CITY OF NEWTON
PURCHASING DEPARTMENT
CONTRACT FOR PUBLIC BUILDINGS

PROJECT MANUAL:
WABAN HILL COMMUNICATIONS TOWER
EQUIPMENT BUILDING
INVITATION FOR BID #15-37

Pre-Bid Meeting: October 23, 2014 at 11:00 a.m.
Filed Sub-Bid Opening: October 30, 2014 at 11:00 a.m.
Bid Opening Date: November 6, 2014 at 11:00 a.m.

Prepared by:
Goldman Reindorf Architects, Inc.
427 Watertown Street
Newton, MA 02458
617-467-3119
Fax 617-467-3124
www.grarchitects.com

OCTOBER 2014
Setti D. Warren, Mayor
## TABLE OF CONTENTS

**WABAN HILL COMMUNICATIONS TOWER EQUIPMENT BUILDING**

<table>
<thead>
<tr>
<th>Cover Page</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table of Contents</td>
<td>2</td>
</tr>
<tr>
<td>1. - Invitation for Bid</td>
<td>3-4</td>
</tr>
<tr>
<td>2. - Instructions to Bidders</td>
<td>5-7</td>
</tr>
<tr>
<td>3. - Bid Form for General Contractor</td>
<td>8-10</td>
</tr>
<tr>
<td>- Bid Form For Sub Bid</td>
<td>11-12</td>
</tr>
<tr>
<td>4. - Bidder’s Qualification Forms</td>
<td></td>
</tr>
<tr>
<td>- Bidder’s Qualifications and References Form</td>
<td>13-14</td>
</tr>
<tr>
<td>- Certificate of Non-Collusion</td>
<td>15</td>
</tr>
<tr>
<td>- Debarment Letter</td>
<td>16</td>
</tr>
<tr>
<td>- IRS Form W-9</td>
<td>17</td>
</tr>
<tr>
<td>5. - Contract Forms (Informational only. Not required at time of bid submittal)</td>
<td></td>
</tr>
<tr>
<td>- City - Contractor Contract</td>
<td>19-21</td>
</tr>
<tr>
<td>- Certificate of Authority - Corporate</td>
<td>22</td>
</tr>
<tr>
<td>- Certification of Tax Compliance</td>
<td>23</td>
</tr>
<tr>
<td>- Performance Bond</td>
<td>24</td>
</tr>
<tr>
<td>- Payment Bond</td>
<td>25</td>
</tr>
<tr>
<td>6. - General Conditions of the Contract</td>
<td>26-31</td>
</tr>
<tr>
<td>7. - Supplemental Conditions</td>
<td>32-37</td>
</tr>
<tr>
<td>8. - Wage Rate Requirements</td>
<td>38</td>
</tr>
<tr>
<td>- Prevailing Wages</td>
<td>39-79</td>
</tr>
<tr>
<td>- Notice to Awarding Authorities and Contractors</td>
<td>80</td>
</tr>
<tr>
<td>- Statement of Compliance</td>
<td>81</td>
</tr>
<tr>
<td>- Weekly Payroll Report Form</td>
<td>82</td>
</tr>
<tr>
<td>9. - Table of Contents for Technical Specifications</td>
<td>83</td>
</tr>
<tr>
<td>10. - List of drawings:</td>
<td>84</td>
</tr>
<tr>
<td>Drawings may be obtained online at <a href="http://www.newtonma.gov/purchasing">www.newtonma.gov/purchasing</a></td>
<td></td>
</tr>
<tr>
<td>Or picked up at Newton City Hall, Purchasing Department, Room 204</td>
<td></td>
</tr>
<tr>
<td>Bidders are advised to call for availability.</td>
<td></td>
</tr>
<tr>
<td>11. - Technical Specifications</td>
<td>85-339</td>
</tr>
</tbody>
</table>

**END OF SECTION**
The City of Newton (City) invites sealed bids from Contractors for

WABAN HILL COMMUNICATIONS TOWER EQUIPMENT BUILDING

Summary of Work: Installation of new modular concrete buildings for communications equipment serviced from the existing tower that remains, including all architectural, site, structural, mechanical, electrical and communications work as indicated on the drawings and in the specifications.

Pre-bid will be held on site at: 11:00 a.m., Thursday, October 23, 2014, 2 Manet Road, Waban Hill, Newton, MA

Filed Sub-Bid Opening: 11:00 a.m., Thursday, October 30, 2014

Bids will be received until 11:00 a.m., Thursday, November 6, 2014

at the Purchasing Department, Room 204, Newton City Hall, 1000 Commonwealth Ave., Newton, MA 02459. Bids will not be accepted nor may submitted bids be corrected, modified or withdrawn after the deadline for bids. Following the deadline for bids, all bids received within the time specified will be publicly opened and read aloud.

Work is expected to begin upon execution of this contract and shall be completed not later than August 1, 2015.

Contract Documents will be available online at the City’s website: www.newtonma.gov/bids or for pickup at the Purchasing Department or after: 10:00 a.m., October 16, 2014.

There will be no charge for contract documents. Award will be made to the bidder with the lowest total contract price, including any accepted alternates, that has been deemed responsible and eligible.

All bids shall be submitted as one ORIGINAL and two COPIES.

All General Bids must be accompanied by a copy of a “Certificate of Eligibility” (DCAMM Form CQ-7) issued by the Department of Capital Asset Management and Maintenance (DCAMM) and a “Contractor Update Statement” (DCAMM Form CQ-3). The category of work for which the Bidder must certified is: General Building Construction

All Sub Trade Bids must be accompanied by a copy of a “Certificate of Eligibility” and Contractor “Update Statement” issued by DCAMM. The category of work for which the Sub Trade Bidder must be certified in is: Electrical

General and Sub Trade Bids must be accompanied by a bid deposit in an amount that is not less than five percent (5%) of the value of the bid, including all alternates. Bid deposits, payable to the City of Newton, shall be either in the form of a bid bond, or cash, or a certified check, or a treasurer's or cashier's check issued by a responsible bank or trust company. Bidders are reminded that the bid deposit covers the City for damages when a bidder withdraws its bid after the bid submission date. Be advised that to the extent permitted by law the City will retain all bid deposits for withdrawn bids.

The costs of any bond and any insurance required in this Invitation For Bid are the responsibility of the bidder; such costs will not be reimbursed by City and should be included in your bid.

All bids are subject to the provisions of M.G.L. c149, §§44 A to 44J. Wages are subject to minimum wage rates determined by the Massachusetts Department of Labor Standards pursuant to M.G.L. c149, §§26 to 27H. The schedule of wage rates applicable to this contract is included in the bidding documents. In addition, the prevailing wage schedule will be updated annually for all public construction projects lasting longer than one (1) year. You will be required to pay the rates set out in any updated prevailing wage schedule. Increases in prevailing wage schedules will not be the basis for change order requests. The successful bidder will be required to provide a Certificate of Insurance demonstrating current coverage of the type and amounts set forth in the Project Manual. The successful bidder will be required to furnish both a Performance Bond and a Labor and Materials Payment Bond in the amount of 100% of the contract total.
Bidders attention is directed to the requirements of the City of Newton Supplemental Equal Employment Opportunity, Anit-Discrimination and Affirmative Action Program and also to the Minority/Women Business Enterprise Plan, December 1999. Copies of the Plans and Program referred to in Sections 3.1 and 3.2 are available at: [www.newtonma.gov/purchasing](http://www.newtonma.gov/purchasing). In the event of conflict between any of the above listed policies, the stricter policy shall apply. If you download bids from the internet website [www.newtonma.gov/bids](http://www.newtonma.gov/bids) I strongly suggest you email (purchasing@newtonma.gov) your company’s NAME, ADDRESS, PHONE, FAX AND INVITATION FOR BID NUMBER, so that we may add you to the Bidders List and you will be notified of any/all addendums.

The City will reject any and all bids in accordance with the above referenced General Laws. In addition, the City reserves the right to waive any informalities in any or all bids, or to reject any or all bids (in whole or in part) if it be in the public interest to do so.

CITY OF NEWTON

Nicholas Read  
*Chief Procurement Officer*  
October 16, 2014
ARTICLE 1 - BIDDER’S REPRESENTATION

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

1. The Bidder has read and understands the Bidding Documents, Contract Forms, General Conditions, Conditions of the Contract, General Requirements and Project Specifications (collectively, referred to as the “Contract Documents”) and the bid is made in accordance therewith.

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

1.2 Failure to so examine the Contract Documents and work site will not relieve any Bidder from any obligation under the bid as submitted.

ARTICLE 2 - REQUEST FOR INTERPRETATION

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

2.2 Bidders requiring clarification or interpretation of the Contract Documents shall make a written request to the Chief Procurement Officer, at purchasing@newtonma.gov or via facsimile (617) 796-1227. The City will only answer such requests if received by Friday, October 24, 2014 at 12:00 noon. In the event that the bid opening date is changed, the deadline for informational requests may also change as provided in an addendum issued by the City.

2.3 Interpretation, correction, or change in the Contract Documents will be made by addendum which will become part of the Contract Documents. The City will not be held accountable for any oral communication.

2.4 Addenda will be emailed to every individual or firm on record as having taken a set of Contract Documents. Addenda will be emailed to every individual or firm on record as having taken a set of Contract Documents. Receipt of all addenda issued must be acknowledged in the Bid Form. YOUR FAILURE TO ACKNOWLEDGE ALL ADDENDA MAY RESULT IN YOUR BID BEING REJECTED AS NON-RESPONSIVE.

2.5 Copies of addenda will be made available for inspection at the location listed in the Invitation for Bids where Contract Documents are on file, in addition to being available online at www.newtonma.gov/bids.

2.6 Bidders or proposers contacting ANY CITY EMPLOYEE regarding an Invitation for Bid (IFB) or a Request for Proposal (RFP), outside of the Purchasing Department, once an IFB or RFP has been released, may be disqualified from the procurement process.

2.7 Bidders downloading information off the internet web site are solely responsible for obtaining any addenda prior to the bid opening. If the bidder makes itself known to the Purchasing Department, at purchasing@newtonma.gov or via facsimile (617) 796-1227, it shall be placed on the bidder’s list. Bidders must provide the Purchasing Department with their company’s name, street address, city, state, zip, phone, fax, email address and INVITATION FOR BID #15-37.

ARTICLE 3 - MBE PARTICIPATION

3.1 Notice is hereby given that the Mayor’s Affirmative Action Plan for the City of Newton in effect at the time of this solicitation is applicable to all construction contracts in excess of $10,000.00.

3.2 Notice is hereby given that the City of Newton Minority/Women Business Enterprise Plan and the Supplemental Equal Employment Opportunity Anti-Discrimination and Affirmative Action Program in effect at the time of this solicitation are applicable to all City contracts for goods and services in excess of $50,000.00.

3.3 Copies of the Plans and Program referred to in Sections 3.1 and 3.2 are available at: www.newtonma.gov/purchasing.
ARTICLE 4 - PREPARATION AND SUBMISSION OF BIDS

4.1 Bids shall be submitted on the "General Bid Form" or “Form For Sub-Bid,” as appropriate, furnished by the City.

4.2 All entries on the Bid Form shall be made by typewriter or in ink.

4.3 Where so indicated on the Bid Form, sums shall be expressed in both words and figures. Where there is a discrepancy between the bid sum expressed in words and the bid sum expressed in figures, the words shall control.

4.4 Bid Deposits shall be submitted in the amount specified in the Invitation for Bids. They shall be made payable to the City and shall be either in the form of cash, certified check, treasurer's or cashier's check issued by a responsible bank or trust company, or a bid bond issued by a surety licensed to do business in the Commonwealth of Massachusetts; and shall be conditioned upon the faithful performance by the principal of the agreements contained in the bid. Bidders are reminded that the bid deposit covers the City for damages when a bidder withdraws its bid after the bid submission date. Be advised that to the extent permitted by the law the City will retain all bid deposits for withdrawn bids.

Bid deposits of the three (3) lowest responsible and eligible Bidders shall be retained until the execution and delivery of the City-Contractor agreement.

4.5 The Bid, including the bid deposit shall be enclosed in a sealed envelope with the following plainly marked on the outside:

* FILED SUB-BID or GENERAL BID FOR: #15-37
* NAME OF PROJECT: Waban Hill Communications Tower Equipment Building
* BIDDER’S NAME, BUSINESS ADDRESS, AND PHONE NUMBER

4.6 Dates and times for receipt of filed sub-bids and general bids are set forth in the Invitation for Bids.

4.7 Timely delivery of a bid at the location designated shall be the full responsibility of the Bidder. In the event that Newton City Hall is closed on the date or at the time that bids are due, the date and time for receipt of bids shall be on the next business day following that the Newton City Hall and the Purchasing Department are open.

4.8 Bids shall be submitted with one original and two copies.

4.9 Be advised that a new Massachusetts law has been enacted that required all employees who work on Massachusetts public works construction sites must have no less than 10 hours of OSHA-approved safety and health training. See Chapter 306 of the Acts of 2004, which became effective July 1, 2006.

1. This requirement will apply to any general bid or sub bid submitted.
2. This law directs the Massachusetts Attorney General to restrain the award of construction contracts to any contractor who is in violation to this requirement and to restrain the performance of these contracts by non-complying contractors.
3. The contractor and all subcontractors on this project will be required to provide certification of compliance with this requirement. Non-compliance with this law will disqualify you from bidding on public contracts.

ARTICLE 5 - ALTERNATES

5.1 Each Bidder shall acknowledge alternates (if any) in Section C on the Bid Form in Section A on the Sub-Bid Form.

5.2 In the event an alternate does not involve a change in the amount of the base bid, the Bidder shall so indicated by writing "No Change", or "N/C" or "0" in the space provided for that alternate.

5.3 Bidders shall enter on the Bid Form a single amount for each alternate which shall consist of the amount for work performed by the Contractor.

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

ARTICLE 6 - WITHDRAWAL OF BIDS

6.1 Any bid may be withdrawn prior to the time designated for receipt of bids on written or electronic request. Electronic withdrawal of bids must be confirmed over the Bidder's signature by written notice postmarked on or before the date and time set for receipt of bids.
6.2 Withdrawn bids may be resubmitted up to the time designated for the receipt of bids.

6.3 No bids may be withdrawn within sixty (60) days, Saturdays, Sundays and legal holidays excluded, after the opening of the bids.

ARTICLE 7 - CONTRACT AWARD

7.1 The City is soliciting prices for items set forth in the Form For General Bid # 15-37 attached hereto. It is the City’s intent to award one contract to the responsive and responsible bidder submitting the lowest bid. Prior to the the opening of the general bids, the City shall receive and screen all filed sub-bids and provide a tabulation sheets to all contractors that have notified the City that they intend to submit a general bid in order that they may select a sub-bidder for inclusion in their bids. General contracts will be awarded within sixty (60) days, Saturdays, Sundays, and legal holidays excluded, after the opening of bids.

7.2 The City reserves the right to waive minor informalities in or to reject any or all Bids if it be in the public interest to do so.

7.3 The City reserves the right to reject any bidder who has failed to pay any local taxes, fees, assessments, betterments, or any other municipal charge, unless the bidder has a pending abatement application or has entered into a payment agreement with the collector-treasurer.

7.4 As used herein, the term "lowest responsible and eligible Bidder" shall mean the Bidder (1) whose bid is the lowest of those bidders possessing the skill, ability and integrity necessary for the faithful performance of the work; (2) who has met all the requirements of the invitation for bids; (3) who shall certify that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work; (4) who, where the provisions of section eight B of chapter twenty-nine apply, shall have been determined to be qualified thereunder.

7.5 Subsequent to the award and within five (5) days, Saturday, Sundays and legal holidays excluded, after the prescribed forms are presented for signature, the successful Bidder shall execute and deliver to the City a contract in the form included in the Contract Documents in such number of counterparts as the City may require.

7.6 In the event that the City receives low bids in identical amount from two or more responsive and responsible Bidders, the City shall select the successful Bidder by a blind selection process chosen by the City such as flipping a coin or drawing names from a hat. The low Bidders who are under consideration will be invited to attend and observe the selection process.

ARTICLE 8 - TAXES

8.1 The Bidder shall not include in this bid any tax imposed upon the sale or rental of tangible personal property in this Commonwealth, such as any and all building materials, supplies, services and equipment required to complete the work.

8.2 The City is exempt from payment of the Massachusetts Sales Tax, and the Bidder shall not include any sales tax on its bid. The City’s exemption Number is E-046-001-404.

ARTICLE 9 – PROPRIETARY SPECIFICATIONS

9.1 The City has used a proprietary specification to describe the supply listed in the specifications. Such specifications are permitted under M.G.L. c. 30, §39M(b), provided that the City state in writing that use of the proprietary specification is in its best interest and that it will accept an “equal” of the item specified. An item is considered equal if (i) it is at least equal in quality, durability, appearance, strength, and design; (ii) will perform the intended function at least equally; and (iii) conforms substantially, even with deviations, to the detailed requirements contained in the specifications. Bidders wishing to provide an equal item should do so with their bids. The City shall have the sole right to determine whether or not said item is equal.

9.2 The required determination and justification have been duly prepared, and a copy may be requested in accordance with the Massachusetts Public Records Law, M.G.L. c. 66, §10.

END OF SECTION
CITY OF NEWTON
PURCHASING DEPARTMENT
FORM FOR GENERAL BID #15-37
WABAN HILL COMMUNICATIONS TOWER EQUIPMENT BUILDING

TO THE AWARDING AUTHORITY:

A. The undersigned proposes to furnish all labor and materials required to

WABAN HILL COMMUNICATIONS TOWER EQUIPMENT BUILDING

in Newton, Massachusetts in accordance with the accompanying plans and specifications for the contract price specified below, subject to additions and deductions according to the terms of the specifications.

B. This bid includes addenda number(s) _____ _____ _____ _____.

C. The proposed contract price is:

TOTAL dollars in words ______________________________________________________

<table>
<thead>
<tr>
<th>Alternate No.</th>
<th>Description</th>
<th>Add</th>
<th>Subtract</th>
</tr>
</thead>
<tbody>
<tr>
<td>No 1.</td>
<td></td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>No 2.</td>
<td></td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>No 3.</td>
<td></td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>No 4.</td>
<td></td>
<td>$</td>
<td></td>
</tr>
</tbody>
</table>

COMPANY: __________________________

The sub-division of the proposed contract price is as follows:

**Item 1.** The work of the General Contractor, being all work other than that covered by Item 2

**Total of Item 1:** $ ______

**Item 2.** Sub-bids as follows:

<table>
<thead>
<tr>
<th>Sub-Trade</th>
<th>Name of Sub-bidder</th>
<th>Amount</th>
<th>Bond Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$</td>
<td>(Yes or No)</td>
</tr>
</tbody>
</table>

**Total of Item 2:** $ ______

COMPANY: __________________________________________
D. **Prompt Payment Discounts.** Bidders are encouraged to offer discounts in exchange for an expedited payment. Payments may be issued earlier than the general goal of within 30 days of receipt of the invoice only when in exchange for discounted prices. Discounts will not be considered in determining the low responsible bidder.

<table>
<thead>
<tr>
<th>Prompt Payment Discount</th>
<th>%</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

E. The undersigned has completed and submits herewith the following documents:

- ☐ Bidder's Qualifications and References Form, 2 pages
- ☐ Bidder’s DCAM (CQ-3 & CQ-7) forms.
- ☐ Certificate of Non-Collusion, 1 page
- ☐ General Contractor or Sub-Bid Contractor Signed Bid Form, 2 pages
- ☐ A five percent (5%) bid deposit.
- ☐ Debarment Letter, 1 page
- ☐ IRS Form W-9, 1 page

F. The undersigned agrees that each of the above named sub-bidders will be used for the work indicated at the amount stated, unless a substitution is made. The undersigned further agrees to pay the premiums for the performance and payment bonds furnished by sub-bidders as requested herein and that all of the cost of all such premiums is included in the amount set forth in Item 1 of this bid.

The undersigned agrees that if s/he is selected as general contractor, s/he will promptly confer with the awarding authority on the question of sub-bidders; and that the awarding authority may substitute for any sub-bid listed above a sub-bid filed with the awarding authority by another sub-bidder for the sub-trade against whose standing and ability the undersigned makes no objection; and that the undersigned will use all such finally selected sub-bidders at the amounts named in their respective sub-bids and be in every way as responsible for them and their work as if they had been originally named in this general bid, the total contract price being adjusted to conform thereto.

On any change order, the general contractor will be allowed only (i) a ten percent (10%) mark up for Overhead and Profit (O&P) for its work and (ii) a five percent (5%) mark up for O&P on sub-contractors’ work. The sub-contractors will be allowed a ten percent (10%) mark up for O&P for their work. For both the general and sub-contractors, any increase in the cost of a bond will be added to the change order at direct cost. Any difference between the allowance for a sub-bid and the actual sub-bid shall not be considered a change order.

G. The undersigned agrees that, if s/he is selected as general contractor, s/he will within five days, Saturdays, Sundays and legal holidays excluded, after presentation thereof by the awarding authority, execute a contract in accordance with the terms of this bid and furnish a performance bond and also a labor and materials payment bond, each of a surety company qualified to do business under the laws of the commonwealth and satisfactory to the awarding authority and each in the sum of the contract price, the premiums for which are to be paid by the general contractor and are included in the contract price.

The undersigned hereby certifies that s/he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that s/he will comply fully with all laws and regulations applicable to awards made subject to M.G.L. c.30, §39M.

The undersigned certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work; (2) that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration (“OSHA”) that is at least 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 (3) that all employees to be employed in the work subject to this bid have successfully completed a course in construction safety and health approved by the United States OSHA that is at least 10 hours in duration. The undersigned understands that any employee found on a worksite subject to this section without documentation of successful completion of 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 shall be subject to immediate removal.

The undersigned further certifies that s/he intends to comply with the City of Newton Minority/Women Business Enterprise Plan, dated December 19, 1999 to further expand business opportunities for minority firms.

The undersigned further certifies under the penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word “person” shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of M.G.L. c29, §29F or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

Date: ____________________________

(Name of General Bidder)

BY: ______________________________

(Signature)

____________________________

(Printed Name and Title of Signatory)

___________________________________________

(Business Address)

___________________________________________

(City, State Zip)

___________________________________________

E-mail address

________________________/________________________

(Telephone) (FAX)

NOTE: If the bidder is a corporation, indicate state of incorporation under signature, and affix corporate seal; if a partnership, give full names and residential addresses of all partners; and if an individual, give residential address if different from business address.

END OF SECTION
CITY OF NEWTON
PURCHASING DEPARTMENT
FORM FOR SUB-BID

To all General Bidders Except those Excluded:

A. The Undersigned 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 ___________________________ (name of architect or engineer) for the Waban Hill Communications Tower Equipment Building(project) in Newton, Massachusetts, for the contract sum of -______________________ dollars ($______________).

For Alternate No 1. ____________; Add $________________ Subtract $ _________________
For Alternate No 2. ____________; Add $________________ Subtract $ _________________
For Alternate No 3. ____________; Add $________________ Subtract $ _________________
For Alternate No 4. ____________; Add $________________ Subtract $ _________________

B. This sub-bid includes addenda numbered___________

C. This sub-bid

☐ may be used by any general bidder except:

________________________________________________________

☐ may only be used by the following general bidders:

________________________________________________________

[To exclude general bidders, insert “X” in one box only and fill in blank following that box. Do not answer C if no general bidders are excluded.}

D. The undersigned agrees that, if he is selected as a sub-bidder, he will, within 5 days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such general bidder a subcontract in accordance with the terms of this sub-bid, and contingent upon the execution of the general contract, and, if requested so to do in the general bid by the general bidder, who shall pay the premiums therefor, or if prequalification is required pursuant to section 44D 3/4, furnish a performance and payment bond of 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:

<table>
<thead>
<tr>
<th>Name</th>
<th>Class of Work</th>
<th>Bid price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Do not give bid price for any class or part thereof furnished by undersigned.]
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.

The undersigned further agrees to be bound to the general contractor by the terms of the hereinbefore described plans, specifications, including all general conditions stated therein, and addenda, and to assume toward him all the obligations and responsibilities that he, by those documents, assumes toward the owner.

The undersigned offers the following information as evidence of his qualifications to perform the work as bid according to all the requirements of the plans and specifications:

1. Have been in business under present business name ______________ years.

2. Ever failed to complete any work awarded? ______________

3. List one or more recent buildings with names of the general contractor and architect on which you served as a sub-contractor for work of similar character as required for the above-named building.

<table>
<thead>
<tr>
<th>Building</th>
<th>Architect</th>
<th>General Contractor</th>
<th>Amount of Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Bank reference _______________________________________________________________________

I. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he will comply fully with all laws and regulations applicable to awards of subcontracts subject to section forty-four F.

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

Date: ____________________________

(Name of Sub Bidder)
BY: ____________________________
(Signature)
(Printed Name and Title of Signatory)
(Business Address)
(City, State Zip)
E-mail address
(Telephone) (FAX)
# BIDDER'S QUALIFICATIONS AND REFERENCES FORM

All questions must be answered, and the data given must be clear and comprehensive. Please type or print legibly. If necessary, add additional sheet for starred items. This information will be utilized by the City for purposes of determining bidder responsiveness and responsibility with regard to the requirements and specifications of the Contract.

1. **FIRM NAME:** __________________________

2. **WHEN ORGANIZED:** __________________________

3. **INCORPORATED?**  
   - YES  
   - NO  
   **DATE AND STATE OF INCORPORATION:** _______________

4. **IS YOUR BUSINESS A MBE?**  
   - YES  
   - NO  
   **WBE?**  
   - YES  
   - NO  
   **MWBE?**  
   - YES  
   - NO

* 5. **LIST ALL CONTRACTS CURRENTLY ON HAND, SHOWING CONTRACT AMOUNT AND ANTICIPATED DATE OF COMPLETION:**  

   __________________________________________________________________________  
   __________________________________________________________________________  
   __________________________________________________________________________  
   __________________________________________________________________________  
   __________________________________________________________________________  

* 6. **HAVE YOU EVER FAILED TO COMPLETE A CONTRACT AWARDED TO YOU?**  
   - YES  
   - NO  
   **IF YES, WHERE AND WHY?**  
   __________________________________________________________________________  

* 7. **HAVE YOU EVER DEFAULTED ON A CONTRACT?**  
   - YES  
   - NO  
   **IF YES, PROVIDE DETAILS.**  
   __________________________________________________________________________  

* 8. **LIST YOUR VEHICLES/EQUIPMENT AVAILABLE FOR THIS CONTRACT:**  

   __________________________________________________________________________  
   __________________________________________________________________________  
   __________________________________________________________________________  
   __________________________________________________________________________  

* 9. **IN THE SPACES FOLLOWING, PROVIDE INFORMATION REGARDING CONTRACTS COMPLETED BY YOUR FIRM SIMILAR IN NATURE TO THE PROJECT BEING BID. A MINIMUM OF FOUR (4) CONTRACTS SHALL BE LISTED. PUBLICLY BID CONTRACTS ARE PREFERRED, BUT NOT MANDATORY.**

   **PROJECT NAME:** __________________________
   **OWNER:** __________________________
   **CITY/STATE:** __________________________
The undersigned certifies that the information contained herein is complete and accurate and hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the City in verification of the recitals comprising this statement of Bidder’s qualifications and experience.

DATE: ____________  BIDDER: ____________________________________________

SIGNATURE: __________________________________________________________

PRINTED NAME: __________________________________ TITLE: __________________

END OF SECTION
CERTIFICATE OF NON-COLLUSION

The undersigned certifies under penalties of perjury that this bid or proposal has been made and submitted in good faith and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the word “person” shall mean any natural person, business, partnership, corporation, union, committee club, or other organization, entity, or group or individuals.

________________________________________
(Signature of individual)

________________________________________
Name of Business
Date

Vendor

Re: Debarment Letter for Invitation For Bid #15-37

As a potential vendor on the above contract, the City requires that you provide a debarment/suspension certification indicating that you are in compliance with the below Federal Executive Order. Certification can be done by completing and signing this form.

PART 1 - Debarment:

Federal Executive Order (E.O.) 12549 “Debarment and Suspension“ requires that all contractors receiving individual awards, using federal funds, and all sub-recipients certify that the organization and its principals are not debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency from doing business with the Federal Government.

I hereby certify under pains and penalties of perjury that neither I nor any principal(s) of the Company identified below is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency.

__________________________________________ (Name)
__________________________________________ (Company)
_____________________________ (Address)
_____________________________ (Address)

PHONE ________________ FAX __________________

EMAIL __________________

__________________________________________ Signature

_____________________________ Date

If you have questions, please contact Nicholas Read, Chief Procurement Officer at (617) 796-1220.
Part I  Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on Line 1 to avoid backup withholding. For individuals, this is your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see How to get a TIN on page 3.

Note: If the account is in more than one name, see the chart on page 4 for guidelines on whose number to enter.

Part II  Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and
3. I am a U.S. citizen or other U.S. person (defined below).

Certification instructions: You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply.

For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the Certification, but you must provide your correct TIN. See the instructions on page 4.

Sign Here

Signature of U.S. person

Date

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Purpose of Form

A person who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) to report, for example, income paid to you, real estate transactions, mortgage interest you paid, acquisition or abandonment of secured property, cancellation of debt, or contributions you made to an IRA.

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN to the person requesting it (the requester) and, when applicable, to:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),
2. Certify that you are not subject to backup withholding, or
3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income.

Note: If a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

• An individual who is a U.S. citizen or U.S. resident alien,
• A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States,
• An estate (other than a foreign estate), or
• A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax on any foreign partners' share of income from such business. Further, in certain cases where a Form W-9 has not been received, a partnership is required to presume that a partner is a foreign person, and pay the withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid withholding on your share of partnership income.

The person who gives Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States is in the following cases:

• The U.S. owner of a disregarded entity and not the entity,

Cata No. 10237X  Form W-9 (Rev. 10-2007)
CONTRACT FORMS

The awarded bidder will be required to complete and submit documents substantially similar in form to the following.

These forms may need to be modified on account of changed circumstances, and are provided for informational purposes only.
CITY - CONTRACTOR AGREEMENT

CONTRACT NO. C-

THIS AGREEMENT made this ___ day of ___ in the year Two Thousand and Fourteen by and between the CITY OF NEWTON, a municipal corporation organized and existing under the laws of the Commonwealth of Massachusetts, hereinafter referred to as the CITY, acting through its Chief Procurement Officer, but without personal liability to him, and

hereinafter referred to as the CONTRACTOR.

The parties hereto for the considerations hereinafter set forth agree as follows:

I. SCOPE OF WORK. The Contractor shall furnish all labor, materials and equipment, and perform all work required in strict accordance with the Contract Documents for the following project:

WABAN HILL COMMUNICATIONS TOWER EQUIPMENT BUILDING

II. CONTRACT DOCUMENTS. The Contract documents consist of the following documents which are either attached to this Agreement or are incorporated herein by referenced:

a. This CITY-CONTRACTOR Agreement;

b. The City's Invitation For Bid #15-37 issued by the Purchasing Department;

c. The Project Manual for Waban Hill Communications Tower Equipment Building including the Instructions to Bidders; General Conditions; Special Conditions; MWBE/AA Requirements, Wage Rate Requirements and Wage Rate Schedule(s) including any updated prevailing wage rate schedules if applicable; The Supplementary Special Conditions; General Requirements and Project Specifications; and Drawings, if included or referenced therein;

d. Addenda Number(s)__________;

e. The Bid Response of the CONTRACTOR submitted for this Project and accompanying documents and certifications;

f. Certificate(s) of Insurance and surety bond(s) submitted by the CONTRACTOR in connection with this Project;

g. Duly authorized and executed Amendments, Work Orders, or Change Orders issued by the CITY after execution of this CITY-CONTRACTOR Agreement.

This CITY-CONTRACTOR Agreement, together with the other documents enumerated in this Article, constitute the entire Agreement between the CITY and the CONTRACTOR.

III. PRIORITY OF DOCUMENTS. In the event of inconsistency between the terms of this CITY-CONTRACTOR Agreement and the Project Manual, the terms of this Agreement shall prevail.

IV. APPLICABLE STATUTES. All applicable federal, state and local laws and regulations are incorporated herein by reference and the Contractor agrees to comply with same.
V. CONTRACT TERM. The Contractor shall commence work under this Contract on the date specified in the written notice of the City to proceed and shall be completed not later than August 1, 2015.

VI. AUTHORIZATION OF AND PAYMENT FOR WORK PERFORMED. The execution of this contract does not constitute a notice to proceed or authorization to perform work. No work shall be commenced unless authorized by a written Work Order prepared by City of Newton Public Buildings Department specifying the work to be performed. The Contractor will be paid for work performed in accordance with the provisions contained in the Project Manual and applicable state law.

VII. RESPONSIBILITY FOR THE WORK/INDEMNIFICATION. The Contractor shall take all responsibility for the work, and shall take all precautions for preventing injuries to persons and property in or about the work and shall defend, indemnify and hold the City harmless from all loss, cost, damage or expense arising from injuries to persons or property in or about the work. The Contractor shall be responsible for any damage which may be caused by the failure or insufficiency of any temporary works. He shall effectively protect his work and shall be liable for all damage and loss by delay or otherwise caused by his neglect or failure so to do.

VIII. WARRANTY. Except as may be otherwise provided in the Project Manual, the Contractor shall replace, repair or make good, without cost to the City, any defects or faults arising within one (1) year after date of acceptance of work and materials furnished hereunder (acceptance not to be unreasonably delayed) resulting from imperfect or defective work done or materials furnished by the Contractor.

IX. PATENT INDEMNIFICATION. The Contractor agrees to assume the defense of and shall indemnify and save harmless the City and all persons acting for or on behalf of it from all suits and claims against them, or any of them, arising from or occasioned by the use of any material, equipment or apparatus, or any part thereof which infringes or is alleged to infringe on any patent rights. In case such material, equipment or apparatus, or any part thereof, in any such suit is held to constitute infringement, the Contractor, within a reasonable time, shall at its own expense, and as the City may elect, replace such material, equipment or apparatus with non-infringing material, equipment or apparatus, or remove the material, equipment, or apparatus and refund the sums paid therefor.

X. ASSIGNMENT/SUB CONTRACTING. The Contractor agrees that he will not sell, assign or transfer this Contract or any part thereof or interest therein without the prior written consent of the City.

