardous conditions.

C. The CM shall not use or store explosives in the performance of the Work unless the CM first obtains THE OWNER's prior written approval.

D. The CM shall not permit cutting or welding in or immediately adjacent to existing property of the Owner or of anyone else without THE OWNER's prior Approval in each instance.

E. The CM shall submit a safety plan to THE OWNER and designate by notice to THE OWNER a full time responsible member of its organization at the Site whose duties shall include preventing accidents.

F. The CM shall submit to THE OWNER without delay verbal and written reports of all accidents involving bodily injury or property damage arising in connection with the Work.

G. In any emergency affecting the safety of persons or property the CM shall immediately act in the exercise of reasonable judgment to prevent threatened damage, injury, or loss. The CM shall immediately notify THE OWNER of such emergency.

14. Debris and Chemical Waste.

A. The CM shall not permit the accumulation of interior or exterior debris. The CM shall keep the Work area clean at all times. Without limitation, garbage shall be removed daily.

B. The CM shall properly classify and remove debris and waste from the Site and transport and dispose of it, all in accordance with Laws, employing a qualified and properly licensed transporter, at any landfill, disposal or recycling facility licensed under applicable Laws, including without limitation, hazardous materials laws. The CM shall make all arrangements and give and obtain all notices, communications, documentation, permits, certificates, and approvals necessary for said disposal from the Owner or officials in charge of such landfills, disposal or recycling facilities. The CM shall bear all fees and costs in connection with such classification, removal, transportation, disposal and storage. The CM shall not permit any storage of debris or waste except in accordance with Laws.

C. The CM shall not permit any open fire on the Site.

D. Chemical Waste: Chemical waste shall be stored in corrosion resistant containers, removed from the Site, and disposed of not less frequently than monthly unless more frequently required by Laws, including without limitation hazardous materials laws, or by the Contract Documents. Disposal of chemical waste shall be performed in accordance with requirements of the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (DEP). Fueling and lubricating of vehicles and equipment shall be conducted in a

manner that affords the maximum protection against spills and evaporation. Lubricants shall be disposed of in accordance with procedures meeting all applicable Laws. The CM shall immediately notify the Designer of any hazardous materials release large enough to require reporting under applicable Laws. The CM shall be responsible for immediately cleaning up in accordance with Laws any oil or hazardous materials releases resulting from its operations. Any costs incurred in cleaning up any such releases shall be borne by the CM.

15. Weather Protection (M.G.L. c. 149, s. 44G.and 44F(1).

The CM shall, as part of its GMP cost, provide "weather protection," which means temporary protection of that Work adversely affected by moisture, wind and cold. Weather protection shall be achieved by covering, enclosing and/or heating working areas such that a minimum temperature of 40 degrees Fahrenheit is maintained at the working surface during the months of October through April in order to permit construction to be carried on during such period in accordance with the Progress Schedule. After the building or portion thereof is completely enclosed by either permanent construction or substantial temporary materials having a resistance comparable to the specified permanent construction, the CM shall provide heat therein of not less than 55 degrees F. nor more than 75 degrees F. The foregoing provisions do not supersede any specific requirements for methods of construction, curing of materials and the like. Such weather protection shall be consistent with the Progress Schedule, shall permit the continuous progress of the Work necessary to maintain an orderly and efficient sequence of construction operations, shall include one thermometer for every 2,000 square feet of floor space or fraction thereof, shall be subject to the Approval of THE OWNER, and shall meet such additional requirements as may be specified by THE OWNER and by the Contract Documents.

16. Furnishings and Equipment.

When, in the opinion of the Designer, any portion of the Work is in a reasonable condition to receive fittings, furniture, or other property of the Owner not covered by this Contract, the CM shall allow THE OWNER to bring such fittings, furniture, and/or other property into such portions of the Work and shall provide all reasonable facilities and protection thereof. No such occupancy shall be construed as interfering with the provisions relating to time of completion, or as constituting an acceptance of the whole or any part of the Work. Any furniture or fittings so installed shall be placed in the Work at the risk of THE OWNER except that the CM shall be liable for damages or losses to such furniture or fittings to the extent such damages or losses arise in whole or in part from the negligence or intentional misconduct of CM, Subcontractors, their agents and/or employees, or anyone for whose acts CM is responsible. The CM shall provide for debris removal facilities at a central location on the Project, in order to provide for the disposal of debris associated with the delivery of furnishings and equipment and technology equipment that will be delivered and installed by others.

17. Sales Tax Exemption and Other Taxes.

All building materials and supplies as well as the rental charges for construction vehicles, equipment and machinery rented exclusively for use on the Site, or while being used exclusively for the transportation of materials for the Work are entitled to an exemption from sales taxes under M.G.L. c. 64H, s. 6(f). The CM shall take all action required to obtain the benefit of such sales tax exemption. The CM shall bear the cost of any sales taxes that CM incurs in connection with the Work and THE OWNER shall not reimburse the CM for any such taxes. The exemption number assigned to the CM as an exempt purchaser shall be provided to the CM by THE OWNER upon the written request of the CM. If the CM incurs any costs for taxes, such costs shall be considered Costs of the Work.

18. Final Cleaning.
At the completion of the Work or any portion thereof, in preparation for turnover to the Owner, the CM shall remove all waste materials, rubbish, tools, equipment, electrical panels, machinery and surplus materials, and professionally clean all sight-exposed surfaces so that the Work is clean and ready for occupancy. Subsequent to installation of Owner furniture, equipment, technology equipment, and telephones, the CM shall provide such additional cleaning as may be necessary to remove any soil resulting from installation of such furniture, telephones and equipment.

19. Maintenance Data.
Subject to such additional requirements as may be provided in the Contract Documents, the CM shall compile four complete and identical binders of operating and maintenance data for the entire Work. The CM shall submit record maintenance data to the Designer for approval, shall submit approved maintenance data to THE OWNER, and shall instruct and train the User Agency's personnel in proper inspection and maintenance procedures.

20. Closeout Procedures.
The CM shall take all actions and submit all items required for the issuance of the Certificate of Use and Occupancy and Final Acceptance as specified in Division 1 of the Contract Specifications. -

ARTICLE V: MATERIALS AND EQUIPMENT

1. Materials Generally.
A. Unless otherwise specifically provided in the Contract Documents, the CM shall provide and pay for materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

The CM shall obtain prior written approval from THE OWNER for permission to store materials or equipment at off-site locations, to be incorporated in the Work, for which progress payments may be requested. Any and all charges for storage, inspection and verification by the Designer and THE OWNER, including insurance, shall be borne solely by the CM. Before approval, THE OWNER may require, without limitation (i) evidence that the off-site location is properly secure, (ii) proper proof of insurance and proof of satisfactory contractual arrangements for transportation to the site, and (iii) a certificate from the CM stating:

1. The name of the CM, Subcontractor or Supplier that leases or owns the warehouse or other storage facility;
2. The location of such storage facility, including the storage space; i.e., the entire premises or certain areas of a warehouse giving the number of floors or portions thereof, and a certification that the CM has visited such location, verified the storage of such material or equipment therein or thereon (including confirmation that the materials or equipment are marked and segregated as provided below), and verified payment of all current storage charges;
3. The date(s) on which the material or equipment is first stored at such facility; and

4. A description of the materials or equipment stored, including quantities, types, manufacturers and other identification information, such as serial numbers.

The CM shall furnish to THE OWNER, not less often than once per month, a current inventory of all materials or equipment being stored at any off-site location.

The CM shall mark each sealed carton or other item with the name of the Project and THE OWNER, and all materials or equipment stored off-site shall be segregated to the extent required by the Project Manager or the Designer.

Payment for materials or equipment stored off-site shall be at the reasonable discretion of THE OWNER, taking into account the schedule requirements of the Work. Title to materials or equipment stored off-site shall be transferred at the time at which THE OWNER pays for them, free of any lien or other interest of the Supplier or any other lien or encumbrance. Notwithstanding such transfer of title, the CM shall retain sole care, custody and control of, and shall have complete responsibility for the security and protection of, all materials or equipment included in any Application for Payment which are stored at locations other than the site, and the CM assumes all risk of loss or damage to such materials or equipment, and the CM shall hold harmless THE OWNER from and against all liabilities arising out of or resulting from loss or damage, from any cause, to such materials or equipment for which payment is requested, including liens, security interests or other claims of any kind by Suppliers or other third parties relating to such materials or equipment.

B. Materials and equipment to be installed as part of the Work (both or either of which are hereinafter referred to as "materials") shall be new, unused, of recent manufacture, assembled, and used in accordance with the best construction practices. The CM shall inform itself as to, and shall comply with, the provisions of M.G.L. c. 7, s. 23A, as amended, and shall abide by the same and all applicable rules, regulations and orders made thereunder in relation to the purchase of supplies and materials in the execution of the Work, including the provisions of M.G.L. c.7, s. 22, paragraph 17 which provides that there be *"a preference in the purchase of supplies and materials, other considerations being equal, in favor, first, of supplies and materials manufactured and sold within the Commonwealth, and, second, of supplies and materials manufactured and sold elsewhere within the United States."*

2. <u>Shop Drawings, Product Data, and Samples.</u>

A. The CM shall prepare and submit to the Designer, in accordance with requirements specified in Section 013300 “Submittal Procedures”, Shop Drawings, Product Data, Samples, and such other Submittals as may be required by the Contract Documents. The Designer will review and approve or take other appropriate action upon the Contractor’s submittals, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review and approval by the Designer of Shop Drawings, Product Data, Samples and other Submittals shall in no way relieve the CM from responsibility for proper fitting, coordinating, construction, and construction sequencing. The CM shall furnish to the Project Manager and the Designer such information and vouchers relative to the Work, the materials therefore, and the persons employed thereon, as the Designer shall from time to time request.

B. Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. The purpose of their submission is to demonstrate for those portions of the Work for which submittals are required the way the CM proposes to conform to the information given and the design concept expressed in the Contract Documents.

C. The CM shall review, and submit to the Designer, Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of THE OWNER or of separate contractors. Submittals made by the CM which are not required by the Contract Documents or which do not comply with the Contract Documents may be returned without action. The CM's attention is directed to the provisions of Section 4 of this Article V and to the Specifications.

D. The CM shall prepare and keep current for the Designer's approval a schedule of submittals which is coordinated with the Progress Schedule and allows the Designer reasonable time to review submittals.

E. The CM shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Designer. Such Work shall be in accordance with Approved submittals.

F. By submitting Shop Drawings, Product Data, Samples and similar submittals, the CM represents that the CM has determined and verified materials, field measurements, and field construction criteria related thereto and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

G. The CM shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Designer's approval of Shop Drawings, Product Data, Samples or similar submittals unless the CM has specifically informed the Designer in writing of such deviation at the time of submittal and the Designer has given explicit written approval to the specific deviation. The CM shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals as a result of the Designer's or THE OWNER's actions.

H. The CM shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Designer on previous submittals.

I. Informational submittals upon which the Designer is not expected to take responsive action may be so identified in the Contract Documents.

J. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, such certification must be stamped by a registered Massachusetts professional in the discipline required. The Designer shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

K. Materials furnished or used or employed under the Contract must be equal in quality to the samples furnished and be satisfactory to the Designer.

3. Tests.

A. Any material to be used in the Work may be tested or inspected at any time by the Designer with an independent testing company with the prior Approval of THE OWNER and may be rejected if it fails to comply with specified tests. THE OWNER shall pay for all testing of specified material. If the CM requests permission to use a material that was not specified, then the CM shall pay for such testing. The cost of testing of any materials that fail the testing criteria shall be borne by the CM

B. The CM shall notify the Designer and THE OWNER of the proposed sources of materials in time to permit all required testing and inspection before the material is needed for incorporation into the Work. The CM shall have no claim arising from CM's failure to designate the proposed source or to order the material in time for adequate testing and inspection. Necessary arrangements shall be made to permit the Designer to make factory, shop or other inspection of materials or equipment ordered for the Work in process of manufacture or fabrication, or in storage elsewhere than the Site.

4. "Or Equal" Submissions.

A. Where products or materials are prescribed by manufacturer name, trade name, or catalog reference, the words "or Approved equal" shall be understood to follow, except where the Owner has approved a proprietary specification as provided in G.L.c. 30 sect. 39M. An item shall be considered equal to the item so named or described if in the opinion of the Designer (a) it is at least equal in quality, durability, appearance, strength and design, (b) it performs at least equally the function imposed in the general design for the Work, and (c) it conforms substantially, even with deviations, to the detailed requirements for the items as indicated by the Specifications. Any changes in the work made necessary to accommodate products or materials substituted as an "or equal" shall be at the expense of the CM. "Approved equal" shall mean an item with respect to which Designer shall have issued a written statement to the CM to the effect that the item is, in Designer's opinion, equal within the meaning of this paragraph to that prescribed in the Contract Documents.

B. The CM shall be responsible for providing the Designer with any information and test results that the Designer reasonably requires to determine whether or not a material is equal to a material named or described in the Contract Documents.

C. Whenever the CM submits a material for approval as a substitute for a material named or described in the Contract Documents, such submission shall be made at least sixty (60) days prior to the date the materials will be used in the Work. In no event shall the CM maintain a claim for delays based upon the Designer's review of such substituted materials if the CM has failed to comply with the sixty (60) day submission requirement.

5. Delivery and Storage of Materials; Inspection.

A. Materials and equipment shall be progressively delivered to the Site so that there will be neither delay in the progress of the Work nor an undue accumulation of materials that are not to be used within a reasonable time and so that their security, quality, and fitness of the materials for the Work is preserved. CM shall prepare adequate storage and staging areas for materials and equipment delivered to the Site.

B. Materials stored off Site shall be insured and stored at the expense of the CM/Subcontractor so as to guarantee the preservation of their security, quality and fitness for the Work. Without derogating from the CM's responsibilities in the previous sentence, when necessary to avoid deterioration or damage, material (on or off Site) shall be placed on wooden platforms or other hard clean surfaces and not on the ground and shall be properly protected.

C. Expenses for inspection of material by the Designer and/or the Project Manager personnel including travel, quarters, and subsistence shall be borne by the CM requesting the inspection of material stored outside the Commonwealth of Massachusetts as part of the Contract Price. If the CM requests an inspection of material stored outside the Commonwealth of Massachusetts, THE OWNER will initially pay for all expenses of inspecting the material incurred by the Designer and/or the Project Manager's personnel including travel, quarters, and subsistence. THE OWNER will then give CM an invoice for those costs and the CM shall submit a credit Change Order for the amount of those expenses.

D. Stored materials either at the Site or at some other location agreed upon in writing shall be so located as to facilitate prompt inspection and even though approved before storage, may again be inspected prior to their use in the Work.

E. All storage sites shall be restored to their original condition by the CM at the CM's expense.

F. The CM shall take charge of materials for its use delivered to or in the vicinity of the place where the Work is being done, whether furnished by the Owner or otherwise; the CM shall notify the Designer as soon as any such materials are so delivered, allow them to be examined by the Designer, and furnish workers to assist therewith.

6. Defective, Damaged, or Deteriorated Materials and Rejection Thereof.
The Designer may reject materials if the Designer reasonably determines that such materials do not conform to the Contract Documents in any manner, including but not limited to materials that have become damaged or deteriorated from improper storage whether or not such materials have previously been accepted. The CM at its own expense shall remove rejected materials from the Work. No rejected material, the defects of which have been subsequently corrected, shall be used except with the written permission of the Designer. Should the CM fail to remove rejected material within a reasonable time, THE OWNER may, in addition to any other available remedies, remove and/or replace the rejected material, and deduct the cost of such removal and/or replacement from any moneys due or to become due the CM by issuing a credit change order against the GMP. No extra time shall be allowed for completion of Work by reason of such rejection. The inspection of the Work shall not relieve the CM of any of its obligations herein prescribed, and any defective Work shall be corrected. Work not conforming to the Contract Documents may be rejected notwithstanding that such Work and materials have been previously overlooked or misjudged by the Designer and accepted for payment. If the Work or any part thereof shall be found defective at any time before Final Acceptance of the whole Work, the CM shall forthwith make good such defect in a manner satisfactory to the Designer. Nothing in the Contract shall be construed as vesting in the CM any property rights in the materials used after they have been attached or affixed to the Work or the Site; but all such materials shall upon being so attached or affixed become a property of the Owner.

ARTICLE VI: PROSECUTION AND PROGRESS

1. Beginning, Progress Schedule, and Completion of Work.
A. The Contract time shall commence upon the date specified and in accordance with any conditions in the Notice to Proceed.
B. Prior to the submission of the first progress payment, CM shall submit to the Designer and the Project Manager for approval a progress schedule which complies with the contract requirements. Upon Approval by THE OWNER, said schedule shall constitute the Progress Schedule.
C. Time is of the essence of this Contract. The Work shall be completed within the time specified in the Owner-CM Agreement. Should the CM require additional time to complete the Work, the CM shall document the reasons therefore and submit a written request for an extension of time within 14 days of the occurrence of the event alleged to be the cause of the delay, as provided in this Article and in Article VII of these General Conditions of the Contract. Failure to submit said written request within the time required by the preceding sentence shall preclude the CM from subsequently claiming any time extension due to said delay.

D. CM must use diligent efforts to mitigate any potential schedule impacts and must demonstrate actual impact on critical path activity to receive a contract time extension. CM acknowledges that managing day-to-day design changes, clarifications, RFIs and the like is part of CM's base scope of Work, and CM has contemplated such work in preparing its critical path schedule. CM agrees to meet with the Architect on a weekly basis to assist in prioritizing RFI responses in order to avoid potential delays or claims. CM agrees that neither the specification by CM of a "due date" or "return date" for any request for

clarification, RFI or the like, nor the failure of Owner or Architect to meet any such required due date or return date, shall necessarily be grounds for a claim for adjustment of the Contract Time. Without limiting the foregoing, CM expressly agrees that due dates or return dates inserted by "default" by any computer software program shall not be binding upon Owner or Architect or be the basis for any claim for adjustment of the Contract Time.

E. If, in the opinion of THE OWNER, the CM fails to comply with the Progress Schedule, due to reasons that are within the reasonable ability of the CM to control, THE OWNER ~~may but~~ shall ~~not be required to~~ give the CM written notice of such failure and five days to cure the same. Unless the CM shall within that five days take all necessary steps to do so, including, if THE OWNER requires, increasing its forces, equipment and plant and continue to do so until, in the opinion of the Designer or Project Manager the failure is corrected, THE OWNER may at the CM's expense and without terminating this Contract employ and direct the labors of existing or such additional forces, equipment and plant as may in the Designer's or Project Manager's opinion be necessary to insure the completion of the Work or such part thereof within the time specified in the Contract Documents or at the earliest possible date thereafter. THE OWNER may exercise its rights under this Article at any time and from time to time without waiving any of its rights under this Contract, at law or in equity, including, without limitation, the right to deem this Contract terminated or to order the CM to discontinue the Work at any time thereafter. The CM shall continue to perform the remaining Work under this Contract even if THE OWNER elects to have another contractor perform a portion of the Work under this Article.

F. THE OWNER shall deduct the cost of any actions THE OWNER takes under this Article from any amount then due or which might have become due to the CM under this Contract had the CM performed as required. On demand, the CM shall pay THE OWNER any amount by which the cost of completing all or any portion of the Work exceeds the amount attributable to that Work under the Contract Documents. THE OWNER shall have no obligation to obtain competitive bids or the lowest cost for completing the Work or any part thereof. THE OWNER's election to complete all or part of the Work shall not release the CM from any liability for failure to complete the Work as the Contract Documents require, and shall not entitle the CM to a claim for an increase in the Contract Price or an extension of the time for completing the Work.

2. <u>Failure to Complete Work on Time - Liquidated Damages.</u>

A. If liquidated damages are specified in the Owner - CM Agreement, THE OWNER has determined that its damages as a result of CM's failure to complete the Work to the point at which it qualifies for the issuance of a Certificate of Substantial Completion will be difficult or impracticable to ascertain. Accordingly, if the Work is not substantially completed by the date specified in this Contract, or by any extended date approved by the Owner, the CM shall pay to THE OWNER the sum designated as liquidated damages in the Contract for each and every calendar day that the CM is in default in substantially completing the Work. Such moneys shall be paid as liquidated damages, not as a penalty, to cover losses and expenses to THE OWNER and/or the User Agency resulting solely from the fact that the Work is not substantially completed on time. The agreed to Liquidated Damages for this project for the CM and Subcontractors is $300/day up to a maximum of $30,000.00.

B. THE OWNER may recover such liquidated damages by deducting the amount thereof from any moneys due or that might become due the CM, and if such moneys shall be

insufficient to cover the liquidated damages, then the CM or the Surety shall pay to THE OWNER the amount due.

C. Permitting the CM to continue and finish the Work or any portion of it after the time fixed in the Contract for its completion shall not be deemed as a waiver of any of the Owner's rights hereunder, at law or in equity.

D. Liquidated damages or a portion thereof may be waived by THE OWNER if the CM submits evidence satisfactory to THE OWNER that the delay was caused solely by conditions beyond the control of the CM or that THE OWNER has not suffered any damages as a result of said delay.

E. Failure by THE OWNER to specify a sum as liquidated damages in the Owner-CM Agreement, or the insertion of "N/A" or "none" in the space provided therein for liquidated damages, shall not be deemed a waiver of THE OWNER's right to recover actual damages arising from the CM's failure to complete the Work on time.

3. Delays; Time Extensions, No Damages for Delay Statutory Provisions (M.G.L. c. 30, s. 39O).

A. Notwithstanding any provision of this Contract to the contrary, except as otherwise provided by law as set forth in paragraph B below, the CM shall not be entitled to an increase in the Contract Price or to receive damages on account of any hindrances or delays, avoidable or unavoidable; but if any delay occurs that is caused in the opinion of THE OWNER, by parties or events beyond the reasonable ability of the CM to control, the CM shall be entitled to an extension of time. Delays caused by suppliers, subcontractors and sub-subcontractors shall be considered to be within the control of the CM. The length of the extension shall be sufficient in the opinion of THE OWNER for the CM to complete the Work.

B. The CM may be entitled to an extension of time if the CM can demonstrate to the reasonable satisfaction of the Owner, upon the recommendation of the Designer and the Project Manager, that the critical path schedule for the Project has been adversely impacted by events of delay that are beyond the reasonable ability of the CM to control, and that the CM cannot revise its critical path schedule to eliminate the need for a time extension; provided however that the Owner and CM are entitled to share the "float" time in the CPM schedule if the utilization of such time avoids a time extension. Should the CM require additional time to complete the work, it shall document its reasons therefore and request an extension of time at the time the alleged delay occurred, as provided in this Article. Failure to notify the Owner of any delay in writing within 14 days from the date the event arose that caused such delay, shall preclude the CM from requesting and obtaining a time extension due to said delay. Requests for extensions of time shall be submitted as a Change Order request to the Owner.

C. No extension of time shall be granted because of normal variations in temperature, humidity or precipitation, which conditions shall be wholly at the risk of the CM, whether occurring within the time originally scheduled for completion or within the period of any extension granted. There shall be no increase in the Contract Sum on account of any additional costs of operations or conditions resulting there from.

D. (1) Extension of Time. Upon a timely and proper request, the CM shall be entitled to an appropriate extension of time to complete the Project should any hindrances, suspensions, interruptions or delays to the critical path schedule result from one or more of the following circumstances:

(i) failure of the Owner to provide the CM with a Notice to Proceed in a timely manner;

(ii) failure of the Owner or Designer, to act, respond, or provide approvals to the CM within 20 days of receipt of a written request from the CM for action or direction; provided, that if the Owner or Designer requires additional time to prepare a response, the Owner and/or Designer shall have 20 additional days to provide a response to the CM;

(iii) issuance by the Owner of Change Orders or Contract Modifications;

(iv) encountering unanticipated special wastes or historical or archaeological resources;

(v) encountering unanticipated subsurface conditions differing from those anticipated from the information provided prior to construction;

(vi) inability of the CM to obtain the required permits and/or jurisdictional approvals despite the best efforts of the CM to obtain such permits and/or approvals;

(vii) failure of the Owner to provide the CM with exclusive physical and legal access to the project site in a timely manner to permit the work to proceed in accordance with the schedule;

(viii) action by any court or public agency, unless such action is due to the fault of the CM;

(ix) actions of other contractors employed by the Owner;

(x) fire, flood, severe weather conditions, unavoidable casualties and strikes;

(xi) any other cause beyond the reasonable ability of the CM to control which the Owner determines justifies an extension of time.

E. The CM's estimates of the extension of time must be accompanied by a detailed analysis identifying each action(s) or additional work item(s) which caused the delay and also identifying exactly which items along the critical path were impacted or delayed. Accumulating the amount of time required to complete a series of additional work items or delays and adding this time to the original Contract Time will not be considered justification for an extension of time. In order to justify an extension of Contract Time, the CM must prove that the critical path for construction has been impacted by circumstances beyond the control of the CM.

F. If a suspension, delay, interruption or failure to act of THE OWNER increases the cost of performance to any Subcontractor, that Subcontractor shall have the same rights against the CM with respect to such increase as the CM shall have against THE OWNER by virtue of (a) and (b) of M.G.L. c. 30, s. 39O set forth below, but nothing in provisions (a) and (b) shall alter any other rights which the CM or the Subcontractor may have against each other. As used in the statutory language of (a) and (b) below, "contract" means this Contract, "general contractor" means the CM and "Awarding Authority" means THE OWNER:

"*(a) The Awarding Authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the Awarding Authority; provided, however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the Awarding Authority to act within the time specified in this contract, the Awarding Authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the Awarding Authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption*

or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.
(*b) The general contractor must submit the amount of a claim under provision (a) to the Awarding Authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract and except for costs due to a suspension order, the Awarding Authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the Awarding Authority in writing of the act or failure to act involved in the claim."*

G. No Damages for Delay

Except as provided in Paragraph F, when the Owner issues a written order suspending the work, as provided in Paragraph F, the CM shall have no claim for damages of any kind against the Owner on account of any delay in the commencement or performance of any of the work or any delay or suspension of any portion of the Work, whether such delay is caused by the Owner, the Designer, or otherwise. The applicable Massachusetts state law shall govern this provision.

4**. Use and Occupancy Prior to Final Acceptance.**

A. If the Project is to be of the Occupied Phased type. The CM agrees to the use and occupancy of the Project or any portion thereof for the entirety of the Work by THE OWNER.

B. THE OWNER and the User Agency will cooperate with the CM with respect to the completion of the Work by taking such reasonable steps as may be possible to avoid interference with the CM's Work provided that they do not interfere with the proper functioning of the facility.

C. The CM shall not be responsible for wear and tear or damage resulting solely from temporary occupancy.

D. The CM shall maintain the building in a secure manner for the safety of the occupants at all times as required by the OWNER. The CM, as part of the Phasing Work, shall maintain all egress and life safety systems and all others systems and code requirements up to applicable Codes, laws and regulations at all times during Construction. The CM shall also maintain all building systems in the occupied portions of the school so as to facilitate the safe and normal operation of the school. These shall be costs of the work and design shall take this into account.

E. Use and occupancy of any part of the Work prior to Final Acceptance by THE OWNER shall not relieve the CM from maintaining the required payment and performance bonds and insurance (to the extent that insurance is required to be maintained after Substantial Completion) required by this Contract.

5. Certificate of Substantial Completion, Final Completion.

A. When the Work, or portion thereof which THE OWNER agrees to accept separately, has reached the state of Substantial Completion, the CM shall develop, with the participation of the Designer and THE OWNER, the Punch List identifying those items of unfinished or unacceptable Work that remain to be performed or corrected under the Contract.

B. Before the Work shall be deemed completed to the point where it is ready for the issuance of a Certificate of Substantial Completion and a Certificate of Final Completion, the CM shall comply with all the requirements designated in Division 1, Section 01770.

C. A certificate of substantial completion for the new Olive Street Parking Garage Building will be issued when the new garage is ready to be occupied (as defined above) by the OWNER. A separate Certificate of Substantial completion will be issued when the existing structure has been demolished and the site-work in the area affected by the existing building

is completed. The certificate of Final Completion will be issued when ALL work associated with the project is completed.

6. <u>One-Year Warranty Repair List and Inspection.</u>
Approximately 30 days prior to the expiration of the comprehensive one-year warranty period required by Article IX, the CM shall schedule an appointment with THE OWNER for a re-inspection of the Work with THE OWNER and User Agency, and shall thereafter inspect the work at the time scheduled. Based on this inspection and on prior inspections, THE OWNER and/or User Agency shall issue a "Warranty Repair List" of items to be corrected by the CM. The CM shall make the repairs and/or replacements listed within 30 days of the issuance of the Warranty Repair List unless otherwise agreed by THE OWNER in writing.

ARTICLE VII: CHANGES IN THE WORK

1. <u>Change Orders Generally.</u>
A. No changes in the Work, the Contract Price, the Substantial and Final Completion dates, or any other provision of an Approval by THE OWNER of the Contract Documents shall be made in absence of a Change Order as defined in Article I of these General Conditions of the Contract, directing the CM to perform such changes. Any request for a change in the provisions of this Contract submitted by the CM must be made in writing and in accordance with the provisions of this Contract.
B. A request for a change in the provisions of this Contract may originate with THE OWNER, the CM, or the Designer. The request must be made in writing and in accordance with the provisions of this Contract. When the CM believes that an event or circumstance gives rise to an adjustment in the Contract Price and/or the Contract Time it shall submit a request for a change order in accordance with the contract.
C. Prior to the approval of a Change Order, the Owner, through the Designer or the Project Manager, may issue a written directive to the CM (sometimes called a Notice to Proceed or a Proposed Change Order instructing the CM to make changes in the Work within the scope of the Contract, including but not limited to, changes in: (1) the Plans and Specifications; (2) the method or manner of performance of the Work; (3) the Owner-furnished facilities, equipment, materials, services or Site; (4) the schedule for performance of the Work.
D. The CM shall immediately perform any changes in the work that are ordered by THE OWNER.
E. Whenever a Change Order or written directive issued under Paragraph C will cause a change in the CM's cost or the time required to perform the Work, the CM or THE OWNER may request an adjustment in the Contract Price. Such request shall be in writing and shall be submitted by the party making such claim to the other party before commencement of the pertinent work or as soon thereafter as possible.
F. THE OWNER and the CM shall negotiate in good faith an agreement on an equitable adjustment in the Contract Price, pursuant to the methods described in the following Paragraph 2, and/or time if appropriate, before commencement of the pertinent work or as soon thereafter as is possible. In the absence of an agreement for an equitable adjustment, THE OWNER shall determine the costs attributable to the change and provide the CM with a written notice to that effect, in which event the CM may follow the procedure described in Paragraph 3. Work Performed under Protest.
G. During the negotiation of an equitable adjustment in the Contract Price, the CM shall, if requested, provide THE OWNER with all cost, pricing data and any other information or documentation used by it in computing the amount of the equitable adjustment, and the CM

shall certify that the pricing data used was accurate, complete, current and reasonable. If THE OWNER subsequently determines that the data submitted by the CM was incomplete, incorrect, not current, or unreasonable, THE OWNER may exclude such data from consideration under the equitable adjustment request.

H. Whenever the Construction Manager is entitled or believes it is entitled to a Change Order adjusting the Contract Price, the Construction Manager shall maintain separate accounts (by job order or other suitable accounting procedure) of all costs incurred and attributable to such work. The Construction Manager shall maintain a computerized accounting system, acceptable to THE OWNER, in which current information as to the status of all such work is maintained. The Construction Manager shall maintain such contemporaneous records as are necessary to provide a clear distinction between the costs of all Change Order Work and proposed Change Order Work, and the costs of other Work.

I. Notwithstanding any provisions in the Contract Documents to the contrary, no additional General Conditions Cost shall be due for any Change Order or portion of a Change Order resulting from or attributable to:

1. Increases in the cost of Allowance items;
2. Substitutions of equipment or materials which are functionally similar to equipment or materials specified in the Contract Documents.

2. <u>Methods of Computing Equitable Adjustments.</u>

A. Equitable adjustments in the Contract Price shall be determined according to one of the following methods, or a combination thereof, as determined by THE OWNER:

(1) fixed price basis, provided that the fixed price shall be inclusive of items listed in (3) (a) through (d) below and shall be computed in accordance with those provisions;

(2) estimated lump sum basis to be adjusted in accordance with Contract unit prices or other agreed upon unit prices, provided that the unit prices shall be inclusive of all costs related to such equitable adjustment;

(3) time and materials basis to be subsequently adjusted on the basis of actual costs (but subject to a predetermined "not to exceed limit") calculated as follows:

(a) the direct cost (or credit) for labor at the prevailing wage rates established for this Contract pursuant to M.G.L. c. 149, s 26-27H, and the direct cost for material and use of equipment; It has been agreed that Contractor owned equipment used for Extra Work will be paid for based on Published Blue Book Equipment Rates. Rates paid will be:

1. Less than 1 day will be paid at the daily rate/8
2. 1 Day – Daily Rate
3. Less than 5 days but more than 1 day - weekly rate /5
4. Less than 1 month but more than 5 days – Monthly Rate/22

(b) plus (or minus) the cost of Workmen's Compensation Insurance, Liability Insurance, Federal Social Security and Massachusetts Unemployment Compensation, or as an alternative the CM may elect to use a flat 30% of the total labor rate computed in accordance with subparagraph (a) above;

(c) plus an allowance equal to 10% of the amount of (a) above for General Conditions, overhead, superintendence, fee, and profit. When change order work is performed by a subcontractor, the subcontractor shall be entitled to 10% of the overhead, superintendence, fee and profit markup, in which event the CM will be entitled to a 5% markup. Maximum Markup for any change is 15% of the cost of The Extra Work.

(d) plus the actual direct premium cost of payment and performance bonds required of CM and Trade Subcontractors for this Contract.

B. If the net change is an addition to the Contract Price, it shall include the CM's overhead, superintendence and profit. For any change that does not include labor performed or materials installed in the project, there will be no markup for the CM's or Subcontractor's overhead, superintendence, and profit, even though there may be a net increase in the Contract Price. Charges for small tools known as "tools of the trade" are not to be computed in the amount of any change in the Contract Price.

C. Adjustment to the amounts of Subcontracts made under the provisions of the Procedure for Award of Subcontracts shall not be considered Change Orders and shall not entitle the CM to any adjustments for overhead, profit, and superintendence, although THE OWNER may require that such Contract adjustments be processed on standard Change Order and equitable adjustment forms.

3. Work Performed Under Protest.
The CM agrees to perform all Work as directed by THE OWNER, and if the THE OWNER determines that certain Work that the CM believes to be or to warrant a Change Order under this Article does not represent a change in the Work, the CM shall perform said Work. The CM shall be deemed to have concurred with the THE OWNER's determination as aforesaid unless the CM shall perform Work under protest in compliance with the following sub-paragraphs (1) and (2) below:
(1) If the CM claims compensation for a change in the Work that is not deemed by the THE OWNER to be a change or to warrant additional compensation as claimed by the CM, the CM shall before the commencement of any such work submit to THE OWNER a written statement of the nature of such work or claim. The CM shall not be entitled to additional compensation for any work performed or damage sustained for which written notice is not given within the time limit specified in the preceding sentence, even though similar in character to work or damage with respect to which notice is timely given.
(2) On or before the second working day after the commencement of such work or the sustaining of such damage, and daily thereafter, the CM shall file to the extent possible with the Clerk of Works, the Designer, and the Project Manager, itemized statements of the details and costs of such work performed or damage sustained. The CM shall submit Daily Time and Materials Reports to record all labor and material used. If the CM fails to submit such statements, then the CM shall not be entitled to later pursue a claim against Owner for additional compensation for any such work or damages.

4. Other Claims. No claim for additional compensation for any other reason will be recognized nor will CM have any entitlement to such additional compensation unless written notice is given to THE OWNER by the CM within fourteen (14) days of the occurrence of the event giving rise to such claim.

5. False Claims, Statutory Provisions Regarding Changes.
A. Criminal Penalties: The CM's attention is directed to M.G.L. c. 30, s. 39I which provides criminal penalties for unauthorized deviations from the Plans and Specifications, and to M.G.L. c. 30, s. 39J and M.G.L. c. 7, s. 42E-42I. The CM's attention is also directed to M.G.L. 266, s. 67B which provides criminal penalties for false claims by Contractor under this Contract:
"Whoever makes or presents to any employee, department, agency or public instrumentality of the commonwealth, or of any political subdivision thereof, any claim upon or against any department, agency, or public instrumentality of the commonwealth, or any political subdivision thereof, knowing such claim to be false, fictitious, or fraudulent, shall be punished by a fine of not more than ten thousand dollars or by imprisonment in the state

prison for not more than five years, or in the house of correction for not more than two and one-half years, or both."

B. Differing Site Conditions (M.G.L. c. 30, s. 39N): "*If, during the progress of the work, the contractor or the Awarding Authority discovers that the actual subsurface or latent physical conditions encountered at the Site differ substantially or materially from those shown on the plans or indicated in the contract documents either the contractor or the contracting authority may request an equitable adjustment in the contract price of the contract applying to work affected by the differing Site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a contractor, or upon its own initiative, the contracting authority shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the contract documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and contract documents and are of such a nature as to cause an increase or decrease in the cost of performance of the work or a change in the construction methods required for the performance of the work which results in an increase or decrease in the cost of the work, the contracting authority shall make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly."*

C. Timely Decision By THE OWNER(M.G.L. c. 30, s. 39P): *"Every contract subject to section thirty-nine M of this chapter or section forty-four A of chapter one hundred forty-nine which requires the Awarding Authority, any official, its architect or engineer to make a decision on interpretation of the specifications, approval of equipment, material or any other approval, or progress of the work, shall require that the decision be made promptly and, in any event, no later than thirty days after the written submission for decision; but if such decision requires extended investigation and study, the Awarding Authority, the official, architect or engineer shall, within thirty days after the receipt of the submission, give the party making the submission written notice of the reasons why the decision cannot be made within the thirty day period and the date by which the decision will be made."*

ARTICLE VIII: PAYMENT PROVISIONS

1. Schedule of Values.
Before submission of the first request for payment under this Contract, the CM shall submit to THE OWNER a schedule of values for its approval, which shall include all preconstruction activities as well as all construction activities and shall be in sufficient detail to reflect the various preconstruction activities and the major components of each construction trade (with relevant Subcontractors as well as MBE/WBEs noted), including quantities when requested, aggregating the GMP with detail for the Contingency and divided so as to facilitate payments for work under each section of the Specifications. The schedule shall be prepared in such form and supported by such data to substantiate its accuracy as the THE OWNER may require. When Approved by the THE OWNER, it shall constitute the Schedule of Values and shall be used only as a basis for the CM's requests for payments and credits, the first of which payments shall not be made until such Schedule of Values is approved by THE OWNER. If the MSBA requires any revisions to the format of the Schedule of Values, the CM and the Owner shall make the revisions.

2. Payment Liabilities of CM.

A. The CM shall pay to THE OWNER all expenses, losses and damages, as determined by THE OWNER , incurred in consequence of any default, defect, omission or mistake of the CM or his employees or Subcontractors or the making good thereof.

B. If the Work (or a portion thereof) is not substantially completed and the CM has not satisfied the requirements for the issuance of a Certificate of Substantial Completion by the date specified in the Contract, the CM shall pay to the Owner liquidated damages as provided in the Contract.

3. Retention of Moneys by THE OWNER.

A. THE OWNER may keep any moneys which would otherwise be payable at any time hereunder, and apply the same, or so much as may be necessary therefor, to (1) the THE OWNER 's expenditures for the CM's account, (2) to secure THE OWNER's remedies against the CM for the CM's breach of its obligations under this Contract or the breach of any person performing any part of the Work and (3) the payment of any expenses, losses or damages incurred by THE OWNER as a result of the failure of the CM to perform its obligations hereunder. THE OWNER may retain, until all claims are settled, such moneys as THE OWNER estimates to be the fair value of THE OWNER's claims against the CM, and of all claims for labor performed or furnished and for materials used or employed in or in connection with the Work and for the rental of vehicles, appliances and equipment employed and for the employment of substitute contractors and labor in connection with the Work filed in accordance with M.G.L. c. 30, s. 39A and s. 39F. THE OWNER may make such settlements and apply thereto any moneys retained under this Contract.

4. Applications for Payment.

A. The CM shall, once in each month submit to THE OWNER an application for payment for its periodic payment estimate, showing the total amount of Work done to the time of such estimate and the value thereof as approved by THE OWNER. It shall be the sole responsibility of the CM to deliver or cause to be delivered to the Designer said periodic estimate, in proper form, approved as provided above and arithmetically correct, and signed by the Designer and the Project Manager, if requested by the Owner. All periodic estimates shall contain such certifications and other evidence supporting the CM's right to payment as THE OWNER may require, including without limitation, forms THE OWNER may require, establishing that title to the equipment or materials is unencumbered and has been transferred to the THE OWNER. The CM shall include in such periodic estimate only such materials as are incorporated in the Work, except as provided in paragraph C below. THE OWNER shall retain five percent of such estimated value as part security for the completion of the Work and shall pay to the CM while carrying on the Work the balance not retained as aforesaid, subject to the Approval of THE OWNER after deducting therefrom all previous payments and all sums to be kept under the provisions of this Contract, provided that the Owner shall not assess retainage against applications for payment for the CM’s Preconstruction Services Fee.

B. Each periodic payment estimate shall constitute the CM's representation that (1) the payment then requested to be disbursed has been incurred by the CM on account of the Work and is justly due to Subcontractors or, to the CM in the case of other Work performed by the CM on account thereof, (2) the materials, supplies and equipment for which Application for Payment is being submitted have been installed or incorporated into the Work or have been stored at the Site or at such off Site storage locations as THE OWNER shall have Approved, (3) the materials, supplies and equipment are insured in accordance with the provisions of this Contract, (4) the materials, supplies and equipment are owned by the Owner and are not subject to any liens or encumbrances, (5) the Work which is the subject of such periodic estimate has been performed in accordance with the Contract Documents and (6) that all due and payable bills with respect to the Work have been paid to date and shall be paid from the

proceeds of such periodic estimate. The CM's attention is directed to the criminal penalties for false claims.

C. The CM may include in a periodic payment estimate the value of materials or equipment delivered at the Site (or at some location agreed to in writing by THE OWNER) only upon delivery to THE OWNER of: (1) an acceptable transfer of title on the form provided by THE OWNER; (2) written certification by the CM (or applicable subcontractor) on the form provided by THE OWNER that the CM (or the Subcontractor which executed the transfer of title) is the lawful owner and that the materials or equipment are free from all encumbrances, accompanied by receipted invoices or other acceptable proof of encumbrance-free ownership if such proof is deemed necessary by THE OWNER; (3) a stored materials insurance binder that covers the materials for which payment is requested, that names the Owner as an insured party should the stored materials be subjected to any casualty, loss, or theft prior to their inclusion in the Work. The material(s) or equipment must, in the judgment of the Designer (1) meet the requirements of the Contract, including prior drawing, product data, and sample approval, (2) be ready for use, and (3) be properly stored by the CM and be adequately protected until incorporated into the Work.

D. THE OWNER may make changes in any periodic payment estimate submitted by the CM and the payment due shall be computed in accordance with the changes so made.

E. No certificate for payment and no progress payment shall constitute acceptance of Work that is not in accordance with the Contract Documents.

F. The CM and all Subcontractors furnishing labor on this Contract agree to furnish certified payroll reports, at no additional expense to THE OWNER on a monthly basis. THE OWNER may at all reasonable times audit such reports.

5. Periodic Payments

THE OWNER shall make payment to the CM in accordance with M.G.L. c. 30 sect. 39K, which provides as follows:

"Within fifteen days after receipt from the CM at the place designated by the Owner, if such a place is so designated, of a periodic estimate requesting payment of the amount due for the preceding month, the Owner shall make a periodic payment to the CM for the work performed during the preceding month and for the materials not incorporated in the work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the CM has title or to which a trade contractor has title and has authorized the CM to transfer title to the Owner less (1) a retention based on its estimate of the fair value of its claims against the CM and less (2) a retention not exceeding five percent of the approved amount of the periodic payment. After the receipt of a periodic estimate requesting final payment and within sixty-five days after (a) the contractor fully completes the work or substantially completes the work so that the value of the work remaining to be done is, in the estimate of the Owner, less than one percent of the adjusted contract price, or (b) the CM substantially completes the work and the Owner takes possession for occupancy, whichever occurs first, the Owner shall pay the CM the entire balance due on the Contract less a retention based on its estimate of the fair value of its claims against the CM and the cost of completing the incomplete and unsatisfactory work."

THE OWNER may make changes in any periodic payment estimate submitted by the CM and the payment due on said periodic payment estimate shall be computed in accordance with the change so made, but such changes or any requirement for a corrected periodic payment estimate shall not affect the due date for the periodic payment or the date for the

commencement of interest charges on the amount of the periodic payment computed in accordance with the changes made, as provided herein; provided, that THE OWNER may, within seven days after receipt, return to the CM for correction, any periodic estimate which is not in the required form or which contains computations not arithmetically correct and, in that event, the date of receipt of such periodic payment estimate shall be the date of receipt of the corrected periodic estimate in proper form and with arithmetically correct computations. The date of receipt of a periodic payment estimate received on a Saturday shall be the first working day thereafter.

All periodic payment estimates shall be submitted to THE OWNER as provided herein, and the date of receipt by THE OWNER or its designee shall be marked on the payment estimate. All periodic estimates shall be based on the Schedule of Values and shall be submitted in form satisfactory to the Designer and the Project Manager.

6. Termination for Failure to Complete Punchlist

Notwithstanding the provisions of this section, at any time after the value of the work remaining to be done is, in the estimation of THE OWNER, less than 1 per cent of the adjusted contract price, or THE OWNER has determined that the CM has substantially completed the work and THE OWNER has taken possession for occupancy, THE OWNER may send to the CM by certified mail, return receipt requested, a complete and final punchlist of all incomplete and unsatisfactory work items, including, for each item on the punchlist, a good faith estimate of the fair and reasonable cost of completing such item. The CM shall then complete all such work items within 30 days of receipt of such list or before the contract completion date, whichever is later. If the CM fails to complete all incomplete and unsatisfactory work items within 45 days after receipt of such items furnished by THE OWNER or before the contract completion date, whichever is later, subsequent to an additional 14 days' written notice to the CM by certified mail, return receipt requested, THE OWNER may terminate the contract and complete the incomplete and unsatisfactory work items and charge the cost of same to the CM and such termination shall be without prejudice to any other rights or remedies THE OWNER may have under the contract. THE OWNER shall note any such termination in the evaluation form to be filed by THE OWNER pursuant to the provisions of section 44D of chapter 149.

7. Payment of Subcontractors (M.G.L. c. 30, s. 39F).

The CM shall make payments to Subcontractors in accordance with M.G.L c.30, s. 39F which is quoted in this section below. For the purposes of this Contract, the word "forthwith" appearing in paragraph (1)(a) of the quoted provision shall be deemed to mean "within five (5) business days."

"1(a) Forthwith after the general contractor receives payment on account of a periodic estimate, the general Contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(b) Not later than the sixty-fifth day after each subcontractor substantially completes his work in accordance with the Plans and Specifications, the entire balance due under the subcontract less amounts retained by THE OWNER as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the Awarding Authority shall pay that amount to the general contractor. The general contractor shall forthwith pay to the subcontractor the full amount received from the Awarding

Authority less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(c) Each payment made by the Awarding Authority to the general contractor pursuant to subparagraphs (a) and (b) of this paragraph for the labor performed and the materials furnished by a subcontractor shall be made to the general contractor for the account of that subcontractor; and the Awarding Authority shall take reasonable steps to compel the general contractor to make each such payment to each such subcontractor. If the Awarding Authority has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the general contractor or which is to be included in a payment to the general contractor for payment to the subcontractor as provided in subparagraphs (1) and (2) the Awarding Authority shall act upon the demand as provided in this section.

(d) If, within seventy days after the subcontractor has substantially completed the subcontract work, the subcontractor has not received from the general contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount retained by the Awarding Authority as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of that balance from the Awarding Authority. The demand shall be by a sworn statement delivered to or sent by certified mail to the Awarding Authority, and a copy shall be delivered to or sent by certified mail to the general contractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed prior to the seventieth day after the subcontractor has substantially completed the subcontract work. Within ten days after the subcontractor has delivered or so mailed the demand to the Awarding Authority and delivered or so mailed a copy to the general contractor, the general contractor may reply to the demand. The reply shall be by a sworn statement to or sent by certified mail to the Awarding Authority and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor and of the amount due for each claim made by the general contractor against the subcontractor.

(e) Within fifteen days after receipt of the demand by the Awarding Authority, but in no event prior to the seventieth day after substantial completion of the subcontract work, the Awarding Authority shall make direct payment to the subcontractor of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount (i) retained by the Awarding Authority as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the general contractor in the sworn reply; provided that the Awarding Authority shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph (d). The Awarding Authority shall make further direct payments to the subcontractor forthwith after the removal of the basis for deduction from direct payments made as provided in parts (i) and (ii) of this subparagraph.

(f) The Awarding Authority shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (5) in an interest-bearing joint account in the names of the general contractor and the subcontractor in a bank in Massachusetts selected by the Awarding Authority or agreed upon by the general contractor and the subcontractor and shall notify the general contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account,

including accrued interest, as provided in an agreement between the general contractor and the subcontractor or as determined by decree of a court of competent jurisdiction.

(g) All direct payments and all deductions from demands for direct payments deposited in an interest bearing account or accounts in a bank pursuant to subparagraph (6) shall be made out of amounts payable to the general contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later become payable to the General contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the Awarding Authority to the general contractor to the extent of such payment.

(h) The Awarding Authority shall deduct from payments to a General contractor amounts which, together with the deposits in interest bearing accounts pursuant to subparagraph (6) are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the general contractor.

(i) If the subcontractor does not receive payment as provided in subparagraph (1) or if the general contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the subcontractor and the subcontractor does not receive payment for same when due less the deductions provided for in subparagraph (1), the subcontractor may demand direct payment by following the procedure in subparagraph (4) and the general contractor may file a sworn reply as provided in that same subparagraph. A demand made after the first day of the month following that for which the subcontractor performed or furnished the labor and materials for which the subcontractor seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the general contractor. Thereafter the Awarding Authority shall proceed as provided in subparagraph (e), (f), (g) and (h)."

(2) Any assignment by a subcontractor of the rights under this section to a surety company furnishing a bond under the provisions of section twenty-nine of chapter one hundred forty-nine shall be invalid. The assignment and subrogation rights of the surety to amounts included in a demand for direct payment which are in the possession of the Awarding Authority or which are on deposit pursuant to subparagraph (6) shall be subordinate to the rights of all subcontractors who are entitled to be paid under this section and who have not been paid in full.

(3) "subcontractor" as used in this section (I) for contracts awarded as provided in sections forty-four A to forty-four L, inclusive, of chapter one hundred forty-nine shall mean a person who files a sub-bid and received a subcontract as a result of that filed sub-bid or who is approved by the Awarding Authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, (ii) for contracts awarded as provided in paragraph (1) of section thirty-nine M of chapter thirty shall mean a person approved by the Awarding Authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, and (iii) for contracts with the commonwealth not awarded as provided in sections forty-four A to forty-four L, inclusive, of chapter one hundred forty-nine shall also mean a person contracting with the general contractor to supply materials used or employed in a public works project for a price in excess of five thousand dollars.

(4) A general contractor or a subcontractor shall enforce a claim to any portion of the amount of a demand for direct payment deposit as provided in subparagraph (6) by a petition in equity in the superior court against the other and the bank shall not be a necessary party. A subcontractor shall enforce a claim for direct payment or a right to require a deposit as provided in subparagraph (6) by a petition in equity in the superior

court against the Awarding Authority and the general contractor shall not be a necessary party. Upon motion of any party the court shall advance for speedy trial any petition filed as provided in this paragraph. Sections fifty-nine and fifty-nine B of chapter two hundred thirty-one shall apply to such petitions. The court shall enter an interlocutory decree upon which execution shall issue for any part of a claim found due pursuant to sections fifty-nine and fifty-nine B and, upon motion of any party, shall advance for speedy trial the petition to collect the remainder of the claim. Any party aggrieved by such interlocutory decree shall have the right to appeal therefrom as from a final decree. The court shall not consolidate for trial the petition of any subcontractor with the petition of one or more subcontractors or the same general Contract unless the court finds that a substantial portion of the evidence of the same events during the course of construction (other than the fact that the claims sought to be consolidated arise under the same general contract) is applicable to the petitions sought to be consolidated and that such consolidation will prevent unnecessary duplication of evidence. A decree in any such proceeding shall not include interest on the disputed amount deposited in excess of the interest earned for the period of any such deposit. No person except a subcontractor filing a demand for direct payment for which no funds due the general contractor are available for direct payment shall have a right to file a petition in court of equity against the Awarding Authority claiming a demand for direct payment is premature and such subcontractor must file the petition before the Awarding Authority has made a direct payment to the subcontractor and has made a deposit of the disputed portion as provided in part (iii) of subparagraph (5) and in subparagraph (6).

(5) In any petition to collect any claim for which a subcontractor has filed a demand for direct payment the court shall, upon motion of the general contractor, reduce by the amount of any deposit of a disputed amount by the Awarding Authority as provided in part (iii) of subparagraph (5) and in subparagraph (6) any amount held under a trustee writ or pursuant to a restraining order or injunction."

8. <u>Final Payment; Release of Claims by CM.</u>
Upon Final Acceptance of the Work the CM shall be entitled to payment of the balance of the Contract Price. Final payment shall be as provided in this Article above and in accordance with any process set forth in the Contract Documents. The CM agrees to execute a Certificate of Final Inspection, Release (with CM's own exceptions listed thereon) and Acceptance as a condition precedent to Final Payment. The acceptance by the CM of the Final Payment made as aforesaid, or the execution of the Certificate of Final Acceptance by the CM, shall constitute a release of the Owner, the Designer, the Project Manager and every member and agent of any of them, from all claims of and liability to the CM for anything done or furnished for or relating to the Work, or for any act or neglect of the Owner, the Designer, the Project Manager, or of any person relating to or affecting the Work, except the claim against the Owner for the remainder, if any there be, of the amounts claimed to be due. Final Acceptance shall not relieve CM of the requirements of any of the provisions of this Contract, to the extent that the same are intended to survive Final Acceptance.

ARTICLE IX. GUARANTEES AND WARRANTIES

1. <u>General Warranty</u>.
If at any time during the period of one (1) year from the date the Owner accepts the Work as Substantially Complete, any part of such Work shall in the reasonable opinion of THE OWNER be defective or require replacing or repairing, or damage to other property of the Owner is caused by any defect in the Work, THE OWNER shall notify the CM in writing to make the required repairs or replacements and repair such damage. If the CM shall neglect to commence such repairs or replacements to the satisfaction ~~to~~ of THE OWNER within ten

(10) days from the date of the giving of such notice, then THE OWNER may employ other persons to make the same. In the case of an emergency, the Owner may direct the CM to perform guaranty work in a shorter period of time and the Owner may undertake any immediate actions and incur reasonable costs to preserve the safety of the building or its occupants. The CM agrees, upon demand, to pay to THE OWNER all amounts which it expends for such repairs, replacements, and/or damages. During this one-year guarantee period any corrective work shall be performed under all the applicable terms of this Contract, and if Change Orders are issued in accordance with the terms of this Contract, the CM shall be entitled to compensation for special insurance, as required. This one-year guarantee shall not limit any express guaranty or warranty provided elsewhere in the Contract.

2. Special Guarantees and Warranties.

A. The CM's obligation to correct Work as set forth in paragraph 1 above is in addition to, and not in substitution of, such guarantees or warranties as may be required in the various sections of the Specifications.

B. Guarantees and warranties required in the various sections of the Specifications must be delivered to the Designer before final payment to the CM may be made, or in the case of guarantees and warranties which originate with a subcontractor's section of the Work, before final payment for the amount of that subtrade or for the phase of Work to which the guarantee or warranty relates.

C. The failure to deliver a required guarantee or warranty shall constitute a failure to fully complete the Work in accordance with the Contract Documents.

D. The warranty period for all equipment will not begin until issuance of "The Certificate of Substantial Completion" by the project Designers regardless of any start-up, commissioning or testing work that may occur prior to that date. If the CM elects to use permanent equipment to power, heat, ventilate the building prior to issuance of the Certificate of Substantial equipment the CM and/or subcontractors will need to: 1) Seek the owners written permission to do so and 2) Assure that all such equipment is properly warranted for period specified form the date of issuance of the Certificate of Substantial Completion. 3) The CM and /or subcontractors will be required to provide all labor and material to assure the equipment is "Like New" including but not limited to cleaning and changing of filters, belts, lubricants and other items that are subject to wear and tear.

ARTICLE X: MISCELLANEOUS LEGAL REQUIREMENTS.

1. CM to be Informed.

The CM shall inform itself of all existing and future Laws in any manner affecting those engaged or employed in the Work, or the materials used or employed in the Work, or in a any way affecting the conduct of the Work, and of all orders and decrees of bodies or tribunals having any applicable jurisdiction or authority over the Work.

2. Compliance with all Laws.

The CM shall cause all persons employed in the performance of the Work to comply with, all existing and future Laws, including but not limited to those set forth below:

A. Corporate Disclosures. The CM, if a foreign corporation, shall comply with M.G.L. c. 181, s.3 and s. 5, and M.G.L. c. 30, s.39L.

B. Veterans Preference. In the employment of mechanics and apprentices, teamsters, chauffeurs, and laborers in the performance of Work in the Commonwealth, preference shall first be given to citizens of the Commonwealth who have been residents of the Commonwealth for at least six months at the commencement of their employment and who are veterans as defined M.G.L. c.4, s.7 (34), and who are qualified to perform the work to which the employment relates;

and secondly, to citizens of the Commonwealth generally who have been residents of the Commonwealth for at least six months at the commencement of their employment, and if they cannot be obtained in sufficient numbers, then to citizens of the United States.

C. Prevailing Wages. The CM shall comply with M.G.L. c. 149, s. 26- 27H. The prevailing wage schedule is found in Exhibit 3 to the Owner-CM Agreement, listing the prevailing minimum wage rates that must be paid to all workers employed in the Work. THE OWNER is not responsible for any errors, omissions, or misprints in the said schedule. Such Schedule shall continue to be the minimum rate wages payable to workers employed in the Work throughout the term of this Contract, subject to the exceptions provided in M.G.L c.149, s. 26-27H. The CM shall not have any claim for extra compensation from the Owner if the actual wages paid to workers employed in the Work exceeds the rates listed on the schedule or as otherwise provided by law. The CM shall cause a copy of said Schedule to be kept in a conspicuous place at the Site during the term of the Contract. If reserve police officers are employed by the CM, they shall be paid the prevailing wage of regular police officers. (See M.G.L c.149, s.34B).

D. Payroll Records and Statement of Compliance. The CM shall comply and shall cause its Subcontractors to comply with Massachusetts General Law c. 149, s. 27B, which requires that a true and accurate record be kept of all persons employed on the a project for which the prevailing wage rates have been provided. The CM and all Subcontractors shall keep these records and preserve them for a period of three years from the date of completion of the Contract. Such records shall be open to inspection by any authorized representative of the Owner at any reasonable time, and as often as may be necessary. The CM shall, and shall cause its Subcontractors to, submit weekly copies of their weekly payroll records to THE OWNER. In addition, the CM and each Subcontractor shall furnish to the Executive Department of Labor within fifteen days after completion of its portion of the Work a signed statement in the form required by THE OWNER.

STATEMENT OF COMPLIANCE

I, _____ (Name of Signatory Party), _____ (Title), do hereby state that I pay or supervise the payment of the persons employed by _____(Contractor or Subcontractor) on the _____ (Building or Project) and that all mechanics and apprentices, teamsters, chauffeurs, and laborers employed on said project have been paid in accordance with wages determined under the provisions of G.L.c. 149, §26 and 27.

Signature: _____

Title: _____

The above mentioned copies of payroll records and statement of compliance shall be available for inspection by any interested party filing a written request to the Contractor for such inspections (G.L.c. 149, §27B).

E. Vehicle operators. If the Director of the Department of Labor and Workforce Development has established a Schedule of wage rates to be paid to the operators of trucks, vehicles or equipment for the Work, the CM shall be obligated to pay such operators at least the minimum wage rate contained on such Schedule. (See M.G.L. c.149, s.26-27H).

F. Eight Hour Day. The CM shall comply with M.G.L. c. 149, s. 30, 34 and 34A which provide that no laborer, workman, mechanic, foreman or inspector working within the Commonwealth in the employ of the CM, subcontractor or other person doing or contracting to do the whole or part of the Work shall be required or permitted to work more than eight

hours in any one day or more than forty-eight hours in any one week, or more than six days in any one week, except in cases of extraordinary emergency.

G. Timely Payment of Wages. The CM shall comply with, and shall cause its Subcontractors to comply with M.G.L. c. 149, s. 148 which requires the weekly or biweekly payment of employees within six days of the end of the pay period during which wages were earned if employed for five or six days of a calendar week, and within other periods of time under certain circumstances as set forth therein.

H. Lodging, etc. The CM shall comply with, and shall cause its Subcontractors to comply with, M.G.L. c. 149, s. 25 which provides that every employee under this Contract shall lodge, board and trade where and with whom he elects, and neither the CM nor his agents or employees shall, either directly or indirectly, require as a condition of the employment of any person that the employee shall lodge, board or trade at a particular place or with a particular person.

I. Truck Rates. The use by the CM of trucks or other motor vehicles hired from either common or contract motor carriers in the course of performance of this Contract is subject to such minimum rates and charges, and rules and regulations as may from time to time be promulgated by the Department of Public Utilities of the Commonwealth of Massachusetts or other agency of the State of Federal government which may be authorized by law to set rates or otherwise regulate the use of such vehicles. The CM expressly assumes the risk of any additional expense that may arise by reason of any change in such minimum rates and charges, and rules and regulations, and shall be entitled to no additional compensation or reimbursement by reason thereof.

ARTICLE XI: CM'S ACCOUNTING METHOD REQUIREMENTS (M.G.L. c. 30, s. 39R)

1. Definitions.

The words defined herein shall have the meaning stated below whenever they appear in this Article XI:

--"Contractor" means the CM.

--"Contract" means any Contract awarded, which is for an amount or estimated amount greater than one hundred thousand dollars.

--"Independent Certified Public Account" means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his/her residence or principal office and who is in fact independent. In determining whether an accountant is independent with aspect to a particular person, appropriate consideration should be given to all relationships between the accountant and that person or any affiliate thereof. Determination of an accountant's independence shall not be confined to the relationships existing in connection with the filing of reports with THE OWNER.

--"Records" means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

--"Audit", when used in regard to financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons, or other person or persons primarily responsible for the financial and operational policies and practices of the Contractor.

Accounting terms, unless otherwise defined herein, shall have a meaning in accordance with generally accepted accounting principles and auditing standards.

2. Record Keeping.

A. The Contractor shall make, and keep for at least six years after final payment, books, records, and accounts that in reasonable detail accurately and fairly reflect the transactions and dispositions of the Contractor.

B. Until the expiration of six years after final payment, the Inspector General, THE OWNER, and THE OWNER shall have the right to examine any books, documents, papers or records of the Contractor and Subcontractors that directly pertain to, and involve transactions relating to the Contractor and Subcontractors. Any request for a change in the provisions of this Contract submitted by the CM must be made in writing and in accordance with the provisions of this Contract.

C. The Contractor shall describe any change in the method of maintaining records or recording transactions which materially affects any statements filed with THE OWNER including the date of the change and reasons therefor, and shall accompany said description with a letter from the Contractor's independent certified public accountant approving or otherwise commenting on the changes.

D. The Contractor represents that it has, prior to the execution of the Contract, filed a statement of management on internal accounting controls as set forth in Section 3 below.

E. The Contractor represents that it has, prior to the execution of the Contract, filed an audited financial statement for the most recent completed fiscal year as set forth in section 4 below and will continue to file such statement annually during the term of the Contract.

3. Statement of Management Controls.

A. The Contractor shall file with THE OWNER a statement of management as to whether the system of internal accounting controls of the Contractor and its subsidiaries reasonably assures that:

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

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

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

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

B. The Contractor shall file with THE OWNER a statement prepared and signed by an independent certified public accountant, stating that the accountant has examined the statement of management on internal accounting controls, and expressing an opinion as to:

(1) whether the representations of management in response to subparagraph 3 above are consistent with the results of management's evaluation of the system of internal accounting controls; and

(2) whether such representations of management are reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statement.

4. Annual Financial Statement.

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

B. The office of Inspector General and THE OWNER shall have the right to enforce the provisions of this Article. A Contractor's failure to satisfy any of the requirements of this section may be grounds for debarment pursuant to M.G.L. c. 149, s. 44C.

5. Bid Pricing Materials.

The Contractor shall save the written calculations, pricing information, and other data that the Contractor used to calculate the bid or other cost quotations that are presented by the induced THE OWNER to enter into this Contract (the "Bid Pricing Materials") and to establish the Guaranteed Maximum Price for the Project.

ARTICLE XII: EQUAL EMPLOYMENT OPPORTUNITY, NON-DISCRIMINATION AND AFFIRMATIVE ACTION PROGRAM.

This Contract includes all provisions of the "Equal Employment Opportunity, Non-Discrimination, and Affirmative Action Program" appearing in Appendix A to these General Conditions of the Contract attached hereto and incorporated herein by reference.

ARTICLE XIII: GOALS FOR PARTICIPATION BY MINORITY BUSINESS ENTERPRISES AND WOMEN BUSINESS ENTERPRISES

This Contract includes all provisions of THE OWNER's program relating to Goals for Participation by Minority Business Enterprises and Women Business Enterprises attached appearing in Appendix B to these General Conditions of the Contract attached hereto and incorporated herein by reference.

ARTICLE XIV: INSURANCE REQUIREMENTS

1. Insurance Generally.

A. The CM shall take out and maintain the insurance coverages listed in this Article with respect to the operations as well as the completed operations of this Contract. This insurance shall be provided at the CM's expense and shall be in full force and effect for the full term of the Contract or for such longer period as this Article requires.

B. All policies shall be written on an occurrence basis and be issued by companies authorized to write that type of insurance under the laws of the Commonwealth and rated in Best's Insurance Guide (or any successor thereto or replacement thereof) as having a general policy holder rating of "A-" or better and a financial rating of at least "9" or otherwise acceptable to THE OWNER.

C. CM shall submit three originals of each certificate of insurance, acceptable to THE OWNER, simultaneously with the execution of this Contract. Certificates shall show THE OWNER, the Designer and the Project Manager, and the Massachusetts School Building Authority as additional insureds as to all policies issued hereunder, except for Workmen's Compensation Insurance. The Massachusetts School Building Authority shall be first payable in the event of a loss under the insurance policies maintained by the CM under this Article XIV. The CM shall state that CM has paid all premiums and that none of the coverages shall

be cancelled, terminated, or materially modified unless and until 30 days prior notice is given in writing to THE OWNER. Contractor shall submit updated certificates prior to the expiration of any of the policies referenced in the certificates so that THE OWNER shall at all times possess certificates indicating current coverage. Certificates shall indicate that the contractual liability coverage, and Contractor's Protective Liability coverage is in force. Certificates shall include specific acknowledgment that the following coverages are included in the policies:
-Contractual liability
-Contractor's protective
-Additional insured by form CG2010 (11/85 ed.) or equivalent, to the general liability
-Additional insured to automobile liability, umbrella liability, and pollution liability
-General Liability is endorsed with CG2404, Waiver of Subrogation, in favor of the Owner

D. The CM shall file one certified copy of all policies with THE OWNER within sixty days after Contract award. If THE OWNER or the Owner is damaged by the CM's failure to maintain such insurance and to comply with the terms of this Article, then the CM shall be responsible for all costs and damages to the Owner attributable thereto.

E. Termination, cancellation, or material modification of any insurance required by this Contract, whether by the insurer or the insured, shall not be valid unless written notice thereof is given to THE OWNER at least thirty days prior to the effective date thereof, which shall be expressed in said notice

2. CM's Commercial General Liability.

A. The CM shall provide the following minimum general liability coverage with respect to the operations performed by CM and any employee, subcontractor, or supplier, unless a higher coverage is specified in Exhibit A to the Owner-CM Agreement, in which case the CM shall provide the additional coverage:

Bodily Injury &	$1,000,000	each occurrence
Property Damage	$2,000,000	general aggregate-
Products & Completed Operations	$1,000,000	annual aggregate
Medical Expenses	$10,000	

B. This policy shall include coverage relating to explosion, collapse, and underground property damage.

C. This policy shall include contractual liability coverage.

D. The completed operations coverage shall be maintained for a period of three (3) years after Substantial Completion.

E. This policy shall include endorsement CG2010 (10/85 edition), *Owner as Additional Insured* and CG2404 (11/85 edition) *Waiver of Subrogation in Favor of Owner.*

3. Vehicle Liability.

A. The CM shall provide the following minimum coverage with respect to the operations of any employee, including coverage for owned, non-owned, and hired vehicles, unless a higher coverage is specified in Exhibit A to the Owner-CM Agreement, in which case the CM shall provide the additional coverage:

Combined Single Limit $1,000,000

B. The policy shall include a CA9948 Pollution Endorsement and shall name the Owner as an Additional Insured.

4. Pollution Liability.

The CM shall provide coverage for bodily injury and property damage resulting from liability arising out of pollution related exposures such as asbestos abatement, lead paint abatement,

tank removal, removal of contaminated soil, etc. The Owner shall be named as an additional insured and coverage must be on an occurrence basis. The amount of coverage for injuries to persons shall be $1,000,000 per occurrence and $~~3~~2,000,000 in the aggregate and damage to property shall be $2,000,000**.**

5. Worker's Compensation.

A. The CM shall provide the following coverage in accordance with M.G.L. c.149 §34A and c.152 as amended, unless a higher coverage is specified in Exhibit B to the Owner-CM Agreement, in which case the CM shall provide the higher coverage:

Worker's Compensation
Part One Provide Statutory Minimum
Employer's Liability $1,000,000 each accident
Part Two $ 500,000 disease per employee
$ 500,000 disease policy aggregate

6. Builders Risk Property Coverage:

The Owner shall maintain Builders Risk Property Insurance for the full insurable value (completed value) of the Project, until such time as the Owner assumes full use and occupancy of the Project. Said coverage shall include "all risks" coverage, including theft, flood and earthquake. Any exclusions or limitations must be enumerated and are subject to acceptant or rejection by the Owner.