XI. TERMINATION. If the work to be done under this Contract shall be abandoned, or if this Contract or any part thereof shall be assigned or transferred, without the previous written consent of the City, or if the Contract or any claim hereunder shall be assigned by the Contractor otherwise than as herein specified, or if at any time the City determines that the conditions herein specified as to the rate of progress are not fulfilled, or that the work or any part thereof, is unnecessarily or unreasonably delayed, or that the Contractor has violated any of the provisions of this Contract, the City may terminate this Contract and/or notify the Contractor to discontinue such work or such part thereof as the City may designate, and the City may thereupon by agreement or otherwise, as it may determine, complete the work, or any part thereof; and for such completion the City for itself or for its Contractor may take possession of and use or cause to be used in the completion of the work thereof any of such materials, apparatus, machinery, implements, and tools of every description as may be found upon said work. Termination pursuant to this paragraph shall not entitle the Contractor to any claim for damages on account thereof, nor shall it relieve the Contractor of any liability under this Contract.

XII. GOVERNING LAW. This Contract shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts.

XIII. SEVERABILITY. The provisions of this Contract are severable. If any section, paragraph, clause or provision of this Contract shall be finally adjudicated by a court of competent jurisdiction to be invalid, the remainder of this Contract shall be unaffected by such adjudication and all of the remaining provisions of this Contract shall remain in full force and effect as though such section, paragraph, clause or provision, or any part thereof so adjudicated to be invalid, had not been included herein, unless such remaining provisions, standing alone, are incomplete and incapable of being executed in accordance with the intent of the parties to this Contract.

XIV. AMENDMENTS TO THIS CONTRACT. This Contract may not be amended except in writing executed in the same manner as this CITY-CONTRACTOR Agreement.
IN WITNESS WHEREOF, the parties have caused this instrument to be executed under seal the day and year first above written.

CONTRACTOR

By________________________________
Print Name_________________________
Title ______________________________
Date ________________________________

Affix Corporate Seal Here

CITY OF NEWTON

By________________________________
Chief Procurement Officer
Date______________________________

By________________________________
Commissioner of Public Buildings
Date______________________________

I hereby certify that funds are available in the following account numbers:
38E11506-530202

I further certify that the Mayor, or his designee, is authorized to execute contracts and approve change orders.

By________________________________
Comptroller of Accounts
Date ________________________________

Approved as to Legal Form and Character

By________________________________
Associate City Solicitor
Date ________________________________

CONTRACT APPROVED

By________________________________
Mayor or his designee
Date ________________________________
CERTIFICATE OF AUTHORITY - CORPORATE

1. I hereby certify that I am the Clerk/Secretary of ________________________________
   (insert full name of Corporation)

2. corporation, and that ________________________________
   (insert the name of officer who signed the contract and bonds)

3. is the duly elected ________________________________
   (insert the title of the officer in line 2)

4. of said corporation, and that on ________________________________
   (insert a date that is ON OR BEFORE the date the officer signed the contract and bonds)
   at a duly authorized meeting of the Board of Directors of said corporation, at which all the directors were present or waived notice, it was voted that

5. ________________________________ the ________________________________
   (insert name from line 2) (insert title from line 3)
   of this corporation be and hereby is authorized to execute contracts and bonds in the name and on behalf of said corporation, and affix its Corporate Seal thereto, and such execution of any contract of obligation in this corporation’s name and on its behalf, with or without the Corporate Seal, shall be valid and binding upon this corporation; and that the above vote has not been amended or rescinded and remains in full force and effect as of the date set forth below.

6. ATTEST: ________________________________
   (Signature of Clerk or Secretary)*
   AFFIX CORPORATE
   SEAL HERE

7. Name: ________________________________
   (Please print or type name in line 6)*

8. Date: ________________________________
   (insert a date that is ON OR AFTER the date the officer signed the contract and bonds)

* The name and signature inserted in lines 6 & 7 must be that of the Clerk or Secretary of the corporation.
CERTIFICATION OF TAX COMPLIANCE

Pursuant to M.G.L. c.62C, §49A and requirements of the City, the undersigned acting on behalf of the Contractor certifies under the penalties of perjury that the Contractor is in compliance with all laws of the Commonwealth relating to taxes including payment of all local taxes, fees, assessments, betterments and any other local or municipal charges (unless the Contractor has a pending abatement application or has entered into a payment agreement with the entity to which such charges were owed), reporting of employees and contractors, and withholding and remitting child support.*

**Signature of Individual or Corporate Contractor (Mandatory)**

Print Name: ___________________________

By: ________________________________

Corporate Officer (Mandatory, if applicable)

Date: ______________________________

*** Contractor's Social Security Number (Voluntary) or Federal Identification Number

Print Name: ___________________________

* The provision in this Certification relating to child support applies only when the Contractor is an individual.

** Approval of a contract or other agreement will not be granted until the City receives a signed copy of this Certification.

*** Your social security number may be furnished to the Massachusetts Department of Revenue to determine whether you have met tax filing or tax payment obligations. Providers who fail to correct their non-filing or delinquency will not have a contract or other agreement issued, renewed, or extended.
CITY OF NEWTON, MASSACHUSETTS

PERFORMANCE BOND

Know All Men By These Presents:

That we, ____________________________, as PRINCIPAL, and _______________________, as SURETY, are held and firmly bound unto the City of Newton as Obligee, in the sum of ____________________ dollars ($__________________) to be paid to the Obligee, for which payments well and truly to be made, we bind ourselves, our respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Whereas, the said PRINCIPAL has made a contract with the Obligee, bearing the date of ____________ 2014, for the construction of _______________________________ in Newton, Massachusetts.

(Project Title)

Now, the condition of this obligation is such that if the PRINCIPAL and all Sub-contractors under said contract shall well and truly keep and perform all the undertakings, covenants, agreements, terms and conditions of said contract on its part to be kept and performed during the original term of said contract and any extensions thereof that may be granted by the Obligee, with or without notice to the SURETY, and during the life and any guarantee required under the contract, and shall also well and truly keep and perform all the undertakings, covenants, agreements, terms and conditions of any and all duly authorized modifications, 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, virtue and effect.

In the event, that the contract is abandoned by the PRINCIPAL, or in the event that the Obligee terminates the employment of the PRINCIPAL or the authority of the PRINCIPAL to continue the work said SURETY hereby further agrees that said SURETY shall, if requested in writing by the Obligee, take such action as is necessary to complete said contract.

In Witness Whereof, the PRINCIPAL and SURETY have hereto set their hands and seals this __ day of __________, 2014.

PRINCIPAL

_______________________________

_______________________________

BY ____________________________

(SEAL)

(ATTORNEY-IN-FACT) (SEAL)

_______________________________

(TITLE)

ATTEST: _________________________

ATTEST: _________________________
CITY OF NEWTON, MASSACHUSETTS
PAYMENT BOND

Know All Men By These Presents:

That we, ____________________________________, as PRINCIPAL, and ________________, as SURETY, are held and firmly bound unto the City of Newton as Obligee, in the sum of ____________________________ dollars ($_________________) to be paid to the Obligee, for which payments well and truly to be made, we bind ourselves, our respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Whereas, the said PRINCIPAL has made a contract with the Obligee, bearing the date of ____________, 2014, for the construction of _____________________________________________ in Newton, Massachusetts.

(Project Title)

Now, the conditions of this obligation are such that if the PRINCIPAL and all Sub-contractors under said contract shall pay for all labor performed or furnished and for all materials used or employed in said contract and in any and all duly authorized modifications, alterations, extensions of time, changes or additions to said contract that may hereafter be made, notice to the SURETY of such modifications, alterations, extensions of time, changes or additions being hereby waived, the foregoing to include any other purposes or items set out in, and to be subject to, provisions of M.G.L. c. 30, sec. 39A, and M.G.L. c. 149 sec. 29, as amended, then this obligation shall become null and void; otherwise it shall remain in full force, virtue and effect.

In Witness Whereof, the PRINCIPAL and SURETY have hereto set their hands and seals this ___day of ________, 2014.

PRINCIPAL
____________________________________

BY_________________________________
(SEAL)

SURETY
____________________________________

BY_________________________________
(ATTOREY-IN-FACT) (SEAL)

>Title)

ATTEST: ___________________________

ATTEST: ___________________________
1.0 DEFINITIONS

1.1 THE CONTRACT DOCUMENTS

The term "Contract Documents" sometimes also referred to as the "Contract", means the contract entered into between the City of Newton (herein after "City") and the Contractor. It includes the Invitation for Bid, General Bid Form, Contract Form, these General Conditions of the Contract, Supplements and Amendments to the General Conditions (if any), Contract Specifications, Drawings, all addenda issued prior to execution of the contract, the Bid Bond, the Labor and Material Payment Bond, or other assurances of completion, the applicable wage rate determinations, and other documents listed in the Agreement and modifications issued after execution of the contract.

1.2 THE WORK

The term "Work", sometimes also referred to as the "Project", means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligation.

1.3 OWNER

The term "Owner" is the City of Newton.

1.4 CONTRACT OFFICER

The term "Contract Officer" means the person appointed by the Owner to administer the terms of the Contract between the Owner and the Contractor, who is also empowered to take certain actions under this Agreement.

1.5 CONTRACTOR

1.5.1 The Contractor, sometimes referred to as the General Contractor, is the person or entity identified as such throughout the Contract Documents as if singular in number. The term Contractor means the Contractor or its authorized representative.

1.5.2 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures, and for coordinating all portions of the Work under the Contract.

1.6 SUBSTANTIAL COMPLETION

The term "Substantial Completion" means the value of the work remaining to be performed by the Contractor is, in the estimate of the awarding authority, less than one percent (1%) of the original contract price.

2.0 CONTRACT ADMINISTRATION

2.1 PRE-CONSTRUCTION CONFERENCE

2.1.1 Prior to commencement of the Work, the Contractor shall meet in conference with representatives of the Owner regarding the Owner's requirements under the Contract for administration of the quality assurance program, safety program, labor provisions, the schedule of work, and other Contract procedures.

2.1.2 The Contractor shall begin work upon receipt of a written Notice to Proceed from the Contract Officer or designee. The Contractor shall not begin work prior to receiving such notice.
2.2 CONTRACT PERIOD

The Contractor shall complete all work required under this contract within the timeframe specified elsewhere in this document, or within the time schedule established in the notice to proceed issued by the Contracting Officer.

2.3 REJECTION OF DEFECTIVE MATERIALS AND WORK

The Owner's inspection of the Work shall not relieve the Contractor of any of its responsibilities to fulfill the Contract obligations, and defective work shall be corrected without cost to the Owner. Unsuitable work may be rejected by the Owner, notwithstanding that such work and materials have been previously overlooked or misjudged by the Owner 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, the Contractor shall forthwith correct such defect in a manner satisfactory to the Owner, and if any material brought upon the site for use in the Work, or selected for the same, shall be rejected by the Owner as unsuitable or not in conformity with the Contract requirements, the Contractor shall forthwith remove such materials from the vicinity of the Work.

2.4 CHANGES

2.4.1 All changes in the work including any increase, decrease, or other equitable adjustment in the Contract price or in the time for performing the Contract, shall be authorized in writing by the Owner and/or Contract Officer prior to commencement.

2.5 CONTRACT PRICE

The Contract Price is stated in the Contract Form, and including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

2.6 APPLICATIONS FOR PAYMENT

2.6.1 Once each month, on a date established by the Owner at the beginning of the Work, the Contractor shall deliver to the Owner an itemized Application for Payment, supported by such data substantiating the Contractor's right to payment as the Owner may require, and reflecting a minimum of 5% retainage until the final acceptance and payment by the Owner.

2.6.2 The Owner shall make payment to the Contractor within 30 days of receipt of said application, less any applicable retainage.

2.6.3 The Owner may make changes in any application for payment submitted by the Contractor for:
   i. Retention based on the value of its claims against the Contractor,
   ii. Retention of 5% of the approved amount of the Application for Payment.

2.7 FINAL PAYMENT

The acceptance by the Contractor of the last payment due under this Contract or the execution of the Final Certificate of Completion, shall operate as a release to the Owner from all claims and liability related to this Contract.

2.8 GUARANTY AND WARRANTY

2.8.1 WARRANTY

The Contractor warrants to the Owner that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

2.8.2 GENERAL GUARANTY

If at any time during the period of one (1) year from the date of Substantial Completion of the Work to be performed under this Contract, any part of the Work shall, in the reasonable determination of the Owner, require replacing or repairing due to the fact that it is broken, defective, or otherwise does not conform to the Contract Documents, the Owner will notify the Contractor to make the required repairs or replacement. If the Contractor shall neglect to commence such repairs or replacement to the satisfaction of the Owner within ten (10) days from the date of giving or mailing such notice, then the Owner may employ other persons to make the same. The Contractor agrees, upon demand, to pay to the Owner all amounts which the Owner expends for...
such repairs or replacements. During this one year guarantee period any corrective work shall be performed in accordance with the applicable terms of this Contract. For items of work completed after use and occupancy has been taken, the one year guarantee shall commence at the time the Owner accepts such items. This one year guarantee shall not limit any express guaranty or warranty provided elsewhere in the Contract.

2.9 INSURANCE REQUIREMENTS

2.9.1 The Contractor shall provide insurance coverage as listed below. This insurance shall be provided at the Contractor's expense and shall be in full force and effect during the full term of this Contract.

WORKER’S COMPENSATION

Worker's Compensation: Per M.G.L. c.. l49, s. 34 and c.. l52 as amended.

COMMERCIAL GENERAL LIABILITY

<table>
<thead>
<tr>
<th>Type</th>
<th>Coverages</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Injury</td>
<td>$500,000 each occurrence</td>
<td>$1,000,000 aggregate</td>
</tr>
<tr>
<td>Property Damage</td>
<td>$500,000 each occurrence</td>
<td>$1,000,000 aggregate</td>
</tr>
</tbody>
</table>

VEHICLE LIABILITY

<table>
<thead>
<tr>
<th>Type</th>
<th>Coverages</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Injury</td>
<td>$500,000 each person</td>
<td>$1,000,000 aggregate</td>
</tr>
<tr>
<td>Property Damage</td>
<td>$300,000 each occurrence</td>
<td>$500,000 aggregate</td>
</tr>
</tbody>
</table>

2.9.2 OWNER AS CO-INSURED

The Owner shall be named as additional insureds on the Contractor's Liability Policies.

2.9.3 CERTIFICATES OF INSURANCE, POLICIES

   i. The Contractor shall not commence the work until proof of compliance with this Section 2.9 has been furnished to the Owner by submitting one copy of a properly endorsed insurance certificate issued by a company authorized to write insurance in the Commonwealth. This certificate shall indicate that the contractual liability coverage is in force.

   ii. The Contractor shall file the original and one certified copy of all policies with the Owner within fifteen (15) days after contract award. If the Owner is damaged by the Contractor's failure to maintain such insurance and to so notify the Owner, then the Contractor shall be responsible for all reasonable costs attributable thereto.

2.9.4 CANCELLATION

Cancellation of any insurance required by this contract, whether by the insurer or the insured, shall not be valid unless written notice thereof is given by the party proposing cancellation to the other party and Owner at least thirty days prior to the effective date thereof, which shall be expressed in said notice.

2.10 INDEMNIFICATION

The Contractor shall take all responsibility for the Work and take all precautions for preventing injuries to persons and property in or about the Work; shall bear all losses resulting to or on account of the amount or character of the Work. The Contractor shall pay or cause payment to be made for all labor performed or furnished and for all materials used or employed in carrying out this Contract. The Contractor shall assume the defense of, and indemnify and save harmless the Owner, and the Owner's officers and agents from all claims relating to labor performed or furnished and materials used or employed for the Work; to inventions, patents and patent rights used in and in doing the Work unless such patent infringement is due to a product or process specified by the Owner; to injuries to any person or corporation received or sustained by or from the Contractor and any employees, and subcontractors and employees, in doing the work, or in consequence of any improper materials, implements or labor used or employed therein; and to any act, omission or neglect of the Contractor and any employees therein.

2.11 BONDS
The Contractor shall provide the Owner with a performance and with a payment or labor and materials bond in the form provided by the Owner, executed by a surety company licensed by the Commonwealth of Massacusetts’ Division of Insurance. Such bond shall be in an amount equal to at least one half of the Contract price unless otherwise stated in the Contract Documents. All bonds shall be accompanied by a current power of attorney.

2.12 TERMINATION

2.12.1 TERMINATION FOR CAUSE

i. The Owner may terminate this contract for cause if it determines that any of the following circumstances have occurred:
   a. The Contractor is adjudged bankrupt or has made a general assignment for the benefit of its creditors.
   b. A receiver has been appointed of the Contractor's property.
   c. All or a part of the Work has been abandoned.
   d. The Contractor 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 provided in the Contract.
   e. The Owner has determined that the rate of progress required on the project is not being met.
   f. The Contractor has substantially violated any provisions of this Contract.

ii. The Owner may complete the Work, or any part thereof, and charge its expense of so completing the Work or part thereof, to the Contractor.

iii. The Owner may take possession of and use any materials, machinery, implements and tools found upon the site of said Work. The Owner shall not be liable for any depreciation, loss or damage to said materials, machinery, implements or tools during said use and the Contractor shall be solely responsible for their removal from the Project site after the Owner has no further use for them.

2.12.2 TERMINATION - NO FAULT

i. In the event that this Contract is terminated by the Owner, prior to the completion of construction and termination is not based on a reason listed in Paragraph 2.12.1, the Contractor shall be compensated for its costs incurred on the Project, including reasonable costs of de-mobilization, covering the period of time between the last approved application for payment and the date of termination.

ii. Payment by the Owner pursuant to Section 2.7 shall be considered to fully compensate the Contractor for all claims and expenses and those of any consultants, subcontractors, and suppliers, directly or indirectly attributable to the termination, including any claims for lost profits.

2.13 PERMITS, FEES, AND NOTICES

2.13.1 The Contractor shall secure and the Owner shall pay for the building permit, if required. The Contractor shall coordinate all efforts required to obtain this permit. All other permits and governmental fees, licenses, and inspections necessary for proper execution and completion of the Work shall be secured and paid for by the Contractor.

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

2.13.3 If the Contractor performs Work that it knows or reasonably should know is contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs.

2.14 SAFETY REQUIREMENTS

2.14.1 The Contractor shall comply with all Federal, State, and local safety laws and regulations applicable to the Work performed under this Contract.

2.15 TEMPORARY HEATING
Not required; do not install Removal & Installation of Gym Flooring in any space which is not heated properly.

2.16 AVAILABILITY AND USE OF UTILITY SERVICES

2.16.1 The City shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the Contract. Unless otherwise provided in the Contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the City or, where the utility is produced by the City, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

2.17 DISPUTES

2.17.1 "Claim," as used in this section, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to the contract. A claim arising under the Contract, unlike a claim relating to the Contract, is a claim that can be resolved under a Contract clause that provides for the relief sought by the claimant. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim. The submission may be converted to a claim by complying with the requirements of this section, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

2.17.2 All disputes arising under or relating to this Contract, including any claims for damages for the alleged breach thereof which are not disposed of by agreement, shall be resolved under this section.

2.17.3 All claims by the Contractor shall be made in writing and submitted to the Contract Officer for a written decision. A claim by the City against the Contractor shall be subject to a written decision by the Contract Officer.

2.17.4 The Contract Officer shall, within thirty (30) days after receipt of the request, decide the claim or notify the Contractor of the date by which the decision will be made.

2.17.5 The Contract Officer's decision shall be final unless the Contractor (1) appeals in writing to a higher level in the City, (2) refers the appeal to an independent mediator or arbitrator, or (3) files suit in a court of competent jurisdiction. Such appeal must be made within thirty (30) days after receipt of the Contract Officer's decision.

2.17.6 The Contractor shall proceed diligently with performance of this Contract and/or any authorized change thereof, pending final resolution of any request for relief, claim, appeal, or action arising under or relating to the Contract and/or any authorized change thereof, and comply with any decision of the Contract Officer.

2.18 LIQUIDATED DAMAGES

2.18.1 If the Contractor fails to complete the Work within the time specified in the contract, or any extension thereof, the Contractor shall pay to the City as liquidated damages, the sum of $250.00 for each day of delay. Completion dates are specified in the Contract for separate phases of the work, and the amount of liquidated damages shall be assessed on each and every phase which is delayed. In the context of this paragraph, “delay” means failure to provide installed and complete Removal & Installation of Gym Flooring on the date required by Peabody Construction, who is the Owner’s Contractor for the Phase 2 Renovation project at Angier Elementary School. To the extent that the Contractor's delay or nonperformance is excused under another section in this Contract, liquidated damages shall not be due the City. The Contractor remains liable for damages caused other than by delay.

2.18.2 If the City terminates the Contractor's right to proceed pursuant to section 2.12.1, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the Work together with any increased costs to the City in completing the Work.

2.18.3 If the City does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the Work is completed or accepted.

3.0 SALES TAX EXEMPTION AND OTHER TAXES
3.0.1 To the extent that materials and supplies are used or incorporated in the performance of this Contract, the Contractor is considered an exempt purchaser under the Massachusetts Sales Act, Chapter 14 of the Acts of 1966.

3.0.2 The Contractor shall be responsible for paying all other taxes and tariffs of any sort, related to the Work.

3.1 PROHIBITION AGAINST LIENS

The Contractor is prohibited from placing a lien on the City's property. This prohibition shall apply to all subcontractors at any tier and all materials suppliers.

3.2 ORDER OF PRECEDENCE

In the event of a conflict between these General Conditions and the Specifications, the General Conditions shall prevail. In the event of a conflict between the Contract and any applicable state or local law or regulation, the state or local law or regulation shall prevail; provided that such state or local law or regulation does not conflict with, or is less restrictive than applicable federal law, regulation, or Executive Order. In the event of such a conflict, applicable federal law, regulation, and Executive Order shall prevail.

3.3 EXAMINATION AND RETENTION OF CONTRACTOR'S RECORDS

The City of Newton shall, until three (3) years after final payment under this Contract, have access to and the right to examine any of the Contractor's directly pertinent books, documents, papers, or other records involving transactions related to this Contract for the purpose of making audit, examination, excerpts, and/or transcriptions.

END OF GENERAL CONDITIONS
INDEX

PAGE #

Article 1 - Method of Paying Subcontractors
(MGL. C.30, s.39F) .................. 33

Article 2 - Method of Paying General Contractors
(MGL. C.30, s.39K) .................. 34

Article 3 - Claims for Unforeseen Conditions
(MGL. C.30, s.39N) ................. 35

Article 4 - Claims for Delay
(MGL. C.30, s.390) ................. 35

Article 5 - Decisions and Approvals by Engineer
or Architect
(MGL. C.30, s.39P) ................. 36

Article 6 - Preference in Employment, Wages
(MGL. C.149, s.26) ................. 36

Article 7 - Hours of Work
(MGL. C.149, s.34) ................. 36

Article 8 - Work by Foreign Corporations
(MGL. C.30, s.39L) ................. 37
Article 1. METHOD OF PAYING SUBCONTRACTORS

(General Laws, Chapter 30, Section 39F as most recently amended by Chapter 450, §76 of the Acts of 1996)

(1.) Every contract awarded pursuant to section forty-four A to L, inclusive, of chapter one hundred and forty-nine shall contain the following subparagraphs (a) through (i) and every contract awarded pursuant to section thirty-nine M of chapter thirty shall contain the following subparagraphs (a) through (h) and in each case those subparagraphs shall be binding between the general contractor and each subcontractor.

(a) Forthwith after the general contractor receives payment on account of a periodic estimate, the general contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by the subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(b) Not later than the sixty-fifth day after each subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the subcontract less amounts retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the awarding authority shall pay that amount to the general contractor. The general contractor shall forthwith pay to the subcontractor the full amount received from the awarding authority less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(c) Each payment made by the awarding authority to the general contractor pursuant to subparagraphs (a) and (b) of this paragraph for the labor performed and the materials furnished by a subcontractor shall be made to the general contractor for the account of that subcontractor, and the awarding authority shall take reasonable steps to compel the general contractor to make each such payment to each such subcontractor. If the awarding authority has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the general contractor or which is to be included in a payment to the general contractor for payment to the subcontractor as provided in subparagraphs (a) and (b), the awarding authority shall act upon the demand as provided in this section.

(d) If, within seventy days after the subcontractor has substantially completed the subcontract work, the subcontractor has not received from the general contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of the balance from the awarding authority. The demand shall be by a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the general contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed prior to the seventieth day after the subcontractor has substantially completed the subcontract work. Within ten days after the subcontractor has delivered or so mailed the demand to the awarding authority and delivered or so mailed a copy to the general contractor, the general contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the awarding authority and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor and of the amount due for each claim made by the general contractor against the subcontractor.

(e) Within fifteen days after receipt of the demand by the awarding authority, but in no event prior to the seventieth day after substantial completion of the subcontract work, the awarding authority shall make direct payment to the subcontractor of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount (i) retained by the awarding authority as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the general contractor in the sworn reply; provided, that the awarding authority shall not deduct form a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph (d). The awarding authority shall make further direct payments to the subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in parts (i) and (ii) of this subparagraph.

(f) The awarding authority shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (e) in an interest-bearing joint account in the names of the general contractor and the subcontractor in a bank in Massachusetts selected by the awarding authority or agreed upon by the general contractor and the subcontractor and shall notify the general contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the
amount in the account, including accrued interest, as provided in an agreement between the general contractor and the subcontractor or as determined by a 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 for accounts in a bank pursuant to subparagraph (f) shall be made out of amounts payable to the general contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later become payable to the general contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the awarding authority to the general contractor to the extent of the such payment.

(h) The awarding authority shall deduct from payments to a general contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (f), are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the general contractor.

(i) If the subcontractor does not receive payment as provided in subparagraph (a) or if the general contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the subcontractor and the subcontractor does not receive payment for same when due less the deductions provided for in subparagraph (a), the subcontractor may demand direct payment by following the procedure in subparagraph (d) and the general contractor may file a sworn reply as provided in that same subparagraph. A demand made after the first day of the month following that for which the subcontractor performed or furnished the labor and materials for which the subcontractor seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the general contractor. Thereafter the awarding authority shall proceed as provided in subparagraph (e), (f), (g) and (h).

**Article 2. METHOD OF PAYING GENERAL CONTRACTORS**


Every contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building by the commonwealth, or by any county, city, town, district, board, commission or other public body, when the amount is more than five thousand dollars in the case of the commonwealth and more than two thousand dollars in the case of any county, city, town, district, board, commission or other public body, shall contain the following paragraph:--Within fifteen days (forty-five days in the case of the commonwealth, including local housing authorities) after receipt from the contractor, at the place designated by the awarding authority if such a place is so designated, of a periodic estimate requesting payment of the amount due for the preceding month, the awarding authority will make a periodic payment to the contractor for the work performed during the preceding month and for the materials not incorporated in the work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the contractor has title or to which a subcontractor has title and has authorized the contractor to transfer title to the awarding authority, less (1) a retention based on its estimate of the fair value of its claims against the contractor and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, and less (3) a retention not exceeding five per cent of the approved amount of the periodic payment. After the receipt of a periodic estimate requesting final payment and within sixty-five days after (a) the contractor fully completes the work or substantially completes the work so that the value of the work remaining to be done is, in the estimate of the awarding authority, less than one per cent of the original contract price, or (b) the contractor substantially completes the work and the awarding authority takes possession for occupancy, whichever occurs first, the awarding authority shall pay the contractor the entire balance due on the contract less (1) a retention based on its estimate of the fair value of its claims against the contractor and of the cost of completing the incomplete and unsatisfactory items of work and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, or based on the record of payments by the contractor to the subcontractors under this contract if such record of payment indicates that the contractor has not paid subcontractors as provided in section thirty-nine F. If the awarding authority fails to make payment as herein provided, there shall be added to each such payment daily interest at the rate of three percentage points above the rediscount rate then charged by the Federal Reserve Bank of Boston commencing on the first day after said payment is due and continuing until the payment is delivered or mailed to the contractor; provided, that no interest shall be due, in any event, on the amount due on a periodic estimate for final payment until fifteen days (twenty-four days in the case of the commonwealth) after receipt of such a periodic estimate from the contractor, at the place designated by the awarding authority if such a place is so designated. The contractor agrees to pay to each subcontractor a portion of any such interest paid in accordance with the amount due each subcontractor.

The awarding authority may make changes in any periodic estimate submitted by the contractor and the payment due on said periodic estimate shall be computed in accordance with the changes so made, but such changes or any requirement for a corrected periodic estimate shall not affect the due date for the periodic payment or the date for the commencement of interest charges on the amount of the periodic payment computed in accordance with the changes made, as provided herein; provided, that the awarding authority may, within seven days after receipt, return to the contractor for correction, any periodic estimate which is not in the
required form or which contains computations not arithmetically correct and, in that event, the date of receipt of such periodic estimate shall be the date of receipt of the corrected periodic estimate in proper form and with arithmetically correct computations. The date of receipt of a periodic estimate received on a Saturday shall be the first working day thereafter. The provisions of section thirty-nine G shall not apply to any contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building to which this section applies.

All periodic estimates shall be submitted to the awarding authority, or to its designee as set forth in writing to the contractor, and the date of receipt by the awarding authority or its designee shall be marked on the estimate. All periodic estimates shall contain a separate item for each filed subtrade and each sub-subtrade listed in sub-bid form as required by specifications and a column listing the amount paid to each subcontractor and sub-subcontractor as of the date the periodic estimate is filed. The person making payment for the awarding authority shall add the daily interest provided for herein to each payment for each day beyond the due date based on the date of receipt marked on the estimate.

A certificate of the architect to the effect that the contractor has fully or substantially completed the work shall, subject to the provisions of section thirty-nine J, be conclusive for the purposes of this section.

Article 3. CLAIMS FOR UNFORESEEN CONDITIONS

(General Laws, Chapter 30, Section 39N as most recently amended by Chapter 774 of the Acts of 1972)

Every contract subject to section forty-four A of chapter one hundred and forty-nine or subject to section thirty-nine M of chapter thirty shall contain the following paragraph in its entirety and an awarding authority may adopt reasonable rules or regulations in conformity with that paragraph concerning the filing, investigation and settlement of such claims:

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.

Article 4. CLAIMS FOR DELAY

(General Laws, Chapter 30, Section 390 as added by Chapter 116 of the Acts of 1973)

Every contract subject to the provisions of section thirty-nine M of this chapter or subject to section forty-four A of chapter one hundred forty-nine shall contain the following provisions (a) and (b) in their entirety and, in the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions (a) and (b) give the general contractor against the awarding authority, but nothing in provisions (a) and (b) shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

(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 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 of 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 of failure to act involved in the claim.

Article 5. DECISIONS AND APPROVALS BY ENGINEER OR ARCHITECT

(General Laws, Chapter 30, Section 39P, as added by Chapter 1164 of the Acts of 1973)

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 6. PREFERENCE IN EMPLOYMENT, WAGES


In the employment of mechanics and apprentices, teamsters, chauffeurs and laborers in the construction of public works by the commonwealth, or by a county, town or district, or by persons contracting or subcontracting for such works, preference shall first be given to citizens of the commonwealth who have been residents of the commonwealth for at least six months at the commencement of their employment who are male veterans as defined in clause Forty-third of section seven of chapter four, 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, and every contract for such work shall contain a provision to this effect. Each county, town or district in the construction of public works, or persons contracting or subcontracting for such works, shall give preference to veterans and citizens who are residents of such county, town or district. The rate per hour of the wages paid to said mechanics and apprentices, teamsters, chauffeurs and laborers in the construction of public works shall not be less than the rate or rates of wages to be determined by the commissioner as hereinafter provided; provided, that the wages paid to laborers employed on said works shall not be less than those paid to laborers in the municipal service of the town or towns where said works are being constructed; provided, further, that where the same public work is to be constructed in two or more towns, the wages paid to laborers shall not be less than those paid to laborers in the municipal service of the town paying the highest rate; provided, further, that if, in any of the towns where the works are to be constructed, a wage rate or wage rates have been established in certain trades and occupations by collective agreements or understandings in the private construction industry between organized labor and employers, the rate or rates to be paid on said works shall not be less than the rates so established, provided, further that in towns where no such rate or rates have been so established, the wages paid to mechanics and apprentices, teamsters, chauffeurs and laborers on public works, shall not be less than the wages paid to the employees in the same trades and occupations by private employers engaged in the construction industry. This section shall also apply to regular employees of the commonwealth or of a county, town or district, when such employees are employed in the construction, addition to or alteration of public buildings for which special appropriation of more than One Thousand Dollars are provided. Payments by employers to health and welfare plans, pension plans and supplementary unemployment benefit plans under collective bargaining agreements or understandings between organized labor and employers shall be included for the purpose of establishing minimum wage rates as herein provided.

Article 7. HOURS OF WORK

(General Laws, Chapter 149 Section 34 as most recently amended by Chapter 552 of the Acts of 1991).

Every contract, except for the purchase of material or supplies, involving the employment of laborers, workmen, mechanics, foremen or inspectors, to which the commonwealth or any county or town, subject to section thirty, is a party, shall contain a stipulation that no laborer, workman, mechanic, foreman or inspector working within the commonwealth, in the employ of the contractor, subcontractor or other person doing or contracting to do the whole or a part of the work contemplated by the contract, 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 case of emergency, or, in case any town subject to section thirty-one is a party to such a contract, more than eight hours in any one day, except as aforesaid, provided, that in contracts entered into by the department of highways for the construction or reconstruction of highways there may be inserted in said stipulation a provision that said department, or any contractor or subcontractor for said department, may employ laborers, workmen, mechanics, foremen and inspectors for more than eight hours in any one day in such construction or reconstruction when, in the opinion of the
commissioner of labor and industries, public necessity so requires. Every such contract not containing the aforesaid stipulation shall be null and void.

Article 8. WORK BY FOREIGN CORPORATIONS

(General Laws, Chapter 30 Section 39L, as most recently amended by Chapter 3 of the Acts of 1967).

The Commonwealth and every county, city, town, district, board, commission or other public body which, as the awarding authority, requests proposals, bids or sub bids for any work in the construction, reconstruction, alteration, remodeling, repair or demolition of any public building or other public works (1) shall not enter into a contract for such work with, and shall not approve as a subcontractor furnishing labor and materials for a part of any such work, a foreign corporation which has not filed with such awarding authority a certificate of the state secretary stating that such corporation has complied with sections three and five of chapter one hundred and eighty-one and the date of such compliance, and (2) shall report to the state secretary and to the department of corporations and taxation any foreign corporation performing work under such contract or subcontract, and any person, other than a corporation, performing work under such contract or subcontract, and residing or having a principal place of business outside the Commonwealth.

END OF SUPPLEMENTAL CONDITIONS
CITY OF NEWTON

WAGE RATE REQUIREMENTS

1. GENERAL

A. This section summarizes the requirements for the payment of wages to laborers and mechanics employed under the Contract.

B. Other duties and requirements of law which may not be specified in this section apply and are inherently a part of the Contract.

2. WAGE RATES

A. The rate per hour to be paid to mechanics, apprentices, teamsters, chauffeurs, and laborers employed on the Work shall not be less than the rate of wages in the attached “Minimum Wage Rates” as determined by the Commissioner of Labor and Industries. This schedule shall continue to be the minimum rate of wages for said employees during the life of this Contract.

B. Keep posted on the site a legible copy of said schedule. Keep on file the wage rates and classifications of labor employed on this Work in order that they may be available for inspection by the Owner, Administrator, or the Architect.

C. Apprentices employed pursuant to this determination of wage rates must be registered and approved by the State Apprenticeship Council wherever rates for journeymen or apprentices are not listed.

D. Pay reserve police officers employed on the Work the prevailing rate of wages paid to regular police officers as required by M.G.L. c149, Sec. 34B, as amended. Such police officers shall be covered by Workmen’s Compensation Insurance and Employers Liability Insurance by the Contractor.

E. The Contractor and all subcontractors shall, on a weekly basis throughout the term of the contract, provide to the City of Newton certified payroll affidavits verifying compliance with M.G.L. c.149, Sec. 27, 27A and 27B. The Contractor is obligated to provide such records to the City directly on a weekly basis. The City may assess a penalty of $100 for each day beyond the required submission date that such records are received, which amount shall be deducted from any amounts to the Contractor from the City. In the event of chronic late submissions, the City shall report the same to the Office of the Attorney General.

F. The Contractor and all subcontractors shall provide a Statement of Compliance within 15 days of the completion of its portion of the work. This statement shall be submitted to the Owner on the form found elsewhere in this section.

G. The Contractor shall maintain accurate and complete records, including payroll records, during the Contract term and for three years thereafter.

END OF SECTION
### 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

<table>
<thead>
<tr>
<th>Awarding Authority:</th>
<th>City of Newton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract Number:</td>
<td>#15-37</td>
</tr>
<tr>
<td>Description of Work:</td>
<td>Waban Hill Communications Tower Equipment Building Work</td>
</tr>
<tr>
<td>Job Location:</td>
<td>2 Manet Road</td>
</tr>
</tbody>
</table>

City/Town: NEWTON

| Date: 10/08/2014 | Wage Request Number: 2014008-018 |

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 Division of Apprentice Standards (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. If an apprentice rate is not listed on the prevailing wage schedule for the trade in which an apprentice is registered with the DAS, the apprentice must be paid the journeyworker's rate for that 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/dole/pw.

- Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.

- Employees not receiving the prevailing wage rate set forth on the wage schedule may report the violation to the Fair Labor Division of the office of the Attorney General at (617) 727-3465.

- Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and criminal penalties.
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Hourly Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2 AXLE) DRIVER - EQUIPMENT</td>
<td>08/01/2014</td>
<td>$32.40</td>
<td>$9.91</td>
<td>$8.89</td>
<td>$0.00</td>
<td>$51.11</td>
</tr>
<tr>
<td>TRAVERSERS JOINT COUNCIL, NO. 10 ZONE A</td>
<td>12/01/2014</td>
<td>$32.40</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$51.64</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$32.75</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$51.99</td>
</tr>
<tr>
<td></td>
<td>08/01/2015</td>
<td>$32.75</td>
<td>$10.41</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$52.49</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$32.75</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$53.24</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$33.25</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$53.74</td>
</tr>
<tr>
<td></td>
<td>08/01/2016</td>
<td>$33.25</td>
<td>$10.91</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$54.24</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$33.25</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$0.00</td>
<td>$55.05</td>
</tr>
<tr>
<td>(3 AXLE) DRIVER - EQUIPMENT</td>
<td>08/01/2014</td>
<td>$32.47</td>
<td>$9.91</td>
<td>$8.89</td>
<td>$0.00</td>
<td>$51.18</td>
</tr>
<tr>
<td>TRAVERSERS JOINT COUNCIL, NO. 10 ZONE A</td>
<td>12/01/2014</td>
<td>$32.47</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$51.71</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$32.82</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$52.06</td>
</tr>
<tr>
<td></td>
<td>08/01/2015</td>
<td>$32.82</td>
<td>$10.41</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$52.56</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$32.82</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$53.31</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$33.32</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$53.81</td>
</tr>
<tr>
<td></td>
<td>08/01/2016</td>
<td>$33.32</td>
<td>$10.91</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$54.31</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$33.32</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$0.00</td>
<td>$55.12</td>
</tr>
<tr>
<td>(4 &amp; 5 AXLE) DRIVER - EQUIPMENT</td>
<td>08/01/2014</td>
<td>$32.59</td>
<td>$9.91</td>
<td>$8.89</td>
<td>$0.00</td>
<td>$51.30</td>
</tr>
<tr>
<td>TRAVERSERS JOINT COUNCIL, NO. 10 ZONE A</td>
<td>12/01/2014</td>
<td>$32.59</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$51.83</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$32.94</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$52.18</td>
</tr>
<tr>
<td></td>
<td>08/01/2015</td>
<td>$32.94</td>
<td>$10.41</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$52.68</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$32.94</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$53.43</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$33.44</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$53.93</td>
</tr>
<tr>
<td></td>
<td>08/01/2016</td>
<td>$33.44</td>
<td>$10.91</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$54.43</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$33.44</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$0.00</td>
<td>$55.24</td>
</tr>
<tr>
<td>ADS/SUBMERSIBLE PILOT</td>
<td>08/01/2014</td>
<td>$87.36</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$115.33</td>
</tr>
<tr>
<td>PIPE DRIVERS LOCAL 96 (ZONE 1)</td>
<td>08/01/2015</td>
<td>$90.51</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$118.48</td>
</tr>
<tr>
<td>AIR TRACK OPERATOR</td>
<td>06/01/2014</td>
<td>$34.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.85</td>
</tr>
<tr>
<td>LABORERS - ZONE 1</td>
<td>12/01/2014</td>
<td>$35.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.60</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$36.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.35</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$37.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.10</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$37.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.85</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$38.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.85</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice - LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASBESTOS REMOVER - PIPE / MECH, EQUIPT,</td>
<td>06/01/2014</td>
<td>$31.58</td>
<td>$10.40</td>
<td>$5.95</td>
<td>$0.00</td>
<td>$47.93</td>
</tr>
<tr>
<td>HEAT &amp; FROST INSULATORS LOCAL 6 (ROSTEX)</td>
<td>12/01/2014</td>
<td>$32.48</td>
<td>$10.40</td>
<td>$5.95</td>
<td>$0.00</td>
<td>$48.83</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$33.43</td>
<td>$10.40</td>
<td>$5.95</td>
<td>$0.00</td>
<td>$49.78</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$34.38</td>
<td>$10.40</td>
<td>$5.95</td>
<td>$0.00</td>
<td>$50.73</td>
</tr>
<tr>
<td>ASPHALT RACKER</td>
<td>06/01/2014</td>
<td>$34.25</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.35</td>
</tr>
<tr>
<td>LABORERS - ZONE 1</td>
<td>12/01/2014</td>
<td>$35.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.10</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$35.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.85</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$36.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.60</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$37.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.35</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$38.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.35</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice - LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Effective Date</td>
<td>Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
<td>Total Rate</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>----------------</td>
<td>-----------</td>
<td>--------</td>
<td>---------</td>
<td>----------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2014</td>
<td>$41.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$65.69</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$42.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$66.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$43.24</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$67.44</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$44.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$68.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$45.24</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$69.44</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$46.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$70.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$47.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$71.69</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$48.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$72.69</td>
</tr>
<tr>
<td>For operations rates see &quot;Apprentice- OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BACKHOE/Front-End Loader</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2014</td>
<td>$41.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$65.69</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$42.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$66.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$43.24</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$67.44</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$44.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$68.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$45.24</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$69.44</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$46.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$70.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$47.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$71.69</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$48.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$72.69</td>
</tr>
<tr>
<td>For operations rates see &quot;Apprentice- OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARCO-Type Jumping Tamper</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LABORERS - ZONE 1</td>
<td>06/01/2014</td>
<td>$34.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.35</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$35.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.10</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$35.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.85</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$36.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.60</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$37.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.35</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$38.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.35</td>
</tr>
<tr>
<td>For operations rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BLOCK Paver, Rammer / Curb Setter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LABORERS - ZONE 1</td>
<td>06/01/2014</td>
<td>$34.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.85</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$35.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.60</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$36.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.35</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$37.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.10</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$37.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.85</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$38.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.85</td>
</tr>
<tr>
<td>For operations rates see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOILER MAKER</td>
<td>01/01/2010</td>
<td>$37.70</td>
<td>$6.97</td>
<td>$11.18</td>
<td>$0.00</td>
<td>$55.85</td>
</tr>
</tbody>
</table>

Issue Date: 10/08/2014  Wage Request Number: 20140008-018  Page 3 of 41
### Apprentice - BRICK/PLASTER/CEMENT MAISON - Local 3 Newton

**Effective Date:** 08/01/2014

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$24.48</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$52.88</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$29.38</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$57.78</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$34.27</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$62.67</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$39.17</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$67.57</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$44.06</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$72.46</td>
</tr>
</tbody>
</table>

**Effective Date:** 02/01/2015

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$24.76</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$53.16</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$29.71</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$58.11</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$34.66</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$63.06</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$39.62</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$68.02</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$44.57</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$72.97</td>
</tr>
</tbody>
</table>

**Notes:**

Apprentice to Journeymen Ratio: 1:5
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Basic Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BULLDOZER/GRADER/SCRAPER OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2014</td>
<td>$41.10</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$75.30</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$42.09</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$76.29</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$42.83</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$77.08</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$44.07</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$78.27</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$44.82</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$79.02</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$46.05</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$79.25</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$47.04</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$78.21</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$48.03</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$78.23</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- OPERATING ENGINEER".

| CAISSON & UNDERPINNING BOTTOM MAN LABORERS - FOUNDATION AND MARINE | 06/01/2014 | $35.20 | $7.30 | $12.90 | $0.00 | $55.40 |
| | 12/01/2014 | $35.95 | $7.30 | $12.90 | $0.00 | $56.15 |
| | 06/01/2015 | $36.70 | $7.30 | $12.90 | $0.00 | $56.90 |
| | 12/01/2015 | $37.45 | $7.30 | $12.90 | $0.00 | $57.60 |
| | 06/01/2016 | $38.20 | $7.30 | $12.90 | $0.00 | $58.40 |
| | 12/01/2016 | $39.20 | $7.30 | $12.90 | $0.00 | $59.40 |

For apprentice rates see "Apprentice- LABORER".

| CAISSON & UNDERPINNING LABORER LABORERS - FOUNDATION AND MARINE | 06/01/2014 | $34.05 | $7.30 | $12.90 | $0.00 | $54.25 |
| | 12/01/2014 | $34.80 | $7.30 | $12.90 | $0.00 | $55.00 |
| | 06/01/2015 | $35.55 | $7.30 | $12.90 | $0.00 | $55.75 |
| | 12/01/2015 | $36.30 | $7.30 | $12.90 | $0.00 | $56.50 |
| | 06/01/2016 | $37.05 | $7.30 | $12.90 | $0.00 | $57.25 |
| | 12/01/2016 | $38.05 | $7.30 | $12.90 | $0.00 | $58.25 |

For apprentice rates see "Apprentice- LABORER".

| CAISSON & UNDERPINNING TOP MAN LABORERS - FOUNDATION AND MARINE | 06/01/2014 | $34.05 | $7.30 | $12.90 | $0.00 | $54.25 |
| | 12/01/2014 | $34.80 | $7.30 | $12.90 | $0.00 | $55.00 |
| | 06/01/2015 | $35.55 | $7.30 | $12.90 | $0.00 | $55.75 |
| | 12/01/2015 | $36.30 | $7.30 | $12.90 | $0.00 | $56.50 |
| | 06/01/2016 | $37.05 | $7.30 | $12.90 | $0.00 | $57.25 |
| | 12/01/2016 | $38.05 | $7.30 | $12.90 | $0.00 | $58.25 |

For apprentice rates see "Apprentice- LABORER".

| CARBIDE CORE DRILL OPERATOR LABORERS - ZONE 2 | 06/01/2014 | $34.35 | $7.30 | $12.70 | $0.00 | $54.35 |
| | 12/01/2014 | $35.10 | $7.30 | $12.70 | $0.00 | $55.10 |
| | 06/01/2015 | $35.85 | $7.30 | $12.70 | $0.00 | $55.85 |
| | 12/01/2015 | $36.60 | $7.30 | $12.70 | $0.00 | $56.60 |
| | 06/01/2016 | $37.35 | $7.30 | $12.70 | $0.00 | $57.35 |
| | 12/01/2016 | $38.35 | $7.30 | $12.70 | $0.00 | $58.35 |

For apprentice rates see "Apprentice- LABORER".

| CARPENTER CARPENTERS - ZONE 2 (Eastern Massachusetts) | 09/01/2014 | $35.35 | $9.80 | $16.11 | $0.00 | $61.26 |
| | 03/01/2015 | $36.12 | $9.80 | $16.11 | $0.00 | $62.03 |
### Apprentice - Carpenter - Zone 2 Eastern MA

#### Effective Date: 09/01/2014

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$17.68</td>
<td>$9.80</td>
<td>$1.57</td>
<td>$0.00</td>
<td>$29.05</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$21.21</td>
<td>$9.80</td>
<td>$1.57</td>
<td>$0.00</td>
<td>$32.58</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$24.75</td>
<td>$9.80</td>
<td>$11.40</td>
<td>$0.00</td>
<td>$45.95</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>$26.51</td>
<td>$9.80</td>
<td>$11.40</td>
<td>$0.00</td>
<td>$47.71</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>$28.28</td>
<td>$9.80</td>
<td>$12.97</td>
<td>$0.00</td>
<td>$51.05</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$28.28</td>
<td>$9.80</td>
<td>$12.97</td>
<td>$0.00</td>
<td>$51.05</td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>$31.82</td>
<td>$9.80</td>
<td>$14.54</td>
<td>$0.00</td>
<td>$56.16</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$31.82</td>
<td>$9.80</td>
<td>$14.54</td>
<td>$0.00</td>
<td>$56.16</td>
</tr>
</tbody>
</table>

#### Effective Date: 03/01/2015

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$18.06</td>
<td>$9.80</td>
<td>$1.57</td>
<td>$0.00</td>
<td>$29.43</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$21.67</td>
<td>$9.80</td>
<td>$1.57</td>
<td>$0.00</td>
<td>$33.04</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$25.28</td>
<td>$9.80</td>
<td>$11.40</td>
<td>$0.00</td>
<td>$46.48</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>$27.89</td>
<td>$9.80</td>
<td>$11.40</td>
<td>$0.00</td>
<td>$48.29</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>$28.90</td>
<td>$9.80</td>
<td>$12.97</td>
<td>$0.00</td>
<td>$51.67</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$28.90</td>
<td>$9.80</td>
<td>$12.97</td>
<td>$0.00</td>
<td>$51.67</td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>$32.51</td>
<td>$9.80</td>
<td>$14.54</td>
<td>$0.00</td>
<td>$56.85</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$32.51</td>
<td>$9.80</td>
<td>$14.54</td>
<td>$0.00</td>
<td>$56.85</td>
</tr>
</tbody>
</table>

**Notes:**

Apprentice to Journeyworker Ratio: 1:5

**CEMENT MASONRY/PLASTERING**

<table>
<thead>
<tr>
<th></th>
<th>07/01/2014</th>
<th>$43.77</th>
<th>$10.90</th>
<th>$18.71</th>
<th>$1.30</th>
<th>$74.68</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/01/2015</td>
<td>$44.69</td>
<td>$10.90</td>
<td>$18.71</td>
<td>$1.30</td>
<td>$75.60</td>
<td></td>
</tr>
<tr>
<td>07/01/2015</td>
<td>$45.29</td>
<td>$10.90</td>
<td>$18.71</td>
<td>$1.30</td>
<td>$76.20</td>
<td></td>
</tr>
<tr>
<td>01/01/2016</td>
<td>$46.21</td>
<td>$10.90</td>
<td>$18.71</td>
<td>$1.30</td>
<td>$77.12</td>
<td></td>
</tr>
</tbody>
</table>

**Issue Date:** 10/06/2014  
**Wage Request Number:** 20141008-018

---

Project Manual #15-37 – Waban Hill Communications Tower Equipment Building

Page 44 of 84
### Apprentice - CEMENT MASONRY/PLASTERING - Eastern Mass (Newton)

**Effective Date:** 07/01/2014

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$21.89</td>
<td>$10.90</td>
<td>$12.21</td>
<td>$1.30</td>
<td>$46.30</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$26.26</td>
<td>$10.90</td>
<td>$13.71</td>
<td>$1.30</td>
<td>$52.17</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$28.43</td>
<td>$10.90</td>
<td>$14.71</td>
<td>$1.30</td>
<td>$55.36</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$30.64</td>
<td>$10.90</td>
<td>$15.71</td>
<td>$1.30</td>
<td>$58.55</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>$32.83</td>
<td>$10.90</td>
<td>$16.71</td>
<td>$1.30</td>
<td>$61.74</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$35.02</td>
<td>$10.90</td>
<td>$17.71</td>
<td>$1.30</td>
<td>$64.93</td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>$39.39</td>
<td>$10.90</td>
<td>$18.71</td>
<td>$1.30</td>
<td>$70.30</td>
</tr>
</tbody>
</table>

**Effective Date:** 01/01/2015

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$22.35</td>
<td>$10.90</td>
<td>$12.21</td>
<td>$1.30</td>
<td>$46.76</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$26.81</td>
<td>$10.90</td>
<td>$13.71</td>
<td>$1.30</td>
<td>$53.21</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$29.05</td>
<td>$10.90</td>
<td>$14.71</td>
<td>$1.30</td>
<td>$55.96</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$31.28</td>
<td>$10.90</td>
<td>$15.71</td>
<td>$1.30</td>
<td>$59.19</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>$33.52</td>
<td>$10.90</td>
<td>$16.71</td>
<td>$1.30</td>
<td>$62.43</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$35.73</td>
<td>$10.90</td>
<td>$17.71</td>
<td>$1.30</td>
<td>$65.66</td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>$40.22</td>
<td>$10.90</td>
<td>$18.71</td>
<td>$1.30</td>
<td>$71.13</td>
</tr>
</tbody>
</table>

**Notes:**
- Steps 3,4 are 500 hrs. All other steps are 1,000 hrs.

---

**CHAIN SAW OPERATOR**

<table>
<thead>
<tr>
<th>LABORER - BORE 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
</tr>
<tr>
<td>12/01/2014</td>
</tr>
<tr>
<td>06/01/2015</td>
</tr>
<tr>
<td>12/01/2015</td>
</tr>
<tr>
<td>06/01/2016</td>
</tr>
<tr>
<td>12/01/2016</td>
</tr>
</tbody>
</table>

**For apprentice rates see "Apprentice-LABORER"**

---

**CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES**

<table>
<thead>
<tr>
<th>OPERATING ENGINEERS LOCAL 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
</tr>
<tr>
<td>12/01/2014</td>
</tr>
<tr>
<td>06/01/2015</td>
</tr>
<tr>
<td>12/01/2015</td>
</tr>
<tr>
<td>06/01/2016</td>
</tr>
<tr>
<td>12/01/2016</td>
</tr>
<tr>
<td>06/01/2017</td>
</tr>
<tr>
<td>12/01/2017</td>
</tr>
</tbody>
</table>

**For apprentice rates see "Apprentice-OPERATING ENGINEERS"**

---

**Issue Date:** 10/08/2014  
**Wage Request Number:** 2014-0908-018  
Page 7 of 41
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPressor OPERATOR OPERATING ENGINEERS LOCAL 1</td>
<td>06/01/2014</td>
<td>$28.80</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$33.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$29.50</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$33.70</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$30.02</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$34.22</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$30.89</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$35.09</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$31.41</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$35.61</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$32.28</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$36.48</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$32.97</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$37.17</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$33.66</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$37.86</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice Operating Engineers"

<table>
<thead>
<tr>
<th>DELEADER (BRIDGE) PAINTERS LOCAL 35-ZONE 1</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/01/2014</td>
<td>$46.76</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$70.71</td>
<td></td>
</tr>
<tr>
<td>01/01/2015</td>
<td>$47.66</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$71.61</td>
<td></td>
</tr>
<tr>
<td>07/01/2015</td>
<td>$48.56</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$72.51</td>
<td></td>
</tr>
<tr>
<td>01/01/2016</td>
<td>$49.51</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$73.46</td>
<td></td>
</tr>
<tr>
<td>07/01/2016</td>
<td>$50.46</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$74.41</td>
<td></td>
</tr>
<tr>
<td>01/01/2017</td>
<td>$51.41</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$75.36</td>
<td></td>
</tr>
</tbody>
</table>

### Apprentice - PAINTER Local 35 - BRIDGES/TANKS

#### Effective Date - 07/01/2014

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$23.28</td>
<td>$7.85</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$31.23</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$25.72</td>
<td>$7.85</td>
<td>$3.66</td>
<td>$0.00</td>
<td>$37.23</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$28.86</td>
<td>$7.85</td>
<td>$3.99</td>
<td>$0.00</td>
<td>$39.90</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$30.39</td>
<td>$7.85</td>
<td>$4.32</td>
<td>$0.00</td>
<td>$42.56</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$32.73</td>
<td>$7.85</td>
<td>$14.11</td>
<td>$0.00</td>
<td>$54.69</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$35.07</td>
<td>$7.85</td>
<td>$14.44</td>
<td>$0.00</td>
<td>$57.36</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$37.41</td>
<td>$7.85</td>
<td>$14.77</td>
<td>$0.00</td>
<td>$60.03</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$42.08</td>
<td>$7.85</td>
<td>$15.44</td>
<td>$0.00</td>
<td>$65.37</td>
</tr>
</tbody>
</table>

#### Effective Date - 01/04/2015

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$23.83</td>
<td>$7.85</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$31.68</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$26.21</td>
<td>$7.85</td>
<td>$3.66</td>
<td>$0.00</td>
<td>$37.72</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$28.69</td>
<td>$7.85</td>
<td>$3.99</td>
<td>$0.00</td>
<td>$40.44</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$30.98</td>
<td>$7.85</td>
<td>$4.32</td>
<td>$0.00</td>
<td>$43.15</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$33.36</td>
<td>$7.85</td>
<td>$14.11</td>
<td>$0.00</td>
<td>$55.32</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$35.75</td>
<td>$7.85</td>
<td>$14.44</td>
<td>$0.00</td>
<td>$58.04</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$38.13</td>
<td>$7.85</td>
<td>$14.77</td>
<td>$0.00</td>
<td>$60.75</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$42.89</td>
<td>$7.85</td>
<td>$15.44</td>
<td>$0.00</td>
<td>$66.18</td>
</tr>
</tbody>
</table>

#### Notes:
- Steps are 750 hrs.
- Apprentice to Journeyworker Ratio: 1:1

Issue Date: 10/08/2014
Wage Request Number: 20141008-018
Page 8 of 41
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEMO: ADZEBIAN</td>
<td>06/01/2014</td>
<td>$34.25</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.25</td>
</tr>
<tr>
<td>LABORERS - ZONE 4</td>
<td>12/01/2014</td>
<td>$35.00</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$35.75</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.75</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$36.50</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.50</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice-LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMO: BACKHOE/LOADER/HAMMER OPERATOR</td>
<td>06/01/2014</td>
<td>$35.25</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.25</td>
</tr>
<tr>
<td>LABORERS - ZONE 4</td>
<td>12/01/2014</td>
<td>$36.00</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$36.75</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.75</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$37.50</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.50</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice-LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMO: BURNERS</td>
<td>06/01/2014</td>
<td>$35.00</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.00</td>
</tr>
<tr>
<td>LABORERS - ZONE 4</td>
<td>12/01/2014</td>
<td>$35.75</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.75</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$36.50</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.50</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$37.25</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.25</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice-LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMO: CONCRETE CUTTER/SAWYER</td>
<td>06/01/2014</td>
<td>$35.25</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.25</td>
</tr>
<tr>
<td>LABORERS - ZONE 4</td>
<td>12/01/2014</td>
<td>$36.00</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$36.75</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.75</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$37.50</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.50</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice-LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMO: JACKHAMMER OPERATOR</td>
<td>06/01/2014</td>
<td>$35.00</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.00</td>
</tr>
<tr>
<td>LABORERS - ZONE 4</td>
<td>12/01/2014</td>
<td>$35.75</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.75</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$36.50</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.50</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$37.25</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.25</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice-LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMO: WRECKING LABORER</td>
<td>06/01/2014</td>
<td>$34.25</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.25</td>
</tr>
<tr>
<td>LABORERS - ZONE 4</td>
<td>12/01/2014</td>
<td>$35.00</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.00</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$35.75</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.75</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$36.50</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.50</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice-LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIRECTIONAL DRELL MACHINE OPERATOR</td>
<td>06/01/2014</td>
<td>$41.10</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$65.30</td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td>12/01/2014</td>
<td>$42.09</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$66.29</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$42.83</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$67.03</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$44.07</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$68.27</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$44.82</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$69.02</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$46.05</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$70.25</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$47.04</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$71.24</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$48.03</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$72.23</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice-OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIVER</td>
<td>08/01/2014</td>
<td>$58.24</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$86.21</td>
</tr>
<tr>
<td>PILE DRIVER LOCAL 56 (ZONE 1)</td>
<td>08/01/2015</td>
<td>$69.34</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$88.31</td>
</tr>
<tr>
<td>DIVER TENDER</td>
<td>08/01/2014</td>
<td>$41.50</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$69.57</td>
</tr>
<tr>
<td>PILE DRIVER LOCAL 56 (ZONE 1)</td>
<td>08/01/2015</td>
<td>$43.10</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$71.07</td>
</tr>
<tr>
<td>DIVER TENDER</td>
<td>08/01/2014</td>
<td>$62.40</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$89.37</td>
</tr>
<tr>
<td>EFFLUENT</td>
<td>08/01/2015</td>
<td>$64.65</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$92.62</td>
</tr>
<tr>
<td>DIVER/SLURRY</td>
<td>08/01/2014</td>
<td>$87.36</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$115.33</td>
</tr>
<tr>
<td>EFFLUENT</td>
<td>08/01/2015</td>
<td>$90.51</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$118.48</td>
</tr>
</tbody>
</table>

Issue Date: 10/08/2014  Wage Request Number: 20141008-018
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAWBRIDGE OPERATOR (Construction)</td>
<td>09/01/2014</td>
<td>$44.79</td>
<td>$13.00</td>
<td>$15.04</td>
<td>$0.00</td>
<td>$72.83</td>
</tr>
<tr>
<td></td>
<td>03/01/2015</td>
<td>$45.23</td>
<td>$13.00</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$73.57</td>
</tr>
<tr>
<td></td>
<td>09/01/2015</td>
<td>$46.32</td>
<td>$13.00</td>
<td>$15.43</td>
<td>$0.00</td>
<td>$74.56</td>
</tr>
<tr>
<td></td>
<td>03/01/2016</td>
<td>$47.08</td>
<td>$13.00</td>
<td>$15.46</td>
<td>$0.00</td>
<td>$75.54</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice: ELECTRICIAN"

| ELECTRICIAN                           | 09/01/2014     | $44.79    | $13.00 | $15.04  | $0.00                     | $72.83     |
|                                        | 03/01/2015     | $45.23    | $13.00 | $15.40  | $0.00                     | $73.57     |
|                                        | 09/01/2015     | $46.32    | $13.00 | $15.43  | $0.00                     | $74.56     |
|                                        | 03/01/2016     | $47.08    | $13.00 | $15.46  | $0.00                     | $75.54     |

### Apprentice - ELECTRICIAN - Local 103

#### Effective Date: 09/01/2014

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40</td>
<td>$17.92</td>
<td>$13.00</td>
<td>$0.54</td>
<td>$0.00</td>
<td>$31.46</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>$17.92</td>
<td>$13.00</td>
<td>$0.54</td>
<td>$0.00</td>
<td>$31.46</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>$20.16</td>
<td>$13.00</td>
<td>$11.33</td>
<td>$0.00</td>
<td>$44.49</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
<td>$20.16</td>
<td>$13.00</td>
<td>$11.33</td>
<td>$0.00</td>
<td>$44.49</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>$22.40</td>
<td>$13.00</td>
<td>$11.67</td>
<td>$0.00</td>
<td>$47.07</td>
</tr>
<tr>
<td>6</td>
<td>55</td>
<td>$24.63</td>
<td>$13.00</td>
<td>$12.01</td>
<td>$0.00</td>
<td>$49.64</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
<td>$26.87</td>
<td>$13.00</td>
<td>$12.35</td>
<td>$0.00</td>
<td>$32.22</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
<td>$29.11</td>
<td>$13.00</td>
<td>$12.68</td>
<td>$0.00</td>
<td>$54.79</td>
</tr>
<tr>
<td>9</td>
<td>70</td>
<td>$31.35</td>
<td>$13.00</td>
<td>$13.02</td>
<td>$0.00</td>
<td>$57.37</td>
</tr>
<tr>
<td>10</td>
<td>75</td>
<td>$33.59</td>
<td>$13.00</td>
<td>$13.36</td>
<td>$0.00</td>
<td>$59.95</td>
</tr>
</tbody>
</table>

#### Effective Date: 03/01/2015

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40</td>
<td>$18.97</td>
<td>$13.00</td>
<td>$0.54</td>
<td>$0.00</td>
<td>$31.61</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>$18.97</td>
<td>$13.00</td>
<td>$0.54</td>
<td>$0.00</td>
<td>$31.61</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>$20.33</td>
<td>$13.00</td>
<td>$11.63</td>
<td>$0.00</td>
<td>$44.96</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
<td>$20.33</td>
<td>$13.00</td>
<td>$11.63</td>
<td>$0.00</td>
<td>$44.96</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>$22.59</td>
<td>$13.00</td>
<td>$11.97</td>
<td>$0.00</td>
<td>$47.56</td>
</tr>
<tr>
<td>6</td>
<td>55</td>
<td>$24.84</td>
<td>$13.00</td>
<td>$12.32</td>
<td>$0.00</td>
<td>$50.16</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
<td>$27.10</td>
<td>$13.00</td>
<td>$12.66</td>
<td>$0.00</td>
<td>$52.76</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
<td>$29.36</td>
<td>$13.00</td>
<td>$13.00</td>
<td>$0.00</td>
<td>$55.36</td>
</tr>
<tr>
<td>9</td>
<td>70</td>
<td>$31.62</td>
<td>$13.00</td>
<td>$13.34</td>
<td>$0.00</td>
<td>$57.96</td>
</tr>
<tr>
<td>10</td>
<td>75</td>
<td>$33.88</td>
<td>$13.00</td>
<td>$13.69</td>
<td>$0.00</td>
<td>$60.57</td>
</tr>
</tbody>
</table>

---

**Notes:**

- App Prior 1/1/03; 30/36/40/45/50/55/65/70/75/80
- Apprentices to Journeyworker Ratios: 2:3

---

**Issue Date:** 10/08/2014

**Wage Request Number:** 20141008-018
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Effective Date</th>
<th>Date Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice - RADIATOR CONSTRUCTOR - Local 4</td>
<td>01/01/2012</td>
<td>Apprentice Date</td>
<td>$26.23</td>
<td>$8.78</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$35.01</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$28.85</td>
<td>$8.78</td>
<td>$6.96</td>
<td>$0.00</td>
<td>$44.59</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$34.09</td>
<td>$8.78</td>
<td>$6.96</td>
<td>$0.00</td>
<td>$49.83</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$36.72</td>
<td>$8.78</td>
<td>$6.96</td>
<td>$0.00</td>
<td>$52.46</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>$41.96</td>
<td>$8.78</td>
<td>$6.96</td>
<td>$0.00</td>
<td>$57.70</td>
<td></td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apprentice to Journeyworker Ratio 1:1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Effective Date</th>
<th>Date Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELEVATOR CONSTRUCTOR HELPER</td>
<td>01/01/2012</td>
<td>$38.99</td>
<td>$8.78</td>
<td>$6.96</td>
<td>$0.00</td>
<td>$54.33</td>
<td></td>
</tr>
<tr>
<td>ELEVATOR CONSTRUCTORS LOCAL 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For apprentice rates use &quot;Apprentice - ELEVATOR CONSTRUCTOR&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Effective Date</th>
<th>Date Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FENCE &amp; GUARD RAIL ERECTOR</td>
<td>06/01/2014</td>
<td>$34.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.35</td>
<td></td>
</tr>
<tr>
<td>LACROSSE - ZONE 1</td>
<td>12/01/2014</td>
<td>$35.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$35.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$36.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$37.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$38.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.35</td>
<td></td>
</tr>
<tr>
<td>For apprentice rates use &quot;Apprentice - LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Effective Date</th>
<th>Date Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIELD ENG INST. PERSON-BLDG, SITE, HIGHWAY</td>
<td>05/01/2014</td>
<td>$38.87</td>
<td>$10.00</td>
<td>$14.18</td>
<td>$0.00</td>
<td>$63.03</td>
<td></td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For apprentice rates use &quot;Apprentice - OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Effective Date</th>
<th>Date Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIELD ENG PARTY CHIEF-BLDG, SITE, HIGHWAY</td>
<td>05/01/2014</td>
<td>$40.29</td>
<td>$10.00</td>
<td>$14.18</td>
<td>$0.00</td>
<td>$64.47</td>
<td></td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For apprentice rates use &quot;Apprentice - OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Effective Date</th>
<th>Date Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIELD ENG PRO PERSON-BLDG, SITE, HIGHWAY</td>
<td>05/01/2014</td>
<td>$20.92</td>
<td>$10.00</td>
<td>$14.18</td>
<td>$0.00</td>
<td>$45.10</td>
<td></td>
</tr>
<tr>
<td>OPERATING ENGINEERS LOCAL 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For apprentice rates use &quot;Apprentice - OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Effective Date</th>
<th>Date Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRE ALARM INSTALLER</td>
<td>09/01/2014</td>
<td>$44.79</td>
<td>$13.00</td>
<td>$15.04</td>
<td>$0.00</td>
<td>$72.83</td>
<td></td>
</tr>
<tr>
<td>ELECTRICIANS LOCAL 103</td>
<td>03/01/2015</td>
<td>$45.17</td>
<td>$13.00</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$73.57</td>
<td></td>
</tr>
<tr>
<td></td>
<td>09/01/2015</td>
<td>$46.13</td>
<td>$13.00</td>
<td>$15.43</td>
<td>$0.00</td>
<td>$74.56</td>
<td></td>
</tr>
<tr>
<td></td>
<td>03/01/2016</td>
<td>$47.08</td>
<td>$13.00</td>
<td>$15.46</td>
<td>$0.00</td>
<td>$75.54</td>
<td></td>
</tr>
<tr>
<td>For apprentice rates use &quot;Apprentice - ELECTRICIAN&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Effective Date</th>
<th>Date Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRE ALARM REPAIR / MAINTENANCE</td>
<td>09/01/2014</td>
<td>$33.59</td>
<td>$13.00</td>
<td>$13.36</td>
<td>$0.00</td>
<td>$59.95</td>
<td></td>
</tr>
<tr>
<td>LOCAL 103</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>03/01/2015</td>
<td>$33.88</td>
<td>$13.00</td>
<td>$13.70</td>
<td>$0.00</td>
<td>$60.68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>09/01/2015</td>
<td>$34.60</td>
<td>$13.00</td>
<td>$13.72</td>
<td>$0.00</td>
<td>$61.32</td>
<td></td>
</tr>
<tr>
<td></td>
<td>03/01/2016</td>
<td>$35.31</td>
<td>$13.00</td>
<td>$13.74</td>
<td>$0.00</td>
<td>$62.05</td>
<td></td>
</tr>
<tr>
<td>For apprentice rates use &quot;Apprentice - TELECOMMUNICATIONS TECHNICIAN&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Issue Date: 10/08/2014  Wage Request Number: 20141008-018  Page 11 of 41
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIREMAN (ASST. ENGINEER)</td>
<td>06/01/2014</td>
<td>$34.59</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$58.79</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$35.43</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$59.63</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$36.65</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$60.25</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$37.10</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$61.30</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$37.72</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$61.92</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$38.76</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$62.96</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$39.60</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$63.80</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$40.43</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$64.63</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - OPERATING ENGINEERS"

| FLAGGER & SIGNALER                  | 06/01/2014     | $20.50    | $7.30  | $12.70  | $0.00                      | $40.50     |
|                                      | 12/01/2014     | $20.50    | $7.30  | $12.70  | $0.00                      | $40.50     |
|                                      | 06/01/2015     | $20.50    | $7.30  | $12.70  | $0.00                      | $40.50     |
|                                      | 12/01/2015     | $20.50    | $7.30  | $12.70  | $0.00                      | $40.50     |
|                                      | 06/01/2016     | $20.50    | $7.30  | $12.70  | $0.00                      | $40.50     |
|                                      | 12/01/2016     | $20.50    | $7.30  | $12.70  | $0.00                      | $40.50     |