7. Boiler and Machinery Insurance:

The CM shall purchase and maintain boiler and machinery insurance which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, CM, Subcontractors and Sub-subcontractors in the Work, and the Owner and the CM shall be named insureds.

8. Umbrella or Excess Liability Coverage.

The CM shall provide Umbrella Coverage in form at least as broad as primary coverages required by Sections 2, 3 and ~~5~~ 6 of this Article in the following amount:

Umbrella Coverage: $20,000,000

9. Additional types of Insurance and Deductibles.

The CM shall provide such other types of insurance as may be required by the Owner-CM Agreement. If the policies required herein contain deductible amounts, the CM shall be responsible for such deductible amounts, unless THE OWNER specifically provides a written waiver to the CM.

10. **Waivers of Subrogation.**

The Owner and CM waive all rights against (1) each other and any of their subcontractors, agents and employees, each of the other, and (2) the Designer, Designer's consultants, the Owner's Project Manager, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other perils to the extent covered by Builders Risk Property insurance obtained pursuant to this Article, or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the CM or the Owner as fiduciary.

ARTICLE XV: INDEMNIFICATION

1. Generally.

Indemnification. To the fullest extent permitted by law, the CM shall indemnify, defend (with counsel subject to the supervision of the Town) and hold harmless the Owner, Designer, the Project Manager and their officers, agents, divisions, agencies, employees, representatives, successors and assigns from and against all claims, damages, losses and expenses, including but not limited to court costs and attorneys' fees, rising out of or resulting from the performance of the Work, including but not limited to those arising or resulting from:

- labor performed or furnished and/or materials used or employed in the performance of the Work;
- violations by CM, any Subcontractor, or by any person directly or indirectly employed or used by any of them in the performance of the Work or any one for whose acts any of them may be liable (CM, subcontractor and all such persons herein collectively called 'CM:~ Personnel") of any Laws;
- violations of any provision of this Contract by any of CM's Personnel;
- injuries to any persons or damage to any property in connection with the Work;
- any act, omission, or neglect of CM's Personnel.

The CM shall be obligated as provided above, regardless of whether or not such claims, damages, losses and/or expenses, are caused in whole or in part by the actions or inactions of a party indemnified hereunder. In any and all claims by CM's Personnel against parties indemnified hereunder, the CM's indemnification obligation set forth above shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the CM or any subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this Article XV.

2. CM's Indemnification of MASS WORKS

To the fullest extent permitted by law, the CM and its contractors and subcontractors hereby agree to indemnify, defend and hold harmless, the Mass Works and its officers and employees from and against all claims, damages, liabilities, injuries, costs, fees, expenses, or losses, including, without limitation, reasonable attorney's fees and costs of investigation and litigation, whatsoever which may be incurred by the Authority arising out of or resulting from the performance or nonperformance of the work performed by the CM, or its contractors and subcontractors, provided that such claims, damages, liabilities, injuries, costs, fees, expenses, or losses are alleged to be caused in whole, or in part, by an act or omission of any of the CM, contractors, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

3. Asbestos Abatement Subcontractor Indemnification

The CM shall obtain an indemnification agreement from the Asbestos Abatement Subcontractor that provides as follows: The Asbestos Abatement subcontractor shall assume full responsibility and liability for the compliance with all applicable Federal, State and local regulations pertaining to work practices, hauling and disposal of asbestos-containing material and protection of workers and visitors to the site, and persons occupying areas adjacent to the site. The CM shall hold the Owner and the Architect harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulation on the part of himself, his employees or his subcontractors.

4. Designer's Actions.
The obligations of the CM under Section 1 above shall not extend to the liability of the Designer, its agents or employees, arising out of (i) the preparation or approval of maps, Drawings, opinions, reports, surveys Change Orders, designs or Specifications, or (ii) the giving of or the failure to give directions or instructions by the Designer, its agents to employees provided such giving or failure to give is the primary cause of the injury or damage.

5. Survival.
The provisions of this Article XV are intended to survive Final Acceptance and/or any termination of this Contract.

ARTICLE XVI: PERFORMANCE AND PAYMENT BONDS

1. CM Bonds.
A. The CM shall provide performance and payment (labor and materials) bonds in the form attached , executed by a surety licensed by the Commonwealth of Massachusetts Division of Insurance. Each such bond shall be in the amount of the GMP.
B. If at any time prior to final payment to the CM, the Surety:
-is adjudged bankrupt or has made a general assignment for the benefit of its creditors;
-has liquidated all assets and/or has made a general assignment for the benefit of its creditors;
-is placed in receivership;
-otherwise petitions a state or federal court for protection from its creditors; or
-allows its license to do business in Massachusetts to lapse or be revoked;
then the CM shall, within 21 days of any such action listed above, provide THE OWNER with new performance and payment bonds as described in Paragraph A above. Such bonds shall be provided solely at the CM's expense.

2. Subcontractor Bonds.

A. Trade Contractors shall provide payment and performance bonds to the CM and the Subcontractors shall include the premiums for those bonds in their Sub-Trade Bids.
B. If the CM requires subcontractors other than Trade Contractors to provide the CM with payment and performance bonds for the full amount of their respective Subcontracts, then the costs for said bonds shall be the responsibility of the CM.

C. Irrespective of whether the CM requests payment and performance bonds from their respective Subcontractors, the CM understands that if the Subcontractor defaults or is terminated, the CM shall have full responsibility for all costs and expenses related to said default or termination.\

3. Cost of Bond Premiums.

The costs of bond premiums for bonds provided by the CM, Trade Contractors and subcontractors shall be considered Costs of the Work.

ARTICLE XVII: TERMINATION OF CONTRACT

1. Termination for Cause.

A. THE OWNER may without prejudice to any other right or remedy terminate this Contract for cause if any of the following defaults shall occur and not be cured within seven (7) days after the giving of written notice thereof by the Owner to the CM:

(1) The CM has filed a petition, or a petition has been filed against the CM with its consent, under any federal or state law concerning bankruptcy, reorganization, insolvency or relief from creditors, or if such a petition is filed against the CM without its consent and is not dismissed within sixty (60) days; or if the CM is generally not paying its debts as they become due; or if the CM becomes insolvent; or if the CM consents to the appointment of a receiver, trustee, liquidate, custodian or the like of the CM or of all or any substantial portion of its assets and such appointment or possession is not terminated within sixty (60) days; or if the CM makes an assignment for the benefit of creditors;

(2) The CM refuses or fails, except in cases for which extension of time is provided under this Contract, to supply enough properly skilled workers or proper materials to perform its obligations under this Contract, or the Owner has determined that the rate of progress required for the timely completion of the Work is not being met;

(3) The CM fails to make prompt payment to Subcontractors or for materials, equipment, or labor;

(4) All or a part of the Work has been abandoned;

(5) The CM has sublet or assigned all or any portion of the Work, the Contract, or claims thereunder, without the prior written consent of the Owner, except as expressly permitted in this Contract;

(6) The CM has failed to comply with Laws;

(7) The CM fails to maintain, or provide to Office evidence of the insurance or bonds required by this Contract, or

(8) The CM has failed to perform the Work or any portion thereof as required by this Contract or has otherwise breached any material provision of this Contract.

B. THE OWNER shall give the CM written notice of such termination for cause, but the giving of notice of such termination shall not be a condition precedent or subsequent to the termination's effectiveness. In the event of such termination, and without limiting any other available remedies, THE OWNER may, at its option:

(1) hold the CM and its sureties liable in damages for a breach of Contract;

(2) notify the CM to discontinue all work, or any part thereof, and the CM shall discontinue all work, or any part thereof, as the Owner may designate;

(3) complete the Work, or any part thereof, and charge the expense of completing the Work or part thereof, to the CM;

(4) require the surety or sureties to complete the Work and perform all of the CM's obligations under this Contract.

(5) take such other lawful action as is deemed by THE OWNER to be in its best interest.

If THE OWNER elects to complete all or any portion of the Work as specified in (3) above, it may take possession of all materials, equipment, tools, machinery, implements at or near the Site owned by the CM and finish the Work at the CM's expense by whatever means THE OWNER may deem expedient; and the CM shall cooperate at its expense in the orderly transfer of the same to a new contractor or to THE OWNER as directed by THE OWNER. In such case THE OWNER shall not make any further payments to the CM until the Work is completely finished. The Owner shall not be liable for any depreciation, loss or damage to said materials, machinery, implements or tools during said use and the CM shall be solely responsible for their removal from the Site after the Owner has no further use for them. Unless so removed within fifteen days after notice to the CM to do so, they may be sold at public auction, after publication of notice thereof at least twice in any newspaper published in the county where the Work is being performed, and the proceeds credited to the CM's account; or they may, at the option of THE OWNER, be stored at the CM's expense subject to a lien for the storage charges.

C. Damages and expenses incurred under paragraph B above shall include, but not be limited to, costs for the Designer's and Project Manager's extra services required, as reasonably determined by THE OWNER, to successfully inspect and administer the construction through final completion of the Work.

D. Expenses charged under paragraph B above may be deducted and paid by THE OWNER out of any moneys then due or to become due the CM under this Contract.

E. All sums, damages, and expenses incurred by the Owner to complete the Work shall be charged to the CM. In case the damages and expenses charged are less than the sum that would have been payable under this Contract if the same had been completed by the CM, the CM shall be entitled to receive the difference. In case such expenses shall exceed the said sum, the CM shall pay the amount of the excess to the Owner.

2. Termination For Convenience.

A. THE OWNER may terminate this Contract for convenience even though the CM is not in default by giving notice to the CM specifying in said notice the date of termination.

B. In case of such termination without cause, the CM shall be paid:
(1) all sums due and owing under this Contract through the date of termination, including any retainage withheld to the date of termination, less any amount which THE OWNER determines is necessary to correct or complete the Work performed to the date of termination; plus (2) a reasonable sum to cover the expenses which CM would not have incurred but for the early termination of the Contract, such as demobilization of the work force, restocking charges, and termination fees payable to Subcontractors.

C. Lost profits shall not be payable. The payment provided in paragraph B above shall be considered to fully compensate the CM for all claims and expenses and those of any consultants, Subcontractors, and suppliers, directly or indirectly attributable to the termination.

3. CM's Duties Upon Termination For Convenience.

Upon termination of this Contract for convenience as provided in Section 2 of this Article, the CM shall: (1) stop the Work; (2) stop placing orders and Subcontracts in connection with this Contract; (3) cancel all existing orders and Subcontracts; (4) surrender the Site to THE OWNER in a safe condition; (5) transfer to THE OWNER all materials, supplies, work in process, appliances, facilities, equipment and machinery of this Contract, and all plans, Drawings, Specifications and other information and documents used in connection with this Contract.

ARTICLE XVIII: MISCELLANEOUS PROVISIONS

1. Written Approval of Assignment by CM.
The CM shall not assign by power of attorney or otherwise, or sublet or subcontract, the Work or any part thereof, without the previous written consent of THE OWNER and shall not, either legally or equitably, assign any of the moneys payable under this Contract, or CM's claims hereunder, except with the written consent of THE OWNER, whether said assignment is made before, at the time of, or after the execution of the Contract. The CM shall remain responsible for satisfactory performance of all Work sublet or assigned complying with all applicable requirements of the Contract.

2. Certificate of Appropriation.
This paragraph applies to contracts for construction, reconstruction, alteration, remodeling, repair or demolition of any public building or public work by any city or town costing more than the amoutn set forth in M.G.L. c.44, § 31C.

This Contract shall not be deemed to have been made until the Town accountant or other officer of the city or town having similar duties has certified thereon that an appropriation in the amount of this Contract is available therefor and than an officer or agent of the city, town, or awarding authority has been authorized to execute said Contract and approve all requisitions and change orders. No order to the Contractor for a change in or addition to the work, whether in the form of a drawing, plan, detail, or any other written instruction, unless it is an order which the Contractor is willing to perform without any increase in the Contract price, shall be deemed to be given until the Town accountant, or other officer of the awarding authority having similar duties, has certified thereon that an appropriation in the amount of such order is available therefore; but such certificate shall not be construed as an admission by the awarding authority of its liability to pay for such work. The certificate of the Town accountant or other officer of the awarding authority having similar duties, that an appropriation in the amount of this Contract, or in the amount of such order, is available shall bar any defense by the awarding authoirty on the grounds of insufficient appropriation.

3. Claims by Others Not Valid.
No person other than the CM and the surety on any bond given pursuant to the terms of this Contract shall acquire any interest in this Contract or any claim against THE OWNER hereunder, and no claim by any other person against Owner shall be valid except as provided in M.G.L. c. 30, s. 39F of the General Laws.

4. No Personal Liability of Public Officials.
No public official, employee, or agent of THE OWNER shall have any personal liability for the obligations of THE OWNER set forth in this Contract.

5. Severability.
The provisions of this Contract are severable, and if any of these provisions shall be held unconstitutional or unenforceable by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the other provisions of this Contract.

6. Choice of Laws.
This Contract shall be governed by the laws of the Commonwealth of Massachusetts for all purposes. All proceedings under this Contract or related to the Project shall be brought in the courts of the Commonwealth of Massachusetts.

7. No Waiver of Subsequent Breach.

No waiver of any breach or obligation of this Contract shall constitute a waiver of any other or subsequent breach or obligation.

8. Remedies Cumulative.
All remedies of THE OWNER provided in this Contract shall be construed as cumulative and may be exercised simultaneously or in any order as determined by THE OWNER in its sole discretion. THE OWNER shall also be entitled as of right to specific performance and equitable relief including the right to an injunction against any breach of any of the provisions of this Contract

9. Notices.
Notices to the CM shall be deemed given when hand delivered or faxed to the CM's temporary field office at or near the Site, or when deposited in the U.S. mail addressed to the CM at the CM's address specified in the Owner-CM Agreement, or when delivered by courier to either location. Unless otherwise specified in writing by THE OWNER, notices and deliveries to THE OWNER shall be effective only when delivered to THE OWNER at the address specified in the Owner-CM Agreement and date-stamped at the reception desk or for which a receipt has been signed by the agent or employee designated by THE OWNER to receive official notices.

10. Interpretation of Contract – Cost of Work.
(A) Wherever these General Conditions or the Agreement for Construction Manager at Risk Services uses words to the effect that the CM shall be responsible for incurring costs on the Project, it is understood that, except where the language used otherwise indicates, such costs shall be considered a Cost of Work under Paragraph 7.1 of the Agreement for Construction Manager at Risk Services, unless they fall within Non-Compensable Costs described in Paragraph 7.3 of said Agreement.
(B) Likewise, wherever the General Conditions or the Agreement for Construction Manager at Risk Services uses words to the effect that the Owner may assess costs against the CM, it is understood that such assessment shall ordinarily take the form of a credit change order that reduces the GMP, except where the language used otherwise indicates.

APPENDIX A to the General Conditions of the Contract

The following provisions are included in the General Conditions of the Contract between THE OWNER and the Construction Manager.

EQUAL EMPLOYMENT OPPORTUNITY, NON-DISCRIMINATION AND AFFIRMATIVE ACTION PROGRAM

1. Compliance Generally

For purpose of this Article, "minority" refers to Asians, Blacks, Western Hemisphere Hispanics, Native Americans, and Cape Verdeans; "Commission" refers to the Massachusetts Commission Against Discrimination. During the performance of this Contract, the Construction Manager and all of its Subcontractors (hereinafter collectively referred to as the Contractor) shall comply with all applicable equal employment opportunity, non-discrimination and affirmative action requirements, including but not limited to the following:

2. Non-Discrimination and Affirmative Action

A. The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religious creed, national origin, age, handicap, sexual orientation, or sex. The aforesaid provision shall include, but not be limited to, the following: employment upgrading, demotion or transfer; recruitment advertising; recruitment layoff; termination; rates of pay or other forms of compensation; conditions or privileges of employment; and selection for apprenticeship. The Contractor shall comply with the provisions of M.G.L. c. 151B and all other applicable anti-discrimination and equal opportunity laws.

B. The Contractor shall comply with the provisions of Executive Order No. 246 entitled Revoking and Superseding Executive Orders Numbers 143 and 150, with respect to affirmative action programs for handicapped individuals, which is herein incorporated by reference and made a part of this Contract.

C. In connection with the performance of the Work, the Contractor shall undertake in good faith affirmative action measures designed to eliminate any discriminatory barriers in the terms and conditions of employment on the grounds of race, color, religious creed, national origin, age, sexual orientation, or sex, and to eliminate and remedy any effects of such discrimination in the past. Such affirmative action shall entail positive and aggressive measures to ensure equal opportunity in the areas of hiring, upgrading, demotion or transfer, recruitment, layoff or termination, rate of compensation, and in-service or apprenticeship training programs. This affirmative action shall include all action required to guarantee equal employment opportunity for all persons, regardless of race, color, religious creed, national origin, age, sexual orientation, or sex. A purpose of this provision is to ensure to the fullest extent possible an adequate supply of skilled tradesmen for future public construction projects.

D. If the Contractor shall use any subcontractor on any work performed under this Contract, the Contractor shall take affirmative steps to negotiate with qualified minority and women subcontractors. These affirmative steps shall cover both pre-bid and post-bid periods. It shall include notification to the State Office of Minority and Women Business Assistance or its designee, while bids are in preparation, of all products, work or services for which the Contractor intends to negotiate bids. In all solicitations either by competitive bidding or negotiation made by the Contractor either for work to be performed under a subcontract or for the procurement of materials or equipment, each potential subcontractor or supplier shall be notified in writing by the Contractor of the Contractor's obligations under this Contract relative to non-discrimination and affirmative action.

E. As part of its obligation of remedial action under this Article, the Contractor shall maintain on this project not less than the percent ratio set forth in the Owner – Construction Manager Agreement of minority employee worker hours to total worker hours in each job category including but not limited to bricklayers, carpenters, cement masons, electricians, ironworkers, operating engineers, and those "classes of work" enumerated in M.G. L. c. 149, s. 44F.

F. In the hiring of minority journeypersons, apprentices, trainees and advanced trainees, the Contractor shall rely on referrals from a multi-employer affirmative action program approved by the Commission, traditional referral methods utilized by the construction industry, and referrals from agencies, not more than three in number at any one time, designated by the Liaison Committee or THE OWNER.

3. Liaison Committee, Reports and Records

A. At the option of THE OWNER there may be established for the term of this Contract a body to be known as the Liaison Committee. The Liaison Committee shall be composed of one representative each from the Awarding Authority, the Commission and such other representatives as may be designated by the Commission in conjunction with the Awarding Authority. The Contractor (or his agent, if any, designated by him as the on-Site equal employment opportunity officer) shall recognize the Liaison Committee as an affirmative action body, and shall establish a continuing working relationship with the Liaison Committee, consulting with the Liaison Committee on all matters related to minority recruitment, referral, employment and training.

B. The Contractor shall prepare projected staffing tables on a quarterly basis. These shall be broken down into projections, by week, of workers required in each trade. Copies shall be furnished one week in advance of the commencement of the period covered, and also when updated, to the Awarding Authority and Liaison Committee. The Contractor shall prepare weekly reports in a form approved by the Awarding Authority of hours worked in each trade by each employee, identified as minority or non-minority. Copies of these shall be provided at the end of each such week to the Awarding Authority and to the Liaison Committee.

C. Records of employment referral orders, prepared by the Contractor, shall be made available to the Awarding Authority and to the Liaison Committee on request.

D. A designee of the Awarding Authority and a designee of the Liaison Committee shall each have right to access to the Site.

E. The Contractor shall comply with the provisions of M.G.L. c. 151B as amended, of the Massachusetts General Laws, both of which are herein incorporated by reference and made a part of this Contract.

F. The Contractor shall provide all information and reports required by the Awarding Authority or the Commission on forms and in accordance with instructions issued by either of them and will permit access to its facilities and any books, records, accounts and other sources of information which may be determined by the Awarding Authority or the Commission to affect the employment of personnel. This provision shall apply only to information pertinent to the Owner's supplementary affirmative action Contract requirements. Where information required is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to the Awarding Authority or the Commission as appropriate and shall set forth what efforts he has made to obtain the information.

4. Sanctions

A. Whenever the Awarding Authority, the Commission, or the Liaison Committee believes the Contractor or any Subcontractor may not be operating in compliance with the terms of this Article, the Commission shall directly, or through its designated agent, conduct an

appropriate investigation, and may confer with the parties, to determine if such Contractor is operating in compliance with the terms of this Article. If the Commission or its agent finds the Contractor or any Subcontractor not in compliance, it may make a preliminary report on non-compliance, and notify such Contractor in writing of such steps as will in the judgment of the Commission or its agent bring such Contractor into compliance. In the event that such Contractor fails or refuses to fully perform such steps, the Commission may make a final report of non-compliance, and recommend to the Awarding Authority the imposition of one or more of the sanctions listed below. If, however, the Commission believes the Contractor or any Subcontractor has taken or is taking every possible measure to achieve compliance, it shall not make a final report of non-compliance. Within fourteen days of the receipt of the recommendations of the Commission, the Awarding Authority shall move to impose one or more of the following sanctions, as it may deem appropriate to attain full and effective enforcement:

(1) The recovery by the Awarding Authority from the Contractor of 1/100 of 1% of the Contract award price or $1,000 whichever sum is greater, in the nature of liquidated damages or, if a Subcontractor is in non-compliance, the recovery by the Awarding Authority from the Contractor, to be assessed by the Contractor as a back charge against the subcontractor, of 1/10 of 1% of the sub-Contract Price, or $400 whichever sum is greater, in the nature of liquidated damages, for each week that such party fails or refuses to comply;

(2) The suspension of any payment or part thereof due under the Contract until such time as the Contractor or any subcontractor is able to demonstrate his compliance with the terms of the Contract;

(3) The termination, or cancellation, of the Contract, in whole or in part, unless the Contractor or any Subcontractor is able to demonstrate within a specified time his compliance with the terms of the contract;

(4) The denial to the Contractor or any subcontractor of the right to participate in any future contracts awarded by the Awarding Authority for a period of up to three years.

B. If at any time after the imposition of one or more of the above sanctions a Contractor is able to demonstrate that it is in compliance with this Article, the Contractor may request the Awarding Authority, in consultation with the Commission, to suspend the sanctions conditionally, pending a final determination by the Commission as to whether the Contractor is in compliance. Upon final determination of the Commission, the Awarding Authority, based on the recommendation of the Commission, shall either lift the sanctions or reimpose them.

C. Sanctions recommended by the Commission and enumerated under Section A above shall not be imposed by the Awarding Authority except after an adjudicatory proceeding, as that term is used in M.G.L. c. 30A, has been conducted. No investigation by the Commission or its agent shall be initiated without prior notice to the Contractor.

D. Notwithstanding the provisions of 4A-4C above, if the Awarding Authority determines after investigation that the Contractor or any Subcontractor is not in compliance with the terms of this Article, it may suspend any payment or portion thereof due under the Contract until the contractor demonstrates to the satisfaction of the Awarding Authority compliance with the terms of this Article. This temporary suspension of payments by the Awarding Authority is separate from the sanctions set forth in Section 4A-4C of this Article above, which are determined by MCAD and recommend to the Awarding Authority. Payment may be suspended only after the Contractor and any other interested party shall have been given the opportunity to present evidence in support of its position at an informal hearing held by the Awarding Authority, and the Awarding Authority has concluded upon review of all the evidence that such penalty is justified. Payment shall not be suspended if the Awarding Authority finds that the Contractor made its best efforts to comply with this

Article, or that some other justifiable reason exists for waiving the provisions of this Article in whole or in part.

CM Initials Owner Initials

APPENDIX B to the General Conditions of the Contract

The following provisions are included in the General Conditions of the Contract between THE OWNER and the Construction Manager.

GOALS FOR PARTICIPATION BY MINORITY BUSINESS ENTERPRISES AND WOMEN BUSINESS ENTERPRISES M.G.L. c. 7, s. 40N

1. MBE and WBE Program

A. The MBE and WBE participation goals for this Contract are as set forth in the Request for Proposals for Construction Management Services and in the Owner-Construction Manager Agreement.
The Minority Business Enterprise participation goal is 7.4 % of the GMP
The Women Business Enterprise participation goal is 4.0% of the GMP
MASS WORKS combined goal of 10.4%
By submitting a proposal the Offeror agrees that if selected as the Construction Manager it will meet or exceed these participation goals. All Offerors are advised that by submitting a proposal they certify that their proposal and services provided under the proposal will fully comply with all requirements of the RFP, including the MBE/WBE requirements.

B. The Construction Manager, all subcontractors, sub-subcontractors, and materials suppliers shall comply with all of the terms and conditions of this Article, which include the provisions pertaining to MBE/WBE participation set forth in the Owner – Construction Manager Agreement in order to meet the MBE/WBE participation goals established for this Contract.

C. A minority owned business shall be considered an MBE only if it has been certified as a minority business enterprise by the State Office of Minority and Women Business Assistance ("SOMWBA").

D. A woman owned business shall be considered a WBE only if it has been certified as a woman business enterprise by SOMWBA.

E. Certification as a disadvantaged business enterprise ("DBE"), certification as an MBE/WBE by any agency other than SOMWBA, or submission of an application to SOMWBA for certification as an MBE/WBE shall not confer MBE/WBE status on a firm for the purposes of this Contract.

2. Waiver Prior to RFP Submission

A. THE OWNER reserves the right to reduce or waive the MBE or WBE participation goals established for this Contract upon written request made by an Offeror submitting a proposal to provide Construction Management Services within the time frame set forth in Section 2.B. below. Such written request must demonstrate to the satisfaction of THE OWNER that it is not feasible for a non-MBE or non-WBE Offeror to meet the goals established for this Contract based upon any or all of the following: (i) actual MBE/WBE availability, (ii) the geographic location of the project to the extent related to MBE/WBE availability, (iii) the scope of the work, (iv) the percentage of work available for subcontracting to MBE/WBEs and/or (v) other relevant factors, including a documented inability by the Offeror to identify MBE/WBE subcontractors sufficient to meet the MBE/WBE goals after having made a diligent, good faith effort to do so. All of the foregoing documentation shall accompany the Proposer's request for a reduction or waiver of the MBE/WBE participation goals.

B. Requests to waive the MBE/WBE participation goals for this Contract must be addressed to THE OWNER and be received no later than fourteen (14) calendar days before the date set for the receipt of proposals.
. Any reduction or waiver of the MBE/WBE participation goals for this Contract will be made by written addendum mailed to all firms pre-qualified to submit proposals for the Project.

3. Trade Contractor Bids

Trade Contractors in the 18 categories of work as set forth in the Procedures for Award of Subcontracts are not required to submit a Schedule of MBE/WBE Participation with their bids. A Trade Contractor may, at its option, submit a Letter of Intent with its bid if it is a SOMWBA certified MBE/WBE. If a Trade Contractor intends to sub-subcontract work to a SOMWBA certified MBE/WBE, and the Trade Contractor wishes that sub-subcontract to be credited toward the participation goals for this Contract, the Trade Contractor should submit a Letter of Intent from that MBE/WBE with its Bid. A Trade Contractor can subcontract out any portion of its work to MBE/WBEs unless such work is designated as work specifically not to be sub-sub-contracted out.

4. MBE/WBE Participation Schedule

A. The Construction Manager shall submit the following documents to the THE OWNER as subcontractors are selected, and at each phase of the subcontractor selection process: i) A properly completed and updated Schedule for Participation by Minority/Women Business Enterprises showing MBE/WBE participation in an amount equal to or exceeding the MBE/WBE participation goals for this contract; and ii) A properly completed Letter of Intent in the form provided by THE OWNER for each MBE/WBE listed in the Schedule for Participation by Minority/Women Business Enterprises; and iii) A current SOMBWA certification letter for each MBE/WBE listed in the Schedule for Participation by Minority/Women Business Enterprises.

B. Each Letter of Intent shall identify and describe the work to be performed by the named MBE/WBE (the "MBE/WBE Work") with enough specificity to permit THE OWNER to identify the particular items of contract work that the MBE/WBE will perform for MBE/WBE participation credit. THE OWNER reserves the right to reject any Letter of Intent if the price to be paid for the MBE/WBE work does not bear a reasonable relationship to the value of such work under the contract as determined by THE OWNER.

C. Within five (5) business days after receipt of the Schedule For Participation by Minority/Women Business Enterprises, Letters of Intent, and SOMWBA certification letters, THE OWNER shall review and either approve or disapprove the Construction Manager's submissions. IF THE CONSTRUCTION MANAGER HAS NOT SUBMITTED AN APPROPRIATE FINAL SCHEDULE FOR PARTICIPATION BY MINORITY/WOMEN BUSINESS ENTERPRISES AND APPROPRIATE LETTERS OF INTENT AND SOMWBA CERTIFICATION LETTERS THAT HAVE BEEN APPROVED BY THE OWNER ESTABLISHING THAT THE MBE/WBE PARTICIPATION GOAL FOR THE PROJECT WILL BE MET, THE CONSTRUCTION MANAGER MAY BE CONSIDERED INELIGIBLE FOR AWARD OF THE CONSTRUCTION PHASE CONTRACT and THE OWNER may award the contract to the next most advantageous proposer, subject to said proposer's compliance with these conditions or the CONSTRUCTION MANAGER MAY BE CONSIDERED IN BREACH OF THE CONTRACT.

5. MBE/WBE Participation Credit.

A. If the Construction Manager is itself an MBE or WBE, MBE or WBE participation credit shall be given in an amount equal to the entire Contract Price. If the Construction Manager is not an MBE or WBE, then MBE or WBE participation credit will be given for

the value of the Work that is actually performed by each MBE or WBE subcontractor or sub-subcontractor.

B. If the Construction Manager is a joint venture with one or more MBE/WBE joint venturers, MBE or WBE participation credit shall be given to the joint venture as follows:
(1) If the joint venture is certified by SOMBWA as an MBE or WBE, MBE or WBE participation credit shall be given in an amount equal to the portion of the Contract Price.
(2) If the joint venture is not certified as an MBE or WBE by SOMWBA, MBE or WBE participation credit shall be given to the joint venture for the value of the Work that is performed by the MBE/WBE joint venturer(s), and for the value of the Work that is actually performed by each MBE or WBE subcontractor or sub-subcontractor.

C. If an MBE/WBE supplies but does not install equipment or materials, MBE or WBE participation credit shall be given only if the MBE/WBE supplier is regularly engaged in sales of equipment or supplies to the construction industry from an established place of business. MBE or WBE participation credit shall be given the full amount of the purchase order only if the MBE/WBE supplier manufactures the goods or substantially alters them before resale. In all other cases, MBE or WBE participation credit shall be given for 10% of the purchase order.

D. MBE participation credit shall be given for the work performed by MBEs only, and WBE participation credit shall be given for the work performed by WBEs only. MBE participation may not be substituted for WBE participation, nor may WBE participation be substituted for MBE participation.

6. MBE/WBE Subcontracts

Within thirty (30) days after the award of each subcontract, the Construction Manager shall furnish the THE OWNER Compliance Office with a signed copy of the subcontract and sub-subcontract for each MBE/WBE Subcontractor listed on the Construction Manager's Schedule of Participation and cause each of its Subcontractors to execute a sub-subcontract with each MBE/WBE sub-subcontractor and provide copies of the sub-subcontracts to THE OWNER's Compliance Office.

7. Performance of Contract Work by MBE/WBEs

A. The Construction Manager shall not perform with its own organization or subcontract or assign to any other firm work designated to be performed by any MBE/WBE in the Letters of Intent or Schedule for Participation of Minority/Women Business Enterprises without the prior Approval of THE OWNER, nor shall any MBE or WBE assign or subcontract to any other firm, or permit any other firm to perform any of its MBE/WBE Work without the prior Approval of THE OWNER. Any such unapproved assignment, subcontracting, sub-subcontracting, or performances of MBE/WBE Work by others is prohibited. THE OWNER WILL NOT APPLY TO THE MBE/WBE PARTICIPATION GOAL(S) ANY SUMS ATTRIBUTABLE TO SUCH UNAPPROVED ASSIGNMENTS, SUB-CONTRACTS, SUB-SUBCONTRACTS, OR PERFORMANCE OF MBE/WBE WORK BY OTHERS.

B. The Construction Manager shall be responsible for monitoring the performance of MBE/WBE Work to ensure that each scheduled MBE/WBE performs its own MBE/WBE Work with its own workforce.

C. The Construction Manager and each MBE/WBE shall provide THE OWNER with all information and documentation that THE OWNER determines is necessary to ascertain whether or not an MBE/WBE has performed its own MBE/WBE Work. At the discretion THE OWNER, failure to submit such documentation to THE OWNER shall establish conclusively for the purpose of giving MBE/WBE participation credit under this Contract that such MBE/WBE did not perform such work.

8. Notification of Changes in MBE/WBE Work

A. If after approval of a Final Schedule for Participation of Minority/Women Business Enterprises and the commencement of construction work under the Contract the Construction Manager determines or has reason to believe that a scheduled MBE/WBE is unable or unwilling to perform its MBE/WBE Work, or that there has been or will be a change in any MBE/WMBE Work, or that the Construction Manager will be unable to meet the MBE/WBE participation goal(s) for this Contract for any reason, the Construction Manager shall immediately notify the THE OWNER in writing of such circumstances.

B. Any notice of a change in MBE/WBE Work pursuant to subparagraph "A" above shall include a revised Schedule for Participation by Minority/Women Business Enterprises, and additional or amended Letters of Intent and subcontracts.

9. Actions Required If There is a Reduction in MBE/WBE Participation

A. If for any reason, the Construction Manager believes that it shall be unable to meet the MBE/WBE participation goals for this Contract the Construction Manager shall immediately undertake a diligent, good faith effort to make up the shortfall in MBE/WBE participation as follows:

(1) The Construction Manager shall identify all items of the Work remaining to be performed under the Contract that may be made available for subcontracting or sub-subcontracting to MBE/WBEs. The Construction Manager shall send a list of such items of work to THE OWNER, together with a list of the remaining items of the Work that was not made available to MBE/WBEs and the reason for not making such work available for subcontracting or sub-subcontracting to MBE/WBEs.

(2) The Construction Manager shall send written notices soliciting proposals to perform the items of the Work that may be made available for subcontracting to MBE/WBEs to all MBE/WBEs qualified to perform such work. The Construction Manager shall advise THE OWNER of (i) each MBE/WBE solicited, and (ii) each MBE/WBE listed in the SOMWBA directory under the applicable trade category who was not solicited and the reasons therefor. The Construction Manager shall also advise THE OWNER of the dates notices were mailed and provide a copy of the written notice(s) sent.

(3) The Construction Manager shall make reasonable efforts to follow up the written notices sent to MBE/WBEs with telephone calls or personal visits in order to determine with certainty whether the MBE/WBEs were interested in performing the work. Phone logs or other documentation must be submitted to THE OWNER evidencing this effort.

(4) The Construction Manager shall make reasonable efforts to assist MBE/WBEs that need assistance in obtaining insurance, bonds, or lines of credit in order to perform work under the Contract, and shall provide THE OWNER with evidence that such efforts were made.

(5) The Construction Manager shall provide THE OWNER with a statement of the response received from each MBE/WBE solicited, including the reason for rejecting any MBE/WBE that submitted a proposal.

(6) The Construction Manager shall take any additional measures reasonably requested by THE OWNER to meet the MBE/WBE participation goal(s) established for this Contract, including, without limitation, placing advertisements in appropriate media and trade association publications announcing the Construction Manager's interest in obtaining proposals from MBE/WBEs, and/or sending written notification to MBE/WBE economic development assistance agencies, trade groups and other organizations notifying them of the project and of the work available to be subcontracted to MBE/WBEs.

B. If the Construction Manager is unable to meet the MBE/WBE participation goals for this Contract because there is a change or reduction in MBE/WBE and after complying fully with each of the requirements of paragraph "A" above, and the Construction Manager is otherwise in full compliance with the terms of this Article, THE OWNER may reduce the

MBE/WBE participation goals for this Contract to the extent that such goals cannot be achieved.

10. Suspension of Payment and/or Performance for Noncompliance

A. If at any time during the performance of this Contract, THE OWNER determines or has reason to believe that (1) there has been a change or reduction in any MBE/WBE Work which will result in the Construction Manager failing to meet the MBE/ WBE participation goal(s) for this Contract, other than a reduction in MBE/WBE Work resulting from a change in the Contract work ordered by THE OWNER, and (2) the Construction Manager has failed to comply fully with all of the terms and conditions of paragraphs 1 through 9 above, THE OWNER may:

(1) Suspend payment to the Construction Manager of an amount equal to the value of the work which was to have been performed by an MBE/WBE pursuant to the Construction Manager's Schedule for Participation by Minority/Women Business Enterprises but which was not so performed, in order to ensure that sufficient Contract funds will be available if liquidated damages are assessed pursuant to paragraph 11, and/or

(2) Suspend the Construction Manager's performance of this Contract in whole or in part.

B. THE OWNER shall give the Construction Manager prompt written notice of any action taken pursuant to paragraph A above and shall give the Construction Manager and any other interested party, including any MBE/WBEs, an opportunity to present evidence to THE OWNER that the Construction Manager is in compliance with the requirements of this Article, or that there is some justifiable reason for waiving the requirements of this Article in whole or in part. THE OWNER may invite SOMWBA and the Massachusetts Commission Against Discrimination to participate in any proceedings undertaken pursuant to this paragraph.

C. Upon a showing that the Construction Manager is in full compliance with the requirements of this Article, or that the Construction Manager has met or will meet the MBE/WBE participation goals for this Contract, THE OWNER shall release any funds withheld pursuant to clause A(1) above, and lift any suspension of the Contractor's performance under clause A(2) above.

11. Liquidated Damages; Termination

A. If payment by THE OWNER or performance by the Construction Manager is suspended by THE OWNER as provided in paragraph 10 above, THE OWNER shall have the following rights and remedies if the Construction Manager thereafter fails to take all action necessary to bring the Construction Manager into full compliance with the requirements of this Article, or if full compliance is no longer possible because the default of the Construction Manager is no longer susceptible to cure, if the Construction Manager fails to take such other action as may be required by THE OWNER to meet the MBE/WBE participation goals set forth in this Contract:

(1) THE OWNER may terminate this Contract, and/or

(2) THE OWNER may retain from final payment to the Construction Manager, as liquidated damages, an amount equal to the difference between (x) the total of the MBE/WBE participation goals set forth in this Contract, and (y) the amount of MBE/WBE participation credit earned by the Construction Manager for MBE/WBE Work performed under this Contract as determined by THE OWNER, the parties agreeing that the damages for failure to meet the MBE/WBE participation goals are difficult to determine and that the foregoing amount to be retained by THE OWNER represents the parties' best estimate of such damages. Any liquidated damages will be assessed separately for MBE and WBE participation.

B. Before exercising its rights and remedies hereunder, THE OWNER may, but THE OWNER shall not be obligated to, give the Construction Manager and any other interested party another opportunity to present evidence to THE OWNER that the Contractor is in compliance with the requirements of this Article or that there is some justifiable reason for waiving the requirements of this Article in whole or in part. THE OWNER may invite SOMWBA and the Massachusetts Commission Against Discrimination to participate in any proceedings undertaken hereunder.

12. Reporting Requirements

The Construction Manager shall submit to THE OWNER all information or documentation that is necessary in the judgment of THE OWNER to ascertain whether or not the Construction Manager has complied with any of the provisions of this Article.

13. Awarding Authority's Right to Waive Provisions of this Article in Whole or In Part

THE OWNER reserves the right to waive any provision or requirement of this Article if THE OWNER determines that such waiver is justified and in the public interest. No such waiver shall be effective unless in writing and signed by THE OWNER. No other action or inaction by THE OWNER shall be construed as a waiver of any provision of this Article.

APPENDIX C to the General Conditions of the Contract

PROCEDURES FOR AWARD OF SUBCONTRACTS

Pursuant to M.G.L. c.149 A, the Owner is required to develop a process consistent with legal requirements for the selection of subcontractors for construction manager at risk projects. This process is described in these Procedures for Award of Subcontracts (the "Procedures"). The Procedures are divided into three parts. The first part describes the prequalification and procurement of "Trade Contractors", which, for the purposes of the Procedures, shall mean the subcontractors performing work in trade categories covered by Section 44F of Chapter 149. The second part describes the prequalification and procurement of all subcontractors that are not Trade Contractors. The third part addresses additional procurement matters.

For the purposes of the Procedures, the term Project shall mean the specific construction project to which the Procedures are being applied; the term CM shall mean the construction manager at risk selected by the Owner to construct the Project; the term Designer shall mean the firm (and its subconsultants) selected by THE OWNER to design; the term Project Manager shall refer to the firm serving as Project Manager on the project; and the term Applicant shall mean any firm that submits a response pursuant to the Procedures.

I. Trade Contractors

1. Applicability of Procedures

1.1 Subcontracts Subject to Trade Contract Procedures. The procedures set forth in Sections 2 and 3 below shall govern the award of subcontracts by the CM for the furnishing of labor, materials, and equipment in the performance of the categories of work listed below whenever the estimated construction cost of such category of work exceeds $20,000:

a. Roofing and Flashing;
b. Metal windows;
c. Waterproofing, Dampproofing and Caulking;
d. Miscellaneous and Ornamental Iron;
e. Lathing and Plastering;
f. Acoustical Tile;
g. Marble;
h. Tile;
i. Terrazzo;
j. Resilient Floors;
k. Glass and Glazing;
l. Painting;
m. Plumbing;
n. Heating, Ventilating, and Air-Conditioning;
o. Electrical work;
p. Elevators;
q. Masonry work; and
r. Any other categories of work selected by Office for designation as Trade Contract work.

CM Initials _____ Owner Initials _____

The subcontractors performing these trades are referred to throughout the Contract Documents as "Trade Contractor(s)." Contracts for work in these categories of work where the estimated cost of such work exceeds $20,000 are referred to as "trade contracts."

2. Qualification of Trade Contractors

2.1 Prequalification Committee. Owner shall establish a prequalification committee ("the Prequalification Committee") consisting of four members. The members shall be appointed by the Pittsfield School Building Committee. They shall include two representatives of THE OWNER, a representative of the Designer, and a representative of the CM. The Prequalification Committee shall conduct the prequalification of trade contractors as set forth in Sections 2 and 3 of the Procedures. The CM will provide assistance to the Prequalification Committee in the exercise of its responsibilities under the Procedures, including assistance from CM staff.

If the CM proposes to perform Trade Subcontract work or other Subcontract Work with its own forces, the CM's representative on the Prequalification Committee shall abstain from participation in any review of the CM's own proposal.

Three members of the Prequalification Committee shall constitute a quorum for the purposes of conducting the Prequalification Committee's official business.

2.2 Request for Qualifications. THE OWNER shall issue a request for qualifications ("RFQ") for each category of work listed in Section 1.1 if such work is required on the Project. The RFQ shall be placed on the Comm-PASS web site; advertised in a newspaper of general circulation in the area of the Project and in the *Central Register* established under Massachusetts General Laws, Chapter 9, Section 20, and in such additional media as THE OWNER and the Prequalification Committee may deem appropriate at least fourteen (14) calendar days before the deadline for Applicants to submit a response to the RFQ by submission of a Statement of Qualifications ("SOQ"). All interested Trade Contractors shall be eligible to respond to the RFQ and participate in the prequalification process. The CM firm may submit its qualifications to bid on trade contract work provided that the CM customarily performs the work for which it submits its qualifications and does so with employees on its own payroll, and provided that the CM meets all the requirements of the selection process. The RFQ shall be prepared by THE OWNER in a form consistent with the requirements of M.G.L. c. 149A and in consultation with the Prequalification Committee and the CM. The RFQ shall contain a form or forms (individually or collectively, THE OWNER "Statement of Qualifications" or "SOQ") requiring the information necessary for the Prequalification Committee to determine if the Applicant is qualified to perform the category of work for which it seeks prequalification on the Project. The RFQ shall include, at a minimum:

a. the date, time, and place for submission;
b. relevant information about the project and the bidding process;
c. the specific criteria for trade contractor prequalification and selection;
d. a statement indicating that the RFQ will be used to prequalify trade contractors that will be invited to submit a bid; and
e. that the responders' names are to be posted, but that there shall be no public opening of responses.

2.3 Prequalification Criteria. The Prequalification Committee shall evaluate the information submitted by each Applicant on its Statement of Qualifications, the results of reference checks performed by the Prequalification Committee and/or the CM, and any other information required or obtained by the Prequalification Committee. The following subparagraphs enumerate the legally required categories to be used by the Prequalification Committee in evaluating the Applicants, the subcategories of information within each category, and the specific point allocation required for prequalification within each category. Applicants must achieve an overall score of 70 or greater and must also achieve the minimum required points within each category in order to be deemed prequalified. Applicants that do not achieve both the minimum scores within each category and do not achieve an overall score of 70 or above shall not be deemed prequalified.

a. Management Experience (50 points, minimum of 25 required for approval)

i) Business owners - The name, title, years with firm of the owner(s) of the business
ii) Management personnel - The names, title, education and construction experience, years with firm, and list of projects completed by all management personnel.
iii) Similar project experience - The project name(s), description, description of scope, original trade contract sum, final trade contract sum with explanation, and date completed of similar projects.
iv) Terminations – A list of any projects on which the trade contractor was terminated or failed to complete the work.
v) Lawsuits – A list of commercial lawsuits in which the trade contractor is a defendant or defendant-in-counterclaim with regard to construction contracts within the last 3 years. The lawsuits shall not include any actions that primarily involve personal injury or workers'compensation claims, or where the sole cause of action involves the trade contractor's exercise of its rights for direct payment under the law.
vi) Safety record – The three-year history of the trade contractor's workers' compensation experience modifier.

b. References (30 points; minimum of 15 required for approval)

i) Client references - for all projects listed in clause (iii) of Management experience above, including the project name, client's name, address, telephone and fax number, and contact person.
ii) Credit references - .A minimum of five credit references, including telephone and fax number of contact person from key suppliers, vendors and banks.
iii) Public project record – A list of all completed public building construction projects as defined in section 44A of chapter 149 during the past three years with client's name, address, telephone and fax number and contact person.

c. Capacity to Complete Projects – (20 points; minimum of 10 required for approval)

i) Annual revenue for prior three fiscal years. There shall be no requirement for submission of financial statements.
ii) Revenue under contract for next three fiscal years.

d. Commitment Letter – (mandatory no points assigned)
Mandatory commitment letters from surety companies or authorized agents stating that payment and performance bonds at 110% of the estimated trade contract value will be provided to the applicant if it is the successful bidder. The surety company providing the commitment letter must be licensed to do business in the Commonwealth and appear on the United States Treasury Department Circular 570.

e. Certificate of Eligibility – (mandatory, no points assigned)
All SOQs submitted after January 1, 2006 must include a certificate of eligibility from DCAM listing the Applicant as currently certified as a subcontractor in the scope of work for which the Applicant is submitting its SOQ.

f. Update Statement – (mandatory, no points assigned)
All SOQs submitted after January 1, 2006 must include a fully completed and current DCAM Update Statement prepared by the Applicant.

Applicants that are certified by the Massachusetts State Office of Minority and Women Business Enterprise ("SOMWBA") as either a Minority Business Enterprise, a Women Business Enterprise or a Minority/Women Business Enterprise and provide documentation of current SOMWBA certification with their SOQ will have an additional 5 points added to their overall score.

If the Applicant is a joint venture, the Applicant must submit a copy of the joint venture agreement, signed by each member, and the joint venture agreement must clearly identify, for each member of the joint venture, such member's proportionate share or interest in the financial or other benefits, risks or liabilities of the venture ("joint venture interest"). One member of the joint venture must have a joint venture interest greater than fifty (50) percent ("the Lead Venturer"). The requirements for prequalification in 2.3 a-f above shall be met by each member of the joint venture; and the bonding requirements of 2.3 d above shall be met by the Lead Venturer or by the joint venture as an entity. A joint venture prequalified by the Prequalification Committee must obtain a Certificate of Eligibility from THE OWNER prior to the time bids are filed and must submit the Joint Venture's Certificate of Eligibility with its bid.

Joint ventures must be submitted for consideration by the Prequalification Committee. Following the deadline for submission of SOQs for a specific category of work, joint ventures for that category of work which were not submitted to the Prequalification Committee may not bid on that category of work, except that two firms both of whom were independently prequalified by the Prequalification Committee for that category of work, may form a joint venture to bid that category of work without further consideration by the Prequalification Committee provided the Joint Venture has been THE OWNER Certified prior to submitting its bid and submits the Joint Venture's Certificate of Eligibility with its bid.

2.4 Deliberations of the Prequalification Committee. The Prequalification Committee shall consider each SOQ submitted based on the criteria set forth in Paragraph 2.3 above. The Prequalification Committee shall require that all mandatory submissions are submitted by the Applicant and apply a numerical scoring system, with both the minimum point scores for each category, and a score of 70 out of a possible 100 overall points, required to be prequalified. The Prequalification Committee shall prepare a written record of the evaluation of each Applicant.

The scoring system shall provide for the assigning of scores as follows. The Prequalification Committee shall first consider whether the Applicant has met the requirements of Subparagraphs d, e and f, bonding commitment letter, certificate of eligibility and update statement. If the Applicant has satisfied those criterion, it shall be awarded up to 100 points using the criteria listed above. Applicants that do not meet the requirements of Subparagraphs d, e and f shall not be presented to the Prequalification Committee for consideration.

Any Applicant that fails to achieve either an overall score of at least 70 or that fails to achieve the minimum required points within each category shall be deemed not to be prequalified for the category of work for which the Applicant sought prequalification. If it is determined at any time during the evaluation process, that an Applicant has willfully supplied materially false or misleading information in its application or otherwise, the Applicant may be eliminated from further consideration for prequalification for the Project and, in the discretion of the Owner, for any other projects requiring prequalification under these Procedures.

The decision of the Prequalification Committee shall be final and not subject to appeal except on the grounds of fraud or collusion. An Applicant firm's prequalification score shall be made available to that Applicant firm only and only upon request. An Applicant firm's score shall not be a public record as defined in M.G.L. c. 4, §7 and shall not be open to pubic inspection to the fullest extent possible under the law.

A list of the Applicants that have been determined by the Prequalification Committee to be prequalified and therefore eligible to bid shall be posted at the offices of THE OWNER listing the firms by trade categories. Applicants shall also be notified of the Prequalification Committee's determination on prequalification by mail at the address furnished by each Applicant.

The Prequalification Committee reserves the right to reopen the prequalification process for any category of work before it has completed its evaluation of firms that previously submitted SOQs and/or to hold multiple rounds of prequalification for any given category of work. In either case, any Applicant that has submitted a complete SOQ shall not be required to submit another one, although any Applicant not prequalified may elect to amend its SOQ prior to the latest deadline for submitting information for the trade contract for which the Applicant seeks to be prequalified.

No person or firm suspended or debarred pursuant to Massachusetts General Laws Chapter 29, Section 29F, or Chapter 149, Section 44C, or disqualified pursuant to Chapter 7, Section 38D, or which has been debarred by the Federal Government shall be determined to be qualified to compete for a trade contract or any other contract or

subcontract to be issued on the Project. If any Applicant determined to be qualified to perform one or more trade contracts is subsequently suspended or debarred pursuant to such laws, the qualification of such Applicant shall be rescinded and such Applicant shall be notified of such action and eliminated from the list of prequalified bidders.

2.5 Determinations to Remain in Effect. The Prequalification Committee's determinations as to which Applicants are prequalified shall remain in effect, subject to the following provisions of this Section 2.5, for the duration of the Project. Upon receipt at any time of additional information deemed material and significant by the Prequalification Committee regarding a previously prequalified Applicant's qualifications or responsibility, including, but not limited to, compliance with any minimum prequalification requirements, the Prequalification Committee may determine, that the Applicant is not qualified to perform the applicable trade contract(s) for the Project. In such event, the Prequalification Committee shall notify the Applicant of its determination, and inform the Applicant of any information on which the Prequalification Committee's determination is based that was not furnished by the Applicant.

3. Bidding

3.1 Requests for Bids. A request for bids ("RFB") will be issued for each trade contract subject to Sections 2 and 3 of these Procedures. The RFB will only be issued to the Trade Contractors appearing on the list of prequalified Applicants for the applicable trade contract determined pursuant to Section 2 above. The RFB shall include at least the following attachments:

a. the date, time and place for submission of responses to the request for bids. All Trade Contractor bids will be submitted and opened at THE OWNER's Bid Room;

b. fully detailed drawings and specifications by class of work in accordance with paragraph (a) of Subsection 1 of Section 44F of Chapter 149 of the Massachusetts General Laws (i.e., separate specification sections for the trades listed in Paragraph 1.1 above) which shall provide for full competition for each item of material to be furnished under the contract as set forth under subsection (b) of M.G.L. c.30, §39M;

c. a detailed definition o the Trade Contractor's scope of work, including alternates and unit price items, if any, within that scope of work;

d. a project schedule indicating the planned sequence and duration of each trade contractor's work;

e. list of the Trade Contractors prequalified for the work covered by the RFB;

f. a Trade Contractor bid form, that shall require, without limitation, a listing of price, addenda, alternates and unit price items, if any, for the trade work; certification that the trade contractor will perform the complete trade work with employees on his own payroll, except for work customarily performed by sub-trade subcontractors within the trade; and the names of all sub-trade

subcontractors to be used if awarded the trade contract and each sub-trade contract sum; to the extent applicable, an identification by the Trade Contractor that it is a MBE or WBE or a list of the MBEs and/or WBEs proposed to be used by the Trade Contractor;

g. an affidavit of tax compliance that must be executed by all bidders;

h. an affidavit of prevailing wage compliance pursuant to M.G.L. c. 149, §§ 26 and 27 that must be executed by all bidders;

i. a noncollusion affidavit that must be executed by all bidders;

j. a requirement that a bidder post a 5% bid bond from a surety company licensed to do business in the Commonwealth and whose names appears on U.S. Treasury Department Circular 570; but the bid bond shall be returned to the bidder if the bidder is not selected as the Trade Contractor;

k. a budget for the project, and the budget amount for the trade contract scope of work as provided in the project guaranteed maximum price, if available, or as provided in the most recent budget for the project;

l. a requirement that a bidder submit a current Certificate of Eligibility issued by DCAM to the Trade Contractor showing that the Trade Contractor is certified for the trade category for which the bid is submitted.

m. A requirement that a bidder submit a completed Update Statement with its bid; and

n. a Trade Contractor agreement form as set forth in M.G.L. c. 149A, §8 (k).

The prequalified Trade Contractors shall submit bids in compliance with the requirements of the Request for Bids package.

3.2 Bid Opening, Award, Rejection and Negotiation of Bids. Bids shall be opened publicly by THE OWNER. Bids for each trade shall be: a) accepted only from firms appearing on the list of prequalified firms described in Paragraph 2.4 for such trade; b) submitted as set forth in the RFB, and c) opened publicly. Any bid which does not include the bid bond or affidavits required pursuant to law or any response in which the information requested is incomplete, conditional, or obscure or which contains any additions not required in the request for bids package shall be rejected. The trade contract for each trade shall be awarded to the lowest prequalified bidder except that THE OWNER reserves the right to reject the bids of any and all Trade Contractors if: a Trade Contractor is not eligible to submit a bid; if the bid does not represent the bid of a person competent to perform the work specified; or if less than three such bids were received and the prices are not reasonable for acceptance without further negotiation or competition. In addition if fewer than three responsive bids are received for any trade category and the lowest bid exceeds the estimated cost for the work, the CM shall attempt to negotiate an acceptable price with the lowest prequalified bidder. If the negotiations are unsuccessful, the construction manager shall terminate negotiations with the lowest prequalified bidder and shall initiate negotiations with the trade contractor who was the second lowest prequalified bidder.

If the CM is unsuccessful in negotiating an acceptable price with the lowest prequalified bidder and second lowest prequalified bidder, the CM, on behalf of and with the consent of the public agency, shall solicit additional bids utilizing the procedures for selection of subcontractors who are not trade contractors, set out below and in M.G.L. c. 149A, § 8 (j).

3.3 Trade Contract Execution. Each trade contractor selected to perform work on the Project shall return an executed trade contract including the required performance and payment bonds and insurance certificate to the CM within 10 business days of receipt of the trade contract from the CM. The trade contract shall be the trade contract agreement required by law.

II. Other Subcontracts

1. Applicability of Procedures

Subcontracts Subject to Procedures For Other Subcontracts. The process set forth in these Sections 4 and 5 of the Procedures shall apply to the procurement of subcontracts and subcontractors that are not subject to the provisions of Sections 2 and 3 above, specifically subcontractors that are not Trade Contractors, and where the subcontract scope of work has an estimated value that is equal to or exceeds $20,000.

2. Prequalification and Procurement

2.1 Subcontract Other than Trade Contracts in With An Estimate Cost equal to or greater than $20,000. For Subcontracts that are not trade contracts with an estimated cost equal to or greater than $20,000, the CM shall submit to THE OWNER for its approval the qualifications which it believes a subcontractor must have to perform the work of the subcontract and a list of a minimum of three (3) subcontracting firms, and preferably at least five (5) subcontracting firms, which the CM believes meet the qualifications. The CM shall submit information in a form and content satisfactory to the Prequalification Committee concerning the qualifications and responsibility of the proposed subcontractors and, when relevant, how the selection will further the CM's compliance with its Project MBE and WBE participation goals. The CM firm may submit its qualifications to bid on subcontract work provided that the CM customarily performs the work for which it submits its qualifications and does so with employees on its own payroll, and provided that the CM meets all the requirements of the selection process. The Prequalification Committee may eliminate firms from the list of firms submitted by the CM, and the Prequalification Committee may add firms to the list submitted by the CM. The CM must add the firms requested by the Prequalification Committee to the list if the firms are acceptable to the CM. If the firms Prequalification Committee requested be added are not acceptable to the CM based upon qualifications, ability or for any other reason, the CM must advise the Prequalification Committee of its objections and the basis for the objections in writing. If the Prequalification Committee determines that the CM's objections to THE OWNER requested firm(s) are valid then the requested firms will not be added to the list, otherwise the firm(s) will be added.

The CM will invite all subcontractors on the approved list to submit bids for the subcontract work, using forms and procedures approved by THE OWNER. The bids shall be based on detailed bidding information developed by the CM for the subcontract work. The CM will submit to THE OWNER a list of bids submitted for

each subcontract and with the list will indicate the bidder it recommends be selected to be awarded a subcontract. The CM shall along with its submission provide a written explanation as to the reasons for its selection and recommendation. The CM's recommendation will be based on relevant factors including, but not limited to, price, quality of work, and MBE and/or WBE participation. THE OWNER approval is required before a subcontract can be awarded by the CM to a subcontractor, which approval shall not be unreasonably withheld provided the selection will not have an adverse effect on meeting project goals including, but not limited to, price, quality of work and/or MBE/WBE participation. In no event will the selection of a subcontractor affect the GMP agreed to by the CM.

The CM may, with the approval of THE OWNER, reject the proposals for a subcontract and either resolicit that scope of work or negotiate with one or more of the firms that submitted the rejected proposals. Such rejection may be based on the proposal being too high compared to the amount carried in the GMP for that scope of work or upon any other basis approved by THE OWNER.

2.2 Subcontracts With An Estimated Cost Less Than $20,000. Subcontracts with an estimated cost less than $20,000, and subcontracts for the supply of materials or equipment not including performance of labor in construction at the Project site, regardless of the estimated cost, may be awarded by the CM using any method selected by the CM with the approval of THE OWNER.

III. Other Procurement Provisions

1. Emergencies

1.1 In case of an emergency, THE OWNER or the CM, with the prior approval of DCAM, may award a contract for such work as is necessary to preserve or protect the health or safety of persons or property on the basis of such competitive bids or proposals as it can reasonably obtain in time to respond to the emergency and without public advertisement or opening of bids or proposals; or the CM may perform such work with its own forces.

2. Termination of Contracts

2.1 Termination of Trade Contracts and Other Subcontracts. If a trade contract, or other subcontract, is terminated in whole or in part by the CM after the subcontractor commences work but prior to completion of the work covered by such trade contract or other subcontract on account of breach or default by the trade contractor or other subcontractor, or for other reasons in the public interest approved by THE OWNER, the CM may engage a replacement subcontractor using any method selected by the CM and approved by THE OWNER, or may perform the affected work with its own forces, as necessary to preserve, protect, or complete the work without following these procedures and without public advertisement or opening of bids or proposals. The termination of a trade or other subcontractor prior to completion of its work shall not be the basis for an increase in the GMP.

3. Miscellaneous Provisions

3.1 Procurement Records. The Prequalification Committee and the CM shall ensure that THE OWNER has a complete set of the following records:

a. All RFQs issued pursuant to Section 2 of these Procedures, including all addenda.

b. All SOQs and other information furnished to or otherwise obtained by the Prequalification Committee and the CM concerning qualification of each Applicant responding to an RFQ including any references or scoring obtained or generated in connection with the SOQs.

c. All RFBs issued by the CM to prequalified Trade Contractors pursuant to Section 3 of these Procedures.

d. All bids received from such Trade Contractors in response to such RFBs.

e. All solicitations for bids or proposals issued by the CM to firms other than Trade Contractors.

f. All bids and proposals received by the CM from such firms in response to such solicitations.

g. All contracts awarded pursuant to these procedures.

h. All other written documents required pursuant to the terms of these Procedures.

i. All other documents referring or relating to the evaluation of qualifications, proposals or bids, including but not limited to, all notes (to the extent included in Project files), memoranda, correspondence and meeting minutes, whether formal or informal, in either electronic media or hard copy.

THE OWNER shall retain copies of such records for a period of six (6) years from the date of final payment under the contract to which such records relate. The Secretary of Administration and Finance and the Inspector General of the Commonwealth shall have access to all such records at any time upon reasonable notice.

3.2 Severability. If any provision of these Procedures shall be determined to be invalid or unenforceable, the remaining provisions of the Procedures shall remain in full force and effect.

3.3 Time. The periods of time within which any party is required to act under the terms of these procedures when described in terms of "days" shall, unless otherwise specified, mean calendar days (and not business days), except that if the last day of any such time period falls on a Saturday, Sunday, or legal holiday in Massachusetts, the period of time during which the required action must be taken will be extended to the next following business day.

APPENDIX D to the General Conditions of the Contract

- Form for Subcontract between Construction Manager and Trade Contractor

CM Initials _____ Owner Initials _____

FORM FOR TRADE CONTRACT BETWEEN CONSTRUCTION MANAGER AND TRADE CONTRACTOR

THIS AGREEMENT made this _____ day of _____ 20____, by and between
_____
a corporation organized and existing under the law of _____
a partnership consisting of _____
an individual doing business as _____
hereinafter called the "Construction Manager or CM" and
_____
a corporation organized and existing under the laws of _____
a partnership consisting of _____
an individual doing business _____
hereinafter called the "Trade Contractor",

WITNESSETH that the CM and the Trade Contractor for the considerations hereafter named, agree as follows:

1. The Trade Contractor agrees to furnish all labor and materials required for the completion of all work specified in Section No. _____
of the Specifications for _____
(Name of Sub-trade)
and the Plans referred to therein and addenda No. _____, _____, _____and
_____ for the _____
_____
(complete title of project and project no. taken from the title page of the Specifications)
all as prepared by _____.
(Name of Designer or Engineer)

All work shall be in accordance with the (project) all as prepared by _____ designer. All work shall be in accordance with the contract documents listed on Exhibit A; and the detailed Scope of Work listed on Exhibit B. The CM agrees to pay the Trade Contractor as full payment for all the work in Exhibit B, the sum of $_____. This price includes the following alternates (and other items set forth in the sub-bid):

Alternate No(s) _____, _____, _____,
_____, _____, _____, _____.

(a) The Trade Contractor agrees to be bound to the CM by the terms of the hereinbefore described Plans, Specifications (including all general conditions stated therein) and addenda No. _____, and _____, and _____, and to assume to the CM all the obligations and responsibilities that the CM by those documents assumes to

_____ CM Initials _____ Owner Initials

the _____ hereinafter called
(Public Agency)
the "Public Agency", except to the extent that provisions contained therein are by their terms or by law applicable only to the CM.

(b) The CM agrees to be bound to the Trade Contractor by the terms of the hereinbefore described documents and to assume to the Trade Contractor all the obligations and responsibilities that the Public Agency by the terms of the hereinbefore described documents assumes to the CM, except to the extent that provisions contained therein are by their terms or by law applicable only to the Public Agency.

2. The CM agrees to begin, prosecute and complete the entire work specified by the Public Agency in an orderly manner so that the Trade Contractor will be able to begin, prosecute and complete the work described in this Trade Contract; and, in consideration thereof, upon notice from the CM, either oral or in writing, the Trade Contractor agrees to begin, prosecute and complete the work described in this Trade Contract in an orderly manner in accordance with the Project Schedule attached as Exhibit C as it may be reasonably modified from time to time by agreement of the CM and the Trade Contractor.

3. The Trade Contractor agrees to furnish to the CM on execution of this Trade Contractor Agreement and prior to commencing the work, evidence of workmen's compensation insurance as required by law and evidence of public liability and property damage insurance of the type and in limits required to be furnished to the Public Agency by the CM.

4. The CM agrees that no claim for services rendered or materials furnished by the CM to the Trade Contractor shall be valid unless written notice thereof is given by the CM to the Trade Contractor during the first ten (10) days of the calendar month following that in which the claim originated.

5. The Trade Contractor Agreement is contingent upon the execution of an amendment to the contract between the CM and the Public Agency for the work of the Trade Contractor.

6. If the Trade Contractor should be adjudged a bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials, of if he should fail to make prompt payment to sub-trade subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the CM, or otherwise be guilty of a substantial violation of any provision of the contract, then the CM may, without prejudice to any other right or remedy and after giving the Trade Contractor and his surety seven days' written notice, terminate the employment of the Trade Contractor and take possession of the premises and of all materials, tools, and appliances thereon and finish the work by whatever method he may deem expedient. In such case the Trade Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the trade contract price shall exceed the expense of finishing the work including compensation for additional architectural, managerial and administrative services, such excess shall be paid to the Trade Contractor. If such expense shall exceed such unpaid balance, the Trade Contractor shall pay the difference to the CM. The CM and Trade Contractor shall have the right to seek damages for breach of this Trade Contract without terminating this Trade Contract or ceasing performance hereunder.

7. The following exhibits are incorporated into their subcontract:

Exhibit A: Contract Documents

Exhibit B: Detailed Scope of Work

Exhibit C: Project Schedule

IN WITNESS WHEREOF, the parties hereto have executed this agreement the day and year first above-written.

SEAL ATTEST

_____ _____

(Name of Trade Contractor)

By: _____

SEAL ATTEST

_____ _____

(Name of CM)

_____ CM Initials _____ Owner Initials

By: _____

_____
(City and State)

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS

that_____

_____

_, as Principal, and

_____

_____,as Surety,

are held and firmly bound unto the Awarding Authority, in the sum of

_____
_

lawful money of the United States to be paid to the Awarding Authority, for which payments, well and truly to be made, we bind ourselves, our respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the said Principal has made a contract with the Awarding Authority bearing date of

_____ 200_, for the construction of _____

_____(Project),

Now the condition of this obligation is such that if the Principal shall well and truly keep and perform all the undertakings, covenants, agreements, terms and conditions of said contract and any extensions thereof that may be granted by the Awarding Authority, with or without notice to the surety, and during the life of any guaranty required under the contract, and shall also well and truly keep and perform all the alterations, changes or additions to said contract that may hereafter be made, notice to the surety of such modifications, alterations, changes or additions being hereby waived, then this obligation shall become null and void; otherwise it shall remain in full force and effect.

In the event that the contract is abandoned by the Contractor, or is terminated by the Awarding Authority, said surety hereby further agrees that said surety shall, if requested in writing by the Awarding Authority, take such action as is necessary to complete said contract.

_____ CM Initials _____ Owner Initials

In witness whereof we hereunto set our hands and seals this ____ day of _____, 200_.

By Principal: _____ [Seal]

By Surety: _____ [Seal]

Address: _____

Surety Agent: _____ [Seal]
Address: _____

Telephone: _____

CERTIFICATE AS TO CORPORATE PRINCIPAL
(PERFORMANCE BOND)

I, _____, certify that I am the _____ of the corporation named a principal in the within bond; that _____who signed said Bond on behalf of the Principal was then _____ of said corporation and I know his signature and his signature thereon is genuine; and that said Bond was duly signed, sealed and attested for and on behalf of said corporation by authority of its governing body.