For apprentice rates see "Apprentice - LABORER"

| FLOORCOVERER                        | 09/01/2014     | $40.40    | $9.80  | $17.21  | $0.00                      | $67.41     |

### Apprentice - FLOORCOVERER - Local 2168 Zone I

<table>
<thead>
<tr>
<th>Effective Date - 09/01/2014</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 50</td>
<td>$20.00</td>
<td>$9.80</td>
<td>$1.79</td>
<td>$0.00</td>
<td>$33.79</td>
</tr>
<tr>
<td>2 55</td>
<td>$22.22</td>
<td>$9.80</td>
<td>$1.79</td>
<td>$0.00</td>
<td>$33.81</td>
</tr>
<tr>
<td>3 60</td>
<td>$24.74</td>
<td>$9.80</td>
<td>$11.84</td>
<td>$0.00</td>
<td>$45.88</td>
</tr>
<tr>
<td>4 65</td>
<td>$26.26</td>
<td>$9.80</td>
<td>$11.84</td>
<td>$0.00</td>
<td>$47.90</td>
</tr>
<tr>
<td>5 70</td>
<td>$28.28</td>
<td>$9.80</td>
<td>$13.63</td>
<td>$0.00</td>
<td>$55.71</td>
</tr>
<tr>
<td>6 75</td>
<td>$30.30</td>
<td>$9.80</td>
<td>$13.63</td>
<td>$0.00</td>
<td>$53.73</td>
</tr>
<tr>
<td>7 80</td>
<td>$32.32</td>
<td>$9.80</td>
<td>$15.42</td>
<td>$0.00</td>
<td>$57.54</td>
</tr>
<tr>
<td>8 85</td>
<td>$34.34</td>
<td>$9.80</td>
<td>$15.42</td>
<td>$0.00</td>
<td>$59.56</td>
</tr>
</tbody>
</table>

### Notes:
- Steps are 750 hrs.
- Apprentice to Journeyworker Ratio: 1

### FORK LIFTER

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$41.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$65.69</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$42.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$66.69</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$43.24</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$67.44</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$44.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$68.69</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$45.24</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$69.44</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$46.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$70.69</td>
</tr>
<tr>
<td>06/01/2017</td>
<td>$47.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$71.69</td>
</tr>
<tr>
<td>12/01/2017</td>
<td>$48.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$72.69</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - OPERATING ENGINEERS"

---

Issue Date: 10/08/2014  
Wage Request Number: 20141008-018  
Page 12 of 41
### GENERATOR/LIGHTING PLANT/HEATERS
*OPERATING ENGINEERS LOCAL 4*

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pensions</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>06/01/2014</td>
<td>$28.80</td>
<td>0.00</td>
<td>$14.20</td>
<td>0.00</td>
<td>$53.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$29.50</td>
<td>0.00</td>
<td>$14.20</td>
<td>0.00</td>
<td>$53.70</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$30.02</td>
<td>0.00</td>
<td>$14.20</td>
<td>0.00</td>
<td>$54.23</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$30.89</td>
<td>0.00</td>
<td>$14.20</td>
<td>0.00</td>
<td>$55.09</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$31.41</td>
<td>0.00</td>
<td>$14.20</td>
<td>0.00</td>
<td>$55.61</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$32.28</td>
<td>0.00</td>
<td>$14.20</td>
<td>0.00</td>
<td>$56.48</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$32.97</td>
<td>0.00</td>
<td>$14.20</td>
<td>0.00</td>
<td>$57.17</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$33.66</td>
<td>0.00</td>
<td>$14.20</td>
<td>0.00</td>
<td>$57.86</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - OPERATING ENGINEERS"

### GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS)
*GLAZIERS LOCAL 15 ZONE 2*

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pensions</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>07/01/2014</td>
<td>$36.26</td>
<td>0.00</td>
<td>$16.10</td>
<td>0.00</td>
<td>$60.21</td>
</tr>
<tr>
<td></td>
<td>01/01/2015</td>
<td>$37.16</td>
<td>0.00</td>
<td>$16.10</td>
<td>0.00</td>
<td>$61.11</td>
</tr>
<tr>
<td></td>
<td>07/01/2015</td>
<td>$38.06</td>
<td>0.00</td>
<td>$16.10</td>
<td>0.00</td>
<td>$62.01</td>
</tr>
<tr>
<td></td>
<td>01/01/2016</td>
<td>$39.01</td>
<td>0.00</td>
<td>$16.10</td>
<td>0.00</td>
<td>$62.96</td>
</tr>
<tr>
<td></td>
<td>07/01/2016</td>
<td>$39.96</td>
<td>0.00</td>
<td>$16.10</td>
<td>0.00</td>
<td>$63.91</td>
</tr>
<tr>
<td></td>
<td>01/01/2017</td>
<td>$40.91</td>
<td>0.00</td>
<td>$16.10</td>
<td>0.00</td>
<td>$64.86</td>
</tr>
</tbody>
</table>

#### Apprentice - GLAZIERS Local 15 Zone 2

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>07/01/2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>01/01/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
</tr>
</tbody>
</table>

**Notes:**
- Steps are 750 hrs.
- Apprentice to Journeyworker Ratio: 1:1

---

**Issue Date:** 10/08/2014  
**Wage Request Number:** 20141008-018  
**Page 13 of 41**
### Classification: HOISTING ENGINEER/CRANES/GRADALLS

**OPERATING ENGINEERS LOCAL 4**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Date Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>06/01/2014</td>
<td>41.49</td>
<td>10.00</td>
<td>14.20</td>
<td>0.00</td>
<td>65.69</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>42.49</td>
<td>10.00</td>
<td>14.20</td>
<td>0.00</td>
<td>66.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>43.24</td>
<td>10.00</td>
<td>14.20</td>
<td>0.00</td>
<td>67.44</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>44.49</td>
<td>10.00</td>
<td>14.20</td>
<td>0.00</td>
<td>68.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>45.24</td>
<td>10.00</td>
<td>14.20</td>
<td>0.00</td>
<td>69.44</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>46.49</td>
<td>10.00</td>
<td>14.20</td>
<td>0.00</td>
<td>70.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>47.49</td>
<td>10.00</td>
<td>14.20</td>
<td>0.00</td>
<td>71.69</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>48.49</td>
<td>10.00</td>
<td>14.20</td>
<td>0.00</td>
<td>72.69</td>
</tr>
</tbody>
</table>

### Apprentices - OPERATING ENGINEERS - Local 4

**Effective Date:** 06/01/2014

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentices Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55</td>
<td>22.82</td>
<td>10.00</td>
<td>0.00</td>
<td>0.00</td>
<td>32.82</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>24.89</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>49.07</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>26.97</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>51.15</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>29.04</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>53.22</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>31.12</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>55.30</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>33.19</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>57.37</td>
</tr>
<tr>
<td>7</td>
<td>85</td>
<td>35.27</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>59.45</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>37.34</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>61.52</td>
</tr>
</tbody>
</table>

**Effective Date:** 12/01/2014

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentices Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55</td>
<td>23.37</td>
<td>10.00</td>
<td>0.00</td>
<td>0.00</td>
<td>33.37</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>25.49</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>49.67</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>27.62</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>51.80</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>29.74</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>53.92</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>31.87</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>56.05</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>33.99</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>58.17</td>
</tr>
<tr>
<td>7</td>
<td>85</td>
<td>36.12</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>60.30</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>38.24</td>
<td>10.00</td>
<td>14.18</td>
<td>0.00</td>
<td>62.42</td>
</tr>
</tbody>
</table>

**Notes:**

- HVAC (DUCTWORK)
  - **SHREITMETAL WORKERS LOCAL 17-A**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/01/2014</td>
<td>42.79</td>
<td>9.82</td>
<td>20.54</td>
<td>2.19</td>
<td>75.34</td>
</tr>
<tr>
<td>02/01/2015</td>
<td>43.69</td>
<td>9.82</td>
<td>20.54</td>
<td>2.19</td>
<td>76.94</td>
</tr>
<tr>
<td>08/01/2015</td>
<td>44.69</td>
<td>9.82</td>
<td>20.54</td>
<td>2.19</td>
<td>77.74</td>
</tr>
<tr>
<td>02/01/2016</td>
<td>45.69</td>
<td>9.82</td>
<td>20.54</td>
<td>2.19</td>
<td>78.24</td>
</tr>
<tr>
<td>08/01/2016</td>
<td>46.84</td>
<td>9.82</td>
<td>20.54</td>
<td>2.19</td>
<td>79.39</td>
</tr>
<tr>
<td>02/01/2017</td>
<td>47.94</td>
<td>9.82</td>
<td>20.54</td>
<td>2.19</td>
<td>80.09</td>
</tr>
<tr>
<td>08/01/2017</td>
<td>49.04</td>
<td>9.82</td>
<td>20.54</td>
<td>2.19</td>
<td>81.59</td>
</tr>
<tr>
<td>02/01/2018</td>
<td>50.19</td>
<td>9.82</td>
<td>20.54</td>
<td>2.19</td>
<td>82.74</td>
</tr>
</tbody>
</table>

*For apprentice rates see "Apprentice - SHEET METAL WORKER"*

**Issue Date:** 10/08/2014

**Wage Request Number:** 20141008-018
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC (ELECTRICAL CONTROLS)</td>
<td>09/01/2014</td>
<td>$44.79</td>
<td>$13.00</td>
<td>$15.04</td>
<td>$0.00</td>
<td>$72.83</td>
</tr>
<tr>
<td></td>
<td>03/01/2015</td>
<td>$45.17</td>
<td>$12.00</td>
<td>$15.40</td>
<td>$0.00</td>
<td>$73.57</td>
</tr>
<tr>
<td></td>
<td>09/01/2015</td>
<td>$46.13</td>
<td>$13.00</td>
<td>$15.43</td>
<td>$0.00</td>
<td>$74.56</td>
</tr>
<tr>
<td></td>
<td>03/01/2016</td>
<td>$47.08</td>
<td>$13.00</td>
<td>$15.46</td>
<td>$0.00</td>
<td>$75.54</td>
</tr>
<tr>
<td>For apprentices see &quot;Apprentice- ELECTRICIAN&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVAC (TESTING AND BALANCING - AIR)</td>
<td>08/01/2014</td>
<td>$42.79</td>
<td>$9.82</td>
<td>$20.54</td>
<td>$2.19</td>
<td>$75.34</td>
</tr>
<tr>
<td>SHEETMETAL WORKERS LOCAL IV - A</td>
<td>02/01/2015</td>
<td>$43.69</td>
<td>$9.82</td>
<td>$20.54</td>
<td>$2.19</td>
<td>$76.24</td>
</tr>
<tr>
<td></td>
<td>08/01/2015</td>
<td>$44.69</td>
<td>$9.82</td>
<td>$20.34</td>
<td>$2.19</td>
<td>$77.24</td>
</tr>
<tr>
<td></td>
<td>02/01/2016</td>
<td>$45.69</td>
<td>$9.82</td>
<td>$20.54</td>
<td>$2.19</td>
<td>$78.24</td>
</tr>
<tr>
<td></td>
<td>08/01/2016</td>
<td>$46.48</td>
<td>$9.82</td>
<td>$20.34</td>
<td>$2.19</td>
<td>$79.39</td>
</tr>
<tr>
<td></td>
<td>02/01/2017</td>
<td>$47.24</td>
<td>$9.82</td>
<td>$20.34</td>
<td>$2.19</td>
<td>$80.49</td>
</tr>
<tr>
<td></td>
<td>08/01/2017</td>
<td>$49.04</td>
<td>$9.82</td>
<td>$20.54</td>
<td>$2.19</td>
<td>$81.59</td>
</tr>
<tr>
<td></td>
<td>03/01/2018</td>
<td>$50.19</td>
<td>$9.82</td>
<td>$20.54</td>
<td>$2.19</td>
<td>$82.74</td>
</tr>
<tr>
<td>For apprentices see &quot;Apprentice- SHEETMETAL WORKER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVAC (TESTING AND BALANCING - WATER)</td>
<td>09/01/2014</td>
<td>$48.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$74.53</td>
</tr>
<tr>
<td>PIPEFITTERS LOCAL 387</td>
<td>03/01/2015</td>
<td>$49.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$75.53</td>
</tr>
<tr>
<td></td>
<td>09/01/2015</td>
<td>$50.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$76.53</td>
</tr>
<tr>
<td></td>
<td>03/01/2016</td>
<td>$51.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$77.53</td>
</tr>
<tr>
<td></td>
<td>09/01/2016</td>
<td>$52.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$78.53</td>
</tr>
<tr>
<td></td>
<td>03/01/2017</td>
<td>$53.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$79.53</td>
</tr>
<tr>
<td>For apprentices see &quot;Apprentice- PIPEFITTER&quot; or &quot;PLUMBER/PIPEFITTER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVAC MECHANIC</td>
<td>09/01/2014</td>
<td>$48.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$74.53</td>
</tr>
<tr>
<td>PIPEFITTERS LOCAL 387</td>
<td>03/01/2015</td>
<td>$49.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$75.53</td>
</tr>
<tr>
<td></td>
<td>09/01/2015</td>
<td>$50.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$76.53</td>
</tr>
<tr>
<td></td>
<td>03/01/2016</td>
<td>$51.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$77.53</td>
</tr>
<tr>
<td></td>
<td>09/01/2016</td>
<td>$52.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$78.53</td>
</tr>
<tr>
<td></td>
<td>03/01/2017</td>
<td>$53.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$79.53</td>
</tr>
<tr>
<td>For apprentices see &quot;Apprentice- PIPEFITTER&quot; or &quot;PLUMBER/PIPEFITTER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HYDRAULIC DRILLS</td>
<td>06/01/2014</td>
<td>$34.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.85</td>
</tr>
<tr>
<td>LABORERS - ZONE 1</td>
<td>12/01/2014</td>
<td>$35.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.60</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$36.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.35</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$37.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.10</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$37.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.85</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$38.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.85</td>
</tr>
<tr>
<td>For apprentices see &quot;Apprentice- LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSULATOR (PIPES &amp; TANKS)</td>
<td>09/01/2014</td>
<td>$43.31</td>
<td>$11.25</td>
<td>$12.60</td>
<td>$0.00</td>
<td>$67.16</td>
</tr>
<tr>
<td>HEAT &amp; FROST INSULATORS LOCAL 6 (BOSTON)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Effective Date</td>
<td>Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
<td>Total Rate</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------</td>
<td>-----------</td>
<td>--------</td>
<td>---------</td>
<td>---------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Apprentice - ASBESTOS INSULATOR (Pipes &amp; Tanks) - Local 6 Boston</td>
<td>09/01/2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>percent</td>
<td>Apprentice Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td></td>
<td>Supplemental Unemployment</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>$21.65</td>
<td>$11.25</td>
<td>$9.35</td>
<td>$0.00</td>
<td>$42.26</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$25.99</td>
<td>$11.25</td>
<td>$10.00</td>
<td>$0.00</td>
<td>$47.24</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$30.32</td>
<td>$11.25</td>
<td>$10.65</td>
<td>$0.00</td>
<td>$52.22</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$34.65</td>
<td>$11.25</td>
<td>$11.30</td>
<td>$0.00</td>
<td>$57.20</td>
</tr>
</tbody>
</table>

**Notes:**
- Steps are 1 year

Apprentice to Journeyworker Ratio: 1:4

IRONWORKER/WELDER
IRONWORKERS LOCAL 7 (BOSTON AREA)
03/16/2014 $41.19 $7.70 $19.25 $0.00 $68.14

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice - IRONWORKER - Local 7 Boston</td>
<td>03/16/2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>percent</td>
<td>Apprentice Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td></td>
<td>Supplemental Unemployment</td>
</tr>
<tr>
<td>1</td>
<td>60</td>
<td>$24.71</td>
<td>$7.70</td>
<td>$19.25</td>
<td>$0.00</td>
<td>$51.66</td>
</tr>
<tr>
<td>2</td>
<td>70</td>
<td>$28.83</td>
<td>$7.70</td>
<td>$19.25</td>
<td>$0.00</td>
<td>$55.78</td>
</tr>
<tr>
<td>3</td>
<td>75</td>
<td>$30.89</td>
<td>$7.70</td>
<td>$19.25</td>
<td>$0.00</td>
<td>$57.84</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$32.95</td>
<td>$7.70</td>
<td>$19.25</td>
<td>$0.00</td>
<td>$59.90</td>
</tr>
<tr>
<td>5</td>
<td>85</td>
<td>$33.01</td>
<td>$7.70</td>
<td>$19.25</td>
<td>$0.00</td>
<td>$61.96</td>
</tr>
<tr>
<td>6</td>
<td>90</td>
<td>$37.67</td>
<td>$7.70</td>
<td>$19.25</td>
<td>$0.00</td>
<td>$64.02</td>
</tr>
</tbody>
</table>

**Notes:**
- ** Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:**

JACKHAMMER & PAVING BREAKER OPERATOR
LABORERS - ZONE 1
06/01/2014 $34.35 $7.30 $12.70 $0.00 $54.35
12/01/2014 $35.10 $7.30 $12.70 $0.00 $55.10
06/01/2015 $35.85 $7.30 $12.70 $0.00 $55.85
12/01/2015 $36.60 $7.30 $12.70 $0.00 $56.60
06/01/2016 $37.35 $7.30 $12.70 $0.00 $57.35
12/01/2016 $38.35 $7.30 $12.70 $0.00 $58.35

For apprentice rates see "Apprentice - LABORER"

LABORER
LABORERS - ZONE 1
06/01/2014 $34.10 $7.30 $12.70 $0.00 $54.10
12/01/2014 $34.85 $7.30 $12.70 $0.00 $54.85
06/01/2015 $35.60 $7.30 $12.70 $0.00 $55.60
12/01/2015 $36.35 $7.30 $12.70 $0.00 $56.35
06/01/2016 $37.10 $7.30 $12.70 $0.00 $57.10
12/01/2016 $38.10 $7.30 $12.70 $0.00 $58.10

Issue Date: 10/08/2014
Wage Request Number: 20141008-018
Page 16 of 41
## Apprentices - LABORER - Zone I

### Effective Date: 06/01/2014

<table>
<thead>
<tr>
<th>Step</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>$29.46</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$40.46</td>
</tr>
<tr>
<td>2</td>
<td>70</td>
<td>$23.87</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$33.87</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>$27.28</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$47.28</td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>$30.69</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$50.69</td>
</tr>
</tbody>
</table>

### Effective Date: 12/01/2014

<table>
<thead>
<tr>
<th>Step</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>$20.91</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$40.91</td>
</tr>
<tr>
<td>2</td>
<td>70</td>
<td>$24.40</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$44.40</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>$27.88</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$47.88</td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>$31.37</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$51.37</td>
</tr>
</tbody>
</table>

**Notes:**

---

LABORER: CARPENTER TENDER
LABORES - ZONE 2

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$34.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.10</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$34.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.85</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$35.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.60</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$36.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.35</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$37.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.10</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$38.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.10</td>
</tr>
</tbody>
</table>

For apprentice rates use "Apprentice - LABORER".

LABORER: CEMENT FINISHER TENDER
LABORES - ZONE 2

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$34.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.10</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$34.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.85</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$35.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.60</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$36.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.35</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$37.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.10</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$38.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.10</td>
</tr>
</tbody>
</table>

For apprentice rates use "Apprentice - LABORER".

LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER
LABORES - ZONE 2

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$34.25</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.25</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$35.00</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.00</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$35.75</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.75</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$36.50</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.50</td>
</tr>
</tbody>
</table>

For apprentice rates use "Apprentice - LABORER".

LABORER: MASON TENDER
LABORES - ZONE 2

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$34.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.35</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$35.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.10</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$35.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.85</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$36.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.60</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$37.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.35</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$38.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.10</td>
</tr>
</tbody>
</table>

For apprentice rates use "Apprentice - LABORER".

---

**Issue Date:** 10/08/2014  
**Wage Request Number:** 2014008-018  
**Page 17 of 41**
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>LABORER: MULTI-TRADE TENDER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LABORERS - ZONE 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>06/01/2014</td>
<td>$34.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.10</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$34.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.85</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$35.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.60</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$36.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.35</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$37.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.10</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$38.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.10</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice-LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LABORER: TREE REMOVER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LABORERS - ZONE 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>06/01/2014</td>
<td>$34.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.10</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$34.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.85</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$35.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.60</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$36.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.35</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$37.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.10</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$38.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.10</td>
</tr>
<tr>
<td>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 &quot;Apprentice-LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LASER BEAM OPERATOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LABORERS - ZONE 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>06/01/2014</td>
<td>$34.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.35</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$35.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.10</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$35.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.85</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$36.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.60</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$37.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.35</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$38.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.35</td>
</tr>
<tr>
<td>For apprentice rates see &quot;Apprentice-LABORER&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MARBLE &amp; TILE FINISHERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRICKLAYER LOCAL 7 - MARBLE &amp; TILE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>08/01/2014</td>
<td>$37.37</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$64.45</td>
</tr>
<tr>
<td></td>
<td>02/01/2015</td>
<td>$37.82</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$64.90</td>
</tr>
<tr>
<td></td>
<td>08/01/2015</td>
<td>$38.53</td>
<td>$10.18</td>
<td>$16.97</td>
<td>$0.00</td>
<td>$66.68</td>
</tr>
<tr>
<td></td>
<td>02/01/2016</td>
<td>$38.98</td>
<td>$10.18</td>
<td>$16.97</td>
<td>$0.00</td>
<td>$66.13</td>
</tr>
<tr>
<td></td>
<td>08/01/2016</td>
<td>$39.68</td>
<td>$10.18</td>
<td>$17.05</td>
<td>$0.00</td>
<td>$66.91</td>
</tr>
<tr>
<td></td>
<td>02/01/2017</td>
<td>$40.14</td>
<td>$10.18</td>
<td>$17.05</td>
<td>$0.00</td>
<td>$67.37</td>
</tr>
</tbody>
</table>

Issue Date: 10/08/2014  
Wage Request Number: 20141008-018  
Page 18 of 41
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice - <em>MARBLE &amp; TILE FINISHER - Local 3 Marble &amp; Tile</em></td>
<td>08/01/2014</td>
<td>$18.69</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$55.77</td>
</tr>
<tr>
<td>1%</td>
<td>50</td>
<td>$18.69</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$55.77</td>
</tr>
<tr>
<td>2%</td>
<td>60</td>
<td>$22.42</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$59.50</td>
</tr>
<tr>
<td>3%</td>
<td>70</td>
<td>$26.16</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$63.24</td>
</tr>
<tr>
<td>4%</td>
<td>80</td>
<td>$29.90</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$66.98</td>
</tr>
<tr>
<td>5%</td>
<td>90</td>
<td>$33.63</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$70.71</td>
</tr>
<tr>
<td>Effective Date - 02/01/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>percent</td>
<td>Apprentice Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental</td>
<td>Total Rate</td>
</tr>
<tr>
<td>1%</td>
<td>50</td>
<td>$18.91</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$45.99</td>
</tr>
<tr>
<td>2%</td>
<td>60</td>
<td>$22.69</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$49.77</td>
</tr>
<tr>
<td>3%</td>
<td>70</td>
<td>$26.47</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$53.55</td>
</tr>
<tr>
<td>4%</td>
<td>80</td>
<td>$30.26</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$57.34</td>
</tr>
<tr>
<td>5%</td>
<td>90</td>
<td>$34.04</td>
<td>$10.18</td>
<td>$16.90</td>
<td>$0.00</td>
<td>$61.12</td>
</tr>
</tbody>
</table>

[Notes:]

Apprentice to Journeyman Ratio: 1:3

**Notes:**  

**MARBLE MASON, TILELAYERS & TERRAZZO MECH**  
**BRICKLAYER/LOCAL 3 - MARBLE & TILE**

<table>
<thead>
<tr>
<th>Issue Date:</th>
<th>Wage Request Number:</th>
<th>Page 19 of 41</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/08/2014</td>
<td>2014008-018</td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Effective Date</td>
<td>Base Wage</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Apprentice - MARBLE TILE FLOOR MECHANIC - Local 3 Marble &amp; Tile</td>
<td>08/01/2014</td>
<td>$24.50</td>
</tr>
<tr>
<td>1  50</td>
<td>2  60</td>
<td>$29.40</td>
</tr>
<tr>
<td>3  70</td>
<td>4  80</td>
<td>$34.50</td>
</tr>
<tr>
<td>5  90</td>
<td>6  100</td>
<td>$39.60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>02/01/2015</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  50</td>
<td>2  60</td>
<td>$24.78</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$53.18</td>
</tr>
<tr>
<td>3  70</td>
<td>4  80</td>
<td>$29.74</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$58.14</td>
</tr>
<tr>
<td>5  90</td>
<td>6  100</td>
<td>$34.69</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$63.09</td>
</tr>
</tbody>
</table>

| Notes: | |

| Apprentice to Journeyworker Ratio: 1:5 |

<table>
<thead>
<tr>
<th>MPH: SWEEPER OPERATOR (ON CONST. SITES)</th>
<th>Operating Engineers Local 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$41.10</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$42.09</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$42.83</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$44.07</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$44.82</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$46.05</td>
</tr>
<tr>
<td>06/01/2017</td>
<td>$47.04</td>
</tr>
<tr>
<td>12/01/2017</td>
<td>$48.03</td>
</tr>
</tbody>
</table>

For apprentice rates use "Apprentice - OPERATING ENGINEERS"

<table>
<thead>
<tr>
<th>MECHANICS MAINTENANCE</th>
<th>Operating Engineers Local 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$41.10</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$42.09</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$42.83</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$44.07</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$44.82</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$46.05</td>
</tr>
<tr>
<td>06/01/2017</td>
<td>$47.04</td>
</tr>
<tr>
<td>12/01/2017</td>
<td>$48.03</td>
</tr>
</tbody>
</table>

For apprentice rates use "Apprentice - OPERATING ENGINEERS"

<table>
<thead>
<tr>
<th>MILLWRIGHT (Zone 1)</th>
<th>MILLWRIGHTS LOCAL 1721 - Zone 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/01/2014</td>
<td>$36.68</td>
</tr>
<tr>
<td>04/01/2015</td>
<td>$37.64</td>
</tr>
</tbody>
</table>

Issue Date: 10/08/2014  Wage Request Number: 20141008-018  Page 20 of 41
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice - MILLWRIGHT - Local 1121 Zone 1</td>
<td>10/01/2014</td>
<td>$20.17</td>
<td>$9.80</td>
<td>$4.48</td>
<td>$0.00</td>
<td>$34.45</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>$23.84</td>
<td>$9.80</td>
<td>$13.36</td>
<td>$0.00</td>
<td>$47.00</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>$27.51</td>
<td>$9.80</td>
<td>$14.18</td>
<td>$0.00</td>
<td>$51.49</td>
</tr>
<tr>
<td></td>
<td>85</td>
<td>$31.18</td>
<td>$9.80</td>
<td>$14.99</td>
<td>$0.00</td>
<td>$55.97</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>04/01/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
</tr>
<tr>
<td>1</td>
<td>55</td>
</tr>
<tr>
<td>2</td>
<td>65</td>
</tr>
<tr>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>85</td>
</tr>
</tbody>
</table>

Notes: Steps = 2,000 hours

MORTAR MIXER (LABORERS - BONE 1)

<table>
<thead>
<tr>
<th>Date</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$34.35</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$35.10</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$35.85</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$36.60</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$37.35</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$38.35</td>
</tr>
</tbody>
</table>

For apprentices see "Apprentice - LABORER"

OILER (OTHER THAN TRUCK CRANES, GRADALLS)

<table>
<thead>
<tr>
<th>Date</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$21.48</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$22.00</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$22.38</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$23.03</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$23.42</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$24.07</td>
</tr>
<tr>
<td>06/01/2017</td>
<td>$24.58</td>
</tr>
<tr>
<td>12/01/2017</td>
<td>$25.10</td>
</tr>
</tbody>
</table>

For apprentices see "Apprentice - OPERATING ENGINEER"

OILER (TRUCK CRANES, GRADALLS)

<table>
<thead>
<tr>
<th>Date</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$25.03</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$25.64</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$26.09</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$26.84</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$27.30</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$28.05</td>
</tr>
<tr>
<td>06/01/2017</td>
<td>$28.65</td>
</tr>
<tr>
<td>12/01/2017</td>
<td>$29.26</td>
</tr>
</tbody>
</table>

For apprentices see "Apprentice - OPERATING ENGINEER"
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTHER POWER DRIVEN EQUIPMENT - CLASS II</td>
<td>06/01/2014</td>
<td>$41.10</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$65.30</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$42.09</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$66.29</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$42.83</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$67.03</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$44.07</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$68.27</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$44.82</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$69.02</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$46.65</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$70.25</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$47.04</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$71.24</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$48.03</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$72.23</td>
</tr>
<tr>
<td>For apprentices see &quot;Apprentice - OPERATING ENGINEERS&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Apprentice - PAINTER Local 35 - BRIDGES/TANKS</th>
<th>Effective Date - 07/01/2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effective Date - 01/01/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>

Notes:
- Steps are 750 hrs.
- Apprentice to Journeyworker Ratio: 1:1
## Apprentice - PAINTER Local 35 Zone 3 - Spray/Sandblast - New

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/01/2014</td>
<td>$18.83</td>
<td>$7.85</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$26.68</td>
</tr>
<tr>
<td>01/01/2015</td>
<td>$20.71</td>
<td>$7.85</td>
<td>$3.66</td>
<td>$0.00</td>
<td>$32.22</td>
</tr>
<tr>
<td>07/01/2015</td>
<td>$22.60</td>
<td>$7.85</td>
<td>$3.99</td>
<td>$0.00</td>
<td>$34.44</td>
</tr>
<tr>
<td>01/01/2016</td>
<td>$24.48</td>
<td>$7.85</td>
<td>$4.32</td>
<td>$0.00</td>
<td>$36.65</td>
</tr>
<tr>
<td>07/01/2016</td>
<td>$26.36</td>
<td>$7.85</td>
<td>$4.11</td>
<td>$0.00</td>
<td>$34.92</td>
</tr>
<tr>
<td>01/01/2017</td>
<td>$28.25</td>
<td>$7.85</td>
<td>$4.44</td>
<td>$0.00</td>
<td>$35.04</td>
</tr>
</tbody>
</table>

### Effective Date - 01/01/2015

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$19.28</td>
<td>$7.85</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$27.13</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$21.21</td>
<td>$7.85</td>
<td>$3.66</td>
<td>$0.00</td>
<td>$32.22</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$23.14</td>
<td>$7.85</td>
<td>$3.99</td>
<td>$0.00</td>
<td>$34.92</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$25.06</td>
<td>$7.85</td>
<td>$4.32</td>
<td>$0.00</td>
<td>$36.65</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$26.99</td>
<td>$7.85</td>
<td>$4.11</td>
<td>$0.00</td>
<td>$34.92</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$28.92</td>
<td>$7.85</td>
<td>$4.44</td>
<td>$0.00</td>
<td>$35.04</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$30.85</td>
<td>$7.85</td>
<td>$4.77</td>
<td>$0.00</td>
<td>$35.42</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$34.70</td>
<td>$7.85</td>
<td>$5.44</td>
<td>$0.00</td>
<td>$35.97</td>
</tr>
</tbody>
</table>

### Notes:
- Steps are 750 hrs.
- Apprentice to Journeyworker Ratio: 1

PAINTER (SPRAY OR SANDBLAST, REPAINT)

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/01/2014</td>
<td>$35.72</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$39.67</td>
</tr>
<tr>
<td>01/01/2015</td>
<td>$36.62</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$60.57</td>
</tr>
<tr>
<td>07/01/2015</td>
<td>$37.52</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$61.47</td>
</tr>
<tr>
<td>01/01/2016</td>
<td>$38.47</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$62.42</td>
</tr>
<tr>
<td>07/01/2016</td>
<td>$39.42</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$63.37</td>
</tr>
<tr>
<td>01/01/2017</td>
<td>$40.37</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$64.32</td>
</tr>
</tbody>
</table>
### Apprentice - PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint

**Effective Date:** 07/01/2014

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$17.86</td>
<td>$7.85</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$25.71</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$19.65</td>
<td>$7.85</td>
<td>$3.66</td>
<td>$0.00</td>
<td>$31.16</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$21.43</td>
<td>$7.85</td>
<td>$3.99</td>
<td>$0.00</td>
<td>$33.32</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$23.22</td>
<td>$7.85</td>
<td>$4.32</td>
<td>$0.00</td>
<td>$35.39</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$25.00</td>
<td>$7.85</td>
<td>$14.11</td>
<td>$0.00</td>
<td>$46.96</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$26.79</td>
<td>$7.85</td>
<td>$14.44</td>
<td>$0.00</td>
<td>$49.08</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$28.58</td>
<td>$7.85</td>
<td>$14.77</td>
<td>$0.00</td>
<td>$51.20</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$32.15</td>
<td>$7.85</td>
<td>$15.44</td>
<td>$0.00</td>
<td>$55.44</td>
</tr>
</tbody>
</table>

**Effective Date:** 01/01/2015

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$18.31</td>
<td>$7.85</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$26.16</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$20.14</td>
<td>$7.85</td>
<td>$3.66</td>
<td>$0.00</td>
<td>$31.65</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$21.97</td>
<td>$7.85</td>
<td>$3.99</td>
<td>$0.00</td>
<td>$33.81</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$23.80</td>
<td>$7.85</td>
<td>$4.32</td>
<td>$0.00</td>
<td>$35.97</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$25.63</td>
<td>$7.85</td>
<td>$14.11</td>
<td>$0.00</td>
<td>$47.59</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$27.47</td>
<td>$7.85</td>
<td>$14.44</td>
<td>$0.00</td>
<td>$49.76</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$29.30</td>
<td>$7.85</td>
<td>$14.77</td>
<td>$0.00</td>
<td>$51.92</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$32.15</td>
<td>$7.85</td>
<td>$15.44</td>
<td>$0.00</td>
<td>$55.44</td>
</tr>
</tbody>
</table>

**Notes:**
- Steps are 750 hrs.

---

**PAINTER (TRAFFIC MARKINGS)**

<table>
<thead>
<tr>
<th></th>
<th>06/01/2014</th>
<th>$34.10</th>
<th>$7.30</th>
<th>$12.70</th>
<th>$0.00</th>
<th>$54.10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$34.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.85</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$35.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.60</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$36.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.35</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$37.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.10</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$38.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.10</td>
</tr>
</tbody>
</table>

**PAINTER / TAPER (BRUSH, NEW)**

* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used, PAINTER LOCAL 35 - ZONE 2

<table>
<thead>
<tr>
<th></th>
<th>07/01/2014</th>
<th>$36.26</th>
<th>$7.85</th>
<th>$16.10</th>
<th>$0.00</th>
<th>$60.21</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>01/01/2015</td>
<td>$37.10</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$61.11</td>
</tr>
<tr>
<td></td>
<td>07/01/2015</td>
<td>$38.06</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$62.01</td>
</tr>
<tr>
<td></td>
<td>01/01/2016</td>
<td>$39.01</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$62.96</td>
</tr>
<tr>
<td></td>
<td>07/01/2016</td>
<td>$39.96</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$63.91</td>
</tr>
<tr>
<td></td>
<td>01/01/2017</td>
<td>$40.91</td>
<td>$7.85</td>
<td>$16.10</td>
<td>$0.00</td>
<td>$64.86</td>
</tr>
</tbody>
</table>

---

**Issue Date:** 10/08/2014

**Wage Request Number:** 20141008-018

Page 24 of 41
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apprentice</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PAINTER - Local 33 Zone 2 - BRUSH NEW</strong></td>
<td><strong>07/01/2014</strong></td>
<td><strong>$18.13</strong></td>
<td><strong>$7.85</strong></td>
<td><strong>$0.00</strong></td>
<td><strong>$0.00</strong></td>
<td><strong>$25.98</strong></td>
</tr>
<tr>
<td><strong>Step</strong></td>
<td><strong>percent</strong></td>
<td><strong>Apprentice Base Wage</strong></td>
<td><strong>Health</strong></td>
<td><strong>Pension</strong></td>
<td><strong>Supplemental Unemployment</strong></td>
<td><strong>Total Rate</strong></td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>$18.13</td>
<td>$7.85</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$25.98</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$19.94</td>
<td>$7.85</td>
<td>$3.66</td>
<td>$0.00</td>
<td>$24.61</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$21.76</td>
<td>$7.85</td>
<td>$3.99</td>
<td>$0.00</td>
<td>$26.61</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$23.57</td>
<td>$7.85</td>
<td>$4.32</td>
<td>$0.00</td>
<td>$27.92</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$25.38</td>
<td>$7.85</td>
<td>$4.11</td>
<td>$0.00</td>
<td>$29.15</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$27.20</td>
<td>$7.85</td>
<td>$4.44</td>
<td>$0.00</td>
<td>$31.64</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$29.01</td>
<td>$7.85</td>
<td>$4.77</td>
<td>$0.00</td>
<td>$33.61</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$30.82</td>
<td>$7.85</td>
<td>$4.44</td>
<td>$0.00</td>
<td>$35.90</td>
</tr>
<tr>
<td><strong>Effective Date</strong></td>
<td><strong>01/01/2015</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step</strong></td>
<td><strong>percent</strong></td>
<td><strong>Apprentice Base Wage</strong></td>
<td><strong>Health</strong></td>
<td><strong>Pension</strong></td>
<td><strong>Supplemental Unemployment</strong></td>
<td><strong>Total Rate</strong></td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>$18.38</td>
<td>$7.85</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$26.43</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$20.14</td>
<td>$7.85</td>
<td>$3.66</td>
<td>$0.00</td>
<td>$24.97</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$21.90</td>
<td>$7.85</td>
<td>$3.99</td>
<td>$0.00</td>
<td>$25.89</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$23.66</td>
<td>$7.85</td>
<td>$4.32</td>
<td>$0.00</td>
<td>$27.98</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$25.42</td>
<td>$7.85</td>
<td>$4.11</td>
<td>$0.00</td>
<td>$29.22</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$27.18</td>
<td>$7.85</td>
<td>$4.44</td>
<td>$0.00</td>
<td>$30.02</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$29.03</td>
<td>$7.85</td>
<td>$4.77</td>
<td>$0.00</td>
<td>$32.99</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$30.89</td>
<td>$7.85</td>
<td>$4.44</td>
<td>$0.00</td>
<td>$34.83</td>
</tr>
</tbody>
</table>

**Notes:**
- Steps are 750 lbs.

**Apprentice to Journeymen Ratio: 1:1**

PAINTER / TAPER (BRUSH, REPAINT)  
PAINTER LOCAL 33 - ZONE 2

| Wage Request Number: 20141008-018 | Issue Date: 10/08/2014 | Page 25 of 41 |

---

Project Manual #15-37 – Waban Hill Communications Tower Equipment Building  
Page 63 of 84
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Rate Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice - PAINTER Local 35 Zone 2 - BRUSH REPAINT</td>
<td>07/01/2014</td>
<td>$17.16</td>
<td>$7.85</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$25.01</td>
<td></td>
</tr>
<tr>
<td>Apprentice - PAINTER Local 35 Zone 2 - BRUSH REPAINT</td>
<td>01/01/2015</td>
<td>$17.61</td>
<td>$7.85</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$25.46</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Steps are 750 hrs.

**Apprentice to Journeymen Ratio:** 1:1

**PANEL & PICKUP TRUCKS DRIVER**
TEAMSTERS JOINT COUNCIL NO. 10 ZONE A

<table>
<thead>
<tr>
<th>Date</th>
<th>Rate Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/01/2014</td>
<td>$32.23</td>
<td>$9.91</td>
<td>$8.80</td>
<td>$0.00</td>
<td>$50.94</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$32.23</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$51.47</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$32.58</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$51.82</td>
</tr>
<tr>
<td>08/01/2015</td>
<td>$32.58</td>
<td>$10.41</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$52.32</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$32.58</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$53.07</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$33.08</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$53.57</td>
</tr>
<tr>
<td>08/01/2016</td>
<td>$33.08</td>
<td>$10.91</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$54.07</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$33.08</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$0.00</td>
<td>$54.88</td>
</tr>
</tbody>
</table>

**PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK)**
PILE DRIVER LOCAL 56 (ZONE 1)

<table>
<thead>
<tr>
<th>Date</th>
<th>Rate Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/01/2014</td>
<td>$41.60</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$69.57</td>
</tr>
<tr>
<td>08/01/2015</td>
<td>$43.10</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$71.07</td>
</tr>
</tbody>
</table>

**PILE DRIVER**
PILE DRIVER LOCAL 56 (ZONE 1)

<table>
<thead>
<tr>
<th>Date</th>
<th>Rate Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/01/2014</td>
<td>$41.60</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$69.57</td>
</tr>
<tr>
<td>08/01/2015</td>
<td>$43.10</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
<td>$71.07</td>
</tr>
<tr>
<td>Classification</td>
<td>Effective Date - 08/01/2014</td>
<td>Apprentice Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------</td>
<td>----------------------</td>
<td>--------</td>
<td>---------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Apprentice - PIPE DRIVER - Local 36 Zone 1</td>
<td></td>
<td>$20.80</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>Step</td>
<td>percent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>$20.80</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$24.96</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$29.12</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>$31.20</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>$33.28</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$33.28</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>$37.44</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$37.44</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effective Date - 08/01/2015</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>$21.53</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$25.86</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$30.17</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>$32.33</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>$34.48</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$34.48</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>$38.79</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$38.79</td>
<td>$9.80</td>
<td>$18.17</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

Notes:

Apprentice to Journeyworker Ratio: 1:3

PIPEFITTER & STEAMFITTER
PIPEFITTERS LOCAL 327

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/2014</td>
<td>$48.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$74.33</td>
</tr>
<tr>
<td>03/01/2015</td>
<td>$49.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$75.53</td>
</tr>
<tr>
<td>09/01/2015</td>
<td>$50.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$76.53</td>
</tr>
<tr>
<td>03/01/2016</td>
<td>$51.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$77.53</td>
</tr>
<tr>
<td>09/01/2016</td>
<td>$52.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$78.53</td>
</tr>
<tr>
<td>03/01/2017</td>
<td>$53.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$79.53</td>
</tr>
</tbody>
</table>

Issue Date: 10/08/2014  Wage Request Number: 20140008-018  Page 27 of 41
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apprentice</strong></td>
<td>09/01/2014</td>
<td>$19.48</td>
<td>$9.20</td>
<td>$7.59</td>
<td>$0.00</td>
<td>$36.18</td>
</tr>
<tr>
<td>1</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>$21.91</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$47.75</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$29.21</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$55.05</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$34.08</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$59.92</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>$38.95</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$64.79</td>
</tr>
<tr>
<td><strong>Effective Date</strong></td>
<td>03/01/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>40</td>
<td>$19.88</td>
<td>$9.20</td>
<td>$7.59</td>
<td>$0.00</td>
<td>$36.58</td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>$22.36</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$48.20</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$29.81</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$55.65</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$34.78</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$60.62</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>$39.75</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$0.00</td>
<td>$65.59</td>
</tr>
</tbody>
</table>

**Notes:**
**1:3; 3:15; 1:10 thereafter / Steps are 1 yr.**
*Relig/AC Mechanic* **1:1; 2:2; 3:3; 4:4; 5:5; 10:6; 12:2; 14:8; 17:9; 20:10; 23:Max**

**Apprentice to Journeyman Ratio**

<table>
<thead>
<tr>
<th>Laborers - Zone 1</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$34.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.35</td>
<td></td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$35.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.10</td>
<td></td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$35.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.85</td>
<td></td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$36.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.60</td>
<td></td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$37.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.35</td>
<td></td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$38.25</td>
<td>$7.20</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.25</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plumbers &amp; Gasfitters</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/2014</td>
<td>$49.66</td>
<td>$10.32</td>
<td>$14.54</td>
<td>$0.00</td>
<td>$74.52</td>
<td></td>
</tr>
<tr>
<td>03/01/2015</td>
<td>$50.66</td>
<td>$10.32</td>
<td>$14.54</td>
<td>$0.00</td>
<td>$75.52</td>
<td></td>
</tr>
<tr>
<td>09/01/2015</td>
<td>$51.66</td>
<td>$10.32</td>
<td>$14.54</td>
<td>$0.00</td>
<td>$76.52</td>
<td></td>
</tr>
<tr>
<td>03/01/2016</td>
<td>$52.81</td>
<td>$10.32</td>
<td>$14.54</td>
<td>$0.00</td>
<td>$77.67</td>
<td></td>
</tr>
<tr>
<td>09/01/2016</td>
<td>$53.86</td>
<td>$10.32</td>
<td>$14.54</td>
<td>$0.00</td>
<td>$78.72</td>
<td></td>
</tr>
<tr>
<td>03/01/2017</td>
<td>$54.86</td>
<td>$10.32</td>
<td>$14.54</td>
<td>$0.00</td>
<td>$79.72</td>
<td></td>
</tr>
</tbody>
</table>

**Issue Date:** 10/08/2014  **Wage Request Number:** 20141008-018  **Page 28 of 41**
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date - 09/01/2014</th>
<th>Effective Date - 03/01/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice - PLUMBER/GASFITTER - Local 12</td>
<td>09/01/2014</td>
<td>03/01/2015</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$17.38</td>
<td>$10.32</td>
<td>$5.42</td>
<td>$0.00</td>
<td>$33.12</td>
</tr>
<tr>
<td>2</td>
<td>$19.86</td>
<td>$10.32</td>
<td>$6.13</td>
<td>$0.00</td>
<td>$36.31</td>
</tr>
<tr>
<td>3</td>
<td>$27.31</td>
<td>$10.32</td>
<td>$8.23</td>
<td>$0.00</td>
<td>$45.86</td>
</tr>
<tr>
<td>4</td>
<td>$32.28</td>
<td>$10.32</td>
<td>$9.64</td>
<td>$0.00</td>
<td>$52.24</td>
</tr>
<tr>
<td>5</td>
<td>$37.25</td>
<td>$10.32</td>
<td>$11.04</td>
<td>$0.00</td>
<td>$58.61</td>
</tr>
</tbody>
</table>

---

**Notes:**

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

Step 4 with lic55-42 Step 5 with lic61-79

Apprentice to Journeyworker Ratio: **

---

PNEUMATIC CONTROLS (TEMPS)

<table>
<thead>
<tr>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/2014</td>
<td>$48.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$74.53</td>
</tr>
<tr>
<td>03/01/2015</td>
<td>$49.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$75.33</td>
</tr>
<tr>
<td>09/01/2015</td>
<td>$50.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$76.33</td>
</tr>
<tr>
<td>03/01/2016</td>
<td>$51.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$77.53</td>
</tr>
<tr>
<td>09/01/2016</td>
<td>$52.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$78.33</td>
</tr>
<tr>
<td>03/01/2017</td>
<td>$53.69</td>
<td>$9.20</td>
<td>$16.64</td>
<td>$79.53</td>
</tr>
</tbody>
</table>

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

---

PNEUMATIC DRILL/TOOL OPERATOR

<table>
<thead>
<tr>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$34.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$54.35</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$35.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$55.10</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$32.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$52.85</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$36.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$56.60</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$37.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$57.35</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$38.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$58.35</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - LABORER"

---

POWDERMAN & BLASTER

<table>
<thead>
<tr>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$35.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$55.10</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$35.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$55.85</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$36.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$56.60</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$37.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$57.35</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$38.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$58.10</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$39.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$59.10</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - LABORER"

---

Issue Date: 10/08/2014  Wage Request Number: 20141008-018
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Rate Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplement</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER SHOVEL/DEERICK/FRENCHING MACHINE OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2014</td>
<td>$41.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$65.69</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$42.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$66.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$43.24</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$67.44</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$44.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$68.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$45.24</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$69.44</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$46.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$70.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$47.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$71.69</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$48.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$72.69</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - OPERATING ENGINEERS".

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Rate Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplement</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUMP OPERATOR (CONCRETE) OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2014</td>
<td>$41.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$65.69</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$42.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$66.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$43.24</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$67.44</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$44.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$68.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$45.24</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$69.44</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$46.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$70.69</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$47.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$71.69</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$48.49</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$72.69</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - OPERATING ENGINEERS".

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Rate Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplement</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUMP OPERATOR (DEWATERING, OTHERS) OPERATING ENGINEERS LOCAL 4</td>
<td>06/01/2014</td>
<td>$28.80</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$53.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$29.50</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$53.70</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$30.02</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$54.22</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$30.89</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$55.09</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$31.41</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$55.61</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$32.28</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$56.48</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$32.97</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$57.17</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$33.66</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$57.86</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - OPERATING ENGINEERS".

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Rate Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplement</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>READY MIX CONCRETE DRIVERS after 4/30/10 (Drivers Hired After 4/30/2010) TEAMSTERS LOCAL 256</td>
<td>07/01/2014</td>
<td>$27.73</td>
<td>$7.73</td>
<td>$8.65</td>
<td>$0.00</td>
<td>$44.11</td>
</tr>
<tr>
<td></td>
<td>05/01/2015</td>
<td>$27.88</td>
<td>$7.73</td>
<td>$8.92</td>
<td>$0.00</td>
<td>$44.53</td>
</tr>
<tr>
<td></td>
<td>07/01/2015</td>
<td>$27.88</td>
<td>$7.98</td>
<td>$8.92</td>
<td>$0.00</td>
<td>$44.78</td>
</tr>
<tr>
<td></td>
<td>05/01/2016</td>
<td>$28.03</td>
<td>$7.98</td>
<td>$9.31</td>
<td>$0.00</td>
<td>$45.32</td>
</tr>
<tr>
<td></td>
<td>07/01/2016</td>
<td>$28.03</td>
<td>$8.23</td>
<td>$9.31</td>
<td>$0.00</td>
<td>$45.57</td>
</tr>
<tr>
<td></td>
<td>05/01/2017</td>
<td>$28.18</td>
<td>$8.23</td>
<td>$9.72</td>
<td>$0.00</td>
<td>$46.13</td>
</tr>
<tr>
<td></td>
<td>07/01/2017</td>
<td>$28.18</td>
<td>$8.48</td>
<td>$9.72</td>
<td>$0.00</td>
<td>$46.38</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Rate Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplement</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>READY MIX CONCRETE DRIVER TEAMSTERS LOCAL 256</td>
<td>07/01/2014</td>
<td>$29.03</td>
<td>$7.73</td>
<td>$8.65</td>
<td>$0.00</td>
<td>$45.41</td>
</tr>
<tr>
<td></td>
<td>05/01/2015</td>
<td>$29.18</td>
<td>$7.73</td>
<td>$8.92</td>
<td>$0.00</td>
<td>$45.83</td>
</tr>
<tr>
<td></td>
<td>07/01/2015</td>
<td>$29.18</td>
<td>$7.98</td>
<td>$8.92</td>
<td>$0.00</td>
<td>$46.08</td>
</tr>
<tr>
<td></td>
<td>05/01/2016</td>
<td>$29.33</td>
<td>$7.98</td>
<td>$9.31</td>
<td>$0.00</td>
<td>$46.62</td>
</tr>
<tr>
<td></td>
<td>07/01/2016</td>
<td>$29.33</td>
<td>$8.23</td>
<td>$9.31</td>
<td>$0.00</td>
<td>$46.87</td>
</tr>
<tr>
<td></td>
<td>05/01/2017</td>
<td>$29.48</td>
<td>$8.23</td>
<td>$9.72</td>
<td>$0.00</td>
<td>$47.43</td>
</tr>
<tr>
<td></td>
<td>07/01/2017</td>
<td>$29.48</td>
<td>$8.48</td>
<td>$9.72</td>
<td>$0.00</td>
<td>$47.68</td>
</tr>
</tbody>
</table>

Issue Date: 10/08/2014  Wage Request Number: 20141008-018  Page 30 of 41
### Classification: Operating Engineers Local 1

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$41.10</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$65.30</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$42.09</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$66.29</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$42.83</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$67.03</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$44.07</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$68.27</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$44.82</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$69.02</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$46.05</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$70.25</td>
</tr>
<tr>
<td>06/01/2017</td>
<td>$47.04</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$71.24</td>
</tr>
<tr>
<td>12/01/2017</td>
<td>$48.03</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$72.23</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice Operating Engineers"

### Residential Wood Frame (All Other Work)

**Carpenters - Zone 2 (Residential Wood)**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/01/2011</td>
<td>$24.24</td>
<td>$8.67</td>
<td>$15.51</td>
<td>$0.00</td>
<td>$48.42</td>
</tr>
</tbody>
</table>

### Residential Wood Frame Carpenter **

**The Residential Wood Frame Carpenter classification applies only to the construction of new, wood frame residences that do not exceed four stories including the basement. Carpenters - Zone 2 (Residential Wood).**

As of 5/1/1991, carpentry work on wood-frame residential weatherization projects shall be paid the RESIDENTIAL WOOD FRAME CARPENTER rates.

### Apprentice - Carpenter (Residential Wood Frame) - Zone 2

**Effective Date: 03/01/2011**

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>$14.54</td>
<td>$6.34</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$20.88</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$14.54</td>
<td>$6.34</td>
<td>$6.23</td>
<td>$0.00</td>
<td>$27.11</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$15.76</td>
<td>$6.34</td>
<td>$6.23</td>
<td>$0.00</td>
<td>$28.33</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>$16.97</td>
<td>$6.34</td>
<td>$6.23</td>
<td>$0.00</td>
<td>$29.54</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>$18.18</td>
<td>$6.34</td>
<td>$6.23</td>
<td>$0.00</td>
<td>$30.75</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>$19.39</td>
<td>$6.34</td>
<td>$6.23</td>
<td>$0.00</td>
<td>$31.96</td>
</tr>
<tr>
<td>7</td>
<td>85</td>
<td>$20.60</td>
<td>$6.34</td>
<td>$6.23</td>
<td>$0.00</td>
<td>$33.17</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
<td>$21.82</td>
<td>$6.34</td>
<td>$6.23</td>
<td>$0.00</td>
<td>$34.39</td>
</tr>
</tbody>
</table>

### Notes:

- Apprentice to Journeyworker Ratio 1:5

### Ride-On Motorized Buggy Operator

**Carpenters - Zone 2**

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2014</td>
<td>$34.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$54.35</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$35.10</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.10</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$35.85</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$55.85</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$36.60</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$56.60</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$37.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$57.35</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$38.35</td>
<td>$7.30</td>
<td>$12.70</td>
<td>$0.00</td>
<td>$58.35</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - Laborer"
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROLLER/SPREADER/MULCHING MACHINE OPERATING ENGINEER/LOCAL 4</td>
<td>06/01/2014</td>
<td>$41.10</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$65.30</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$42.09</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$66.29</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$42.83</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$67.03</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$44.07</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$68.27</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$44.82</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$69.02</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$46.05</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$70.25</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$47.04</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$71.24</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$48.03</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$72.23</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - OPERATING ENGINEERS".

---

<table>
<thead>
<tr>
<th>Apprentice - ROOFER - Local 33</th>
<th>Effective Date - 08/01/2014</th>
<th>Appra rent Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
<td>1</td>
<td>50</td>
<td>$19.61</td>
<td>$10.50</td>
<td>$3.38</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$23.53</td>
<td>$10.50</td>
<td>$11.60</td>
<td>$0.00</td>
<td>$45.63</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$25.49</td>
<td>$10.50</td>
<td>$11.60</td>
<td>$0.00</td>
<td>$47.59</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>$29.41</td>
<td>$10.50</td>
<td>$11.60</td>
<td>$0.00</td>
<td>$51.51</td>
</tr>
<tr>
<td>5</td>
<td>85</td>
<td>$33.33</td>
<td>$10.50</td>
<td>$11.60</td>
<td>$0.00</td>
<td>$55.43</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Effective Date - 02/01/2015</th>
<th>Step</th>
<th>percent</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>$20.66</td>
<td>$10.50</td>
<td>$3.38</td>
<td>$0.00</td>
<td>$33.94</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$24.07</td>
<td>$10.50</td>
<td>$11.60</td>
<td>$0.00</td>
<td>$46.17</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>$26.07</td>
<td>$10.50</td>
<td>$11.60</td>
<td>$0.00</td>
<td>$48.17</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>$30.08</td>
<td>$10.50</td>
<td>$11.60</td>
<td>$0.00</td>
<td>$52.18</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>85</td>
<td>$34.09</td>
<td>$10.50</td>
<td>$11.60</td>
<td>$0.00</td>
<td>$56.19</td>
<td></td>
</tr>
</tbody>
</table>

Notes: **1: 5, 2: 6-10, the 1:10; Reroofing: 1:4, then 1:1 Step 1 in 2000 hrs.; Steps 2-5 are 1000 hrs.**

---

<table>
<thead>
<tr>
<th>Apprentice to Journeyworker Ratio**</th>
<th>ROOFER SLATE / TILE / PRECAST CONCRETE</th>
<th>ROOFER LOCAL 33</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/01/2014</td>
<td>$39.46</td>
<td>$10.50</td>
</tr>
<tr>
<td>02/01/2015</td>
<td>$40.36</td>
<td>$10.50</td>
</tr>
<tr>
<td>08/01/2015</td>
<td>$41.26</td>
<td>$10.50</td>
</tr>
<tr>
<td>02/01/2016</td>
<td>$42.16</td>
<td>$10.50</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice - ROOFER".

---

Issue Date: 10/08/2014  
Wage Request Number: 20141008-018  
Page 32 of 41
### Apprentice - SHEET METAL WORKER - Local 17-A

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Effective Date Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40</td>
<td>08/01/2014 $17.12</td>
<td>$9.82</td>
<td>$4.58</td>
<td>$0.00</td>
<td>$31.52</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>08/01/2015 $17.12</td>
<td>$9.82</td>
<td>$4.58</td>
<td>$0.00</td>
<td>$31.52</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>02/01/2016 $19.26</td>
<td>$9.82</td>
<td>$9.99</td>
<td>$1.15</td>
<td>$39.32</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
<td>08/01/2016 $19.26</td>
<td>$9.82</td>
<td>$9.99</td>
<td>$1.15</td>
<td>$39.32</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>08/01/2017 $21.40</td>
<td>$9.82</td>
<td>$9.91</td>
<td>$1.23</td>
<td>$42.36</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>08/01/2017 $21.40</td>
<td>$9.82</td>
<td>$10.16</td>
<td>$1.24</td>
<td>$43.62</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
<td>08/01/2017 $25.07</td>
<td>$9.82</td>
<td>$11.55</td>
<td>$1.41</td>
<td>$48.45</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
<td>08/01/2017 $27.81</td>
<td>$9.82</td>
<td>$12.38</td>
<td>$1.50</td>
<td>$51.51</td>
</tr>
<tr>
<td>9</td>
<td>75</td>
<td>08/01/2017 $32.09</td>
<td>$9.82</td>
<td>$14.02</td>
<td>$1.68</td>
<td>$57.61</td>
</tr>
<tr>
<td>10</td>
<td>85</td>
<td>08/01/2017 $36.37</td>
<td>$9.82</td>
<td>$15.16</td>
<td>$1.84</td>
<td>$63.19</td>
</tr>
</tbody>
</table>

### Effective Date - 02/01/2015

<table>
<thead>
<tr>
<th>Step</th>
<th>percent</th>
<th>Effective Date Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40</td>
<td>02/01/2015 $17.48</td>
<td>$9.82</td>
<td>$4.58</td>
<td>$0.00</td>
<td>$31.88</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>02/01/2016 $17.48</td>
<td>$9.82</td>
<td>$4.58</td>
<td>$0.00</td>
<td>$31.88</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>02/01/2016 $19.66</td>
<td>$9.82</td>
<td>$9.09</td>
<td>$1.16</td>
<td>$39.73</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
<td>02/01/2016 $19.66</td>
<td>$9.82</td>
<td>$9.09</td>
<td>$1.16</td>
<td>$39.73</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>02/01/2017 $21.83</td>
<td>$9.82</td>
<td>$9.91</td>
<td>$1.25</td>
<td>$42.83</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>02/01/2017 $21.83</td>
<td>$9.82</td>
<td>$10.16</td>
<td>$1.25</td>
<td>$43.08</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
<td>02/01/2017 $26.21</td>
<td>$9.82</td>
<td>$11.55</td>
<td>$1.43</td>
<td>$49.01</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
<td>02/01/2017 $28.40</td>
<td>$9.82</td>
<td>$12.38</td>
<td>$1.52</td>
<td>$52.12</td>
</tr>
<tr>
<td>9</td>
<td>75</td>
<td>02/01/2017 $32.77</td>
<td>$9.82</td>
<td>$14.02</td>
<td>$1.70</td>
<td>$58.31</td>
</tr>
<tr>
<td>10</td>
<td>85</td>
<td>02/01/2017 $37.14</td>
<td>$9.82</td>
<td>$15.16</td>
<td>$1.86</td>
<td>$63.98</td>
</tr>
</tbody>
</table>

**Notes:**
- Steps are 6 mos.

**Apprentice to Journeyworker Ratio: 1:4**

### SIGN ERECTORS

| PANTHERS LOCAL 35 - ZONE 2 | 06/01/2013 $25.81 | $7.07 | $7.02 | $0.00 | $39.95 |

**Issue Date:** 10/08/2014  
**Wage Request Number:** 20141008-018  
**Page 33 of 41**
### Project Manual #15-37 – Waban Hill Communications Tower Equipment Building

<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice - SIGN ERECTOR - Local 35 Zone 2</td>
<td>06/01/2013</td>
<td>$12.91</td>
<td>$7.07</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$19.98</td>
</tr>
<tr>
<td>Step</td>
<td>percent</td>
<td>Apprentice Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
<td>Total Rate</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>$12.91</td>
<td>$7.07</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$19.98</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>$14.20</td>
<td>$7.07</td>
<td>$2.45</td>
<td>$0.00</td>
<td>$23.72</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>$15.49</td>
<td>$7.07</td>
<td>$2.45</td>
<td>$0.00</td>
<td>$25.01</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>$16.78</td>
<td>$7.07</td>
<td>$2.45</td>
<td>$0.00</td>
<td>$26.30</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>$18.07</td>
<td>$7.07</td>
<td>$7.05</td>
<td>$0.00</td>
<td>$32.19</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>$19.36</td>
<td>$7.07</td>
<td>$7.05</td>
<td>$0.00</td>
<td>$33.48</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>$20.65</td>
<td>$7.07</td>
<td>$7.05</td>
<td>$0.00</td>
<td>$34.77</td>
</tr>
<tr>
<td>8</td>
<td>85</td>
<td>$21.94</td>
<td>$7.07</td>
<td>$7.05</td>
<td>$0.00</td>
<td>$36.06</td>
</tr>
<tr>
<td>9</td>
<td>90</td>
<td>$23.23</td>
<td>$7.07</td>
<td>$7.05</td>
<td>$0.00</td>
<td>$37.35</td>
</tr>
</tbody>
</table>

Notes:
- Steps are 4 mos.

---

### SPECIALIZED EARTH MOVING EQUIP < 35 TONS

TEAMSTERS UNION COUNCIL NO. 60 ZONE A

<table>
<thead>
<tr>
<th>Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/01/2014</td>
<td>$32.69</td>
<td>$9.91</td>
<td>$8.80</td>
<td>$0.00</td>
<td>$51.40</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$32.69</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$51.93</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$33.04</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$52.38</td>
</tr>
<tr>
<td>08/01/2015</td>
<td>$33.04</td>
<td>$10.41</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$52.78</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$33.04</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$53.53</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$33.54</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$54.03</td>
</tr>
<tr>
<td>08/01/2016</td>
<td>$33.54</td>
<td>$10.91</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$54.53</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$33.54</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$0.00</td>
<td>$55.34</td>
</tr>
</tbody>
</table>

### SPECIALIZED EARTH MOVING EQUIP > 35 TONS

TEAMSTERS UNION COUNCIL NO. 60 ZONE A

<table>
<thead>
<tr>
<th>Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/01/2014</td>
<td>$32.98</td>
<td>$9.91</td>
<td>$8.80</td>
<td>$0.00</td>
<td>$51.69</td>
</tr>
<tr>
<td>12/01/2014</td>
<td>$32.98</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$52.22</td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$33.33</td>
<td>$9.91</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$52.77</td>
</tr>
<tr>
<td>08/01/2015</td>
<td>$33.33</td>
<td>$10.41</td>
<td>$9.33</td>
<td>$0.00</td>
<td>$53.07</td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$33.33</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$53.82</td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$33.83</td>
<td>$10.41</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$54.32</td>
</tr>
<tr>
<td>08/01/2016</td>
<td>$33.83</td>
<td>$10.91</td>
<td>$10.08</td>
<td>$0.00</td>
<td>$54.82</td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$33.83</td>
<td>$10.91</td>
<td>$10.89</td>
<td>$0.00</td>
<td>$55.63</td>
</tr>
</tbody>
</table>

### SPRINKLER FITTER

SPRINKLER FITTERS LOCAL 559 - (Section A) Zone 1

<table>
<thead>
<tr>
<th>Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/01/2015</td>
<td>$53.73</td>
<td>$8.42</td>
<td>$14.60</td>
<td>$0.00</td>
<td>$76.75</td>
</tr>
<tr>
<td>01/01/2016</td>
<td>$53.73</td>
<td>$8.42</td>
<td>$14.75</td>
<td>$0.00</td>
<td>$76.90</td>
</tr>
<tr>
<td>03/01/2015</td>
<td>$54.73</td>
<td>$8.42</td>
<td>$14.75</td>
<td>$0.00</td>
<td>$77.90</td>
</tr>
<tr>
<td>10/01/2015</td>
<td>$55.88</td>
<td>$8.42</td>
<td>$14.75</td>
<td>$0.00</td>
<td>$79.05</td>
</tr>
<tr>
<td>01/01/2016</td>
<td>$55.88</td>
<td>$8.67</td>
<td>$14.90</td>
<td>$0.00</td>
<td>$79.45</td>
</tr>
<tr>
<td>03/01/2016</td>
<td>$56.88</td>
<td>$8.67</td>
<td>$14.90</td>
<td>$0.00</td>
<td>$80.45</td>
</tr>
<tr>
<td>10/01/2016</td>
<td>$58.03</td>
<td>$8.67</td>
<td>$14.90</td>
<td>$0.00</td>
<td>$81.60</td>
</tr>
<tr>
<td>03/01/2017</td>
<td>$59.03</td>
<td>$8.67</td>
<td>$14.90</td>
<td>$0.00</td>
<td>$82.60</td>
</tr>
</tbody>
</table>

Issue Date: 10/08/2014
Wage Request Number: 20141008-018
Page 34 of 41
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice - SPRINKLER FITTER - Local 550 (Section 4) Zone 1</td>
<td>10/01/2014</td>
<td>$18.81</td>
<td>$8.42</td>
<td>$8.25</td>
<td>$0.00</td>
<td>$35.48</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>40</td>
<td>$21.49</td>
<td>$8.42</td>
<td>$8.25</td>
<td>$0.00</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>45</td>
<td>$24.18</td>
<td>$8.42</td>
<td>$8.25</td>
<td>$0.00</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>50</td>
<td>$26.87</td>
<td>$8.42</td>
<td>$8.25</td>
<td>$0.00</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>55</td>
<td>$29.55</td>
<td>$8.42</td>
<td>$8.25</td>
<td>$0.00</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>60</td>
<td>$32.24</td>
<td>$8.42</td>
<td>$8.25</td>
<td>$0.00</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>65</td>
<td>$34.92</td>
<td>$8.42</td>
<td>$8.25</td>
<td>$0.00</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>70</td>
<td>$37.61</td>
<td>$8.42</td>
<td>$8.25</td>
<td>$0.00</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>75</td>
<td>$40.30</td>
<td>$8.42</td>
<td>$8.25</td>
<td>$0.00</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>80</td>
<td>$42.98</td>
<td>$8.42</td>
<td>$8.25</td>
<td>$0.00</td>
</tr>
<tr>
<td>Effective Date -</td>
<td>01/01/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step percent</td>
<td>Apprentice Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental Unemployment</td>
<td>Total Rate</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>35</td>
<td>$18.81</td>
<td>$8.42</td>
<td>$8.40</td>
<td>$0.00</td>
<td>$35.63</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>$21.49</td>
<td>$8.42</td>
<td>$8.40</td>
<td>$0.00</td>
<td>$38.31</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>$24.18</td>
<td>$8.42</td>
<td>$8.40</td>
<td>$0.00</td>
<td>$41.00</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>$26.87</td>
<td>$8.42</td>
<td>$8.40</td>
<td>$0.00</td>
<td>$43.69</td>
</tr>
<tr>
<td>5</td>
<td>55</td>
<td>$29.55</td>
<td>$8.42</td>
<td>$8.40</td>
<td>$0.00</td>
<td>$46.37</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
<td>$32.24</td>
<td>$8.42</td>
<td>$8.40</td>
<td>$0.00</td>
<td>$49.06</td>
</tr>
<tr>
<td>7</td>
<td>65</td>
<td>$34.92</td>
<td>$8.42</td>
<td>$8.40</td>
<td>$0.00</td>
<td>$51.74</td>
</tr>
<tr>
<td>8</td>
<td>70</td>
<td>$37.61</td>
<td>$8.42</td>
<td>$8.40</td>
<td>$0.00</td>
<td>$54.43</td>
</tr>
<tr>
<td>9</td>
<td>75</td>
<td>$40.30</td>
<td>$8.42</td>
<td>$8.40</td>
<td>$0.00</td>
<td>$57.12</td>
</tr>
<tr>
<td>10</td>
<td>80</td>
<td>$42.98</td>
<td>$8.42</td>
<td>$8.40</td>
<td>$0.00</td>
<td>$59.80</td>
</tr>
</tbody>
</table>

Notes: Apprentice entered prior 9/30/10. Steps are 850 hours.