Signed: _____ [Seal]

Date: _____, 200_

END OF PERFORMANCE BOND

LABOR AND MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that _____

_____

_____as

principal, and _____

as surety, are held and firmly bound unto the Awarding Authority in the sum of _____

_____

lawful money of the United States of America, to be paid to the Awarding Authority, for which payment, well and truly to be made, we bind ourselves, our respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said principal has made a contract with the Awarding Authority under date of _____, 200_,

for: _____

Now the condition of this obligation is such that if the principal shall promptly pay for all labor performed or furnished and for all materials used or employed in said contract and in any and all duly authorized modifications, alterations, extensions of time, changes or additions to said contract that may hereafter be made, notice to the surety of such modifications, alterations, extensions of time, changes or additions being hereby waived, the foregoing to include any other purposes of items set out in, and to be subject to, the provision of Massachusetts General Laws (Ter. Ed.), Chapter 30, Section 39A, and Chapter 149, Section 29 as amended, then this obligation shall become null and void; otherwise it shall remain in full force and effect.

In witness whereof we hereunto set our hands and seals this ____ day of _____, 200_.

By Principal: _____ [Seal]

By Surety: _____

Address: _____

Surety Agent: _____ [Seal]

Address: _____

Telephone: _____

CERTIFICATE AS TO CORPORATE PRINCIPAL
(LABOR AND MATERIAL BOND)

I, _____, certify that I am the _____

of the corporation named as principal in the within bond; that _____ who signed said Bond on behalf of the Principal was then _____ of said corporation and I know his signature and his signature thereon is genuine; and that said Bond was duly signed, sealed and attested for and on behalf of said corporation by authority of its governing body.

Signed: _____ [Seal]

Date: _____, 200_

END OF LABOR AND MATERIAL PAYMENT BOND

SECTION 02000
TECHNICAL SPECIFICATIONS
SITE WORK

FOR

OLIVE STREET PARKING FACILITY
GREENFIELD, MA

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CONSTRUCTION FACILITIES

Summary. Section includes:

a. Temporary utilities required by the Contractor
b. Temporary sanitary facilities
c. First aid station

Quality Assurance. Maintain temporary construction facilities in proper and safe condition throughout the progress of the Work.

Temporary Utilities. Temporary utilities services (Water, Electricity, Telephone, etc) shall be arranged by the Contractor if any of these are required by the Contractor.

Temporary Sanitary and First Aid Facilities. Provide suitably enclosed chemical or self-contained toilets for the use of the labor force employed on the Work. Toilets shall be located near the Work sites and secluded from observation insofar as possible. Toilets shall be serviced weekly, kept clean and supplied throughout the course of the Work.

Contractor shall enforce proper use of sanitary facilities.

Use of the Owner's sanitary facilities by the Contractor is prohibited.

Provide a first aid station at the site.

MOBILIZATION AND DE-MOBILIZATION

General
Erosion Control
Clearing
Grubbing
Disposal
Care of Loam
Work on Improved Property
Relocation of Trees, Shrubs, Hedges, and Fences
Work in Easements
Stone Walls and Fences
Fill
De-Mobilization
Construction Signs
Sawcutting

General. The Contractor shall furnish all labor, materials, tools and equipment necessary and shall do all work to prepare the site as indicated on the drawings and as herein specified.

Extreme care shall be taken by the Contractor and his employees not to damage trees, located outside the lime of work or that are shown to be protected on in place. The Contractor shall be responsible for all damage done.

Erosion Control. Contractor shall furnish and install all temporary erosion control measures shown on the Drawings and required by the Engineer during the life of the Contract to control soil erosion and water pollution. This includes installation and maintenance of silt fence, berms, ditches, sedimentation basins, stabilized construction exits, fiber mats, catch basin silt sacs, straw, netting, gravel, trenches, mulches, grasses, slope drains and other approved erosion control devices or methods. Erosion control shall be in place prior to any soil distributing activities including, but not limited to, clearing and grubbing, earthwork, dewatering and excavation work.

The Contractor shall inspect erosion control devise immediately after each storm event and at least daily during prolonged rainfall and maintain them in good operating condition for the life of the Contract. Fiber Rolls shall be replaced when deteriorated, and as directed by the engineer. Accumulated sediment trapped by erosion and sedimentation control devise shall be removed as required, and as directed by the Engineer.

Temporary soil erosion and sedimentation control devices shall be removed and adjacent areas outside the limits of grading restored upon completion of the work or when directed by the Engineer. Upon removal of the temporary controls, the site shall be restored to original condition.

Clearing. From areas to be cleared, the Contractor shall cut or otherwise remove all designated trees, saplings, brush, vines, and other vegetable matter such as snags, sawdust, bark, etc., and refuse.

Grubbing. The area to be grubbed shall be the same as that which is to be cleared. Grubbing shall consist of the complete removal of all tree stumps and all roots larger than 3 in. in diameter to a depth of 12 in. below the ground surface. Such depths shall be measured from the existing ground surface or the proposed finished grade, whichever is the lower.

Disposal. All material collected by the Contractor in the course of clearing and grubbing shall be hauled away for disposal off the site. Such disposal shall be carried on as promptly as possible after removal of material in the grubbing operations and shall not be left until the final period of cleaning up.

Care of Loam. Wherever work in easements is to be done, the Contractor shall first scrape all loam to one side so that it will not become mixed with the roadway or other excavation materials. After the construction work is completed, the loam shall be re-spread upon the land. No loam shall be taken away from the easements, and if the existing loam is of an insufficient amount, the Contractor at his own expense, shall furnish and spread loam to a minimum compacted thickness of 6 in.

Work on Improved Property. Trees, cultivated hedges, lawns, shrubs, and plants which might be damaged by the Contractor's operations shall be protected by suitable means or shall be dug up and temporarily replanted and cared for. After the construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If trees, cultivated hedges, lawns, shrubs and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced at the Contractor's expense by items of kind and quality at least equal to the kind and quality existing at the start of the Work.

In all work in improved property, the Contractor shall do such hand work as may be required to prevent damage to buildings or trees.

Relocation of Trees, Shrubs, Hedges, and Fences. Where trees, shrubs, hedges, and fences interfere with the Work, the trees, shrubs, and hedges will be replanted by the Contractor, as indicated on the plans, or directed by the Engineer. Said trees, shrubs, and hedges will be replanted on improved property. The Contractor shall be responsible for care of said plantings, and responsible for re-establishing growth. If the trees, shrubs, or hedges are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced at the Contractor's expense.

In the instance of fences conflicting with the construction work these fences shall be relocated to private property by the Contractor as indicated on the plans, or directed by the Engineer.

Any trees, shrubs, or hedges requiring trimming over Town land shall be done by the Contractor as indicated on the plans, or as directed by the Engineer.

Work in Easements. After the construction work is completed, all easements shall be loamed and seeded as specified under LOAMING AND SEEDING.

MOBILIZATION AND DE-MOBILIZATION

Stone Walls and Fences. Wherever stone walls or fences need to be removed to provide access to the Work or if stone walls or fences are damaged during the progress of the Work, they shall be restored or repaired to as good condition as existed prior to entry, or disposed of if directed by the Engineer.

Fill. The Contractor shall fill where needed, within the easement, to provide cover as indicated on the drawings.

De-Mobilization. During its progress the work and the adjacent areas affected thereby shall be kept cleaned up and all rubbish, surplus materials, and unneeded construction equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible.

Where material or debris have washed or flowed into or been placed in existing water courses, ditches, gutters, drains, pipes, structures, work done under this contract or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the work, and the ditches, channels, drains, pipes, structures, and work, etc., shall upon completion of the work, be left in a clean and neat condition.

On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted, in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic matter and material containing organic matter in, under, and around privies, houses and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.

The Contractor shall restore or replace, when and as directed, any public or private property damage by his work, equipment, or employees, to a condition at lease equal to that existing immediately prior to the beginning of operations. To this end, the Contractor shall do as required all necessary highway or driveway walk and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The Contractor shall be responsible for replacing or resetting lost or damaged property pins and bounds, whether private or public, by a registered land surveyor.

Construction Signs. The Contractor shall supply, erect, and properly maintain all temporary advance warning construction signs in all areas to be affected by his operations. Signs shall be placed in locations shown on the plans or as specified and no work will begin until all such signs are in place and their locations approved by the Engineer.

All signs shall conform to the specifications set forth in the Manual on Uniform Traffic Control Devices, latest edition, or to specifications shown in the detail section of the plans.

Sawcutting. Any sawcutting required for the sidewalk, roadways and driveways shall be performed by the Contractor utilizing a water cooled saw, as indicated on the plans, or as directed by the Engineer.

TRAFFIC CONTROL AND UNIFORM TRAFFIC POLICE

General
Description
Traffic Requirements

General. The Contractor is responsible for furnishing and installing all traffic control devices along with the scheduling of traffic officers, and for providing all documentation.

Traffic Requirements. The Contractor is to reference the Manual of Uniform Traffic Control Devices, U.S Department of Transportation along with adhering to all applicable Greenfield Town ordinances that relate to traffic control.

The Contractor is to arrange construction activities so that all streets shall remain open to at least one-way traffic during periods of work and two-way traffic during all other time periods. Provide a traffic control plan to the Engineer for approval showing traffic signs, barrels, cones, traffic officers, including detour signs, meeting the approval of the Engineer, Owner, and local Police Departments in accordance with the Manual of Uniform Traffic Control Devices.

The Contractor shall have no claim of delay if they do not notify the Police Department of their scheduled location in time or arrange for traffic officers. The Contractor is to hand deliver written notices to individual houses affected by driveway and side road closings or detours a minimum of 24 hours in advance.

Uniformed traffic officers shall be required at locations deemed necessary by the Owner, working in conjunction with local Police and Fire Departments, for the protection of the public.

EARTH EXCAVATION, BACKFILL, FILL, AND GRADING ASSOCIATED WITH UTILITY CONSTRUCTION

General
Description
Extent of Open Excavation
Separation of Surface Materials
Sheeting and Bracing
Drainage
Trench Excavation
Depth of Trench
Width of Trench
Trench Excavation in Fill
Excavation Near Existing Structures
Protection of Existing Structures
Relocation and Replacement of Existing Structures
Care and Restoration of Property
Unauthorized Excavation
Elimination of Unsuitable Material
Disposal of Surplus Excavated Materials
Dust Control
Bridging Trenches
Backfilling - General
Fill and Backfill Under Structures
Backfilling Around Structures
Backfilling Pipe Trenches
Material for Filling and Embankments
Preparation of Subgrade
Placing and Compacting Embankment Material

General. The Contractor shall make excavation of normal depth in earth for trenches and structures; shall backfill such excavations to the extent necessary; shall furnish the necessary materials and construct embankments and fills and shall make miscellaneous earth excavations and do miscellaneous grading. All such work shall be done as indicated on the drawings and as herein specified; including recommendations presented in the "Geotechnical Engineering Recommendations, New Parking Garage, Olive Street, Greenfield, Massachusetts" by O'Reilly, Talbot & Okun dated February 23, 2017.

The program of excavation, dewatering, sheeting, and bracing shall be carried out in such manner as to eliminate all possibility of undermining or disturbing the foundations of existing structures or of work previously completed under this contract.

Description. The Contractor shall make excavations in such manner and to such widths as will give suitable room for building the structures or laying and jointing the piping; shall furnish and place all sheeting, bracing, and supports; shall do all cofferdamming, pumping, and draining; and shall render the bottom of the excavations firm and dry and acceptable in all respects.
In no case, except as provided for in the sections TRENCH EXCAVATION and PREPARATION OF SUBGRADE, shall the earth be plowed, scraped, or dug by machinery so near to the finished subgrade as to result in the disturbance of material below said subgrade, but the last of the material to be excavated shall be removed with pick and shovel just before the placing of the pipe, masonry, or other structure.

All excavation, except as otherwise specified or permitted, shall be made in the open.

Extent of Open Excavation. The length of trench open at any one time will be controlled by the conditions, subject to any limits that may be prescribed by the Engineer.

Separation of Surface Materials. The Contractor shall remove only as much of any existing pavement as is necessary for the prosecution of the work. The pavement cut shall be made with an approved saw, without extra compensation to the Contractor. Where pavement is removed in large pieces, it shall be disposed of before proceeding with the excavation.

Sheeting and Bracing. Contractor shall observe all safety requirements and regulations set forth by the State Labor Department for the protection of the workmen, and all regulations and directives set forth under the Occupational Safety and Health Act (OSHA), as it applies to construction activities.

The Contractor shall furnish, put in place, and maintain such sheeting, bracing, etc., as may be necessary to support the sided of the excavation and to prevent any movement of earth which could in any way diminish the width of the excavation to less than that necessary for proper construction, or could otherwise injure or delay the work, or endanger adjacent structures.

Sheeting shall be driven and excavation work conducted in such a manner as to prevent material in back of sheeting from running under sheeting and into trench. Care shall be taken to prevent voids outside of sheeting and, if voids are formed, they shall be immediately filled and well rammed.

Sheeting shall not be carried to such a depth at catch basins and manholes, if it crosses the pipe that it will bear upon the pipe.

Special precautions by using sheeting, shoring and bracing shall be taken to guard against any damage to or settlement of buildings, walls, or structures that are adjacent to work.

Sheeting driven below pipe invert will be permanently left in place.

Do not brace to concrete unless express permission is given by Engineer, and only then if concrete has reached design strength as determined by compressive test of representative sample cylinders and has been cured on-site for a period of at least 14 days.

Do not embed any part or portion of sheeting or bracing in the completed work. Do not construct sleeves or openings in the structures to permit bracing through the structures unless given express permission by the Engineer.

Where sheeting is placed alongside a pipe and extends below mid-diameter, it shall be cut off at an elevation not less than 1 foot above the top of the pipe.

The sheeting, shoring, bracing, etc., or parts thereof, may be left in place after completion of work in locations where accepted in writing by Engineer. Engineer may require that, at intervals, the sheeting be left in place to support existing structures and that other sheeting be removed. All sheeting which is left in place, whether ordered by the Engineer or left for the convenience of or to serve the interests of the Contractor, shall be cut off at least 3 feet below the surface.

Drainage.

a. General. To ensure proper conditions at all time during construction, the Contractor shall provide and maintain ample means and device (including spare units kept ready for immediate use in case of breakdowns) with which to intercept and/or remove promptly and dispose properly of all water entering trenches and other excavation. Such excavations shall be kept dry until the structures, pipes, and appurtenances to be built therein have been completed to such extent that they will not be floated or otherwise damaged.

   All water pumped or drained from the work shall be disposed of in a suitable manner without undue interference with other work, damage to pavements, other surfaces, or property. Suitable temporary pipes, flumes, or channels shall be provided for water that may flow along or across the site of the work.

b. Temporary Underdrains. Temporary underdrains, if used, shall be laid in trenches beneath the grade of the structure. Trenches shall be of suitable dimensions to provide room for the chosen size of underdrain and its surrounding gravel.

   Underdrain pipe shall be acceptable vitrified clay or concrete pipe of standard thickness. Sewer pipe of the quality know as “seconds” will be acceptable.

   Underdrains, if used, shall be laid at an approved distance below the bottom of the normal excavation and with open joints wrapped in cheesecloth, and entirely surrounded by graded gravel, or crushed stone to prevent the admission of sand or other soil into the underdrains. The distance between the bottom of the pipe or structure and the top of the bell of the underdrain pipe shall be at least 3 inches unless otherwise permitted. The space between the underdrain and the pipe or structure shall be filled with screened gravel or crushed stone which shall be rammed if necessary and left with a surface suitable for laying the pipe or building the structure.

c. Drainage Wellpoint System. If necessary, the Contractor shall dewater the excavations by means of an efficient drainage wellpoint system which will drain the soil and prevent saturated soil from flowing into the excavation. The wellpoints shall be designed especially for this type of service. The pumping until shall be designed for use with the wellpoints, and shall be capable of maintaining a high vacuum and, of handling large volumes of air and water at the same time.

The installation of the wellpoints and pump shall be done under the supervision of a competent representative of the manufacturer. The Contractor shall do all special work such as surrounding the wellpoints with sand or gravel or other work which is necessary for the wellpoint system to operate for the successful dewatering of the excavations.

Trench Excavation. Where pipe is to be laid in gravel bedding or concrete cradle, the trench may be excavated by machinery to, or to just below, the designated subgrade, provided that the material remaining at the bottom of the trench is no more than slightly disturbed.

Where pipe is to be laid directly on the trench bottom, the lowest part of trenches in earth shall not be excavated to subgrade by machinery, but just before the pipe is to be placed, the last of the material to be excavated shall be removed by means of hand tools to form a flat or shaped bottom, true to grade, so that the pipe will have a uniform and continuous bearing and support on firm and undisturbed material between joint except for limited areas where the use of pipe slings may have disturbed the bottom.

Depth of Trench. Trenches shall be excavated to such depths as will permit the pipe to be laid at the elevations, slopes, or depths of cover indicated on the drawings and as specified.

Width of Trench. Pipe trenches shall be made as narrow as practicable and shall not be widened by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.

Trenches shall be excavated with approximately vertical sides between the elevation of the center of the pipe and an elevation one foot above the top of the pipe.

Trench Excavation in Fill. If pipe is to be laid in embankments or other recently filled material, the material shall first be placed to the top of the fill or to a height of at least one foot above the top of the pipe, whichever is the lesser. Particular care shall be taken to ensure maximum consolidation of material under the pipe location. The pipe trench shall be excavated as though in undisturbed material.

Excavation Near Existing Structures. Attention is directed to the fact that there are pipes, drains, and other utilities in certain locations. Some of these have indicated on the drawings, but no attempt has been made to show all of the services and the completeness of accuracy of the information given is not guaranteed.

As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools. Such manual excavation when incidental to normal excavation shall be included in the work to be done under items involving normal excavation.

Where determination of the exact location of pipe or other underground structure is necessary for doing the work properly, the Contractor may be required to excavate test pits to determine such locations. When such test pits may be properly considered as incidental to other excavation, the Contractor shall receive no additional compensation, the work being understood to be included as part of the excavation. When the Engineer orders test pits beyond the limits of excavation he considers a part of the work, such test pits shall be paid for as specified under MEASUREMENT AND PAYMENT.

Protection of Existing Structures. All existing pipes, poles, wires, fences, curbing, property line markers and other structures which the Engineer decided must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from injury by the Contractor. Should such items be injured, they shall be restored by the Contractor, without compensation, to at least as good condition as that in which they were found immediately before the work was begun.

Relocation and Replacement of Existing Structures. Whenever the Contractor encounters certain existing structures as described below and is so ordered in writing, he shall do the whole or such portions of the work as he may be directed, to change the location of, remove and later restore, replace such structures, or to assist the owner thereof in so doing. For all such work the Contractor shall be paid under such items of work as may be applicable, other as Extra Work.

In removing existing pipes or other structures, the Contractor shall use care to avoid damage to materials, and the Engineer shall include for payment only those new materials which, in his judgment, are necessary to replace those unavoidably damaged.

The structures to which the provisions of the preceding two paragraphs shall apply include pipes, wires and other structures which meets all of the following: (a) are not indicated on the drawings otherwise provided for, (b) encroach upon or are encountered near and substantially parallel to the edge of the excavation, and (c) in the opinion of the Engineer will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced.

When fences interfere with the Contractor's operations, he shall remove and (unless otherwise specified) later restore them to at least as good condition as that in which they were found immediately before the work was begun, all without additional compensation. The restoration of fences shall be done as promptly as possible and not left until the end of the construction period.

Care and Restoration of Property. The Contractor shall enclose the trunks of trees adjacent to his work and not to be cut, with substantial wooden boxes of such height as may be necessary to protect them from injury from piled material, from equipment, from his operations, or otherwise due to his work. Excavation machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees not to be cut and particularly to overhanging branches and limbs.

Branches, limbs, and roots shall be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. In case of cutting or unavoidable injury to branches, limbs, and trunks or trees, the cut or injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.

Cultivated hedges, shrubs, and plants which might be injured by the Contractor's operations shall be protected by suitable means or shall be dug up and temporarily replanted and maintained. After the construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of kinds and quality at least equal to the kinds and quality existing at the start of the work.

On paved surfaces the Contractor shall not use or operate tractors, bulldozers, or other power-operated equipment the treads or wheels of which are so shaped as to cut otherwise injure such surfaces.

In locations where excavation passes thus existing agricultural areas and fields, the cost of repairing the trench surface is to be included in the pipe laying price.

In such areas, the existing loam and surface materials are to be stripped and placed one side prior to excavation. After completion of backfilling, this "saved" surface material is to be returned tot he top of the trench. After natural settlement and compaction has taken place, the trench surface is to be harrowed, dragged and mechanically raked as necessary to produce a smooth and level surface. The area is then to be sowed with "orchard grass" or "rye grass" or other such materials to hold the soil and produce a growth similar to that existing prior to pipe laying operations.

This provision for clean-up in agricultural areas applies only to locations where the trench surface is now substantially pasture land or the equivalent thereof. In cases where the trench surface running alongside a road is in scrub growth or natural weed growth, this provision will not apply.

All surfaces which have been injured by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately before work was begun. Suitable materials and methods shall be used for such restoration.

The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

Unauthorized Excavation. If the bottom of any excavation is taken out beyond the limits indicated or prescribed, the resulting void shall be backfilled at the Contractor's expense with thoroughly compacted, screened gravel, if the excavation was for a pipeline, or with Class B concrete, if the excavation was for a masonry precast structure.

Elimination of Unsuitable Material. If material unsuitable for foundation (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried in accordance with the drawings and/or specifications, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted screened gravel, bank-run gravel, fine aggregate or concrete as directed.

Disposal of Surplus Excavated Materials. No excavated materials shall be removed from the site of the work or disposed of by the Contractor except as directed or approved.

Surplus excavated materials suitable for backfill shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill; shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes within a haul of one mile from the point of excavation; all as directed or approved and without additional compensation.

Surplus excavated materials not needed as specified above shall be hauled away and dumped by the Contractor, at his expense, at appropriate locations, and in accordance with arrangements made by him.

Dust Control. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, so as to minimize the creation and dispersion of dust. If the Engineer decides that it is necessary to use liquid or pelletized calcium chloride for more effective dust control, the Contractor shall furnish and spread the material as directed at no additional cost to the Owner.

Bridging Trenches. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings where requires for the accommodation of travel, and to provide access to private property during construction, and shall remove said structures thereafter.

Backfilling – General. In general, and unless other material is indicated on the drawings or specified, material used for backfilling trenches and excavations around structures shall be suitable material which was removed in the course of making the construction excavations.

Frozen material shall not be placed in the backfill nor shall backfill be placed upon frozen material. Previously frozen material shall be removed or shall be otherwise treated as required, before new backfill is placed.

Wherever a percentage of compaction for backfill is indicated or specified, it shall be the percent of maximum density at optimum moisture as determined by Method D of ASTM Standard Methods of Test for Moisture – Density Relations of Soils Using 10 lbs. Rammer and 18-inch Drop, Designation D1157-70.

Fill and Backfill Under Structures. Unless otherwise indicated or specified, all fill and backfill under structures and pavements adjacent to structures shall be compacted bank-run gravel containing not more than ten percent material passing a 200 sieve. When coarse aggregate and fine aggregate are indicated or specified for use under structures, they shall conform to the requirements for coarse and fine aggregate specified under CONCRETE MASONRY.

The fill and backfill materials shall be placed in layers not exceeding 6 inches in thickness. Unless otherwise indicated or specified, each layer shall be compacted to 95 percent.

Backfilling Around Structures. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage. As soon as practicable after the structures are structurally adequate and other necessary work has been done, special leakage tests, if required, shall be made. Promptly after the completion of such tests, the backfilling shall be started and then shall proceed until its completion.

The best of the excavated materials shall be used in backfilling within two feet of the structures. Unequal soil pressures shall be avoided by depositing the material evenly around the structures. The material shall be placed and compacted to 90 percent unless otherwise indicated or specified.

Backfilling Pipe Trenches. As soon as practicable after the pipes have been laid and the joints have acquired a suitable degree of hardness, if applicable, or the structures have been build and are structurally adequate to support the loads, including construction loads to which they will be subjected, the backfilling shall be started and thereafter it shall proceed until its completion.

With the exception mentioned below in this paragraph, trenches shall not be backfilled at pipe joints until after that section of the pipeline has successfully passed any specified test required. Should the Contractor wish to minimize the maintenance of lights and barricades and the obstruction of traffic, he may, at his own risk backfill the entire trench, omitting or including backfill at joints as soon as practicable after the joints have acquired a suitable degree of strength. He shall, however, be responsible for removing and later replacing such backfill, at his own expense, should he be ordered to do so in order to locate and repair or replace leaking or defective joints or pipe.

a. Materials. The nature of materials will govern both their acceptability for backfill and the methods best suited for their placement and compaction in the backfill. No stone or rock fragment larger than 12 inches in greatest dimension shall be placed in the backfill nor shall large masses of backfill material be dropped into the trench in such a manner as to endanger the pipeline. If necessary, a timber grillage shall be used to break the fall of material dropped from a height of more than five feet. Pieces of bituminous pavement shall be excluded from the backfill unless their use is expressly permitted, in which case they shall be broken up as directed.

b. Zone Around Pipe. The zone around the pipe shall be backfilled with the materials and to the limits indicated on the drawings. Material shall be compacted to 90 percent by tamping.

c. Remainder of Trench. The remainder of the trench above the zone around the pipe shall be compacted by tamping in accordance with the nature of the material and the compaction requirements. In general, the tamping method will be used by the Contractor to achieve the desired compaction.

d. Tamping. If the material is to be compacted by tamping, or under appropriate circumstances, rolling, the material shall be deposited and spread in uniform, parallel layers not exceeding 8 inches thick before compaction. Before the next layer is placed, each layer shall be tamped as required so as to obtain a thoroughly compacted mass. Care shall be taken that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted. When the trench width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe, backfill may, on approval, be compacted by the use of suitable rollers, tractors, or similar powered equipment instead of by tamping. For compaction by tamping (or rolling), the rate at which backfilling material is deposited in the trench shall not exceed that permitted by the facilities for its spreading, leveling and compacting as furnished by the Contractor.

   If necessary to ensure proper compaction by tamping (or rolling), the material shall first be wet by sprinkling. However, no compaction by tamping (or rolling) shall be done when the material is too wet either from rain or too great an application of water to be compacted properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compacting, or such other precautions shall be taken as may be necessary to obtain proper compaction.

g. Miscellaneous Requirements. Whatever method of compacting backfill is used, care shall be taken that stones and lumps shall not become nested and that all voids between stones shall be completely filled with fine material. Only approved quantities of stones and rock fragments shall be used in the backfill; the Contractor shall, as part of the work done under the items involving earth excavation and rock excavation as appropriate, furnish and place all other necessary backfill material.

   All voids left by removal of sheeting shall be completely backfilled with suitable materials, and thoroughly compacted.

   Excavated material which is acceptable to the Engineer for surfacing or pavement sub-base shall be placed at the top of the backfill to such depths as may be specified elsewhere or as directed. The surface shall be brought to the required grade and stones raked out and removed.

Material for Filling and Embankments. Approved selected materials available from the excavations and not required for backfill around pipes or against structures, shall be sued for filling and building embankments, except as otherwise specified. The contractor shall be responsible to handle this material, stockpile, and re-handle it as directed; all without additional compensation. Material needed in addition to that available from construction operations shall be obtained from approved gravel banks or other approved deposits.

All material, whether from the excavations or from borrow, shall be made of such nature that after it's been placed and properly compacted, it will make a dense, stable fill. It shall not contain vegetation, masses of roots, individual roots, more that 18 inches long, or more than ½ inch in diameter, stones over 6 inches in diameter, or porous matter. Organic matter shall not exceed minor quantities and shall be well distributed.

Preparation of Subgrade. The Contractor shall remove loam and topsoil, loose vegetable matter, stumps, large roots, etc., from areas upon which embankments will be built or material will be placed for grading. The subgrade shall be shaped as indicated on the drawings and shall be so prepared by forking, furrowing, or plowing that the first layer of the new material placed thereon will be well bonded to it.

Placing and Compacting Embankment Material. After the subgrade has been prepared as hereinbefore specified, the material shall be placed thereon and built up in successive layers until it has reached the required elevation.

Layers shall not exceed 12 inches in thickness before compaction. In embankments at structures, the layers shall have a slight downward slope away from the structure; in other embankments the layers shall have a slight downward slope away from the center. In general, the finer and less previous materials shall be placed against the structures or in the center, and the coarser and more pervious materials, upon the outer parts of embankments.

Each layer of material shall be compacted by the use of approved rollers or other approved means so as to secure a dense, stable, and thoroughly compacted mass. At such points as cannot be reached by mobile mechanical equipment, the materials shall be thoroughly compacted by the use of suitable power-driven tampers.

Previously placed or new materials shall be moistened by sprinkling, if required, to ensure proper bond and compaction. No compacting shall be done when the material is too wet, from either rain or too great an application of water, to compact it properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction, or such other precautions shall be taken as may be necessary to obtain proper compaction.

The portion of embankment constructed below proposed structures shall be compacted to 95 percent. The top two feet of an embankment below a pavement base shall be compacted to 95 percent. All other embankments shall be compacted to 90 percent.

GRAVEL BORROW

General
Gravel Borrow
Placement and Compaction

General. The gravel borrow base shall conform to the specifications set forth in the following sub-sections as well as the Commonwealth of Massachusetts Highway Department "Standard Specification for Highway and Bridges," 1988 Edition, as amended and corrected along with recommendations presented in "Geotechnical Engineering Recommendations, New Parking Garage, Olive Street, Greenfield, Massachusetts" by O'Reilly, Talbot & Okun, dated February 23, 2017.

Gravel Borrow. Gravel Borrow shall consist of inert material that is hard, durable stone and course sand, free from loam and clay, surface coatings, and deleterious materials. Gradation requirements for gravel shall be determined by AASHTO-T11 and T27 and shall conform to the following:

Sieve	Percent Passing
½ inch	50-85
No. 4	40-75
No.50	8-28
No. 200	0-10

Maximum size stone in Gravel Borrow shall be 2 inches.

All gravel borrow must be approved prior to placement. The Contractor shall deliver suitable samples of gravel borrow to the Engineer for testing purposes. At the end of a 48 hour period, the Engineer shall either accept or reject the material. Existing on-site base material must be approved by the Engineer prior to re-use.

Placement and Compaction. The base course shall be placed to the depths as specified by the Engineer or his representatives. The gravel shall be placed in a maximum of 4-inch lifts and shall be thoroughly compacted to not less than 95% of the maximum dry density.

STONE BORROW

General
Stone Borrow
Placement

General. The stone borrow base shall conform to the specifications set forth in the following sub-sections as well as the Commonwealth of Massachusetts Highway Department "Standard Specification for Highway and Bridges," 1988 Edition, as amended and corrected along with recommendations presented in "Geotechnical Engineering Recommendations, New Parking Garage, Olive Street, Greenfield, Massachusetts" by O'Reilly, Talbot & Okun, dated February 23, 2017.

Stone Borrow. Crushed stone shall consist of one or the other of the following material:

1. Durable crushed rock consisting of the angular fragments obtained by breaking and crushing solid or shattered natural rock, and free from a detrimental quantity of thin, flat, elongated or other objectionable pieces. A detrimental quantity will be considered as any amount in excess of 15% of the total weight. Thin or elongated pieces are defined as follows: Thin stones shall be considered stones whose average width exceeds four (4) times the average thickness. Elongated stones shall be considered stones whose average length exceeds four (4) times the average width

2. Durable crushed stone obtained by artificial crushing of gravel boulders for fieldstone with a minimum diameter before crushing of 8 in.

The crushed stone shall be free from clay, loam or deleterious material and not more than 1.0% of satisfactory material passing a No. 200 sieve will be allowed to adhere to the crushed stone. Where crushed stone is to be used for surfacing, this requirement shall be not more than 0.5% of satisfactory material passing a No.200 sieve. The crushed stone shall have a maximum percentage wear as determined by the Los Angeles Abrasion Test (AASHTO-T-96) as follows:

1.	For Class 1 Bit. Conc.	30%**
2.	For Cement Concrete Aggregate	45%***
3.	Crushed Stone for Subbase	45%

**Crushed stone for this use shall consist of crushed or shattered natural rock only.
***Except for 5000 psi or greater cement concrete and pre-stressed concrete which shall be 30%

The crushed stone shall be uniformly blended according to the grading requirements for the respective stone sizes shown in the following table.

Sieve	Percent Passing
1 ½” Crushed Stone	
2”	100
1 ½”	95 – 100
1”	35 – 70
¾”	0 – 25

Sieve	Percent Passing
¾ ” Crushed Stone	
1”	100
¾”	90 – 100
½”	10 – 50
3/8”	0 – 20
No. 4	0 – 5

Placement. The stone borrow shall be placed as specified by the Engineer or his representatives. The stone borrow is not intended to be an aide to dewatering.

SUBSURFACE INVESTIGATION (TEST PITS)

General. Copies of soil boring logs and groundwater monitoring data are included in the contract documents. The drawings indicate conditions as they are believed to exist upon limited subsurface exploration. Investigations and field tests should be conducted to verify conditions that exist in the field. All investigations must be conducted under the Engineer's observation.

Provide the Engineer with a 24-hour notice prior to subsurface investigation. Excavate test pit as indicated or as requested by the owner. Expose the top of the pipeline, and adjacent utilities at each test pit location. Measure the depth to the top of the pipeline, as well as to adjacent utilities, from the ground surface. Record location, depth, and size of pipelines and utilities uncovered. Record any pertinent information as a result of excavating the test pit. The Contractor may, at their expense and with permission by the Owner, perform addition explorations not ordered by the Engineer.

All subsurface investigations shall be conducted in accordance with 29 CFR Part 1926 Subpart P – OSHA Excavation Regulations 1926.650 through 1926.652 including Appendices A through F. After observation by the Engineer, backfill and compact the test pit, repair disturbed area using appropriate means.

REMOVE AND REPLACE SIDEWALK

General
Excavation to Subgrade
Forms
Adjusting Embedded Items
Placement, Finishing and Contraction Joints
Expansion Joints
Wheelchair Ramps
Linseed Anti-Spalling Compound
Joint Sealer
Curing
Welded Wire Fabric
Cure Time at Driveways
Access to Properties

General. The Contractor shall furnish all labor, materials, tools and equipment necessary to excavate and dispose of all existing sidewalks, aprons, driveway materials, and bituminous concrete as indicated on the drawings and as directed by the Engineer. The existing sidewalk shall be broken up using pneumatic hammers or other approved means, and removed and disposed of in a suitable manner. Care shall be taken to not damage or destroy any existing utilities. The Contractor shall furnish all labor, materials, tools and equipment necessary to construct a reinforced concrete sidewalk as shown on the plans and herein specified including recommendations presented in the "Geotechnical Engineering Recommendations, New Parking Garage, Olive Street, Greenfield, Massachusetts" By O'Reilly, Talbot & Okun, dated February 23, 2017.

Excavation to Subgrade. If, upon inspection of the existing gravel base course, the Engineer decided that it is a suitable base, the Contractor shall grade the existing base course to provide for surface drainage. The pitch of the sidewalk shall meet the existing grade or a grade of ¼ inch maximum per foot towards the street. If the existing base is inadequate, the Contractor shall excavate this material to the required depth and place a gravel base at a 6-inch depth under 4-inch sidewalks and 12-inch depth under 6-inch sidewalks at driveways and 9" of gravel under 6" sidewalks and handicap ramps, and pitch the sidewalk to achieve proper drainage to the street. Gravel shall be placed as specified.

Forms. Side forms and transverse forms for sidewalks shall be clean, smooth, free from warp, of sufficient strength to resist springing out of shape, and of a depth to conform to the thickness of the proposed walk. The forms shall be well staked and thoroughly braced and set to the established lines. All forms shall be oiled before placing concrete. Forms shall not be removed for 12 hours after the concrete has been placed, or long if directed.

Adjusting Embedded Items. As necessary to meet the final finished grade as indicated on the drawings, all embedded items (including but not limited to manhole covers and frames, catch basin grates and frames, valve boxes and other construction castings) shall be properly adjusted to their new elevation.

If, in the opinion of the Engineer, the existing water service valve boxes are suitable for use, the valve boxes shall be adjusted to meet proposed grade. If the existing top section cannot be adjusted to meet proposed grade a new top section shall be provided.

Placement and Finishing. The concrete sidewalk slabs shall be placed in alternate slabs 30 feet in length except as otherwise ordered. The slabs for sidewalks shall be separated by transverse preformed expansion joint fillers and sealer ½ inch thickness, as specified. Concrete placement shall comply with the requirements as specified under CONCRETE WORK for mixing and placing concrete and as herein specified. Concrete shall not be placed until forms have been checked for line and grade.

Unless otherwise specified, concrete shall be 4000 psi and shall meet MHD Standard Specifications as specified in Section M4.02.00 of the "Standard Specifications for Highways and Bridges," Commonwealth of Massachusetts, Department of Public Works, 1988 Ed., as amended and corrected. Subbase shall be moistened as necessary to provide a uniform damp condition at the time of concrete placement.

Concrete shall be placed in a continuous operation using methods which prevent segregation of mix. If placement is interrupted for more than ¼ hour, the Contractor shall place a construction joint. Construction joints shall be placed at score lines only, using a standard metal key-way section form.

After striking off and consolidating the concrete, the contractor shall smooth the surface by screening and floating. The surface shall then be checked for trueness and troweled to remove irregularities.

After troweling, contraction joints shall be scored and edging done. When excess moisture or surface sheen has disappeared, the surface shall be broomed lightly at right angles to the curb or as directed.

Tooling of edges and contraction joints shall then be repeated to remove broom finish in these areas.

The surface of all concrete sidewalks shall be uniformly scored with contraction joints into block unit of areas not more than 36 square feet as directed. The depth of the scoring shall be 1 inch.

Expansion Joints. The premolded expansion joint filler and sealer shall be as indicated on the drawings or as herein specified.

The premolded joint filler shall be:

Preformed resilient, bituminous-type filler, conforming to ASTM D994-71.

The filler strips shall be the full depth of the indicated ½-inch thick joint.

The Contractor shall provide smooth #5 bar dowels at all expansion joints and install the dowels with expansion caps as detailed at intervals of 18 to 24 inches on center.

The Contractor shall drill holes 18" minimum on center for the sliding end of dowels, in existing abutting stone or masonry to prevent surface differential movement as indicated on the plans or as directed by the Engineer.

The Contractor shall provide premolded joint filler for joints abutting curbs, manholes, hydrants, telephone poles and other fixed objects, unless otherwise indicated or directed.

Expansion joints shall be provided at approximately 30 feet on centers at the nearest even multiple of the scoring interval.

The joint filler shall extend full width and full depth of joint and shall have a cap insert or other suitable device to maintain a full joint width and an open joint of not less than ½ inch or more than 1 inch for the joint sealer. The joint sealer shall be of the polyurethane type (conforming to A.S.T.M. C920 Class 25).

Wheelchair Ramps. Wheelchair ramps shall be built at all corners and crosswalks. Wheelchair ramps shall be built to the specifications set forth in the preceding sub-sections and the concrete shall meet MHD Standard Specifications as specified in Section M4.02.00 of the "Standard Specifications for Highways and Bridges," Commonwealth of Massachusetts, Department of Public Works, 1988 Ed., as amended and corrected. Curb work shall conform to the specifications set forth, whichever applies to a given case.

Linseed Anti-Spalling Compound. The Contractor shall coat the freshly poured concrete with linseed anti-spalling compound in front of all gasoline stations. The linseed anti-spalling compound shall conform to the specifications set forth in Section M9.15.0 of the Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, 1988 Ed., as amended and corrected.

Joint Sealer. Joint sealant shall be a multi-component polyurethane type and shall comply with ASTM C920 Class 25. Joint sealants shall be installed according to the manufacturer's recommendations.

Curing. All concrete work shall be kept continuously moist for a period of 120 hours immediately following initial or completion of surface finishing. The temperature of the concrete shall be maintained between 40 degrees F and 90 degrees F during the curing period.

A membrane curing compound shall be applied after finishing work is complete. Two coats shall be applied totaling one gallon per 150 square feet, at right angles, with an approved sprayer.

Welded Wire Fabric. Welded wire fabric shall be six by six inch cold drawn steel welded mesh. All wire shall be ten (10) gauge, unless otherwise noted. Wire fabric shall be embedded in the concrete 1" from the bottom of the slab.

Cure Time at Driveways. A curing time of at least five (5) days must elapse before a sidewalk is opened to heavy truck traffic. All other vehicles may pass over the sidewalk after two (2) days have elapsed. When high early concrete is used cure time may be reduced at the Engineer's discretion.

Access to Properties. Where access to properties is critical ramps shall be placed as directed by the Engineer. Payment for ramps shall be under Item 1 Mobilization/De-Mobilization.

ADJUSTMENTS TO EXISTING STRUCTURES

General
Drainage Structures Adjusted
Sewer Manholes Adjusted
Valve Boxes and Curb Boxes Adjusted

General. The contractor shall furnish all labor, materials, and equipment and shall do all work necessary to adjust existing drainage structures, sewer manholes, valve boxes and curb boxes as indicated on the plans or as directed by the Engineer.

The work shall consist of adjusting line and/or grade of the existing frames or boxes including removal, replacement or addition of brick, mortar, and concrete.

Drainage Structures Adjusted. All work necessary for the adjustment of existing drainage structures shall conform to Item 201 of the Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, 1988 Ed., as amended and corrected.

Sewer Manholes Adjusted. All work necessary for the adjustment of existing sewer manholes shall conform to Item 202 of the Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, 1988 Ed., as amended and corrected.

Valve Boxes and Curb Boxes Adjusted. The existing valve boxes and curb boxes shall be completely removed, if necessary, and shall be reset plumb and centered directly over the operating nut.

Heavy pattern valve box and curb box extensions shall be used when the overlap of the upper section and lower section of the existing valve box or curb box is less than six (6) inches.

Concrete collars, as shown on the standard details shall be installed on all valve boxes and curb boxes located in paved areas.

FURNISHING NEW CASTINGS

Inadequate Castings: If, in the opinion of the Engineer, any of the castings to be adjusted (either frames and grates or water gate boxes) are inadequate, the Contractor shall be responsible for furnishing and delivering to the site new castings to replace them.

The Contractor shall excavate and remove the inadequate casting and replace it with the provided new casting. The inadequate castings shall be set aside for salvage by the Town.

For payment purposes, a casting removed and replaced with one provided by the Contractor, will be compensated at the same lump sum price as a casting removed and reset under the appropriate bid item.

FURNISHING AND SETTING GRANITE, PRECAST CONCRETE CURB, OR CAST IN PLACE CONCRETE CURB

General
Excavating Trench
Foundation
Setting Curb
Trench Filling
Concrete Patch
Bituminous Concrete Patch
Pointing
Mortar
Granite Curb
Precast Concrete Curb
Cast in Place Concrete Curb
Cast in Place Curb Reinforcement

General. The Contractor shall furnish all labor, materials, tools and equipment necessary to install curb as indicated on the plans and as herein specified.

Excavating Trench. The trench for the curb shall be excavated to width of 12 inches. Bituminous and cement concrete surfaces required to be removed adjacent to pavement that is to remain shall be saw-cut to 2-inch minimum depth and removed by hand pneumatic tools. The trench shall be excavated to a depth below the proposed finished grade of the curb equal to the depth of the curbstone plus 6 inches.

Foundation. The foundation for the curb shall be 6 inches deep and consist of approved gravel conforming to the specifications set forth, placed on the subgrade and thoroughly compacted.

Setting Curb. Curbing or curb corners shall be set on additional gravel placed on the foundation. All spaces under the curb or curb corners shall be filled with gravel and compacted so that the curb or curb corners will be completely supported throughout their length. The curb or curb corners shall be fitted together as close as possible. All curbs except corners shall be set with straight alignments and grades and shall, where new curb meets existing curb, match the grade and alignment.

Trench Filling. After the curb or curb corners are set, the space between the curb and the wall of the trench shall be filled with approved gravel and compacted to the proper depth.

Concrete Patch. A concrete patch 4 inches in depth shall be placed to allow for a one inch bituminous concrete patch. Concrete shall be a minimum 3000 psi mix.

Bituminous Concrete Patch. A one inch bituminous concrete patch shall be placed on the concrete and rolled to match the road surface.

Pointing. The joints between curbstones, both front and back, shall be filled with cement mortar and neatly pointed on the top and front exposed portions. After pointing, the curbstones shall be cleaned of all excess mortar that may have been forced out of the joints.

Mortar. Mortar shall conform to the specifications set forth in Section M4.02.15 of the Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, 1988 Ed., as amended and corrected.

Granite Curb. All granite curb shall conform to the specifications set forth in Section M9.04.01 of the Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, 1988 Ed., as amended and corrected, for granite curb Type VA4.

Precast Concrete Curb. All precast concrete curb shall conform to the specifications set forth in Section M4.02.14 of the Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, 1988 Ed., as amended and corrected, for precast units.

Cast in Place Concrete Curb. Cast in place concrete curb shall conform to the specifications set forth in Section 501.63 of the Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, 1988 Ed., as amended and corrected. Cast in place concrete curb shall be used whenever grades, alignments, or placement specifications cannot be met using the other types of curb.

Cast in Place Concrete Curb Reinforcement. Where concrete curbing is to be poured on an existing concrete curb base or concrete base, rodding to the existing concrete is required. The reinforcing shall be #3 bar, nine inches long placed 12 inches on center. The concrete base shall be drilled to a minimum depth of three inches. All bars shall be at least 2” below the top of the proposed curb for the full longitudinal length of the piece. This bar is to be drilled into the existing curb to each side. Drill depth is to be a minimum of 3”. This bar is to be cut and overlapped in the center, and wire tied to the other reinforcing bars. Reinforcing bars shall conform to specifications set forth in Section M8 of the Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, 1988 Ed., as amended and corrected.

CURB REMOVED AND STACKED, REMOVED AND DISPOSED

General
Removal
Stacking
Disposal

General. The Contractor shall remove the present curb, curb corners, and curb inlets of every type and cross section made of granite, bituminous concrete, or concrete, in areas shown on the plans or as directed by the Engineer, and dispose, and/or reset and/or stack them, in an area designated by the Engineer, in accordance with the specifications herein or as directed.

Removal. A trench of sufficient width and depth shall be excavated so that the present curb, curb corners, and curb inlets can be removed without damage.

Stacking. The Contractor shall be responsible for removing, handling, and stacking, in an area designated by the Engineer, all curb that is not to be reused.

Disposal. The Contractor shall be responsible for removing, handling, and disposing of all unusable curb.

BITUMINOUS CONCRETE BINDER AND SURFACE COURSES

General
Gravel
Bituminous Concrete
Clearing and Grubbing
Walk Forms
Guarantee Period

General. The Contractor shall furnish all labor, materials, tools, and equipment necessary to construct the pavement complete, including subgrade preparations, gravel base, base and surface courses on paved areas as indicated on the drawings and as herein specified including recommendations presented in the "Geotechnical Engineering Recommendations, New Parking Garage, Olive Street, Greenfield, Massachusetts" By O'Reilly, Talbot & Okun, dated February 23, 2017.

Prior to any excavation in paved areas, the Contractor shall cut the surface between the existing and proposed pavement with an approved saw. The pavement shall be cut in as straight a line as possible to assure proper bonding between the two surfaces.

Pavement shall be placed so that the whole area will have a true and uniform surface and will conform to the proper grade and cross section.

The paving plant used by the Contractor in preparation of the bituminous concrete shall be acceptable to the Engineer who shall have the right to inspect the plant and making of the material.

All manhole covers, catch basin grates, valve and meter boxes, curbs, walks, and walls shall be adequately protected and left in a clean condition.

Gravel Base. The gravel base shall conform to the specifications. The depth of gravel shall be 10" unless otherwise indicated on the plan or specified.

Bituminous Concrete. Bituminous concrete shall conform to the specifications set forth by the applicable subsections of the Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, 1988 Ed., as amended and corrected. Pavement thickness shall be equal to a 2-inch base and a 2-inch top in all areas, or as directed by the Engineer.

All longitudinal joints occurring at interface of paved lanes shall be seated utilizing a bituminous "wedge joint" at no extra cost per MA Highway Specifications Section 430.63, all intersections and driveway approaches shall be flared and matched as directed by the Engineer, Contractor to ensure proper runoff so to prevent R.O.W. runoff onto residents' property.

Clearing and Grubbing. Clearing and grubbing shall conform to the specifications.

Walk Forms. Side forms and transverse forms for sidewalks shall be clean, smooth, free from warp, of sufficient strength to resist springing out of shape and of a depth to conform to the thickness of the proposed walk. The forms shall be well staked and thoroughly braced and set to the established lines. Forms shall be removed upon completion.

Guarantee Period. For a period of one (1) year the contractor will be required to refill and or repave areas which have settled or are otherwise unsatisfactory for traffic.

BITUMINOUS CONCRETE BERM

General. The Contractor shall furnish all labor, material, and equipment to install bituminous concrete curb which is placed on a bituminous concrete base. In accordance with these specifications and in close conformity with the lines and grades shown on the plans or established by the Engineer.

The bituminous concrete mixture shall be placed and compacted with a machine acceptable and approved by the Engineer. The machine shall be capable of spreading the mixture true to line and grade and to the shape stipulated.

If at any time before the acceptance of the work any soft or imperfect spots develop in the exposed surface of the curb, such material placed shall be removed and replaced with new material and compacted. No additional compensation shall be made to the Contractor.

TEMPORARY TRENCH PATCH

General. The Contractor shall furnish all labor, material, and equipment to install and maintain temporary bituminous concrete patches associated with the Work. No permanent paving shall proceed until a minimum of 90 days has elapsed since placement of any temporary pavement. The Contractor at his own expense and with the approval of the Engineer may hire a third party testing company to insure 95% of maximum dry density at optimum moisture content as determined in accordance with ASTM D1557 has been attained in all trenches in order to waive the 90 days prior to permanent paving.

All manhole frames, catch basin frames, and utility boxes are to be set to grade of the trench patch.

Prior to work being completed at the end of the work day, place and compact a minimum of 12 inches of gravel subbase. The Contractor will be allowed to backfill the remaining trenches to grade with gravel during the work week.

All temporary pavement and structures shall be set to the existing roadway elevations with care being taken to avoid puddles.

All trenches shall be temporarily patched at the end of the work week

BITUMINOUS CONCRETE SIDEWALK AND DRIVEWAY REPAIR

General. The Contractor shall furnish all labor, material, and equipment to repair and make new bituminous concrete sidewalk and driveways. No permanent paving shall proceed until a minimum of 90 days has elapsed since placement of any temporary pavement. The Contractor at his own expense and with the approval of the Engineer may hire a third party testing company to insure 95% of maximum dry density at optimum moisture content as determined in accordance with ASTM D1557 has been attained in all trenches in order to waive the 90 days prior to permanent paving.

Driveway aprons pavements shall be removed and replaced between the edge of the road and the sidewalk or to the property line (unless otherwise marked out by the Engineer), full width, under the following conditions. If there is a trench patch in or through the driveway, if the restoration of the roadway adversely affects the pitch or drainage of the driveway, or other reasons as approved by the Engineer.

For driveway aprons approved for replacement, remove the existing pavement back to the edge of the sidewalk, property line, or other point approved by the Engineer. If there is no sidewalk, sawcut existing pavements where the new pavement will abut. The exposed subbase shall be regraded and prepared; processed gravel shall be added or removed as necessary to properly grade the subbase to accept the specified thickness of new pavement.

TACK COAT

General: The Contractor shall furnish all labor, materials and equipment and shall do all work necessary to apply Asphalt Emulsion "Tack Coat" as directed by the Engineer.

All pavement surfaces shall be tack coated immediately prior to placing each HMA lift. HMA placed over milled surfaces shall be tack coated at an application rate of 0.07 gallon per square yard. HMA placed over smooth pavements (unmilled) shall be tack coated at an application rate of 0.05 gallons per square yard.

Tack coat shall conform to the requirements of M3.11.06 of the Commonwealth of Massachusetts Department of Public Works Standard Specifications for Highways and Bridges 1988 Ed., as amended and corrected.

The existing surface shall be cleaned of all foreign matter and loose material and shall be dry before the tack coat is placed.

PRECAST CONCRETE CATCH BASINS AND MANHOLES

Summary
References
Submittals
Quality Assurance
Products/Materials
Installation
Testing

Summary. Section includes:

a. Precast concrete catch basins and manholes
b. Cast iron frames and covers

References.

AASHTO – American Association of State Highway and Transportation Officials, Standard Specifications for Highways and Bridges, most recent edition.
ASTM C32 - Standard Specification for Sewer and Manhole Brick (made from clay or shale).
ASTM A48 – Standard Specification for Gray Iron Castings.
ASTM C150 – Standard Specification for Portland Cement.
ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.
ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections.
ASTM C443 – Standard Specification for Joints for Circular Concrete Sewer and Culvert Piping Using Rubber Gaskets.
ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Laterals.
ASTM C990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

Submittals. Submit Shop Drawings, showing details of construction, reinforcing, joints, pipe connections to structures, manhole rungs, frames and covers, and dampproofing coating.
Submit weights of frames and covers.

Submit design calculations including verification of adequate anti-flotation features and lateral earth pressures. Calculations shall verify that the manhole or catch basin structure has been designed to withstand the burial depth, submergence due to flooding, flotation, and dead and live loads.

Quality Assurance. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer, or other representative of the Owner. Such inspection may be made at the place of manufacture, or at the Site after delivery, or at both places, and the materials shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though samples may have been accepted as satisfactory at the place of manufacture. Material rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. Materials which have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced, at no additional cost to the Owner.

At the time of inspection, the materials will be carefully examined for compliance with the latest ASTM designation specified and these Specifications, and with the approved manufacturer's drawings. Precast concrete sections will be inspected for general appearance, dimension, "scratch-strength," blisters, cracks, roughness, and soundness. The surface shall be dense and close-textured.

Imperfections in precast concrete sections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs will be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at 7 days and 5,000 psi at 28 days, when tested in 3 inch by 6 inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

Personnel shall have confined space entry training as appropriate for the work to be performed. Catch basins and manholes shall be designed for lateral earth pressures and to resist flotation.

Products/Materials.
PRECAST CONCRETE SECTIONS

Precast concrete barrel sections and transition top sections, shall conform to ASTM C478 and the following requirements:

a. The wall thickness shall not be less than 5 inches for 48 inch diameter reinforced barrel sections, 6 inches for 60 inch diameter reinforced barrel sections and 7 inches for 72 inch diameter reinforced barrel sections. Wall sections shall be increased to account for extra depth conditions
b. Top sections shall be eccentric except that flat top sections shall be used where shallow cover requires a top section less than 4 feet as shown on the Drawings.
c. Barrel sections shall have tongue and groove joints.
d. All sections shall be cured by an approved method and shall not be shipped nor subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 5 days after fabrication and/or repair, whichever is longer.
e. Precast concrete barrel sections with precast top slabs and precast concrete transition sections shall be designed for a minimum of AASHTO HS20-44 loading plus the weight of the soil above at 120 pcf.
f. The date of manufacture and the name and trademark of the manufacturer shall be clearly marked on each precast section.
g. Precast concrete bases shall be monolithically constructed. The thickness of the bottom slab of the precast bases shall not be less than the barrel sections or top slab whichever is greater. Precast concrete bases shall be constructed with a 6 inch extended base, unless otherwise shown on the Drawings.
h. Knock out panels for piping shall be provided in precast sections at the locations shown on the Drawings. They shall be integrally cast with the section, 2½ inches thick and shall be sized as shown on the Drawings. There shall be no steel reinforcing in knock out panels.
i. The side wall height of the base section shall be a minimum of 12 inches above the top of the pipe coming into the manholes.

BRICK MASONRY

Bricks shall be good, sound, hard and uniformly burned, regular and uniform in shape and size, of compact texture. Underburned or salmon brick will not be acceptable and only whole brick shall be used unless otherwise permitted. In case bricks are rejected by the Engineer, they shall be immediately removed from the site of the work and satisfactory bricks substituted, at no additional cost to the Owner.

a. Bricks for the channels and shelves shall comply with the latest specifications of ASTM C32 for Sewer Brick, Grade SM.

b. Bricks for building up and leveling catch basin and manhole frames shall conform to ASTM C32 Grade MS.

c. Poured concrete inverts will not be allowed.

Mortar used in the brickwork shall be composed of one part Type II Portland cement conforming to ASTM C150 to two parts sand to which a small amount of hydrated lime not to exceed 10 lbs. to each bag of cement shall be added.
Sand used shall be washed, cleaned, screened, sharp and well graded as to different sizes and with no grain larger than will pass a No. 4 sieve. Sand shall be free from vegetable matter, loam, organic or other materials of such nature or of such quantity as to render it unsatisfactory.

Hydrated lime shall conform to ASTM C207, Type S.

FRAMES AND COVERS

Frames and covers shall be of good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of any kind. Covers and frame seats shall be machined to a true surface. Castings shall be thoroughly cleaned and subject to hammer inspection. Cast iron shall conform to ASTM A48, Class 30B.

Manhole covers shall have a diamond pattern, pickholes and the word "DRAIN", cast in 3 inch letters. Catch basin and manhole frames and covers shall be manufactured by LeBaron Foundry; Mechanics Iron Foundry; Neenah Foundry or approved equal.

Frames and covers shall comply with the detail shown on the Drawings.

JOINTING PRECAST CONCRETE SECTIONS

Tongue and groove joints of precast concrete sections shall be sealed with a preformed flexible joint sealant. The preformed flexible joint sealant shall conform to ASTM C990.

MANHOLE RUNGS

Manhole rungs shall be drop front design, 14 inches wide with an abrasive step surface, steel reinforced, copolymer, polypropylene, plastic. Manhole rungs shall conform to OSHA requirements.

FLEXIBLE PIPE-TO-STRUCTURE CONNECTORS

The flexible pipe-to-structure connectors shall be designed to provide a positive seal between the connector and the structure wall and between the connector and the pipe.

The flexible boot shall be manufactured of EPDM synthetic rubber in accordance with ASTM C443 and C923 and shall be 3/8 inch thick or greater.

The external bands shall be made entirely of 304 series non-magnetic stainless steel.

The flexible connectors shall be provided with a wedge-type or toggle-type expander to secure the pipe in the structure opening.

The flexible connectors shall meet the following criteria, in accordance with ASTM C923:

a. Shall not leak when subjected to a head pressure of 10 psi for 10 minutes.
b. Shall have the ability to deflect 7 degrees in any direction without leakage under the head pressure conditions described above.
c. Shall not leak when subject to a load of 150 lbs./in. pipe diameter and the head pressure conditions described above.

DAMPPROOFING

Provide two coats of bituminous dampproofing on outer surfaces of precast manholes at the rate of 20-25 square feet per gallon in accordance with manufacturer's instructions.

Dampproofing coating shall be a factory-applied asphalt compound specially made to adhere to below grade concrete structures.

The dampproofing shall be Sonoshield semi-mastic, as manufactured by BASF; Dehydratine 4 by Euclid Chemical; RIW Marine Liquid by Toch Brothers; or approved equal.

NON-SHRINK, WATER-PROOF GROUT

Non-shrink, water-proof grout shall be Hallemite; Waterplug; Embeco; or equal.

Installation. Construct catch basins and manholes to the dimensions shown on the Drawings and as specified. Protect all work against flooding and flotation.
Set precast concrete barrel sections so as to be plumb and with sections in true alignment with a ¼ inch maximum tolerance to be allowed.

Install the precast sections in a manner that will result in a watertight joint. Seal the joints of precast concrete barrel sections with the preformed flexible joint sealant used in sufficient quantity to fill 75% of the joint cavity. Fill the outside and inside precast section joints with non-shrink grout and finish flush with the adjoining surfaces. Plug holes in the concrete barrel sections required for handling or other purposes with a non-shrink, water-proof grout or concrete and rubber plugs, and finish flush on the inside.

Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides.

Pipe Connections

a. Stubs
    1. Connect pipe stubs for future extensions to the structures as shown on the Drawings and close the stub end by a suitable watertight plug.
b. For pipes with smooth exterior surfaces (PVC, ductile iron, HDPE pressure pipe, steel, etc), use flexible pipe-to-structure connectors.
c. Where flexible pipe-to-structure connectors cannot be used, such as pipes with rough, irregular or corrugated exterior surfaces (concrete, corrugated metal, HDPE drainage pipe, etc):
    1. After the new pipe has been set in place, completely fill the hole around the new pipe and structure with non-shrink, water-proof grout.
    2. Place a 6 inch thick concrete encasement a total of 12 inches in length around the pipe stub adjacent to the exterior wall of the structure. Concrete shall have a 28 day compressive strength of 3,000 psi.

Manhole Rung Installation

a. Steel reinforced copolymer polypropylene plastic steps shall be press fitted by hand driven hammer into preformed holes in cured precast sections, on 12 inch centers, by the precast concrete manufacturer.

Brickwork

a. Mix mortar only in such quantity as may be required for immediate use and use before the initial set has taken place. Do not retain mortar for more than one and one-half hours and constantly work over with a hoe or shovel until used. Anti-freeze mixtures will not be allowed in the mortar. No masonry shall be laid when the outside temperature is below 40°F unless provisions are made to protect the mortar, bricks, and finished work from frost by heating and enclosing the work with tarpaulins or other suitable material. The Engineer's decision as to the adequacy of protection against freezing shall be final.
b. Construct channels and shelves of brick as shown on the Drawings. The brick channels shall correspond in shape with the lower half of the pipe. The top of the shelf shall be set at the elevation of the crown of the highest pipe and shall be sloped 1 inch per foot to drain toward the flow through channel. Construct brick surfaces exposed to sewage flow with the nominal 2 inch by 8 inch face exposed (i.e., bricks on edge).
c. Set catch basin and manhole covers and frames in a full mortar bed and bricks, a maximum of 12 inches thick for conical tops and 6 inches thick for flat top sections, utilized to assure frame and cover are set to the existing grade. Reset the frames and covers to final grade prior to placement of final paving.

CLEANING

Clean new catch basins and manholes of silt, debris and foreign matter of any kind, prior to final inspection.

Testing. All precast manholes shall be subject to testing. The testing shall be one of two ways.
Vacuum Testing:

- Plug all openings with non-shrink grout and plug all pipes with suitable plugs.
- An initial vacuum of ten (10) inches Hg. Shall be drawn
- Test times shall be determined by the time required for the vacuum to drop from ten (10) inches Hg. to nine (9) inches Hg.
  - -Allowance test times are listed below:

Manhole Depth	Minimum Test Time
0 to 10 feet	1 minute
10 to 15 feet	1 ¼ minutes
15 to 25 feet	1 ½ minutes

Manholes which fail to meet the above minimum test times shall be repaired using methods approved by the Engineer.

After the manhole has been repaired it shall be re-tested using the same vacuum test procedure. Following a second vacuum test failure, the manhole shall be repaired and tested using the water exfiltration method.

Exfiltration Test.

- All pipes and openings shall be suitably plugged and braced to prevent blowouts.
- Fill manhole to the top, seal all visible leaks.
- Allow a period of time for absorption by the concrete and refill as required.
- The test period shall be eight (8) hours.
- At the end of the test period, the manhole shall be refilled to the top measuring the volume of water added. This amount shall be extrapolated to a 24 hour rate and the leakage determined on the basis of depth.
  - -The leakage for each manhole shall not exceed one (1) gallon per vertical foot for a 24 hour period
  - -If the manhole fails this requirement, and the leakage does not exceed three (3) gallons per vertical foot per day, repairs by approved methods may be made to bring the leakage within the allowable rate of one (1) gallon per foot per day
  - -Leakage due to a defective section or joint or exceeding the three (3) gallons per vertical foot per day, shall be the cause for the rejection of the manhole.
  - -It shall be the Contractors responsibility to uncover the manhole as necessary and to disassemble, reconstruct, replace it.

If the groundwater table is above the highest joint in the manhole, and if there is no leakage into the manhole, such a test can be used to evaluate the water-tightness of the manhole.

REHABILITATE EXISTING STRUCTURES

General: The Contractor shall furnish all labor, materials and equipment and shall do all work necessary to rehabilitate existing sewer or drain structures as directed by the Engineer.

The work shall consist of removing castings and deteriorated masonry until a clean sound base is obtained upon which concrete blocks and clay bricks may be used to rebuild the structure.

The remodeling shall conform to the Commonwealth of Massachusetts Department of Public Works Standard Specifications for Highways and Bridges 1988 Ed., as amended and corrected, applicable parts of Section 201.

24”, 18”, 15”, 12”, 8”, & 6” HDPE, PVC, RCP STORM DRAIN AND SEWER PIPE

General
Installation
Inspection/Testing

General. The contractor shall furnish all labor, materials, and equipment and shall do all work necessary to install dual wall, smooth interior, corrugated polypropylene pipe meeting or exceeding AASHTO MP 21-11 or corrugated polyethylene pipe meeting or exceeding AASHTO M294. All pipe joints shall be gasketed bell and spigot. Gaskets shall be integral to the spigot and protected from debris during installation. A gasket lubricant shall be applied to the bell and gasket during assembly.

The contractor shall furnish all labor, materials, and equipment and shall do all work necessary to install Poly Vinyl Chloride (PVC) or Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe, Schedule 35, and Reinforced Concrete Pipe (RCP). All PVC pipe shall meet ASTM D 1785 Standard Specification. Fittings, such as adapters, couplings, etc. shall be the same materials as the pipe. Joints shall be made in accordance with ASTM D 2855 Recommended Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe Fittings. Cements shall meet ASTM D 2564. All RCP pipe shall meet ASTM C 76-16 Standard Specification for RCP or ASTM C 655-15 standards for RCP D-Load .

All storm drain system pipes shall consist of RCP pipe that conforms to the requirements of AASHOT-M170 for Standard Strength Reinforced Concrete Culvert Pipe for Class III Pipe, unless otherwise designated on the plans, except that the steel area for 24 in. pipe shall be 0.10 square inch per foot and circular reinforcement only shall be used in circular pipes. All pipe 24 in. in diameter or smaller shall be of the bell-and spigot type. Pipes larger than 24 in. in diameter shall be tongue and groove or bell and spigot.

Installation. The Contractor shall be responsible for and pay all costs for the layout of the drain and sewer system. The Contractor shall be responsible for verifying in the field all lines, grades, dimensions and conditions affecting the work, and for all correct connections of all parts of the piping and structures in the completed drain.

The Contractor shall be responsible to verify existing invert elevations at the locations where new work shall connect to existing systems. Notify the Engineer in writing of any discrepancies found prior to starting work.

Each pipe shall be inspected prior to installation. Any pipe unit deemed defective, either before or after installation shall be removed and replaced at no additional cost to the Owner.

All pipe and fittings shall be clear of all debris, dirt, etc., prior to installation and shall be kept clean until work is accepted. Pipe and fittings shall be installed accurately to the lines and grades indicated on the drawings or as required by the Engineer. Pipes shall be laid in the dry and with the spigot end pointing in the direction of flow. At all times when pipe installation is not in progress, the open ends of the pipe shall be closed with temporary water tight plugs, or by other suitable means.

In order to insure minimum amount of movement or disturbance, no more than two (2) lengths of pipe may be laid before backfilling to a minimum of twelve (12) inches over the pipe.

The Contractor shall make all connections to the existing facilities as required by the Contract Documents.

- Provide all pipe, fittings, and appurtenances.
- Shall do all excavation and backfill as required.
- The pipe entrance to existing manholes shall be core drilled to the required diameter.
- Special attention shall be made to protect the existing sewers and structures.

Inspection/Testing.. At intervals along the sewer work, usually not more than 1000 feet, at the option of the Engineer, all portions of all sewers shall be subject to leakage tests witnessed by the Engineer. The Contractor shall have on hand all plugs, pumps, weirs, water trucks, compressors, etc., necessary to conduct the tests.

- Low Pressure Air Test: Leakage testing by means of low pressure air shall be in accordance with the procedures described in UNI-B-6, “Recommended Practices for Low Pressure Air Testing of Installed Sewer Pipe”, published by the Uni-Bell Plastic Pipe Association.

The leakage test shall be made on each manhole-to-manhole section of pipeline.

ABANDON EXISTING STRUCTURES

General. The Contractor shall furnish all labor, materials, tools and equipment necessary and shall do all work to abandon existing manholes, as specified below, as indicated on the drawings and as directed by the Engineer. Care will be taken not to damage other subsurface utilities.

Seal pipes that are to be abandoned with a concrete plug not less than 1 ½ times the pipe diameter long in the barrel of the pipeline. For example, a 10-inch diameter pipe will require that a minimum 15-inch long plug be installed. This should be performed at the manhole unless the existing manhole is to be removed. Concrete shall have a 28-day compressive strength of 3000 psi and a maximum stone size of 1 ½ inches.

Structures shall be abandoned to 3 feet below grade. The removed frames and covers shall be stored on the site for salvage by the Owner.

The Contractor shall backfill the remaining portion of the structure with clean sand and compact the sand to 90 percent density.

The excavation shall be backfilled with an approved material in accordance with EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

LOAM AND SEED

Summary
References
Quality Assurance
Submittals
Products/Materials
Preparation
Lawn Areas
Maintenance
Guarantee Period and Final Acceptance

Summary. Section includes:

a. Restoration of all vegetated areas disturbed during construction including lawn areas
b. Loam, starter fertilizer, lime, and lawn seed
c. Mulch

References.
ASTM D5539 – Standard Specification for Seed Starter Mix.

Quality Assurance. Place seed only between the periods from April 15th to June 1st, and from August 15th to October 1st, unless otherwise approved by the Engineer.