For apprentice rates see "Apprentice - OPERATING ENGINEERS"
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAMPER, SELF-PROPELLED OR TRACTOR DRAWN OPERATING ENGINEER, LOCAL 4</td>
<td>06/01/2014</td>
<td>$41.10</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$65.30</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$42.09</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$66.29</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$42.83</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$67.03</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$44.07</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$68.27</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$44.82</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$69.02</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$46.05</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$70.30</td>
</tr>
<tr>
<td></td>
<td>06/01/2017</td>
<td>$47.04</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$71.24</td>
</tr>
<tr>
<td></td>
<td>12/01/2017</td>
<td>$48.03</td>
<td>$10.00</td>
<td>$14.20</td>
<td>$0.00</td>
<td>$72.23</td>
</tr>
<tr>
<td>TELECOMMUNICATION TECHNICIAN ELECTRICIANS, LOCAL 103</td>
<td>09/01/2014</td>
<td>$33.59</td>
<td>$13.00</td>
<td>$13.36</td>
<td>$0.00</td>
<td>$59.95</td>
</tr>
<tr>
<td></td>
<td>03/01/2015</td>
<td>$33.88</td>
<td>$13.00</td>
<td>$13.70</td>
<td>$0.00</td>
<td>$60.58</td>
</tr>
<tr>
<td></td>
<td>09/01/2015</td>
<td>$34.60</td>
<td>$13.00</td>
<td>$13.72</td>
<td>$0.00</td>
<td>$61.32</td>
</tr>
<tr>
<td></td>
<td>03/01/2016</td>
<td>$35.31</td>
<td>$13.00</td>
<td>$13.74</td>
<td>$0.00</td>
<td>$62.05</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice Operating Engineers"

<table>
<thead>
<tr>
<th>Apprentice - TELECOMMUNICATION TECHNICIAN - LOCAL 103</th>
<th>Effective Date - 09/01/2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
</tr>
<tr>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>55</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
</tr>
<tr>
<td>9</td>
<td>70</td>
</tr>
<tr>
<td>10</td>
<td>75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Apprentice - TELECOMMUNICATION TECHNICIAN - Local 103</th>
<th>Effective Date - 03/01/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
</tr>
<tr>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>55</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
</tr>
<tr>
<td>9</td>
<td>70</td>
</tr>
<tr>
<td>10</td>
<td>75</td>
</tr>
</tbody>
</table>

Notes:

Apprentice to Journeyworker Ratio: 1:1

Issue Date: 10/08/2014
Wage Request Number: 20141008-018
Page 36 of 41
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>TERRAZZO FINISHERS</td>
<td>08/01/2014</td>
<td>$47.90</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$76.30</td>
</tr>
<tr>
<td>BDirect Local #3 - Marble &amp; Tile</td>
<td>02/01/2015</td>
<td>$48.46</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$9.00</td>
<td>$76.86</td>
</tr>
<tr>
<td></td>
<td>08/01/2015</td>
<td>$49.36</td>
<td>$10.18</td>
<td>$18.29</td>
<td>$9.00</td>
<td>$77.83</td>
</tr>
<tr>
<td></td>
<td>02/01/2016</td>
<td>$49.93</td>
<td>$10.18</td>
<td>$18.29</td>
<td>$9.00</td>
<td>$78.40</td>
</tr>
<tr>
<td></td>
<td>08/01/2016</td>
<td>$50.83</td>
<td>$10.18</td>
<td>$18.37</td>
<td>$9.00</td>
<td>$79.30</td>
</tr>
<tr>
<td></td>
<td>02/01/2017</td>
<td>$51.40</td>
<td>$10.18</td>
<td>$18.27</td>
<td>$9.00</td>
<td>$79.95</td>
</tr>
</tbody>
</table>

Apprentice - TERRAZZO FINISHER - Local 3 Marble & Tile

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>08/01/2014</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
<td>Apprentice Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental</td>
<td>Total Rate</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>$23.95</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$52.35</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$28.74</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$57.14</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$33.53</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$61.93</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$38.32</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$66.72</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$43.11</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$71.51</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>02/01/2015</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>percent</td>
<td>Apprentice Base Wage</td>
<td>Health</td>
<td>Pension</td>
<td>Supplemental</td>
<td>Total Rate</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>$24.33</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$52.65</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>$29.08</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$57.48</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>$33.92</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$62.32</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>$38.77</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$67.17</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>$43.61</td>
<td>$10.18</td>
<td>$18.22</td>
<td>$0.00</td>
<td>$72.01</td>
</tr>
</tbody>
</table>

Notes:

Apprentice to Journeyworker Ratio: 1:3

TEST BORING DRILLER
LABORERS - FOUNDATION AND MARINE

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>06/01/2014</th>
<th>$35.45</th>
<th>$7.30</th>
<th>$12.90</th>
<th>$9.00</th>
<th>$55.65</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/01/2014</td>
<td>$36.20</td>
<td>$7.30</td>
<td>$12.90</td>
<td>$9.00</td>
<td>$56.40</td>
<td></td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$36.95</td>
<td>$7.30</td>
<td>$12.90</td>
<td>$9.00</td>
<td>$57.15</td>
<td></td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$37.70</td>
<td>$7.30</td>
<td>$12.90</td>
<td>$9.00</td>
<td>$57.90</td>
<td></td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$38.45</td>
<td>$7.30</td>
<td>$12.90</td>
<td>$9.00</td>
<td>$58.65</td>
<td></td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$39.45</td>
<td>$7.30</td>
<td>$12.90</td>
<td>$9.00</td>
<td>$59.65</td>
<td></td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"

TEST BORING DRILLER HELPER
LABORERS - FOUNDATION AND MARINE

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>06/01/2014</th>
<th>$34.17</th>
<th>$7.30</th>
<th>$12.90</th>
<th>$9.00</th>
<th>$54.37</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/01/2014</td>
<td>$34.92</td>
<td>$7.30</td>
<td>$12.90</td>
<td>$9.00</td>
<td>$55.12</td>
<td></td>
</tr>
<tr>
<td>06/01/2015</td>
<td>$35.67</td>
<td>$7.30</td>
<td>$12.90</td>
<td>$9.00</td>
<td>$55.89</td>
<td></td>
</tr>
<tr>
<td>12/01/2015</td>
<td>$36.42</td>
<td>$7.30</td>
<td>$12.90</td>
<td>$9.00</td>
<td>$56.62</td>
<td></td>
</tr>
<tr>
<td>06/01/2016</td>
<td>$37.17</td>
<td>$7.30</td>
<td>$12.90</td>
<td>$9.00</td>
<td>$57.37</td>
<td></td>
</tr>
<tr>
<td>12/01/2016</td>
<td>$38.17</td>
<td>$7.30</td>
<td>$12.90</td>
<td>$9.00</td>
<td>$58.37</td>
<td></td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice- LABORER"
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
</table>
| TEST BORING LABORER  
LABORERS - FOUNDATION AND MARINE | 06/01/2014 | $34.05 | $7.30 | $12.90 | $0.00 | $54.23 |
| | 12/01/2014 | $34.80 | $7.30 | $12.90 | $0.00 | $55.00 |
| | 06/01/2015 | $35.55 | $7.30 | $12.90 | $0.00 | $55.75 |
| | 12/01/2015 | $36.30 | $7.30 | $12.90 | $0.00 | $56.50 |
| | 06/01/2016 | $37.05 | $7.30 | $12.90 | $0.00 | $57.25 |
| | 12/01/2016 | $38.05 | $7.30 | $12.90 | $0.00 | $58.25 |
| TRACTORS/PORTABLE STEAM GENERATORS  
OPERATING ENGINEERS LOCAL 4 | 06/01/2014 | $41.10 | $10.00 | $14.20 | $0.00 | $65.30 |
| | 12/01/2014 | $42.09 | $10.00 | $14.20 | $0.00 | $66.29 |
| | 06/01/2015 | $42.83 | $10.00 | $14.20 | $0.00 | $67.03 |
| | 12/01/2015 | $44.07 | $10.00 | $14.20 | $0.00 | $68.27 |
| | 06/01/2016 | $44.82 | $10.00 | $14.20 | $0.00 | $69.02 |
| | 12/01/2016 | $46.05 | $10.00 | $14.20 | $0.00 | $70.25 |
| | 06/01/2017 | $47.04 | $10.00 | $14.20 | $0.00 | $71.24 |
| | 12/01/2017 | $48.03 | $10.00 | $14.20 | $0.00 | $72.23 |
| TRAILERS FOR EARTH MOVING EQUIPMENT  
TRANSFER, Joint Council No. 10 Local 4 | 08/01/2014 | $33.27 | $9.91 | $8.80 | $0.00 | $51.98 |
| | 12/01/2014 | $33.27 | $9.91 | $9.33 | $0.00 | $52.51 |
| | 06/01/2015 | $33.62 | $9.91 | $9.33 | $0.00 | $52.86 |
| | 08/01/2015 | $33.62 | $10.41 | $9.33 | $0.00 | $53.36 |
| | 12/01/2015 | $33.62 | $10.41 | $10.08 | $0.00 | $54.11 |
| | 06/01/2016 | $34.12 | $10.41 | $10.08 | $0.00 | $54.61 |
| | 08/01/2016 | $34.12 | $10.41 | $10.08 | $0.00 | $55.11 |
| | 12/01/2016 | $34.12 | $10.41 | $10.89 | $0.00 | $55.92 |
| TUNNEL WORK - COMPRESSED AIR  
LABORERS (COMPRESSED AIR) | 06/01/2014 | $46.33 | $7.30 | $13.30 | $0.00 | $66.93 |
| | 12/01/2014 | $47.06 | $7.30 | $13.30 | $0.00 | $67.68 |
| | 06/01/2015 | $47.83 | $7.30 | $13.30 | $0.00 | $68.43 |
| | 12/01/2015 | $48.58 | $7.30 | $13.30 | $0.00 | $69.18 |
| | 06/01/2016 | $49.33 | $7.30 | $13.30 | $0.00 | $69.93 |
| | 12/01/2016 | $50.33 | $7.30 | $13.30 | $0.00 | $70.93 |
| TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE)  
LABORERS (COMPRESSED AIR) | 06/01/2014 | $48.33 | $7.30 | $13.30 | $0.00 | $68.93 |
| | 12/01/2014 | $49.08 | $7.30 | $13.30 | $0.00 | $69.68 |
| | 06/01/2015 | $49.83 | $7.30 | $13.30 | $0.00 | $70.43 |
| | 12/01/2015 | $50.58 | $7.30 | $13.30 | $0.00 | $71.18 |
| | 06/01/2016 | $51.33 | $7.30 | $13.30 | $0.00 | $71.93 |
| | 12/01/2016 | $52.33 | $7.30 | $13.30 | $0.00 | $72.93 |
| TUNNEL WORK - FREE AIR  
LABORERS (FREE AIR TUNNEL) | 06/01/2014 | $38.40 | $7.30 | $13.30 | $0.00 | $59.00 |
| | 12/01/2014 | $39.15 | $7.30 | $13.30 | $0.00 | $59.75 |
| | 06/01/2015 | $39.90 | $7.30 | $13.30 | $0.00 | $60.50 |
| | 12/01/2015 | $40.65 | $7.30 | $13.30 | $0.00 | $61.25 |
| | 06/01/2016 | $41.40 | $7.30 | $13.30 | $0.00 | $62.00 |
| | 12/01/2016 | $42.40 | $7.30 | $13.30 | $0.00 | $63.00 |

Issue Date: 10/08/2014    Wage Request Number: 20141008-018    Page 38 of 41
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>TUNNEL WORK - FREE AIR (RAZ, WASTE) LABORERS (FREE AIR TUNNEL)</td>
<td>06/01/2014</td>
<td>$40.40</td>
<td>$7.30</td>
<td>$13.30</td>
<td>$0.00</td>
<td>$61.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2014</td>
<td>$41.15</td>
<td>$7.30</td>
<td>$13.30</td>
<td>$0.00</td>
<td>$61.75</td>
</tr>
<tr>
<td></td>
<td>06/01/2015</td>
<td>$41.90</td>
<td>$7.30</td>
<td>$13.30</td>
<td>$0.00</td>
<td>$62.50</td>
</tr>
<tr>
<td></td>
<td>12/01/2015</td>
<td>$42.65</td>
<td>$7.30</td>
<td>$13.30</td>
<td>$0.00</td>
<td>$63.25</td>
</tr>
<tr>
<td></td>
<td>06/01/2016</td>
<td>$43.40</td>
<td>$7.30</td>
<td>$13.30</td>
<td>$0.00</td>
<td>$64.00</td>
</tr>
<tr>
<td></td>
<td>12/01/2016</td>
<td>$44.15</td>
<td>$7.30</td>
<td>$13.30</td>
<td>$0.00</td>
<td>$64.80</td>
</tr>
</tbody>
</table>

For apprentice rates see "Apprentice LABORER"

| VAC-HAUL, CHAVALIERS IND COUNCIL NO. 10 ZONE A | 08/01/2014 | $32.69    | $9.91  | $8.80   | $0.00                     | $51.40     |
|                                               | 12/01/2014 | $32.69    | $9.91  | $9.33   | $0.00                     | $51.93     |
|                                               | 06/01/2015 | $33.04    | $9.91  | $9.23   | $0.00                     | $52.28     |
|                                               | 08/01/2015 | $33.04    | $10.41 | $9.33   | $0.00                     | $52.78     |
|                                               | 12/01/2015 | $33.04    | $10.41 | $10.08  | $0.00                     | $53.33     |
|                                               | 06/01/2016 | $33.54    | $10.41 | $10.08  | $0.00                     | $54.03     |
|                                               | 08/01/2016 | $33.54    | $10.91 | $10.08  | $0.00                     | $54.53     |
|                                               | 12/01/2016 | $33.54    | $10.91 | $10.89  | $0.00                     | $55.34     |

For apprentice rates see "Apprentice LABORER"

| WAGON DRILL OPERATOR LABORERS - ZONE 1          | 06/01/2014 | $34.35    | $7.30  | $12.70 | $0.00                     | $54.35     |
|                                               | 12/01/2014 | $35.10    | $7.30  | $12.70 | $0.00                     | $55.10     |
|                                               | 06/01/2015 | $35.83    | $7.30  | $12.70 | $0.00                     | $55.85     |
|                                               | 12/01/2015 | $36.60    | $7.30  | $12.70 | $0.00                     | $56.60     |
|                                               | 06/01/2016 | $37.35    | $7.30  | $12.70 | $0.00                     | $57.35     |
|                                               | 12/01/2016 | $38.35    | $7.30  | $12.70 | $0.00                     | $58.35     |

For apprentice rates see "Apprentice LABORER"

| WASTE WATER PUMP OPERATOR OPERATING ENGINEERS LOCAL 1 | 06/01/2014 | $41.49    | $10.00 | $14.20 | $0.00                     | $65.69     |
|                                                       | 12/01/2014 | $42.49    | $10.00 | $14.20 | $0.00                     | $66.69     |
|                                                       | 06/01/2015 | $43.24    | $10.00 | $14.20 | $0.00                     | $67.44     |
|                                                       | 12/01/2015 | $44.49    | $10.00 | $14.20 | $0.00                     | $68.69     |
|                                                       | 06/01/2016 | $45.24    | $10.00 | $14.20 | $0.00                     | $69.44     |
|                                                       | 12/01/2016 | $46.49    | $10.00 | $14.20 | $0.00                     | $70.69     |
|                                                       | 06/01/2017 | $47.49    | $10.00 | $14.20 | $0.00                     | $71.69     |
|                                                       | 12/01/2017 | $48.49    | $10.00 | $14.20 | $0.00                     | $72.69     |

For apprentice rates see "Apprentice OPERATING ENGINEERS"

| WATER METER INSTALLER PLUMBERS & GASFITTERS LOCAL 12 | 09/01/2014 | $49.66    | $10.32 | $14.34 | $0.00                     | $74.52     |
|                                                       | 03/01/2015 | $50.66    | $10.32 | $14.34 | $0.00                     | $75.52     |
|                                                       | 09/01/2015 | $51.66    | $10.32 | $14.34 | $0.00                     | $76.52     |
|                                                       | 03/01/2016 | $52.81    | $10.32 | $14.34 | $0.00                     | $77.67     |
|                                                       | 09/01/2016 | $53.86    | $10.32 | $14.34 | $0.00                     | $78.72     |
|                                                       | 03/01/2017 | $54.86    | $10.32 | $14.34 | $0.00                     | $79.72     |

For apprentice rates see "Apprentice PLUMBER/PipesFitter" or "PLUMBER/GASFITTER"

Outside Electrical - East

| CABLE TECHNICIAN (Power Zone) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 184 | 09/01/2013 | $25.66    | $8.70  | $4.48  | $0.00                     | $38.84     |

For apprentice rates see "Apprentice - LINEMAN"

| CABLEMAN (Underground Ducts & Cables) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 184 | 09/01/2013 | $36.55    | $8.70  | $6.58  | $0.00                     | $51.83     |

For apprentice rates see "Apprentice - LINEMAN"

| DRIVER / GROUNDMAN CTD OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 184 | 09/01/2013 | $29.94    | $8.70  | $6.05  | $0.00                     | $44.69     |

For apprentice rates see "Apprentice - LINEMAN"

Issue Date: 10/08/2014
Wage Request Number: 20141008-018
Page 39 of 41
<table>
<thead>
<tr>
<th>Classification</th>
<th>Effective Date</th>
<th>Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRIVER / GROUNDMAN - Inexperienced (&lt; 2000 Hrs.)</td>
<td>09/01/2013</td>
<td>$23.52</td>
<td>$8.70</td>
<td>$5.24</td>
<td>$0.00</td>
<td>$37.46</td>
</tr>
<tr>
<td>EQUIPMENT OPERATOR (Class A Cdl.)</td>
<td>09/01/2013</td>
<td>$36.35</td>
<td>$8.70</td>
<td>$9.43</td>
<td>$0.00</td>
<td>$54.88</td>
</tr>
<tr>
<td>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</td>
<td>09/01/2013</td>
<td>$32.58</td>
<td>$8.70</td>
<td>$6.59</td>
<td>$0.00</td>
<td>$47.37</td>
</tr>
<tr>
<td>GROUNDMAN</td>
<td>09/01/2013</td>
<td>$23.52</td>
<td>$8.70</td>
<td>$3.72</td>
<td>$0.00</td>
<td>$35.94</td>
</tr>
<tr>
<td>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</td>
<td>09/01/2013</td>
<td>$19.25</td>
<td>$8.70</td>
<td>$2.85</td>
<td>$0.00</td>
<td>$30.80</td>
</tr>
<tr>
<td>GROUNDMAN - Inexperienced (&lt;2000 Hrs.)</td>
<td>09/01/2013</td>
<td>$42.77</td>
<td>$8.70</td>
<td>$11.78</td>
<td>$0.00</td>
<td>$63.25</td>
</tr>
<tr>
<td>JOURNEYMAN LINEMAN</td>
<td>09/01/2013</td>
<td>$42.77</td>
<td>$8.70</td>
<td>$11.78</td>
<td>$0.00</td>
<td>$63.25</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Step</th>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>09/01/2013</td>
<td>$25.66</td>
<td>$8.70</td>
<td>$4.24</td>
<td>$0.00</td>
<td>$38.60</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>$27.80</td>
<td>$8.70</td>
<td>$4.71</td>
<td>$0.00</td>
<td>$41.21</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>$32.08</td>
<td>$8.70</td>
<td>$5.43</td>
<td>$0.00</td>
<td>$44.67</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>$34.22</td>
<td>$8.70</td>
<td>$6.16</td>
<td>$0.00</td>
<td>$46.94</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>$34.42</td>
<td>$8.70</td>
<td>$6.88</td>
<td>$0.00</td>
<td>$49.01</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>$36.35</td>
<td>$8.70</td>
<td>$7.62</td>
<td>$0.00</td>
<td>$52.77</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>$38.49</td>
<td>$8.70</td>
<td>$8.33</td>
<td>$0.00</td>
<td>$56.46</td>
</tr>
</tbody>
</table>

### Notes:

- Apprentice to Journeymen Ratio: 1:2
- TELEDATA CABLE SPLICER
- OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104
  
<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/16/2012</td>
<td>$26.33</td>
<td>$4.18</td>
<td>$2.79</td>
<td>$0.00</td>
<td>$33.30</td>
</tr>
</tbody>
</table>

- TELEDATA LINEMAN/EQUIPMENT OPERATOR
  
<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/16/2012</td>
<td>$24.78</td>
<td>$4.18</td>
<td>$2.74</td>
<td>$0.00</td>
<td>$31.70</td>
</tr>
</tbody>
</table>

- TELEDATA WIREMAN/INSTALLER/TECHNICIAN
  
<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/16/2012</td>
<td>$24.78</td>
<td>$4.18</td>
<td>$2.74</td>
<td>$0.00</td>
<td>$31.70</td>
</tr>
</tbody>
</table>

- TREE TRIMMER
  
<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/29/2012</td>
<td>$17.18</td>
<td>$3.37</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$20.55</td>
</tr>
</tbody>
</table>

- TREE TRIMMER GROUNDMAN
  
<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Apprentice Base Wage</th>
<th>Health</th>
<th>Pension</th>
<th>Supplemental Unemployment</th>
<th>Total Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/29/2012</td>
<td>$15.15</td>
<td>$3.37</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$18.52</td>
</tr>
</tbody>
</table>

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.

- 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.

Issue Date: 10/08/2014
Wage Request Number: 20141008-018
Page 46 of 41
Classification

Effective Date  Base Wage  Health  Pension  Supplemental Unemployment  Total Rate

Additional Apprenticeship Information:

Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the previously determined hourly wage rate established by the
Construction under the provisions of the M.G.L. c. 149, ss. 26-270. Apprentices rates 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).
Rates are expressed in allowable number of apprentices to journeyman or fraction thereof, unless otherwise specified.

** Multiple ratios are listed in the common field.
*** APP to Del. 1:1, 2:2, 3:3, 4:4, 5:5, 6:6, 7:7, 8:8, 9:9, 10:10, 11:11, 12:12, etc.
**** APP to Del. 1:1, 2:2, 3:3, 4:4, 5:5, 6:6, 7:7, 8:8, 9:9, 10:10, 11:11, 12:12, etc.

Issue Date: 10/08/2014  Wage Request Number: 20141008-018  Page 41 of 41
The Massachusetts Prevailing Wage Law
M.G.L. c.149, §§26 – 27

NOTICE TO AWARDING AUTHORITIES

- The enclosed wage schedule applies only to the specific project listed at the top and will be updated for any public construction project lasting longer than one (1) year.

- You should request an updated wage schedule from the Division of Occupational Safety if you have not opened bids or selected a contractor within 90 days of the date of issuance of the enclosed wage schedule.

- The wage schedule shall be incorporated in any advertisement or call for bids for the project for which it has been issued.

- Once a contractor has been selected by the awarding authority, the wage schedule shall be made a part of the contract for that project.

NOTICE TO CONTRACTORS

- The enclosed wage schedule, and any updated schedule, must be posted in a conspicuous place at the work site during the life of the project.

- The wages listed on the enclosed wage schedule must be paid to employees on public works projects regardless of whether they are employed by the prime contractor, a filed sub-bidder, or any sub-contractor.

- The enclosed wage schedule applies to all phases of the project including the final clean-up. Contractors whose only role is to perform final clean-up must pay their employees according to this wage schedule.

- All apprentices must be registered with the Massachusetts Division of Apprentice Training in order to be paid at the reduced apprentice rates. If a worker is not registered with the Division of Apprentice Training, they must be paid the “total rate” listed on the wage schedule regardless of experience or skill level. For further information, please call (617) 727-3486 or write to the Division of Apprentice Training, 399 Washington Street, 4th Floor, Boston, MA 02108
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 has been printed on the reverse of this page 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.

In addition, every contractor and subcontractor is required to submit a copy of their weekly payroll records to the awarding authority. This is required to be done on a weekly basis. Once collected, the awarding authority is also required to preserve those records for three years.

In addition, each such contractor, subcontractor or public body shall furnish to the Department of Labor & Workforce Development/Division of Occupational Safety within fifteen days after completion of its portion of the work a statement, executed by the contractor, subcontractor or public body who supervises the payment of wages, in the following form:

STATEMENT OF COMPLIANCE

______________, 2014

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

do hereby state:
That I pay or supervise the payment of the persons employed by
___________________________________
(Contractor, subcontractor or public body)

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 M.G.L. c.149, §§26-27.

Signature _____________________________

Title _____________________________

DIVISION OF OCCUPATIONAL SAFETY, 399 WASHINGTON STREET, 5th FL., BOSTON, MA. 02108

END OF SECTION
<table>
<thead>
<tr>
<th>S</th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>T</th>
<th>F</th>
<th>S</th>
</tr>
</thead>
</table>

**WEEKLY PAYROLL REPORT FORM**

<table>
<thead>
<tr>
<th>Employee Name &amp; Address</th>
<th>Work Classification</th>
<th>Hours Worked</th>
<th>Weekly Total</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>(A)</th>
<th>(B)</th>
<th>(C)</th>
<th>(D)</th>
<th>(E)</th>
<th>(F)</th>
<th>(G)</th>
</tr>
</thead>
</table>

Note: Every contractor and subcontractor is required to submit a copy of their weekly payroll records to the awarding authority.
**TECHNICAL SPECIFICATIONS – TABLE OF CONTENTS**

**DIVISION 01 - GENERAL REQUIREMENTS**
- Section 011000 ....................................................................................................... General Requirements
- Section 012000 ....................................................................................................... Unit Prices
- Section 012210 ....................................................................................................... Unit Price Proposal Sheet
- Section 016200 ....................................................................................................... Substitution Request Form
- Section 017400 ....................................................................................................... Construction Waste Management

**DIVISION 02 - EXISTING CONDITIONS**
- Section 024100 ....................................................................................................... Demolition

**DIVISION 03 - CONCRETE**
- Section 033000 ....................................................................................................... Cast-In-Place Concrete

**DIVISION 05 - METALS**
- Section 054000 ....................................................................................................... Cold-Formed Metal Framing
- Section 055100 ....................................................................................................... Exterior Metal Railings

**DIVISION 06 - WOOD, PLASTICS AND COMPOSITES**
- Section 061000 ....................................................................................................... Rough Carpentry

**DIVISION 07 - THERMAL AND MOISTURE PROTECTION**
- Section 072100 ....................................................................................................... Thermal Insulation
- Section 075400 ....................................................................................................... Thermoplastic Membrane Roofing
- Section 076200 ....................................................................................................... Sheet Metal Flashing and Trim
- Section 079200 ....................................................................................................... Joint Sealants

**DIVISION 08 - OPENINGS**
- Section 081110 ....................................................................................................... Hollow Metal Doors and Frames
- Section 087100 ....................................................................................................... Door Hardware
- Section 089000 ....................................................................................................... Louvers and Vents

**DIVISION 09 - FINISHES**
- Section 099000 ....................................................................................................... Painting and Coating

**DIVISION 13 - SPECIAL CONSTRUCTION**
- Section 131200 ....................................................................................................... Precast Concrete Building

**DIVISION 22 - PLUMBING**
- Section 220000 ....................................................................................................... Plumbing

**DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING**
- Section 230000 ....................................................................................................... Heating, Ventilating and Air-Conditioning

**DIVISION 26 - ELECTRICAL**
- Section *261000 ....................................................................................................... Electrical

**DIVISION 31 - EARTHWORK**
- Section 311000 ....................................................................................................... Site Clearing
- Section 312000 ....................................................................................................... Earth Moving
- Section 312500 ....................................................................................................... Sedimentation and Erosion Control

**DIVISION 32 - EXTERIOR IMPROVEMENTS**
- Section 321000 ....................................................................................................... Bases, Ballasts, and Paving
- Section 321243 ....................................................................................................... Porous Asphalt
- Section 329200 ....................................................................................................... Turf and Grasses

**DIVISION 33 - UTILITIES**
- Section 334000 ....................................................................................................... Storm Drainage Utilities
LIST OF DRAWINGS

ARCHITECTURAL:
T-1 - TITLE PAGE, AND NOTES
A-1 - PLANS, AND ELEVATIONS
A-2 - SECTIONS, ELEVATIONS AND DETAILS

STRUCTURAL:
S-1 - STRUCTURAL PLAN SKETCHES AND NOTES
S-2 - FOUNDATION, FOOTING AND RETAINING WALL STRUCTURAL SKETCHES

CIVIL:
C-1.1 - EROSION & SEDIMENTATION CONTROL & SITE DEMOLITION PLAN
C-1.2 - EROSION & SEDIMENTATION CONTROL DETAILS
C-2.1 - LAYOUT & MATERIAL PLAN
C-2.2 - SITE UTILITY
C-2.3 - SITE GRADING PLAN
C-3.1 - SITE DETAILS

MECHANICAL:
M-1 - MECHANICAL AND PLUMBING PLAN
M-2 - MECHANICAL SPECIFICATIONS

ELECTRICAL:
E-1 - ELECTRICAL LEGEND
E-2 - ELECTRICAL PLAN
E-3 - ELECTRICAL RISER AND SITE DETAILS
PROJECT MANUAL

CITY OF NEWTON
Waban Hill Communications Tower
Equipment Building
Newton, MA

October 3, 2014

ARCHITECT:
Goldman Reindorf Architects Inc.
427 Watertown Street, Suite 102
Newton, MA 02458
PROJECT MANUAL

TABLE OF CONTENTS

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

Issued by the City of Newton

SPECIFICATIONS

DIVISION 01 - GENERAL REQUIREMENTS

Section 011000 General Requirements
Section 012200 Unit Prices
Section 012210 Unit Price Proposal Sheet
Section 016200 Substitution Request Form
Section 017400 Construction Waste Management

DIVISION 02 - EXISTING CONDITIONS

Section 024100 Demolition

DIVISION 03 - CONCRETE

Section 033000 Cast-In-Place Concrete

DIVISION 05 - METALS

Section 054000 Cold-Formed Metal Framing
Section 055100 Exterior Metal Railings

DIVISION 06 - WOOD, PLASTICS AND COMPOSITES

Section 061000 Rough Carpentry

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

Section 072100 Thermal Insulation
Section 075400 Thermoplastic Membrane Roofing
Section 076200 Sheet Metal Flashing and Trim
Section 079200 Joint Sealants

DIVISION 08 - OPENINGS

Section 081110 Hollow Metal Doors and Frames
Section 087100 Door Hardware
Section 089000 Louvers and Vents

DIVISION 09 - FINISHES

Section 099000 Painting and Coating

* Filed Sub-Bid required
DIVISION 13 - SPECIAL CONSTRUCTION

Section 131200  Precast Concrete Building

DIVISION 26 - ELECTRICAL

Section *261000  Electrical

DIVISION 31 - EARTHWORK

Section 311000  Site Clearing
Section 312000  Earth Moving
Section 312500  Sedimentation and Erosion Control

DIVISION 32 - EXTERIOR IMPROVEMENTS

Section 321000  Bases, Ballasts, and Paving
Section 321243  Porous Asphalt
Section 329200  Turf and Grasses

DIVISION 33 - UTILITIES

Section 334000  Storm Drainage Utilities

END OF TABLE OF CONTENTS
SECTION 011000

GENERAL REQUIREMENTS

1.1 Related Documents

1.2 Project Requirements

1.3 Specification Information

1.4 Definitions

1.5 Industry Standards

1.6 Codes and Regulations

1.7 Progress Schedule

1.8 Schedule of Values

1.9 Payment Requests

1.10 Procedures and Controls

1.11 Submittals

1.12 Warranties

1.13 Cutting and Patching

1.14 Temporary Facilities and Utilities

1.15 Products and Substitutions

1.16 Delivery, Storage and Handling

1.17 Owner-Furnished (OFCI) Products

1.18 Labels

1.19 Record Documents

1.20 Project Close Out

1.21 Final Cleaning and Repair

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents apply to this Section. This Section applies to all Work performed under the Contract.

1.2 PROJECT REQUIREMENTS

A. Project Identification: City of Newton - Waban Hill Communications Tower Equipment Building, in Newton, MA

B. Summary of Work:

1. Work under this contract shall consist of: Installation of new modular concrete buildings over a new concrete slab supported by foundation walls for communications equipment serviced from the existing tower that remains, and includes all architectural, site, structural, mechanical and electrical work as indicated on the drawings.

2. New communications equipment work and hook up to the existing tower and disconnection of the old communication equipment in the existing building. This work will be done by the City of Newton’s Communications Contractor under a separate contract.