Submittals. Submit the following for approval:
Lawn seed mixture including percent by weight of each seed type, and manufacturer/supplier name.
Suitable laboratory analysis of the soil to determine the quantity of fertilizer and lime to be applied.
Lime and starter fertilizer application rates based on laboratory soil tests.

Products/Materials.

Loam

Loam shall consist of fertile, friable, natural topsoil typical of the locality without admixture of subsoil, refuse or other foreign materials and shall be obtained from a well-drained arable site. It shall be such a mixture of sand, silt and clay particles as to exhibit sandy and clayey properties in and about equal proportions. It shall be reasonably free of stumps, roots, heavy or stiff clay, stones larger than 1-inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter. Topsoil as delivered to the site or stockpiled shall have pH between 6.0 and 7.0 and shall contain not less than 5 percent or more than 8 percent organic matter as determined by loss of ignition of moisture-free samples dried at 100 degrees Celsius. The topsoil shall meet the following mechanical analysis:

	PERCENTAGE FINER
1-in screen opening	100
No. 10 mesh	95 to 100
No. 270 mesh	35 to 75
0.002 mm*	5 to 25

* Clay size fraction determined by pipette or hydrometer analysis.
Place a minimum of 4 inches of loam.

Starter Fertilizer

Starter fertilizer shall bear the manufacturer's name and guaranteed statement of analysis, and shall be applied in accordance with the manufacturer's directions.
Starter fertilizer shall be Scott's Starter Fertilizer, or equal, with timed nitrogen release to prevent burning.

Lime

Lime shall be an agricultural type ground limestone.
Lime shall be pelletized type for prolonged time release to soil.

Lawn Seed

Seed shall be of the previous year's crop.

Required ranges:
Purity > 90%
Germination > 80%
Crop < 0.5%
Weed < 0.3%
Noxious Weed – 0%
Inert < 8%

The standard seed mixture shall be applied at a minimum rate of 4 lbs./1,000 sf.
Grass seed shall conform to the following mixture in proportion by weight and weed content and shall pass the minimum percentages of purity and germination as indicated for same.

LAWN AREA SEED MIX	% WEIGHT
"Rebel II" Tall Fescue	70%
"Baron" Kentucky Bluegrass	10%
"Palmer" Perennial Ryegrass	20%

All seed shall comply with State and Federal seed laws.

A sworn certificate indicating each variety of seed, weed content, germination of seed, net weight, date of shipment and manufacturer's name shall accompany each seed shipment. Responsibility for satisfactory results rests entirely on the Contractor.

Mulch

Shall be a specially processed 100 percent Virgin wood fiber mulch containing no growth or germination-inhibiting factors. Wood fiber mulch shall be Second Nature Regenerated wood fiber as by Central Fiber Corporation, Wellsville, KS or equal. It shall be manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a homogenous slurry. When sprayed on the ground, the material shall allow absorption and percolation of moisture. Each package of the wood fiber shall be marked by the manufacturer to show the air dry weight content and not contain in excess of 10 percent moisture.

Preparation. The ground surface shall be fine graded and raked to prepare the surface of the loam for lime, fertilizer and seed.
Perform a laboratory soil test on the proposed loam before placing any lime, fertilizer, or seed. This work shall be in accordance with ASTM D5539.

Lawn Areas. Apply fertilizer and lime to the surface of the ground in accordance with the manufacturers' instructions, and based on the results of the certified soils test.
Place the seed using a drop or rotary spreader at the rate recommended by the seed manufacturer for the intended use of the lawn or grass area being restored.
After spreading the seed, lightly rake the surface to work the seed in. The surface shall then be rolled.

Maintenance. Maintain loamed and seeded areas by mulching, covering, netting, watering, cutting, and fencing until an acceptable stand of vegetation is approved by the Engineer.

The dressed and seeded areas shall be sprinkled with water as necessary from time to time. Signs and barricades should be placed to protect the seeded areas. After the grass has started to grow, all areas and parts of areas that fail to show a uniform stand of grass shall be seeded repeatedly until all areas are covered with a satisfactory growth of grass.

Guarantee Period and Final Acceptance. At the end of the guaranteed period, inspection will be made by the Engineer upon written request submitted at least 10 days before the anticipated date. Seeded areas not demonstrating satisfactory stands as outlined above, as determined by the Engineer, shall be renovated, reseeded and maintained meeting all requirements as specified herein.
After all necessary corrective work has been completed, the Engineer shall certify in writing the final acceptance of the seeded areas.

LANDSCAPING

General
Products/Materials
Construction
Maintenance
Final Acceptance

General. The Contractor shall provide all operations pertaining to the planting and maintenance of trees, shrubs, ground cover, perennials and annuals.

Products/Materials.

Plants.

A complete schedule of plants, including quantities, sizes, and other requirements, is shown on the Landscaping Drawings. The Contractor shall furnish all types of plants that are listed on the schedule. In the event of plant count discrepancy between the Plant Schedule and the plants counted on the Drawings, the Drawings shall prevail. Discrepancies between the Plant Schedule and the Drawings shall not entitle the Contractor to claim any additional compensation, nor relieve him of the obligation to complete the Work shown on the Drawings.

No substitutes shall be accepted, except with the written permission of the Engineer. The Contractor shall submit all substitution requests, noting the source of plants, location, size, and condition, within thirty (30) days of receiving the Notice to Proceed.

Each plan shall have a durable legible label with plant size and name (genus, species, variety, cultivar) securely attached when delivered and in place until after acceptance. Labels shall not girdle or damage plants.

All plants shall be true to species and variety specified and nursery grown in accordance with good horticultural practices. All plants shall be packed, transported, and handled with utmost care to ensure adequate protection against injury or damage to the root ball, and desiccation. Plants must be protected from excessive vibrations. Plants shall not be thrown or bounced off a truck or loader to the ground. Plants shall not be dragged, lifted, or pulled by the trunk or braces in a manner that will damage the branches or loosen the roots in the ball. Plants material transported in vehicles shall be protected from wind whipping either by use of covered vehicle or secure tarps.

The Engineer shall make periodic inspections prior to and during the installation and maintenance periods of the Work. All plants shall be inspected upon delivery to the job site whereupon the Engineer has the right to reject unacceptable plant material. Should plant materials observed not be in keeping with the Drawings, details, and these Specifications, the Engineer will direct the Contractor to correct by repair and/or replacement as appropriate. All rejected plant materials shall be immediately removed from the site and replaced with specified material at no additional cost to the Owner. The Engineer shall be the sole judge of the conditions of quality and acceptability and will direct all corrections in writing to the Contractor.

Mulch

Mulch shall consist of shredded bark mulch, wood chips or rock mulch as specified on the drawings. Material shall be uniform in size, color, quality and overall appearance. Mulch shall be free of material injurious to plant growth. Sources of mulch should be free of weeds and invasive plant parts or seeds. Sawdust, dirt, garbage, or other debris mixed in the mulch is not acceptable. See Mulch Specification in Section Loam and Seed within this specification package. Contractor shall submit two pounds of proposed mulch for inspection by Engineer.

Construction. Contractor shall notify Engineer five (5) working days prior to delivery of plant material to the site. Engineer shall inspect plant material prior to off-loading.

Planting shall be done when temperatures are above freezing, the ground is frost free, and the soil is in a workable condition. Unless otherwise specified in writing by the Engineer, planting of trees shall be done between May 1 and October 1.

The Contractor shall mark all planting areas with stakes or paint. The Engineer shall approve the layout before planting begins. Contractor shall not stage planting operations on sidewalks.

The Contractor shall obtain a utility locate and ensure that utility marking is complete before any excavation begins. The Contractor shall locate and subsurface improvements such as sprinkling system or conduits. The Contractor shall be responsible for all damage resulting from neglect or failure to comply with this requirement.

Maintenance. The Contractor shall furnish all labor, materials, supplies and equipment required to establish, maintain, and protect the planted and seeded areas, for a guaranteed period (typ. 1 year grow period). However, maintenance activities shall commence immediately after each item is planted or when areas have been seeded. The Contractor shall supply a maintenance schedule to the Engineer, thirty (30) days prior to the landscape inspection. The Contractor shall also be responsible for protection of his work during the maintenance period, and shall repair and replace all materials and seeded areas damaged or destroyed within the scope of Work, regardless of cause. Contractor shall replace any tree or shrub damaged by a lawnmower, weed whip or other equipment at no additional cost to the Owner.

Contractor shall supply a proposed watering schedule to the Engineer thirty (30) days prior to installation of plant materials.

Final Acceptance. A Final Acceptance Inspection of the project will occur after completion of the one year plant establishment period. Conditions governing final acceptance of the planted and seeded areas are that, in the opinion of the Engineer, all plants are in a live, uniform, and sound and healthy and flourishing condition; free of disease, insect infestation and physical damage, and free of weeds, rubbish and construction debris. If the Engineer does not accept the improvements, the Contractor shall correct all deficiencies until acceptance is received from the Engineer. All costs associated with correcting the deficiencies shall be paid by the Contractor without additional cost to the Owner.

CONCRETE WORK

General
Cement
Admixtures
Water
Fine Aggregate
Coarse Aggregate
Samples of Aggregate
Classes of Concrete
Quality and Proportioning of Concrete
Determining Proportions
Consistency of Concrete
Measuring Materials
Mixing Concrete
Ready-Mixed Concrete
Forms
Embedded Work in Concrete
Placing Concrete
Curing and Protection
Finishing Concrete
Trimming and Repairs
Expansion Joints
Construction Joints
Weep Holes

General. The Contractor shall furnish all necessary materials and build all concrete masonry required under this contract and not otherwise provided for, as indicated on the drawings and as herein specified including recommendations presented in the "Geotechnical Engineering Recommendations, New Parking Garage, Olive Street, Greenfield, Massachusetts" by O'Reilly, Talbot & Okun dated, February 23, 2017.

All concrete shall be site-mixed or ready-mixed as produced by a plant acceptable to the Engineer.

Cement. Cement shall be a single brand of approved, American-made Portland Cement conforming to the ASTM Standard Specifications for Portland Cement, Designation C150, for Type II cement, or, with written permission of the Engineer Type III (high-early strength) cement.

When used in the work, cement shall be free from lumps and partially or wholly set cement.

No cement shall be used without prior approval of the Engineer.

If required, the Contractor shall furnish sworn certificate of mill tests of cement, in triplicate, at least seven days before the cement will be used. The Owner reserves the right to make such independent tests as he may deem necessary at any time.

When high early strength concrete is required, it shall be obtained by using Type III or by adding 15% additional Type I or Type II.

Admixtures. The use of admixtures shall meet MHD Standard Specifications as specified in Section M4.02.05 of the "Standard Specifications for Highways and Bridges," Commonwealth of Massachusetts, Department of Public Works, 1988 Ed. as amended and corrected.

Water. For mixing concrete, the Contractor shall use clean water from an approved source.

Fine Aggregate. Fine aggregate shall be clean, sound, sharp, screened, and well-graded sand conforming to the ASTM Standard Specifications for Concrete Aggregates, Designation C33, and the additional requirement that the aggregate shall have not less than 15 percent more than 30 percent, by weight, passing No. 50 sieve.

No fine aggregate shall be used if it contains more than two percent of silt or which shows a color darker than Plate 2 when tested according to the ASTM Standard Method of Test for Organic Impurities in Sands for Concrete, Designation C-40.

The weight average loss when fine aggregate is subjected to five cycles of the soundness test using magnesium sulfate shall not exceed 10 percent.

Coarse Aggregate. Coarse aggregate shall be washed, hard, tough and durable screened gravel or crushed stone conforming to the ASTM Standard Specifications for Concrete Aggregates, Designation C33 and the additional requirements specified herein. Coarse aggregate shall have not more than five percent by weight of deleterious substances and soft fragments. Unless otherwise approved, aggregate shall be well graded and shall conform to the grading requirements for coarse aggregates for nominal size 1 inch to No. 4.

No coarse aggregate shall be used if it contains more than one percent of silt or which shows a color darker than Plate 1 when tested as above specified for fine aggregate.

The weighted average loss when coarse aggregate is subjected to five cycles of the soundness test using magnesium sulfate shall not exceed 14 percent.

Samples of Aggregate. As required, the Contractor shall submit clearly labeled samples of fine and coarse aggregates to the Engineer. No aggregates shall be delivered and used shall be equal to the approved samples in all respects.

Classes of Concrete. 4000 psi concrete shall be used for all concrete not otherwise specified or noted on the drawings.

Quality and Proportioning of Concrete. Materials for concrete shall be proportioned to produce a thoroughly workable, plastic mixture resulting in a dense watertight concrete. The concrete shall meet MHD Standard Specifications as specified in Section M4.02.00 of the "Standard Specifications for Highways and Bridges," Commonwealth of Massachusetts, Department of Public Works, 1988 Ed. as amended and corrected.

The use of an approved additive other than air-entrained additives shall not affect a change in the maximum water-cement ratio or the minimum cement content. The minimum cement content can be changed only with the prior written approval of the Engineer.

Determining Proportions. The proportions of cement, fine and coarse aggregate and water to be used to obtain the specified concrete shall be determined by trial at the site. Proportions may be varied as approved, and shall be varied as required, provided that, in no case, shall the resulting mix violate the limitations set forth above under the heading "Quality and Proportions of Concrete."

Consistence of Concrete. Concrete shall be of plastic consistency such that it can be work readily into all parts of the forms and around embedded work without segregation of constituent materials or collection of free water on the surface.

Measuring Materials. Cement, fine aggregate, coarse aggregate and water for concrete shall be measure separately and with accuracy. Particular care shall be taken that fractional bags of cement are correctly measured. Aggregates shall be measured by weight or loose in approved boxes, with allowance as directed for bulking of sand. Water shall be measured by volume.

Mixing Concrete. Concrete shall be mixed in an approved batch mixer of suitable capacity except for small quantities, which, by permission, are hand mixed. The volume of the mixed batch shall not exceed the manufacturer's rated capacity of the mixer. Adequate facilities shall be provided for accurate measurement of water and the control of materials entering the drum. The mixer shall revolve at a uniform peripheral speed of above 200 rpm.

The minimum mixing time for each batch (from the time when all solid materials and water are first in the drum) shall be 1-½ minutes for mixers of 1 c.y. capacity or less; for mixers of larger capacity, the mixing time shall be increased 30 seconds for each additional half cubic yard or fraction thereof. The entire batch shall be discharged before the mixer is recharged.

If the concrete is mixed by hand, it shall be done on a suitable surface. The cement and aggregates shall be mixed dry until an even and uniform color has been attained throughout. The proper quantity of water shall then be added and the whole mass turned with square-edged shovels until it has become intimately mixed.

Ready-Mixed Concrete. The use of ready-mixed concrete will be permitted provided that the Engineer shall have the right to inspect the plant of the manufacturer and the proportioning and mixing of the concrete and shall be given every facility therefore, and that the materials and methods of proportioning, mixing and delivering are satisfactory and generally in accordance with the above specifications. The manufacturer shall furnish, from an Independent testing laboratory and through the Contractor, appropriate certificates of tests, materials, proportions mixing and strengths. Such certificates shall have an effective date not more than six months prior to the time when the concrete will be used and shall be furnished to the Engineer at least seven days before the time of use. No ready-mixed concrete shall be ordered before the Engineer has given his approval thereof.

The quantity of concrete to be mixed or delivered in any one batch shall not exceed the rated capacity of the mixer or agitator as stated on the nameplate for the type of mixing in use.

At the time of delivery of each load of concrete, the Engineer shall be given a slip stating the actual quantity of each ingredient in that load.

Attention is directed to the importance of dispatching trucks from the batching plant so that they shall arrive at the site of the work just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms. Concrete shall be discharged into forms within 1 ½ hours after water was first added to the mix, and shall be mixed at least five minutes after all water has been added.

Forms. Forms shall be constructed of sound lumber, plywood or metal and shall conform accurately to the dimensions, shapes and elevations indicated on the drawings. They shall be mortar-tight, rigid and unyielding during the placing and compacting of the concrete. The Contractor shall be entirely responsible for the adequacy. Forms for manhole inverts shall be smooth, carefully built to true size and shape and accurately set.

Suitable molding or bevels shall be placed so as to produce a ¾ inch chamber on all exposed projecting corners.

Form surfaces to be in contact with concrete shall be oiled, and if reused, shall first be cleaned, repaired and re-oiled.

Forms shall not be removed until the product of the elapsed number of days after placement and the average daily air temperature at the surface of the concrete equal 100 for walls and vertical surfaces and 500 for slabs.

Embedded Work in Concrete. All embedded work shall be accurately built into or encased in the masonry by the Contractor as directed and all necessary precautions shall be taken to prevent such work from being displaced or deformed.

Placing Concrete. No concrete shall be placed on frozen subgrade or in water. Forms and excavations shall be free from water and all dirt, debris and other foreign matter when concrete is placed.

If chutes are used for conveying concrete, they shall be of metal or shall be metal lined.

Concrete shall be deposited in suitable layers, one layer quickly following another until the placement has been completed. While being deposited, the concrete shall be thoroughly compacted by rodding and spading or by mechanical vibration. If mechanical vibration is used, the concrete consistency as measured by slump shall not exceed 3 inches. Vibration shall be done by experienced operators under close supervision and the duration shall be held at the minimum necessary to produce thorough compaction without segregation. Hand spading shall always be used adjacent to forms to produce a smooth, dense surface. The concrete shall be thoroughly and carefully rodded about embedded materials.

Curing and Protection. Water shall not be permitted to rise on concrete within 24 hours after it is placed, nor shall running water be allowed to flow over complete concrete within four days after it has been placed.

For at least seven days after having been placed, all concrete shall be so protected that the temperature at the surface will not fall below 50 degrees F. The methods of protecting the concrete shall be as specified and shall be subject to approval.

Finishing Concrete. Manhole tables and all surfaces shaped without forms and over which liquids will flow shall be smoothly finished by means of a steel trowel without the use of additional cement of sprinkling with water. Troweling shall not be started until all water has disappeared from the surface. Over troweling shall be avoided.

Trimming and Repairs. It is expected that forms, concrete and workmanship shall be such that the quantity of trimming and repair work is kept to a minimum.

Defective concrete shall be cut normal to the surface until sound concrete is reached, but not less than one inch deep; the remaining concrete shall be thoroughly roughened and cleaned. Concrete around the cavity or the form-tie recess shall be thoroughly wetted and promptly painted with a 1/16-inch brush coat of neat cement mixed to the consistency of thick lead paint. The hole shall then be filled with mortar mixed in the proportions of one part cement and 1 ½ parts sand, both being form the same sources as in the apparent concrete.

Expansion Joints. Performed expansion joints shall be ½" bituminous impregnated expansion joint filler, type conforming to ASTM D994, or approved equal place where shown on the plans. The joint filler material shall be placed according to the manufacturer's recommendations. The joint filler material shall be placed such that it's top surface is one inch below the top surface of the new concrete.

Joint sealant shall be a multi-component polyurethane type and shall comply with ASTM C920, Class 25. Joint sealants shall be installed according to the manufacturer's recommendations. The Contractor shall supply smooth #35 bar dowels at all expansion joints and install the dowels, with expansion caps, 18" on center. Dowels shall be a minimum of 14" long. Depth of the dowels not shown of the plans or specified shall be as directed by the Engineer.

Expansion joints for retaining walls shall be placed 90' on center maximum, intermediate construction joints shall be placed 30' on center maximum.

Construction Joints. All construction joints in retaining walls shall be provided with a keyway and a waterstop. Keyway shall be as indicated on the plans or as specified by the Engineer.

The waterstop material shall be a minimum of 5" wide and of type, size and configuration approved by the Engineer. All waterstop material shall be installed in accordance with manufacturer's instructions and special care shall be taken in jointing the material. Waterstop shall be a diaphragm type of multirib design thermo-plastic material unless otherwise specified.

Concrete in structures shall be placed in such a manner that all construction joints shall be exactly horizontal or vertical, as the case may be, and that they shall be straight and as inconspicuous as possible.

When construction joints are definitely shown on the plans, all concrete between consecutive joints shall be placed in a continuous operation.

In order to allow for shrinkage, concrete shall not be placed against the second side of the construction joints for at least 12 hours after that on the first side has been placed.

Weep Holes. Weep holes shall be provided through all structures as indicated on the plans and as directed. Ends of weep holes that are to be covered by filling material shall be protected by ¼" mesh galvanized wire screen 23 gauge and not less than one (1) cubic yard of crushed stone.

Pipe for weep holes shall be 4" PVC pipe SDR 35 or approved equal, and shall have a minimum pitch of 1/8" per foot.

PAVEMENT MARKINGS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work includes preparation of surfaces and furnishing and applying paint for pavement and curb markings, traffic stripping, directional arrows and messages.

1.02 QUALITY ASSURANCE

A. Provide paint which is compatible with substrate material.

B. Codes and Standards: Conform to state requirements for volatile organic compound (V.O.C.) contents where applicable.

1.03 SUBMITTALS

1. Submit manufacturer's technical information in standard printed published form, including performance criteria and application instructions for each material proposed for use.

2. List each material and cross reference to the specific paint and finish system and application. Identify by manufacturer's catalog number and general classification.

1.04 JOB CONDITIONS

A. Weather: Apply traffic paint only when the ambient air temperature is 40 degrees Fahrenheit or higher and the temperature on the surface to be painted is 45 degrees Fahrenheit or higher. If pavement is wet, allow the surface to dry for a minimum of eight hours after it appears surface dry.

B. Protection of the work: Exercise care to prevent paint from dripping on the pavement, curb and sidewalks, and remove any drippings or spillage before they harden. Protect adjoining surfaces against over-spray or paint splash stains, throughout painting operations.

C. Traffic Maintenance: Furnish, install and maintain traffic cones, barricades, lights and other protective devices required to protect traffic, workmen and completed pavement marking and striping, and remove when marking and striping, including painted sections of curbing and raised traffic bars, have set and hardened to such degree that they will not be damaged.

D. Scheduling of the Work: Schedule marking and striping operations to permit paint to set and harden before the area is to be opened to traffic.

PART 2 – PRODUCTS

2.01 TRAFFIC AND PARKING STALL MARKINGS

A. Products offered by manufacturers to comply with the requirements include the following:

1. Franklin Paint, Fast Dry Waterborne Traffic Paint, item# 2015, Yellow 1952E or item# 2014, White 1952E.

2. Sherwin Williams, Hotline Fast Dry Latex Traffic Marking Paint, TM2153 LF Yellow TTP-1952D or TM2152 White TTP-1952D.

3. Or approved equal

B. Paint Application

1. First Coat: Latex Acrylic Emulsion 15 mils wet coat; yellow (AASHTO Designation M248, Traffic Type II Paints)

2. Second Coat: Same as first.

PART 3 – EXECUTION

3.01 EQUIPMENT

A. Use atomizing spray-type equipment, guides, and templates designed for the purpose and which are also designed to apply strips, symbols, and letter of uniform size and cross section, with clear-cut edges and uniform thickness for the coverage specified.

3.02 LAYOUT OF THE WORK

A. Provide sufficient control points to permit application of stripes, directional arrows, messages, crosswalk marking, and parking space delineations as shown on the drawings.

1. Locate and layout marking in a manner that will not interfere with adhesion of point or leave permanent non-specified markings.

3.03 APPLICATION

A. Surface Conditions: Do not apply paint to new bituminous pavement until 24 hours after pavement has been placed. On new Portland Cement concrete pavement, do not apply paint until the pavement has been allowed to cure for a minimum of seven days.

B. Cleaning: Clean the surface of areas to be painted of dust, dirt, laitance, oil, and other foreign substances detrimental to paint adhesion.

C. Paint directional arrows, parking stalls, marking lines, etc., to be as detailed on the Drawings. Unless otherwise detailed, single line width to be four (4") inches wide. Striped areas shall be four (4) inch wide lines eighteen (18) feet on center. Lay out all painted lines and define with chalk markings for approval before proceeding with painting.

D. Painting:

Apply paint only during daylight hours. Except for special area and markings requiring hand painting, apply all pavement marking by machine.

2. Suspend painting operations when wind conditions are such that blowing of spray-applied paint and deposit of dust on newly applied paint is likely.

3.04 CORRECTIVE MEASURES

A. Repair or remove and reapply any pavement markings that fail to satisfy the requirements indicated. Submit proposed means of cleaning, removing, or obliterating unsatisfactory markings to the Architect for approval prior to commencing corrective work. Use materials for cleaning pavement of spills, spatter, or overspray that will not injure the paved surface.

END OF SECTION

CLOSEOUT

Summary. Section includes:

a. Documentation required for the transfer of the completed Work to the Owner
b. Final Cleaning

Submittals.

a. Evidence of payment and release of liens
b. List of Subcontractors

Substantial Completion. Refer to General Conditions, for procedures relating to obtaining Substantial Completion.

Project Closeout Documents. Provide evidence of payment and release of liens.

Provide list of Subcontractors including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.

Final Payment. Refer to General Conditions, for procedures relating to final inspection and payment.

The Contract shall be considered complete and final payment made, only when:

a. All provisions of the Contract Documents have been strictly adhered to.
b. The project and premises have been left in good order, including removal of all temporary construction, Contractor-owned and extraneous materials.

Cleaning. Remove and entirely dispose of material or debris that has washed, flowed or has been placed in existing watercourses, ditches, gutters, drains, pipe, or structures, for work done under the Contract work limits. Leave ditches, channels, drains, pipes, structures, and watercourses in a clean and neat condition upon completion of the Work.

Restore or replace any public or private property damaged or removed during the course of the Work. Property shall be returned to a condition at least equal to that existing immediately prior to the beginning of operations. Complete all highway or driveway, walk, and landscaping work using suitable materials, equipment and methods. Perform restoration of existing property, signs or structures promptly as work progresses; do not leave restoration work until the end of the Contract Time.

SECTION 02300
EARTHWORK

PART 1 - GENERAL

1.1 INTRODUCTION

A. This section specifies requirements for the earthwork portion of the project, including the placement fill beneath pavements and foundations (including the load transfer pad above Rigid Inclusions).

B. Subsurface information is provided in the project geotechnical report entitled "Geotechnical Engineering Recommendations, New Parking Garage, Olive Street, Greenfield, Massachusetts, dated February 23, 2017, prepared by O'Reilly, Talbot & Okun Associates, Inc.

C. It is noted that concrete foundation walls and footings from a former site building remain along the western (adjacent to the 45 Bank Row structure) and southern (along Olive Street) sides of the site. The walls and approximately 12-inches wide, and footings are approximately 36-inches wide. They extend to a depth of approximately four feet below the existing ground surface. These walls and footings are within the footprint of the new parking garage and need to be removed in their entirety, and the excavations backfilled with sand and gravel. The cost of this work shall be included in the Contractor's bid. It is noted that other walls and footings may be present beneath the site. If these buried structures are encountered during construction, it may be necessary to remove them. If instructed to do so by the Owner, the extra cost to remove of any unidentified buried walls or footings will be compensated on a negotiated extra cost basis.

D. A stone culvert is located beneath the site. This culvert will be decommissioned as part of the project. Portions of the culvert will need to be removed as part of the project, to allow for the installation of the Rigid Inclusions. The limits of the areas where the culvert will need to be removed are shown on the plans. The contractor shall include the cost to excavate and remove the line and backfill the excavation in his bid.

1.2 SCOPE OF WORK

A. Prior to the start of construction, the General Contractor shall conduct a Preconstruction Condition Survey of residential buildings abutting the site.

B. The Contractor shall clear and grub the entire building footprint and strip pavement, sidewalks, and topsoil from the building subgrade. All trees and stumps shall be removed in their entirety.

C. The Contractor shall remove the former building foundations in the southwest portion of the site and the stone culvert as shown on the plans.

D. Following the installation of Rigid Inclusions in accordance with the requirements of Section 316600, the Contractor shall proof compact the existing soil subgrade within the building pad area and construct the Load Transfer Pad as required by the design prepared by the Rigid Inclusion specialty contractor.

E. The Contractor shall use suitable soil from off-site sources as fill to achieve final grades.

F. The Contractor shall make excavations in such a manner and to such widths that they will give suitable room for performing the Work and shall furnish and place all sheeting, bracing and supports as necessary.

G. The Contractor shall control erosion, groundwater and surface water run off such that the excavations and areas of fill placement are firm and dry and in all respects acceptable. The Contractor shall prevent the migration of sediment off site, and collect and properly dispose of all discharge water in accordance with local and state requirements and permits.

H. The Contractor shall backfill the site to the final grades and compact the subgrade in intermediate layers to the requirements set forth in this Section.

1.3 SECTION INCLUDES

A. Submittals.

B. Products.

C. Excavation and shoring or bracing as necessary.

D. Excavation and placement of Fill Materials.

E. Backfilling and Compaction.

F. Grading.

G. Geotechnical Engineering Testing.

1.4 RELATED SECTIONS

A. Section 316600, Ground Improvement by Rigid Inclusions

1.5 DEFINITIONS

A. Compaction: The tamping and rolling of all backfill placed in uniform horizontal layers not exceeding a defined uncompacted lift thickness.

B. “In-the-dry”: In-situ moisture content of no more than two percentage points above the optimum moisture content.

C. Proof-rolling: The tamping and rolling of all subgrades and processed material not exceeding a defined uncompacted lift thickness.

D. Unsuitable material: Material containing vegetation or organic material, such as mulch, peat, organic silt, topsoil sod, deleterious material, and/or particles greater than 4 inches in diameter, that are not satisfactory for use as determined by the Geotechnical Engineer.

1.6 SUBMITTALS

A. Prior to transporting any material to the site, the Contractor shall submit the name of imported material suppliers. These suppliers shall provide materials from same source throughout the work. Change of source suppliers shall require approval from Owner and the Engineer.

B. Soil samples of each proposed material shall be submitted, in airtight containers, to the Geotechnical Engineer. Samples shall consist of a 50 lb. sample of each type of fill and shall be delivered to the Engineer and Owner two weeks prior to start of construction activities.

C. Grain-size distribution analysis test data shall be delivered with the samples. The analysis shall be performed in accordance with ASTM D422.

D. Moisture-density curve data indicating the maximum dry density and optimum moisture content as determined by ASTM D1557 for each proposed source of backfill shall be submitted to the Geotechnical Engineer.

E. The Contractor shall submit to the Geotechnical Engineer and Owner, manufacturer's literature and data on proposed compaction equipment.

1.7 QUALITY CONTROL

A. Inspection and testing will be performed by the Contractor to ensure that the materials placed meet the requirements in this section. Fill materials imported from off site sources shall be chemically and geotechnically tested once for every 2,000 tons of material.

B. If fill soils are not obtained from a commercial gravel pit, the Contractor shall provide certified analytical testing of off site backfill to demonstrate that the soil does not exceed the limitations for MCP reference/reportable concentrations. Analytes shall include RCRA-8 metals, Extractable and Volatile Petroleum Hydrocarbons (EPH/VPH), and Volatile Organic Compounds (by EPA Method 8260B/5035).

C. Tests and analysis of soil material will be performed in accordance with ASTM D422, ASTM D1557, ASTM D2922, ASTM D3017 and ASTM D4318.

D. If tests indicate materials do not meet specified requirements, the Contractor shall identify an alternative borrow source, test the new material, and submit results to the Geotechnical Engineer at no cost to Owner.

1.8 LAYOUT AND GRADES

A. The Contractor shall establish permanent bench marks and replace as directed any, which are destroyed or disturbed. The Contractor shall maintain sufficient reference points at all times during construction to properly perform site grading. The existing survey benchmark shall be protected throughout the construction project.

B. Finished grades, contours, and elevations indicated on the Drawings describe final surface elevation for completed construction. The words "finished grade" as used herein shall mean 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 and existing established grades.

1.9 QUALITY ASSURANCE

A. Field inspection and testing may be performed by the Geotechnical Engineer at the Owner's expense to supplement the Contractor's Quality Control testing. Classification of all materials will be made by the Geotechnical Engineer whose decision shall be final and binding on the Contractor.

B. The Contractor shall be responsible for managing and tracking all materials excavated and placed in stockpiles for testing.

C. The Contractor shall perform in place density tests in accordance with ASTM D2922 or D3017 as the Work progresses, to determine the degree of compaction. Any corrective work required as a result of such tests, such as additional compaction, or a decrease in the thickness of layers, shall be performed by the Contractor at no additional expense to Owner. In place density testing shall be made at the Contractor's expense by a qualified geotechnical testing laboratory.

D. The Engineer's duties do not include the supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the Engineer nor any observation and testing by the Geotechnical Engineer shall excuse the Contractor from defects discovered in his Work at that time or subsequent to the testing.

E. Subgrades shall be approved for compactness and material composition prior to placing subsequent lifts. If inspections indicate Work does not meet specified requirements, the work shall be removed, replaced, and compacted at no additional cost to Owner.

1.10 REGULATORY REQUIREMENTS

A. All excavations shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P), State, and local requirements. Where conflict between OSHA, State, and local regulations exists, the most stringent requirements shall apply.

PART 2 PRODUCTS

2.1 GENERAL

A. Sand and Gravel Fill shall be a natural soil obtained from an off-site commercial source. It shall be free of ice, snow, roots, sod, rubbish, oil, hazardous material and other deleterious or organic matter. It shall be graded within the following limits:

U. S. Standard Sieve Size	Percent Finer by Weight
4 inch	100
½ inch	50-85
No. 4	40-75
No. 40	10-35
No. 200	0-8

B. Gravel Base Course Fill will be used beneath pavements and to construct the Load Transfer Pad. It shall be a natural soil obtained from an off-site commercial source. It shall be free of ice, snow, roots, sod, rubbish, oil, hazardous material and other deleterious or organic matter. It shall be graded within the following limits:

U. S. Standard Sieve Size	Percent Finer by Weight
4 inch	100
½ inch	50-85
No. 4	40-75
No. 10	30-60
No. 40	10-35
No. 100	5-20
No. 200	0-8

C. Granular Fill shall be a natural soil obtained from an off-site commercial source. It shall be free of ice, snow, roots, sod, rubbish, oil, hazardous material and other deleterious or organic matter. It shall be graded within the following limits:

U. S. Standard Sieve Size	Percent Finer by Weight
4 inch	100
No. 10	30-90
No. 40	10-70
No. 200	0-15

D. Sand and Gravel, Gravel Base Course, and Granular Fill materials obtained from off-site sources shall be acceptable for use only when accompanied by an LSP Opinion stating that the soils do not contain detectable quantities of oil and/or hazardous materials.

E. Crushed Stone shall be durable crushed rock or crushed gravel stone, free of ice, snow, sand, silt, clay, loam, shale, or other deleterious matter, graded within the following limits:

Sieve Size	Percent Finer by Weight
1 inch	100
3/4 inch	90-100
1/2 - inch	10-50
3/8 - inch	0-20
No.4	0-5

F. Dense-graded crushed stone shall consist of hard, durable particles of stone or gravel and natural or crushed sand that conforms to section M2.01.7 of the Standard Specifications and shall conform to the following grade requirements:

Sieve Size	Percent Finer by Weight
3 inch	100
1-1/2 inch	70-100
3/4 inch	50-85
No.4	30-55
No. 50	8-24
No.200	3-10

PART 3 EXECUTION

3.1 EXCAVATION AND GRADES

A. Place erosion control measures including the straw bales and silt fence prior to the intrusive work activities.

B. Contractor shall strip the subgrade of pavement, concrete slabs and unsuitable materials, and place or excavate fill materials to the grades shown on the Drawings.

C. Approximate limits of areas to be filled are shown on the Drawings.

D. Placement thickness criteria for Sand and Gravel, Gravel Base Course and Granular Fill shall be in accordance with paragraph 3.7 of this section.

E. Prior to the placement of any fill, the Contractor shall remove any unsuitable soils, as determined by the Engineer, and proof roll the existing site soils with at least four passes with a vibrating drum roller (weighing a minimum of 6,000 pounds).

3.2 GRADING

A. Clean Sand and Grave, Gravel Base Course, and Granular Fill (as specified in this Section) shall be imported to the site, and used for grading as shown on the Drawings and as directed by the Engineer.

B. The final ground surface shall be graded to the elevations shown on the Drawings.

3.3 BACKFILLING - GENERAL

A. The Contractor shall not commence backfilling operations without approval of the Engineer.

B. The contractor shall maintain a dry and firm subgrade throughout construction. Dewatering shall be performed as needed at the Contractor's expense.

C. Fill shall be placed in lifts no thicker than 9 inches and compacted to 95 percent of its maximum dry density as determined by ASTM D-1557

D. The Contractor shall strip the existing subgrade of any vegetation, topsoil, organics, debris or other unsuitable materials to the extent shown on the plans, and as required by the engineer. The subgrade shall be proof compacted using a vibratory roller to treat any loose or disturbed areas, and to provide a dense uniform surface.

E. After the subgrade has been prepared, fill material shall be placed and built-up in successive layers until the required elevations are reached. No fill shall be placed on a frozen surface, nor shall snow, ice, or other frozen material be included in fill. Wet materials containing moisture in excess of the amount necessary for satisfactory placement or compaction shall not be used.

F. All fill shall be brought up in essentially level lifts and shall be placed in levels by standard methods. Layers of fill shall not exceed nine inches in uncompacted thickness before compaction, unless otherwise specified, or as required for proper subgrade stabilization.

G. Filling operations shall continue until the fill has been brought up to the finished slopes, lines, and grades making proper allowances for thickness of the overlying topsoil

H. The entire surface of the work shall be maintained free from ruts and in a condition that will permit construction equipment to travel over any section readily. The top surface of each layer shall be made level or slightly sloped toward the center of the filled area.

I. Backfilling shall not be performed when weather conditions or the conditions of the materials are such that, in the opinion of the Geotechnical Engineer, work cannot be performed satisfactorily.

3.4 MOISTURE CONTROL

A. Moisture in fill materials shall be at or near optimum moisture content. Moisture control shall be within the range of +1 to -3 percent of optimum. This standard shall apply to all compacted fill regardless of the method of compaction used. If the Geotechnical Engineer determines that the fill material to be used is excessively wet, the Contractor shall dry the material.

B. If, in the opinion of the Geotechnical Engineer, additional moisture is required, water shall be applied by sprinkler tanks or other uniform distribution devises. If excessive amounts of water or if rain should cause excessive wetness, the area shall be allowed to dry as provided above.

3.5 COMPACTION

A. No compaction shall be done when the material is too wet. If the compacted surface of the fill layer is determined to be too smooth to provide an adequate bond with the succeeding layer, the layer shall be loosened by scarifying or disked to allow interlocking with the overlying lift.

B. Each layer of Fill material shall be compacted to secure a dense, stable, and thoroughly compacted mass.

C. If at any time, the Engineer judges the degree of compaction being obtained is insufficient; the Engineer may at her/his discretion order that a compaction test be taken. Tests in each area shall be performed at the Contractor's expense. No less than three tests per lift will be conducted in each area to confirm that adequate compaction has been achieved. Areas found to be deficient in degree of compaction shall be reworked, recompacted, regraded, and retested if required, at the sole expense of the Contractor.

D. Compaction of Fill shall be in accordance with Paragraph 3.7.

3.6 FINISHED GRADES

A. All areas covered by the project, including excavated and filled areas and adjacent transition areas shall be uniformly graded so that finished surfaces are graded to meet the surrounding topography. Areas to receive future topsoil shall be graded to allow for such material.

B. Grading shall be done by standard methods. Areas inaccessible to heavy grading equipment shall be graded by manual methods. Embankments shall be graded at all times to ensure runoff of water.

C. Final grading shall be performed in such manner as to provide proper drainage from the project site. Finished grades shall be pitched to drain away from structures completed under this Contract. In no case shall drainage from the project site be so altered or controlled as to result in damage or the potential for damage, to adjacent property, or to any portion of the Work executed under this Contract from erosion or flooding.

3.8 LIFT THICKNESS AND COMPACTION REQUIREMENTS

A. Fill material may be placed in lifts up to 9 inches and compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557.

B. Topsoil shall be placed in 6-inch lifts to finish grade, proof-rolled with two passes.

END OF SECTION

SECTION 02400
GROUND IMPROVEMENT BY RIGID INCLUSIONS

PART 1 GENERAL

1.1 INTRODUCTION

This Section specifies requirements for the construction of Rigid Inclusions (RI) as identified in the Plans and Specifications for the Project, as well as quality control testing and performance testing. Rigid Inclusions are columns of grout or concrete used to reinforce the ground to increase bearing capacity and reduce settlement of the subject parking garage structure. Rigid Inclusions are constructed with a drilling tool that displaces soil laterally, producing very little spoils. The intent of the Rigid Inclusions program specified herein is to aid in supporting the applied loads and control the settlement to less than the specified maximum values. The Contractor shall furnish all supervision, labor, material, equipment, and related services necessary to perform the work.

1.2 SCOPE OF WORK

In general, the scope of the work including the main tasks required to perform the work.

A. General Description: The work shall consist of designing, construction, monitoring, and testing of RIs as identified in this specification within the limits indicated on the 5/10/17 Precast Package and 5/10/17 Site & Utility Relocation Package. In particular, reference drawing numbers S-002 & S-101 for design loading conditons. RIs work shall meet the acceptance criteria presented in the following sections of these specifications.

B. Overview of Tasks: In connection with the RI program, as shown on the drawings, the RI Contractor shall provide all labor, materials, and equipment to accomplish the following items of work:

1. Furnish and convey grout/concrete to RI locations.

2. Construction of RIs to the lines, grades, and criteria detailed on the approved RI Shop Drawings.

3. Load test a selected RI(s) to confirm design assumptions and demonstrate that they achieve the required load carrying capacity.

4. Monitor installation parameters utilizing a Data Acquisition System.

5. Trim RI tops to design elevations and backfill open hole with material designated by RI design engineer.

6. Complete QA/QC program.

C. Performance Responsibility: It shall be the RI Contractor's responsibility to determine and implement the systems to ensure that specified criteria is achieved.

1. RI design shall be sealed by a Professional Engineer in the State of Massachusetts, and compliance with the loads and performance specifications (provided by Structural Engineer of record) shall be the responsibility of the RI Contractor.

2. RI design shall provide details and construction requirements for the Load Transfer Platform.

D. Performance Criteria

1. Provide the specified bearing pressure/capacity of the garage footings of 9,000 pounds per square foot (psf).

2. Limit total static settlement of the foundation to one inch during service conditions, as described in the drawings and geotechnical report.

3. Limit differential static settlement of the foundation to 3/4 inch during service conditions, as described in the drawings and geotechnical report.

1.3 STANDARDS AND REFERENCES

All material testing to determine specification compliance will be provided by an independent testing agency retained by the Owner. Load testing to be performed by the Contractor.

A. Applicable Standards: The most recent version of the following testing methods or standards shall/may be employed:

1. ASTM C31: Standard Practice for Making and Curing Cement Test Specimens in the Field.

2. ASTM C39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

3. ASTM C94: Standard Specification for Ready-Mixed Concrete.

4. ASTM C143: Standard Test Method for Slump of Hydraulic-Cement Concrete.

5. ASTM C150: Standard Specification for Portland Cement.

6. ASTM C172: Standard Practice for Sampling Freshly Mixed Concrete

7. ASTM C1064: Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

8. ASTM D1143: Standard Test Methods for Piles Under Static Axial Compressive Load

9. ASTM D1194: Standard Test Method for Bearing Capacity of Soil for Static Load and Spread Footings

10. ASTM D3689: Standard Test Methods for Deep Foundations Under Static Axial Tensile Load

B. Reference Documents: Reference documents to be used by the RI Contractor shall include:

1. This specification,

2. Project Drawings, and

3. Project geotechnical report entitled “Geotechnical Engineering Recommendations, New Parking Garage, Olive Street, Greenfield, Massachusetts, dated February 23, 2017, prepared by O’Reilly, Talbot & Okun Associates, Inc.

1.4 DEFINITIONS

The key terms used in this specification are defined below.

A. **Rigid Inclusions (RIs):** Ground improvement by the use of Rigid Inclusions typically uses grout elements to reinforce weak or compressible strata; resulting in increased bearing capacity and reduced settlement.

B. **Displacement Tools**: Auger or Pipe tools specially designed to displace soil laterally while advancing or retracting the tool. The displacement tool creates very little spoil.

C. **Field Quality Control Representative (FQCR):** The individual, generally titled Superintendent or Field Engineer, given specific inspection and testing tasks identified in this specification.

1.5 FOUNDATION CONTRACTOR QUALIFICATIONS

A. The RIs shall be engineered and installed by an experienced specialty foundation contractor. The RI contractor shall provide evidence of the successful completion of a minimum of five RI projects of similar (or greater) size, and with similar soil conditions. Per Paragraph 1.6, a list of these projects shall be provided with the bid.

B. The RI Contractor's job superintendent shall have a minimum of two years of method specific experience.

C. The project manager shall have at least three years of experience in RI construction, with at least the last two years in the full-time employment of the RI Contractor.

1.6 SUBMITTALS

This section details all submittals required with the bid, prior to field work, during production work, and after the work is completed. The Contractor's design submittals shall be prepared and stamped by a Professionsl Engineer, licensed in the State of Massaachusetts.

A. Bid Time Submittals: The following shall be submitted to the Owner's representative by the RI Contractor with the bid documents:

   A list of at least five previously completed projects of similar scope and purpose for approval by the Owner's representative. The list shall include a description of the project, relative size, and contact person with phone number.

B. Pre-Field Work Submittals: The following shall be submitted to the Owner's representative by the RI Contractor two weeks prior to the start of the work:

   1. Resumes of the management, supervisory, and key personnel for approval by the Owner's representative.

   2. A ground improvement design based on information contained in the project geotechnical report, sealed by an engineer licensed in the state of Massachusetts the work to be performed that demonstrates that the program achieves the specified performance criteria provided in section 1.3 of these specifications. Design calculations and working drawings shall show conformance with the RI design performance criteria. Calculations shall include an evaluation of vertical and

horizontal displacements, as well as structural requirements for the RIs to resist loads at each structural column and wall location. The working drawings shall include requirements for the materials, compaction, lateral extent and thickness of the load transfer pad.

3. Description of the equipment to be used and a detailed discussion of the RI installation procedure.

4. Proposed grout/concrete mix design and a description fo the materials to be used.

5. Proposed RI reinforcing configuration and means, methods and sequence of installation.

6. A ground improvement QA plan, as detailed in section 3.4 of the specifications.

7. Work procedures and Quality Control criteria.

8. Load test details, including the number and location of tests, test layout and procedures, and loading increments.

9. A shop drawing for review indicating the spacing, location, and depth or installation criteria of RIs to achieve the criteria outlined in this specification.

10. Schedule of values.

11. Grout mix design.

12. Grout compression test results

C. During Production Submittals: The following shall be submitted to the Owner's representative by the RI Contractor during the work:

1. Accurate daily records of all RIs constructed as detailed in section 2.1.C.2 below.

2. Any change in the predetermined RI program necessitated by a change in the subsurface conditions.

3. Load test results, analysis of the data and recommendations for design parameters prepared by an engineer licensed in the state of Massachusetts.

D. Closeout Submittal: The following shall be submitted to the Owner's representative by the RI Contractor within 15 business days of the completion of the RI work.

1. As built drawings: Drawings documenting the as built conditions of the RI work.
2. A warranty document good for one year from the date of RI work completion.

PART 2 EQUIPMENT AND MATERIALS

2.1 EQUIPMENT

The equipment used to perform the RI construction may consist of the common construction equipment, specialty equipment and data acquisition system required to perform this work.

A. General: The RI Contractor shall supply equipment in good operating condition capable of performing the work specified herein.

B. Specific Equipment Capabilities: The choice of installation rig is largely dictated by site conditions and is left to the experience of the Contractor. The equipment shall be able to apply sufficient force and/or torque to penetrate to the design depth based on the subsurface conditions represented in the project geotechnical report. The installation tool shall be of sufficient length to reach the required depth.

   Grout/concrete shall be placed using suitable pumping equipment and through suitable tubing. The system shall have a means of determining the volume of grout delivered to the tooling at any time during construction.

C. Equipment Instrumentation: The RI Contractor shall provide gauges or other instrumentation (measuring devices) to provide real time measurement and recording through a date acquisition system of:

   1. RI number, start/finish time of installation, rate of penetration, crowd pressure and/or torque, depth of treatment (or tip elevation), neat volume based on depth of treatment and volume of grout placed.

D. Communication Equipment: An adequate communication system shall be maintained between the RI rig operator and the grout pump operator.

2.2 MATERIALS

The materials incorporated in this work shall meet the following minimum standards:

A. Portland Cement: Conforming to the ASTM Standard C150/C150M.

B. Fluidifier (if required): Shall be a compound possessing characteristics which will increase the fluidity of the mixture, act as water reducing agent and retardant.

C. Water: Shall be potable, fresh, clean and free of sewage, oil, acid, alkali, salts, or organic matter.

D. Fine and Coarse Aggregate: Fine and coarse aggregate shall conform to the requirements of the RI designer, subject to review by the Owner's structural engineer..

E. Reinforcing Steel: If required, reinforcing steel shall conform to the requirements of the RI designer.

F. Geogrid/Geotextile: Geogrid (if required per the RI designer) shall conform to and be installed in accordance with the manufactures specifications and guidelines, as per the details in the drawings.

G. Grout/Concrete Mixes: Grout/concrete for Rigid Inclusions shall consist of Portland cement, sand, and water, and may also contain coarse aggregate, a mineral admixture and/or approved fluidifier. The components shall be proportioned and mixed to produce a grout capable of maintaining the solids in suspension, minimizing bleed and being pumped without difficulty. The required grout strength shall be determined by the design engineer.

PART 3 EXECUTION

3.1 SITE VISIT

Site visits are necessary in order to be aware of conditions at the work site.

A. Pre Bid Site Visit: Prior to submitting a bid price for the rigid inclusion program, the RI Contractor shall visit the site during the project prebid meeting to identify readily visible conditions in order to account for them in the bid.

B. Existing Structures: Prior to initiating work, a condition survey of structures in the immediate vicinity of the work will be performed by either the Owner or General Contractor to determine that the conditions are safe to perform the specified work. A copy of the pre-cnstruction building survey will be provided to the RI contractor prior to the start of work and a copy will be maintained in the field throughout construction. The work shall be stopped and the engineer notified if any negative structural impacts are observed (settlement, increase in crack width, etc) to nearby structures.

3.2 SITE PREPARATION

The following shall be performed by the General Contractor in support of the RI Contractor*:*

A. Removal of all surface or subsurface topsoil, brush, organic material, and other unacceptable material in accordance with the requirements of the contract documents. Removal of any surface or subsurface obstructions to the RI work.

B. Site shall be graded to an agreed working elevation. A dry, level, and stable working platform shall be provided and maintained throughout the work. Platform stability should be evaluated and certified by the owner's geotechnical engineer and the general contractor, based on equipment information provided by the specialty contractor.

C. Provision of all-weather access and maintenance thereof for the RI Contractor's equipment and workforce, and for delivery of materials to the worksite.

D. Horizontal and vertical survey control and survey layout of building corners, grid lines, footing locations, embankment limits, utilities etc., for reference by the RI Contractor for layout and performance of the RI work.

3.3 RIGID INCLUSIONS

Rigid inclusions shall be constructed in accordance with the approved design and shop drawings, provided in the design submittal (section 1.6.B).

A. Procedures: Rigid inclusions shall be constructed at the locations shown on the RI layout drawing.

(General procedure, actual procedures will vary based upon the Specialty Contractor's Means and Methods) The RI tool shall be advanced to design depth or tool refusal. During grouting the RI tool shall be filled with a grout/concrete volume adequate to maintain a positive grout head for the RI withdrawal of the tool. Grout/concrete shall be placed fully to the final RI cutoff elevation.

The grout/concrete shall be supplied at a sufficient rate during tool withdrawal to ensure that a continuous element of the full specified cross-section is formed, free from debris. The depth of the tool and volume of grout shall be measured and recorded for each element. If the grout placement in any element cannot be completed as described above, then the element shall be re-penetrated before grout has hardened and grout placed to the final RI cutoff elevation or the RI shall be completely replaced.

B. Installation criteria: Installation criteria shall be as follows:

1. Location of RIs: The RIs shall be located within 6 inches of the planned horizontal location unless otherwise approved by the RI designer.

2. Obstructions: We note that subsurface obstructions, such as old building foundations or buried utilities) may be present in the subsurface. Obstructions encountered during advancement of the RI tool that will prevent installation to the design depth, or cause the RI tool to redirect from its design location during installation shall be removed.

   Obstruction include, but are not limited to: boulders, timbers, concrete, bricks, utility lines, etc. that prevent advancement of the RI tool to the required depth or cause the RI tool to redirect from the design location. Dense natural soil, natural rock or weathered rock shall not be considered obstructions. The RI design engineer shall be notified within 24 hours of any obstructions or unexpected early refusal to verify the revised location and/or depth are acceptable.

3. Depth of work: The RIs shall be constructed to the depth/elevation shown on the approved shop drawings or to the specified refusal criteria. RI installation rigs are equipped with instrumentation to measure, display and record the tool penetration rate versus depth.

4. Diameter of RIs: The RIs shall be constructed to the diameter shown on the project drawings or the approved shop drawings.

5. Refusal Criteria: Refusal of the RI tool is defined as a reduction in the penetration rate during installation, and shall be determined by competent field personnel and the RI designer. Specific refusal criteria will depend on project geology and equipment used, and will be established at the start of fieldwork.

6. Limits of work: As shown on the project drawings.

C. Completion: Prior to completion of the RI program the following shall be completed at each RI location.

1. Grout/concrete shall be cast to the final RI cutoff elevation unless otherwise specified. If necessary, to protect Rigid Inclusions from damage due to subsequent construction activities, elements shall be dipped out prior to initial set and backfilled with gravel or granular fill. Alternatively, a steel reinforcing member may be installed into the upper portion of the element to protect against damage.

D. Subsequent Construction: A Load Transfer Platform (LTP) shall be constructed over the RI heads to transfer the design loads to the elements. The LTP shall be constructed by the project Earthwork Contractor. The lateral extend and thickness of the LTP shall be included in the RI Contractor's design submittal.

1. The LTP shall be constructed of a dense graded granular material (specified in the Earthwork specification section) and may be reinforced with one or more layers of biaxial geogrid and/or geotextile as shown in the approved RI design and shop drawings.

   Construction of the LTP shall not commence until the compressive strength of the grout has reached a value provided by the RI design engineer. LTP material, lift thickness, and compaction shall conform to the approved RI design and shop

drawings. Testing requirements shall be equal to those required by the project geotechnical engineer of record. Materials shall conform to those specified in the approved RI design and shop drawings.

Construction of the LTP shall be installed in a manner as to avoid direct contact with cured rigid inclusions. The RI Contractor and RI Design Engineer shall be notified if any heavy machinery makes contact with a cured RI during LTP construction or excessive rutting is experienced adjacent to cured RIs. Replacement RIs may be required if RIs are damaged during LTP construction. Cost of construction of the replacement RI shall be borne by the owner or LTP installer.

2. The Owner's engineer shall monitor LTP construction and foundation construction. Compaction shall be performed and accomplished as specified in the contract drawings for structural fill or LTP construction. Footing/wall construction shall be performed in a timely manner so that no degradation of the bearing surface occurs. In the case of foundation construction, if foundation concrete cannot be placed on the same day that excavation takes place, then a minimum 3 inch thick mud mat shall be placed immediately following approval of the footing excavation and LTP construction.

3.4 QUALITY CONTROL

The details of the quality control program are as follows:

A. Oversight: All RI construction shall be performed under the inspection of the Contractor's field Quality Control Officer.

B. Monitoring and logging of all RI operations for all test areas and production work will be observed and documented by the Owner's Engineer. And include at a minimum Project name, number, contactor name, column location, column diameter, tip elevation, drilling ground surface elevation, total and incremental volume of grout placed, amount of water (if any) added to the ready mix grout truck at the site, column reinforcing (if applicable) any unusual occurrences during the column installation.

C. A test program to determine specification and design compliance shall be determined by the RI designer of record and the Owner's Engineer. This test program shall be implemented in accordance with the approved design submittal and shall include; grout/concrete sampling & testing, and at a minimum of one Compression Load Test. The load test shall be conducted consistent with applicable ASTM Standards and shall be conducted to a minimum of 125% of the design RI capacity.

D. A production quality control program shall be included in the work plan submittal describing sampling and testing procedures, frequency, and performance criteria to ensure that all construction materials are meeting the design requirements.

E. Layout of rigid inclusions is the responsibility of the RI contractor, based on sufficient specified layout or control points provided by the General Contractor.

3.5 ACCEPTANCE MEASUREMENTS, TESTING AND CRITERIA

The acceptance of the RI work shall be solely based on the following:

A. The performance verification load test program meets the requirements established by the RI designer of record.

B. All Rigid Inclusions are installed per the approved design and shop drawings.

C. All Rigid Inclusions are monitored in accordance with the quality control plan established by the RI designer of record.

A Rigid Inclusion may be rejected if it is installed in an incorrect location or the location exceeds the specified tolerance stated in Section 3.3B. If a Rigid Inclusion is rejected, the RI Specialty Contractor shall replace the RI. Replacement of the RI may be avoided if alternate remedial procedures are approved by the RI design engineer.

3.6 RESPONSIBILITIES OF OTHERS

The following restrictions apply to the performance of the work.

A. Permits and Regulations: The Owner or General Contractor shall be responsible for obtaining any State and municipal permits (if required).

B. Utilities and Obstructions: The General Contractor shall be responsible for the precise delineation of all above and below ground utilities and obstructions and shall accurately mark their layout at the site, as referenced in Section 3.02 C. Utilities which cannot be removed shall be exposed and made known to the RI Specialty Contractor prior to installation of adjacent RIs. When necessary, the General Contractor shall pot hole RI locations to verify no utilities are present prior to RI installation.

C. Other Restrictions: (ex. Environmental restrictions, work boundaries, hours for construction, etc.)

END OF SECTION

SECTION 031000

CONCRETE FORMING & ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL REFERENCE

A. The work of this section is integral with the whole of the Contract Documents and is not intended to be outside that context.

1.2 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, services, and accessories necessary to furnish and install the Work of this Section, complete and functional, as indication in the Contract Documents and specified herein.

B. Provide formwork for cast-in-place concrete as indicated in the Drawings and specified herein.

C. Work includes formwork and shoring for cast-in-place concrete, and installation into formwork of items such as anchor bolts, setting plates, bearing plates, anchorages, inserts and other items to be embedded in concrete.

1.3 ALTERNATIVE (NOT USED)

1.4 RELATED WORK

A. Section 032000 – Concrete Reinforcing

B. Section 033000 – Cast-in-Place Concrete

C. Section 034100 – Structural Precast Concrete

1.5 SHOP DRAWINGS

A. Submit shop drawings for fabrication and erection of formwork for finished concrete surfaces. Show the general construction of forms including jointing, special formed joints for reveals, location and pattern of form tie placement, and other items, which affect the exposed concrete visually.

B. Architect’s review of shop drawings is for general architectural applications and features only.

1.6 SAMPLES (NOT USED)

1.7 PROJECT LITERATURE

A. Manufacturer’s Data:

1. Submit for Architect’s record manufacturer's data and installation instructions for materials including form coatings, manufactured form systems, ties and accessories.

1.8 MOCK UPS (NOT USED)

1.9 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be stored in the area designated by the General Contractor or Consultant. Containers shall have manufacturer's printed label.

B. Only approved materials or formwork that complies with PART 2 – PRODUCTS may be brought to designated storage area and used.

C. Store materials in single place designated by Owner and/or Consultant. Keep storage place neat and clean. Waste materials shall be removed from the site and storage area and placed in waste receptacle each night.

1.10 COORDINATION (NOT USED)

1.11 QUALITY ASSURANCE

A. Manufacturer's Qualifications (Not Used)

B. Subcontractor's Qualifications

1. Design of formwork & shoring for structural stability, strength and sufficiency to carry all applicable loads is the Contractor's responsibility.

C. Engineering

1. Reference Standards: Comply with the following standards, latest edition, except where more stringent requirements are shown or specified.

a. American Concrete Institute (ACI), ACI 347: Recommended Practice for Concrete Formwork.

b. American Concrete Institute (ACI): ACI 117, Standard Specifications for tolerances for Concrete Construction and Materials.

c. American Concrete Institute (ACI); ACI 301, Specifications for Structural Concrete.

d. Natinal Institute of Standards and Technology: Voluntary Product Standard PS-1.

2. Allowable Tolerances

a. Construction formwork to provide completed cast in place concrete structures complying with the tolerances specified in ACI 117, and as recommended by ACI 347 and ACI 301.

b. For concrete that is to be exposed and in view of the public including public or private streets, alley right of ways and including the interior of the garage area, formwork tolerances are to be Class B.

c. For concrete that is to be covered by architectural precast concrete and/or masonry, and structural panels that will be hidden from public view, formwork tolerances are to be Class C.

d. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and locations of concrete members and stability of forming systems.

e. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed Work will be within specified tolerances.

f. Make provisions to compensate for shrinkage and post-tensioning process in order to maintain formwork tolerances.

3. Design of Formwork

a. Formwork and formwork systems shall be designed by a Professional Engineer employed by the Contractor. The Professional Engineer shall be registered in the state of Massachusetts. The Contractor shall submit written certification indicating conformance with this requirement.

b. Design, erect, support, brace and maintain formwork in accordance with ACI 301 and following recommendations of ACI 347, as modified herein. Forms shall be capable of safely supporting vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose.

c. Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.

d. Design formwork to be readily removable without impact, shock or damage to cast in place concrete surfaces and adjacent materials.

e. Use shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Use trussed supports when adequate foundations for shores and struts cannot be secured.

f. Formwork for Grade Beams and Footings: Side forms are required for all footings and grade beams.

1.12 WARRANTIES

A. Attention is directed to provisions of the CONDITIONS OF CONTRACT and applicable parts of Division 1 regarding guaranties and warranties.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS (NOT USED)

2.2 MATERIALS

A. Forms of Exposed Finish Concrete

1. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal framed plywood faced or other panel type materials acceptable to Architect, to provide continuous, straight, smooth as cast surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

2. Plywood: Use overlaid plywood complying with PS 1, B B High Density Concrete Form Overlay, Class I.

B. Forms for Concrete Not Exposed

1. Form concrete surfaces, which will not be exposed in the finished structure with plywood, lumber, metal, or other acceptable material. Use lumber that is dressed on at least 2 edges and 1 side for tight fit.

C. Form Ties

1. Use factory fabricated, adjustable length, removable or snapoff metal or fiber reinforced plastic form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

2. Unless otherwise shown, use ties so that portion remaining within concrete after removal of exterior parts is at least 1 inch from the outer concrete surface. Unless otherwise shown, use form ties, which will not leave a hole larger than 1-inch diameter in the concrete surface.

3. For exposed finish concrete, use plastic cones and coil ties. All cone holes shall be plugged with plastic plugs set in a bed of sealant as approved by the Architect.

D. Nails and similar forming accessories, if to be left cast in concrete, shall be stainless steel.

E. Reglets: Fabricate of galvanized sheet steel not thinner than 26 gage. Opening at the face of reglet shall be temporarily covered or filled with removable material to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Fabricate of galvanized sheet steel not thinner than 22 gage. Opening at the slot exterior shall be temporarily covered or filled with removable material to prevent intrusion of concrete or debris.

G. Form Coating

1. Use commercial formulation form coating compounds with a maximum VOC of 350 grams per liter that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

2. Provide a release agent equal to Nox Crete "Form Coating".

H. Metal Inserts

1. Use galvanized metal insets for anchorage of materials or equipment to concrete construction as required for the Work.
2. Use galvanized threaded inserts for thin slabs, furnished complete with full depth bolts; 3/4-inch bolt size, unless otherwise shown. Provide inserts manufactured by Dayton/Richmond Concrete Accessories or approved equal.

2.3 MIXES (NOT USED)

2.4 FABRICATION (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION AND INSPECTION

A. Examine the conditions under which concrete formwork is to be erected. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 WORKMANSHIP, PERFORMANCE (NOT USED)

3.3 INSTALLATION / APPLICATION / ERECTION

A. Form Construction

1. Construct forms to be the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, levels, and plumb Work in finish structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustifications, reglets, chamfers, blocking screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.

2. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Use crush plates or wrecking plates where stripping may damage cast concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.

3. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible; consistent with project requirements.

4. Construct formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

B. Falsework

1. Erect falsework and support, brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in place concrete structures. Construct falsework so that adjustments can be made for take up and settlement.

2. Use wedges, jacks or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce Work of required dimensions.

C. Forms of Exposed Concrete

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.

2. Do not use metal cover plates for patching holes or defects in forms.

3. Provide chamfered corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, intersections.

4. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete.

5. Place ties and spreaders symmetrically in plumb tiers and level rows.

6. Place pouring strips in the forms wherever horizontal construction joints are made.

7. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.

8. Form molding shapes, recesses and projections with smooth finish materials, and install in forms with sealed joints to prevent displacement.

D. Corner Treatment

1. Form exposed corners to produce smooth, solid, unbroken lines, except as otherwise shown.

2. Form chamfers with 3/4 inch x 3/4-inch strips unless otherwise noted. Extend terminal edges to required limit and miter chamfer strips at changes in direction.

3. Unexposed corners may be formed either square or chamfered.

E. Edge Forms and Screed Strips for Slabs

1. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

F. Provision for Other Trades

1. Provide openings in concrete formwork to accommodate Work of others. Accurately place and securely support items to be built into forms.

G. Cleaning and Tightening

1. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

H. Form Coatings

1. Prior to each concrete pour, treat form surfaces with a suitable release agent. Do not allow excess material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete. Do not use release agents that stain or discolor concrete surfaces at areas exposed to view.

I. Installation of Embedded Items

1. General: Set and build into the Work anchorage devices 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 the items to be attached thereto.

J. Removal of Forms

1. Formwork not supporting 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 F. for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operation, and provided that curing and protection operations are maintained.

2. Formwork supporting weight of concrete, such as beam soffits, joists, slabs and other structural elements shall not be removed until concrete has attained its 28 day compressive design strength or as follows.

3. Form supports of non prestressed members may be removed when concrete has attained 75 percent of design compressive strength provided reshores are installed per Section 3.3.

3.4 FIELD QUALITY CONTROL (NOT USED)

3.5 CLEANING AND PROTECTION

A. Reuse of Forms

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

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

3.6 EXTRA STOCK / SPARE PARTS (NOT USED)

3.7 SCHEDULES (NOT USED)

END OF SECTION

SECTION 032000

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 GENERAL REFERENCE

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

1.2 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, services and accessories necessary to furnish and install the work of this Section, complete and functional, as indication in the Contract Documents and specified herein.

B. The work includes furnishing, fabrication and placement of reinforcement for concrete, including bars, welded wire fabric, ties and supports.

C. Extent of concrete reinforcing work is shown on drawings and in schedules and includes the following:

1. Spread Footings
2. Retaining Walls
3. Cast-in-place concrete topping slabs around stairs and in stair towers
4. Slab-on-grade areas within stair towers
5. Slab-on-grade area at the Electrical Room and Storage room

1.3 ALTERNATIVES (NOT USED)

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 10 00 – Concrete Forming & Accessories

B. Section 03 30 00 – Cast-in-Place Concrete

C. Section 03 41 00 – Structural Precast Concrete

1.5 SHOP DRAWINGS

A. Submit to the Architect/Engineer for review shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with the ACI 315, and follow Standard Practice of ACI 315R and CRSI MSP. Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement.

1.6 SAMPLES (NOT USED)

1.7 PRODUCT LITERATURE

A. Submit copies of manufacturer's specifications and installation instructions for all proprietary materials and reinforcement accessories.

B. Contractor shall furnish the copies of the manufacturer's records of chemical and physical properties of all heats of billet steel bars and, copies of affidavits for all material stating that the respective material furnished meets the requirements for the steel reinforcement specified. Manufacturer's records shall include certificates of mill analysis, tensile and bend tests.

1.8 MOCKUPS (NOT USED)

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to the project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

1.10 COORDINATION (NOT USED)

1.11 QUALITY ASSURANCE

A. Manufacturer's Qualifications

B. Subcontractor's Qualifications

C. Engineering

1. Codes and Standards: Comply with requirements of the following codes and standards, latest edition, unless more stringent provisions are indicated:

a. ACI 301, "Specifications for Structural Concrete".

b. ACI 318, "Building Code Requirements for Structural Concrete".

c. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials".

d. ACI 315, "Details and Detailing of Concrete Reinforcement".

e. ACI 315R, "Manual of Engineering and Placing Drawings for Reinforced Concrete Structures".

f. CRSI MSP, "Manual of Standard Practice".

g. ASTM A 185, "Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement."

h. ASTM A 615, "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."

i. ASTM A 706, “Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.”

j. ASTM A 775, “Standard Specification for Epoxy-Coated Steel Reinforcing Bars.”

k. ASTM A 884, “Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.”

l. D1.1 “Structural Welding Code – Steel”.

m. D1.4 “Structural Welding Code – Reinforcing Steel”.

2. Testing will be performed by an Independent Testing Laboratory paid for by the Owner.

3. Testing

a. Slump – Perform conventional slump test in accordance with A.S.T.M. C143 prior to adding the fibrous reinforcement.

b. Test Specimens – Fiber-reinforced concrete test specimens prepared for quality control/material acceptance shall be vibrated externally as opposed to internal rodding per the recommendations of ACI 544.

1.12 WARRANTIES

A. Attention is directed to provisions of the CONDITIONS OF CONTRACT and applicable parts of Division 1 regarding guaranties and warranties.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS (NOT USED)

2.2 MATERIALS

A. Concrete Reinforcing materials shall comply with the following requirements and standards, unless more stringent provisions are indicated:

1. Reinforcing Bars: ASTM A615, deformed billet-steel bars, yield strength as noted on the Drawings.

B. Welded Wire Fabric: ASTM A185.

1. Furnish in flat sheets, roll stock not acceptable.

2. Furnish epoxy coated wire mesh in pour strips over precast concrete members.

C. Fibrous Movement:

1. Chemical: Fibrous reinforcement shall be chemically and alkali inert, virgin, polypropylene.

2. Air-Entraining Admixture: ASTM C260.

3. Length: The fibrous bundle length shall be a minimum of 0.75”

4. Length: The fibrous bundle length shall be a minimum of 0.75”

5. Tensile Strength: 70,000 p.s.i. minimum.

D. Epoxy Coated: ASTM A775. Fusion bonded coating, apply after fabrication and bending. Film thickness of coating after curing to be 7 to 12 mils, when measured in accordance with Method G12. Provide epoxy coated reinforcing as indicated on the drawings and as defined below:

1. All reinforcement except welded wire fabric, in the upper 3” of the following concrete areas: elevated structural slab, rebar reinforced slab-on-grade, curbs or topping slabs, including but not limited to slab and beam/girder top bars, beam/girder stirrups and support steel for all epoxy coated reinforcement.

2. All parapet wall reinforcement, all “crash” wall and upturned beam reinforcement.

3. Retaining and foundation wall reinforcement adjacent to a face subject to “splash-zone” of de-icing chemicals.

4. All pour strip reinforcement, except as specified to be stainless steel in Section 03 41 00 “Structural Precast Concrete”.

5. All tie wire for epoxy coated rebar assemblies shall be epoxy or plastic coated. Wires shall be 16 gauge or heavier.

E. Supports for reinforcement. Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.

1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick and other unacceptable materials.

2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with plastic tip protected legs.

   a. Chairs and metal accessories supporting epoxy coated rebar shall also be epoxy coated.

4. Over waterproof membranes, use concrete chairs to prevent penetration of the membrane.

5. Provide accessories and supports for welded wire fabric and reinforcement in slabs as required to maintain concrete cover and position as shown on the drawings.

F. Weldable Reinforcing Bars: ASTM A706, Grade 60.

1. Tie Wire: All tie wires for noon-epoxy coated assemblies shall be 16 gauge or heavier, black annealed, unless noted otherwise.

2.3 MIXES (NOT USED)

2.4 FABRICATION (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION AND INSPECTION

A. Inspection of Reinforcement

1. Completed installation of concrete reinforcement shall be reviewed and approved by the Inspector prior to depositing concrete.

3.2 WORKMANSHIP, PERFORMANCE (NOT USED)

3.3 INSTALLATION / APPLICATION / ERECTION

A. Installation of Reinforcing

1. Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars" for details and methods of reinforcement placement and supports, and as herein specified.

2. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

3. Repair the damaged bar coating with a procedure acceptable to the Architect/Engineer and in accordance with the coating manufacturer's instructions, to the satisfaction of the Independent Testing Laboratory prior to the reinforcement placement into forms. See Part 3, Paragraph B of this section for epoxy coated rebar handling.

4. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

5. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.

6. Install welded wire fabric in as long lengths as practicable lap adjoining pieces at least one full mesh and lace splices with 16-gauge wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.

7. Provide sufficient numbers of supports and of strength to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

8. Install reinforcement to tolerances given in ACI 117 2.2.

9. Splices:

a. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Comply with requirements of ACI 318 for minimum lap of spliced bars. Unless otherwise indicated on the design drawings, comply with requirements of ACI 318 Chapter 12 for Class B tension lap splices for reinforcement with proper adjustment for location, clear cover and spacing.

b. Do not make splices at points of maximum stress if possible.

c. Stagger splices in horizontal wall reinforcement and separate at least five (5) ft. longitudinally in alternate bars of opposite tiers.

d. Stubs and dowels required to receive and engage subsequent work shall extend a sufficient length to develop the strength of the bar. Place dowel and stub bars in the forms and secure against displacement during the placing of concrete. Where stub steel and dowels extend through construction joints in structural members, they shall be adequately protected from corrosion and thoroughly cleaned of adhering particles of concrete, before continuing the placing of any subsequent concrete.

10. Welding of Reinforcement: Welding of reinforcing bars is not permitted except where specifically indicated or approved by the Architect. Where permitted, only weldable reinforcement meeting ASTM A706 shall be permitted. Weld in accordance with AWS D1.4. Notify the Architect and the Testing Laboratory at least one day prior to welding operation.

11. Field Bending of Reinforcement: Reinforcement partially embedded in concrete shall not be field bent except as shown on the drawings or specifically permitted by the Architect.

B. Placing Epoxy-Coated Bars

C. Addition of Fibrous Reinforcement

1. Volume: Where identified on the Plans, Specifications, and at all stair landings or as allowed by the Engineer, fibrous reinforcement shall be used at the rate of 1.6 pounds (minimum) per cubic yard of concrete.

2. Addition and Mixing - The fibrous reinforcement shall be added directly into the concrete either at the batch plant or at the job site. If added at the batch plant with the aggregates, typically no additional site mixing time is required. If a superplasticizer is used, the fibrous reinforcement shall be added first. If the mixing drum contains less than 50% of capacity (i.e., 4 cubic yards in a 10 cubic yard capacity drum), back the concrete up to the top of discharge and empty the fibrous reinforcement directly on top of the concrete before mixing.

3. Placement - Fibrous reinforced concrete shall be moved and placed per standard A.C.I. recommendations. Tined rakes are prohibited as a means of moving the fibrous concrete. If pumping or shooting fibrous concrete, elevate ready mix discharge chute approximately 12" (or higher) above the pump grate or screen to improve the fibrous concrete flow into the pump.

3.4 FIELD QUALTIY CONTROL (NOT USED)

3.5 CLEANING AND PROTECTION (NOT USED)

3.6 EXTRA STOCK/SPARE PARTS (NOT USED)

3.7 SCHEDULES (NOT USED)

END OF SECTION

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 GENERAL REFERENCE

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

1.2 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, services and accessories necessary to furnish and install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein.

B. The principal work of this Section includes, but may not be limited to, the following:

1. Spread Footings
2. Retaining Walls
3. Cast-in-place concrete topping slabs around stairs and in stair towers
4. Slab-on-grade areas within stair tower
5. Slab-on-grade area at grade level
6. Sidewalks

C. Work includes providing cast-in-place concrete consisting of Portland cement, fine and coarse aggregate, water, and selected admixtures; combined, mixed, transported, placed, finished and cured as herein specified.

D. The work includes constructing expansion joints, contraction joints and water stops for cast-in-place concrete.

1.3 ALTERNATES (NOT USED)

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 10 00 – Concrete Forming & Accessories

B. Section 03 20 00 – Concrete Reinforcing

C. Section 03 41 00 – Structural Precast Concrete

D. Section 04 20 00 – Unit Masonry

E. Section 05 70 00 – Decorative Metals

F. Section 07 50 00 – Single Ply Adhered Roofing

G. Section 07 95 00 – Expansion Control

H. Section 09 91 00 – Painting

1.5 SHOP DRAWINGS (NOT USED)

1.6 SAMPLES (NOT USED)

A. Submit samples of concrete materials if requested by the Architect, including names, sources, and descriptions.

1.7 PRODUCT LITERATURE

A. Manufacturer's Data:

1. Submit manufacturer’s data for proprietary items and other information described herein and as specified in the Project documents.

B. Mix Designs:

1. Submit substantiating data for each concrete mix design contemplated for use to the Architect not less than four (4) weeks prior to the pre-concrete conference; Part 2, Section 2.2, Paragraph K and J. Data for each mix shall, as a minimum, include the following:

a. Mix identification designation (unique for each mix submitted).

b. Statement of intended use for mix.

c. Method used to establish a proposed design for each mix (ACI 301).

d. Mix proportions, including all admixtures used.

e. Manufacturer's data and material certifications signed by the material manufacturer and the Contractor certifying conformance of all materials, including admixtures, with specified requirements.

f. Wet and dry unit weight.

g. Entrained air content. Determine of freshly mixed concrete by pressure method, ASTM C231, or volumetric method, ASTM C173.

h. Design slump, per ASTM C143.

i. When statistical data for a proposed mix is available, and has been compiled within the 12 months time prior to the commencement of this project, and is spanning a period of not less than 60 calendar days, submit required average strength qualification data per ACI 301. Submit separate qualification data for each production facility, which will supply concrete to the project.

j. Average strength qualification data (trial mix data or field test data per ACI 301. When field test data for at least 10 consecutive strength tests for one mixture is used to qualify average strength with the same materials and data acquisition encompassing a period of not less than 60 days, or trial mixtures are used to establish a design mixture proportions, submit separate qualification data for each

production facility, which will supply concrete to the project. Trial mixtures evaluation shall be in strict accordance with ACI 301.

k. Field test data submitted for qualification of average strength under ACI 301 shall include copies of the Concrete Testing Agency's reports from which the data was compiled.

l. Tests of proposed mixes for water soluble chloride ion content for all above grade structural concrete and for slab-on-grade reinforced concrete in accordance with ASTM C1218.

m. Submit one copy of a representative concrete batch trip ticket containing information as specified herein.

n. Separate design mixes are required for each strength and class of concrete, each change in type and/or quantity of mix materials including admixtures, each change in slump limits, and each change in entrained air content.

C. Mix designs submitted without the required information outlined above will be rejected. Concrete shall not be placed without an approved mix design.

D. Product Data:

1. Submit product data with application and installation instructions for proprietary materials and items including admixtures, patching compounds, epoxies, grouts, and others as required by the Architect.

2. Submit curing compound product data and verification of its compatibility with other finish materials and surface treatments required.

E. Submit to the Architect for record a written program outlining procedures/measures to protect and monitor freshly mixed and/or placed concrete in cold and hot weather and procedures for protection of the freshly placed concrete against rain. The program shall be submitted no later than two weeks prior to the pre-concrete conference, and shall be discussed therein.

1.8 MOCK UPS

A. Cast concrete supported slab mockups to demonstrate typical joints, surface finish, texture, tolerance, and standard of workmanship including for the following areas

1. 5'x10' sidewalk mock-up:

2. 5'x5' area of smooth rubbed wall finish within 4 hours of form removal, if necessary re-work until finish smooth, uniform and free of fins, formwork marks and imperfections as directed prior to finishing remainder of wall area.

3. Provide 4'x4' mock-up of broom finish required at cast-in-place surfaces defined in Section 1.2, Paragraph B, 3, 4 and 5. Only one mock-up required for all areas.

4. Do not proceed with cast-in-place concrete work until mock-up for corresponding is approved.

5. Mockups, if accepted may become part of final work.

1.9 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver materials in manufacturer's unopened containers fully identified with manufacturer's name, trade name, type, class, grade, size, and color.

B. Storage of Materials: Store materials in unopened containers. Store off ground and under cover, protected from damage.

C. Concrete:

1. Hauling Time: Discharge all concrete transmitted in a truck mixer, agitator, or other transportation device not later than 1 1/2 hours, or 300 revolutions of the drum after the mixing water has been added, whichever is earliest.

2. Extra Water: Deliver concrete to the job in exact quantities required by the design mix. No water shall be added after batching of concrete.

1.10 COORDINATION (NOT USED)

1.11 QUALITY ASSURANCE

A. Codes and Standards: Comply with requirements of the following codes and standards, latest edition, unless more stringent provisions are indicated:

1. ACI 301, “Specification for Structural Concrete.”

2. ACI 117, “Standard Specifications for Tolerances for Concrete Construction and Materials.”

3. ACI 311.4R, “Guide for Concrete Inspection.”

4. ACI 318, “Building Code Requirements for Structural Concrete”.

5. ACI 304, “Guide for Measuring, Mixing, Transporting and Placing Concrete.”

6. ACI 305R, “Hot Weather Concreting.”

7. ACI 306.1, “Cold Weather Concreting.”

8. ASTM C 33, Standard Specifications for Concrete Aggregates.

9. ASTM C 94, Standard Specifications for Ready Mix Concrete.

10. ACI SP-66 ACI Detailing Manual.

11. ACI SP-15, ACI Field Reference Manual.

12. Concrete Reinforcing Steel Institute “Manual of Standard Practice”.

B. Record of Work: A record shall be kept by the General Contractor listing the time and date for all cast-in-place concrete placements for the structure. Such records shall be kept until the completion of the project and shall be available to the Architect for examination at any time including concrete batch trip tickets. Concrete batch trip tickets shall contain all information specified in ASTM C94, paragraph entitled "Batch Ticket Information" including:

1. Name of ready-mix batch plant,

2. Serial number of ticket,

3. Date,

4. Truck Number,

5. Name of Purchaser,

6. Specific Job name & location,

7. Specific class or designation of the concrete (ie; footings, retaining wall, side walk)

8. Amount of concrete in cubic yards

9. Time Loaded or first mixing of cement and aggregates

10. Water Added by receiver of concrete & his initials

11. Additional information for certification purposes including:

    a. Type & brand of cement

    b. Type, brand & amount of admixtures

    c. Total amount of water in the mix as batched (including water present in the aggregate before batching) and the amount of water required by the design mix proportions.

    d. All information necessary to calculate the total mixing water added by the producer including free water of the aggregates water, ice and water added by the truck operator.

    e. Maximum size of aggregate

    f. Total lbs of fibrous reinforcement added

    g. Weights of fine and coarse aggregates

C. The Contractor shall be responsible for designing the required concrete mixes such that mixing, placing and finishing operations are possible without compromising the performance of the finished product during service life.

1.12 WARRANTIES

A. Attention is directed to provisions of the CONDITIONS OF CONTRACT regarding guaranties and warranties.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Self-Expanding Strip Waterstops:

1. Volclay Waterstop-RX; Colloid Environmental Technologies Co.

2. Superstop; Progress Unlimited Inc.

3. Swell Stop – Green Streak.

B. Patching Mortar:

1. "SikaTop 121 Plus or122 Plus": Sika Chemical Corp.

2. "Verticoat or Verticoat Supreme": Euclid Chemical Co.

3. "EMACO R310 CI or R320 CI": Master Builders.

4. "HB2 Repair Mortar": ChemRex, a Div. of Degussa, Inc.

C. Liquid Membrane-Forming Curing Compound or Dissipating Resin Compound:

1. "Kurez DR" - Euclid Chemical Co.

2. "L & M Cure R" - L & M Construction Chemicals, Inc.

3. "Clear 1100" - W. R. Meadows

4. "EZ Strip Cure" - ChemMasters

5. Approved Equivalent

D. Evaporation Retarder:

1. "Eucobar" - Euclid Chemical Co.

2. "E-Con"- L & M Construction Chemicals, Inc.

3. "Confilm" - Master Builders, Inc.

E. Non Shrink Non Metallic Grout:

1. Euco NS: The Euclid Chemical Co.

2. Masterflow 713: Master Builders

3. Or approved equal

F. High Flow Grout:

1. Euco Hi-Flow Grout: The Euclid Chemical Co.

2. Masterflow 928: Master Builders

3. Sikadur 42 Grout-PAK PT: Sika Corporation

G. Air Entraining Admixtures:

1. "Air-Mix": Euclid Chemical Co.

2. "Sika Aer": Sika Corporation

3. "MB-VR or MB- Ae": Master Builders

4. "Darex AEA" or "Daravair": W.R. Grace

H. Water Reducing Admixture:

1. WRDA Hycol": W. R. Grace

2. "Eucon WR-75 or WR-89": Euclid Chemical Co.

3. "Pozzolith Normal": Master Builders

4. "Plastocrete 160": Sika Chemical Corp.

I. High-Range Water-Reducing Admixture (Superplasticizer):

1. "Sikament 300": Sika Chemical Corporation

2. "Eucon 37': Euclid Chemical Co.

3. "Daracem-100": W. R. Grace

4. "Rheobuild 1000": Master Builders

J. Water Reducing, Non-Corrosive Accelerating Admixture:

1. "Accelguard 2 R. Grace

2. “Sika Rapid-1”: Sika Corporation

K. Water-Reducing and Retarding Admixture:

1. "Pozzolith Retarder": Master Builders

2. "Eucon Retarder 75": Euclid Chemical Co.

3. "Daratard": W. R. Grace

4. "Plastiment": Sika Chemical Co.

L. Corrosion Inhibiting Concrete Admixture:

1. "Catexol 1000 CN-CI": Axim Concrete Technologies

2. "Eucon CIA": Euclid Chemical Co.

3. "DCI or DCI-S": W. R. Grace

4. "Rheocrete CNI”: Master Builders, Inc.

No substitutions allowed.

M. Structural Fiber for areas of concrete structure specifically designated:

1. "Strux 90/40”: Grace Construction Products

2. "Tuf-Strand SF": Euclid Chemical Co.

3. “Sika Fiber”: Sika Corporation

2.2 MATERIALS

A. Cementitious Materials:

1. General: Provide materials of the same brand or source throughout the project unless otherwise specified.

2. Portland Cement: ASTM C150, Type I. High-Early Strength Type III cement may be used in lieu of Type I at Contractor's option, provided a written notification is submitted to the Architect prior to use and the concrete ready mix supplier certifies in writing the compatibility of the proposed cement with other constituents of the mix. Type III cement shall not be used for hot weather concreting.

3. Fly Ash: ASTM C618, Class C or F.

4. Ground Granulated Blast Furnace Slag (GGBFS): ASTM C989, Grade 100 or 120.

B. Aggregates: ASTM C33, and as herein specified.

1. General: Provide aggregates from the same source throughout the project unless otherwise specified.

2. Fine aggregate: clean, sharp, natural sand free from loam, clay lumps or other deleterious substances.

3. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay lumps, mud, loam, or foreign matter, as follows:

a. Crushed stone, processed from natural rock or stone.

b. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.

c. Maximum Aggregate Size shall be per ACI 318. For P.T. slabs and beams, maximum aggregate size shall be 1”.

d. No chert or lignite allowed.

e. Water: Clean, fresh, drinkable.

C. Waterstops

1. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes, minimum web thickness 3/8 inch.

a. Profile: Ribbed with center bulb.

2. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

a. Profile: Ribbed with center bulb.

D. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, for adhesive bonding to concrete.

E. Joint Materials

1. Joint Sealing Compound & Expansion Joint: See Division 7 Sections.

2. Joint-Filler Strips: See ASTM D1751, Asphalt-Saturated Cellulosic Fiber.

F. Moisture Barrier

1. Polyethylene sheet: minimum 6 mils thick complying with ASTM E154. Provide where shown on the Drawings.

G. Bonding and Repair Materials

1. Bonding Grout: After the existing concrete surface has been cleaned, it shall be uniformly saturated by pre-wetting for 2 hours, and free standing water shall be removed prior to placing the bonding grout before concrete repairs.

a. Bonding grout for concrete applied to existing concrete shall consist of equal parts by weight of Portland Cement and sand mixed in a portable mechanical mixer with sufficient water to form a stiff slurry. The consistency of this slurry shall be such that it can be applied with a stiff brush or broom to the old concrete in a thin, even coating that will not run or puddle in low spots.

b. Should the bonding grout dry before the concrete repairs, the Contractor will remove the dried grout and sandblast clean the grouted surface, before placing fresh bonding grout.

2. Patching Mortar: Provide free-flowing, polymer-modified cement-based repair mortar, suitable for thin applications. All proposed repairs and repair applications shall be submitted and approved prior to application.

H. Concrete Curing Materials

1. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd. and complying with AASHTO M182, Class 3

2. Moisture Retaining Cover: Provide one of the following, complying with ASTM C171:

a. Waterproof paper

b. Polyethylene film

c. White burlap polyethylene sheet

3. Liquid Membrane-Forming Curing Compound or Dissipating Resin Compound: ASTM C309, Type 1 Curing compound shall leave no surface residue and shall be compatible with paint and finish floor materials specified in other sections of this Specification. The dissipating resin compound film must chemically break down in a two to four week period. Provide data from an independent laboratory indicating a maximum moisture loss of 0.03 grams per sq. cm. in 72 hours when applied at a coverage rate of 300 ft2 per gallon. Manufacturer's certification and method of removal are required.

a. The contractor shall anticipate providing as a minimum concrete surface preparation by a power sweep or low pressure water blast (3,000 psi), as a normal part of the work.

4. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Evaporation retarder shall be used to retard rapid evaporation of bleeding water from exposed concrete under adverse curing conditions.

I. Grout Materials:

1. Non shrink non metallic grout shall be premixed and packaged silica aggregates, Portland cement, water reducing and shrinkage compensating agents. Grout shall conform to ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 4' x 4' base plate.

2. High Flow Grout: Where high fluidity and/or increase placing time are required use high flow grout. Non-shrink, natural aggregate factory pre-mixed grout shall conform to ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under an 18" x 36" base plate.

J. Proportioning and Design of Mixes

1. Design and Properties of Concrete:

a. Prepare a concrete design mix composed of Portland cement, water, fine and coarse aggregate, appropriate admixtures and cementitious materials as required to obtain the specified strength requirements and will produce concrete with equal finish quality, surface appearance and durability required.

b. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

2. The concrete mixes proportioned on the basis of trial mixture shall meet the provisions of ACI 301.

3. Requirements for concrete mix unless otherwise shown on drawings.

a. Compressive Strength

1) 4,000 psi @ 28 days or as indicated on drawing for footings, foundation mats, sidewalks and pads.

2) 5,000 psi @ 28 days or as indicated on drawing for all other applications.

b. Slump = 3” maximum prior to addition of super plasticizer.

c. Water-cementitious ratio = 0.38 (Elevated Deck)
= 0.40 (Foundations, Slab-On-Grade, sidewalks and Walls)

d. Air Content = 4½ to 6½ %

e. Minimum Cement Content = 560 lb/cyd.

f. Admixtures as specified in the contract documents.

4. Prepare design mixes for each type and strength of concrete determined by either laboratory mix or field test data.

5. Cementitious Materials: For concrete exposed to deicers, limit percentage by weight, of cementitious materials other than Portland cement according to ACI 301 requirements.

6. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

a. Fly Ash: 25 Percent

b. Fly Ash plus Pozzolan: 25 Percent

c. Ground Granulated Blast Furnace Slag (GEBFS): 25 Percent

d. Fly Ash or Pozzolan plus GGBFS: 35 Percent (Min. GGBFS = 15 Percent.)

7. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the Owner and as accepted by the Architect. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by the Architect before using in the work.

K. Pre-Concrete Conference

1. At least 10 days prior to start of the cast-in-place concrete construction, the contractor shall conduct a meeting with the Owner's representative, testing agent, resident engineer and Contractor's representatives to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete quality. The contractor shall send a pre-concrete conference agenda to all attendees 5 days prior to the schedule date of the conference.

2. The contractor shall require responsible representatives or every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

a. Contractor's superintendent

b. Laboratory responsible for the concrete design mix.

c. Laboratory responsible for field quality control.

d. Concrete subcontractor.

e. Ready-mix concrete producer

f. Admixture manufacturer(s)

g. Concrete pumping contractor

h. Concrete finishing Foreman

3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes:

   a. Owner's representative

   b. Resident engineer

   c. Consultant engineer

   d. The minutes shall include a statement by the admixture manufacturer(s) indicating that the proposed mix design and placing techniques can produce the concrete quality required by these specifications.

2.3 MIXES

A. General: Admixtures certified by manufacturer to contain not more than 0.05 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride or other corrosive elements. Do not use admixtures which have not been incorporated and tested in the accepted design mixes, unless otherwise authorized in writing by the Architect/Engineer.

B. Prohibited Products: Calcium chloride or admixtures containing more than 0.05% chloride ions or thiocyanates are not permitted.

C. Air Entraining Admixtures: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

D. Water Reducing Admixture: ASTM C494, Type A.

E. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or Type G.

F. Water Reducing, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C494, Type C or E. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.

G. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

H. Corrosion Inhibiting Concrete Admixture: ASTM C494, Type C, shall be used in elevated structure, columns, and rebar reinforced slab-on-grade, unless otherwise noted. Minimum dosage: 2.5 gal./cu. yd.

I. Structural Fiber for areas of concrete structure specifically designated: Monofilament polypropylene/polyethylene fibers, 1.5 to 2 inch in length with a minimum tensile strength of 70 ksi and the minimum Modulus of Elasticity of 600 ksi. The manufacturer shall demonstrate the attainment of average residual strength of not less than 140 psi per ASTM C1399 based on the proposed dosage. Minimum dosage shall not be less than 3 lbs/cu. yd.

J. Certification: Written certification of conformance to above requirements will be required from all admixture manufacturers prior to mix design review by the Architect.

K. Job Conditions

   1. Environmental Requirements:

a. Cold Weather Placement: When depositing concrete after the first frost or when the mean daily temperatures are below 40 degrees F., follow requirements of ACI 306.1 and recommendations of ACI 306R as modified herein.

1) Maintain concrete temperature at a minimum of 55 degrees F. for sections having a minimum dimension of less than 12", or 50 degrees F. for sections having a minimum dimension of 12" or greater, for not less than 72 hours after depositing.

2) Maintain temperature of concrete record during the required minimum protection period and as described in Section 014500, Quality Control, of these specifications.

3) The specified non-chloride accelerator or high-early strength Type III cement may be used when accepted by the Architect. Site-cured cylinders for verification of early strength and/or the adequacy of the Contractor's protective methods, may be required by the Architect.

b. Hot Weather Placement: When depositing concrete in hot weather, follow recommendations of ACI 305R as modified herein. The temperature of concrete at time of placement shall not exceed 90 degrees F. Protect to prevent rapid drying. Start finishing and curing as soon as possible. When the air temperature is expected to exceed 90 degrees F., the Contractor shall obtain acceptance from the Architect of the procedures to be used in protecting, depositing, finishing, and curing the concrete. The specified water reducing retarding admixture may be used upon acceptance of the Architect. The use of continuous wetting or fog sprays may be required by the Architect for 24 hours after depositing.

2.4 FABRICATION (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION AND INSPECTION

A. Pre placement Inspection:

1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and securely install all required inserts, anchors, sleeves, conduits and other items specified under other sections or as shown on the Contract Drawings to be embedded or cast in.

a. The contractor shall provide reasonable opportunity for the Owner and his representative(s) to perform pre placement inspection of items noted above.

2. Where concrete is placed on the ground or subcourse, the foundation upon which concrete is placed shall be clean, damp, and free from frost, ice, and standing or running water. Prior to placing concrete, bottom of the foundation shall be compacted and approved by the Geotechnical Engineer.

3. Soil at bottom of foundation systems are subject to testing for soil bearing value by the testing laboratory, as directed by the Geotechnical Engineer. Place concrete immediately after approval of foundation excavations.

4. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.

5. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

3.2 WORKMANSHIP, PERFORMANCE (NOT USED)

3.3 INSTALLATION/APPLICATION/ERECTION

A. Concrete Placement

1. General: Place concrete in compliance with the practices and recommendations of ACI 304R and ACI 304.2R and as herein specified.

   a. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete, which is hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be place continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation.

   b. Do not use concrete which becomes non plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use re-tempered concrete. Remove rejected concrete from the project site and dispose of it in an acceptable location.

2. Placement Schedule: Place concrete in conformance with the approved placement schedule to ensure an even distribution of loads throughout the entire structure.

3. Concrete Conveying: Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.

   a. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.

4. Placing Concrete Into Forms:

   a. Deposit concrete in forms in horizontal layers not deeper than 12 inches unless additional thickness is permitted by the Architect, and in a manner to avoid inclined construction joints.

   b. Free fall shall not exceed ten (10) feet for concrete containing a high range water reducing admixture (super plasticizer) or six (6) feet for other concrete. Use chutes or trunks of variable lengths to prevent segregation of concrete.

   c. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.

   d. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by handspading, rodding or tamping. Use equipment and

procedures for consolidation of concrete in accordance with the recommended practices of ACI 309R, to suite the type concrete and project conditions. Vibration of forms and reinforcing will not be permitted.

e. Use appropriate size vibrators for the elements, in which concrete is being consolidated.

f. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set.

g. In order to allow for shrinkage or settlement, at least 4 hours shall elapse after placing concrete in walls, columns or beams before depositing concrete in girders, beams or slabs supported thereon, unless otherwise specified or shown on the plans.

5. Placing Concrete Slabs:

a. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

b. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

c. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

d. Floor slabs shall be poured up hill at ramps.

e. Bring slab surfaces to the correct level with a straight edge over screed rails and strike off space screed rails at 10 to 12 feet on center, or as required based on screed stiffness, to produce a concrete slab of uniform thickness. Use bull floats, highway straight edges or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

6. Bonding:

a. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured by using neat cement grout.

1) Roughen surfaces of set concrete at all joints, except where bonding is obtained by use of a concrete bonding agent, and clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly.

2) At joints between footings and walls, and between walls and slabs they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

3) At joints in exposed work: At vertical joints in walls, at joints in supported slabs and other structural members; dampen the roughened and cleaned

surface of set concrete and apply a liberal coating of the neat cement grout consisting of equal parts Portland cement and fine aggregate by weight and sufficient water to achieve the consistency of stiff grout or thick paint. Apply with a stiff broom, brush, or spray to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

7. Cold Weather Placing:

a. Protect all concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306.1, recommendations of ACI 306R and as herein specified.

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

c. Provide adequate means to maintain a cure temperature in the area where concrete is being placed at either 70 degrees F. for 3 days or 50 degrees F. for 5 days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. Avoid rapid dry out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.

d. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.

e. Only the specified non-corrosive non-chloride accelerator shall be used. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.

f. Use set control admixtures when required and accepted in mix designs.

8. Hot Weather Placing:

a. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place and protect concrete in compliance with ACI 305R and as herein specified.

b. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

c. Wet forms thoroughly before placing concrete.

d. Retarding admixture may be used with approval of Architect/Engineer.

B. Joints

1. Construction Joints:

a. Locate and install construction joints, which are not shown on the drawings, so as not to impair strength and appearance of the structure, as acceptable to the Architect.

b. Provide keyways at least 1 1/2 inches deep in all construction joints in walls, slabs on grade, and between walls and footings.

c. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints.

d. Construction joints in walls and beams shall not be located within 10 feet of corners.

e. Tool or saw cut construction joints in supported slabs approximately 3/8 inch wide by 3/4 inch deep.

2. Waterstops:

a. Provide waterstops in construction joints and expansion joints as shown on the drawings. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work.

3. Isolation Joints in Slabs on Ground:

a. Provide isolation joints in slabs on ground at all points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, and elsewhere as indicated.

4. Control Joints in Slabs on Ground:

a. Provide control joints in slabs on ground to form panels or patters as shown. If not shown, provide joints to form panels approximately fifteen (15) feet by fifteen (15) feet in size. Ratio of long side to short side shall not exceed 1.25.

b. Tool or Soff-cut with V-blade within one to four hours after the finishing process and before final set without dislodging aggregates. The V-joint shall be 1 (one) inch deep and ¼ inch wide.

5. Control Joints in Walls:

a. Control joint spacing shall not be any greater than:

1) 3 times the wall height for walls 8 feet and lower

2) 2 times the wall height for walls greater than 8 feet and lower than 12 feet

3) Equal to the wall height for walls 12 feet and taller

b. The total depth of the control joint shall be at least a ¼ of the wall thickness

6. Control Joints in Topping Slabs:

a. Provide control joints in the topping slabs to form panels or patterns as shown on the drawings.

b. Tool or Soff-cut with V-blade within one to four hours after the finishing process and before final set without dislodging aggregates. The V-joint shall be 1 (one) inch deep and 3/8 inch wide.

7. Joint Sealant/Filler Strips:

a. All construction joints and isolation joints shall be filled with filler strips.

C. Finishing Formed Surfaces

1. General:

a. The intent is to obtain materials and workmanship of such quality that only nominal finishing will be required to produce concrete surfaces equal to the best obtainable with the concrete and forming material specified.

2. Rough Formed Finish:

a. Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and all fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

3. Smooth Formed Finish:

a. Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrical with a minimum of seams. Repair and patch defective areas with all fins or other projections exceeding 1/16 inch in height completely removed and smoothed.

b. Apply to concrete surfaces that are to be exposed to public view, or that are to be covered with coating material applied directly to the concrete, or a covering material bonded to the concrete such as waterproofing, dampproofing, painting, or other similar system.

4. Smooth Rubbed Finish:

a. Provide a smooth rubbed finish to surfaces which have received smooth form finish treatment, not later than the day after form removal. **All cast-in-place walls exposed to view shall receive a smooth rubbed finish.**

b. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than cement paste drawn from the concrete itself by the rubbing process.

5. Related Unformed Surfaces:

a. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

D. Finishing Floors and Slabs

1. Floor Slabs in Parking and Driving Areas shall have a medium to heavy Non Slip Broom Finish:

2. Sidewalks and Stair Tower landing slabs shall have a light, non-slip broom finish.

3. Placement and finishing of broom finished slab surfaces shall be as follows:

   a. Placement: The concrete per the approved mix design shall be placed, consolidated and screeded to eliminate high and low spots as recommended per ACI 301 and ACI 302R.

   b. Float Finish: Begin floating when the bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit the operation. The finish tolerance shall be per the requirements of ACI 301 and ACI 117. Finish all concrete slab surfaces to proper elevations to insure that all surface moisture will drain freely to floor drains, and that no puddle areas exist.

   c. Non-Slip Broom Finish: Immediately after concrete has received a floated finish, roughen the concrete surface by brooming in the direction perpendicular to the main traffic route or as directed by the Engineer. Use fiber-bristle broom unless otherwise directed. The final texture and finish shall be per the approved mock-up panel. It may be necessary to adjust finishing techniques to duplicate the appearance of the mock-up panel.

4. Slabs in Enclosed Areas and/or Areas to be covered with other Finishes:

   a. Float Finish: After the concrete is placed, consolidated and screeded, apply float finish. The finish tolerance shall be per the requirements of ACI 301 and ACI 117.

   b. Trowel Finish: Apply trowel finish to the slab surface areas and the texture shall be per the mock-up panel appearance accepted by the Architect/Engineer.

   c. Surfaces to be covered with waterproofing membrane systems shall be finished and cured in accordance with the waterproofing manufacturer's recommendation.

E. Miscellaneous Concrete Items

1. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel troweling surfaces to a hard, dense finish with corners, intersection, and terminations slightly rounded.

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

3. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, 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 indicated or required to complete Work.

F. Concrete Surface Repairs

1. Patching Defective Areas: No patching work shall be done without prior review by the Architect. The Contractor shall submit actual repair locations, procedures and material to be used. The following is a general guideline for concrete repair work.

a. Cut out honeycomb, rock pockets, voids over ½ inch diameter, and holes left by tie rods and bolts, down to solid concrete but in no case, to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush coat the area to be patched with a bonding grout consisting of one part cement, one and a half part fine sand and a 50/50 mixture of the specified bonding admixture and water to achieve the consistency of thick paint.

1) For exposed to public view surfaces, blend white Portland cement and standard Portland cement, when dry, the patching mortar will match the color of the surrounding concrete. Compact mortar in place and strike off slightly higher than the surrounding surface.

b. Proprietary patching compounds may be used in lieu of the cement mortar with prior approval of the Architect and when color match of the adjacent concrete is not required.

2. Remove fins and irregularities in exposed concrete surfaces while concrete is green. Grind smooth and patch with mortar if required, to make surface smooth.

3. Repair of Unformed Surfaces:

a. Slabs with low area and improper slopes to drains shall be corrected by the use of a polymer patching mortar.

1) Sawcut the edges of the defective area to a minimum depth of ½ inch and roughen and clean hardened concrete. Coat surface with bonding grout or bonding compound.

2) Mix polymer repair mortar in strict conformance with manufacturer's instructions.

3) Apply fill to the required thickness and blend into adjacent areas. Finish surface to match surrounding concrete.

b. Repair unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects, such as, include crazing, cracks in excess of 0.01 inch wide or which penetrate to the reinforcement or completely through concrete sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.

1) Use high-pressure epoxy injection to repair cracks in beams and girders.

2) Route a "v" groove in cracks at support slabs and slabs on grade, 3/8 inch wide at the top and 3/8 inch deep. Caulk with sealant specified in Section 079200.

3) Use polymer-patching mortar to repair crazing, spalling, popouts, honeycomb, rock pockets and other objectionable surface conditions
.

4. Structural Repair:

a. All proposed structural repairs shall be submitted for approval prior to application.

3.4 FIELD QUALITY CONTROL

A. Quality Control

1. Testing Agency: Owner will engage a qualified independent testing and inspecting agency, approved by the Engineer, to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

2. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

a. Testing Frequency for Slabs, Slabs-On-Grade, Walls and Concrete In-Fill Washes: Obtain one composite sample for each concrete mix exceeding 5 cu. Yd., but less than 25 cu. Yd., plus one set for each additional 50 cu. Yd. or fraction thereof.

b. Testing Frequency for Footings, Grade beams and Piers: Obtain at least one composite sample for each 50 cu. Yd. or fraction thereof of each concrete mix placed each day.

1) When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

c. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

d. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

e. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

f. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of five standard cylinder specimens for each composite sample (for laboratory curing) and one set of three standard cylinder specimens (for field curing).

g. Compressive-Strength Test: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days, retain one laboratory-cured cylinder.

B. Evaluation and Acceptance Criteria

1. Evaluation and acceptance of work under this section shall be in accordance with the provisions of ACI 301 and the following:

2. If the average of any three consecutive strength test results is less than f'c or if any strength test results falls below f'c by more than 500 psi, test a minimum of three ASTM C31 field-cured samples from the in-place work represented by the low test cylinder results and test. Concrete represented by field-cured samples shall be considered structurally adequate if the average of three strength tests is equal to at least 85 percent of f'c and if no single core is less than 75 percent of f'c. Locations represented by erratic

strengths shall be retested by core sampling per ASTM C42. Remove and replace all concrete that fails to meet the specified strength criteria. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

3. Test results shall be reported in writing to the Engineer, concrete manufacturer, and Contractor within 40 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7 and 28-day tests.

4. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

5. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when tests results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by the Engineer.

C. Miscellaneous Concrete Requirements

1. All other concrete work indicated on the drawings shall be provided and installed, even though not specifically mentioned herein, to complete the work, including the following:

a. Anchors: Install anchors furnished under other sections in accordance with approved shop drawings and/or setting instructions.

b. Equipment Bases: Install concrete bases for all pumps, tanks, fans, transformers, floor mounted electrical equipment, etc., including anchor bolts and inserts in accordance with setting instructions furnished by the Contractor responsible for installing the equipment. Finish all bases in a workmanlike manner with a troweled finish. The bases shall be located and sizes determined by the Contractor furnishing the equipment.

3.5 CLEANING AND PROTECTION

A. Concrete Curing and Protection

1. General:

a. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

b. Protect newly finished slabs from rain, snow or wind damage. Protect finished slabs from mortar leakage from pouring of concrete above. Cover masonry walls, glazing, and other finish materials with polyethylene or otherwise protect from potential damage due to placement of concrete.

c. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing.

d. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

2. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

3. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

   a. Moisture Curing: Keep surfaces continuously moist for not less than seven days, for slabs, landings sidewalks, pour strips, and all other horizontal cast-in-place concrete with the following materials:

      1) Water.
      2) Continuous water-fog-spray.

      3) Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

4. Moisture-retaining cover curing:

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

   b. Do not apply covering on finished and broomed surfaces prematurely to prevent damage to finished and broomed surfaces. Finished surfaces adversely affected by curing operations shall be repaired and restored to match the textures and finishes of the approved mock-up. Contractor shall submit proposed repair materials and methodologies for approval prior to application.

5. Liquid curing and hardening compound:

   a. Apply the specified liquid curing and hardening compound immediately after final finishing. Apply uniformly in a continuous operation by power spray equipment in accordance with the manufacturer's direction. Recoat areas, which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period. Do not use curing or hardening compounds that discolor or stain concrete surfaces.

   b. Coordinate the use of this curing and hardening compound with surfaces, which are to receive subsequent coatings or finishes.

   c. Formed Surfaces: Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs, and other similar surfaces by moist curing with the 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.

3.6 EXTRA STOCK/SPARE PARTS (NOT USED)

3.7 SCHEDULES

A. Placement Schedule: Prepare a placement schedule and submit to Architect for review no less than two weeks prior to the pre-concrete conference; Part 2, Section 2.2, Paragraph K, and shall be discussed therein.

END OF SECTION

SECTION 034100

STRUCTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 GENERAL REFERENCE

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

1.2 DESCRIPTION OF WORK

A. Provide all design, labor, materials, equipment, design services and accessories necessary to furnish and install the work of this section, complete and functional, as indicated in the Contract Documents and as specified herein.

B. Extent of structural precast concrete work is shown on drawings and in schedules and includes the following:

1. Long span double tee units.
2. Structural framing units including columns, beams and girders.
3. Exterior spandrels, wall panels and perimeter columns with architectural finishes.
4. Stairs and solid slab/plank units.
5. Load bearing light-wall and shear wall units.
6. Stair and elevator walls.

1.3 ALTERNATIVES

A. Alternates 1-3 do not affect the precast scope of work.

B. ADD/ALT No. 4: Precast spandrel panels to be 10” shorter with railings for pedestrian fall protection on the east and west elevations. Base bid spandrels 6’-11” without railings. Alternate bid spandrels to be 6’-1” with post-installed railings. North elevation spandrels not affected.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 10 00 - Concrete Forming

B. Section 03 20 00 - Concrete Reinforcing

C. Section 03 30 00 Cast-In-Place Concrete

D. Section 04 20 00 – Unit Masonry

E. Section 07 92 00 – Joint Sealants

F. Section 07 95 00 – Expansion Control

1.5 SHOP DRAWINGS

A. Shop Drawings: Submit shop drawings showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross section; location, size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection. Shop drawings shall be stamped and signed by a Professional Structural Engineer licensed to practice in the State of Massachusetts.

1. Indicate layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS Standard symbols. Provide location and details of inserts, connections, and joints, including accessories and construction at openings in precast units.

2. Provide location and details of anchorage devices that are to be embedded in other construction. (foundations, structural support members other than precast concrete, etc.) Furnish templates if required for accurate placement.

3. Include temporary shoring, bracing and erection procedure for precast units and sequence of erection. Temporary shoring and bracing plans and details shall include stamped and signed design calculations prepared by the registered Professional Engineer licensed to practice in the State of Massachusetts.

4. Provide mock-up shop drawings reflecting sample of all architectural finishes as identified in paragraph 1.8.

1.6 SAMPLES

A. Initial Selection Samples: Submit samples showing complete range of colors, textures and finishes available for each material used.

B. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected.

C. Submit the following samples:

1. Submit no less than three sets of samples approximately 12 inches x 12 inches x 2 inches to illustrate the quality, color, and texture of the surface finish for each type of architectural finish; exterior spandrels, wall panels and perimeter columns. Initial samples to include both desired color samples as directed.

2. Submit Manufactures thin brick sample selection with complete available color range, texture and finishes including full size samples of selected brick types.

1.7 PRODUCT LITERATURE

A. Product Data: Submit manufacturer's specifications and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.

B. Mix Designs: Submit written reports of proposed concrete mix as specified in Part 2 of this section.

C. Calculations: Provide stamped and signed design calculations including calculations for structural repairs prepared by the registered Professional Engineer licensed to practice in the State of Massachusetts. Precast concrete units and connections shall be designed to withstand all applicable loads required by governing codes and erection conditions.

D. Review Period: Precast Shop Drawings and Calculations shall be subject to the Owners Architect and Engineer. Review period for each submission shall be up to 14 calendar days and reflected in the precast manufacture's schedule.

1.8 MOCK UPS

A. Submit three sets of precast samples for each required color, approximately 12 inches x 12 inches x 2 inches, to illustrate the quality, color, and texture of the surface finish for each Architectural Finish of the structural precast units.

B. Thin Brick Mock-up: Provide 3 ft x 3 ft mock-up boards depicting thin brick color range, blend, texture, patterns and mortar joint color, size, and configuration. Mock-up shall be representative fo surface preparation techniques, forms and workmanship. Do not proceed with remaining work until workmanship, color, blend, jointing are approved by the architect. If directed by the architect, provide subsequent mock-up boards to achieve final approval.

C. Full Scale Mock-Up Panels: Upon approval of small sample panels, and before fabrication of any other architectural precast concrete work commences, fabricate two (2) mockups in accordance with the mockup detail as shown on A-002 for inspection by the Owner and Architect. The mockups are to display all exposed, exterior finishes featured on the garage and align with the provided mock-up drawing. If the range of color and applied finish on the panels is approved by the Architect, one mock-up panel shall remain at the precaster's plant and be used as a standard of quality for architectural finish of the structural precast concrete work required for this project. The second mock-up panel shall be delivered and stored on-site at a location designated by the Architect and remain on site for use as a standard of quality through the delivery, erection and punch-listing phases of the project. The precaster shall provide and assemble materials to maintain sample panel in upright position throughout the project duration. Fabrication of the precast work shall not commence until the mock-up panel has been approved by the Architect. At the conclusion of the project, the panel shall be removed and disposed of in a legal manner. The precast manufacture shall notify the Architect at least 2 weeks in advance of casting of the mock-up panel.

D. The initial casting of the precast tees may serve as the mock-up for review for the finishes including the surface broom finish. The precaster shall notify the Architect at least 2 weeks in advance of casting of the initial precast tees.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store units at project site to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at designated lift points.

B. Deliver anchorage items, which are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.

1.10 COORDINATION (NOT USED)

1.11 QUALITY ASSURANCE

A. Manufacturer's qualifications.

1. Fabricator Qualifications: Firms which have five years successful experience in fabrication of precast concrete units similar to units required for this project will be

acceptable. Fabricator must have sufficient production capacity to produce required units without causing delay in work.

a. Fabricator must be producer member of the Prestressed Concrete Institute (PCI) and/or participate in its Plant Certification Program.

b. Each facility utilized must be certified for the type of product produced.

B. Subcontractor's qualifications

1. Erector Qualifications: The erector must be certified by PCI and shall have five years successful experience in the erection of precast concrete units similar to those required for this project. Submit proof of current erection certification certified for complex structural systems.

a. Welder Qualifications: Field Welder shall be certified on the material and for the type of welding performed. Proof of current certification shall be submitted no less than two weeks prior to start of welding.

C. Engineering:

1. Codes and Standards: Comply with provisions of following codes, specifications and standards, except as otherwise indicated.

a. 780 CMR: Massachusetts Amendments to the International Building Code 2009

b. ACI 301 "Specifications for Structural Concrete".

c. ACI 318 "Building Code Requirements for Structural Concrete".

d. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

e. Prestressed Concrete Institute MNL 116, Manual for Quality Control for Plants and Production of Precast Concrete Products".

f. Prestressed Concrete Institute MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products".

g. Prestressed Concrete Institute MNL 135, "Tolerance Manual for Precast and Prestressed Concrete Construction".

h. Prestressed Concrete Institute, MNL 120, "PCI Design Handbook".

i. American Welding Society, AWS D1.1, "Structural Welding Code-Steel", D1.4 "Structural Welding Code – Reinforcing Steel", D1.6 "Structural Welding Code – Stainless Steel", C5.4, "Recommended Practices for Stud Welding".

2. Analysis and Design by the Professional Structural Engineer retained by the Fabricator: The Professional Engineer shall have a minimum of five years of experience in designing Precast Concrete Parking Structures.

3. All precast concrete units and precast concrete structural frame shall be analyzed and designed by the fabricator to support self-weight, superimposed dead, live and impact loads, volume change and thermal loads, handling loads and lateral (including but not limited to wind and seismic) loads as required for compliance with the governing Building Code.

4. For precast concrete structures where stability of the structure and the structural resistance to the lateral loads in accordance with the governing Building Code is to be provided by the precast concrete components, walls, frames, braces, etc., either by themselves or in combination with other structural members, the precast concrete fabricator shall analyze the structure in accordance with the structural system identified in the contract documents. The fabricator shall calculate lateral loads as required by the Building Code to be used in such analysis.

5. The precast concrete fabricator shall provide complete analysis and design calculations prepared and stamped by the Registered Engineer, licensed in State where project is located. The information in the calculations shall be paginated, provided with the index page, and shall include the following as a minimum:

   a. Sketches of structural system(s) which have been analyzed.

   b. Calculation of the required gravity and lateral loads.

   c. Sketches of models analyzed (with node and member numbering per computer analysis, if used).

   d. Summary of material and member properties and boundary conditions assumed.

   e. Summary of individual loadings and load combinations.

   f. Reactions at supports and connections due to the loading combinations considered.

   g. Forces in most critical individual members due to the loading combinations considered.

   h. Design calculations of representative connections and member reinforcement.

   i. (Where word “Fabricator” is used, it means the Engineering Work to be done by the approved Professional Engineer retained by the Fabricator.)

D. Fire Resistance Rated Precast Units: Where precast concrete units required by Code to meet a particular fire resistance classification, provide units tested and listed by U.L. in "Fire Resistance Directory", with each unit bearing U.L. label and marking, or in accordance with PCI Manual, MNL – 124, “Design for Fire Resistance of Precast Prestressed Concrete”.

   1. Provide complete design calculations by the Professional Engineer registered in the State where the Project is located.

E. The fabrication of precast concrete will be performed under a Quality Assurance program, including monitoring, inspecting, testing, and documenting production of elements according to the Project Specifications. The Fabricator of the precast concrete shall be certified by the Precast/Prestressed Concrete Institute (PCI). The Testing Agency will certify and document the following:

   1. Location and installation details of the reinforcing and prestressing steel.

   2. Application of prestressing forces.

3. Grouting (non-shrink and dry pack) at column and pier bases, and at all joints.

4. Grouting at embedded inserts and splice sleeves.

5. Location and installation of inserts and blockouts.

6. Plant concrete mix design.

1.12 WARRANTIES

A. Attention is directed to provisions of the CONDITIONS OF CONTRACT and applicable parts of Division 1 regarding guaranties and warranties.

B. Manufacturers shall provide their standard guaranties for work specified in this Section. However, such guaranties shall be in addition to and not in lieu of all other liabilities which manufacturers and Contractor may have by law or by other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 ACCPETABLE MAUNFACTURERS (NOT USED)

2.2 MATERIALS

A. Formwork

1. Provide forms and where required, form facing materials of metal, plastic, wood, or other acceptable material that is non reactive with concrete and will produce required finish surfaces.

2. Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL.

B. Reinforcing Materials

1. Reinforcing Bars: ASTM A615, Grade 60, unless otherwise indicated. Reinforcement to be welded shall conform to ASTM A706 Grade 60.

2. Steel Wire: ASTM A82, plain, cold drawn, steel.

3. Welded Wire Fabric: ASTM A185.

4. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations.

a. Epoxy Coated: ASTM A775/A. Fusion bonded coating, apply after fabrication and bending. Film thickness of coating after curing to be 7 to 12 mils when measured in accordance with Method G12. Provide epoxy coated reinforcing as defined below.

1) All reinforcement except welded wire fabric, placed within the top 3" of elevated structural slabs including precast double tees, beams and girders.

2) All reinforcement extending from precast concrete components into the cast-in-place concrete topping.

3) Support steel for all epoxy coated reinforcing steel.

b. Epoxy Patching Compound: ASTM A775/A.

C. Pre-stressing Tendons

1. Uncoated Grade 270, 7-wire stress relieved strand complying with ASTM A416.

2. Strand similar to above, but having size and ultimate strength of wires increased so that ultimate strength of the strand is increased approximately 15 percent, or strand with increased strength but with fewer number of wires per strand, may be used at manufacturer's option.

D. Concrete Materials

1. Portland Cement: ASTM C150, Type I or Type III.

a. Use only one brand and type of cement, fly ash and round granulated blast furnace slag throughout project, unless otherwise acceptable to Architect.

b. Uniformity of cured concrete appearance resulting from the concrete mix and its constituents, manufacturing or handling practices is the manufacturer's responsibility.

2. Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source for exposed concrete.

3. Water: Potable.

4. Air Entraining Admixture: ASTM C260.

5. Water Reducing Admixture: ASTM C494, Type A, or other Type approved for fabricator's units.

6. Corrosion Inhibiting Admixture: ASTM C494/C Type C. Application rate of 2 1/2 gal/cy of concrete for precast units used in horizontal applications only including double tees, beams and girders.

7. Pigment admixtures: natural and synthetic materials conforming to ASTM C979. Not to exceed 10% by weight of cement, exterior formed finish panels and exterior sand blast finish shall have colored concrete as selected by the Architect.

E. Connection Materials

1. Carbon Steel Shapes and Plates: ASTM A36.

2. Anchor Bolts: ASTM A307, low carbon steel bolts, regular hexagon nuts and carbon steel washers.

a. Galvanized: Provide ASTM A307, hot-dip zinc coated, with ASTM A563 heavy hex nuts and carbon steel washers, hot-dip galvanized ASTM A153.

3. Threaded Fasteners: ASTM A307 or A325 heavy hexagon structural bolts, heavy hexagon nuts and washers.

   a. Galvanized: ASTM A307 or A325, with ASTM A563 heavy hex nuts and carbon steel washers, hot-dip galvanized ASTM A153.

4. Bolts at column splices: For anchoring columns within a 2'-0" height above a respective floor level, stainless steel anchor bolts conforming to ASTM F593, Group A, Type 304 shall be used together with corresponding stainless steel nuts and washers. For column splices outside of the 2'-0" zone above any floor level, see paragraph 3 above, or the use of mechanical splice sleeves meeting ACI 318, 12.14.3.2.

5. Bearing Pads: Provide bearing pads for precast concrete units as indicated on drawings.

   a. Elastomeric Pads: Vulcanized, chloroprene elastomeric compound, molded to size or cut from a molded sheet, 50 60 shore A durometer.

   b. Frictionless Pads: Tetrafluoroethylene (TFE), with glass fiber reinforcing as required for service load bearing stress.

   c. Random Oriented Fiber Reinforced: Shall support compressive stress of 3,000 psi with no cracking, splitting or delaminating in internal portions of the pad. One specimen shall be tested for every 100 pads used.

   d. Cotton Duck Layer Reinforced: Elastomeric pads with closely spaced layers of fabric meeting AASHTO specification section 18.10.2.

   e. Plastic: Multi-monomer plastic strips shall be non-leaching and support construction loads with no visible overall expansion. Limit to plank bearing only.

   f. Tempered or Untempered Hardboard: Limit use to plank bearing only. Do not use in areas where bearing material in service may remain wet for extended periods of time.

6. Tee Flange Connection: Plates and bars; stainless steel per ASTM A666, AISI Type 304, or ASTM A276 Type 304 or 304N.

7. Welding Electrodes: Comply with AWS standards.

8. Accessories: Install clips, hangers, and other accessories required for installation of project units and for support of subsequent construction or finishes as supplied to the precast manufacture by others.

F. Grout Materials

1. Cement Grout: Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C404. Mix at ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.

2. Non-metallic, Shrinkage Resistant Grout: Pre mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with ASTM C1107 and U.S. Army Corps of Engineers CRD-C621.

a. Available Products: Subject to compliance with requirements, products, which may be incorporated in the work, include, but are not limited to, the following:

1) Euco N.S.: The Euclid Chemical Co.

2) Crystex; L & M Construction Chemicals

3) Masterflow 713 Plus; Master Builders

4) Five Star Grout; U.S. Grout Corp.

G. THIN BRICK MATERIALS

1. Thin Brick Units: ASTM C 1088, Grade Exterior, Type TBX, not less than 9/16 inch thick, and as follows:

a. Basis of design: Feldhaus Klinker 991 “Bacco | Ador Matiz”

b. Face Size: 2-1/4 inches high by 7-5/8 inches long.

c. Special Shapes: Include corners, edge corners, and end edge corners.

d. Initial Rate of Absorption: Less than 30g/30 sq. in. per minute when tested per ASTM C 67.

e. Efflorescence: Provide thin brick units that meet ASTM C 67 and is rated “not effloresced”.

f. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

1) Feldhaus

2) Summitville Thin Brick

3) Endicott

4) or approved equal

2.3 MIXES

A. Prepare design mixes for each type of concrete required in conformance with the requirements of the Plans and Section 03 30 00 Cast-in-Place Concrete.

1. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option

B. Produce standard weight concrete consisting of specified Portland cement, aggregates, admixtures, and water to produce the following minimum properties.

1. Compressive strength; 5000-psi minimum at 28 days. Release strength for prestressed units: 3500 psi.

2. Cure compression test cylinders using same methods as used for cast-in-place concrete work, and as required by PCI & ASTM C31.

C. Submit written reports to Architect of proposed mix for each type of concrete at least 15 days prior to start of precast unit production. Do not begin concrete production until mixes and evaluations have been reviewed by Architect.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using in the work.

E. Admixtures:

1. Use air entraining admixture in concrete and shall conform to the air content limits indicated in the plan documents.

2. Use water reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low slump concrete, may be used subject to Architect's acceptance.

3. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

F. Chloride Ion Content of Design Mix (ASTM C1218): For the purposes of this sub-section only, compliance to the requirements below shall be provided for elements of the structure exposed to the chloride ions in service. These include among others, precast concrete double-tees, double-ledger beams, single-ledger beams, spandrel beams, hollow-core slabs/planks, walls and columns in parking areas, reinforced concrete walls, columns and piers in parking areas, and cast-in-place concrete topping.

1. For protection against corrosion, maximum water soluble chloride ion concentration in hardened concrete at 28 days shall be limited to quantities indicated in the ACI 318 Table 4.4.1, except that percentages listed shall be taken against the weight of cementitious materials (Portland Cement plus Fly Ash or other pozzolans, plus GGBFS).

2. Mixes with the water soluble chloride ion concentration in excess of the limits per ACI 318 Table 4.4.1 as determined by testing per ASTM C1218, will not be accepted. The contractor shall identify the source of the excess chloride ions (aggregates, water, admixtures, etc.) take measures to remove it from the affected mix(es).

G. Stair treads: Two component stair noising mill finish aluminum to accommodate pre-installation of aluminum extruded base to be cast into the concrete step with wood blocking during construction and finished stair nosing at time of occupancy: Balco XH-330 2626 S. Sheridan, Wichita Kansas 67217, (316) 945-9328, Babcockdavis BSTTF, Brooklyn Park, MN 55428 (888) 412-3726 or approved equal.

2.4 FABRICATION

A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL 116, and as specified for types of units required.

B. Ready Mix Concrete: Comply with requirements of ASTM C94, and as herein specified.

1. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to batch will not be permitted.

2. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required when the air temperature is between 85 deg. F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1 1/2 hour to 75 minutes and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

C. Built in Anchorages: Accurately position built in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or placing of concrete. Do not relocate bearing plates in units unless acceptable to Architect.

1. Lifting devices shall be placed and cast so as not to weaken the unit during manufacturing, handling and erection. Such devices shall not interfere with the erection or placing of the unit in its final position in the building. These devices shall also be protected from rusting, or other deterioration or damage. Under no circumstances shall these devices be visible in the completed work.

D. Cast in Holes for openings larger than 10" diameter or 10" square in accordance with final shop drawings. Provide sleeves for horizontal electrical conduit runs and plumbing lines as required. Holes in precast flanges and other small holes that will be field cut by trades requiring them will not be allowed without prior approval by the Architect/Engineer and the Precast Concrete Manufacturer. See Part 3 of this Section for additional information.

E. Coat Surfaces of forms with bond breaking compound before reinforcement is placed. Provide commercial formulation form coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

F. Clean reinforcement of loose rust and mill scale, earth and other materials, which reduce or destroy bond with concrete.

G. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

H. Cast-in materials for other trades:

1. Hardware, conduit, inserts and similar materials required by other trades shall be located and detailed on the shop drawings by the Precast Manufacturer. Hardware, conduit inserts and similar materials required by other trades shall be furnished to Precast Manufacturer by the trade in a timely manner that accommodates the Precast Manufacturers schedule. Precast Manufacturer shall not cast precast components without hardware, conduit, inserts and similar materials as identified on approved shop drawings.

I. Place reinforcement to obtain at least the minimum cover for concrete protection per ACI 318. 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.

J. Pretensioning of tendons for prestressed concrete may be accomplished either by single strand tensioning method or multiple strand tensioning method. Comply with PCI MNL 116 requirements.

K. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304R. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built in items.

L. Identification: Provide permanent markings to identify pick up points and orientation in structure, complying with markings indicated on final shop drawings. Imprint date of casting on each precast unit on a surface, which will not show in finished structure.

M. Curing by low pressure steam, by steam vapor, by radiant heat and moisture, or other similar process may be employed to accelerate concrete hardening and to reduce curing time.

N. Delay detensioning of prestressed units until concrete has attained at least 3500 psi or higher as required by design.

1. If concrete has been heat cured, perform detensioning while concrete is still warm and moist to avoid dimensional changes which may cause cracking or undesirable stresses in concrete.

2. Detensioning of pretensioned tendons may be accomplished either by gradual release of tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

O. Finish of Formed Surfaces: Provide finishes for formed surfaces of precast concrete as indicated for each type of unit, and as follows:

1. Standard Finish: Tees, Beams, Girders and Interior Columns Normal plant run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted.

2. Architectural Finish: All exterior precast units including but not limited to columns, girders, shear walls, wall panels, stair towers and spandrels shall be cast and finished to produce an structural precast finish as follows:

a. Colored Units: Precast units shall have a sandblast finish as directed by the Architect and approved on the mock-up. Where indicated on the drawings, exterior precast color and texture shall meet approved sample with selected sandblast finish.

1) Samples shall assimilate in color and textures as shown in 363 & 364 in the Architectural Precast Concrete, Color and Texture Selection Guide, 2nd Edition, Precast/Prestressed Concrete Institute, 2010. The selected color will be in the same family of colors as 363 & 364. Reference drawings for finish schedule and elevations.

a) Finish Type A: Typical exterior precast finish with medium sandblast Basis of Design 363AE-L & 364AE-L
b) Finish Type B: Polished aggregate finish at spandrel inset at East and West Elevations. Basis of Design 363P & 364P

2) Precast units shall be uniform in appearance, color and texture to match sample panels and mock-up prepared by the Precaster and approved by the Owner and the Architect.

b. Interior face of spandrel and wall panels shall receive a smooth troweled finish, unless otherwise noted.

P. Finish of Unformed Surfaces: Apply trowel finish to unformed surfaces unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float and trowel to a smooth uniform finish. No surfaces exposed to freeze-thaw cycles in service shall be finished with power equipment, unless evidence acceptable to the Architect/Engineer presented by the manufacturer that such a finishing does not reduce the amount of air entrainment in the top 1/8" of precast concrete.

1. Provide a medium to heavy broom finish on tees parallel with the long direction of the unit as approved by the mock-up.

2. Provide an intentionally roughened surface (1/4" amplitude) on tees and beams to receive a concrete topping, where indicated on drawings and where required or determined by the precaster for erection/construction.

Q. For Structural Precast with architectural finish: Comply with the dimensional tolerances of PCI MNL 116.

R. Long Span Units

1. Type: Plant fabricated, precast prestressed double tee concrete units, produced under rigid, factory inspected process. Precast tee units shall include 4" tee flange with an overall depth not less than 2 ft. – 10 in.

2. Furnish units, which are free of voids or honeycomb, with straight true edges and surfaces.

3. Provide "Standard Finish" units as specified.

4. Where ends of strands will not be enclosed or covered, cut flush and cover with high strength mortar, bonded to unit with epoxy resin bonding agent.

5. Adequately reinforce units to resist transporting and handling stresses.

6. Include cast in weld plates where required for anchorage or lateral bracing to framing units and adjacent precast members.

7. Coordinate with other trades for installation of items to be cast in long span units. Include drain frame cast into precast double tees, Zurn Model No. 662 or approved equal in quantities as indicated on the plan documents. Balance of drain body to be shipped to site for installation by others.

8. Provide block outs for openings in accordance with design drawings or precast unit manufacturer's recommendations. Including block outs for conduit runs as shown on plan documents or, if not detailed, at 1/3rd points.

S. Structural Framing Units

1. Type: Plant fabricated precast prestressed column, girder, floor and stair slab panels, wall panels and spandrel units produced under a rigid factory inspected process.

2. Furnish units, which are free of voids or honeycomb, with straight true edges and surfaces.

3. Provide "Standard Finish" or “Architectural Finish” units as specified.

4. Where ends of strands will not be enclosed or covered, cut flush and cover with a high strength mortar bonded with an epoxy resin-bonding agent.

5. Adequately reinforce units to resist transporting and handling stresses.

6. Include cast in weld plates where required for anchorage or lateral bracing to other supporting members.

7. Coordinate with other trades for the installation of items to be cast in precast structural framing units.

PART 3 - EXECUTION

3.1 PREPARATION AND INSPECTION

A. Inspection:

1. Welding and Materials: Inspection of welding by the Testing Agency will be such as to assure that the work conforms to specified requirements, and will include:

a. Confirmation that electrodes used for manual shielded metal-arc welding and the electrodes and flux used for submerged arc welding conform to the requirements of the specifications.

b. Confirmation that the approved welding procedure and the approved welding sequence are followed without deviation, unless specific approval for change is obtained by the Architect.

c. Confirmation that the welding is performed only by welding operators and welders who are properly certified. The Testing Agency shall witness such qualification testing of welding operators and welders, as may be required.

d. Confirmation that the fit-up, joint preparation, size, contour, extent and length and location of welds conform to Project requirements and where applicable, the contract drawings, and that no welds are omitted or unspecified welds added without approval of the Architect.

e. Verify that quality of welds meet the requirements of paragraph 6.9, table 6.1, “Quality of Welds”, AWS D1.1.

f. The Inspector shall be notified in advance of the start of operation subject to inspection and verification.

g. The testing agency shall test the field welds as follows:

1) All welds, including wall and shoring connections: 100% visual (subject to Table 6.1 “Visual Inspection Acceptance Criteria).

2) All full or partial penetration groove welds: 100% ultrasonic or as directed by the Architect (subject to Table 6.2 “Ultrasonic Acceptance-Rejection Criteria).

3) All other welds, including curtain wall and shoring connections: 10% magnetic particle (10% dye-penetrant for stainless steel).

h. Additional testing will be required of:

1) If more than 10 percent of the ultrasonically inspected welds are rejected, then 100 percent of all such welds shall be ultrasonically tested after the repairs.

2) All cost of additional inspection required by this paragraph shall be borne by the Contractor.

i. In addition, if defective welds are discovered, the remaining uninspected welds may, at the Engineers direction, receive such ultrasonic or magnetic particle inspection.

j. The welding inspector will have the authority to reject weldments. Such rejection may be based on visual inspection where in his opinion the weldment would not pass a more detailed investigation.

k. Reports by the Testing Agency's inspector will contain, as a minimum, an adequate description of each weld tested. The report shall have the identifying mark of the welder responsible for the weld, a critique of any defects noted by visual inspection or testing, and a statement regarding the acceptability of the weld tested, as judged by current AWS standards. Reports shall be distributed as early as possible by not later than one (1) work week after the tests have been performed. The Engineer shall be notified by phone if, in the judgment of the inspector, test results require immediate comment.

l. Radiographic testing may be substituted for ultrasonic.

B. Bolted Connections: Visually inspect all bolted connections to ascertain that all bolts, nuts and required washers have been installed and are of proper type and that all faying surfaces have been brought into snug contact.

C. Precast Concrete:

1. Note that required inspections and tests for embedded steel (carbon and stainless) connections and materials associated with precast concrete elements are included under the Welding and Material of this program.

D. The Contractor and the Testing Agency will perform erection inspections of all precast concrete installation. The Contractor will record inspection results and retain them on-site and submit a copy to the SER.

E. At the start of field operations, and periodically during the course of work, the Testing Agency will conduct compression tests of grout prisms in accordance with ASTM C 109. A set of five (5) grout prisms shall be cast for the first day's work for each grout application (non-shrink and dry-pack grout at joints, grout at inserts and splice sleeves). Another three (3) grout prisms shall be cast for each additional day's work. There shall be a minimum of three (3) grout prism cast, in addition to the initial five (5), for the project. Provide an additional set of five (5) prisms for each change in mix proportions, mix methods, or materials. The prisms shall be delivered to the Testing Agency within 24 hours of placement and shall be tested at 7-days and 28-days, with one prism held in reserve.

3.2 WORKMANSHIP, PERFORMANCE

A. The Owner may employ a separate testing laboratory to evaluate precast manufacturer's quality control and testing methods.

B. The precast manufacturer shall allow Owner's testing facility access to materials storage areas, concrete production equipment and concrete placement and curing facilities. Cooperate with Owner's testing laboratory and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.

C. Dimensional Tolerances: Units having dimensions smaller or greater than required, and outside specified tolerance limits of MNL 116, will be subject to additional testing as herein specified.

D. Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction. Repair, or remove and replace rejected units as required to meet construction conditions.

1. Precast units having dimensions smaller than required will be rejected unless directed otherwise by the Architect.

E. Strength of Units: The strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements which may affect the strength of the precast units, including the following conditions.

1. Failure to meet compressive strength tests requirements.

2. Reinforcement, and pretensioning and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.

3. Concrete curing, and protection of precast units against extremes in temperature, not as specified.

4. Precast units damaged during handling and erection.

F. Testing Precast Units: When there is evidence that strength of precast concrete units does not meet specification requirements, the concrete testing service shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C42 and as follows.

1. Take at least three representative cores from precast units of suspect strength, from locations directed by Architect.