3. When the new communication equipment is operational in the new building, the old communications building, including equipment, structure, slabs and foundations will be removed and the area will be replanted as indicated on the drawings.

4. Construction is expected to begin on 11/1/2014 and shall be completed within 36 weeks but not later than August 1, 2015.

C. Particular Phasing Requirements:

1. Phase 1: Installation of three new modular concrete buildings for new communications equipment to be serviced from the existing communications tower that is to remain. Work includes all site work for new construction, new foundations and retaining walls, new
modular buildings and associated architectural work and mechanical and electrical work as indicated on the drawings.

a. New communications equipment work and hook up to the existing tower and disconnection of the old communication equipment in the existing building. This work will be done by the City of Newton’s Communications Contractor under a separate contract. Communications work will include providing all communications equipment, materials and labor to provide an operational communication service for the City of Newton in the new modular buildings. After delivery of the new communication service the Communications Contractor shall disconnect the old communications equipment, salvage reusable equipment and make safe the remaining equipment ready for removal by the demolition contractor in Phase 2.

2. Phase 2: Commences only after the new communications equipment has been installed in the new modular building by the City of Newton’s Communications Contractor, and the communications services are operational. Phase 2 includes demolition of the old existing Communications Equipment Building including but not limited to: removal of non salvageable communications equipment; demolition and removal of existing building and foundation materials. All new Site Work as shown on the drawings including but not limited to: site demolition, excavation, fill and regrading, landscape materials and plantings, new fencing, new walkways and asphalt repairs.

D. Project Requirements for Temporary Utilities and Facilities:

1. Utility Costs: The Contractor shall meter and pay for cost of utility services consumed, including electricity, water, gas and temporary heat.

2. Temporary Offices: A separate field office for the Architect and the Owner's Representative is not required.

3. Toilet Facilities: The Contractor shall provide and maintain temporary toilets outside the building.

E. Permits and Fees: Apply for, obtain, and pay for permits, fees, and utility company backcharges required to perform the work. Submit copies to Architect.

F. Codes: Comply with applicable codes and regulations of authorities having jurisdiction. Submit copies of inspection reports, notices and similar communications to Architect.

G. Dimensions: Verify dimensions indicated on drawings with field dimensions before fabrication or ordering of materials. Do not scale drawings.

H. Existing Conditions: Notify Architect of existing conditions differing from those indicated on the drawings.

I. Contractor’s Conduct on Premises: The Contractor and their employees shall behave in a respectful, courteous and safe manner. Abusive, harassing, and lewd behavior is prohibited. Music playing is prohibited. Alcohol, tobacco, and drug use is prohibited.

1. Comply with Owner’s security requirements.
and bold print is only used to assist reader in finding information and no other meaning is implied.

B. Except where specifically indicated otherwise, the subject of all imperative statements is the Contractor.

C. Sections are generally numbered in conformance with Construction Specifications Institute Masterformat System. Numbering sequence is not consecutive. Refer to the table of contents for names and numbers of sections included in this Project.

D. Pages are numbered separately for each section. Each section is noted with "End of Section" to indicate the last page of a section.

1.4 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.5 INDUSTRY STANDARDS

A. Referenced standards are part of the Contract Documents and have the same force and effect as if bound with these specifications.
B. Except where specifically indicated otherwise, comply with the current standard in effect as of the date of the Owner/Contractor Agreement. Obtain copies of industry standards directly from publisher.

C. The titles of industry standard organizations are commonly abbreviated; full titles may be found in Encyclopedia of Associations or consult Architect.

1.6 CODES AND REGULATIONS

A. Comply with all applicable codes, ordinances, regulations and requirements of authorities having jurisdiction.

B. Submit copies of all permits, licenses, certifications, inspection reports, releases, notices, judgments, and communications from authorities having jurisdiction to the Architect.

1.7 PROGRESS SCHEDULE

A. Provide comprehensive bar chart schedule showing all major and critical minor portions of the work, sequence of work and duration of each activity. Update and reissue regularly, but not less than monthly.

1.8 SCHEDULE OF VALUES

A. Prepare Schedule of Values to coordinate with application for payment breakdown. Submit at least 10 days before first payment application. Update and reissue regularly, but not less than monthly.

1.9 PAYMENT REQUESTS

A. Provide three copies of each request on completely filled out copies of AIA G702 and continuation sheet G703. Substantiate requests with complete documentation; include change orders to date. Provide partial lien waivers for work in progress and full lien waivers for completed work.

B. Record Drawing Certification: Certify as a part of each application for payment that the project record documents are current at the time of application is submitted. The Contractor shall require such drawings to be current as a condition of approving any payment to the trade Contractor and Subcontractor.

C. Before first payment application, provide the following:

1. List of subcontractors, suppliers and fabricators.
2. Schedule of values.
3. Progress schedule.
4. Submittal schedule keyed to project schedule.
5. List of Contractor's key project personnel.
6. Copies of permits and other communications from authorities.
7. Contractor's certificate of insurance.
8. Performance and payment bonds if required.
9. Unit price schedule.

D. Before final payment application, provide and complete the following:
1. Complete closeout requirements.
2. Complete punch list items.
3. Settle all claims.
4. Transmit record documents to Architect.
5. Prove that all taxes, fees and similar obligations have been paid.
6. Remove temporary facilities and surplus materials.
7. Change lock cylinders or cores.
8. Clean the work.
9. Submit consent of surety, if any, for final payment.

1.10 PROCEDURES AND CONTROLS

A. Project Meetings: Arrange for and attend meetings with the Architect and such other persons as the Architect requests to have present. The Contractor shall be represented by a principal, project manager, general superintendent or other authorized main office representative, as well as by the Contractor’s field superintendent. An authorized representative of any subcontractor or sub-subcontractor shall attend such meetings if the representative’s presence is requested by the Architect. Such representatives shall be empowered to make binding commitments on all matters to be discussed at such meetings, including costs, payments, change orders, time schedules and manpower. Any notices required under the Contract may be served on such representatives. Written reports of meeting minutes shall be prepared by the Contractor and distributed by the Contractor to attendees, the Architect, and Owner within three business days.

1. Pre-Construction Conference: Attendance by Architect, Contractor, major subcontractors. Agenda shall include: Quality of workmanship, coordination, interpretations, job schedule, submittals, approvals, requisition procedures, testing, protection of construction, and construction waste management.
2. Exterior Envelope Meeting: Attendance by Architect, Contractor, major subcontractors. Agenda shall include as applicable: Review of exterior wall details, wall construction, sample panel preparation, cleaning, control and expansion joints, cold weather procedures.
3. Roofing/Flashings Meeting: Attendance by Architect, Contractor, roofing subcontractor, and representative of roofing manufacturer. Agenda shall include as applicable: Preparation of roof decks, flashing and blocking details, roofing procedures and inspections, bonds and guarantees, weather conditions during roofing, protection of roof membrane during construction.
4. Progress Meetings: Hold regularly before preparation of payment requests and additional meetings as requested by the Architect. Attendance by Architect, Contractor, and others as determined by Contractor. Agenda shall include work in progress and payment requests.
5. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction, as specified. Preinstallation Conferences may be part of Progress Meeting agenda. Attendance by Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow. Agenda shall include a review of progress of other construction activities and preparations for the particular activity under consideration.

B. Emergency Addresses: Furnish the Owner and Architect, in writing, the names addresses and telephone numbers of individuals to be contacted in the event of an out-of-hours emergency at the building site. Post a similar list readily visible from the outside of the field office or a location acceptable to the Architect.
C. Layout: Layout work and be responsible for all lines, elevations, and measurements of the building, grading, utilities and other work executed under the contract. Retain a registered professional engineer or registered land surveyor, acceptable to the Architect, to initially establish exterior lines and required elevations of all buildings and structures to be erected on the site. The registered professional engineer or registered land surveyor shall certify the actual location of the constructed facilities in relation to property lines, building lines, easements, setbacks, and other restrictive boundaries.

D. Field Measurements: Verify measurements at the building prior to ordering materials or commencing work. No extra charge or compensation will be allowed because of differences between actual dimensions and measurements indicated on the Drawings. Differences which may be found shall be submitted to the Architect for decision before proceeding with the work.

E. Field Measurements for Fixed Equipment: Dimensions for fixed equipment to be supplied under this Contract or separate contracts shall be determined by field measurements taken jointly by the Contractor and the equipment supplier involved. A record of the field measurements shall be kept until time of substantial completion of the project, or until the equipment has been fully installed and accepted by the Owner, whichever is later. Responsibility for fixed equipment fabricated accurately to field measurements for proper fit and operation shall be that of the Contractor. Contractor shall pay all costs involved in correcting any misfitting fixed equipment as fabricated.

F. Project Limit Line: The boundaries of the site do not limit the responsibility of the Contractor to perform the work in its entirety. Make utility connections as indicated.

G. Matching: Where matching is indicated, the Architect shall be the sole and final judge of what is an acceptable match. Mockups and sample submissions are required.

H. Observation: Notify the Architect and authorities having jurisdiction at least thirty-six hours in advance of concealing any work.

I. Utilities: Prior to interrupting utilities, services or facilities, notify the utility owner and the Owner and obtain their written approval a minimum 48 hours in advance.

J. Furnishings, Fixtures, and Equipment: Cooperate and permit the Owner to install their furnishings and equipment during the progress of the work. Owner's installation of furnishings or equipment does not signify Owner's acceptance of any portion of the work.

K. Clean-Up: Frequently clean-up all waste, remove from site regularly, and legally dispose of off-site. Comply with requirements of Section 017400 - CONSTRUCTION WASTE MANAGEMENT.

L. Installer's Acceptance of Conditions: All installers shall inspect substrates and conditions under which work is to be executed and shall report in writing to the Contractor all conditions detrimental to the proper execution and completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means installer accepts previous work and conditions.

M. Coordination: The Contractor shall be fully responsible for coordinating all trades, coordinating construction sequences and schedules, and coordinating the actual installed location and interface of all work.
1. Prior to beginning mechanical, electrical and fire protection work, the Contractor shall prepare coordination drawings showing the exact alignment, physical location and configuration of the mechanical, electrical and fire protection installations and demonstrating to the Contractor's satisfaction that the installations will clear all obstructions, permit proper clearances for the Work of other trades, and present an orderly appearance where exposed. The Contractor shall be solely liable and responsible for any costs and delays resulting from the Contractor's failure to prepare such coordination drawings or from the negligent preparation of such coordination drawings.

2. Exact locations and groupings of mechanical, electrical and fire protection fixtures, switches, heads and outlets shall be obtained from the Architect before the Work is roughed in. Work installed without such information from the Architect shall be relocated at the Contractor's expense if the Architect so requests.

N. Request For Interpretation (RFIs):

1. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
   a. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.

2. Content of the RFI: Include a detailed, legible description of item needing interpretation.

3. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow three working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

4. The following RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for interpretation of Architect's actions on submittals.
   f. Incomplete RFIs or RFIs with numerous errors.

O. Existing Articles of Unusual Value: If during demolition, excavation, or disposal work articles of unusual value or of historical or archaeological significance are encountered, the ownership of such articles is retained by the Owner, and information regarding their discovery shall be immediately furnished to the Architect. If the nature of the article is such that work cannot proceed without danger of damage, work in the area shall be immediately discontinued until the Architect has determined the proper procedure to be followed. Delays in time thereby shall be a condition for which the time of the Contract may be extended. Costs incurred after discovery in the salvaging of such articles shall be borne by the Owner.
proposed date first due at Architect's office and proposed date due to be returned to Contractor. Note relevant specification section number.

C. Contractor's Preparation of Submittals: Modify and customize all submittals to show interface with adjacent work and attachment to building. Identify each submittal with name of project, date, Contractor's name, subcontractor's name, manufacturer's name, submittal name, relevant specification section numbers, and Submittal Schedule reference number. Stamp and sign each submittal to show the Contractor's review and approval of each submittal before delivery to Architect's office; unstamped and unsigned submittals will be returned without action by the Architect. Leave 4” x 6” open space for Architect's "action" stamp.

1. Electronic Submittals: Provide a copy of all submittals in electronic format to the Architect. Architect will return a file of reviewed submittal in electronic format to the Contractor for distribution to subcontractors, suppliers, fabricators, governing authorities and others as necessary for proper performance of the Work. Unless otherwise amenable to the Architect, additional hard copies of submittals will not be reviewed by the Architect (or Consultant) and will not be returned to the Contractor.

2. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

3. Name file with submittal number or other unique identifier, including revision identifier.

4. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.

5. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Architect.

D. Product Data: Provide manufacturer's preprinted literature including, without limitation, manufacturer's standard printed description of product, materials and construction, recommendations for application and use, certification of compliance with standards, instructions for installation, and special coordination requirements. Collect data into one submittal for each unit of work or system; mark each copy to show which choices and options are applicable to project.

1. Installer Copy: Verify that the Installer has a current copy of the relevant product data, including installation instructions, before permitting installation to begin.

E. Shop Drawings: Provide accurately prepared, large scale and detailed shop drawings prepared specifically for this project. Show adjacent conditions and related work. Show accurate field dimensions and clearly note field conditions. Identify materials and products in the work shown. Note special coordination required.

1. After Architect's action, follow specified distribution procedure.

F. Samples: Provide units identical with final materials and products to be installed in the work. Where indicated, prepare samples to match Architect's sample. Label each sample with description, source, generic name or manufacturer's name and model number. Architect will review samples for confirmation of visual design intent, color, pattern, texture and type only; Architect will not test samples for compliance with other Contract requirements which shall remain the exclusive responsibility of the Contractor.

1. Initial Selection Samples Submittal Quantities: For initial selection purposes, submit 1 set of samples showing the complete range of colors and finishes available.
2. Verification Samples Submittal Quantities: For verification of an initial selection, submit 3 sets of samples; one set will be returned to Contractor to be maintained at project site for quality control comparisons.

G. Timing of Submittals: Submit submittals in a timely fashion to allow at least 10 business days for each office's review and handling. This means that submittals which have to be reviewed by the Architect and one of their consultants require at least 20 business days for review and handling. Add ten business days for each additional consultant who must review a submission.

H. Architect's Action on Submittals: Architect will review submittals, stamp with "action stamp", mark action, and return to Contractor. Architect will review submittals only for conformance with the design concept of the project. The Contractor is responsible for confirming compliance with other Contract requirements, including without limitation, performance requirements, field dimensions, fabrication methods, means, methods, techniques, sequences and procedures of construction, coordination with other work. The Architect's review and approval of submittals shall be held to the limitations stated in the Owner/Architect Agreement and the Conditions of the Contract. In no case shall approval or acceptance by the Architect be interpreted as a release of Contractor of their responsibilities to fulfill all of the requirements of the Contract Documents.

1. Required Resubmittal: Unless submittal is noted "reviewed" or "reviewed except as noted, resubmission not required," make corrections or changes to original and resubmit to Architect.

2. Distribution: When submittal is noted "reviewed" or "reviewed as noted, resubmittal not required," make prints or copies and distribute to Owner, Subcontractors involved, and to all other parties requiring information from the submittal for performance or coordination of related work.

1.12 WARRANTIES

A. Warranties Required: Refer to individual trade sections for specific product warranty requirements.

B. Procurement: Where a warranty is required, do not purchase or subcontract for materials or work until it has been determined that parties required to countersign warranties are willing to do so.

C. Warranty Forms: Submit written warranty to Owner through Architect for approval prior to execution. Furnish two copies of executed warranty to Owner for their records; furnish two additional conformed copies where required for maintenance manual.

D. Work Covered: Contractor shall remove and replace other work of project which has been damaged as a result of failure of warranted work or equipment, or which must be removed and replaced to provide access to work under warranty. Unless otherwise specified, warranty shall cover full cost of replacement or repair, and shall not be pro-rated on basis of useful service life.

E. Warranty Extensions: Work repaired or replaced under warranty shall be warranted until the original warranty expiration date or for ninety days whichever is later in time.

F. Warranty Effective Starting Date: Guarantee period for all work, material and equipment shall begin on the date of substantial completion, not when subcontractor has completed their work nor when equipment is turned on. In addition to the one year guarantees for the entire work...
covered by these Contract Documents, refer to the various sections of the specifications for extended guarantee or maintenance requirements for various material and equipment.

1.13 CUTTING AND PATCHING

A. Limitations: Do not cut and patch any work in a manner that would result in a failure of the work to perform as intended, decreased energy performance, increased maintenance, decreased operational life, or decreased safety.

1. Structural Work: Do not cut structural work or bearing walls without written approval from Architect. Where cutting and patching of structural work is necessary and approved by Architect, perform work in a manner which will not diminish structural capacity nor increase deflection of member. Provide temporary shoring and bracing as necessary. Ensure the safety of people and property at all times.

B. Cutting and Patching Materials: Use materials identical to materials to be cut and patched. If identical materials are not available or cannot be used, use materials that match existing materials to the greatest extent possible. Provide finished work that will result in equal to or better than existing performance characteristics.

C. Inspection: Before cutting and patching, examine surfaces and conditions under which work is to be performed and correct unsafe and unsatisfactory conditions prior to proceeding.

D. Protection: Protect adjacent work from damage. Protect the work from adverse conditions.

E. Cutting: Cut work using methods least likely to damage adjoining work. Use tools designed for sawing or grinding, not hammering or chopping. Use saws or drills to ensure neat, accurately formed holes to sizes required with minimum disturbance to adjacent work. Temporarily cover openings; maintain weathertightness and safety.

1. Utilities: Locate utilities before cutting. Provide temporary utilities as needed. Cap, valve, or plug and seal ends of abandoned utilities to prevent entrance of moisture or other foreign matter.

F. Patching: Patch with seams and joints which are durable and not visible. Comply with specified tolerances for similar new work; create true even planes with uniform continuous appearance. Restore finishes of patched areas and, if necessary, extend finish restoration onto adjoining unpatched area to eliminate evidence of patching and refinishing. Repaint entire assemblies, not just patched area. Remove and replace work which has been cut and patched in a visually unsatisfactory manner as determined by the Architect.

G. Qualifications: Retain experienced and specialized firms, original installers if possible, to perform cutting and patching. Workmen shall be skilled in type of cutting and patching required.

1.14 TEMPORARY FACILITIES AND UTILITIES

A. Scope of Temporary Work: This article is not intended to limit the scope of temporary work required under the Contract. Provide all temporary facilities and utilities needed.

B. Permits and Fees: Obtain and pay for all permits, fees and charges related to temporary work.
C. **Codes and Authorities Having Jurisdiction for Temporary Facilities and Utilities:** Comply with all requirements of authorities having jurisdiction, codes, utility companies, OSHA, and industry standards including, but not limited to the following:

2. ANSI-A10 Series, Safety Requirements for Construction and Demolition.
4. Electrical Service: NEMA, NECA, and UL.

D. **Field Offices:** Provide Contractor's field offices as needed. Keep current copies of all Contract Documents and project paperwork neatly on file at jobsite. Permit Architect's unrestricted use of Contractor's field office facilities including copiers, telephones, plan tables, and other equipment. Furnish, maintain, and pay for light, power, phone, fax, and other field office services.

E. **Shops and Sheds:** At Contractor's option, provide shops and sheds for Contractor's use as needed. Locate shops and sheds where acceptable to Owner and authorities having jurisdiction. Prior to completion of construction, temporary storage facilities and surplus stored materials shall be removed from the site.

F. **Temporary Heat:** Provide temporary heat as needed to protect the work and create a suitable work environment. Provide temporary heat to protect the exterior construction against injury or damage resulting from cold temperature and dampness, to heat materials, and to maintain the minimum temperatures specified herein and in individual specification sections. Protect building from soot, smoke and fire damage. Do not use heaters which would interfere with curing of mortar and grout or damage any materials.

1. Heaters for temporary heat shall be approved temporary steam generators or forced warm air heaters located outside the building or vented to the outside, or other safety type UL approved heating devices acceptable to the Architect.
2. Oil burning salamander type heaters will not be permitted. Non-vented, open flame heaters will not be permitted inside the building once the building is closed-in.
3. Propane type-heaters will not be permitted within the area of the building or near stockpiles of combustible materials.
4. Permanent building equipment shall not be used without written permission from the Owner. If the equipment is used for temporary heating or cooling, it shall be adequately maintained per manufacturer's instructions and protected with filters, strainers, controls, reliefs, and similar items. Prior to turnover to Owner, the equipment shall be in a clean, like new condition. The guarantee period shall not start until the equipment is turned over to the Owner for their use. Do not invalidate existing warranty by any action or failure to act. Clean and change air filters frequently to prevent construction dust and debris from contaminating system.

G. **Pumping and Drainage:** Protect excavations, trenches, buildings and materials from rain water, ground water, backup or leakage of sewers, drains and other piping, and from water of any other origin. Promptly remove any accumulation of water. Provide and operate all pumps, piping and other equipment necessary for pumping, drainage and protection from water.

H. **Equipment and Tools:** Provide all equipment including, but not limited to, hoists, lifts, scaffolding, machines, tools and the like, as needed for execution of the work. Provide safe access to all parts of the work.
I. Temporary Enclosures: Provide temporary enclosures to maintain proper temperatures and to prevent weather damage. Always maintain legal means of egress.

J. Snow and Ice: Remove all snow and ice which interferes with work or safety.

K. Streets, Walks and Grounds: Maintain public and private roads and walks clear of debris caused by construction operations. Repair all damage caused to streets, drives, curbs, sidewalks, fences, poles and similar items where disturbed or damaged by building construction and leave them in as good condition after completion of the work as before operations started.

L. Protection: Protect nearby property and the public from construction activities. Provide and maintain barricades, warning signs and lights, railings, walkways and similar items. Immediately repair damaged property to its condition before being damaged.

M. Public Services: Provide temporary public services such as, street lighting, night lighting, sidewalks, covered passages, signs, signals and the like, as requested by authorities having jurisdiction.

N. Construction Fencing: Provide construction fencing and barriers as applicable to the project and as required by code to protect personnel, the public, and to control access.

O. Security: Secure site against unauthorized entry at all times. Provide secure, locked temporary enclosures. Protect the work at all times. Provide watchman service, if necessary, to protect the work.

P. Signs: Erect project identification signs in compliance with details to be provided by Architect. Signs shall be minimum 4’ x 8’ exterior grade plywood and shall contain the names of the project, Owner, Architect, major Consultants, Contractor, and major financing institution. Except for safety and warning signs, no other signs are permitted. Location as acceptable to the Architect.

Q. Fire Prevention: Take every precaution to prevent fire. Provide and maintain in good operating condition suitable and adequate fire protection equipment and services, and comply with recommendations regarding fire protection made by the representative of the fire insurance company carrying insurance on the Work or by the local fire chief or fire marshal. The area within the site limits shall be kept orderly and clean, and all combustible rubbish shall be promptly removed from the site.

R. Egress: Maintain safe and legal means of egress at all times. At all times, provide at least two separate means of egress.

S. Mold Control and Remediation During Construction: The Contractor shall protect construction materials and building systems from moisture damage and from conditions which promote mold growth during and after construction. The Contractor shall be responsible for mold remediation and replacement of materials which cannot be successfully remediated in accordance with the following requirements:

1. Materials which become wet prior to installation shall be cleaned, treated and dried in accordance with EPA Guidelines.
2. Materials which exhibit mold growth prior to installation shall not be installed and shall be removed from the site.

GENERAL REQUIREMENTS
011000 - 12
3. Materials which exhibit mold growth after installation shall be remediated in accordance with EPA Guidelines for Remediating Building Materials with Mold Growth Caused by Clean Water. The Contractor shall engage and pay for a qualified industrial hygienist acceptable to the Owner to determine the cause of the mold growth, and to certify in writing that materials have been successfully remediated. In the event that the industrial hygienist recommends methods of remediation in addition to those in the Guidelines, the Contractor shall also be responsible for the additional remediation. Materials which can not be successfully remediated shall be removed and replaced with new materials at no additional expense to the Owner.

4. Prior to the start of construction, the Contractor shall submit the name of the person in the Contractor's organization responsible for ensuring compliance with these requirements for mold control and remediation.

1.15 PRODUCTS AND SUBSTITUTIONS

A. Specified Products: In all cases in which a manufacturer's name, trade name or other proprietary designation is used in connection with materials or articles to be furnished under this Contract, whether or not the phrase "or equal" is used after such name, the Contractor shall provide the product of the named manufacturers without substitution, unless a written request for a substitution has been submitted by the Contractor and approved in writing by the Architect.

B. Deviations from Detailed Requirements: If the Contractor proposes to use material which, while suitable for the intended use, deviates in any way from the detailed requirements of the Contract Documents, the Contractor shall inform the Architect in writing of the nature of such deviations at the time the materials is submitted for approval, and shall request written approval of the deviation from the requirements of the Contract Documents.

C. Approval of Substitutions: In requesting approval of deviations or substitutions, the Contractor shall provide evidence, including, but not limited to manufacturer's data, leading to a reasonable certainty that the proposed substitution or deviation will provide a quality of result at least equal to that attainable if the detailed requirements of the Contract Documents were strictly followed. If, in the opinion of the Architect, the evidence presented by the Contractor does not provide a sufficient basis for such reasonable certainty, the Architect may reject such substitution or deviation without further investigation.

D. Intent of Contract Documents: The Contract Documents are intended to produce a building of consistent character and quality of design. All components of the building including visible items of mechanical and electrical equipment have been selected to have a coordinated design in relation to the overall appearance of the building. The Architect shall judge the design and appearance of proposed substitutes on the basis of the suitability in relation to the overall design of the Project, as well as for their intrinsic merits. The Architect will not approve as equal to materials specified proposed substitutes which in the Architect's opinion, would be out of character, obtrusive, or otherwise inconsistent with the character or quality of design of the Project. In order to permit coordinated design of color and finishes the Contractor shall furnish the substituted material in any color, finish texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to the owner.

E. Additional Costs or Impact: Any additional cost, or any loss or damage arising from the substitution of any material or any method for those originally specified shall be borne by the contractor, notwithstanding approval or acceptance of such substitution by the Owner or the Architect, unless such substitution was made at the written request or direction of the Owner and the Architect. Any decrease in the cost of the substitution shall be returned to the Owner.
F. Manufacturers: To the greatest degree possible, provide primary materials and products from one manufacturer for each type or kind. Provide secondary materials as recommended by manufacturers of primary materials.

G. Substitution Requests: Refer to Section 016200 - SUBSTITUTION REQUEST FORM. Submit 3 copies. Identify product to be replaced by substitute by reference to specification sections and drawing numbers. Provide Contractor's certification and evidence to prove compliance with Contract Document requirements as acceptable to Architect.

H. Substitution Conditions: Substitution requests will be returned without action unless one of the following conditions is satisfied. The Contractor shall state which of the following conditions applies to the requested substitution:

1. Request is due to an "or equal" clause.
2. Specified material or product cannot be coordinated with other work.
3. Specified material or product is not acceptable to authorities having jurisdiction.
4. Substantial advantage is offered Owner in terms of cost, time, or other valuable consideration.
5. Specified material or product is not available.

I. Invalid Substitutions: Contractor's submittal and Architect's acceptance of shop drawings, samples, product data or other submittal is not a valid request for, nor an approval of a substitution unless the Contractor presents the information when first submitted as a Request for Substitution.

J. Compatibility of Materials Used in the Work:

1. Ensure complete compatibility between materials.
2. Compatibility shall include adhesion, erosion, solubility, differential thermal response, and galvanic action.
3. Provide evidence of compatibility.
4. Provide custom testing where evidence is not available.
5. Where materials are not compatible, provide necessary isolation or transition materials and provide details of same.
6. Correct defects resulting from incompatibility including de-construction and re-construction of assemblies – whether materials are part of a submittal and substitution process or not.
7. Proposed substitutions may be rejected where compatibility information is not provided; or where compatibility is not adequately addressed, according to the Architect’s judgment; or where incompatible materials would negatively impact the project’s success.

1.16 DELIVERY, STORAGE AND HANDLING

A. Manufacturer’s Instructions: Strictly comply with manufacturer’s instructions and recommendations and prevent damage, deterioration and loss, including theft. Minimize long-term storage at the site. Maintain environmental conditions, temperature, ventilation, and humidity within range permitted by manufacturers of materials and products used.
1.17 OWNER-FURNISHED CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner will furnish products indicated. The Contractor's Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.

1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

B. Owner-Furnished Products: As directed by the Architect.

1.18 LABELS

A. Labels, Trademarks, & Tradenames: Locate required labels on inconspicuous surfaces. Do not provide labels, nameplates, or trademarks which are not required. Provide permanent data plate on each item of equipment stating manufacturer, model, serial number, capacity, ratings and all other essential data.

1.19 RECORD DOCUMENTS

A. General: Keep record documents neatly and accurately. Record information as the work progresses and deliver to Architect at time of final acceptance. Include in record documents all field changes made, all relevant dimensions, and all relevant details of the work. Keep record documents up to date with all field orders and change orders clearly indicated.

B. Drawings: Keep four separate sets of blackline prints at the site, one set each for mechanical, electrical, plumbing, and architectural/structural disciplines. Neatly and accurately note all deviations from the Contract Documents and the exact actual location of the work as installed. Marked-up and colored prints will be used as a guide to determine the progress of the work installed. Requisitions for payment will not be approved until the record documents are accurate and up-to-date.
1. Work Outside Building: Record data outside of building to an accuracy of plus or minus 1 inch and determine and record the invert elevation of all drain lines.

2. At completion of the work, submit one complete set of marked-up prints for review. After acceptance, these marked-up prints shall be used in the preparation of the record drawings.

3. Architect shall furnish Contractor with AutoCAD files for originals of the Contract Drawings. Make modifications to these files as shown on the marked-up prints. Remove superseded data to show the completed installation.

4. Deliver the completed AutoCAD record drawings, in the same version as Contract Drawings, properly titled and dated to the Architect. Indicate preparer of record drawings. These record drawings shall become the property of the Owner.

C. Specifications: Maintain one clean copy of complete specifications [including addenda, modifications, and bulletins with changes, substitutions, and selected options clearly noted. Circle or otherwise clearly indicate which manufacturer and products are actually used.

D. Operating and Maintenance Manuals: Manuals shall be submitted which contain the following:

1. Description of the system provided.
2. Handling, storage, and installation instructions.
3. Detailed description of the function of each principal component of the systems or equipment.
4. Operating procedures, including prestart up, startup, normal operation, emergency shutdown, normal shutdown and troubleshooting.
5. Maintenance procedures including lubrication requirements, intervals between lubrication, preventative and repair procedures, and complete spare parts list with cross reference to original equipment manufacturer's part numbers.
6. Control and alarm features including schematic of control systems, control loop electric ladder diagrams, controller operating set points, settings for alarms and shutdown systems, pump curves and fan curves.
7. Safety and environmental considerations.

E. Copies of Operating and Maintenance Manuals: Three copies of the manuals shall be provided within sufficient time to allow for training of Owner's personnel. Submit one copy of the manuals to the Architect for review no later than 90 calendar days prior to substantial completion, or building turn over, whichever comes first. Submit the remaining five copies within 15 days after first review set is returned to contractor. Progress payment may be withheld if this requirement is not met.

F. Additional Requirements for Operating and Maintenance Manuals: The requirements for manuals applies to each packaged and field-fabricated operating system. The manuals shall be provided in three-ring side binders with durable plastic covers. The manuals shall contain a detailed table of contents and have tab dividers for major sections and special equipment.

G. Framed Data: Provide charts and lists of all valves, circuits, switches, controls and equipment. Install on walls under glass at locations directed by Architect.

1.20 PROJECT CLOSE OUT

A. Complete the following prior to Substantial Completion:
1. Provide Contractor's Punch List of incomplete items stating reason for incompletion and value of incompletion.
2. Advise Owner of insurance change over requirements.
3. Submit all warranties, maintenance contracts, final certificates and similar documents.
4. Obtain Certificate of Occupancy and similar releases which permit the Owner’s full and unrestricted use of the areas claimed "Substantially Complete".
5. Submit record documents.
6. Deliver maintenance stocks of materials where specified.
7. Make final change over of lock cylinders or cores and advise Owner of change of security responsibility.
8. Complete startup of all systems and instruct Owner's personnel in proper operation and routine maintenance of systems and equipment.
9. Complete clean up and restoration of damaged finishes.
10. Remove all temporary facilities and utilities that are no longer needed.
11. Request Architect's inspection for Substantial Completion.

B. Architect will either issue a Certificate of Substantial Completion or notify Contractor of work which must be performed prior to issue of certificate.

C. Complete the following prior to Final Acceptance and payment:

1. Obtain Certificate of Substantial Completion.
2. Submit final application for payment, showing final accounting of changes in the work.
3. Provide final releases and lien waivers not previously submitted.
4. Submit certified copy of final punch list stating that Contractor has completed or corrected each item.
5. Submit final meter readings, record of stored fuel and similar information.
6. Submit Consent of Surety for final payment.
7. Submit evidence of Contractor's continuing insurance coverage (if required by Contract Documents).

1.21 FINAL CLEANING AND REPAIR

A. Clean Up: Immediately prior to the Architect's inspection for Substantial Completion, the Contractor shall completely clean the premises and clean and prepare the completed work in order for it to be used for its intended purpose in accordance with the Contract Documents. Such work shall include, but not be limited to the following:

1. Concrete and ceramic surfaces shall be cleaned and washed.
2. Resilient coverings shall be cleaned, waxed and buffed as applicable.
3. Woodwork shall be dusted and cleaned.
4. Sash, fixtures and equipment shall be thoroughly cleaned.
5. Stains, spots, dust, marks and smears shall be removed from all surfaces.
6. Hardware and metal surfaces shall be cleaned and polished.
7. Glass and plastic surfaces shall be thoroughly cleaned by professional window cleaners.
8. Damaged, broken or scratched glass or plastic shall be replaced by the Contractor at the Contractor's expense.
9. Vacuum carpeted and soft surfaces with high efficiency particulate arrestor (HEPA) vacuum.
10. Use low-emitting, environmentally friendly cleaning agents and procedures.
B. Pest Control: Engage a licensed exterminator, who practices integrated pest management (IPM), to inspect the project and eliminate rodents, termites and all other insects and pests. Coordinate pest control plan with Owner. Owner’s written approval is required prior to application. Submit proposed program to Owner and Architect. Program shall clearly indicate the following:

1. Area or areas to be treated.
2. Manufacturer's printed instructions and MSDS for each chemical to be used.
3. Pollution preventive measures to be employed.

C. Repairs: Repair and touch-up all damaged and deteriorated products and surfaces.

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION [Not Used]

END OF SECTION
SECTION 012200
UNIT PRICES

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. This Section includes administrative and procedural requirements for unit prices and estimated quantities.