2. Test scores in a saturated surface dry condition per ACI 318 if concrete will be wet during use of completed structure.

3. Test scores in an air dry condition per ACI 318 if concrete will be dry during use of completed structure.

4. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85 percent of 28 day design compressive strength.

5. Test results will be made in writing on same day that tests are made, with copies to Architect, Contractor, and precast manufacturer. Include in test reports the project identification name and number, date, name of precast concrete manufacturer, name of concrete testing service, identification letter, name, and type of member or members

represented by core tests, design compressive strength compression breaking strength and type of break (corrected for length diameter ratio), direction of applied load to core with respect to horizontal plan of concrete as placed, and moisture condition of core at time of bearing.

G. Patching: Where core test results are satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.

H. Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be replaced with precast concrete units that meet requirements of this section. Contractor shall also be responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.

I. Repair Work: If repairs are required for any precast concrete member after casting, the Contractor shall submit a description of the repair (E.G. crack, spall, etc.) and a detailed description of the proposed fix to be used for Architect's review. Specific repair details should be stamped and signed by Professional Engineer registered in the state of the project and approved by the architect/engineer prior to work commencing.

1. Mock-up: Upon acceptances by the Architect of the Contractor's repair procedure, repairs shall be made for Architect review on the project markup in accordance with the accepted procedure upon acceptance; the repairs shall be maintained as a standard of acceptance for all future repairs of this type.

J. Precast Fabricator shall employ a licensed surveyor registered in the state of Massachusetts to survey and verify alignment, placement and elevations of erected precast units for compliance to the tolerance limits of PCI MNL-127 and PCI MNL-120. Precaster and erector shall provide timely access for the surveyor to verify tolerance compliance and to notify Architect, precaster and erector of non-complying erected precast units. Precaster and/or precaster's erector shall correct all non-complying conditions. Survey and tolerance reports shall be submitted to the Architect at the close of each day's work.

K. Precast fabricator shall survey all anchor bolts, embeds, plates, footing and pier locations, alignments and elevations for conformance to precast layout. Precaster shall notify contractor at least 2 weeks prior to precast erection of all non-conforming conditions to allow contractor sufficient time to implement adjustments.

3.3 INSTALLATION / APPLICATION / ERECTION

A. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads during erection. All columns are to be braced in all directions prior to erecting other members. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

B. Bearing Pads: Install flexible pads where indicated, as precast units are being erected. Set pads on level, uniform bearing surfaces and maintain in correct position until precast units are placed. Stacking or multiple bearing pads, or use of high density plastic shims except at grade and wall panels, shall not be allowed. Erector shall have sufficient pads of varying thicknesses to enable continuous erection within design tolerances. Bearing pad thicknesses shall be evaluated for loading and shape factor by precasters Engineer. Submit bearing pad evaluation with precast design calculations. Multiple shims, pads or any combination at double tee and girder locations shall be removed and replaced with approved pad thickness.

C. Welding: Perform welding in compliance with AWS D 1.1, including qualification of welders.

1. Protect units from damage by field welding or cutting operations and provide non combustible shield as required.

2. Zinc coated (galvanized) surfaces shall be properly prepared for welding by grinding the coating and ascertaining no inclusion of zinc into any weld.

   a. Surfaces where zinc coating has been either removed for welding or damaged due to handling shall be repaired. Repair damaged metal surfaces by cleaning in accordance with SSPC-SP6 and applying a coat of approved galvanizing repair compound. Where cleaning per SSPC-SP6 is impractical, use SSPC-SP3 standard. In all instances of coating repair on shop galvanized surfaces, the surface preparation prior to coating application as well the application of the coating shall be witnessed by the Owner's Testing Agency per Section 014500 of these Specifications.

D. Powder Actuated Fasteners: Do not use powder actuated fasteners for surface attachment of accessory items in precast, prestressed unit unless otherwise accepted by precast manufacturer.

E. Erection Tolerances: Install precast units without exceeding tolerance limits specified in PCI MNL 127 "Recommended Practice for Erection of Precast Concrete" or PCI MNL-120 Chapter 8.

F. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at connection and joints as follows:

   1. Non structural joints: The joints shall be grouted with material per Part 2, section 2.2, F.

   2. Structural joints: shrinkage resistant grout consisting of premixed compound and water to provide a flyable mixture without segregation or bleeding.

   3. Provide forms or other acceptable method to retain grout in place until sufficiently hard to support itself. Pack spaces with stiff grout materials, tamping until voids are completely filled. Recess grout within joints to allow no less than ½ inch depth of sealant application into joint in addition to all miters, chamfers, and beveled edges. Example: ¾" miter + ½" sealant = 1 ¼" min. depth to hold grout from face of panel. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

G. Close coordination and cooperation must be maintained between the General Contractor and the Precast Concrete Fabricator to overcome any physical obstructions in the area of the work which would prevent suitable access for trucks and cranes in the delivery, receipt and placing of the precast material.

H. Any attachments made to the precast units in the field must be accepted by the Precast Concrete Fabricator as well as the Architect/Engineer to avoid cutting or otherwise damaging the prestressing tendons or reinforcing steel.

I. If field cut openings are required by the Contractor, the Contractor shall coordinate with the Precast Concrete Fabricator. Locations and sizes shall be approved by the Architect/Engineer.

3.4 FIELD QUALITY CONTROL (NOT USED)

3.5 CLEANING AND PROTECTION

A. Precast panels, spandrels, planks and tees that are broken, cracked or chipped shall be repaired or replaced, as directed by the Architect/Engineer.

B. After erection and grouting is completed the Contractor shall be responsible for the protection of slabs and wall panels.

C. Surfaces to receive topping shall be clean and thoroughly wetted prior to placing topping slab.

D. Patch lifting pockets, inserts and other openings to within ½ in. of surface (to allow for caulking) with patching mortar blended to match the color of the surrounding concrete. See Section 033000 for patching materials.

E. Patch defective areas with cement mortar and bonding agents as specified in Section 033000. Blend patching mortar to match surrounding area.

1. Repair or patch concrete with architectural finishes with mortar material identical in color to precast members so that when dry, the repair will match surrounding concrete surface.

F. Repair procedures, materials and analysis for structural repairs shall be submitted and accepted prior to application. All design work for structural repairs shall bear the fabricators engineer professional engineers stamp in the state where the project is located.

G. Remove rubbish and debris resulting from precast concrete work from premises upon completion. Protect work of this Section from fabrication to the completion of installation.

3.6 EXTRA STOCK/SPARE PARTS (NOT USED)

3.7 SCHEDULES (NOT USED)

END OF SECTION

SECTION 04200

UNIT MASONRY
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 Specification Sections, apply to this section.

B. Examine all Drawings and all Sections of the Specifications and requirements and provisions affecting the work of this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.
   1. The Work of this section is shown on Drawings: A101, A301, A401, A502, A701, S005, S104, S105, S140, S201.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. The extent of each type of unit masonry work is shown on the drawings and includes but is not limited to the following:
   1. Concrete masonry units.
   2. Building in metal doorframes.

B. Related Work Specified Elsewhere:
   1. Section 03300 - Cast-in-Place Concrete
   2. Section 03410 - Structural Precast Concrete
   3. Section 05500 - Miscellaneous Metals
   4. Section 07920 - Joint Sealants
   5. Section 08113 - Hollow Metal Doors and Frames

1.4 QUALITY ASSURANCE

A. Masonry operations are controlled in accordance with the Standard and Project Specification Sections 04180. Specific inspections and tests performed during masonry operations are as follows:
   1. Materials: The Contractor will submit certified test reports for each type of concrete masonry unit. The Testing Agency shall qualify the materials used for masonry production. Grout and mortar mix proportions shall be approved by the SER. Records of the material and mix proportions shall be maintained on file in the Project Office. No alternate materials or mix proportions will be used unless approved by the Testing Agency and the SER.
   2. Construction Operations: At the start of field operations, and periodically during the course of work, the Testing Agency will test materials and conduct inspections of measuring, mixing, laying, and curing of mortar and grout, including prism tests in accordance with

ASTM C 952, ASTM E 447 (Method B), and ASTM C 109. A set of five (5) grout prisms shall be cast at the start of construction; with two prisms compression tested at 7-days, two at 28-days, and one held in reserve. Another three (3) grout prisms shall be cast for each 5,000 square feet of wall area, or each 30 cubic yards of grout, whichever occurs first; with one prism compression tested at 7-days, one at 28-days, and one held in reserve. There shall be a minimum of three (3) grout prism cast, in addition to the initial five (5), for the project. The prisms shall be delivered to the Testing Agency within 24 hours of placement. Provide an additional set of five (5) prisms for each change in mix proportions, mix methods, or materials.

3. The Contractor will ensure that masonry received on-site meets the requirements of the Project Specifications. Mortar is not allowed to be placed if it is more than 1 hour old from the time of initial mixing. The Inspector will oversee the mixing and delivering operations to ensure that the Contractor is producing masonry as specified and may request additional tests to ensure that quality masonry is being produced. Results of these inspections will be recorded in the Contractor's Daily Construction Report.

The above noted verification and testing program is not intended to replace the project specification requirements as they apply to material testing requirements. Where duplication or similar tests are required the more comprehensive/stringent testing procedure shall be required.

Codes: Comply with the applicable requirements of governing authorities and codes for the types of masonry construction shown.

B. Fire Resistance: Where fire-resistance ratings are indicated or required by authorities having jurisdiction, provide materials and construction which is identical to assemblies whose fire-resistance rating has been tested in compliance with ASTM E119 and authorities having jurisdiction.

C. Coordination: Review installation procedures and coordinate with work that must be integrated with masonry.

D. Construction Tolerances: Lay up all wall and partitions plumb and true with courses level and accurately spaced and coordinated with other work. Variations from plumb, true or level of more than 1/8 inch in 10 feet 0 inches in any direction are unacceptable.

E. Job Mock-up: prior to installation of masonry work, erect sample wall panel mock-up using materials, bond and joint tooling shown or specified for final work. Build mock-up at the site, where directed, of full thickness and approximately 4 feet x 3 feet, unless otherwise shown, indicating the proposed range of color, texture and workmanship to be expected in the completed work. Obtain Architect's acceptance of visual qualities of the mock-up before start of masonry work. Retain mock-up during construction as a standard for judging completed masonry work. Do not alter, move or destroy mock-up until work is completed – mock-up may become part of Final Work.

F. Provide adequate bracing of walls during erection to prevent damage due to high winds or other lateral loads until permanent bracing is installed. Contractor shall assume all responsibility for damage due to failure to take such precautions.

1.5 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's data for concrete masonry units required, including certified copies of laboratory test reports and other data as may be required to show compliance with the specified requirements.

B. Samples: Submit samples of each type of masonry unit specified. Select units to show the range of color and texture which can be expected in the finished work.

1.6 JOB CONDITIONS

A. Masonry Protections:
1. Protect masonry materials during storage and construction from wetting by rain, snow or ground water and from soilage or intermixture with earth or other materials.
2. In exposed work, do not use masonry units with chips, cracks, voids, discolorations or other defects, which might be visible or cause staining in finished work.
3. Protect partially completed masonry against weather, when work is not in progress, by covering top of walls with strong, waterproof, non staining membrane.
4. Protect masonry from freezing when the temperature of the surrounding air is 40 degrees F. and falling. Heat materials and provide temporary protection of completed portions of masonry work. Comply with governing codes and NCMA TEK 16 recommendations for cold weather concrete masonry construction.
5. Frozen Materials: Do not use frozen materials or materials mixed or coated with ice or frost.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Units: Hollow load-bearing, ASTM C90, Type 1, Grade N. Aggregate shall conform with ASTM C-33.
1. Size: Manufacturer's standard units with nominal face dimensions of 16 inches long x 8 inches high. Provide thicknesses indicated on the drawings.
2. Special Shapes: Provide special shaped units for lintels, corners, jambs, headers, control joints and other conditions. Never expose cores.
3. Color/Finish: Provide manufacturers standard units suitable for field applied paint finish unless otherwise noted on the drawings.

2.2 MORTAR & GROUT MATERIALS

A. Portland Cement: ASTM C150 86, Type I, non staining, without air entrainment and of natural color or white to produce the required color of mortar or grout.
1. Use Type III high early strength as required for laying masonry in cold weather.

B. Hydrated Lime: ASTM C207, Type S.

C. Aggregates: ASTM C144.

D. Water: Clean, free of deleterious materials, which would impair strength or bond.

E. Mortar Mix:
1. Type S for reinforced and load bearing masonry; ASTM C270
2. Type N for masonry above grade and interior work.
3. Type M for masonry below grade and in contact with earth.

F. Grout for Masonry Fill: Portland cement, sand, gravel and water, proportioned as required to provide a 28-day minimum compressive strength of 3000 psi.

2.3 REINFORCEMENT, TIES & ANCHORS

A. Horizontal Joint Reinforcement: Provide galvanized ladder or truss type reinforcement for single Wythe masonry equal to Durowal "Standard" types unless otherwise noted.
   1. Wire: 9 (nine) gauge side and cross rods hot dip galvanized in conformance with ASTM A153, Class B2, 1.5 oz. per sq. ft.
   2. Corners and Intersections: Provide prefabricated corners and tees.
   3. Width: Provide one side rod for each concrete masonry shell face. Provide width as recommended by manufacturer for wall width and which gives at least 5/8" minimum cover on exterior walls.

B. Reinforcing Steel: Provide deformed rebars complying with ASTM A615, Grade 60.

2.4 ISOLATION CONTROL GASKETS

A. Gaskets: Closed cell neoprene conforming to ASTM C 509 equal to "Everlastic Neoprene" Type NN as manufactured by William Products, Inc.

PART 3 - EXECUTION

3.1 CONDITION OF SUBSTRATE

A. Examine the areas and conditions under which unit masonry work is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Do not wet concrete masonry units.

3.3 INSTALLATION, GENERAL

A. Thickness: Build single wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. Cut masonry units using motor driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full size units without cutting wherever possible.

3.4 LAYING MASONRY WALLS

A. General:
   1. Do not use mortar or grout which has begun to set or if more than 2-1/2 hours have elapsed since initial mixing. Re-temper mortar during the 2-1/2 hour period only as required to restore workability.
   2. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement type joints, returns and offsets. Avoid the use of less than half size units at corners, jambs and wherever possible at other locations.
   3. Lay up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other work.
   4. Pattern Bond: Lay concrete masonry units in running bond with vertical joint in each course centered on units in courses above and below, unless otherwise shown on the drawings.

B. Mortar Bedding and Jointing:

1. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on floor slabs and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
2. Joint Width: Lay masonry with 3/8-inch wide joints, unless otherwise indicated.
3. Lay solid masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
4. Tool exposed joints slightly concave unless otherwise shown. Compress mortar to form a dense, smooth, water tight surface.
5. Remove masonry units disturbed after laying; clean and reset in fresh mortar. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

C. Stooping and Resuming Work: Rake back 1/2 block length in each course; do not tooth. Clean exposed surfaces of set masonry and remove loose masonry units and mortar prior to laying fresh masonry.

D. Grouting: Grout cells of masonry units where shown and at all masonry lintels, bond beams, jambs and bearing points. Fully grout concrete masonry for three full courses below bearing points. Fully grout metal frames built into masonry work. Fully grout cells of masonry units, which contain vertical reinforcing bars.
1. Pour grout using container with spout and consolidate immediately by rodding or puddling; do not use trowels. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate pour 1 1/2 inches below top of highest course in pour.

E. Expansion Joints: Provide expansion, and isolation joints in masonry where shown. Build in related items as the masonry work progresses. Rake out mortar in preparation for application of caulking and sealants. See "Sealants and Caulking" section.
1. If expansion joints are not shown, provide joints 30 feet o.c. throughout the work.
2. For non load bearing work allow for deflection between top of walls and structure above. Maintain lateral stability with concealed clip angles attached to structure above in a manner acceptable to Architect. Provide compressible fillers and joint sealers to maintain acoustical performance of wall assembly.

3.5 REINFORCEMENT, TIES AND ANCHOR INSTALLATION

A. Horizontal Joint Reinforcing: Provide continuous horizontal joint reinforcing as shown and specified. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on side of walls. Lap reinforcement a minimum of 6 inches at ends of units.
1. Reinforce all single Wythe or multi wythe walls with continuous horizontal joint reinforcing not more than 16 inches on center vertically unless otherwise shown.
2. Space reinforcing at 8 inches o.c. above and below openings and extend reinforcing at least 2 feet beyond each jamb.

B. Reinforced Concrete Masonry: Reinforce concrete masonry units where shown on the drawing with #4 rebars at 16 inches o.c. unless otherwise noted. Provide horizontal joint reinforcing as stated above.

3.6 LINTEL INSTALLATION

A. Metal Lintels: Install loose metal lintels where shown on the Drawings.

B. Masonry Lintels: Provide masonry lintels where indicated and wherever openings are shown without another type of lintel. Provide precast, preformed or built in place lintels which are adequate for loading conditions encountered. Provide at least 8 inches of bearing at each end. Obtain Architect's approval of all masonry lintels used.

3.7 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, and completely fill with mortar. Point up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

C. Cleaning Exposed, Unglazed Masonry Surfaces:
   1. Wipe off excess mortar as the work progresses. Dry brush at the end of each day's work.
   2. Final Cleaning: After mortar is thoroughly set and cured, clean sample wall area of approximately 20 sq. ft. as follows. Obtain Architect's acceptance of sample cleaning before proceeding to clean rest of masonry work.
      a. Dry Clean to remove large particles of mortar using wood paddles and scrappers. Use chisel or wire brush if required.
      b. Presoak wall before saturating with water and flush off loose mortar and dirt.
      c. Scrub down wall with stiff fiber brush and a solution of 1/2 cup of trisodium phosphate and 1/2 cup of household detergent dissolved in one gallon of water.
      d. Rinse walls, using clean, pressurized water, to neutralize cleaning solution and remove loose material.
      e. Acid cleaning of masonry will not be permitted.

3.8 PROTECTION

A. Protect the masonry work from deterioration, discoloration or damage during subsequent construction operations.

B. Normal weathering of masonry work, exposed to the weather after completion, will be acceptable, provided other conditions and activities do not interfere and result in an unacceptable condition.

END OF SECTION

SECTION 05120

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of structural steel work is shown on the drawings.

1. Structural steel is that work defined in the AISC "Code of Standard Practice" and as otherwise shown on the drawings.

B. Related Work Specified Elsewhere:

1. Section 03330 - Cast-in-Place Concrete
2. Section 03410 - Structural Precast Concrete
3. Section 04200 - Unit Masonry
4. Section 05300 - Metal Decking
5. Section 05500 - Miscellaneous Metals

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Elevator Hoist Beam
2. Stair Enclosure Framing
3. Barrier Cable Supports
4. Bas-relief Panel Supports
5. Steel lintels

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes and standards except as otherwise indicated:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges".

2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and including the "Commentary" and supplements thereto as issued.

3. AISC "Specifications for Structural Joints using ASTM A325 OR A490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

4. AWS D1.1 "Structural Welding Code".

5. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

B. Qualifications:

1. Qualify welding processes and welding operators in accordance with AWS D1.1.

2. Provide certification that welders to be employed in the work have satisfactorily passed AWS

qualification tests within the previous 12 months.

3. All welders working on this project will be assigned an identifying symbol or mark. Each welder will be required to mark or stamp his symbol on each weldment completed for identification. Contractor shall maintain a record of welders employed, date of qualification and symbol or identification mark assigned to each.

4. Steel Fabricator: Fabricator shall have not less than five (5) years experience in the fabrication of structural steel. Submit a written description of fabrication ability including fabricating and surface preparation facilities, personnel and list of similar completed projects.

5. Steel Erector: Erector shall have not less than five (5) years experience in the erection of structural steel. Submit a written description of structural steel erection ability including equipment, personnel and a list of similar completed projects.

C. Source Quality Control:

1. Materials and fabrication procedures are subject to inspection and tests in the mill, shop, and field by the Architect. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

D. Design of Members and Connections:

1. All details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the site whenever possible without causing delay in the work.

2. Promptly notify the Architect whenever design of members and connections for any portion of the structure are not clearly indicated.

E. Steel Testing: Materials and installed work may require testing and retesting, as directed by the Architect, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. Tests, not specifically indicated to be done at the Owner's expense, including the retesting of rejected materials and installed work, shall be done at the Contractor's expense.

1.4 SUBMITTALS

A. Manufacturer's Data:

1. Submit five (5) copies of producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data as required to show compliance with these specifications.

a. Structural steel (each type), including certified copies of mill reports covering the chemical and physical properties.

b. High-strength bolts (each type), including nuts and washers.

c. Unfinished bolts and nuts.

d. Paint products.

e. Shrinkage-resistant grout.

f. Description of each type of welding stud and arc shield.

B. Shop Drawings:

1. Submit shop drawings including complete details and schedules for fabrication and shop assembly of members, and details, schedules, procedures and diagrams showing the sequence

of erection.

2. Review of shop drawings will be for general considerations only. Compliance with requirements for materials fabrication and erection of structural steel is the Contractor's responsibility.

   a. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.

   b. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.

   c. Shop drawings shall include complete details of the painting work to be performed.

C. Erection Procedure: Submit data, illustrative and written to describe the structural steel erection procedure, including the sequence of erection and temporary staying and bracing. Contractor shall provide sufficient bracing, etc. so that the erected steel is stable during construction or until all the concrete slabs are poured.

D. Welding Procedure and Equipment:

1. Submit written description as required to illustrate each welding procedure to be performed in the specified work.

2. Submit descriptive data for field welding equipment, including type, voltage and amperage.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site at such intervals to insure uninterrupted progress of the work.

1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay that work.

B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures. Repair or replace damaged materials or structures as directed.

C. Handling, shipping, and erecting of painted steel shall not be performed until thoroughly dry. Special care shall be exercised to avoid abrasion or other damage to the coated surfaces. Stacking and storing of painted members in the shop, in transit, and at the job site shall be done using softeners and timbers to keep individual members free from contact with the ground, and with each other; and shall be protected from soiling by adjacent fabrication of construction operations.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Steel Base Plates: ASTM A36, Grade 36, except where other type steel is shown.

B. Structural Steel Beams, Columns, and Cross Bracing Members, Low Alloy Steel: ASTM A572 Grade 50 or 50W.

C. Cold-Formed Steel Tubing: ASTM A500, Grade B, Fy 46 ksi.

D. Steel Pipe: ASTM A53, Type E or S, Grade B, double extra strong.

E. Carbon Steel Castings: ASTM A27, Grade 65-35, medium-strength carbon steel.

F. Anchor Bolts: ASTM A307, nonheaded type unless otherwise indicated.

G. Headed Stud Type Shear Connectors: ASTM A108, Grade 1015 or 1020, cold finished carbon steel; with dimensions complying with AISC Specifications.

1. Studs shall be end welded, spacing as per drawings or the number of studs per beam length to be uniformly distributed in a zigzag pattern along the length of the beam.

2. Mechanical properties of finished studs, ASTM A370, shall be:

a. Minimum tensile strength, 60,000 psi.
b. Minimum yield strength, 50,000 psi (2% offset).
c. Minimum elongation, 20% in 2 inches.
d. Minimum reduction in area, 50%.

H. High-Strength Bolts and Nuts: Heavy hexagonal structural bolts, heavy hexagon nuts, and hardened washers, all galvanized and complying with ASTM A325.

I. Electrodes for Welding: Comply with AWS Code.

J. Filler Material for Welding:

1. Shielded metal-arc welding AWS A5.1

2. Welded joints designed using E7018 low hydrogen electrodes.

3. Fabricator or Erector may substitute filler material in accordance with Section 1.17.2 of AISC Specification for Structural Steel for Buildings after obtaining Architect's approval.

K. Metallic Non-Shrink Grout: Corps of Engineers CRD-C588, Type M, pre-mixed factory-packaged ferrous aggregate grouting compound.

1. Products offered by manufacturers to comply with the requirements include the following:

a. MasterFlow; Master Builders.
b. Sonogrout; Sonneborn.
c. SikaGrout; Sika.
d. Construction Grout; W.R. Grace.

L. The coatings materials specified are products of the Tnemec Company. Equal products by Koppers, Dupont or an approved equal will be considered for approval if submitted with a copy of data sheets that include performance criteria of the proposed coating and color charts. Minimum dry film thickness herein specified shall hold precedence over whatever recommendations are made for other supplier's products. Colors shall be as selected by the Architect.

M. The coatings system shall consist of the following: NOTE COORDINATE WITH SECTION 09900.

1. Shop Applied Primer: No. 90-97
Tneme-Zinc at 2.0 to 4.0 mils
dry film thickness.

2. Shop Applied Topcoat: No. 73
Endurashield III at 3.5 to 5.0 mils
dry film thickness.

3. Field Touch-up: No. 50-330

Poly-ura-primer at 2.0 to 4.0 mils
dry film thickness

N. The manufacturer's printed label instructions for all handling, applying, and re-coat intervals for the coatings system shall be followed. No work shall be performed when temperature and humidity conditions are outside the limitations stated by the coatings manufacturer.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. The Owner shall employ an approved testing laboratory to perform field quality control testing.

B. Provide access for the Architect to places where structural steel work is being fabricated or produced.

C. The Architect reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.

D. Correct deficiencies in structural steel work, which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests as may be necessary to reconfirm any non-compliance of the original work, and as may be necessary to show compliance of corrected work.

E. All certificates and reports as specified shall be submitted to the Architect. A Testing Agency shall be employed by the Owner for the tests specified below, and for other tests as may be required.

F. The Testing Agency shall perform the following tests:

1. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:

a. Certify welders and conduct inspections and tests as required. Record types and locations of all defects found in the work. Record work required and performed to correct deficiencies.

b. Perform visual inspection of all welds.

c. Perform tests of welds as follows:

* Magnetic Particle Inspection: ASTM E109; performed on the root pass and on the finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.

* Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T".

* Ultrasonic Inspection: ASTM E164.

2. Field Bolted Connections: Inspect in accordance with AISC specifications.

3. Field Welding: Inspect and test during erection of structural steel as follows:

a. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in the work. Record work required and performed to correct deficiencies.

b. Perform visual inspection of all welds.

c. Perform tests of welds as follows:

* Magnetic Particle Inspection: ASTM E109; performed on the root pass and on the

finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.

* Radiographic Inspection: ASTM E94 and ASTM E142 minimum quality level "2-2T".

4. Determine mechanical properties, in accordance with ASTM A370, of the following materials:

   a. Anchor bolts.

   b. Filler metals for welding.

5. Inspection of Shop Painting:

   a. Surface preparation prior to painting shall be visually evaluated for degree of cleaning by comparison with SSPC pictorial standards Vis-1.

6. Testing laboratory shall report test results in writing to the Architect on the same day that tests are made. The reports shall contain the project identification name and number, date, name of Contractor, name of material supplier, name of testing service, type and class of steel, location of test in the structure, and type and results of tests taken.

G. Defective Work: Steel work, which does not conform to the specified requirements, including strength, tolerances, and finishes, shall be corrected at the Contractor's expense. The Contractor shall also be responsible for the cost of corrections to any work affected by or resulting from corrections to the steel work, including but not limited to any additional testing as may be required when unacceptable steel work is suspected and verified.

3.2 FABRICATION

A. Shop Fabrication and Assembly:

1. Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with the governing specifications and as indicated on the final shop drawings. Provide camber in structural members as shown, and fabricate so that the natural camber of the beams is turned upward.

2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence, which will expedite erection and minimize field handling of materials.

3. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in the final structure free of markings, burrs, and other defects.

4. Fabricate Structural Steel in accordance with the latest AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. Connections:

1. Weld or bolt shop connections, as indicated. Contractor to provide all design calculations for these connections.

2. Bolt field connections, except where welded connections or other connections are indicated.

   a. Provide high-strength threaded fasteners for all principal bolted connections, except where otherwise shown.

3. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with

AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts".

a. All high strength bolts shall be tightened by standard impact wrench using the turn-of-the-nut method.

b. Other tightening methods, conforming to specifications for structural steel joints may be used only with approval of the Architect.

4. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

   a. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

5. Shear Connectors: Prepare steel surfaces as recommended by the manufacturer of the shear connectors.

   a. Provide headed stud type shear connectors welded to beams, girders, and other areas as detailed. Spacing as indicated on the drawings or, if not so indicated, studs to be uniformly spaced in a zigzag pattern along the length of the member.

   b. Headed type shear connectors shall be automatically end welded in accordance with Article 431 and 432 of AWS Building Code.

6. Bearing Plates:

   a. Bearing plates shall be provided under beams and girders resting on footings, piers and walls.

   b. Bearing plates shall be either loose or attached.

7. Base Plates:

   a. Column base plates shall be rolled, pressed and milled as per AISC Specification, Sect. 1.21.3 and furnished attached to the column.

C. Holes for Other Work:

1. Provide holes required for securing other work to structural steel framing, and for the passage of other work through steel framing members, as shown on the final shop drawings. Provide threaded nuts welded to framing, and other specialty items as shown to receive other work.

2. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

3.3 SURFACE PREPARATION AND PAINTING

A. It is intended that the primer and finish coats of the protective coatings system be applied in the shop. Provisions shall be made for proper handling at all stages of the painting, shipping, storing at the job site, and erecting that will protect coated surfaces from damage or soiling.

B. Surface Preparation:

1. All steel shall be cleaned in accordance with Steel Structures Painting Council SP-6; Commercial Blast Cleaning.

2. Surface profile shall not exceed 1.5 mils.

3. Cleaning shall be done after fabrication and no more than six (6) hours prior to shop painting.

C. Shop paint all structural steel work, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel, which is partially exposed on the exposed portions and the initial 2" of embedded areas only.

D. Painting:

1. Immediately after surface preparation, apply structural steel primer paint in accordance with the manufacturer's instructions. Use painting methods, which will result in full coverage of joints, corners, edges and all exposed surfaces.

2. Application shall be by spray to thoroughly cleaned surfaces only, in accordance with all provisions of SSPC PA-1 Paint Application, with specified dry film thicknesses maintained on edges and corners. Sharp cut edges shall be uniformly relieved to form a slight radius sufficient to permit proper wrap of the coatings.

E. Surfaces inaccessible to blast cleaning after assembly shall be blast cleaned and coated beforehand. Paint faying surfaces of high strength bolted friction connections as permitted by AISC Manual of Construction for the specified primer.

F. A pre-production conference shall be arranged by the Contractor with the Architect, the Fabricator and a representative of the paint manufacturer in attendance, to discuss all details relevant to performing the work in accordance with the requirements.

G. Mock-up shall be produced on a sample piece or section, for approval before production.

H. Touch-up after erection shall consist of smoothing all damaged painted areas, and building back each coat to achieve initial condition. Where abraded to bare metal, and all other bare surfaces such as on field welds, bolts, washers and nuts - the surfaces shall be cleaned to the standard of the shop applied system and painted with the two coat system, in proper re-coating intervals.

3.4 INSPECTION

A. Examine the areas and conditions under which structural steel work is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.5 ERECTION

A. General: Comply with the governing Specifications and as herein specified.

B. Employ a Professional Engineer, registered in the jurisdiction where the work is performed, to supervise surveys during erection as follows:

1. Check elevations of bearing surfaces.

2. Check locations of anchor bolts.

3. Ensure accuracy of erection within specified tolerances.

4. Individual pieces shall be erected so that deviation from plumb, level and alignment shall not exceed 1 to 500.

C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections

of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made.

D. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete the work. Comply with all City, State, and OSHA regulations as required.

E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

a. Refer to Division 3 of these specifications for anchor bolt installation requirements in concrete, and Division 4 for masonry installation.

F. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.

1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

2. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.

3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions, or as otherwise required.

G. Field Assembly: Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces, which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of the structure within specified AISC tolerances.

2. Fastening of splices of compression members shall be done after the abutting surfaces have been brought completely into contact.

3. Splices shall be permitted only where indicated.

4. Field connections, including high strength bolted construction, welded construction and shear connectors shall be as specified under "Fabrication".

H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

I. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to field welds.

1. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

J. Gas Cutting: Do not use gas-cutting torches in the field for correcting fabrication errors in the

structural framing. Cutting will be permitted only on secondary members, which are not under stress, as acceptable to the Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

END OF SECTION

SECTION 05216

PRESTRESSED BARRIER CABLE GUARD SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:
   1. Prestressed barrier cable assemblies for vehicular guards and pedestrian guards at the south façade.

B. The work includes furnishing and installing an engineered barrier cable guard system consisting of prestressed seven-wire steel strands and complete with all related sleeves, supports and anchors, jacks and jacking, distribution plates, spacer bars, accessories, devices, etc.

C. The work also consists of furnishing all labor, material, and equipment necessary for completion of the following work:
   1. Furnish and install all system materials intended for use in aggressive environments.
   2. Perform all prestressing operations, including but, not limited to stressing, backstressing and anchoring tendons.
   3. Keep records of stressing operations.
   4. Terminating tendon ends (after Architect's review) and patching stressing pockets (as applicable).
   5. See Structural Drawings for additional general notes applying to work under this section. In case of discrepancy between the Specifications and the Drawings, the most stringent will govern as determined by the Architect.

1.2 DEFINITIONS

A. Barrier Cable: A steel prestressing strand meeting the requirements of this Specification. Barrier cables may interchangeably be referred to as either "cables", "tendons" or "strands".

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design Prestressed Barrier Cable Guard Systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated and in compliance with the design intent as indicated in the Contract Documents.
   1. Employ a professional engineer, registered in the state where the project is located, to perform design. Professional Engineer shall sign and seal Shop Drawings and Calculations submitted for review.

B. Structural Performance: All guard assemblies, including cables, anchors and connections, shall withstand the effects of gravity loads and the following loads within limits and under conditions indicated in the Structural General Notes and on the Drawings:
   1. Pedestrian Guard Loads: See Section 055100 – Metal Stairs and Railings.
   2. Vehicular Guard Loads:
      a. Pedestrian guard loads are applicable to all vehicle barrier systems and are not required to act concurrently with loads applicable to those systems.
      b. Vehicle Barrier Systems for Passenger Vehicles:
         1) The loading selected must be that producing a more unfavorable effect of the following:

a) Article 4.5.3. of ASCE 7-10, “Minimum loads for Buildings and other Structures”.
b) Local governing building code.

1.4 SUBMITTALS

A. Manufacturer’s Data: Submit manufacturer's product data, specifications, anchor details and installation instructions for products to be used in the fabrication of guard assemblies, including painting products and patching materials.

B. Samples: Submit one (1) sample of all Prestressed Barrier Cable Guard System materials.

C. Shop Drawings: Submit shop drawings for fabrication and erection of guard assemblies. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor bolt installation. All shop drawings shall be signed and sealed by a professional engineer, registered in the state where the project is located.
   1. Shop Drawings shall include, but not be limited to, the following information:
      a. Tendon layout and dimensions locating tendons.
      b. Final effective forces of each tendon. Type and description of a method to ascertain that this force has been achieved.
      c. Details, location and arrangement of tendon dead end and stressing end anchorage devices. These details shall be thoroughly coordinated with the placement of the corresponding column and beam reinforcement to ascertain ability to install anchorages without interference with other components within the supporting structure or the joints between structural support members.
      d. Details and/or description of procedure ascertaining proper field connection between the cable and anchor as per the system manufacturer’s requirements.

D. Calculations: Submit calculations as follows for review and acceptance by the Engineer of Record (EOR) along with the shop drawings for each portion of the work. All calculations shall be signed and sealed by a professional engineer, registered in the state where the project is located.
   1. Calculations of anticipated elongations based on the required effective prestress for each type of cable and anchor. When seating loss is not available, use 3/8" for a wedge based anchorage.
   2. Calculations of bearing stress applied to the structure by the proposed anchoring device and engineering opinion on the adequacy of the structural component to carry this bearing stress.

E. Test Results and Certifications: Submit the following for review and acceptance by the Architect not less than three weeks prior to commencement of work:
   1. Mill Tests: Results of certified mill tests (including typical stress-strain curve) for each production lot from which project material will be taken. Such results shall include guaranteed ultimate tensile strength, yield strength, elongation, cross-sectional area and modulus of elasticity of the material tested.
   2. Equipment Calibration Tests: Results of certified calibration tests made within the last three months by an independent testing agency of all stressing equipment to be used on the project. Stressing equipment shall be calibrated as a unit especially when consisting of jack, gage, and pump. Components of calibrated units may not be interchanged during the course of the work without recalibration. Contractor shall submit method of identification of all stressing units. Calibration reports shall include a curve relating jack forces to gage readings. For other types of stressing equipment and/or anchoring systems, submit respective calibration tests relating gage readings to attained force.

F. Stressing Record: The Installer shall provide a stressing record for all tendons to the Architect. This record shall be in a form in conformance with recommendations of PTI and acceptable to the Architect, and include as a minimum for each tendon its mark, location and length, stressing unit identification, required and actual field gauge reading at each anchorage, and signatures of the pump/gage operator and the Testing Agency's representative witnessing the stressing operation.

G. Certifications: Provide certifications indicating compliance with the Quality Assurance article below.

1.5 QUALITY ASSURANCE

A. Codes and Standards
   1. Comply with requirements of the following codes and standards, latest edition, except as herein modified:
      a. American Society of Civil Engineers (ASCE)
         1) ASCE 7-10 – "Minimum Design Loads for Buildings and Other Structures".
      b. Post-Tensioning Institute (PTI)
         1) "Guide Specifications for Post-Tensioning Materials".
         2) "Specifications for Unbonded Single Strand Tendons".
         3) "Post-Tensioning Manual".
         4) "Field Procedures Manual for Unbonded Single Strand Tendons".
         5) "Specification for Seven-Wire Prestressing Steel Strand for Barrier Cable Applications".
      c. See Section 05 50 00 – Miscellaneous Metals for additional information pertaining to fabricated steel assemblies.
   2. In case of any discrepancy or conflicting requirements between codes and/or standards, the most stringent requirements will govern as determined by the Architect.

B. Installer Qualifications
   1. All stressing of tendons shall be under the immediate control of an Installer experienced in this type of work, who has successfully performed a minimum of five (5) previous installations similar to the one involved in this Contract. The Installer shall exercise close check and rigid control of all operations as necessary for full compliance with all contract requirements.
   2. Work shall be supervised by individuals experienced in post-tensioning construction. Qualifications of project supervisor(s) shall be included in bid submittal.

C. Inspection of Barrier Cable Placement and Stressing Operations
   1. An Independent Testing Agency will be retained by the Owner to observe and verify all post-tensioning work as specified this Section.

D. Personnel Required Onsite
   1. Contractor shall have supervisory personnel onsite at all times during tendon stressing operations.
   2. Installer shall have supervisory personnel onsite at all times during tendon placement, and stressing operations. Name and position of such supervisory personnel shall be provided to the Contractor and the Architect at the start of work but not later than seven (7) days prior to tensioning.
   3. The Testing Agency representative shall be onsite at all times during tendon layout, placement, and stressing operations. Stressing operations shall not proceed without a Testing Agency's representative present during operations.
   4. The Prestressed Barrier Cable Guard System Manufacturer shall supervise, as a minimum, the first occurrence of each stressing operation with subsequent monitoring as deemed necessary.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver guard systems and related components in protective packaging and store components to avoid damage from moisture, abrasion and other construction activities.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for guard systems. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items in time for installation.

B. The prestressed barrier cable assemblies are solely intended to act as guards as prescribed by the performance requirements of this Section. No ancillary attachments shall be made to any prestressed barrier cable assemblies without prior approval by the Architect in writing.

1.8 INDEPENDENT TESTING AGENCY SERVICES

A. Independent Testing Agency's Services related to Prestressed Barrier Cable Guard Systems Work:
   1. The Testing Agency's Inspector shall observe the condition of tendons and anchorages in place prior to concreting (as applicable) and again prior to stressing. Any unsatisfactory condition of tendons or anchors must immediately be brought to the attention of the responsible supervisor, who must address said condition in a timely fashion to the satisfaction of the Testing Agency's Inspector, Any and all conditions not properly addressed by the Contractor prior to stressing, must be recorded and brought to the attention of the Architect in a most expedient way prior to stressing.
   2. The Testing Agency's Inspector shall review the contractors stressing and backstressing procedure, and witness the stressing operation and recording. In the event anchoring system for barrier cables does not require backstressing, verify proper connection of anchorage to cable.
   3. The Testing Agency's Inspector shall review the contractor's tendon terminating procedure and the condition of terminated tendons prior to grouting of pockets or installation of anchor end caps or corrosion-protective coating.
   4. Where fabricated steel items are utilized within Prestressed Barrier Cable Guard Systems and/or where the guard systems are attached to other building components by means of welding, bolting and/or drilled-in inserts, the Testing Agency shall perform inspection and tests as required within Division 1 specifications and the applicable Division 5 Sections.
   5. See Section Division 01 specifications for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers offering systems of products complying with the requirements for Prestressed Barrier Cable Guard Systems include the following:
   1. AMSYSCO, Inc.
   2. DYWIDAG-Systems International USA Inc.
   3. Suncoast Post-Tension, Ltd.
   4. VStructural, LLC (VSL)
   5. Another manufacturer approved based on equivalent qualifications demonstrated by submitting information relative to record of successful projects of similar type and

complexity within the past 5 (five) years, participation in the industry and professional organizations, and at least 3 (three) positive client references.

2.2 MATERIALS

A. General: Provide cables, anchors, tensioning, grouting, etc. as indicated on the Drawings. All components are to be hot-dip galvanized. Comply with PTI "Specification for Seven-Wire Prestressing Steel Strand for Barrier Cable Applications".

B. Barrier Cables: Seven-wire steel strand, 0.5 in. diameter, galvanized per ASTM A475, Extra high Strength Grade, Class A with a minimum breaking strength of 26,500lbs. All strand to be manufactured by a single source.

C. Anchorages: All castings and machined barrel anchors shall comply with PTI requirements applicable to corrosive environments. Where specifically indicated on the Drawings, provide capped anchors with exterior thread and corresponding galvanized metal or otherwise corrosion resistant caps acceptable to the Architect.
   1. Wedges shall be designed to preclude premature failure of the barrier strand due to notch or pinching effects under test load conditions specified in Section 2.2.1.1 and 2.2.1.2 in PTI's "Specification for Unbonded Single Strand Tendons"

D. Related Steel Components and Fabrications: Where steel brackets and supports are indicated in the Drawings, these shall comply with the requirements of Section 055120 – Structural Steel.
   1. Finish: All related steel components and fabrications shall be factory primed and painted.

E. Manufacturer's standard corrosion resistant assembly components shall be hot dip galvanized and shall conform to ASTM A123 or ASTM A153, As applicable.

F. Sleeves: General Contractor to coordinate the provision of PVC pipe sleeves to accommodate cables passing through structural concrete items as indicated in the Drawings.

G. Grout Materials for Stressing Pockets (where specifically detailed only):
   1. Non-metallic Shrinkage-resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland Cement, shrinkage compensating agents, plasticizing, water reducing agents and corrosion inhibitors, complying with ASTM C 1107, grade B and Army Corps of Engineers CRD-C621. Subject to compliance with requirements, provide one of the following:
      a. "Euco NS" - The Euclid Chemical Co.
      b. "Crystex" - L & M Construction Chemicals.
      c. Masterflow 713" or Masterflow 928Plus" - Master Builders
      d. "Five Star Grout" - U.S. Grout Corp.
      e. Approved Equivalent.

H. When specifically directed by the Architect, adjust color of the pre-manufactured product by mixing it with trial-and-error selected quantity of white cement, to attain final cured color of the patch as close as possible to the surrounding concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. {Retain option in paragraph below for electric operation.}

B. Examine substrates, structural support, sleeves, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete for installation of Cable Guard Systems.

3.3 INSTALLATION

A. Provide system as indicated on the Drawings installing cables in straight lines and at true heights.

B. Trim ends of PVC pipe sleeves flush with face of concrete. Patch spalling around PVC pipe sleeves as directed by the Architect.

C. Install fabricated anchorage, attachment and support items as shown in the final approved Shop Drawings.

D. Stressing Procedure for Cables
   1. Backstress and stress cables to seat wedges as shown on the Drawings. Follow PTI recommended procedures. Consult with Architect concerning stressing/backstressing against materials other than concrete.
   2. Wedges shall be seated at 80% minimum ultimate tensile strength (MUTS) of the strand.
   3. Coordinate jack placement and bracing as required to protect any structural members being attached to from damage during tensioning process.

E. Upon completion of the stressing and receiving the Architect's approval of the stressing record, terminate excess length of cable by an approved method and apply two coats of galvanizing compound and/or install manufacturer's screw-on cap tightly.

F. Final Disposition of Cable Anchors:
   1. For anchors left exposed in the final condition, provide approved caps or cover assemblies to completely conceal trimmed ends of cables, unless otherwise detailed on the Drawings.
   2. For anchors recessed in concrete construction, fill pockets with non-shrink grout for smooth, flush condition.

3.4 REPAIRS

A. Galvanized Coatings
   1. Field Repair: For field touch up of hot-dip galvanized components, repair using zinc rich coating or "cold galvanizing" compound. Provide factory mixed and prepared organic binder, zinc-rich paint specifically formulated for use on steel surfaces and for repair of hot dip galvanized steel. Minimum 95% by weight of dry film of "ultra-pure" zinc dust per ASTM D520 Type III. Provide a minimum dry film thickness of 8 mils.

END OF SECTION

SECTION 05300

METAL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of metal deck work is shown on the drawings and is hereby defined to include closure strips and miscellaneous accessories required for a complete system. The following types of steel form deck are required:

1. Roof Deck North Stair Roof Enclosure & South Stair Roof Enclosure

A. Related Work Specified Elsewhere:

1. Section 03410 – Structural Precast Concrete
2. Section 05500 – Miscellaneous Metals

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated:

1. American Iron and Steel Institute (AISI), "Specification for the Design of Cold-Formed Steel Structural Members."
2. American Welding Society (AWS), D1.3 "Structural Welding Code - Sheet Steel."
3. Steel Deck Institute (SDI), "Design Manual for Composite Decks, Form Decks and Roof Decks."

B. Qualification of Field Welding: Use qualified welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS.

C. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.

D. FM Listing: Provide steel roof deck units that have been evaluated by Factory Mutual System and are listed in "Factory Mutual Approval Guide" for "Class I" fire-rated construction.

1.3 SUBMITTALS

A. Product data including manufacturer's specifications and installation instructions for each type of decking and accessories.

1. Provide test data for mechanical fasteners used in lieu of welding for fastening deck to supporting structures.

B. Shop drawings showing layout and types of deck units, anchorage details, and conditions requiring closure strips, supplementary framing, sump pans, cant strips, cut openings, special jointing, and other accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include but are not limited to the following:

1. Vulcraft Div., Nucor Corp.
2. Consolidated Systems, Inc.
3. H. H. Robertson Co.
4. Wheeling Corrugating Co.

2.2 MATERIALS

A. Steel for Painted Metal Deck Units: ASTM A 1008, Grade A, with a minimal yield stress of 33 KSI.

1. Paint: Manufacturer's baked-on, rust-inhibitive paint, for application to metal surfaces which have been chemically cleaned and phosphate chemical treated. All decking to be factory primed and field painted.

B. Miscellaneous Steel Shapes: ASTM A 36.

C. Shear Connectors: Headed stud type, ASTM A 108, Grade 1015 or 1020, cold-finished carbon steel, with dimensions complying with AISC specifications.

D. Sheet Metal Accessories: ASTM A 653, commercial quality, galvanized or painted to match steel deck finish.

E. Flexible Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

2.3 FABRICATION

A. General: Fabricate deck units in lengths to span three or more supports, unless otherwise shown; with flush, telescoped, or nested 2 inch laps at ends and interlocking or nested side laps, of metal thickness, depth, and width as shown.

B. Roof Decks: Comply with the depth and gage requirements, physical cross-sectional properties of the deck and design criteria shown on the Drawings and as follows:

1. Design the decking for the superimposed dead and live loads as indicated, on a simple span condition with a limiting deflection of L/240, steel stress of 0.60 FY.
2. Comply with other design criteria as indicated in metal decking notes and design criteria notes.
3. Provide cellular decking to prevent visibility of screws and attachments.
4. Provide deck gauges as required by calculation, but not less than 20 ga.

C. Metal Closure Strips: Fabricate metal closure strips for openings between decking and other construction, of not less than 0.045-inch min. (18 gage) sheet steel. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking. Finish to match decking finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturer's recommendations, shop drawings, and as specified herein.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

C. Place deck units flat and square, secured to adjacent framing without warp or deflection.

D. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

E. Do not use floor deck units for storage or working platforms until permanently secured.

3.2 FASTENING DECK UNITS

A. Fasten floor deck units to steel supporting members by nominal 5/8 inch puddle welds or elongated welds of equal strength, spaced not more than 12 inches o.c. with a minimum of two welds per unit at each support.

B. Tack weld or use self-tapping No. 8 or larger machine screws at 4 feet o.c. for fastening end closures.

C. Fasten roof deck units to steel supporting members by not less than 1/2 inch diameter puddle welds or elongated welds of equal strength, spaced not more than 12 inches at every support and at closer spacing where indicated. In addition, secure deck to each supporting member in ribs where side laps occur.

D. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

   1. Use welding washers where recommended by deck manufacturer.

E. Mechanically fasten side laps of adjacent deck units between supports, at intervals not exceeding 36 inches o.c., using self-tapping No. 8 or larger machine screws.

F. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 45 lbs. psf at eave overhang and 30 lbs. psf for other roof areas.

G. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.

H. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

I. Hanger Slots or Clips: Provide UL-approved punched hanger slots between cells or flutes of lower element where floor deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.

   1. Locate slots or clips at not more than 14 inches o.c. in both directions, not over 9 inches from walls at ends, and not more than 12 inches from walls at sides, unless otherwise indicated.

J. Roof Sump Pans: Place over openings provided in roof decking and weld to top decking surface. Space welds not more than 12 inches o.c. with at least one weld at each corner.

K. Shear Connectors: Weld shear connectors to supports through decking units in accordance with manufacturer's instructions. Do not weld shear connectors through two layers (lapped ends) of decking units. Weld only on clean, dry deck surfaces.

L. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking and in voids between decking and other construction. Weld into position to provide a complete decking installation.

M. Touch-Up Painting: After decking installation, wire brush, clean, and paint scarred areas, welds, and rust spots on top and bottom surfaces of decking units and supporting steel members.

1. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

2. Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.

END OF SECTION

SECTION 05500

MISCELLANEOUS METALS
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: G000; G001; A002, A101-5, A201-208, A301, A302, A401, A402, A501, A502, A701.

B. Sub-sub Bids are not required for this trade.

1.3 SCOPE OF WORK

A. This work shall consist of miscellaneous and ornamental items including the following:

1. Loose steel bearing and leveling plates, including bearing plates for steel rafters

2. Galvanized steel lintels

3. Steel stair and ramp railings, guardrails, handrails, subrails, and bracket supports (See Alternates).

4. Steel support angles for elevator door sills.

5. Cants in elevator hoistway made from sheet steel.

6. Miscellaneous steel framing and supports, at stairwells.

7. Aluminum entry canopy framing at northwest Entry/Stair.

8. Aluminum tube columns (See Alternates)

9. Seismic clips.

10. Bollards & accessories.

B. Requirements for materials, hot-dip galvanizing, and shop-applied primers are included with each item as applicable.

C. Related Work:

1. Section 05120 STRUCTURAL STEEL FRAMING for structural steel items.

2. Section 05521 PRESTRESSED BARRIER CABLE GUARD SYSTEM: for pretensioned cable railings.

3. Section 099000 PAINTING for field painting work of this section

4. Section 10240 METAL ARCHITECTURAL MESH for hanging mesh panels.

5. Section 14240 HYDRAULIC ELEVATORS for metal ladder and accessories.

1.4 GENERAL

A. The work of this Section includes, but is not limited to, metal fabrications, installation of listed items, and final product performance.

B. Examine existing surfaces and verify existing conditions. Determine acceptability of the proposed installation conditions. Verify dimensions as no extras will be allowed for inconsistency in dimensions.

C. Cleaning and preparation of existing surfaces to receive materials shall be the Contractor's responsibility. Prepare surfaces as specified hereinafter and as recommended by manufacturer of the material selected.

1.5 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design stairs and railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and Code required loads and stresses within limits and under conditions indicated.

C. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to Code.

1.6 QUALITY ASSURANCE

A. Delegated design: Design ladders and miscellaneous framing and supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. NAAMM Stair Standard: Comply with "Recommended Design Standards for Metal Stair Railings" in NAAMM AMP 510, "Metal Stairs Manual."

C. Welding: Qualify procedures and personnel according to the following:

1. AWSD1.1, “Structural Welding Code—Steel.”

2. AWSD1.3, “Structural Welding Code—Sheet Steel.

D. Metal Surfaces, General: provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

1.7 SUBMITTALS

A. Product data. For the following

1. Coatings and Paint products

2. Grout.

B. Shop Drawings: Submit fabrication and installation details for metal fabrications.

1. Include plans, elevations, section, and details. Show anchorage and accessory items.

2. Provide templates for anchors and bolts specified for installation under other Sections.

3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified engineer, licensed in the jurisdiction where Project is located, responsible for their preparation.

C. Welding certificates.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal items without field measurements. Coordinate such dimensions with trades responsible for connecting construction to ensure that actual dimensions correspond to established dimensions.

2. Provide allowance for trimming and fitting at site.

1.9 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section, in a timely manner.

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M, sizes as indicated on the Drawings.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing, sizes as indicated on the Drawings.

E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads, sizes as indicated on the Drawings.

1. Provide Schedule 80 pipe for bollards.

F. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.

2.2 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

C. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

2. Plastic covers for bollards: as shown on the Drawings.

D. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.

2.3 ALUMINUM STOCK

A. Alloy and temper recommended by manufacturer for use and finish indicated.

1. Extruded bars, profiles, and tubes: ASTM B 221.

2. Extruded structural pipe and tubes: ASTM B 429.

3. Structural profiles: ASTM B 308/B 308M.

4. Welding rods and bare electrodes: AWS A5.10/A5.10M.

B. Finish: anodized, brush aluminum.

2.4 ALUMINUM CANOPY

A. Aluminum protective cover, equal to Mitchell Metals, LLC framed canopy, with perimeter extruded gutter and extruded decking, in a roll-locked design with extruded cap and pan interlock forming a rigid structure.
B. Fasteners: 300 series stainless steel with neoprene washers. Rivets to be 3/16" aluminum. Decking fasteners to be long life coated steel with 300 series stainless steel cap and neoprene washer.
C. Supply full shop drawings.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

1. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for exterior applications.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.7 STEEL TUBE RAILINGS

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

C. Form changes in direction of railings as detailed on the Drawings.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

G. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.11 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

2.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.13 STEEL PRIMERS AND FINISHES

A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Urethane Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2 inches.

3. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

4. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with magnetic Gages."

B. Zinc-Rich Primer: Urethane zinc rich primer compatible with topcoat Specified in Section 099000 - PAINTS AND COATINGS. Provide primer with a VOC content of 420 g/L (2.8 lb/gal.) or less per OTC and HAPS COMPLIANT STANDARDS PER 2007 standards when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Provide Tnemec Series 394 Perimerprime at 3.0 mils DFT or approved equal by DuPont or Carboline.

C. Hot-Dip Galvanizing: for all bollards, railings, guardrails (except spandrel guardrails, see below), and other steel indicated to be galvanized:

1. For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.

2. Basis of design: Duragalv, as manufactured by Duncan Galvanizing. .

3. Galvanize full assemblies after fabrication. Where size of assembly is too large for complete unit galvanizing, galvanize prior to frabrication in as large sections as possible with Architect's written approval.

4. Provide thickness of galvanizing specified in referenced standards. The galvanizing bath shall contain high grade zinc and other earthly materials. Fill vent holes and grind smooth after galvanizing.

5. Galvanizing shall exhibit a rugosity (smoothness) of less than 25 microns when measured by a profilometer, for elements that are less than 24 lbs. per running foot.

D. For guardrails at spandrels (see drawings and Alternates), provide hot-dip galvanizing and factory-applied high performance polyamide epoxy primer, aliphatic acrylic polyurethane topcoat and aliphatic acrylic UV resistant anti-graffit clear coat, equal to Colorgalv Plus, as manufactured by Duncan Galvanizing, www.duncangalvanizing.com.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING STEEL TUBE RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as shown on the drawings.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 07000

ROOFING AND FLASHING
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: G000; G001; A002, A101-5, A201-208, A301-A302, A401-A402, A501-A502, A701.

B. Sub-sub Bids are not required for this trade.

1.3 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 07541 – POLYVINYL CHLORIDE MEMBRANE ROOFING

2. All Work of Section 07620 –FLASHING AND SHEET METAL

3. All Work of Section 07710 – ROOF SPECIALTIES

END OF SECTION

SECTION 07541

POLYVINYL CHLORIDE (PVC) MEMBRANE ROOFING
(Part of Work of Section 07000 - ROOFING AND FLASHING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: G000; G001; A002, A101-A105, A201-208, A301-A302, A401-402, A701.

B. Sub-sub Bids are not required for this trade.

1.3 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Adhered membrane-roofing system.

2. Adhered cover board.

3. Vapor retarder.

4. Substrate board.

5. Flashing for equipment mounted on roofing and roofing penetrations.

6. Wood blocking, nailers, curbs and blocking associated with roofing.

B. Items To Be Furnished Only: Not Applicable.

C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 03410 – STRUCTURAL PRECAST CONCRETE for substructure.

2. Section 05300 – METAL DECKING for roofing substrate in one section.

3. Section 05120 – STRUCTURAL STEEL FRAMING for substructure.

4. Section 07600 - FLASHING AND SHEET METAL for metal roof penetration flashings, flashings, and counter flashings.

5. Section 07730 - ROOF ACCESSORIES for fascia, rakes, gutters and downspouts.

6. Section 079200 - JOINT SEALANTS for sealants.

1.4 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7. Provide documentation that proposed roofing system design meets all applicable Massachusetts State Building Code requirements.

D. Flashings: Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations in FMG 1-49 Loss Prevention Data Sheet for Perimeter Flashings; FMG 1-29 Loss Prevention Data Sheet for Above Deck Roof Components; NRCA Roofing and Waterproofing Manual (Fourth Edition) for Construction Details and SMACNA Architectural Sheet Metal Manual (Fifth Edition) for Construction Details, as applicable.

E. Energy Performance: Provide roofing system with Solar Reflectance Index (SRI) not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

C. Qualification Data: For Installer and manufacturer.

D. Maintenance Data: For roofing system to include in maintenance manuals.

E. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.

B. Installer Qualifications: Contractor, Contractor's Superintendent and Foreman shall have at least five years experience successfully constructing single-ply thermoplastic roof systems similar to system specified in material, design and importance and with a record of successful in-service performance.

C. Pre-installation Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with the Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.

9. Review roof observation and repair procedures after roofing installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Roofing Contractor's Warranty: The roofing subcontractor shall supply Owner with a minimum two-year workmanship warranty for each roof. In the event any work related to the roofing, flashing, or metalwork is found to be defective within two years of substantial completion, the roofing contractor shall remove and replace such at no additional cost to the Owner. The roofing subcontractor's warranty obligation shall run directly to the Owner, and a copy the roofing signed warranty shall be sent to the roofing system's manufacturer.

1. The duration of the Roofing Contractor's two-year warranty shall run concurrent with the roofing system's manufacturer's 30-year warranty.

B. Roofing Systems Manufacturer's Warranty: The roofing manufacturer shall guarantee roof areas to be in a watertight condition, for a period of 30 years, from the date of final acceptance of the roofing system. The warranty shall be a 30-year no dollar limit (NDL), non-prorated total system labor and material warranty, for wind speeds up to 72 miles per hour. Total system warranty shall include all roofing materials, related components and accessories including, but not limited to the substrate board, vapor retarder, insulation board, cover board, roofing membrane, membrane flashings, fasteners, adhesives, metal roof copings, metal roof edges and termination metals and roof drain assemblies. The manufacturer shall repair defects in materials and workmanship as promptly after observation as weather and site conditions permit. All requirements in the fabrication and installation of the roofing system shall meet the requirements to uphold the 30 year warranty.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) ROOFING MEMBRANE

A. Fiberglass mat reinforced membrane with lacquer coating:

1. Products: Membrane shall conform to ASTM D4434 (latest version), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type II, Grade 1. Basis of Design:

a. Sarnafil G410-20

2. Subject to compliance with requirements, equivalent products by the following manufacturers may be incorporated into the Work:

a. Durolast

b. Fibertite by Seaman Corp.

c. Flex MF/R 80 by Flex Roofing Systems

d. Everguard, by GAF.

3. Thickness: 80 mils. Include all requirements for obtaining a 30 year system warranty.

4. Exposed Face Color: White and or Gray / meeting LEED reflectance requirements. Pitched roof color to be from standard color options of 7 or more colors, with ribs.

5. Physical Properties:

a. Tensile Strength: ASTM D638, machine direction 1675 psi, cross direction 1625 psi

b. Elongation at Break: ASTM D638, machine direction 250, cross direction 220

c. Tearing Strength: ASTM D1004, 22

d. Water Absorption: ASTM D570 >1.7%

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.

C. Metal Flashings: Manufacturer’s standard sheet flashing of same material and color of sheet membrane adhered to metal sheet.

D. Bonding Adhesive: Manufacturer's standard bonding adhesive for membrane, and solvent- based bonding adhesive for base flashings.

E. Metal Termination Bars: Manufacturer's standard predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.3 VAPOR RETARDER

A. Self-Adhering Sheet Vapor Retarder at 80 mils Roofing Areas: ASTM D 1970, minimum 40-mil-thick film laminated to layer of rubberized asphalt adhesive; maximum permeance rating of 0.1 perm; cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.4 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and as required to achieve R-30 over the roof area. See roof drawings for roof insulation conditions.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Sarnatherm by Sika Sarnafil

b. FTR – value by Seaman Corp.

c. Duro-Guard ISO II by Durolast

d. ISO II by Flex

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.

2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Section 053100 - STEEL DECKING.

4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

7. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.4 VAPOR-RETARDER INSTALLATION

A. Self-Adhering Sheet Vapor Retarder at 80 Mils Areas: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side, and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.

3.5 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply solvent-based bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing as indicated on the Drawings.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.

2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

H. Provide overlay membrane, fully adhered, at all seams in 80 mil roof area.

I. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement (except for heat-welded application), and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Manufacturer’s Technical Representative: Engage a qualified manufacturer’s technical representative to perform roof tests and inspections and to prepare test reports. Provide inspection at end of first week of installation.

1. Perform daily seam weld tests.

C. Final Roof Inspection: Engage roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect and the Owner 48 hours in advance of date and time of inspection.

D. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 PROTECTING AND CLEANING

A. Protect membrane-roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and the Owner.

B. Correct deficiencies in or remove membrane-roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane-roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 076200

FLASHING AND SHEET METAL
(Part of Work of Section 07000 - ROOFING AND FLASHING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: G000; G001; A002, A101-5, A201-208, A301-2, A401-2, A701.

B. Sub-sub Bids are not required for this trade.

1.3 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Rough carpentry for nailers, cants, and blocking.

2. Cutting of flashing reglets into precast concrete to receive new flashings.

3. Sheet metal flashing and trim for the following applications:

a. Formed wall flashing and trim.

b. Formed low-slope roof flashing and trim.

B. Alternates: Not Applicable.

C. Items To Be Installed Only: Not Applicable.

D. Items To Be Furnished Only: Not Applicable

E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 07540 - POLYVINYL CHLORIDE (PVC) MEMBRANE ROOFING for installing sheet metal flashing and trim integral with roofing membrane.

2. Section 07710 – ROOF ACCESSORIES for installing Galvalume gutters and downspouts with accessories.

1.4 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing and copings capable of resisting the Wind Zone forces required by Code according to recommendations in FMG Loss Prevention Data Sheet 1-49.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.

3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.

2. Trim: 12 inches long. Include fasteners and other exposed accessories.

3. Accessories: Full-size Sample.

1.6 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.8 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. Copings:

1. Zinc/Tin Alloy-Coated Copper Sheet: ASTM B 370-03, Temper H00 and H01, cold-rolled copper sheet, of weight indicated below, coated both sides with zinc/tin alloy approximately 0.5 mils thick.

a. Use 20 oz. sheet for copings and counterflashing cleats.

b. Use 20 oz. sheet for thru-wall scuppers.

c. Use 16 oz. sheet for counterflashings and VTR caps.

B. Underlayment Materials

C. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

D. Slip Sheet: Rosin-sized paper, minimum 3 lb./100 sq. ft.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.

2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.

3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Solder:

1. Stainless Steel: ASTM B 32, Grade Sn60, with phosphoric acid based flux as recommended by manufacturer.

2. Zinc Alloy Copper: ASTM B 32, Grade Sn95, 95 percent tin, 5 percent antimony. Product: #497 SuperFlo by Johnson Manufacturing Co., Princeton, IA. Use with Johnson's E-127 Flux-'N-Solder with Pure Tin soldering flux.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Copper Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Fabricate plumbing vent flashings with separate cap from zinc/tin alloy coated copper.

E. Fabricate flashings for plumbing vents and pitch pans with a minimum 4 in. wide 4 lb. lead flange extended completely around flange periphery.

F. Fabricate end caps for ends of open base flashings with concealed fasteners.

G. Form pieces in single length sheets.

H. Fabricate continuous cleats to design shown on Drawings interlockable with sheet. Provide cleat with 3/4 in. lock.

I. Hem exposed edges 1/2 in. to underside.

J. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

K. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

L. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

M. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.4 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Coping covers: Fabricate in minimum 96-inch-long, but not exceeding 10-foot- long, sections. Furnish with 8-inch-wide joint cover plates. Provide membrane flashing between cover plates.

B. Thru-Wall Scuppers: Fabricate to meet Drawing requirements.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect paved areas, building and its contents, autos, trucks, and the site from the effects of work in this Section and against all risks associated with this Work. Repair all damage to the building and appurtenances as a result of the work of this Section to the condition at start of work, or if this cannot be determined, to the original condition, by approved means at no extra cost.

3.2 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip-sheet or install a course of polyethylene underlayment.

3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space counterflashing cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Copper: Use copper or stainless-steel fasteners.

H. Soldered joints with membrane flashing at expansion joints.

1. Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

a. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements[, sheet metal manufacturer's written installation instructions,] and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of snap-in installation and sealant.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for flashing on vent piping.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated.

3.6 FIELD QUALITY CONTROL

A. Cooperate with field quality control personnel. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

B. Additional inspections and retesting of materials which fail to comply with specified material and installation requirements shall be performed at Contractor's expense.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 077100

ROOF SPECIALTIES
(Part of Work of Section 07000 - ROOFING AND FLASHING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 -GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS. The Work of this section is shown on Drawings: G000; G001; A002, A101-5, A201-208, A301-2, A401-2, A501-2, A701.

B. Sub-sub Bids are not required for this trade.

1.3 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Wood nailers, curbs, and blocking.

2. Roof-edge fascia and rakes.

3. Metal Soffit Materials.

4. Gutters, scuppers, and downspouts.

B. Alternates: Not Applicable.

C. Items To Be Installed Only: Not Applicable.

D. Items To Be Furnished Only: Not Applicable.

E. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 075419 – POLYVINYL CHLORIDE (PVC) ROOFING.

2. Section 076200 - SHEET METAL FLASHING AND TRIM for flashing.

3. Section 079200 - JOINT SEALANTS for sealants.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant-and field-assembled work. Include the following:

1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.

2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.

3. Details of termination points and assemblies, including fixed points.

4. Details of special conditions.

C. Samples for Verification: For roof-edge drainage systems made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, including gutter and downspout approximately 10 feet long, including supporting construction, seams, attachments, and accessories.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

PART 2 - PRODUCTS

2.1 EXPOSED METALS AND ROOF-EDGE DRAINAGE SYSTEMS

A. Fascia and Rakes.

1. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

a. Surface: Smooth, flat finish.

b. Exposed Coil-Coated Finishes at Fascia and Rakes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1) Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight. Custom color per Architect.

B. Gutters, Scupper and Downspouts

1. Hanging Gutters: K style gutters fabricated from 26 gauge Galvalume, 7” size. Finish to be natural finish Galvalume.

2. Scupper: fabricated from 26 gauge Galvalume, 7” size. Finish to be natural finish Galvalume.

3. Downspouts, 3” x 4” rectangular downspouts, fabricated from 26 gauge Galvalume. Finish to be natural finish Galvalume.

4. Heavy duty wall brackets, furnish brackets at 60 inch minimum spacing.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ATAS International, Inc.

2. Berger Building Products, Inc.

3. Cheney Flashing Company.

4. Hickman Company, W. P.

5. Merchant & Evans, Inc.

6. Metal-Era, Inc.

7. Metal-Fab Manufacturing, LLC.

2.2 CONCEALED METALS

A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.

2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.

3. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.

b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.

c. Henry Company; Blueskin PE200 HT.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 ROOF-EDGE FASCIA AND RAKES

A. Roof-Edge Fascia and Rakes: Manufactured roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed wood blocking to engage fascia cover. Provide matching corner units.

1. Cover: Fabricated from the following exposed metal:

a. Formed Aluminum: 0.032 inch.

2. Corners: Factory mitered and continuously welded.

3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.

2.6 METAL SOFFIT PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcoa

2. Air Vent, Inc.

3. Petersen Aluminum

B. Soffit Panels: 12” wide traditional perforated v-groove panels, .019” thick aluminum, smooth texture, factory finished in color to be selected from manufacturers standard color range. Basis of Design is Alcoa SVG12V20

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Gutters to be placed below the slope line so that snow and ice can slide clear.

E. Fabricate gutters to fit locations and trim conditions, standard size to be 7” profile in width. Fabricate complete with end pieces, outlet tubes and other accessories as required. Fabricate in minimum 96 inch long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.

2. Provide uniform, neat seams with minimum exposure of solder and sealant.

3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

4. Torch cutting of roof specialties is not permitted.

5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.

2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.

1. Provide elbows at base of downspout to direct water away from building.

C. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below gutter discharge.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 079200

JOINT SEALANTS
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 GENERAL REFERENCE

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: A001, A101, A102, A103, A104, A204, A206, A207, A501, A502, A701, S003, S004, S005, S103, S104, S106, S201, S202, S203, A204, S301, S302, S303.

B. Sub-sub Bids are not required for this trade.

1.3 DESCRIPTION OF WORK

A. The extent of sealant and caulking work shall be as specified herein and at all the following joint locations unless specifically excluded or detailed with other materials:

1. All precast to precast joints, including grouted joints exposed to view.
2. All precast to curtain wall and store front joints.
3. All store front to store front joints.
4. All masonry to precast joints.
5. All precast lifting loops and recesses.
6. All masonry to masonry joints.
7. All cast-in-place to precast joints.
8. All cast-in-place to curtainwall and store front joints.
9. All masonry to store front joints.
10. All curtainwall to precast joints.
11. All roof level plumbing chases.

1.4 ALTERNATES (NOT USED)

1.5 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 30 00 – Cast in Place Concrete

B. Section 03 41 00 – Structural Precast Concrete

C. Section 04 20 00 – Unit Masonry

D. Section 07 95 00 – Expansion Control

1.6 SHOP DRAWINGS (NOT USED)

1.7 SAMPLES (NOT USED)

A. Initial Selection Samples: Submit samples showing complete range of colors, textures and finishes available for each material used.

B. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected.

C. Submit the following samples:

1. Submit color samples of caulking from which the Architect will select color.

1.8 PRODUCT LITERATURE

A. Manufacturer's Data: Submit manufacturer's specifications, recommendations and installation instructions for sealant, caulking compound and associated miscellaneous material required. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown.

1.9 MOCK UPS

A. Install selected color sealants in lengths of no less than (3) three feet at locations selected by the architect for review and approval. Remove mock-up sealants at direction of architect. Upon removal of mockup sealants, prepare, prime, and apply selected sealants in accordance with this section

1.10 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered and stored in original, unopened manufacturer's containers with brand marked clearly thereon. Materials shall be stored in a dry location, protected from adverse conditions.

1.11 COORDINATION

A. Examine all surfaces to receive work of this Section and report to the Architect any condition which is not acceptable. Commencement of work on any continuous run constitutes acceptance of conditions and places the responsibility of a sound installation on this section.

B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations

for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures. Coordinate time schedule to avoid delay of project.

1.12 QUALITY ASSURANCE

A. Manufacturer shall send a qualified technical representative to project site for the purpose of advising the installer of proper procedures and precautions for the use of the materials.

1.13 WARRANTIES

A. Attention is directed to provisions of the CONDITIONS OF CONTRACT regarding guaranties and warranties.

1.14 Manufacturers shall provide their standard guaranties for work specified in this Section. However, such guaranties shall be in addition to and not in lieu of all other liabilities which manufacturers and Contractor may have by law or by other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS (NOT USED)

A. Two Component Polyurethane Non Sag Sealant:

1. Products offered by manufacturers to comply with the requirements include the following:

a. “Sikaflex-2C-NS,” Sika Corporation.

b. THC-901; Tremco Mfg. Company

c. Sonolastic NP2; Sonneborn Building Products

B. Two Component Polyurethane Self Leveling Sealant:

1. Products offered by manufacturers to comply with the requirements include the following:

a. Sikaflex-2C-SL, Sika Corporation.

b. Sonolastic SL2; Sonneborn Building Products

c. “Vulkem 245/255 or THC/900”: Tremco Mfg. Co.

d. 790 Silicone Sealant : Dow Corning

C. Preformed Expanding Foam Joint Sealants

1. Products offered by manufacturers to comply with the requirements include the following:

a. InverSeal : Watson Bowman Acme

b. Iso-Flex Precom B : Lymtal International, Inc.

c. 20H System : Emseal

2.2 MATERIALS

A. Caulking/Sealant

1. Application:

a. Provide two component polyurethane, non-sag sealant at vertical and horizontal joints.

b. Provide two component polyurethane self-leveling sealant at joints subject to traffic conditions.

c. Provide polyurethane joint fillers at expansion joints shown to be caulked.

d. Provide bituminous joint fillers at concrete installations not required to be caulked.

2. Two Component Polyurethane Non Sag Sealant:

a. ASTM 920, Class A, Type 2, proprietary two component primerless sealant.

3. Two Component Polyurethane Self Leveling Sealant:

a. Polyurethane based, 2 part elastomeric sealant, complying with ASTM 920, Class A, Type 1 unless Type 2 (non-sag) is recommended by manufacturer for the application shown.

B. Primer and Fillers

1. Joint Cleaner: Provide the type of joint cleaning compound recommended by the sealant or caulking compound manufacturer, for the joint surfaces to be cleaned.

2. Joint Primer/Sealer: Provide the type joint primer/sealer recommended by the sealant manufacturer, for the joint surfaces to be primed or sealed.

3. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by the sealant manufacturer, to be applied to sealant contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.

4. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non absorptive closed-cell or “hybrid” material as recommended for compatibility with sealant by the sealant manufacturer. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize the possibility of sealant extrusion when joint is compressed.

C. Cellular Foam Expansion Joint Fillers

1. Expanded Polyethylene Joint Filler:

a. Provide flexible, compressible, closed-cell polyethylene of not less than 10 psi compression deflection (25%); except provide higher compression deflection

strength as may be necessary to withstand installation forces and provide proper support for sealants; surface water absorption of not more than 0.1 lbs. per sq. ft.

b. Products offered by manufactured to comply with the requirements include the following:

1) Ethafoam SB: Dow Chemical Co.

2) Sonofoam; Sonneborn Building Products.

3) Expand O Foam; Williams Products, Inc.

2. Concrete Control – Expansion Joint Fillers

3. Bituminous and Fiber Joint Filler:

a. Provide resilient and non-extruding type premolded bituminous impregnated fiberboard units complying with ASTM D1751 73 (78), FS HH F 341 F 77, Type I and AASHTO M213 74.

b. Products offered by manufacturers to comply with the requirements include the following:

1) Flexcell; Celotex Corporation

2) Cane Fiber 1290; W. R. Grace & Co.

3) Fibre; W. R. Meadows, Inc.

D. Preformed Expanding Foam Joint Sealants

1. Proved preformed foam waterproofed foam expanded foam joint sealant intended for below grade application.

2.3 MIXES (NOT USED)

2.4 FABRICATION (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION AND INSPECTION

A. Joint Sealant and Joint Preparation

1. Joint Surface Preparation: Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or caulking compound.

a. Review joint size and shape for conformance with drawings and sealant manufacture's recommendations. Provide sufficient notification to contractor of non-conforming conditions to allow re-profiling of joints.

b. Non-conforming joint sizes shall be ground to size and shape. In the event grinding cannot modify joint precast component shall be adjusted to provide a conforming condition.

c. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance.

3.2 WORKMANSHIP, PERFORMANCE (NOT USED)

3.3 INSTALLATION/APPLICATION/ERECTION

A. Joint Sealant Application:

1. Installation: Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

a. Prime or seal the joint surfaces as required by product data specifications. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

b. Install sealant backer rod for sealants, except where recommended to be omitted by sealant manufacturer for the application shown.

c. Install bond breaker tape as required by manufacturer's recommendations to ensure that sealants will perform properly.

d. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

e. Install sealants to depths as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead.

1) For pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but not more than 5/8 inch deep or less than 3/8 inch deep.

2) For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but not more than ½ inch deep or less than 1/4 inch deep.

2. Cure and Protection:

a. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.

B. Joint Fillers

1. Set units at proper depth or position in the joint to coordinate with other work, including the installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between the ends of joint filler units.

3.4 FIELD QUALITY CONTROL (NOT USED)

3.5 CLEANING AND PROTECTION

A. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or the sealant/caulking compound.

B. Remove excess and spillage of compounds promptly as the work progresses. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to the adjoining surfaces or finishes.

C. Provide all procedures required for the protection of sealants and caulking compounds during the construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at the time of acceptance

3.6 EXTRA STOCK/SPARE PARTS (NOT USED)

3.7 SCHEDULES (NOT USED)

END OF SECTION

SECTION 079500

EXPANSION CONTROL
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 GENERAL REFERENCE

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: A101, A207, A701, S001, S003, S004, S005, S103, S104, S121, S201.

B. Sub-sub Bids are not required for this trade.

1.3 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, services and accessories necessary to furnish and install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein.

B. The principal work of this Section includes, but may not be limited to, the following:

1. Horizontal deck joint seals at transition to initial double tee at ramp.
2. Expansion joint at top of curtain wall and precast roof plank at south stair

1.4 ALTERNATES (NOT USED)

1.5 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 30 00 Cast-In-Place Concrete

B. Section 03 41 00 - Structural Precast Concrete

C. Section 07 92 00 – Joint Sealants

1.6 SHOP DRAWINGS

A. Shop Drawings: Submit shop drawings for installation of expansion joints. Include plans and details of sections and connections. Show anchorage and accessory items.

1.7 SAMPLES (NOT USED)

A. Initial Selection Samples: Submit samples showing complete range of colors, textures and finishes available for each material used.

B. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected.

C. Submit the following samples:

1. Submit sample of expansion joint, not less than 6 inches long.
2. Submit manufacturers color palette for expansion joints subject to façade and architectural treatments

1.8 PRODUCT LITERATURE

A. Manufacturer's Data: Submit specifications, installation instructions and general recommendations from the expansion joint material manufacturer, for the type of product required.

B. Warranty: Submit Contractor’s warranty for review and acceptance prior to commencement of expansion joint work.

1.9 MOCK UPS (NOT USED)

1.10 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered on the job and stored in a place protected from damage, moisture and exposure to the elements in exact accordance with manufacturer's instructions.

1.11 COORDINATION

A. Weather Conditions: Do not proceed with installation of expansion joints and sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and strength development of the adhesive materials.

1.12 QUALITY ASSURANCE

A. Manufacturer's qualifications.

1. Manufacturer's Instructions: In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for all phases of the work, including preparation of substrate, application of materials, and protection of installed units.

a. The manufacturer will verify that the expansion joint system is properly sized for the movement expected in the structure.

b. The manufacturer will verify or make recommendations regarding the size of concrete block outs to receive the expansion joint system taking into consideration climate conditions at the time concrete is placed and shrinkage of concrete.

c. The manufacturer will insure that the expansion joint system is set at the proper width to account for variations in the concrete joint opening due to temperature conditions at the time of installation.

d. The manufacturer and approved applicator shall guarantee the expansion joint system for a period of five (5 years). Any type of failure of the new joint system which occurs within the specified warranty period shall be repaired or replaced by the Contractor at no cost to the Owner.

e. Consult the Manufacturer's representative and establish the minimum provisions required to ensure satisfactory work.

f. The expansion joint system shall meet or exceed any fire rating requirements set forth by the local building code requirements.

g. Expansion joint systems intended for accessible pathways shall conform to Americans with Disabilities Accessibility (ADA) guidelines.

B. Subcontractor's qualifications.

C. The installer shall be licensed by the manufacturer of the joint system.

1.13 WARRANTIES

A. Attention is directed to provisions of the CONDITIONS OF CONTRACT and applicable parts of Division 1 regarding guaranties and warranties.

B. Manufacturers shall provide their standard guaranties for work specified in this Section. However, such guaranties shall be in addition to and not in lieu of all other liabilities which manufacturers and Contractor may have by law or by other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Horizontal expansion joints at supported floor slab, tee to tee:

1. BASF/Watson Bowman: WaboCrete ME Series Membrane (model as applicable)

2. Emseal: Thermaflex TCR System (model as applicable)

3. Lymtal International, Inc.: Iso-Flex Winged J-Series (model as applicable)

2.2 MATERIALS

A. The expansion joint seal system shall be a complete system of compatible materials designed by the manufacturer to produce a waterproof, traffic-bearing expansion joint seal.

B. The gland elements shall be a continuous, factory extruded unit for the entire straight run length of the joint. Changes in direction or elevation shall be accomplished by factory molded elbows, tees, crosses and the like. The seal shall be turned up a minimum of 6 inches (vertically) unless otherwise shown on plans. The seal element shall not be mitered/jointed unless approved by the Consultant in writing.

C. Due to variations in specific details of the locations, expected movement, expected traffic exposure, all systems are not suitable for one particular condition. The Contractor shall reference the specific expansion joint detail and approved products shown on the drawings, including gland size, etc. for the respective condition.

D. Contractor shall review specific details on drawings regarding products and model numbers approved for use.

2.3 MIXES (NOT USED)

2.4 FABRICATION (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION AND INSPECTION (NOT USED)

A. Preparation

1. The block-out shall be provided to the specified dimensions as indicated on the drawing and acceptable to the manufacturer. Any edge raveling at the joint opening or spalls shall be repaired with a suitable compound to provide a solid, square block-out.

2. The block-out substrate shall be sandblasted clean of all contaminants and impurities immediately prior to the system installation to assure proper adhesion.

3. The membrane gland element shall be unpackaged and laid in a relaxed position to believe any temporary set from shipment packaging prior to placement. The pre-molded element shall be wiped clean with a solvent solution such as toluene.

4. Adjacent deck surfaces shall be taped off and protected to assure a clean, neat professional installation.

3.2 WORKMANSHIP, PERFORMANCE (NOR USED)

3.3 INSTALLATION/APPLICATION/ERECTION

A. Installation

1. The entire installation shall be made in accordance with the manufacturer's written instruction.

2. Follow standard manufacturer’s recommendation for installation of the material, including block-out dimensions, joint width and ambient temperature conditions.

3.4 FIELD QUALITY CONTROL

A. All expansion joint seals shall be tested by applying water and by flooding for a minimum of 24 hours. Any leaking observed shall be rectified by the Contractor and the joint shall be re-tested until no leakage is observed. It is the responsibility of the Contractor to absolutely make certain that the joints are totally waterproofed.

3.5 CLEANING AND PROTECTION (NOT USED)

3.6 EXTRA STOCK/SPARE PARTS (NOT USED)

3.7 SCHEDULES (NOT USED)

END OF SECTION

SECTION 08113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Standard hollow-metal steel doors.

2. Standard hollow-metal steel frames.

3. Fire-rated frames.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 08710 - DOOR HARDWARE for door hardware for steel doors.

2. Section 09900 - PAINTING AND COATING for field painting steel doors and frames.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, temperature-rise ratings, and finishes for each type of steel door and frame specified.

B. Shop Drawings:

1. Elevations of each door design.

2. Details of doors, including vertical and horizontal edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware.

5. Details of each different wall opening condition.

6. Details of anchorages, joints, field splices, and connections.

7. Details of accessories.

C. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

C. Fire-Rated Door Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amweld Building Products, LLC.

2. Ceco Door Products; an ASSA ABLOY Group Company.

3. CURRIES Company; an ASSA ABLOY Group Company.

4. de LaFontaine

5. Mesker Door Inc.

6. Pioneer Industries, Inc.

7. Philipp Manufacturing Company.

8. Republic Builders Products Company.

9. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to

H. ASTM C 143/C 143M.

I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.

1. Design: Flush panel.

2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.

3. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick end closures or channels of same material as face sheets.

5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), 1-3/4 inches thick.

C. Description: Provide flush-design sound- control doors, 1-3/4 inches thick, of seamless construction; with manufacturer’s standard sound-retardant core as required to provide STC and fire rating indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Fabricate according to ANSI/NAAMM-HMMA 865.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.

2. Frames for Level 3 Steel Doors: 0.067-inch-thick steel sheet.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and not visible.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

5. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 087100 - DOOR HARDWARE.

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.

3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 - ELECTRICAL.

2.8 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.

b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

c. Install door silencers in frames before grouting.

d. Remove temporary braces necessary for installation only after frames have been properly set and secured.

e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

f. Field apply bituminous coating to backs of frames that are filled with grout.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.

b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch .

c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer. Primer shall be compliant with low-emitting requirements as herein stated.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08413

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 SCOPE OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Exterior aluminum-framed storefronts at stairwells.

2. Exterior manual-swing aluminum doors.

3. Provide and install all glazing, including tinted glazing for exterior storefront system.

B. Related Work: The following items are not included in this Section:

1. Section 07920 - JOINT SEALANTS for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.

2. Section 84411 – GLAZED ALUMINUM CURTAIN WALL for glazed enclosure of south stairwell.

3. Section 87100 - DOOR HARDWARE for lock cylinders and keying.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.

2. Thermal movements.

3. Dimensional tolerances of building frame and other adjacent construction.

4. Failure includes the following:

a. Deflection exceeding specified limits.

b. Thermal stresses transferred to building structure.

c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.

d. Noise or vibration created by wind and thermal and structural movements.

e. Loosening or weakening of fasteners, attachments, and other components.

f. Sealant failure.

B. Structural Loads: Wind and seismic loads as indicated on the Structural Drawings, but not less than that required by Code.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller, amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 1/8 inch and clearance between members and operable units directly below to less than 1/16 inch.

D. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Air Infiltration Test: Test unit in accordance with ASTM E 283, as follows:

1. Static Air Pressure Difference: 6.24 psf for fixed storefront units, and 1.567 psf for doors.

2. Performance: Maximum air leakage shall not exceed the following: fixed storefront units,1.0 cfm/sf.: glazed entrance door units, 0.3 cfm/sf of other areas.

F. Water Leakage Test: Test fixed framing system in accordance with ASTM E 331.

1. Test Pressure: 8 psf.

2. Performance: No leakage as defined in test method at specified test pressure. No uncontrolled water penetrating system or appearing on normally exposed interior surfaces.

G. Solar Heat-Gain Coefficient: Provide units with a whole-unit SHGC maximum of 0.40, as required by the Massachusetts Stretch Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer registered in the state the project is located, responsible for their preparation.

2. Include structural analysis of story drift and deflection from anticipated live loads, and determination whether head receptors are required.

3. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.

4. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

F. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that units as glazed for this Project meet or exceed Code requirements for the following:

1. Solar heat-gain coefficient.

G. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.

1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

B. Accessible Entrances: Comply with authorities having jurisdiction, local state building code and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

C. Mock-Ups: Build mock-ups of entrance as directed by the Architect.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems

without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

B. Performance Warranty: Provide a written warranty assuming full responsibility for the satisfactory performance of each system including but not limited to, framing, hardware, doors, anchorage, setting, perimeter sealing, flashing and other work as it relates to the performance of the system. Repair or replace all work not meeting specified performance requirements including removal and replacement of covering or connected work.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Storefront, Thermal Break, 1 3/4 inch by 6 inch profile, front glazed:

a. Basis-of-Design: Oldcastle North America, Trifab 601UT.

b. Kawneer North America, Trifab 601UT.Tubelite Inc., 14650T.

2. Doors, Wide Stile:

a. EFCO, a Pella Company, D-500.

b. Kawneer North America, 500.

c. Tubelite Inc., Wide.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.

2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

3. Extruded Structural Pipe and Tubes: ASTM B 429.

4. Structural Profiles: ASTM B 308/B 308M.

5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.

2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.

3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermal-break.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.

2. Reinforce members as required to receive fastener threads.

3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Tempered Glass for Vertical Exterior Glazing (Type IT): 1/4 inch tempered glass, low e coating on the No. 2 surface. Provide one of the following or equal:

1. Basis-of-Design: Tempered by AGC Flat Glass North America.

a. Visible Light Transmittance: 70 percent.

b. Solar Heat Gain Coefficient: 0.37.

2. VE1-2M by Viracon.

a. Visible Light Transmittance: 70 percent.

b. Reflectance Visible Light: 11 percent.

c. Shading Coefficient: 0.43.

d. Solar Heat Gain Coefficient: 0.37.

3. Solarban 60 by PPG Industries.

a. Visible Light Transmittance: 70 percent.

b. Reflectance Visible Light: 11 percent.

c. Shading Coefficient: 0.44.

d. Solar Heat Gain Coefficient: 0.38.

4. SN-68 by Guardian Industries.

a. Visible Light Transmittance: 68 percent.

b. Reflectance Visible Light: 10 percent.

c. Shading Coefficient: 0.43.

d. Solar Heat Gain Coefficient: 0.37.

2.5 DOORS

A. Doors: Manufacturer's standard glazed doors, for manual swing operation.

1. Door Construction: Mechanical clip fastening, SIGMA deep penetration plus welds and 1-1/8 inch long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type and EPDM glazing gaskets reinforced with non-stretchable cord.

2.6 DOOR HARDWARE

A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.

1. Opening-Force Requirements:

a. Egress Doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.

B. Hardware Cores: Provide as specified in Section 087100 - DOOR HARDWARE.

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 - JOINT SEALANTS.

B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.

2. Accurately fitted joints with ends coped or mitered.

3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

4. Physical and thermal isolation of glazing from framing members.

5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

E. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.

2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

F. Doors: Reinforce doors as required for installing hardware.

1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.

2. At exterior doors that open to conditioned space, provide weather sweeps applied to door bottoms.

G. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Base of Design Finish: Satin aluminum, clear anodized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.

2. Do not install damaged components.

3. Fit joints to produce hairline joints free of burrs and distortion.

4. Rigidly secure nonmovement joints.

5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.

6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.

2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 - JOINT SEALANTS and to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Furnish and install glazing as specified.

1. Structural-Sealant Glazing:

a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

b. Install weatherseal sealant according to Section 079200 - JOINT SEALANTS and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

G. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.

2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.

2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.

b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner’s Project manager will determine compliance with specification performance levels.

1. Water Penetration: Areas shall comply with ASTM E 1105 at a minimum cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under Part 1 "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft., and shall not evidence water penetration.

B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.

1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

3.5 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 08441

GLAZED ALUMINUM CURTAIN WALL

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Aluminum curtain wall system with factory- installed glass and glazing and reinforced mullions, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall framing.

B. Alternates: Not Applicable.

C. Items To Be Installed Only: Not Applicable.

D. Items To Be Furnished Only: Not Applicable.

E. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 07920 - JOINT SEALANTS for sealing the frame perimeter.

2. Section 08413 - ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide a curtain wall system capable of complying with performance requirements indicated, based on testing manufacturer's curtain wall systems that are representative of those specified.

B. AAMA Performance Requirements: Provide a curtain wall system of the performance class and grade indicated that comply with AAMA 503.

1. Performance Class: CW- Commercial.

2. Performance Grade: Minimum for performance class indicated.

C. Structural Performance: Provide curtain walls capable of withstanding the following, including wind loads based on passing AAMA, Uniform Load Structural Test, at basic wind speed indicated:

1. Deflection: A static air design load of 40 psf (1915 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in

excess of L/175 of the span of any framing member at design load. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

2. Wind Speed: 100 MPH.

3. Seismic: When tested to AAMA 501.4, system must meet design displacement of 0.010 x the story height and ultimate displacement of 1.5 x the design displacement.

D. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft^2 at a static air pressure differential of 6.24 psf (300 Pa).

E. Water Resistance: (static): The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a static air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

F. Water Resistance: (dynamic): The test specimen shall be tested in accordance with AAMA 501.1. There shall be no leakage at an air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

G. Solar Heat-Gain Coefficient: Provide system with a whole-window SHGC per below and determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.

1. 0.40

H. Visible Light Transmittance: Provide system with a glazing visible light transmittance as follows:

1. Facades: varies, according to glazing option.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:

1. Mullion details, including reinforcement and stiffeners.

2. Joinery details.

3. Expansion provisions.

4. Flashing and drainage details.

5. Weather-stripping details.

6. Glazing details.

7. Window cleaning provisions.

8. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation and used to determine the following:

a. Structural test pressures and design pressures from basic wind speeds.

b. Deflection limitations of glass framing systems.

C. Samples for Verification: For curtain wall system components required, prepared on Samples of size indicated below.

1. Main Framing Member: 12-inch-long, full-size sections of extrusions with factory-applied color finish.

2. Hardware: Full-size units with factory-applied finish.

3. Weather Stripping: 12-inch-long sections.

D. Qualification Data: For Installer and professional engineer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency. Test results based on use of downsized test units will not be accepted.

F. Maintenance Data: For operable sash, operating hardware, weather-stripping and finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to curtain wall manufacturer for installation required for this Project.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain the curtain wall system through one source from a single manufacturer.

D. Product Options: Information on Drawings and in Specifications establishes requirements for curtain wall system aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

E. Fenestration Standard: Comply with AAMA guides, for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Provide AAMA-certified system with an attached label.

F. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Failure to meet performance requirements.

2. Structural failures including excessive deflection.

3. Water leakage, air infiltration, or condensation.

4. Faulty operation of hardware.

5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

6. Glass failure.

B. Warranty Period: Two years from date of Substantial Completion.

C. Warranty Period for Metal Finishes: 20 years from date of Substantial Completion.

D. Warranty Period for Glass: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The following products have been selected:

1. Curtain Wall System:

a. As manufactured by Kawneer Corporation.

2. Basis-of-Design: Series 1600 Wall System by Kawneer.

3. Equal products, by Wausau Window and Wall Systems, thermal curtain wall, or Thermal Curtain Wall by Oldcastle Building Envelope are acceptable, subject to compliance with requirements, manufacturers' offering products equal in aesthetic quality, function, and performance will be considered.

2.2 MATERIALS

A. Aluminum Extrusions: Manufacturer's standard formed sheet or extruded-aluminum. Provide aluminum alloy and temper recommended by window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, and not less than 16,000-psi minimum yield strength.

B. Member Wall Thickness: Each framing member shall have a wall thickness sufficient to meet the specified structural requirements.

C. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.

D. Glazing Stops: Material and finish to match frame members.

E. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with wood window members, cladding, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

F. Gaskets: Glazing gaskets shall comply with ASTM C 864 and be extruded of a silicone compatible EPDM rubber that provides for silicone adhesion.

G. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

H. Reinforcing Members: Aluminum, or nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

I. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when wood window is closed.

1. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C 509.

J. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.

1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

K. Replaceable Weather Seals: Comply with AAMA 701/702.

2.3 GLAZING

A. Glass for Vertical Glazing: Minimum 1/4” inch tempered, Low-e glass, clear. For three colors shown on Drawings, provide tinted glass from manufacturer’s standard colors of bronze, blue, and green. Basis of Design: PPG Industries Inc.; or comparable product by one of the following:

1. Guardian Industries Corp.

2. Viracon, Inc.

2.4 FABRICATION

A. General: Fabricate the curtain wall system, in sizes indicated, for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.

B. Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.

D. Mullions: Provide steel reinforced mullions and cover plates as shown, matching the curtain wall system, complete with anchors for support to structure and installation. Allow for erection tolerances and provide for movement of the system due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

F. Arrange fasteners and attachments to conceal from view.

2.5 FINISHES

A. Aluminum Finish: Manufacturer's standard anodized brushed aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; and other conditions affecting performance of work.

1. Concrete Surfaces: Visibly dry and free of excess cement, sand, and other construction debris.

2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with drawings, and shop drawings, and manufacturer's written instructions, for installing the curtain wall system, hardware, accessories, and other components.

B. Install curtain wall systems level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 FIELD QUALITY CONTROL

A. Remove and replace components that do not comply with specified requirements.

3.4 ADJUSTING

A. Adjust hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.5 PROTECTION AND CLEANING

A. Protect curtain wall surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact the curtain wall surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean exposed surfaces immediately after installing curtain wall systems. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing the system. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 08710

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Hollow metal framed swinging doors.
2. Cylinders for aluminum swinging doors.

B. Door operating hardware to be supplied by the following:

1. Section 08413, Aluminum Framed Entrances and Storefronts
2. Section 08441 Glazed Aluminum Curtain Wall.

C. Related Sections:

1. Section 08113 Hollow Metal Doors and Frames.

2. Section 08413 Aluminum-Framed Entrances and Storefronts.

3. Section 08441 Glazed Aluminum Curtain Wall.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

2. ICC/IBC - International Building Code.

3. NFPA 80 - Fire Doors and Windows.

4. NFPA 101 - Life Safety Code.

5. NFPA 105 - Installation of Smoke Door Assemblies.

6. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.

7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series

2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.

b. Manufacturer of each item.

c. Fastenings and other pertinent information.

d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.

e. Explanation of abbreviations, symbols, and codes contained in schedule.

f. Mounting locations for door hardware.

g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service

representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

E. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:

1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

b. Door Closers: Comply with the following maximum opening-force requirements indicated:

1) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

b. Thresholds: Not more than 1/2 inch high.

3. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.

a. Test Pressure: Positive pressure labeling.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.

2. Plans for existing and future key system expansion.

3. Requirements for key control storage and software.

4. Installation of permanent keys, cylinder cores and software.

5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Inspect and discuss preparatory work performed by other trades.

2. Review and finalize construction schedule and verify availability of materials.

3. Review the required inspecting, testing, commissioning, and demonstration procedures.

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.

2. Faulty operation of the hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.

2. Five years for exit hardware.

3. Twenty five years for manual surface door closers.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Acceptable Manufacturers:

a. Bommer Industries (BO).

b. Hager Companies (HA).

c. McKinney Products (MK).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90 minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.

1. Acceptable Manufacturers:

a. Bommer Industries (BO).

b. McKinney Products (MK).

c. Pemko Manufacturing (PE).

2.3 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

1. Acceptable Manufacturers:

a. Rockwood Manufacturing (RO).

b. Trimco (TC).

B. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.

2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.

3. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

a. Acceptable Manufacturers:
1) Burns Manufacturing (BU).
2) Rockwood Manufacturing (RO).
3) Trimco (TC).

2.4 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.

2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

3. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.

4. Keyway: Manufacturer’s Standard.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide removable core (small or large format) as specified in Hardware Sets.

E. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified cylinders employing a utility patented and restricted keyway requiring the use of patented controlled keys. Provide bump resistant, fixed core cylinders as standard with solid recessed cylinder collars. Cylinders are to be factory keyed where permanent keying records will be established and maintained.

1. Provide a 6 pin multi-level master key system comprised of patented controlled keys and security and high security cylinders operated by one (1) key of the highest level. Geographical exclusivity to be provided for all security and high security cylinders and UL437 certification where specified.

a. Level 1 Cylinders: Provide utility patented controlled keyway cylinders that are furnished with patented keys available only from authorized distribution.

2. Acceptable Manufacturer:

a. Sargent Manufacturing (SA) - Degree Series.

b. Corbin Russwin (RU) – Access 3 Series.

c. Schlage (SC) – Everest 29 Restricted Series.

F. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference.

G. Key Quantity: Provide the following minimum number of keys:

1. All Master Key Levels: three (3)

2. Change Keys per Cylinder: Four (4)

3. Construction Keys: Five (5)

4. Construction Control Keys: Two (2)

5. Permanent Control Keys: Two (2)

H. Construction Keying: Provide temporary keyed construction cores where specified. Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".

I. Key Registration List: Provide keying transcript list to Owner's representative in the proper format for importing into key control software.

J. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Acceptable Manufacturers:

a. Lund Equipment (LU).

b. MMF Industries (MM).

c. Telkee (TK).

K. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into “Key Wizard” software.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Locksets to be manufactured with a corrosion resistant, stamped 12 gauge minimum formed steel case and be field-reversible for handing without disassembly of the lock body. Lockset trim (including knobs, levers, escutcheons, roses) to be the product of a single manufacturer. Furnish with standard 2 3/4" backset, 3/4" throw anti-friction stainless steel latchbolt, and a full 1" throw stainless steel bolt for deadbolt functions.

1. Acceptable Manufacturers:

a. Corbin Russwin Hardware (RU) – ML2000 Series.

b. Sargent Manufacturing (SA) – 8200 Series.

c. Schlage (SC) – L9000 Series.

B. Lock Trim Design: As specified in Hardware Sets.

C. Knurling: Where required by local code provide knurling or abrasive coating to all levers on doors leading to hazardous areas such as mechanical rooms, etc.

2.6 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.5, Grade 1, certified small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Acceptable Manufacturers:

a. Corbin Russwin Hardware (RU) - DL4100 Series.

b. Sargent Manufacturing (SA) - 4870 Series.

c. Schlage (SC) - L460 Series.

2.7 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

2. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.

2. Strikes for Auxiliary Deadlocks: BHMA A156.5.

3. Dustproof Strikes: BHMA A156.16.

2.8 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is not acceptable except in any case where the door light extends behind the device as in a full glass configuration.

5. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.

6. Vertical Rod Exit Devices: Provide and install interior surface and concealed vertical rod exit devices as Less Bottom Rod (LBR) unless otherwise indicated.

7. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

8. Rail Sizing: Provide exit device rails factory sized for proper door width application.

B. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish. Provide keyed removable feature, stabilizers, and mounting brackets as specified in the Hardware Sets. At openings designed for severe wind load conditions due to hurricanes or tornadoes, provide manufacturers approved mullion and accessories to meet applicable state and local windstorm codes.

1. Acceptable Manufacturers:

a. Corbin Russwin Hardware (RU) - 900 Series.

b. Sargent Manufacturing (SA) - 980S Series.

c. Von Duprin (VD) - 9954 Series.

2.9 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Acceptable Manufacturers:

a. Burns Manufacturing (BU).

b. Rockwood Manufacturing (RO).

c. Trimco (TC).

2.10 ARCHITECTURAL SEALS

A. General: Thresholds and gasket seals to be of type and design as specified below or in the Hardware Sets. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

1. Acceptable Manufacturers:

a. Pemko Manufacturing (PE).

b. Reese Enterprises, Inc. (RS).

c. Zero International (ZE).

2.11 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.12 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. General finish standard: brushed aluminum.

D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Frames: Comply with ANSI/DHI A115 series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

   2. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."

C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products as listed in the door hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer's Abbreviations:
   1. MK - McKinney
   2. PE - Pemko
   3. RF - Rixson
   4. RO - Rockwood
   5. YA - Yale
   6. NO - Norton
   7. SU - Securitron
   8. TC - Trimco
   9. 00 - Other

Hardware Schedule

Set: 1.0

Description: Sgl w/ Storeroom Lock; No Closer

3	Hinge	TA2714	US26D	MK
1	Mortise Lock (storeroom)	TCR6 8805RL K825xCT6LL	626	YA
1	Core	K800	626	YA
1	Kickplate	K1050 10" 4BE CSK	US26D	RO
1	Door Stop	404 (wall) / 441CU (floor)	US26D	RO
3	Silencer	608/609		RO

Set: 2.0

Description: Double w/ Storeroom Lock; No Closer

6	Hinge	TA2714	US26D	MK
1	Mortise Lock (storeroom)	TCR6 8805RL K825xCT6LL	626	YA
1	Core	K800	626	YA
2	Kickplate	K1050 10" 4BE CSK	US26D	RO
1	Door Stop	404 (wall) / 441CU (floor)	US26D	RO
6	Silencer	608/609		RO

END OF SECTION

SECTION 09900

PAINTING AND COATING
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Form for Sub Bid, Bid Bond, DCAMM Eligibility Certificate and Update Statement, at a time and place as stipulated in the "INSTRUCTIONS TO BIDDERS".

2. Each sub-bid submitted for work under this Section shall be on forms furnished herein as required by Section 44F of Chapter 149 of the General Laws, as amended.

C. Sub Sub-Bid Requirements: (None required under this Section.)

D. Reference Drawings: The Work of this Filed Sub-Bid is shown on the following Contract Drawings: G000; G001; A002, A101-5, A201-208, A301-302, A401-402, A 501-502, A701.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Field painting of certain exposed exterior items and surfaces.

2. Field painting of Metal Roof decking, factory primed.

3. Surface preparation for painting.

4. Note: precast concrete, hot-dipped galvanized steel, and aluminum items to remain uncoated beyond shop applied coatings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 05120 - STRUCTURAL STEEL FRAMING for shop primed structural steel.

2. Section 05500 – MISCELLANEOUS METALS for shop primed metal to be coated. Hot dip galvanized ferrous metal to remain unpainted.

3. Section 08113 - HOLLOW METAL DOORS AND FRAMES for factory primed steel doors and frames.

1.3 DEFINITIONS AND EXTENT

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

2. Eggshell refers to low-sheen finish with a gloss range between 20 and 25 when measured at a 60-degree meter.

3. Satin refers to low/medium-sheen finish with a gloss range between 25 and 35 when measured at a 60-degree meter.

4. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.

5. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

B. This Section includes surface preparation and field painting of exposed exterior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

2. Exposed items to be painted: doors, door frames, and miscellaneous items, to be determined.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Elevator entrance doors and frames.

b. Elevator equipment.

c. Finished mechanical and electrical equipment, including sprinkler risers and electrical conduit.

d. Plumbing piping.

e. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.

b. Furred areas.

c. Pipe spaces.

d. Duct shafts.

e. Elevator shafts.

3. Finished metal surfaces include the following:

   a. Anodized aluminum.

   b. Stainless steel.

   c. Chromium plate.

4. Operating parts include moving parts of operating equipment and the following:

   a. Valve and damper operators.

   b. Linkages.

   c. Sensing devices.

   d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other plates.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

   1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

   2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

   1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

   2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.

   3. Submit two eight inch by 12 inch Samples for each type of finish coating for Architect's review of color and texture only.

C. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Mockups: Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1. Architect will select one surface to represent surfaces and conditions for application of each type of coating and substrate.

2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.

a. After finishes are accepted, Architect will use the surface to evaluate coating systems of a similar nature.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.

2. Product description (generic classification or binder type).

3. Manufacturer's stock number and date of manufacture.

4. Contents by volume, for pigment and vehicle constituents.

5. Thinning instructions.

6. Application instructions.

7. Color name and number.

8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work are listed in the Finish Schedule at the end of this Section.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Materials: No coating of precast concrete required.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.

b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

4. Galvanized Surfaces: to remain as coated, grey color, or per colored galvanizing process.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir continuously during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

3. Provide finish coats that are compatible with primers used.

4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

5. Sand lightly between each succeeding enamel or varnish coat.

6. Regardless of coats applied of paint, provide additional coats as needed to obtain satisfactory final result in terms of full coverage on all surfaces to receive paint or coating.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer over metal surfaces that have been shop primed and touchup painted.

3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.

2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

A. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

E. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.

2. Uninsulated plastic piping.

3. Pipe hangers and supports.

4. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

F. Electrical items to be painted include, but are not limited to, the following:

1. Electrical equipment that is indicated to have a factory-primed finish for field painting.

G. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:

1. The Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.

2. The Architect may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 PAINT SCHEDULE

A. Schedule: Provide products and number of coats specified. Use of manufacturer's proprietary product names to designate colors, materials, generic class, standard of quality and performance criteria and is not intended to imply that products named are required to be used to the exclusion of equivalent performing products of other manufacturers.

B. Exterior Paint Schedule:

1. Concrete Unit Masonry: for Ground floor exterior concrete masonry unit wall, exposed to view: Low-Luster Acrylic Enamel Finish.

   a. Block Filler: concrete unit masonry block filler

   b. Two finish coats: Acrylic solid enamel, semi-gloss.

2. Full-Gloss Acrylic Enamel Finish: Two finish coats over shop primer:

   a. Primer: Metal primer, touch up surfaces with factory primer

   b. Two finish Coats: Exterior full gloss enamel.

END OF SECTION

SECTION 10140

SIGNAGE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Code-required panel signage, including but not limited to, accessibility signage, vehicular directional signage, and elevator, mechanical and electrical room signage.

2. Building-mounted identification signs, including custom design wayfinding signage.

3. Cut metal signage for site based building identification signage.

B. Alternates: Not Applicable.

C. Items To Be Installed Only: Not Applicable.

D. Items To Be Furnished Only: Not Applicable.

E. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Division 5 – MISC METALS for framework supporting cut lettering for exterior site based building identification signage.

2. Division 26- ELECTRICAL for backlit and illuminated exit signs.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.

C. Samples for Verification: For each type of sign, include the following Samples to verify colors selected:

1. Panel Signs: Full-size Samples of each type of sign required.

2. Approved samples will not be returned for installation into Project.

D. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each sign type through one source from a single manufacturer.

B. Regulatory Requirements: Comply with the Massachusetts Architectural Access Board, Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

PART 2 - PRODUCTS

2.1 PANEL SIGNS

A. General: Provide signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction as indicated. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally. Provide the following:

1. Code-Required Signs for Certificate of Occupancy:

a. Type: Photopolymer on acrylic or printed acrylic / aluminum as applicable.

b. Color: Selected from manufacturer’s standard colors including metallic silver, off white, champagne, light gray, dark red, dark green, dark blue, dark bronze, charcoal. White letters on color background.

c. Type Size: As selected.

d. Typeface: As selected.

e. Size: As indicated on the Drawings.

B. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Raised-Copy Thickness: Not less than 1/32 inch

C. Symbols of Accessibility: Provide at all accessible parking spaces as part of identification signage.

2.2 PANEL SIGNS, WAYFINDING

A. Provide custom, floor identification signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction. Produce panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.

1. Type: Photopolymer on printed aluminum.

2. Color: Selected from manufacturer's standard colors including metallic silver, off white, champagne, light gray, dark red, dark green, dark blue, dark bronze, charcoal.

3. Size: As indicated on the Drawings.

2.3 BUILDING-MOUNTED IDENTIFICATION SIGNAGE

A. Provide separate cast aluminum letters for mounting on brick siding above entry as shown on drawings.

B. Provide anchoring system per manufacturer's recommendations and metal panel system requirements.

2.4 ACCESSORIES

A. Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.

B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods recommended by manufacturer for exterior, tamper proof locations.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by the Design Professional.

END OF SECTION

SECTION 10606

CHAIN LINK SCREEN

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The following specialty items are included under this section.

1. Vinyl Coated Chain Link Screen, located at openings in precast concrete wall panels and entrance gate to storage area at grade level.

1.2 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting wherever taking field measurements before fabrication might delay work.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's specifications, anchor details, and installation instructions. Submit certification that all materials fully comply with specifications and that the vinyl clad coating is warranted against rust and corrosion for 15 years.

B. Shop Drawings: Submit shop drawings for fabrication and installation including plans, elevations, and details of sections and connections. Show anchorage and accessory items.

C. Full Size Panel: One full size panel for a typical bay to be available to view at precast plant. Fabrication of the screens shall not commence until on shop drawings have been approved and typical screen detail is reviewed by architect at plant.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fabric: Commercial quality medium high carbon, hot dipped galvanized steel wire. Zinc coating shall be minimum of .30 ounces per square foot. Vinyl coating (PVC) shall be continuously extrusion bonded (not sprayed or dipped) over the galvanized steel wire by the thermal extrusion bonding process under pressure to 5,000 psi. The wire shall be vinyl-clad before weaving and shall be free and flexible at all joints.

1. Wire size - 9 gauge
2. Mesh size - 1-1/2 inch
3. Selvage at edges - Knuckled
4. Color - Black

B. Framework: Vertical, horizontal and diagonal members shall be 1 5/8 inch outside diameter, schedule 40 hot dipped galvanized pipe. Zinc coating shall be a minimum of 1.8 ounces per square foot of the total coated surface.

1. Finish: Black vinyl coating.

C. Accessories: All accessories shall be vinyl coated to match color of fabric. Fabric ties shall be min. 9-

gauge thickness.

PART 3 - EXECUTION

3.1 FABRICATION

A. Cope pipe connections accurately to form tight joints. Continuously weld connections and grind joints smooth. Touch up galvanized coating with galvanizing repair paint.

B. Comply with manufacturer's specifications and recommendations for the installation of chain link fabric.

3.2 INSTALLATION

A. Set units plumb, level and true to line. Anchor securely in place with non-corrosive expansion bolts. Separate corrodible metal surfaces form sources of corrosion or electrolytic action at points of contact with other materials.

B. Provide all protective treatment and other precautions required through the remainder of the construction period, to ensure that specialty units will be without damage or deterioration (other than normal weathering) at time of acceptance.

END OF SECTION

SECTION 10820

GRILLES AND SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK

A. This work shall consist of providing mesh screening, including installation accessories and attachment to precast structure (see Alternates).

1.3 QUALIFICATIONS

A. Work specified herein shall be performed by and be the responsibility of the Installation Contractor authorized, approved and qualified by the manufacturer of materials used; having necessary equipment and facilities to fulfill requirements of the manufacturer and this section.

1.4 SUBMITTALS

A. Manufacturer's Data: Submit specifications, installation instructions and general recommendations by the manufacturer of architectural mesh screening.

B. Shop Drawings: Submit shop drawings showing dimensioned elevations, large scale details of all edge terminations, fastening details, and interface with lighting fixtures, mullions, and other construction to be encountered..

C. Samples: Submit 12” x 16” sample of selected screen.

1.5 DELIVERY AND STORAGE

A. Deliver materials to project site in sealed, original packages or containers bearing name and brand of manufacturer.

B. Store materials in single place designated by Owner and/or Consultant, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures and humidity. Keep storage place neat and clean.

C. Deliver and store products in packaging that ensures products will not be cracked or otherwise damaged.

1.6 JOB CONDITIONS

A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate installation of anchorages for mesh screens. Furnish setting drawings, templates, and direction for installing anchorages. Deliver such items to Project site in time for installation.

1.8 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace mesh systems that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Failure to meet performance requirements.

2. Structural failures including excessive deflection across span.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Period: One year from date of Substantial Completion.

C. Warranty Period for Metal Finishes: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXTERIOR MESH SCREEN SYSTEM

A. Basis of Design Product: Subject to compliance with requirements, provide HUDSON stainless steel mesh, by Cambridge Architectural Mesh. 82% open area, 1.46 lbs/sq.ft., with a maximum width of 240", per www.CambridgeArchitectural.com, or comparable product by one of the following:

1. Kovach Building enclosures, Inc.

2. Bunting Architectural Metals, Inc.

B. FASTENERS

1. Fastener Material: Type 304 stainless steel fasteners and angle iron as shown on the drawings.

2. Fasteners for Anchoring to structure: select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated item to other types of construction, and as shown on the Drawings.

PART 3 - EXECUTION

3.1 CONDITION OF SUBSTRATE

A. Examine the substrate and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of ornamental metal. Do not proceed with the work until unsatisfactory conditions have been corrected and approved by the manufacturer's representative.

1. Installation of products constitutes Installers and Manufacturer's acceptance of existing construction.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Provide anchorage devices, fasteners, and structural angles where needed to secure screens to precast substrate. Perform cutting, drilling, and fitting required to install screens. Set products accurately in location, alignment, and elevation; measured from established lines and levels.

C. Do not cut or abrade finishes that cannot be completely restored in the field.

3.3 CLEANING

A. Upon completion of work, clean mesh screen as directed by manufacturer.

B. Correct all defective or damaged work.

C. Upon completion, or at such other times as directed, remove all surplus materials, cartons, rubbish and debris resulting from these operations and legally dispose of off-site.

3.4 PROTECTION

A. Provide protection to ensure that work will be without damage or deteriorations at time of final acceptance.

END OF SECTION

SECTION 14240

HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. One hydraulic passenger elevator, four stop, 38 foot travel distance, gurney sized. Pit depth of 4'-0". Elevator to meet stretcher requirements as defined by 524 CMR 17.4(1) (c) and 17.4(1)(d).

2. All required brackets, inserts, and accessories, including steel elevator pit ladder.

B. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections

1. Section 03 40 00 – PRECAST CONCRETE:

a. Elevator rail bracket inserts.

C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 34000 - P R E C A S T CONCRETE for lintels, sleeves, anchors, inserts, plates and similar items for elevators.

2. Section 51200 - STRUCTURAL STEEL FRAMING for the hoist beams, attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.

3. Section 55000 - METAL FABRICATIONS for miscellaneous framing and supports for hoisting machines, and for elevator door sills, cants in hoistway made from sheet steel.

4. Division 26 - ELECTRICAL for electrical service for elevators to and including disconnect switches at machine room door and telephone wiring to elevator.

1.3 DEFINITIONS

A. Definitions in ASME A17.1 apply to work of this Section.

B. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe

conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.4 SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:

1. Car enclosures and hoistway entrances.

2. Operation, control, and signal systems.

B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Include large-scale layout of car control station and standby power operation control panel. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Verification: For exposed finishes of cars, hoistway doors and frames, and signal equipment; samples or photos to be provided.

D. Qualification Data: For Installer.

E. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

F. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

G. Warranty: Special warranty specified in this Section.

H. Continuing Maintenance Proposal: Service agreement specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain elevators through one source from a single manufacturer.

1. Provide major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.

C. Regulatory Requirements: Comply with ASME A17.1 and Massachusetts Elevator Code.

D. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG) and the Massachusetts Architectural Access Board.

E. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to

authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging.

B. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

1.7 COORDINATION

A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.

B. Furnish well casing and coordinate delivery with related excavation work.

C. Coordinate sequence of elevator installation with other work to avoid delaying the Work.

D. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide one year's full maintenance service by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1. Include 24-hour-per-day, 7-day-per-week emergency callback service.

B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering hydraulic elevators that may be incorporated into the Work include, but are not limited to, the following:

1. Otis Elevator Co.

2. Schindler Elevator Corp.

3. ThyssenKrupp Elevator.

2.2 PASSENGER ELEVATORS

A. Elevators: Basis of Design: ThyssenKrupp Elevator – Endura Twinpost above-ground 3-stage

1. Type: Holeless.

2. Two jacks, one at each side.

3. Rated Load: 4000 lb.

4. Rated Speed: 125 fpm up 150 fpm down.

5. Operation System: Selective collective automatic operation.

6. Auxiliary Operations:
   a. Battery power return to ground floor.
   b. Automatic dispatching of loaded car.
   c. Nuisance call cancel.

7. Car Enclosures: As follows:
   a. Inside Width: 7’-8” min clear.
   b. Inside Depth: 5’-5” min clear.
   c. Inside Height: 7’-4”.
   d. Front Walls: Stainless steel.
   e. Car Fixtures: Satin stainless steel.
   f. Side and Rear Wall Panels: Plastic Laminate –chosen from manufacturer standard colors.
   g. Door Faces (Interior): Stainless steel.
   h. Door Sills: Aluminum.
   i. Ceiling: LED downlights with powder coated painted finish – color chosen by architect.
   j. Handrails: stainless steel, at side and rear walls.
      Floor: ¼” stainless steel non-skid diamond plate.

8. Hoistway Entrances: As follows:
   a. Width: 48 in. minimum.
   b. Height: 7’-0”.
   c. Type: Center opening sliding.
   d. Frames: stainless steel.
   e. Doors: Stainless steel.
      Sills: Aluminum.

9. Hall Fixtures: #4 Stainless steel.

10. Additional Requirements: As follows:
    a. Provide inspection certificate in each car, mounted under acrylic cover with satin stainless-steel frame.
    b. Provide protective blanket hooks in all cars and two complete sets of full-height blankets.
    c. Provide all necessary warning signage required by local and state codes.

2.3 SYSTEMS AND COMPONENTS

A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard pre-engineered elevator systems and as necessary for complete system.

B. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations. Provide the following:

1. Submersible pump, with submersible squirrel-cage induction motor, suspended inside oil tank from vibration isolation mounts.

2. Provide motor with solid-state starting.

C. Hydraulic Silencers: Provide hydraulic silencer containing pulsation-absorbing material in a blowout-proof housing at pump unit.

D. Piping: Provide size, type, and weight piping recommended by manufacturer, and provide flexible connectors to minimize sound and vibration transmissions from power unit.

1. Provide dielectric couplings at cylinder units.

2. Casing for Underground Piping: PVC pipe complying with ASTM D 1785, joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.

E. Hydraulic Fluid: Nontoxic, readily biodegradable, fire-resistant fluid made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Hydraulic fluid is approved by elevator manufacturer for use with elevator equipment.

F. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Section.

G. Car Frame and Platform: Welded steel units.

H. Guides: Provide either roller guides or sliding guides at top and bottom of car and counterweight frames. If sliding guides are used, provide guide-rail lubricators or polymer-coated, nonlubricated guides.

I. Hall & Car station light fixtures: provide vandal resistant fixtures.

2.4 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system for each elevator as necessary to provide type of operation system indicated.

B. Single-Car Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:

1. Emergency Operation: On activation of smoke alarm, car is returned to a designated floor and parked with doors open.

2. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.

C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.

1. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car control stations. Key is removable in both positions.

2. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby that causes car to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.

2.5 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and re-open.

2.6 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

2.7 HOISTWAY ENTRANCES

A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.

2.8 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, nonyellowing translucent plastic diffusers or LEDs.

B. Car Control Stations: Provide manufacturer's standard recessed car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 26 - ELECTRICAL.

E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.

1. Include travel direction arrows if not provided in car control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than one station for each four elevators in a group.

G. Car Lanterns: Units with illuminated Up/Down arrows

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on car.

I. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.

D. Install piping above the floor, where possible. Where not possible, install underground piping in Schedule 40 PVC pipe casing assembled with solvent-cemented fittings.

E. Lubricate operating parts of systems as recommended by manufacturers.

F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

G. Leveling Tolerance: 1/4 inch, up or down, regardless of load and direction of travel.

H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

I. Locate hall signal equipment for elevators as follows, unless otherwise indicated:

1. Place hall lanterns either above or beside each hoistway entrance.

2. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as recommended by ASME A17.1 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary use of installed elevator during construction is not allowed.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator.

B. Check operation of elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

END OF SECTION

SECTION 15126

SPLIT-SYSTEM AIR-CONDITIONERS
(Filed sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: P001, P100, P101, P102, P103, P104.

B. Sub-sub Bids are not required for this trade.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

1.6 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year(s) from date of Substantial Completion.
c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements.

2.2 INDOOR UNITS

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
5. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Three-phase, permanently lubricated, ball-bearing motors with built-in thermal-overload protection.
    d. Wiring Terminations: Connect motor to chassis wiring with plug connection.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
7. Filters: 1 inch thick, in fiberboard frames
8. Condensate Drain Pans:

    a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
        2) Depth: A minimum of 2 inches.

    b. Single-wall, stainless-steel sheet.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

        1) Minimum Connection Size: NPS 1.

    d. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

    a. Compressor Type: Scroll or reciprocating.
    b. One-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.
3. Fan: Aluminum-propeller type, directly connected to motor.
4. Motor: Permanently lubricated, with integral thermal-overload protection.
5. Low Ambient Kit: Permits operation down to 0 deg F.

2.4 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

2.5 CAPACITIES AND CHARACTERISTICS

A. Refer to drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified inSection 077200 "Roof Accessories."Section 07720 "Roof Accessories."Anchor units to supports with removable, cadmium-plated fasteners.

D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Remote, Water-Cooled Condenser Connections: Comply with requirements specified in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Connect hydronic piping to supply and return connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply [and return] ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. [Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 15126

SECTION 15239

PROPELLER UNIT HEATERS
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: P001, P100, P101, P102, P103, P104.

B. Sub-sub Bids are not required for this trade.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

A. Section includes propeller unit heaters with electric-resistance heating coils.

1.5 DEFINITIONS

A. CWP: Cold working pressure.

B. PTFE: Polytetrafluoroethylene plastic.

C. TFE: Tetrafluoroethylene plastic.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements.

1.

2.2 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in **horizontal** discharge configuration with adjustable discharge louvers.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 2021.

D. Comply with UL 823.

2.3 HOUSINGS

A. Finish: Manufacturer's **standard** baked enamel applied to factory-assembled and - tested propeller unit heaters before shipping.

B. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.4 COILS

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch . Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.

1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.

2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

2.5 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

A. Control Devices:
1. **Unit**-mounted thermostat.

2.7 CAPACITIES AND CHARACTERISTICS

A. As scheduled on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with all-thread hanger rods and **elastomeric hangers**.

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 CONNECTIONS

A. Ground equipment according to Div 26.

B. Connect wiring according to Div 26.

3.4 ADJUSTING

A. Adjust initial temperature set points.

END OF SECTION 15239

SECTION 15300

REFRIGERANT PIPING
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: P001, P100, P101, P102, P103, P104.

B. Sub-sub Bids are not required for this trade.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.5 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig .
2. Suction Lines for Heat-Pump Applications: 535 psig .
3. Hot-Gas and Liquid Lines: 535 psig .

1.6 ACTION SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.
2. Filter dryers.
3. Pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment. Coordinate all pipe sizes, insulation and routing with architectural elements, walls, floors, etc.…

1. Shop Drawing Scale: 1/4 inch equals 1 foot.
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.7 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.9 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.10 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

A. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F.
6. Reverse-flow option (for heat-pump applications).
7. End Connections: Socket, flare, or threaded union.
8. Working Pressure Rating: 700 psig.

B. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

2.3 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Hot-Gas and Liquid Lines, Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

B. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

3.3 PRE-INSTALLTION CONFERENCE

A. At least 10 days prior to installation of the electrical, mechanical, plumbing & fire protection components within the precast superstructure, the contractor shall conduct a meeting with the Owner’s representative, resident engineer and Contractor’s representatives to review and to discuss the methods and procedures to achieve the quality installation as specified under “Installation”. The contractor shall send a preinstallation conference agenda to all attendees 5 days prior to the schedule date of the conference.

B. The contractor shall require responsible representatives or every party who is concerned with the concrete work to attend the conference, including but not limited to the following: Contractor's superintendent

a. Contractor responsible for field quality control.
b. Electrical/Fire Protection/Plumbing subcontractor.
c. Electrical/Fire Protection/Plumbing Foreman.

C. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes:

a. Owner's representative
b. Resident engineer
c. Consultant engineer

3.4 PIPING INSTALLATION

A. No installation of any MEP/FP shall commence until coordination plans indicating proposed routings, locations, mountings and similar information submitted and reviewed. No installation shall be allowed until preinstallation meetings have been conducted.

B. Contractor shall install conduit, branch circuitry, home runs, risers and all other electrical components at locations and in a manner that they will not be subject to damage by vehicles including and not limited to vehicles bumpers.

C. Branch conduit to shall be ceiling mounted.

D. Contractor shall install conduit, branch circuitry, home runs, risers and all other electrical components in a neat workmanship manner at locations and routes that do not visually detract from the garage aesthetics with attention to walls, stairs, lobbies, ceilings areas at stair and stair/elevator towers and areas subject to pedestrian traffic.

E. Installations shall be located and installed in such a manner to minimize the potential for moisture related deterioration under precast floor joints with joint sealants.

F. No electrified fixtures, lamps etc… shall be installed at ceiling locations between precast tee stems with tee to tee joints. No horizontal conduit runs shall be installed parallel to precast tee to tee joints between tee stems with tee to tee joints.

G. No conduit shall be allowed to be mounted at or on an inverted “T” beam

H. All conduit shall be mounted tight against precast elements; no suspended conduit allowed.

I. Contractor shall utilize designated vertical chases as shown on the drawings or as approved by the Owner for ALL vertical risers.

J. ALL conduit routed to a wall or column mounted device/equipment shall be routed up to the ceiling to the ceiling mounted branch circuitry.

K. Any fixture, conduit, circuit that does not comply or is a zone subject to vehicular damage shall be relocated at no cost to the owner.

L. MEP/FP material installed prior to the review of coordination drawings and the distribution of accepted preinstallation coordination meeting minutes shall be subject to removal and reinstallation at routes and locations designated by the Owner, Owner’s Project Manager and/or the Engineer.

M. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

N. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

O. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

P. Install piping to permit valve servicing.

Q. Install piping at indicated slopes.

R. Install piping free of sags and bends.

S. Install fittings for changes in direction and branch connections.

T. Install piping to allow application of insulation.

U. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

V. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

W. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

X. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

Y. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Z. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

AA. Install refrigerant piping according to ASHRAE 15.

BB. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

CC. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

DD. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

EE. Install piping adjacent to machines to allow service and maintenance.

FF. Install piping free of sags and bends.

GG. Install fittings for changes in direction and branch connections.

HH. Select system components with pressure rating equal to or greater than system operating pressure.

II. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

JJ. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.

KK. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

LL. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

MM. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

NN. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

OO. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

PP. Install sleeves for piping penetrations of walls, ceilings, and floors.

QQ. Install sleeve seals for piping penetrations of concrete walls and slabs.

RR. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.6 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches ; minimum rod size, 1/4 inch .
2. NPS 5/8 : Maximum span, 60 inches ; minimum rod size, 1/4 inch .
3. NPS 1 : Maximum span, 72 inches ; minimum rod size, 1/4 inch .

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 2 : Maximum span, 10 feet ; minimum rod size, 3/8 inch .

E. Support multifloor vertical runs at least at each floor.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.8 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

END OF SECTION 15300

SECTION 15301

SPRINKLER AND STANDPIPE PIPING

PART 1 - GENERAL

1.01 REFERENCES

A. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

1.02 SUBMITTALS

A. Product Data:

1. Catalog sheets and specifications indicating manufacturer name, type, applicable reference standard, schedule, or class for specified pipe and fittings.
2. Material Schedule: Itemize pipe and fitting materials for each specified application in Pipe and Fittings Schedule in Part 3 of this Section. Where optional materials are specified indicate option selected.

1.03 PRE-INSTALLATION CONFERENCE (FOR ALL MEP/FP TRADE CONTRACTORS)

A. Installation of MEP/FP systems within the superstructure of the parking garage shall not proceed until after the conclusion and distribution of the pre-installation meeting minutes.

B. At least 10 days prior to installation of the electrical, mechanical, plumbing & fire protection components within the precast superstructure, the contractor shall conduct a meeting with the Owner's representative, resident engineer and Contractor's representatives to review and to discuss the methods and procedures to achieve the quality installation as specified under "Installation". The contractor shall send a pre-installation conference agenda to all attendees 5 days prior to the schedule date of the conference.

C. The contractor shall require responsible representatives or every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

1. Contractor's superintendent
2. Contractor responsible for field quality control.
3. Electrical/Fire Protection/Plumbing subcontractor
4. Electrical/Fire Protection/Plumbing Foreman

D. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed to all parties concerned within 5 days of meeting. One copy of the minutes shall also be transmitted to the following for informational purposes:

1. Owner's representative
2. Resident engineer
3. Consultant Engineer

PART 2 - PRODUCTS

2.01 STEEL PIPE AND FITTINGS

A. Steel Pipe for Threading: Standard weight, Schedule 40, black or galvanized; ASTM A 53 or ASTM A 135.

B. Steel Pipe for Roll Grooving: Standard weight, Schedule 10 or 40, black or galvanized; ASTM A 53 or ASTM A 135.

C. Cast Iron Fittings:

1. Drainage Pattern, Threaded: ASME B16.12.
2. Steam Pattern, Threaded: ASME B16.4.

a. Standard Weight: Class 125.
b. Extra Heavy Weight: Class 250.

3. Flanged Fittings and Threaded Flanges: ASME B16.1.

a. Standard Weight: Class 125.
b. Extra Heavy: Class 250.

D. Unions: Malleable iron, 250 lb class, brass to iron or brass to brass seats.

E. Couplings: Same material and pressure rating as adjoining pipe, conforming to standards for fittings in such pipe. Use taper tapped threaded type in screwed pipe systems operating in excess of 15 psig.

F. Nipples: Same material and strength as adjoining pipe, except nipples having a length of less than one inch between threads shall be extra heavy.

2.02 COUPLINGS AND FITTINGS FOR GROOVED END PIPE

A. Couplings: Victaulic Co.'s FireLock EZ Style 009H or equal.

B. Fittings: By same manufacturer as couplings, having pressure ratings equal to or greater than couplings. Comply with the following standards:

1. Steel: ASTM A 53 or A 106, Grade B.
2. Malleable Iron: ASTM A 47.
3. Ductile Iron: ASTM A 536.

2.03 BOLTED MECHANICAL BRANCH CONNECTION

A. Victaulic Co.'s 920 Mechanical T.

2.04 JOINING AND SEALANT MATERIALS

A. Thread Sealant:

1. LA-CO Industries' Slic-Tite Paste with Teflon.
2. Loctite Corp.'s No. 565 Thread Sealant.
3. Thread sealants for potable water shall be NSF approved.

B. Joint Packing:

1. Oiled Oakum: Manufactured by Nupak of New Orleans, Inc., 931 Daniel St., Kenner, LA 70062, (504) 466-1484.

C. Gaskets For Use With Ductile Iron Water Pipe: Synthetic rubber rings (molded or tubular): Clow Corp.'s Belltite, Tyler Pipe Industries Inc.'s Ty-Seal, or U.S. Pipe and Foundry Co.'s Tyton.

D. Flange Gasket Material:

1. For Use With Cold Water: 1/16 inch thick rubber.

E. Gaskets For Use With Grooved End Pipe and Fittings: Type and materials as recommended and furnished by the fitting manufacturer, for the service of piping system in which installed.

F. Anti-Seize Lubricant: Bostik Inc.'s Never Seez or Dow Corning Corp.'s Molykote 1000.

2.05 PACKING MATERIALS FOR BUILDING CONSTRUCTION PENETRATIONS

A. Oiled Oakum: Manufactured by Nupak of New Orleans, Inc., 931 Daniel St., Kenner, LA 70062, (504)466-1484.

B. Mechanical Modular Seals: Thunderline Corp.'s Link Seal wall and floor seals designed for the service of piping system in which installed.

2.06 PIPE SLEEVES

A. Type A: Schedule 40 steel pipe.

B. Type B: No. 16 gage galvanized sheet steel.

C. Type D: No. 16 gage galvanized sheet steel with 16 gage sheet steel metal collar rigidly secured to sleeve. Size metal collars as required to span a minimum of one cell or corrugation, on all sides of the rough opening thru the metal deck.

2.07 FLOOR, WALL AND CEILING PLATES

A. Cast Brass: Solid type with polished chrome plated finish, and set screw.

1. Series Z89 by Zurn, 929 Riverside Drive, Grosvenordale, CT 06255, (800) 243-1830.
2. Model 127XXXX by Maguire Mfg., Cheshire CT 06410, (203) 699-1801.

B. Stamped Steel: Split type, polished chrome plated finish, with set screw.

1. Figures 2 and 13 by Anvil International, Portsmouth, NH 03802, (603) 422-8000.

C. Cast Iron or Malleable Iron : Solid type, galvanized finish, with set screw:

1. Model 395 by Anvil International, Portsmouth, NH 03802, (603) 422-8000.
2. Model 900-016XX by Landsdale International, Westville, NJ 08093, (800) 908-0523.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install piping at approximate locations indicated, and at maximum height.

B. Install piping clear of door swings, and above sash heads.

C. Make allowances for expansion and contraction.

D. Allow for a minimum of one inch free air space around pipe or pipe covering, unless otherwise specified.

E. Install horizontal piping with a constant pitch, and without sags or humps.

F. Install vertical piping plumb.

G. Use fittings for offsets and direction changes.

H. Cut pipe and tubing ends square; ream before joining.

I. Threading: Use American Standard Taper Pipe Thread Dies.

3.02 FIRE STANDPIPE PIPING SYSTEM

A. Install piping to be completely drainable.

3.03 PIPE JOINT MAKE-UP

A. Threaded Joint: Make up joint with a pipe thread compound applied in accordance with manufacturer's printed application instructions for the intended service.

B. Flanged Pipe Joint:

1. Install threaded companion flanges on steel pipe; flanges on galvanized pipe are not required to be galvanized.
2. Provide a gasket for each joint.
3. Coat bolt threads and nuts with anti-seize lubricant before making up joint.

C. Grooved Pipe Joint: Roll groove pipe ends, make up joint with grooved end fittings and couplings, in conformance with the manufacturer's printed installation instructions.

1. Cut grooved end piping is not acceptable.

D. Mechanical Joint: Make up joint in conformance with the manufacturer's printed installation instructions, with particular reference to tightening of bolts.

3.04 PIPING PENETRATIONS

A. Sleeve Schedule: Unless otherwise shown, comply with the following schedule for the type of sleeve to be used where piping penetrates wall or floor construction:

	CONSTRUCTION	SLEEVE TYPE
1.	Frame construction.	None Required

2.	Foundation walls.	A*
3.	Non-waterproof interior walls.	B*
4.	Non-waterproof interior floors on metal decks.	D*
5.	Non-waterproof interior floors not on metal decks.	B*
6.	Floors not on grade having a floor drain.	A
7.	Floors over mechanical equipment, steam service, machine, and boiler rooms.	A
8.	Floors finished or to be finished with latex composition or terrazzo, and on metal decks.	D*
9.	Floors finished or to be finished with latex composition or terrazzo, and not on metal decks.	A
10.	Earth supported concrete floors.	None Required
11.	Exterior concrete slabs on grade.	A
12.	Fixtures with floor outlet waste piping.	None Required
13.	Metal roof decks.	C
14.	Non-metal roof decks.	A
15.	Waterproof floors on metal decks.	D
16.	Waterproof floors not on metal decks.	A
17.	Waterproof walls.	A

*Core drilling is permissible in lieu of sleeves where marked with asterisks.

B. Diameter of Sleeves and Core Drilled Holes:

1. Unless otherwise specified, size holes thru floors and walls in accordance with the through penetration fire stopping system being used.
2. Size holes thru exterior walls or waterproofed walls above inside earth or finished floors, and exterior concrete slabs in accordance with the following:

   a. Uninsulated (Bare) Pipe: Inside diameter of sleeve or core drilled hole 1/2 inch greater than outside diameter of pipe, unless otherwise specified.
   b. Insulated Pipe: Inside diameter of sleeve or core drilled hole 1/2 inch greater than outside diameter of insulation, unless otherwise specified.
   c. Mechanical Modular Seals: Size holes in accordance with the manufacturer's recommendations.

3. Size holes for sprinkler and fire standpipe piping in accordance with NFPA 13.

C. Length of Sleeves (except as shown otherwise on Drawings):

1. Walls and Partitions: Equal in length to total finished thickness of wall or partition.
2. Floors, Finished: Equal in length to total finished thickness of floor and extending 1/2 inch above the finished floor level, except as follows:

    a. In furred spaces at exterior walls, extend sleeve one inch above the finished floor level.

3. Exterior Concrete Slabs: Equal in length to total thickness of slab and extending 1/2 inch above the concrete slab.
4. Roofs: Equal in length to the total thickness of roof construction, including insulation and roofing materials, and extending one inch above the finished roof level.

D. Packing of Sleeves and Core Drilled Holes:

1. Unless otherwise specified, pack sleeves or cored drilled holes in accordance with Section 078400 - FIRESTOPPING.
2. Pack sleeves in exterior walls or waterproofed walls above inside earth or finished floors with oakum to within 1/2 inch of each wall face, and finish both sides with Type 1C (one part) sealant. See Section 079200.

    a. Mechanical modular seals may be used in lieu of packing and sealant for sleeves and core drilled holes.

3. Pack sleeves in exterior concrete slabs with oakum to full depth, and within 1/2 inch of top of sleeve and finish the remainder with sealant. See Section 079200.

    a. Sealant Types:

        1) Piping Conveying Materials up to 140 degrees F other than Motor Fuel Dispensing System Piping: Type 1C (one part).

    b. Mechanical modular seals may be used in lieu of packing and sealant for sleeves and core drilled holes.

E. Weld metal collars of Type C and D sleeves to the upper surface of the metal deck. Seal voids under the metal collar as recommended by the manufacturer of the metal deck.

3.05 FLOOR, WALL AND CEILING PLATES

A. Install plates for exposed uninsulated piping passing thru floors, walls, ceilings, and exterior concrete slabs as follows:

1. Piping 2 Inch Size and Smaller In Finished Spaces:

    a. Solid Type: Chrome plated cast brass construction with set screw.
    b. Split Type: Chrome plated stamped steel construction with set screw.

2. Piping over 2 inch size In Finished Spaces, and Piping in Unfinished Spaces:

    a. Solid Type: Galvanized cast iron construction with set screw.
    b. Split Type: Chrome plated stamped steel construction with set screw.

3. Piping in Unfinished Spaces (Including Exterior Concrete Slabs): Solid type, galvanized, cast iron or malleable iron construction.
4. Fasten plates with set screws.
5. Plates are not required in pipe shafts or furred spaces.

3.06 PIPE AND FITTING SCHEDULE

A. Where options are given, choose only one option for each piping service. No deviations from the selected option will be allowed.

B. Fire Standpipe and Sprinkler:

1. Option No. 1: Standard weight black steel pipe, with standard weight cast iron fittings, and threaded joints.
2. Option No. 2: Standard weight black steel pipe, with roll grooved ends, grooved pipe fittings, and couplings.

END OF SECTION

SECTION 15310

FIRE PROTECTION PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop Drawings:

1. Details of trapeze hangers and upper hanger attachments for piping 4 inches in diameter and over. Include the number and size of pipe lines to be supported on each type of trapeze hanger.
2. Drawings identifying seismic locations with corresponding details of pre-approved seismic restraints, with seismic loads and seismic force level (Fp) calculations; pre-engineered and stamped by a Massachusetts Licensed Professional Engineer experienced in seismic restraint systems.

B. Product Data: Catalog sheets, specifications and installation instructions for each item specified except fasteners.

C. Quality Control Submittals:

1. Seismic Restraint Manufacturer's Qualifications Data:

a. Name of firm producing the seismic restraints, business address and telephone number.
b. Period of time firm has been in the business producing seismic restraints, and names and addresses of 3 similar projects that the manufacturer has produced seismic restraints for during the past 5 years.

2. Company Field Advisor Data:

a. Name, business address and telephone number of Company Field Advisor secured for the required services.
b. Certified statement from the Company listing the qualifications of the Company Field Advisor.
c. Services and each product for which authorization is given by the Company, listed specifically for this project.

3. Manufacturer's Certificate of Compliance for Seismic Restraints: Certificate from seismic restraint manufacturer stating that the restraint and its mounting system or anchorage has been tested or analyzed and meets the requirements of Massachusetts Building Code, 780 CMR.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with the applicable requirements of the ASME B31 Piping Codes.
2. Unless otherwise shown or specified, comply with the requirements of the Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Standards SP-58, and SP-69.
3. Materials for use in Sprinkler Systems and Standpipe and Hose Systems shall comply with the requirements of NFPA 13 and NFPA 14 as applicable.
4. The contractor shall provide pre-engineered or stamped and signed details (by a Massachusetts Licensed Professional Engineer) of seismic restraint systems to meet total design lateral force requirements for support and restraint of mechanical and electrical systems.
5. Seismic components shall be UL listed or California OSHPD (Office of Statewide Health Planning and Development) approved.

B. Seismic Restraint Manufacturer Qualifications: The firm producing the seismic restraints shall be experienced in seismic restraint work and shall have produced seismic restraints for a minimum of 5 years.

C. Company Field Advisor: Secure the services of a Company Field Advisor from seismic restraint manufacturer for the following:

1. Render advice regarding installation and final adjustment of seismic restraint system.
2. Render advice on the suitability of each seismic restraint for its particular application.
3. Inspect completed installation of seismic restraint system and certify with an affidavit that the system is installed in accordance with the Contract Documents and is operating properly.
4. Train facility maintenance personnel on the installation of seismic restraint system and routine maintenance of the system.

1.03 PRE-INSTALLATION CONFERENCE (FOR ALL MEP/FP TRADE CONTRACTORS)

A. Installation of MEP/FP systems within the superstructure of the parking garage shall not proceed until after the conclusion and distribution of the pre-installation meeting minutes.

B. At least 10 days prior to installation of the electrical, mechanical, plumbing & fire protection components within the precast superstructure, the contractor shall conduct a meeting with the Owner's representative, resident engineer and Contractor's representatives to review and to discuss the methods and procedures to achieve the quality installation as specified under "Installation". The contractor

shall send a pre-installation conference agenda to all attendees 5 days prior to the schedule date of the conference.

C. The contractor shall require responsible representatives or every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

1. Contractor's superintendent
2. Contractor responsible for field quality control.
3. Electrical/Fire Protection/Plumbing subcontractor
4. Electrical/Fire Protection/Plumbing Foreman

D. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed to all parties concerned within 5 days of meeting. One copy of the minutes shall also be transmitted to the following for informational purposes:

1. Owner's representative
2. Resident engineer
3. Consultant Engineer

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Combination clevis hanger.

B. Pipe Hangers: Height adjustable standard duty clevis type, with cross bolt and nut.

1. Swivel ring type hangers will be allowed for sprinkler piping up to a maximum of 2 inches in size.

C. Adjustable Floor Rests and Base Flanges: Steel.

D. Hanger Rods: Mild, low carbon steel, fully threaded or threaded at each end, with two nuts at each end for positioning rod and hanger, and locking each in place.

E. Riser Clamps: Malleable iron or steel.

2.02 ANCHORS AND ATTACHMENTS

A. Sleeve Anchors (Group II, Type 3, Class 3): Molly's Div./USM Corp. Parasleeve Series, Ramset's Dynabolt Series, or Red Head/Phillips AN, HN, or FS Series.

B. Wedge Anchors (Zinc Plated, Group II, Type 4, Class 1): Hilti's Kwik Bolt Series, Molly's Div./USM Corp. Parabolt PB Series, Ramset's Trubolt T Series, or Red Head/Phillips WS Series.

C. Self-Drilling Anchors (Group III, Type 1): Ramset's RD Series, or Red Head/Phillips S Series.

D. Non-Drilling Anchors (Group VIII, Type 1): Ramset's Dynaset DS Series, Hilti's HDI Series, or Red Head/Phillips J Series.

E. Stud Anchors (Group VIII, Type 2): Red Head/Phillips JS Series.

F. Beam Clamps: Forged steel beam clamp, with weldless eye nut (right hand thread), steel tie rod, nuts, and washers, Grinnell's Fig No. 292 (size for load, beam flange width, and rod size required).

G. Metal Deck Ceiling Bolts: B-Line Systems' Fig. B3019.

H. Continuous Slotted Type Concrete Insert, Galvanized:

1. Load Rating 800 lbs/ft: Kindorf's D-986.
2. Load Rating 1500 lbs/ft: Kindorf's D-980.
3. Load Rating 3000 lbs/ft: Hohmann & Barnard's Inc. Type CS-H.
4. Load Rating 4500 lbs/ft: Hohmann & Barnard's Inc. Type CS-HD.

I. Threaded Type Concrete Insert: Galvanized ferrous castings, internally threaded to receive 3/4 inch diameter machine bolts.

J. Wedge Type Concrete Insert: Galvanized box-type ferrous castings, designed to accept 3/4 inch diameter bolts having special wedge shaped heads.

2.03 SEISMIC RESTRAINT SYSTEM FOR PIPING

A. General:

1. Coordinate all structural attachments with the Owner's Representative.
2. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
3. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
4. Design seismic restraint devices to accept without failure the forces calculated per the applicable building code and as specified.
5. Friction from gravity loads shall not be considered resistance to seismic forces.
6. Fire protection systems shall meet the requirements of NFPA-13 and NFPA-14 for the building seismic requirements.
7. Construct seismic supports constructed so that support engagement is maintained.
8. Stamp seismic supports with manufacturer's name and part number for identification.
9. Design seismic supports specifically for mitigation of seismic force loads.
10. Design the stiffness of seismic restraints for mechanical equipment so that the load path for the restraint performs its intended function.
11. Where possible, utilize components designed with tamper resistant break-off bolt heads or break-off nuts to assure visual verification of proper installation.

12. Attachment components shall be UL Listed catalog components with published loads designed specifically for seismic application.

B. Type: Pre-engineered seismic restraint system designed to support and restrain piping to meet applicable lateral force requirements.

C. Acceptable Manufacturers:

1. B-Line.
2. Mason Industries.
3. TOLCO Inc.

D. Strut/Channel Bracing: 12 gauge solid steel with no holes, 1-5/8 inches wide x 1-5/8 inches deep of single lengths or stitch-welded back-to-back configurations.

E. Pipe Bracing: Schedule 40 steel pipe.

F. Cable Bracing: Pre-stretched galvanized aircraft cable 7 x 19 strand core.

G. Rigid Seismic Braces For Single Hung Pipe Systems: A12 strut channel or schedule 40 steel pipe.

1. Maximum Brace Length: 13 feet 1 inches.

H. Rigid Seismic Braces For Trapeze Supported Pipe Systems: A12 strut channel or schedule 40 steel pipe.

1. Maximum Brace Length: 13 feet 1 inches.

I. Cable Seismic Braces For Single Hung Pipe Systems: Pre-stretched aircraft cable 7 x 19 core.

J. Cable Seismic Braces For Trapeze Supported Pipe Systems: Pre-stretched aircraft cable 7 x 19 core.

K. Structural Attachments for Rigid and Cable Seismic Braces For Single Hung and Trapeze Supported Pipe Systems:

1. Structural attachments shall be positive.
2. Do not make structural attachments to the bottom of a bar joist.
3. Supplemental steel shall be installed for all pre-cast decks less than 4 inches thick
4. Do not use concrete inserts or continuous concrete insert strut to attach brace.
5. Wedge type anchors are permitted. The size and embedment depth shall be determined by the supplier of the seismic restraint system and as approved.

L. Vertical Brace Component (up-thrust protection)

1. Reinforce Vertical Hanger Rod when lengths exceed the following:

a. 3/8 inch dia rod: 19 inches.
b. 1/2 inch dia rod: 25 inches.
c. 5/8 inch dia rod: 31 inches.
d. 7/8 inch dia rod: 43 inches.
e. 1 inch dia rod: 50 inches.
f. 1-1/4 inch dia rod: 62 inches.

2.04 FASTENERS

A. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; size and type to suit application; galvanized for high humidity locations, and treated wood; plain finish for other interior locations. Except where shown otherwise on the Drawings, furnish type, size, and grade required for proper installation of the Work.

2.05 SHOP PAINTING AND PLATING

A. Hangers, supports, rods, inserts and accessories used for pipe supports, unless chromium plated, cadmium plated or galvanized shall be shop coated with metal primer paint.

PART 3 - EXECUTION

3.01 PREPARATORY WORK

A. Place inserts into construction form work expeditiously, so as not to delay the Work.

3.02 INSTALLATION

A. Do not hang or support one pipe from another or from ductwork.

1. Do not bend threaded rod.

B. Support all insulated horizontal piping conveying fluids below ambient temperature, by means of hangers or supports with insulation shields installed outside of the insulation.

C. Space hangers or supports for horizontal piping on maximum center distances as listed in the following hanger schedules, except as otherwise specified, or noted on the Drawings.

1. For Steel Pipe:

PIPE SIZE (Inches)	MAXIMUM SPACING (Feet)
1 and under	8
1-1/4 and 1-1/2	9
2	10
2-1/2 and up	12

2. For Grooved End Steel Pipe: No pipe length shall be left unsupported between any two coupling joints.

PIPE SIZE (Inches)	MAXIMUM SPACING (Feet)
1-1/2 and under	7
2 through 4	10
5 and over	12

3. For Directional Changes: Install a hanger or support close to the point of change of direction of all pipe runs in either a horizontal or vertical plane.
4. For Concentrated Loads: Install additional hangers or supports, spaced as required and directed, at locations where concentrated loads such as in-line pumps, valves, fittings or accessories occur, to support the concentrated loads.
5. For Branch Piping Runs and Runouts Over 5 feet In Length: Install a minimum of one hanger, and additional hangers if required by the hanger spacing schedules.
6. Parallel Piping Runs: Where several pipe lines run parallel in the same plane and in close proximity to each other, trapeze hangers may be submitted for approval. Base hanger spacing for trapeze type hangers on the smallest size of pipe being supported. Design the entire hanger assembly based on a safety factor of five, for the ultimate strength of the material being used.

D. Minimum Hanger Rod Size: Increase hanger rod size as required to meet requirements of seismic restraint system.

PIPE OR TUBING SIZE (Inches)	SINGLE ROD HANGER SIZE (Inches)		DOUBLE ROD HANGER SIZE (Inches)	
	PIPE	TUBING	PIPE	TUBING
1/2 to 2	3/8	1/4	3/8	1/4
2-1/2 and 3	1/2	3/8	3/8	1/4
4 and 5	5/8	1/2	1/2	3/8
6	3/4	1/2	5/8	1/2

PIPE OR TUBING SIZE (Inches)	SINGLE ROD HANGER SIZE (Inches)		DOUBLE ROD HANGER SIZE (Inches)	
	PIPE	TUBING	PIPE	TUBING
8, 10 and 12	7/8	5/8	3/4	5/8

1. Secure hanger rods as follows: Install one nut under clevis, angle or steel member; one nut on top of clevis, angle or steel member; one nut inside insert or on top of upper hanger attachment and one nut and washer against insert or on lower side of upper hanger attachment. A total of four nuts are required for each rod, two at upper hanger attachment and two at hanger.

E. Vertical Piping:

1. Support vertical risers of piping systems, by means of heavy duty hangers installed close to base of pipe risers, and by riser clamps with extension arms at intermediate floors, with the distance between clamps not to exceed 25 feet, unless otherwise specified. Support pipe risers in vertical shafts equivalent to the aforementioned. Install riser clamps above floor slabs, with the extension arms resting on floor slabs. Provide adequate clearances for risers that are subject to appreciable expansion and contraction, caused by operating temperature ranges.
2. Support extension arms of riser clamps, secured to risers to be insulated for cold service, 4 inches above floor slabs, to allow room for insulating and vapor sealing around riser clamps.

F. Floor Supports: Install adjustable yoke rests with base flanges, for the support of piping, unless otherwise indicated on the Drawings. Install supports in a manner, which will not be detrimental to the building structure.

3.03 UPPER HANGER ATTACHMENTS

A. General:

1. Secure upper hanger attachments to overhead structural steel, steel bar joists, or other suitable structural members.
2. Do not attach hangers to steel decks that are not to receive concrete fill.
3. Do not attach hangers to precast concrete plank decks less than 2-3/4 inches thick.
4. Do not use flat bars or bent rods as upper hanger attachments.

B. Attachment to Steel Frame Construction: Provide intermediate structural steel members where required by pipe support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of five.

1. Do not use drive-on beam clamps.
2. Do not support piping over 4 inches in size from steel bar joists. Secure upper hanger attachments to steel bar joists at panel points of joists.
3. Do not drill holes in main structural steel members.
4. Beam clamps, with tie rods as specified, may be used as upper hanger attachments for the support of piping, subject to clamp manufacturer's recommended limits.

C. Attachment to Concrete Filled Steel Decks:

1. New Construction: Install metal deck ceiling bolts.
2. Existing Construction: Install welding studs (except at roof decks). Do not support a load in excess of 250 lbs from any single welded stud.
3. Do not attach hangers to decks less than 2-1/2 inches thick.

D. Attachment to Cast-In-Place Concrete: Secure to overhead construction by means of cast-in-place concrete inserts.

E. Attachment to Cored Precast Concrete Decks (Flexicore, Dox Plank, Spancrete, etc.): Toggle bolts may be installed in cells for the support of piping up to a maximum of 2-1/2 inches in size.

F. Attachment to Hollow Block or Hollow Tile Filled Concrete Decks:

1. New Construction: Omit block or tile and pour solid concrete with cast-in-place inserts.
2. Existing Construction: Break out block or tile to access, and install machine bolt anchors at highest practical point on side of web.

G. Attachment to Waffle Type Concrete Decks:

1. New Construction: Install cast-in-place inserts.
2. Existing Construction: Install machine bolt expansion anchors at highest practical point on side of web.

H. Attachment to Precast Concrete Tee Construction:

1. New Construction: Tee hanger inserts between adjacent flanges, except at roof deck without concrete fill.
2. Existing Construction: Dual unit expansion shields in webs of tees. Install shields as high as possible in the webs.

a. Exercise extreme care in the field drilling of holes to avoid damage to reinforcing.
b. Do not use powder driven fasteners.

3.04 SEISMIC RESTRAINT SYSTEMS

A. General:

1. Install seismic restraints in accordance with seismic restraint manufacturer's printed installation instructions and guidelines unless otherwise specified.
2. Do not use powder-actuated fasteners for seismic restraint anchorage in tension applications.
3. Laterally support vertical risers with riser clamps at each floor unless otherwise specified.
4. When systems cross building seismic separation points, pass between buildings, or are supported from different portions of the building, install to allow differential support displacements without damaging the pipe, equipment or support connections. Install pipe loops, anchors, offsets, and guides as required to provide specified capability of motion and limit movement of adjacent piping.
5. Do not brace seismic bracing to different parts of the building that may respond differently during seismic activity.
6. Provide adequately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire stopping in fire-rated walls.
7. Seismic restraint installations shall not cause any modifications in the positioning of equipment or piping resulting in stresses or misalignment.
8. No rigid connections between equipment, piping, duct, or conduit shall be made to the building structure that degrades the noise and vibration-isolation system specified.
9. Bracing attached to structural members may present additional stresses. Submit loads to the Owner's Representative.
10. Provide vertical stiffening components to support rods when necessary to accept compressive loads. Welding of components to vertical support rods is not acceptable.
11. Clevis supported pipe must have cross-bolt support at each seismic bracing location.
12. Notify Owner's Representative if any discrepancies between the specifications and field conditions prior to installation.

B. Seismic Restraints for Piping:

1. Trapeze assemblies supporting pipes shall be braced considering the total weight of the pipes on the trapeze.
2. Provide transverse bracing at 40 ft. maximum spacing for welded steel pipe, brazed copper pipe or grooved piping with UL 213 listed connections.

a. Traverse bracing for threaded steel or copper pipe or non-listed UL grooved connections shall not exceed 20 ft. maximum.

3. Provide longitudinal bracing at 80 ft. maximum spacing for welded steel pipe, brazed copper pipe or grooved piping with UL 213 listed connections.

   a. Traverse bracing for threaded steel or copper pipe or non-listed UL grooved connections shall not exceed 40 ft. maximum.

4. Transverse piping restraints for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24-inches of the elbow centerline or tee or combined stresses are within allowable limits at longer distances.
5. Branch line piping shall not be used to brace main piping.

   a. No larger diameter pipe shall be braced by a smaller diameter pipe.

6. Attach all longitudinal seismic braces directly to piping.

   a. Encapsulate clamp and brace with insulation equal to that on the pipe.

7. Use hold down clamps to attach pipe to trapeze hangers before installing seismic restraints.
8. Brace vibration isolated piping with cables to allow flexibility.

END OF SECTION

SECTION 15316

SANITARY WASTE AND VENT PIPING
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: P001, P100, P101, P102, P103, P104.

B. Sub-sub Bids are not required for this trade.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.

1.5 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

PART 3 - EXECUTION

3.1 PRE-INSTALLTION CONFERENCE

A. At least 10 days prior to installation of the electrical, mechanical, plumbing & fire protection components within the precast superstructure, the contractor shall conduct a meeting with the Owner’s representative, resident engineer and Contractor’s representatives to review and to discuss the methods and procedures to achieve the quality installation as specified under “Installation”. The contractor shall send a preinstallation conference agenda to all attendees 5 days prior to the schedule date of the conference.

B. The contractor shall require responsible representatives or every party who is concerned with the concrete work to attend the conference, including but not limited to the following: Contractor's superintendent
   a. Contractor responsible for field quality control.

b. Electrical/Fire Protection/Plumbing subcontractor.
c. Electrical/Fire Protection/Plumbing Foreman.

C. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes:
   a. Owner's representative
   b. Resident engineer
   c. Consultant engineer

3.2 PIPING INSTALLATION

A. No installation of any MEP/FP shall commence until coordination plans indicating proposed routings, locations, mountings and similar information submitted and reviewed. No installation shall be allowed until preinstallation meetings have been conducted.

B. Contractor shall install conduit, branch circuitry, home runs, risers and all other electrical components at locations and in a manner that they will not be subject to damage by vehicles including and not limited to vehicles bumpers.

C. Branch conduit to shall be ceiling mounted.

D. Contractor shall install conduit, branch circuitry, home runs, risers and all other electrical components in a neat workmanship manner at locations and routes that do not visually detract from the garage aesthetics with attention to walls, stairs, lobbies, ceilings areas at stair and stair/elevator towers and areas subject to pedestrian traffic.

E. Installations shall be located and installed in such a manner to minimize the potential for moisture related deterioration under precast floor joints with joint sealants.

F. No electrified fixtures, lamps etc… shall be installed at ceiling locations between precast tee stems with tee to tee joints. No horizontal conduit runs shall be installed parallel to precast tee to tee joints between tee stems with tee to tee joints.

G. No conduit shall be allowed to be mounted at or on an inverted “T” beam

H. All conduit shall be mounted tight against precast elements; no suspended conduit allowed.

I. Contractor shall utilize designated vertical chases as shown on the drawings or as approved by the Owner for ALL vertical risers.

J. ALL conduit routed to a wall or column mounted device/equipment shall be routed up to the ceiling to the ceiling mounted branch circuitry.

K. Any fixture, conduit, circuit that does not comply or is a zone subject to vehicular damage shall be relocated at no cost to the owner.

L. MEP/FP material installed prior to the review of coordination drawings and the distribution of accepted preinstallation coordination meeting minutes shall be subject to removal

and reinstallation at routes and locations designated by the Owner, Owner's Project Manager and/or the Engineer.

M. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

N. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

O. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

P. Install piping to permit valve servicing.

Q. Install piping at indicated slopes.

R. Install piping free of sags and bends.

S. Install fittings for changes in direction and branch connections.

T. Install piping to allow application of insulation.

U. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

V. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

W. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

X. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

Y. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.4 HANGER AND SUPPORT INSTALLATION

A. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

E. Install supports for vertical cast-iron soil piping every 15 feet.

F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.
2. Sewage Pump: To sewage pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.6 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

C. Aboveground, vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

E. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

END OF SECTION 15316

SECTION 15319

SANITARY WASTE PIPING SPECIALTIES
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: P001, P100, P101, P102, P103, P104.

B. Sub-sub Bids are not required for this trade.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Floor drains.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. Cleanouts.
2. Floor drains.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Standard: Insert standard for cleanout test tee.
2. Size: Same as connected drainage piping
3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
4. Closure: Raised brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:

1. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.
2. Size: Same as connected branch.
3. Type: Cast-iron soil pipe with cast-iron ferrule.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Not required.
6. Outlet Connection: Inside calk.
7. Closure: Cast-iron plug.
8. Top Loading Classification: Heavy Duty.
9. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains P-001:

1. Standard: ASME A112.6.3.
2. Pattern: Floor drain.
3. Outlet: Bottom.
4. Coating on Interior and Exposed Exterior Surfaces: Not required.
5. Top or Strainer Material: Cast Iron.
6. Top of Body and Strainer Finish: Cast Iron.
7. Top Shape: Square.

PART 3 - EXECUTION

3.1 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

   a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
   b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
   c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install piping adjacent to equipment to allow service and maintenance.

3.2 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 15319

SECTION 15320

STANDPIPE AND HOSE SYSTEM

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Standpipe Piping: Section 15300.

B. Fire Protection Pipe Hangers and Supports: Section 15310.

1.02 SUBMITTALS

A. Product Data:

1. Catalog sheets, specifications and installation instructions for each item specified.
2. Schedule of pipe and fittings including manufacturer, materials, and pressure rating of fitting.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Except as otherwise shown, or specified, comply with the National Fire Protection Association Standard for the Installation of Standpipe and Hose Systems, NFPA-14,

   a. Standpipe System Type: Manual-Dry.
   b. Standpipe System Class: I.

2. Conform to Local Fire Department Regulations. Where conflicts occur in the above Code requirements, the most stringent requirements shall apply.

B. Listing and Approval:

1. All materials and equipment installed shall be Underwriters' listed, or Factory Mutual approved, as being suitable for use in standpipe and hose systems.

1.04 MAINTENANCE

A. Special Tools: Deliver 2 keys for each lock to the Owner's Representative.

1.05 PRE-INSTALLATION CONFERENCE (FOR ALL MEP/FP TRADE CONTRACTORS)

A. Installation of MEP/FP systems within the superstructure of the parking garage shall not proceed until after the conclusion and distribution of the pre-installation meeting minutes.

B. At least 10 days prior to installation of the electrical, mechanical, plumbing & fire protection components within the precast superstructure, the contractor shall conduct a meeting with the Owner's representative, resident engineer and Contractor's representatives to review and to discuss the methods and procedures to achieve the quality installation as specified under "Installation". The contractor shall send a pre-installation conference agenda to all attendees 5 days prior to the schedule date of the conference.

C. The contractor shall require responsible representatives or every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

1. Contractor's superintendent
2. Contractor responsible for field quality control.
3. Electrical/Fire Protection/Plumbing subcontractor
4. Electrical/Fire Protection/Plumbing Foreman

D. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed to all parties concerned within 5 days of meeting. One copy of the minutes shall also be transmitted to the following for informational purposes:

1. Owner's representative
2. Resident engineer
3. Consultant Engineer

PART 2 - PRODUCTS

2.01 HOSE VALVES

A. Hose Valve for Class I Service: 2-1/2 inch double ips female compression angle valve, 300 psig WOG, rough brass body with a bonnet and spindle of polished brass, and spoked handwheel.

1. Reducer: Cast brass, rough finish, oval lug reducing fitting 2-1/2 inch female hose to 1-1/2 inch male hose threads with cap and chain.

B. Coordinate hose valve thread requirements with local fire department.

C. Spanner: Malleable iron with head size and configuration to fit all hose connections within the cabinet; provide brass chain and hook.

2.02 FIRE DEPARTMENT CONNECTIONS (Contractor shall coordinate final type and location with local fire department)

A. 5" Storz Connection: Projecting wall type at 30 angle down, brass with polished finish, plugs and chains, and escutcheon.

B. Identification: Cast the word "STANDPIPE" on escutcheon. Provide signage at the fire department connection indicating the system demand flow and pressure. Coordinate signage requirements with the local fire department.

2.03 GAGES

A. Accuracy: ASME B40.1 Grade B, plus or minus 2 percent of span; 0 to 300 psi standard range.

1. Case: Anodized aluminum, glass lens; copper alloy tube, tip and socket; brass movement.
2. Connection: 1/4 inch NPT male bottom connection.

2.04 LOCK FOR GATE VALVE

A. Padlock: Yale, Series No. 800. Furnish 2 keys with 1-1/2 inch diameter identification tags stamped with valve number and service and delete to the Owner's Representative..

B. Chain: Alloy steel, hot dipped galvanized; 3/16 inch welded link.

C. Coordinate lock requirements and specifications with the Owner's Representative.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed installation instructions unless specified otherwise.

B. Ball Drip: Pipe to at suitable point of discharge over a floor drain, or as otherwise directed.

C. Air Chamber: Cap each standpipe at the ceiling of the highest hose connection, or 24 inches above the highest connection, whichever is higher.

D. Pressure Gage: Install at the top of each standpipe and placed so that gage may easily be read from the floor level.

E. Gate Valve: Lock in open position by means of chain looped through handwheel and around adjacent fire riser. Secure chain with padlock.

3.02 FIELD QUALITY CONTROL

A. System Tests:

1. Test all new Work. Test existing system only if directed.
2. Notify the Owner's Representative when the Work of this Section is ready for testing.
3. Perform tests in accordance with NFPA-14.

B. Identification: Affix decal to the exterior of the hose cabinet door after finish painting is applied.

END OF SECTION

SECTION 15323

SANITARY WASTE INTERCEPTORS
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: P001, P100, P101, P102, P103, P104.

B. Sub-sub Bids are not required for this trade.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

A. Section Includes:

1. Oil/water interceptors.

1.5 ACTION SUBMITTALS

A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:

1. Interceptors.

2. Piping connections. Include size, location, and elevation of each.
3. Interface with underground structures and utility services.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:

1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of service.
2. Do not proceed with interruption of sewer services without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 OIL/WATER INTERCEPTORS

A. Oil/sand Interceptors: Precast concrete comply with ASTM C 913. Fiberglass portion shall comply with ASTM D-4097.

1. The separator shall be circular and constructed from pre-cast concrete with circular riser and slab components.

2. The concrete separator shall include a fiberglass insert bolted and sealed, watertight inside the concrete precast chamber, prior to delivery to the project site. The fiberglass insert must provide a lining for oil storage and retention as a secondary containment system within the OGS.

3. The separator shall be allowed to be considered as a bend or junction structure within the stormwater drainage system.

4. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow. The concrete joints shall be water-tight and meet the design criteria according to ASTM C-443.

5. Structural Design Loads:

   a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10-44).
   b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
   c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
   d. Walkway Load: Comply with ASTM C 890, A-03.

6. Resilient Pipe Connectors: ASTM C 923, cast or fitted into interceptor walls, for each pipe connection.

7. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
8. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch-diameter cover.

    a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
    b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.

2.2 PRECAST-CONCRETE MANHOLE RISERS

A. Precast-Concrete Manhole Risers: ASTM C 913, with rubber-gasket joints.

1. Structural Design Loads:

    a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10-44).
    b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
    c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
    d. Walkway Load: Comply with ASTM C 890, A-03.

2. Length: From top of underground concrete structure to grade.
3. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
4. Gaskets: ASTM C 443, rubber.

B. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, diameter matching manhole frame and cover, and height as required to adjust the manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch-diameter cover.

1. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
2. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.

B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

C. Set tops of manhole frames and covers flush with finished surface in pavements. Set tops 3 inches above finish surface elsewhere, unless otherwise indicated.

D. Set tops of grating frames and grates flush with finished surface.

3.2 CONNECTIONS

A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.3 IDENTIFICATION

A. Identification materials and installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.

1. Use warning tapes or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 15323

SECTION 15413

FACILITY STORM DRAINAGE PIPING
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: P001, P100, P101, P102, P103, P104.

B. Sub-sub Bids are not required for this trade.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.

1.5 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.7 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service classes.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and CISPI 310.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

PART 3 - EXECUTION

3.1 PRE-INSTALLTION CONFERENCE

A. At least 10 days prior to installation of the electrical, mechanical, plumbing & fire protection components within the precast superstructure, the contractor shall conduct a meeting with the Owner’s representative, resident engineer and Contractor’s representatives to review and to discuss the methods and procedures to achieve the quality installation as specified under “Installation”. The contractor shall send a preinstallation conference agenda to all attendees 5 days prior to the schedule date of the conference.

B. The contractor shall require responsible representatives or every party who is concerned with the concrete work to attend the conference, including but not limited to the following: Contractor's superintendent

a. Contractor responsible for field quality control.
b. Electrical/Fire Protection/Plumbing subcontractor.
c. Electrical/Fire Protection/Plumbing Foreman.

C. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes:
   a. Owner's representative
   b. Resident engineer
   c. Consultant engineer

3.2 PIPING INSTALLATION

A. No installation of any MEP/FP shall commence until coordination plans indicating proposed routings, locations, mountings and similar information submitted and reviewed. No installation shall be allowed until preinstallation meetings have been conducted.

B. Contractor shall install conduit, branch circuitry, home runs, risers and all other electrical components at locations and in a manner that they will not be subject to damage by vehicles including and not limited to vehicles bumpers.

C. Branch conduit to shall be ceiling mounted.

D. Contractor shall install conduit, branch circuitry, home runs, risers and all other electrical components in a neat workmanship manner at locations and routes that do not visually detract from the garage aesthetics with attention to walls, stairs, lobbies, ceilings areas at stair and stair/elevator towers and areas subject to pedestrian traffic.

E. Installations shall be located and installed in such a manner to minimize the potential for moisture related deterioration under precast floor joints with joint sealants.

F. No electrified fixtures, lamps etc… shall be installed at ceiling locations between precast tee stems with tee to tee joints. No horizontal conduit runs shall be installed parallel to precast tee to tee joints between tee stems with tee to tee joints.

G. No conduit shall be allowed to be mounted at or on an inverted “T” beam

H. All conduit shall be mounted tight against precast elements; no suspended conduit allowed.

I. Contractor shall utilize designated vertical chases as shown on the drawings or as approved by the Owner for ALL vertical risers.

J. ALL conduit routed to a wall or column mounted device/equipment shall be routed up to the ceiling to the ceiling mounted branch circuitry.

K. Any fixture, conduit, circuit that does not comply or is a zone subject to vehicular damage shall be relocated at no cost to the owner.

L. MEP/FP material installed prior to the review of coordination drawings and the distribution of accepted preinstallation coordination meeting minutes shall be subject to removal and reinstallation at routes and locations designated by the Owner, Owner's Project Manager and/or the Engineer.

M. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

N. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

O. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

P. Install piping to permit valve servicing.

Q. Install piping at indicated slopes.

R. Install piping free of sags and bends.

S. Install fittings for changes in direction and branch connections.

T. Install piping to allow application of insulation.

U. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

V. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

W. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

X. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

Y. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 PIPING INSTALLATION

A. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

B. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

D. Install piping at indicated slopes.

E. Install piping free of sags and bends.

F. Install fittings for changes in direction and branch connections.

G. Install piping to allow application of insulation.

H. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

   1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

K. Plumbing Specialties:

   1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
   2. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.

C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller shall be the following:

1. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.

C. Underground storm drainage piping NPS 6 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

D. Underground, storm drainage piping NPS 8 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

END OF SECTION 15413

SECTION 15529

HANGERS AND SUPPORTS FOR PLUMBING PIPING
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: P001, P100, P101, P102, P103, P104.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Fastener systems.
3. Pipe stands.
4. Pipe positioning systems.
5. Equipment supports.

1.4 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.5 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.3 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Fastener System Installation:
   1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

F. Install lateral bracing with pipe hangers and supports to prevent swaying.

G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

J. Insulated Piping:

   1. Attach clamps and spacers to piping.

      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   3. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

4. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.3 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

6. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
2. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

END OF SECTION 15529

SECTION 15719

PIPING INSULATION
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: P001, P100, P101, P102, P103, P104.

B. Sub-sub Bids are not required for this trade.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors.
2. Refrigerant suction and hot-gas piping, indoors.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.8 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.9 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

G. All insulation subject to condensation shall have a permeance rating of 0.0000.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

   1. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   2. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

N. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches .
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."
3. Refer to architectural drawings for locations of fire-rated assemblies.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the

connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.
4. Near-piping to radiators. (piping located within the conditioned space).

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F :

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 3/4 inch thick.

B. Refrigerant Suction and Hot-Gas tubing and piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

3.9 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Flexible tubing and piping:
1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

END OF SECTION 15719

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. This Section includes the following:
1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Common electrical installation requirements.

1.4 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene rubber.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

1.6 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.7 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.3 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   3. Pressure Plates: Carbon steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

E. Rectangular Sleeve Minimum Metal Thickness:
   1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
   2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

F. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

G. Cut sleeves to length for mounting flush with both surfaces of walls.

H. Extend sleeves installed in floors 2 inches above finished floor level.

I. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require a different clearance.

J. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."

M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

O. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.5 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

END OF SECTION 16050

SECTION 16060

GROUNDING AND BONDING
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.
   1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Bare Copper Conductors:

1. Stranded Conductors: ASTM B 8.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductor Terminations and Connections:

1. Underground Connections: Welded connectors except as otherwise indicated.
2. Connections to Structural Steel: Welded connectors.

3.2 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

C. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least two locations and to anchor bolts.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power System electric service equipment: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060

SECTION 16073

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. This Section includes the following:
1. Hangers and supports for electrical equipment and systems.

1.4 DEFINITIONS

A. EMT: Electrical metallic tubing.

1.5 SUBMITTALS

A. Product Data: For the following:
1. Steel slotted support systems.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
   g. Wesanco, Inc.
2. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
         1) Cooper B-Line, Inc.; a division of Cooper Industries.
         2) Empire Tool and Manufacturing Co., Inc.
         3) Hilti Inc.
         4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         5) MKT Fastening, LLC.
   2. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
   3. Toggle Bolts: All-steel springhead type.
   4. Hanger Rods: Threaded steel.

2.2 SUPPORTING DEVICES IN DROP T-GRID CEILING

A. Support for devices in ceilings.
   1. Available manufacturer:
      a. Caddy
   2. For support of device boxes in ceilings for power or communication outlets. Provide Caddy 512HD hangers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with single-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

B. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   2. To Existing Concrete: Expansion anchor fasteners.
   3. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.

C. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 16073

SECTION 16074

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.
   1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.3 General

1. This dual purpose section provides for vibration isolation and seismic control for the "equipment" as listed below.
2. It is the intent of the seismic restraint portion of this specification to provide restraint of non-structural building components. Restraint systems are intended to withstand the stipulated seismic accelerations applied through the component's center of gravity.
3. The work in this section includes the following:
   a. Vibration isolation elements for equipment.
   b. Seismic restraints for isolated equipment.
   c. Seismic restraints for non-isolated equipment.
   d. Certification of seismic restraint designs and installation supervision.

1.4 The term EQUIPMENT will be used throughout this specification and it includes ALL non-structural components within the facility and/or serving this facility, such as equipment located in outbuildings or outside of the main structure on grade within five

feet of the foundation wall. Equipment buried underground are excluded but entry of services through the foundation walls are included. Equipment referred to below is a partial list of equipment for reference. (Equipment not listed are still included in this specification) Battery Chargers, Battery Racks, Bus Ducts, Cable Trays, Conduit, Generators, Light Fixtures, Motor Control Centers, Panelboards, Switchboards, Switchgear, Transfer Switches, Transformers, Unit Substations, Variable Frequency Drives.

1.5 Life safety systems defined

a. All systems involved with fire protection systems.

b. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers, panelboards and all circuits to fire protection, smoke evacuation and/or emergency lighting systems.

c. All medical and life support systems.

d. Fresh air relief systems on emergency control sequence including conduit, dampers, etc.

1.6 Positive Attachment

a. Positive attachment is defined as a support location with a cast-in or wedge type expansion anchor, a double sided beam clamp, a welded or through bolted connection to the structure.

1.7 Transverse Bracing

a. Restraint(s) applied to limit motion perpendicular or angular to the centerline of the conduit, cable tray or busduct.

1.8 Longitudinal Bracing

a. Restraint(s) applied to limit motion along the centerline of the conduit, cable tray or busduct.

1.9 OEM Equipment Isolation Packages

A. Internal and/or External Systems

1. Substitution of internally or externally isolated and restrained equipment in lieu of the isolation and restraints specified in this section is acceptable provided all conditions of this section are met. The equipment manufacturer shall provide a letter of guarantee from their Engineering Department stamped and certified per the section on Seismic Restraints and Analysis stating that the seismic restraints are in full compliance with these specifications. Letters from field offices or representatives are unacceptable.

2. All costs for converting to the specified vibration isolation and/or restraints shall be borne by the equipment manufacturer in the event of non-compliance with the preceding.
3. In the event that the equipment is internally isolated and restrained, the entire unit assembly must be seismically attached to the structure. This attachment and certification thereof shall be by this section.

B. Submittal Data Requirements
1. Submittals
2. Catalog cuts or data sheets on specific vibration isolators and restraints to be utilized detailing compliance with the specification. Reference "TYPE" as per "MATERIALS" Section of this specification.
3. An itemized list of all isolated and non-isolated equipment. Detailed schedules showing isolator and seismic restraints proposed for each piece of equipment, referencing material and seismic calculation drawing numbers.

C. Shop Drawings
1. When walls and slabs are used as seismic restraint locations, details of acceptable methods for ducts, conduit and pipe must be included.
2. Indicate isolation devices selected with complete dimensional and deflection data before condition is accepted for installation.
3. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
4. Coordinated or contract drawings shall be marked-up with the specific locations and types of restraints shown for all conduits, bus duct and cable tray. Rod bracing and assigned load at each restraint location shall be clearly delineated. Any and all tributary loads shall be considered for proper restraint sizing.
5. For ceiling suspended equipment provide minimum/maximum installation angle allowed for restraint system as well as braced and unbraced rod lengths at each allowable installation condition.

D. Seismic Certification and Analysis
1. Seismic restraint calculations must be provided for all connections of equipment to the structure. All performance of products (such as; strut, cable, anchors, clips, etc.) associated with restraints must be supported with manufacturer's data sheets or certified calculations.
2. Seismic restraint calculations must be based on the acceleration criteria shown in Table A acting through the equipment’s center of gravity.
3. Certification of calculations to support seismic restraint designs must be stamped by a registered professional engineer in New Hampshire.

4. Analysis must indicate calculated dead loads, derived loads and materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedding and/or weld length.
5. Manufacturer's Responsibility

a. Manufacturer of vibration and seismic control equipment shall have the following responsibilities:

(1) Determine vibration isolation and seismic restraint sizes and locations.
(2) Provide equipment vibration isolation and seismic restraints as specified.
(3) Guarantee specified isolation system deflections.
(4) Provide installation instructions, drawings and field supervision to insure proper installation and performance of systems.
(5) Certify correctness of installation upon completion.

E. Related Work

1. Housekeeping Pads

a. Housekeeping pad attachment shall be by the Project Structural Engineer. Material and labor required for attachment and construction shall be by the Concrete Section Contractor.

b. Housekeeping pads shall be coordinated with the Seismic Restraint vendor and sized to provide a minimum edge distance of 10 bolt diameters of clearance all around the outermost anchor bolt to allow for the use of full anchor ratings.

2. Supplementary Support Steel

a. Contractor shall supply supplementary support steel and connections for all equipment and piping, as required.

3. Attachments

a. Contractor shall provide restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the Seismic Restraint vendor.

TABLE A

"G" FORCES FOR VARIOUS CONDITIONS (SEISMIC ZONE 2 - AV > 0.1 < 0.2)			
CONDUIT, CABLE TRAY and BUS DUCT	RIGIDLY MOUNTED EQUIPMENT	FLEXIBLY MOUNTED EQUIPMENT	ALL LIFE SAFETY
.25	.40	.40	.60

F. Materials

1. Devices

a. All vibration isolation and seismic devices described in this section shall be the product of a single manufacturer. Mason Industries is the base manufacturer of these specifications; products of other manufacturers are acceptable provided their systems strictly comply with intent, structural design, performance and deflections of the Base Manufacturer.

2. Seismic Restraints and Vibration Isolation Types

a. All isolation and seismic restraint devices shall be capable of accepting, without failure, the "G" forces as determined by the seismic certification and calculations as described in the "SUBMITTAL DATA REQUIREMENTS" section of these specifications.

b. Corrosion protection for outdoor applications shall be as follows:

(1) Springs cadmium plated, zinc electroplated or powder coat.

(2) Hardware cadmium plated.

(3) All other metal parts hot spray or hot dipped galvanized.

c. All seismic restraint devices

(1) Shall maintain the equipment in a captive position and not short circuit isolation devices during normal operating conditions.

(2) Shall have provisions for bolting and/or welding to the structure.

d. Welding of springs to isolator housing, base plates, etc. is strictly prohibited.

3. Seismic Restraint Types

a. TYPE I: Same as Type B. Cast or aluminum housings, (except ductile iron) are not acceptable: Mason Ind. TYPE SLR.

b. TYPE II: Where required, each corner or side of equipment base shall incorporate a seismic restraint snubber having an all directional resilient pad limit stop. Restraints shall be fabricated of plate, structural members or square metal tubing. Angle bumpers are not acceptable: Mason Ind. Type Z-1225/Z-1011.

c. TYPE III: Restraints for suspended systems.

(1) Vibration isolated systems braced with multiple 7 x 19 strand galvanized cable rope. Mason Industries Type SCB.

(2) Non-isolated systems braced with structural steel strut type with approved fastening devices to equipment and structure: Mason Ind. Type SSB.

(3) Steel angles (by contractor) shall be provided to prevent rod bending of hung equipment where indicated by the Seismic Restraint vendor’s submittals. Steel angles shall be attached to the rods with a minimum of three ductile iron

clamps at each restraint location. Welding of support rods to angles is not acceptable. Rod clamp assemblies shall have Anchorage Pre-approval “R” number from California OSHPD: Mason Ind. Model “SRC”.

(4) Pipe clevis cross braces are required at all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the clevis cross bolt. Clevis cross braces shall have Anchorage Pre-approval “R” number from California OSHPD: Mason Ind. Model “CCB”.

d. TYPE IV: Double deflection neoprene isolator encased in ductile iron or steel casing.

(1) Mountings shall have Anchorage Pre-approval “R” number from California OSHPD, certifying the horizontal and vertical seismic load ratings: Mason Industries Type RC or BR.

e. TYPE V: Rigid attachment to structure utilizing wedge type expansion anchors for bolting and steel plates, either cast-in or anchored with wedge type expansion bolts, for welding. Powder shots are not acceptable. Concrete anchor bolt spacing shall be in accordance with manufacturer’s published standards.

4. Vibration Isolator Types

a. TYPE A: Spring Isolator - Free Standing

(1) Spring shall have a minimum outer diameter to overall height ratio of 0.8: 1 at rated deflection.

(2) Reserve deflection (from published load ratings to solid height) of 50% of the rated deflection.

(3) Ductile top cup with adjusting bolt tapped for equipment attachment locking cap screw.

(4) Minimum 1/4" thick neoprene acoustical base pad or cup on underside, unless designated otherwise: Mason Industries Type SLF.

b. TYPE B: Spring Isolator - Restrained

(1) Shall be the same as TYPE A with the following additional features.

(a) Integral restraining bolts with elastomeric cushions preventing metal-to-metal contact.

(b) Internal spring adjusting nut or bolt with leveling capability.

(c) Built-in all-directional limit stops with minimum 1/4" clearance under normal operation.

(d) Mountings shall have Anchorage Pre-approval “R” number from California OSHPD, certifying the horizontal and vertical seismic load ratings.

Mason Industries Type SLR, SSLFH.

c. TYPE C: NOT USED

d. TYPE D: Double deflection neoprene isolator encased in ductile iron or steel casing.

(1) Mountings shall have Anchorage Pre-approval "R" number from California OSHPD, certifying the horizontal and vertical seismic load ratings: Mason Industries Type RC or BR.

e. TYPE E: Elastomer Hanger Isolator

(1) Molded neoprene element with an integral bushing to insulate lower support rod from the hanger box.

(a) Steel hanger box shall withstand three times the rated load without failure: Mason Industries Type HD.

G. Installation

1. General

a. Isolation and seismic restraint systems must be installed in strict accordance with the manufacturer's written instructions and all submittal data.

b. Vibration isolators shall not cause any change of position of equipment resulting in stress on equipment connections.

2. Equipment Installation

a. Equipment shall be isolated as indicated in TABLE B at the end of this section.

b. Additional Requirements:

(1) Spring isolators shall be installed after all equipment is installed without changing equipment elevations.

(2) After the entire installation is complete and under full operational load, the spring isolators shall be adjusted so that the load is transferred from the blocks to the isolators.

(3) Remove all debris from beneath the equipment and verify that there are no short circuits of the isolation. The equipment shall be free in all directions.

(4) Install equipment with flexibility in wiring.

(5) Housekeeping pads for equipment in this Section must be properly doweled or bolted, using wedge type expansion bolted to the structure to meet the acceleration criteria. Anchor equipment or isolators to housekeeping pads, See D. RELATED WORK.

3. Seismic Restraints

a. Installation

(1) All floor mounted equipment whether isolated or not shall be snubbed, anchored, bolted or welded to the structure to comply with the required acceleration. Calculations that determine that isolated equipment movement may be less than the operating clearance of snubbers (restraints) do not preclude the need for snubbers. All equipment must be positively restrained to the structure.

(2) All suspended equipment shall be two or four point independently braced with TYPE III restraints, installed taught for non-isolated equipment and slack with ½" cable deflection for isolated equipment. Rod bracing shall be installed as per approved submittals and shop drawings. Equipment less than 50 lbs. is excluded.

(3) All horizontally suspended cable trays, bus duct and conduit shall use RESTRAINT TYPE III. Spacing of seismic bracing shall be as per TABLE C at the end of this Section.

(4) For all trapeze supported piping and conduit, the individual pipes and conduits must be transversely and vertically restrained to the trapeze support at the designated restraint locations.

(5) For overhead supported equipment, over stress of the building structure must not occur. Bracing may occur from:

(a) Flanges of structural beams.

(b) Upper truss chords in bar joists.

(c) Cast in place inserts or drilled and shielded inserts in concrete structures.

(6) Conduit Risers

(a) Where conduits pass through cored holes, core diameters to be a maximum of 2 inches larger than pipe O.D. Cored holes must be packed with resilient material or fire stop as specified in other Sections of this Specification and/or State and Local Codes. No additional horizontal seismic bracing is required at these locations.

(b) Conduit risers through cored holes require a riser clamp at each level on top of the slab attached in a seismically approved manner for vertical restraint.

(c) Conduit risers in pipe shafts require structural steel attached in a seismically approved manner at each floor level and a riser clamp at each floor level on top of, and fastened to the structural steel. The riser clamp and structural steel must be capable of withstanding all static and seismic loads.

(7) Ceiling mounted panel light fixtures shall be attached to lay-in ceilings with earthquake clips or other approved means of positive attachment to T-bar structure.
(8) All non-isolated floor or wall-mounted equipment shall use RESTRAINT TYPE III or V.
(9) Where base anchoring of equipment is insufficient to resist seismic forces, restraint TYPE III shall be located above the units' center of gravity to suitably resist "G" forces specified.
(10) A rigid piping system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: Wall and roof; solid concrete wall and a metal deck with lightweight concrete fill, bus duct, conduit, etc. crossing a building expansion joint.

b. Exclusions for Seismic Restraints On Non-Life Safety Systems:
(1) All conduit less than 2-1/2 inch diameter.
(2) All clevis or trapeze supported conduit, cable tray or bus duct suspended by hangers with positive attachment to the structure that are less than 12 inches in length as measured from the top of the conduit, cable tray or bus duct to the point of attachment to the structure. If the 12 inch limit is exceeded by any hanger in the run, seismic bracing is required for the run.

c. Exclusions for Seismic Restraints On Life Safety Equipment.
(1) Critical, Standby or Emergency power conduit less than 1 inch nominal diameter.

4. Inspection

a. Upon completion of installation of all vibration isolation and seismic restraint devices, the owner may elect to contract and outside consultant at the owner's expense to review the installation. Any deficiencies in the installation will be corrected immediately at the contractor's expense.

TABLE B Vibration Isolation & Seismic Restraint Requirements for Electrical Equipment			EQUIPMENT INSTALLATION ATTACHMENT POINT					
			ON GRADE			ABOVE GRADE		
EQUIPMENT	SIZE		ISOL	DEFL	BASE	ISOL	DEFL	BASE

		MOUNTIN G						
General Purpose Transformers - Dry Type	All	Floor	- -	- -	- -	D	0.30	- -
		Ceiling	- -	- -	- -	E	0.30	- -
Generators	All	Floor	B	0.75	- -	B	1.50	- -

TABLE B NOTES:
GENERAL : ISOL = Isolator, DEFL. = Deflection, All deflections indicated are in inches.

TABLE C SEISMIC BRACING TABLE			
EQUIPMENT	ON CENTER SPACING (Max)		WITHIN EACH CHANGE OF DIRECTION
	TRANSVERSE	LONGITUDIN AL	
CONDUIT	40 Feet	80 Feet	10 Feet
BUS DUCT	30 Feet	60 Feet	4 Feet

CABLE TRAY	40 Feet	80 Feet	10 Feet

END OF SECTION

SECTION 16075

ELECTRICAL IDENTIFICATION
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. Section Includes:
1. Identification for conductors.
2. Underground-line warning tape.
3. Equipment identification labels.
4. Miscellaneous identification products.

1.4 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.5 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

1.6 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.2 UNDERGROUND-LINE WARNING TAPE

A. Tape:
1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:
1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.3 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

G. Painted Identification: Comply with requirements in Division 9 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
   a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
   b. Colors for 208/120-V Circuits:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
   c. Colors for 480/277-V Circuits:
      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.
   d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to

prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

B. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

C. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
   1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

E. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
      b. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
   2. Equipment to Be Labeled:
      a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
      b. Enclosures and electrical cabinets.
      c. Identify circuits contained in; pull-boxes, junction boxes and connection boxes, by labeling the inside of the cover using a indelible marker.
      d. Access doors and panels for concealed electrical items.
      e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
      f. Emergency system boxes and enclosures.
      g. Enclosed switches.
      h. Enclosed circuit breakers.
      i. Enclosed controllers.

j. Variable-speed controllers.
k. Push-button stations.
l. Contactors.
m. Remote-controlled switches, dimmer modules, and control devices.
n. Power-generating units.
o. Monitoring and control equipment.

END OF SECTION

SECTION 16120

CONDUCTORS AND CABLES
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. This Section includes the following:
1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Alcan Products Corporation; Alcan Cable Division.
   2. American Insulated Wire Corp.; a Leviton Company.
   3. General Cable Corporation.
   4. Senator Wire & Cable Company.
   5. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. AFC Cable Systems, Inc.
   2. Hubbell Power Systems, Inc.
   3. O-Z/Gedney; EGS Electrical Group LLC.
   4. 3M; Electrical Products Division.
   5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

C. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.

E. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 16 Section "Electrical Supports and Seismic Restraints."

F. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

END OF SECTION 16120

SECTION 16130

RACEWAYS AND BOXES
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.4 DEFINITIONS

A. RNC: Rigid nonmetallic conduit.

B. EMT:Electrical Metallic Tubing

1.5 SUBMITTALS

A. Product Data: For hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

C. Rigid Steel Conduit: ANSI C80.1.

D. Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.

6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

C. RNC: NEMA TC 2, Type EPC-80-PVC, unless otherwise indicated.

D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

D. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

E. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: RNC, Type EPC-80-PVC.
2. Underground Conduit: RNC, Type EPC-80-PVC, direct buried.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Enclosures: NEMA 250, Type 1.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. Provide rigid steel conduit 90's for all PVC conduit runs.

3.2 INSTALLATION

A. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

D. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

E. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

F. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

G. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

J. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

K. No installation of any MEP/FP shall commence until coordination plans indicating proposed routings, locations, mountings and similar information submitted and reviewed. No installation shall be allowed until preinstallation meetings have been conducted.

1. Contractor shall install conduit, branch circuitry, home runs, risers and all other electrical components at locations and in a manner that they will not be subject to damage by vehicles including and not limited to vehicles bumpers.
2. Branch conduit to shall be ceiling mounted,
3. Contractor shall install conduit, branch circuitry, home runs, risers and all other electrical components in a neat workmanship manner at locations and routes that do not visually detract from the garage aesthetics with attention to walls, stairs, lobbies, ceilings areas at stair and stair/elevator towers and areas subject to pedestrian traffic.
4. Installations shall be located and installed in such a manner to minimize the potential for moisture related deterioration under precast floor joints with joint sealants.

5. No electrified fixtures, lamps etc… shall be installed at ceiling locations between precast tee stems with tee to tee joints. No horizontal conduit runs shall be installed parallel to precast tee to tee joints between tee stems with tee to tee joints.
6. No conduit shall be allowed to be mounted at or on an inverted "T" beam
7. All conduit shall be mounted tight against precast elements; no suspended conduit allowed.
8. Contractor shall utilize designated vertical chases as shown on the drawings or as approved by the Owner for ALL vertical risers.
9. ALL conduit routed to a wall or column mounted device/equipment shall be routed up to the ceiling to the ceiling mounted branch circuitry.
10. Any fixture, conduit, circuit that does not comply or is a zone subject to vehicular damage shall be relocated at no cost to the owner.
11. MEP/FP material installed prior to the review of coordination drawings and the distribution of accepted preinstallation coordination meeting minutes shall be subject to removal and reinstallation at routes and locations designated by the Owner, Owner's Project Manager and/or the Engineer.

Pre-Installation Conference: (for all MEP/FP trade contractors)

1. At least 10 days prior to installation of the electrical, mechanical, plumbing & fire protection components within the precast superstructure, the contractor shall conduct a meeting with the Owner's representative, resident engineer and Contractor's representatives to review and to discuss the methods and procedures to achieve the quality installation as specified under "Installation". The contractor shall send a preinstallation conference agenda to all attendees 5 days prior to the schedule date of the conference.
2. The contractor shall require responsible representatives or every party who is concerned with the concrete work to attend the conference, including but not limited to the following:
    a. Contractor's superintendent
    b. Contractor responsible for field quality control.
    c. Electrical/Fire Protection/Plumbing subcontractor
    d. Electrical/Fire Protection/Plumbing Foreman
3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes:
    a. Owner's representative
    b. Resident engineer
    c. Consultant engineer

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit.

2. Provide sand to surround conduits 6” in all directions.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose.

5. Warning Tape: Bury warning tape approximately 18 inches above direct-buried conduits.

3.4 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16130

SECTION 16140

WIRING DEVICES
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.1 SUMMARY

A. This Section includes the following:
1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Snap switches and wall-box dimmers.
4. Floor service outlets and multioutlet assemblies.

1.2 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available,

obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

1.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

1.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

1.3 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-30R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Cooper.
b. Hubbell.
c. Leviton
d. Pass & Seymour.

1.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
      b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
      c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
      d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

1.5 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
   1. 1000 W; dimmers shall require no derating when ganged with other devices.

1.6 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: .035-inch-thick, satin-finished stainless steel.

1.7 MULTIOUTLET ASSEMBLIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Hubbell Incorporated; Wiring Device-Kellems.
   2. Wiremold Company (The).

B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. System: Provide surface raceway systems for branch circuit, data network and voice wiring. Surface raceway system shall consist of raceway bases, covers,

pre-divided raceway bases, dual covers, appropriate fittings and device mounting plates necessary for a complete installation.

D. Configuration:
1. Raceways for classified wiring shall be two-piece design with base and snap-on cover. Raceway shall be available in widths of 2-3/4-inch and depths of 1-15/32-inch.
2. Raceways for power and unclassified wiring shall be multi-piece design with metal base and snap-on metal covers. Assembled base and cover is 4-3/4 inches wide by 1-3/4 inch. Base shall have 2 wiring channels, separated by 1 integral divider, large enough to accept standard power and communication devices without restricting capacity of the adjacent channel. Provide the base with tunnel knockouts in the divider wall that will facilitate the crossing over of services.

E. AF Series Raised Floor Boxes as manufactured by Wiremold / Legrand.
1. AF1 Series contains three separate compartments that accommodate a combination of both power and communication devices. The box lid shall be constructed of polycarbonate material, available in standard colors of black, brown and gray. The lid shall provide a removable cable guard for egress of power and communication workstation cables. The cable guards shall hold workstation cables in place with the lid either in the open or closed position.
2. The wiring chamber shall provide a minimum of three separate compartments to accommodate a combination of both power and communication wiring. The compartments shall be separated by use of die cast aluminum built in dividers.
3. The box shall be secured to the raised floor by the use of two locking tabs. The locking tabs shall be integral to the box and adjusted by use of their locking screws.

F. Raceway Material: Metal, with manufacturer's standard finish.

1.8 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
1. Wiring Devices Connected to Normal Power System: White or Ivory, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Delta Power System: Orange.

PART 2 - EXECUTION

2.1 INSTALLATION

A. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

B. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

C. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

D. Receptacle Orientation:
   1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Dimmers:
   1. Install dimmers within terms of their listing.
   2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

2.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."
   1. Receptacles: Identify panelboard and circuit number from which served. Use machine printing with black lettering on face of plate, and durable wire markers or tags inside outlet boxes.

END OF SECTION 16140

SECTION 16410

ENCLOSED SWITCHES AND CIRCUIT BREAKERS
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
1. Fusible switches.
2. Nonfusible switches.
3. Bolted-pressure contact switches.
4. High-pressure, butt-type contact switches.
5. Molded-case circuit breakers.
6. Molded-case switches.
7. Enclosures.

1.4 DEFINITIONS

A. GD: General duty.

B. GFCI: Ground-fault circuit interrupter.

C. HD: Heavy duty.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

1.5 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Current and voltage ratings.
   3. Short-circuit current rating.
   4. UL listing for series rating of installed devices.
   5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:
   1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
      b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For testing agency.

E. Field quality-control test reports including the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Manufacturer's field service report.

G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:
   1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
   2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
   2. Altitude: Not exceeding 6600 feet.

1.8 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Spares: For the following:
      a. Potential Transformer Fuses: 6
      b. Control-Power Fuses: 6
      c. Fuses and Fusible Devices for Fused Circuit Breakers: 6
      d. Fuses for Fusible Switches: 6
      e. Fuses for Fused Power Circuit Devices: 6
   2. Spare Indicating Lights: Six of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Available Manufacturers:
   1. Eaton Corporation; Cutler-Hammer Products.
   2. General Electric Co.; Electrical Distribution & Control Division.
   3. Siemens Energy & Automation, Inc.
   4. Square D/Group Schneider.

B. Fusible Switch, 1200A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 1200A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.

3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 FUSED POWER CIRCUIT DEVICES

A. Bolted-Pressure Contact Switch: UL 977; operating mechanism shall use a rotary-mechanical-bolting action to produce and maintain high-clamping pressure on the switch blade after it engages the stationary contacts.
   1. Available Manufacturers:
      a. Boltswitch, Inc.
      b. Eaton Corporation; Cutler-Hammer Products.
      c. Pringle Electrical Mfg. Co.
      d. Siemens Energy & Automation, Inc.
      e. Square D/Group Schneider.

B. High-Pressure, Butt-Type Contact Switch: UL 977; operating mechanism shall use butt-type contacts and a spring-charged mechanism to produce and maintain high-contact pressure when switch is closed.
   1. Available Manufacturers:
      a. General Electric Co.; Electrical Distribution & Control Division.
   2. Main Contact Interrupting Capability: Twelve times the switch current rating, minimum.
   3. Operating Mechanism: Manual handle operation to close switch stores energy in mechanism for closing and opening.
      a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
      b. Mechanical Trip: Operation of mechanical lever or push button or another device causes switch to open.
   4. Auxiliary Switches: Factory installed, SPDT, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
   5. Service-Rated Switches: Labeled for use as service equipment.
   6. Ground-Fault Relay: Comply with UL 1053. Self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
      a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground fault indicator.
      b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
      c. No-Trip Relay Test: Operation of "no-trip" test control permits ground-fault simulation test without tripping switch.
      d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).
   7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

2.4 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Available Manufacturers:
   1. Eaton Corporation; Cutler-Hammer Products.
   2. General Electric Co.; Electrical Distribution & Control Division.
   3. Moeller Electric Corporation.
   4. Siemens Energy & Automation, Inc.
   5. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short-time pickup levels.
      c. Long- and short-time time adjustments.
      d. Ground-fault pickup level, time delay, and I^2t response.
   4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
   5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
   6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

C. Molded-Case Circuit-Breaker Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
   4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   5. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 16 Section "Electrical Power Monitoring and Control."
   6. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
   7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.

8. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
10. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

E. Molded-Case Switch Accessories:
1. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage. Provide "dummy" trip unit where required for proper operation.
4. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay. Provide "dummy" trip unit where required for proper operation.
5. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
6. Key Interlock Kit: Externally mounted to prohibit operation; key shall be removable only when switch is in off position.

2.5 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

B. Concrete base is specified in Division 16 Section "Electrical Supports and Seismic Restraints," and concrete materials and installation requirements are specified in Division 3.

3.3 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 16 Section "Electrical Identification."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Prepare for acceptance testing as follows:
   1. Inspect mechanical and electrical connections.
   2. Verify switch and relay type and labeling verification.
   3. Verify rating of installed fuses.
   4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

C. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

D. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

E. Perform the following field tests and inspections and prepare test reports:
   1. Test mounting and anchorage devices according to requirements in Division 16 Section "Electrical Supports and Seismic Restraints."
   2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
   3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   4. Infrared Scanning:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.
      b. Follow-Up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.
      c. Instruments, Equipment and Reports:
         1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
         2) Prepare a certified report that identifies enclosed switches and circuit breakers included and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 16410

SECTION 16442

PANELBOARDS
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. Section Includes:
1. Lighting and appliance branch-circuit panelboards.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.
   2. Do not proceed with interruption of electric service without Owner's written permission.
   3. Comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface-mounted cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
   4. Finishes:
      a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Same finish as panels and trim.
   5. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top or bottom.

C. Phase, Neutral, and Ground Buses:
   1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.
   1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus-Configured Terminators: Mechanical type.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 90 inches above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

E. Install filler plates in unused spaces.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 16 Section "Electrical Identification."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final circuit designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 16 Section"Electrical Identification."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 16 Section "Electrical Identification."

3.4 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 16442

SECTION 16511

INTERIOR LIGHTING
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.

1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and LED drivers.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.4 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. Lumen: Measured output of lamp and luminaire, or both.

D. Luminaire: Complete lighting fixture, including ballast housing if provided.

E. LED: Light Emitting Diode

1.5 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. LED drivers.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.7 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

2.3 LED LIGHT FIXTURES

A. General:

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
3. LED drivers shall include the following features unless otherwise indicated:
   a. Minimum efficiency: 85% at full load.
   b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)

c. Input Voltage: 120 - 277V (±10%) at 60 Hz.

d. Integral short circuit, open circuit, and overload protection.

e. Power Factor: ≥ 0.95.

f. Total Harmonic Distortion: ≤ 20%.

g. Comply with FCC 47 CFR Part 15.

4. LED modules shall include the following features unless otherwise indicated:

a. Comply with IES LM-79 and LM-80 requirements.

b. Minimum CRI 80 and color temperature 3500˚ K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.

c. Minimum Rated Life: 50,000 hours per IES L70.

d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

B. LED Downlights:

1. Housing, LED driver, and LED module shall be products of the same manufacturer.

C. LED Troffers:

1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.

2. Housing, LED driver, and LED module shall be products of the same manufacturer.

2.4 EXIT SIGNS

A General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B Internally Lighted Signs:

Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.

b. Charger: Fully automatic, solid-state type with sealed transfer relay.

c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

1. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

2. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

PART 3 EXECUTION

3.1 INSTALLATION

1. Lighting fixtures:

a. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
b. Install lamps in each luminaire.

2. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

3. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

a. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
b. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
c. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
d. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

4. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. IDENTIFICATION

1. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. ADJUSTING

1. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

a. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 16511

SECTION 16521

EXTERIOR LIGHTING
(Filed Sub-Bids Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 FILED SUB-BIDS

A. Sub-bids shall be submitted for the Work of this Section in accordance with the provisions of M.G.L. c. 149A §§ 1-13. The time and place for submission of sub-bids are set forth in the ADVERTISEMENT. The procedures and requirements for submitting sub-bids are set forth in the INSTRUCTIONS TO BIDDERS.
   1. The Work of this section is shown on Drawings: E-001, E-002, E-111, E-121, E-131, E-141.

B. Sub-sub Bids are not required for this trade.

1.3 SUMMARY

A. Section Includes:

   1. Exterior luminaires with lamps and ballasts.

1.4 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LER: Luminaire efficacy rating.

D. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.5 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
6. Ballasts, including energy-efficiency data.
7. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.

B. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 FLUORESCENT BALLASTS AND LAMPS

A. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F and Higher: Electronic type rated for 0 deg F starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F and Higher: Electromagnetic type designed for use with indicated lamp types.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: Class A.
3. Total Harmonic Distortion Rating: Less than 10 percent.
4. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
5. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures minus 20 deg F and higher.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

3.2 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 16521