B. Related Sections include the following:

1. Appendix 012210 – UNIT PRICE PROPOSAL SHEET, for unit prices and estimated quantities.

2. DIVISION 02 through DIVISION 26 for procedures, materials, and execution requirements related to unit price work.

1.3 DEFINITIONS

A. Unit Price: A unit price is an amount proposed by Bidders on the Bid Form as a price per unit of measurement for materials or services added to the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased. If the estimated quantities of Work required are decreased, the value of the Unit Price will be reduced as described on the Unit Price Proposal Sheet.

1.4 PROCEDURES

A. Each unit price includes all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections and Appendix 012210 – UNIT PRICE PROPOSAL SHEET for work that requires establishment of unit prices and estimated quantities. Methods of measurement and payment for unit prices and estimated quantities are as follows:

1. For work covered by scheduled quantities, notify the Owner and Architect a minimum of 24 hours in advance of the performance of such work.

2. Document such work in writing, identifying type of work, quantity and location of work. Submit documentation on Contractor’s letterhead.

3. All documentation of work covered by scheduled quantities will be subject to verification and approval by the Owner and Architect.

4. In order to be considered for payment, documentation for work covered by scheduled quantities shall be submitted within one month of performance of such work. Requests for payment of such work submitted more than one month after the work has been per-
formed will not be accepted.

5. Only Documentation signed and verified by the Contractor, Trade, and the Owner’s Representative will be considered valid. Documentation not signed by all these parties will be considered invalid.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and estimated quantities and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. Schedule of Unit Prices:

1. Specification Sections referenced in the Unit Price Proposal Sheet contain requirements for materials described under each unit price.

2. A Schedule of unit prices and estimated quantities to be proposed by Bidders follows this section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES AND ESTIMATED QUANTITIES

A. See Appendix 012210 – UNIT PRICE PROPOSAL SHEET following this section.

END OF SECTION
APPENDIX 012210
UNIT PRICE PROPOSAL SHEET

CITY OF NEWTON
WABAN HILL COMMUNICATIONS TOWER EQUIPMENT BUILDING
NEWTON, MA

1. The following unit prices as defined in the specifications are designated for items of work on the basis of unknown quantities. These unit prices will be used to deduct from the dollar amounts shown.

<table>
<thead>
<tr>
<th>Unit Price Number</th>
<th>Specification section and Description</th>
<th>Estimated Quantity</th>
<th>Unit Measure</th>
<th>Unit Price Dollars/Cents</th>
<th>Total Amount for estimated quantity - Dollars/Cents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Section 031200 – Earth moving – Rock excavation for ledge.</td>
<td>50</td>
<td>Cubic yards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Drilling and embedding of dowels in discovered ledge as noted in Section 033000 and on the drawings.</td>
<td>160</td>
<td>Each</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. The unit prices requested herein shall include their pro-rata share of all costs for the indicated items of work, including such items as overhead, superintendence, general conditions, profit, bond, labor, materials, payments to and coordination of subcontractors, equipment costs, disposal fees, etc., and all other work incidental thereto.

3. Any unit price proposal that contains a unit price which is unduly high or low may be rejected as unbalanced.

***THIS FORM MUST BE SUBMITTED WITH THE GENERAL BID FORM***

________________________________________
NAME OF CONTRACTOR (PLEASE PRINT)

END OF APPENDIX
SECTION 016200

SUBSTITUTION REQUEST FORM

No substitutions will be considered without this completed substitution request form and supporting documentation.

Substitutions made without completion of this form will be considered defective work as stated in AIA A201.

Date: _____________________ Number: _________

Project: City of Newton - Waban Hill Communications Tower Equipment Building

To: Goldman Reindorf Architects, Inc.

Re: Request for Substitution

The Contractor proposes the following substitution in accordance with the requirements of the Contract Documents:

Scope of Substitution

______________________________________________________________

Specification Reference

______________________________________________________________

Drawing Reference

______________________________________________________________

Reason for Proposed Substitution

______________________________________________________________

Benefit to Owner

______________________________________________________________

Impact on Project Cost

______________________________________________________________

Impact on Project Schedule

______________________________________________________________

Impact on

______________________________________________________________

SUBSTITUTION REQUEST FORM
016200 - 1
Guarantees and Warranties

Coordination and Compatibility Required with Adjacent Materials and System

List Deviations From Specified Requirements

Attachments: Attach supporting documentation sufficient for Architect to evaluate substitution. Substitution Request Forms submitted without adequate documentation will be returned without review.

Attachments

Response Date: List date by which response by Architect is requested to maintain project schedule and allow sufficient time for inclusion of proposed substitution.

Response Date

Submitted By

Firm and Address

Signature below signifies acceptance of responsibility for accuracy and completeness of information included in this Substitution Request Form.

Authorized Signature
ARCHITECT'S RESPONSE

Notations listed below shall have same meaning as on Architect's approval stamp. Clarifications to or changes in project schedule or time shall be processed using standard project forms.

Architect's Response

- ______ Approved
- ______ Approved as Corrected
- ______ Revise and Resubmit
- ______ Rejected
- ______ Returned Without Review

Remarks
___________________________________________________
___________________________________________________
___________________________________________________
___________________________________________________

Date
___________________________________________________

Signed
___________________________________________________

END OF FORM
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 SUMMARY
A. This Section includes requirements for the Contractor's implementation of waste management controls and systems for the duration of the Work.
B. Develop a waste management plan, quantifying material diversion by either weight or volume to recycle and/or salvage at least 75 percent of non-hazardous construction and demolition debris.

1.3 INTENT
A. The Owner and Architect have established that this Project shall generate the least amount of waste practical and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.
B. With regard to these goals the Contractor shall develop, for the Architect's review, a Construction Waste Management Plan (CWMP) for this Project.
C. Each Subcontractor shall be responsible for segregating his own waste into different dumpsters as directed by the Contractor.
D. Contractor shall be responsible for ensuring that debris will be disposed of at appropriately designated licensed solid waste disposal facilities, as defined by MGL Chapter 111, Section 150A.

1.4 SUBMITTALS
A. Waste Management Plan (WMP): Submit within 21 calendar days after receipt of Notice to Proceed, in a format acceptable to the Owner.
   1. Analysis of the proposed jobsite waste to be generated, including types and rough quantities.
   2. Landfill Options: The name of the landfills where trash and building debris will be disposed of, the applicable landfill tipping fees, and the projected cost of disposing of all Project waste in the landfills.
   3. Landfill Certification: Contractor's statement of verification that landfills proposed for use are licensed for types of waste to be deposited and have sufficient capacity to receive waste from this project.
4. Alternatives to Landfilling: A list of each material proposed to be salvaged or recycled during the course of the Project. Include the following and any additional items proposed:
   a. Cardboard and paper products.
   b. Clean dimensional wood.
   c. Beverage containers.
   d. Concrete.
   e. Slurry wall materials.
   f. Bricks and masonry.
   g. Asphalt.
   h. Metals from framing, banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   i. Mechanical and electrical equipment.
   j. Building components which can be removed relatively intact from existing construction.
   k. Packaging materials, including cardboard, boxes, plastic sheet and film, polystyrene packaging, wood crates, plastic pails.
   l. Glass.
   m. Scraps from new gypsum wall board.
   n. Carpet and pad.
   o. Acoustical ceiling panels.
   p. Plastics.

5. Meetings: A description of the regular meetings to be held to address waste management.

6. Materials Handling Procedures: A description of the means by which any waste materials identified above will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.

7. Transportation: A description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials.


C. Waste Management Final Report: Prior to Substantial Completion, submit a written Waste Management Final Report summarizing the types and quantities of materials recycled and disposed of under the Waste Management Plan. Include the name and location of disposal facilities.

D. Other Submittals:

   1. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
   2. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
   3. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, and/or receipts.
4. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, and/or receipts.

5. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.5 CONTRACTORS

A. Contractor may subcontract work of this Section to a sub-contractor specializing in recycling and salvaging of construction waste.

1. Eco One Solutions, LLC, Natick, MA 01760; tel. 978-270-8950; contact John Gundling, JGundling@EcoOneSolutions.com.

B. Gypsum Wallboard Recycling: New, paper-faced gypsum wallboard scrap (cuts from construction - not demolition waste) generated at project shall be recycled by Gypsum Recycling America, LLC. Keep scrap dry. Contact Gypsum Recycling America at 617-596-4297 or www.gypsumrecycling.us to coordinate recycling efforts.

C. Acoustical Ceiling Panel Recycling: Demolition and construction waste pulpable mineral fiber ceiling panels may be recycled by Armstrong World Industries and US Gypsum. Contact Armstrong at 1-877-ARMSTRONG (1-877-276-7876) or www.armstrong.com or contact USG at 1-800-USG-4YOU or www.usg.com, to coordinate recycling efforts, apply for product approvals, and receive reclamation procedure requirements.

D. Carpet Recycling: Demolition and construction waste carpet and carpet padding may be recycled by Carpet America Recovery Effort (CARE). Visit www.carpetrecovery.org to locate carpet reclaimers in local project area and reclamation procedure requirements.

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement Waste Management Plan as approved by the Architect. Provide containers, storage, signage, transportation, and other items as required to implement WMP for the entire duration of the Contract.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.
B. Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner and the Architect.

C. Instruction: The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.

D. Separation Facilities: The Contractor shall lay out and label a specific area to facilitate separation of materials for recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials. Location shall be acceptable to the Architect.

E. Hazardous Wastes: Any unforeseen hazardous wastes shall be separated, stored, and disposed of according to local regulations and as directed by the Owner.

END OF SECTION
SECTION 024100

DEMOLITION

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:

1. Demolition and removal of existing Communications Equipment Building including building, concrete slab and foundation walls.
2. Demolition and removal of existing fencing, poles and bases as noted on the drawings.
3. Demolition and removal (or/ salvage per City of Newton direction) existing generator and concrete slab.
4. Removal of all non-salvaged Communications Equipment after make safe by Communications Contractor.
5. Removal and legal disposal of demolished materials off site. Except those items specifically designated to be relocated, reused, or turned over to the facility, all existing removed materials, items, trash and debris shall become property of the Contractor and shall be completely removed from the site and legally disposed of at her/his expense. Salvage value belongs to the Contractor. On-site sale of materials is not permitted.
6. Demolition and removal work shall properly prepare for alteration work and new construction to be provided under the Contract.
7. See Section 011000 GENERAL REQUIREMENTS for Phasing Requirements for scheduling of work.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 011000 - GENERAL REQUIREMENTS for Temporary Facilities And Controls:
   a. Maintenance of access, cleaning during construction, dust and noise control.
2. Section 017400 - CONSTRUCTION WASTE MANAGEMENT:
   a. Waste management and recycling.
3. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:
   a. Disconnecting, capping and otherwise making inactive existing mechanical services in areas where demolition and removal work is required. Mechanical tradesmen will disconnect, cap, inactivate and lower to floor such items where required to be removed under Division 23 - HEATING, VENTILATING AND AIR CONDITIONING. Removal and storage of such materials shall be then done under this Section 024100 - DEMOLITION.
   b. Disconnect and reinstallation of HVAC equipment temporarily interrupted during construction.
4. Division 26 - ELECTRICAL:
a. Disconnecting, capping and otherwise making inactive existing electrical services in areas where demolition and removal work is required. Electrical tradesmen will disconnect, cap, inactivate and lower to floor such items where required to be removed under Division 26 - ELECTRICAL. Removal and storage of such materials shall be then done under this Section 024100 - DEMOLITION.
b. Disconnect and reinstallation of electrical equipment temporarily interrupted during construction.

5. Division 31 - EARTHWORK:
a. Excavating and removal of existing pavement, sub-surface building and utility structures and lines, appurtenances, and other elements indicated on the Drawings.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to the Owner ready for reuse, at a location designated by the Owner. Protect from weather until accepted by Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated. Protect from weather until reinstallation.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain property of the Owner as applicable. Carefully remove each item or object in a manner to prevent damage and deliver promptly to a location acceptable to the Owner.

1.5 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with early and late starting and finishing dates for each activity. Ensure Owner’s on-site operations are uninterrupted if applicable.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other occupants affected by selective demolition operations.
6. Coordination of Owner’s continuing occupancy of portions of existing building and of Owner’s partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.
B. **Inventory:** After selective demolition is complete, submit a list of items that have been removed and salvaged, and turned over the Owner.

C. **Predemolition Videotapes:** Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Comply with Division 01. Submit before Work begins.

D. **Landfill Records:** Provide trip tickets (receipts) indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

   1. Comply with submittal requirements in Section 017400 - CONSTRUCTION WASTE MANAGEMENT.

1.6 **QUALITY ASSURANCE**

A. **Examination of Existing Conditions:** The Contractor shall examine the Contract Drawings for demolition and removal requirements and provisions for new work. Verify all existing conditions and dimensions before commencing work. The Contractor shall visit the site and examine the existing conditions as he finds them and shall inform herself/himself of the character, extent and type of demolition and removal work to be performed. Submit any questions regarding the extent and character of the demolition and removal work in the manner and within the time period established for receipt of such questions during the bidding period.

B. **Demolition Firm Qualifications:** An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

C. **Refrigerant Recovery Technician Qualifications:** Certified by an EPA-approved certification program.

D. **Regulatory Requirements:** Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

E. **Standards:** Comply with ANSI A10.6 and NFPA 241.

F. **Predemolition Conference:** Conduct conference at Project site to comply with requirements in Section 011000 - GENERAL REQUIREMENTS, Project Meetings. Review methods and procedures related to selective demolition including, but not limited to, the following:

   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires protection.
1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer registered in the state that the project is located to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of preconstruction videotapes.

1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies and Owner.

2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

4. Prior to commencing cutting work in existing surfaces, take all precautionary measures to assure that mechanical and electrical services to the particular area have been made inactive. Coordinate with Fire Suppression, Plumbing, HVAC, and Electrical subcontractors. Only licensed tradesmen of that particular trade shall disconnect and cap existing mechanical and electrical items that are to be removed, abandoned and/or relocated.

5. If, during the process of cutting work, existing utility lines are encountered which are not indicated on the Drawings, regardless of their condition, immediately report such items to the Architect. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 011000 - GENERAL REQUIREMENTS, Temporary Facilities and Controls.
2. Maintain adequate passage to and from all exits at all times. Before any work is done which significantly alters access or egress patterns, consult with the Architect and obtain approval of code required egress. Under no condition block or interfere with the free flow of people at legally required exits, or in any way alter the required condition of such exits.

B. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.
2. Remove temporary shoring, bracing and structural supports when no longer required.
3. Post warning signs and place barricades as applicable during placement and removal of temporary shoring.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area(s).

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction. Provide temporary barricades as required to limit access to demolition areas.
2. Protect existing site improvements, appurtenances, and landscaping to remain.

D. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.
3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Section 017400 - CONSTRUCTION WASTE MANAGEMENT.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by the Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
E. Items for Re-use and Preservation of Existing Surfaces to Remain:

1. The Contractor shall inspect closely each item specifically designated to be relocated, re-used, or turned over to the Owner prior to its removal, and immediately report damages and defects to the Architect and the Owner. The Contractor shall be responsible for any subsequent damage to the same other than latent defects not readily apparent from close inspection, and shall bear responsibility for its repair or same replacement as directed by the Architect, to the satisfaction of the Owner.

2. Unless special surface preparation is specified under other Specification Sections, leave existing surfaces that are to remain in a condition suitable to receive new materials and/or finishes.

3.5 PROTECTION OF PUBLIC AND PROPERTY

A. Provide all measures required by federal, state and municipal laws, regulations, and ordinances for the protection of surrounding property, the public, workmen, and Owner's employees during all demolition and removal operations. Measures are to be taken, but not limited to installation of sidewalks, sheds, barricades, fences, warning lights and signs, trash chutes and temporary lighting.

B. Protect all walks, roads, streets, curbs, pavements, trees and plantings, on and off premises, and bear all costs for correcting such damage as directed by the Architect, and to the satisfaction of the Owner.

C. Demolition shall be performed in such a manner that will insure the safety of adjacent property. Protect adjacent property from damage and protect persons occupying adjacent property from injuries which might occur from falling debris or other cause and so as not to cause interference with the use of other portions of the building, of adjacent buildings or the free access and safe passage to and from the same.

D. Every precaution shall be taken to protect against movement or settlement of the building, of adjacent buildings, sidewalks, roads, streets, curbs and pavements. Provide and place at the Contractor's own expense, all necessary bracing and shoring in connection with demolition and removal work.

E. Remove portions of structures with care by using tools and methods that will not transfer heavy shocks to existing and adjacent building structures, both internal and external of the particular work area.

F. Provide and maintain in proper condition, suitable fire resistive dust barriers around areas where interior demolition and removal work is in progress. Dust barriers shall prevent the dust migration to adjacent areas. Remove dust barriers upon completion of major demolition and removal in the particular work area.

3.6 DISCOVERY OF HAZARDOUS MATERIALS

A. If hazardous materials, such as chemicals, asbestos-containing materials, or other hazardous materials are discovered during the course of the work, cease work in affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.
B. If unmarked containers are discovered during the course of the work, cease work in the affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Take immediate precautions to prohibit endangering the containers integrity. Continue work in other areas.

3.7 CUTTING

A. Perform all cutting of existing surfaces in a manner which will ensure a minimal difference between the cut area and new materials when patched. Use extreme care when cutting existing surfaces containing concealed utility lines which are indicated to remain and bear full responsibility for repairing or replacement of all such utilities that are accidentally damaged.

B. Provide a flush saw cut edge where pavement, curb and concrete removals abut new construction work or existing surfaces to remain undisturbed.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Comply with requirements of Section 017400 - CONSTRUCTION WASTE MANAGEMENT and the following:

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.9 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Premises shall be left in a clean condition and ready to accept alteration work and new construction.
SECTION 033000
CAST-IN-PLACE CONCRETE

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. Cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following applications:
   a. Footings.
   b. Foundation walls.
   c. Slabs-on-grade.
   d. Retaining walls.
   e. Equipment pads.
   f. Coordination with and cutting and patching of mechanical and electrical penetrations through cast-in-place concrete.
   g. Landscape stairs.
   h. Drilling and embedding of dowels in discovered ledge.

B. Alternates: Not Applicable.

C. Items To Be Installed Only: Install the following items as furnished by the designated Sections:

1. Section 011000 GENERAL REQUIREMENTS for Phasing Requirements for scheduling of work.
2. Section 055000 - METAL FABRICATIONS:
   a. Lintels, sleeves, anchors, inserts, plates, and similar items for miscellaneous and ornamental metal.
3. Section 131200 – PRECAST CONCRETE BUILDINGS:
   a. Anchoring hardware for Precast Modular Buildings.
4. Drawing M1 – PLUMBING PLAN:
   a. Sleeves, anchors, inserts, sumps, and similar items for plumbing systems.
5. Drawing M2 – MECHANICAL SPECIFICATIONS:
   a. Sleeves, anchors, inserts, and similar items for heating, ventilating, and air conditioning systems.
   b. Pipe and duct sleeves for placement into cast-in-place concrete openings.
6. Section 261000 - ELECTRICAL WORK:
   a. Sleeves, anchors, inserts, floor boxes, and similar items for electrical systems.
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 012200 UNIT PRICES for drilling and embedding of dowels at discovered ledge.
2. Section 312000 - EARTH MOVING for drainage fill under slabs-on-grade and at retaining walls.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Anchor Bolt Location: Indicate compliance with approved shop drawings.

E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates.

F. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Floor and slab treatments.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Semi-rigid joint filler.

G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances and requirements for applied finishes and materials, except as noted for slope to drains.
H. Field quality-control test and inspection reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Ready-mix concrete manufacturer.
   c. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: shall be Portland Cement, free from water soluble salts or alkalis which will cause efflorescence on exposed surfaces. Portland Cement shall be Type II, ASTM C150. Use only one brand of cement for each type of cement throughout project.

1. Fly Ash: ASTM C 618
2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal weight Fine Aggregate: shall be washed, inert, natural sand conforming to ASTM C33.

C. Normal weight Coarse Aggregate: shall be well graded crushed stone or washed gravel conforming to ASTM C33 and the following additional requirements:

<table>
<thead>
<tr>
<th>Designated Size (inches)</th>
<th>3/4</th>
<th>1/2</th>
<th>3/8</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.M.(+/-0.20)</td>
<td>Silt 1.0 percent maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soundness</td>
<td>5 percent maximum loss, magnesium sulfate, five cycles</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Maximum designated sizes for normal weight coarse aggregate to be used in concrete sections shall be as noted below, except that sizes shall also be chosen in conjunction with required clearances.

D. Water: shall be from approved source, potable, clean and free from oils, acids, alkali, organic matter and other deleterious material.

E. Admixtures:

1. Water-reducing agent:
   b. "PDA25" - Protex Industries, Inc.
   c. "Pozzolith 344H" - Master Builder's Co.
   d. Note: Water-reducing agent shall be by same manufacturer as air-entraining agent.

2. Air-entraining agent:
   b. "PROTEX AEA" - Protex Industries
   c. "MB-VR" or "MB-AE" - Master Builder's Co.

2.2 CONCRETE MIXTURES

A. The Contractor shall recommend, on the basis of trial mixes and strength curves specified below, design mixes for each type and strength of concrete. The Testing Agency will verify that the proposed mix designs conform to all specification requirements.

B. Mixes shall be designed in accordance with "Method 1, 2, or 3" of ACI 301, and the requirements of this Section. All concrete is normal eight unless specifically designated otherwise; air-dry weight not to exceed 150 lbs. per cubic foot.
C. Limiting values shown below apply for specific strengths of concrete with coarse aggregates less than one and one-half inches unless noted otherwise in TABLE A below.

<table>
<thead>
<tr>
<th>Compressive Strength at 28 day (psi)</th>
<th>Minimum Allowable</th>
<th>Max. Allowable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Allowable Content</td>
<td>Net Water Gallons/Sack*</td>
</tr>
<tr>
<td>4000</td>
<td>5.75</td>
<td>6.50</td>
</tr>
<tr>
<td>3000</td>
<td>6.50</td>
<td>5.50</td>
</tr>
</tbody>
</table>

- Maximum; decrease if possible. This represents total water in mix at time of mixing, including free water on aggregate.
- Minimum; increase as necessary to meet other requirements.

D. In all slabs and walls exposed to weather, all concrete shall contain the approved air-entraining admixture as per manufacturer's written instructions, to provide entrained air, by volume, in the cured concrete within 4.5 to 6.5 percent.

E. Water-Reducing Admixture - The approved water-reducing admixture shall be used in all concrete, in accordance with manufacturer's written instructions.

F. Concrete slabs, including slabs on grade, shall have a maximum water cement ratio of 0.45.

G. Any deviation from approved mix design, which Contractor deems desirable under certain project conditions, will not be allowed without written approval of Designer. Cost of any additional testing by Testing Agency associated therewith shall be paid for by Contractor.

2.3 FORM MATERIALS

A. Construct formwork to shapes, lines, and dimensions required, plumb and straight, secured and braced sufficiently rigid to prevent deformation under load, and sufficiently tight to prevent leakage, all in conformance with ACI Standard 347, “Recommended Practice for Concrete Formwork”.

B. Formwork for exposed concrete shall be medium-density plastic overlaid plywood, 5/8” minimum thickness; for concealed concrete shall be “Plyform” plywood, 5/8” minimum thickness.

C. Chamfer Strips: Half-inch, 45 degree poplar wood strips, nailed six inches on center, and installed in inside corners of all forms, unless otherwise directed by Designer.

D. Form Ties and Spreaders: Richmond Tyscrus by Richmond Screw Anchor Co.; Superior-ties by Superior Concrete Accessories, Ind.; or Sure-Grip Ties by Dayton Sure-Grip and Shore Co. Wire ties shall not be used. Ties for foundation walls shall be snap-ties or type specified above with removal cones and shall incorporate water seal washer. Ties shall be arranged in a symmetrical manner.
E. Form Release Agent: Non-staining and non-emulsifiable type, or equal approved by Designer. Form release agent shall be biodegradable and shall not impart any stain to concrete nor interfere with adherence of any material to be applied to concrete surfaces.

2.4 REINFORCEMENT AND ACCESSORIES

A. Reinforcing Steel Bars: shall be newly rolled billet steel conforming to ASTM A615 Grade 60. Bars shall be bent cold.

B. Welded Wire Fabric: shall conform to ASTM A185.

C. All structural steel reinforcement and embedded items shall be hot-dip galvanized after fabrication in accordance with ASTM A123.

D. All hot-dip galvanized steel shall be inspected for compliance with ASTM A123 and shall be marked with a stamp that indicates the number of ounces of zinc per square foot of steel. After galvanizing, the bars shall be dipped in a 0.2 percent chromic acid solution. A notarized Certificate of Compliance with all of the above shall be required from the galvanizer.

E. Reinforcement Accessories: shall conform to Product Standard PS7-766, National Bureau of Standards, Department of Commerce, Class C, as produced by Superior Concrete Accessories, Inc.; Dayton Sure-Grip Co.; or R.K.L. Building Specialties Co., Inc. Reinforcement accessories shall include spacers, chairs, ties, slab bolsters, clips, chair bars, and other devices for properly assembling, placing, spacing, supporting, and fastening reinforcement. Tie wire shall be galvanized or stainless wire of sufficient strength for intended purpose, but not less than No. 18 gage. Metal supports shall be of such type as not to penetrate surface of formwork and show through surface of concrete. Accessories touching interior formed surfaces exposed to view shall have not less than 1/8 inch of plastic between metal and concrete surface. Plastic tips touching interior formed surfaces shall have not less than 1/8 inch of plastic between metal and concrete surface. Individual and continuous slab bolsters and chairs shall be of type to suit various conditions encountered and must be capable of supporting 300 pound load without damage or permanent distortion.

2.5 MISCELLANEOUS MATERIALS

A. Grout: shall be ready-to-use metallic aggregate product requiring only addition of water at job site such as "Embeco Pre-mixed Grout" by Master Builder's; "Vibro-Foil Ready-Mixed" by W.R. Grace & Co.; or "Ferrolith G" by Sonneborn Building Products, Inc. Grout shall be easily workable and shall have no drying shrinkage at any age. Compressive strength of grout (2" x 2" cubes) shall not be less than 5000 psi at 7 days, and 7500 psi at 28 days.

B. Vapor Retarder: Minimum 10 mil polyethylene, unless specifically specified elsewhere.

C. Membrane Curing Compound: Conform to ASTM C309, Type 1. Product used shall be shown to be compatible with the later application of coatings. Curing compound shall not be used on any floor slab scheduled to receive an adhered floor finish.

D. PVC pipe for weep holes at retaining walls. (2” dia at 4 feet on center as indicated on drawings).

E. Epoxy adhesive grout for embedment of dowels in discovered ledge.
PART 3 - EXECUTION

3.1 INSPECTION

A. Examine all work prepared by others to receive work of this Section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

1. Inspection shall be performed by a structural engineer licensed in the Commonwealth of Massachusetts. Certify compliance with shop drawings.

3.2 HANDLING, STORAGE, AND PROTECTION OF MATERIALS

A. Handle and store materials separately in such manner as to prevent intrusion of foreign matter, segregation, or deterioration. Do not use foreign materials or those containing ice. Remove improper and rejected materials immediately from point of use. Cover materials, including steel reinforcement and accessories, during construction period. Stockpile concrete constituents properly to assure uniformity throughout project.

3.3 ERECTION OF FORMWORK, SHORING AND RESHORING

A. Set and maintain formwork to insure complete concrete work within tolerance limits listed in ACI 347 latest edition, "Recommended Practice for Concrete Formwork", and with following additional requirements:

1. Maximum variations from plumb:
   a. In surfaces of columns and walls:
      1) In any 10 feet of length: 1/4 inch
      2) Maximum for entire length: 1/4 inch
   2. Maximum variations from established position in plan shown on the drawings:
      a. Column: 1/2 inch
      b. Walls: 1/2 inch
   3. Variations in cross-sectional dimensions of columns and beams and in thickness of slabs and walls:
      a. Minus: 1/8 inch
      b. Plus: 1/4 inch

3.4 PLACING OF REINFORCEMENT

A. Reinforcement shall be placed in accordance with requirements of CRSI 93, "Recommended Practice for Placing Reinforcing Bars" and CRSI 93, "Recommended Practice for Placing Bar Supports" and with further requirements below.

B. Reinforcement shall be accurately placed in accordance with Contract Documents and shall be firmly secured in position by wire ties, chairs, spacers, and hangers, each of type approved by Designer.
C. Bending, welding or cutting reinforcement in field in any manner other than as shown on Drawings, is prohibited, unless specific approval for each case is given by Designer.

D. Reinforcement shall be continuous through construction joints unless otherwise indicated on Drawings.

E. Reinforcement shall be spliced only in accordance with requirements of Contract Documents or as otherwise specifically approved by Designer. Splices of reinforcement at points of maximum stress shall generally be avoided. Welded wire fabric shall lap six inches or one full space plus two inches whichever is larger, and shall be wired together.

F. At time concrete is placed, reinforcement shall be free of excessive rust, scale, or other coatings that will destroy or reduce bond requirements. Reinforcement expected to be exposed to weather for a considerable length of time shall be painted with a heavy coat of cement grout. Protect stored materials so as not to end or distort bars in any way. Bars that become damaged will be rejected.

G. Before concrete is cast, check all reinforcement after it is placed to insure that reinforcement conforms to Contract Documents and approved Shop Drawings. Such checking shall be done only by qualified experienced personnel. In addition, the Designer shall be notified at least 36 hours prior to concrete placement and given opportunity to inspect completed reinforcement and formwork before concrete placement. Prior approval of Shop Drawings shall in no way limit Designer's right to demand modifications or additions to reinforcement or accessories.

3.5 JOINTS

A. Construction and control joints indicated on Drawings are mandatory and shall not be omitted.

B. Joints not indicated or specified shall be placed to least impair strength of structure and shall be subject to approval of Designer.

3.6 INSTALLATION OF EMBEDDED ITEMS

A. Conform to requirements of ACI 318, paragraph 6.3, "Conduits and Pipes Embedded in Concrete", and as specified below.

B. Install steel sleeves, embedded wall plates and similar items, furnished by other trades, at locations shown on the drawings.

C. Anchor bolts and connection hardware be installed with templates provided by the precast manufacturer. Vertical alignment and plan locations shall be maintained within one-sixteenth inches of the locations shown on the drawings.

3.7 MIXING, CONSISTENCY, AND DELIVERY OF CONCRETE

A. Concrete shall be ready-mixed, produced by plant acceptable to Designer. Hand or site mixing shall not be done. Admixtures shall be premixed in solution form and dispensed as recommended by manufacturer.
B. Consistency of concrete at time of deposit shall be as follows:

<table>
<thead>
<tr>
<th>Portion of Structure</th>
<th>Recommended</th>
<th>Max. Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footings, Walls</td>
<td>4&quot;</td>
<td>3&quot; - 5&quot;</td>
</tr>
<tr>
<td>Slabs</td>
<td>3&quot;</td>
<td>2&quot; - 4&quot;</td>
</tr>
</tbody>
</table>

C. Retempering of concrete which has partially hardened, that is, mixing with or without additional cement, aggregates, or water, will not be permitted.

3.8 PLACING CONCRETE

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

B. To secure full bond at construction joints, surfaces of concrete already placed, including vertical and inclined surfaces, shall be thoroughly cleaned of foreign materials and laitance, roughened with suitable tools such as chipping hammers or wire brushes, and recleaned by stream of water or compressed air. Well before new concrete is deposited, joints shall be saturated with water. After free or glistening water disappears joints shall be given thorough coating of neat cement slurry mixed to consistency of very heavy paste. Surface shall receive coating of approximately one-eighth inch thick; this shall be scrubbed in by means of stiff bristle brushes. New concrete shall be deposited before neat cement dries or changes color.

C. Do not place concrete having slump outside of allowable slump range.

D. Transport concrete from mixer to place of final deposit as rapidly as practical by methods which prevent separation of ingredients and displacement of reinforcement, and which avoid re-handling. Deposit no partially hardened concrete. Concrete shall be placed in such manner as to prevent segregation, and accumulations of hardened concrete on forms or reinforcement above mass of concrete being placed.

E. During and immediately after depositing, concrete shall be thoroughly compacted by means of internal type mechanical vibrators or other tools, or by spading to produce required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be carried on only enough to produce homogeneity and optimum consolidation without permitting segregation of constituents or "pumping" of air. Vibrators shall operate at speed at not less than 7,000 rpm. Do not use vibrators to move concrete.

F. Vertical lifts shall not exceed 18 inches. Vibrate completely through successive lifts to avoid pour lines. Vibrate first lift thoroughly until top of lift glistens to avoid stone pockets, honeycomb, and segregation.

G. Concrete shall be deposited continuously, and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within section. If section cannot be placed continuously between planned construction joints, as specified, field joint and additional reinforcement shall be introduced so as to preserve structural continuity. Designer shall be notified in any such case.
Cold joints, particularly in exposed concrete, including "honeycomb", are unacceptable. If they occur in concrete surfaces exposed to view, Designer will require that entire section in which blemish occurs be removed and replaced with new materials at Contractor's expense.

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

Chutes, hoppers, spouts, adjacent work, etc. shall be thoroughly cleaned before and after each run and water and debris shall be discharged outside form.

3.9 FINISHING OF UNFORMED CONCRETE SURFACES

A. Smooth troweled finish: shall be provided where concrete flatwork is to be exposed in the finished work or is to receive resilient flooring materials.

B. Floated finish: shall be provided where concrete flatwork is to receive waterproofing membranes or setting beds for finished materials.

C. Floated finish: shall be provided for top surfaces of walls, slabs and beams.

D. Steel Broom Finish (with smooth edging): shall be provided at exterior concrete walks, pavements and steps.

E. Contractor, at his own expense, shall level depressed spots and grind high spots in concrete surfaces which are in excess of specified tolerances. Leveling materials proposed for providing proper surface shall be approved by Designer.

3.10 REPAIRING OF UNFORMED CONCRETE SURFACES

A. Tops of slabs and walls shall be repaired by using either same material as originally cast or by use of dry-pack material, as approved by Designer. Areas affected shall be chipped back square and to depth of one inch minimum. Hole shall then be moistened with water for a minimum of two hours, followed by brush coat of 1/16 inch thick cement paste. Immediately plug hole with concrete, or with dry pack material consisting of 1:1.5 mixture of cement and concrete sand mixed slightly damp to touch. Hammer dry-pack into hole until dense, and excess paste appears on surface. Finish patch flush and to same texture as surrounding concrete. For large repairs employ 1-1-2 mixture of cement, concrete sand and pea gravel at same dry-pack consistency.

3.11 CURING AND PROTECTION

A. When concrete is placed at or below ambient air temperatures of 40 degrees F. or whenever in opinion of Designer, such or lower temperatures are likely to occur within 48 hours after placement of concrete, cold weather concreting procedures, according to ACI 306 and as specified herein, shall be followed. To this end, entire area affected shall be protected by adequate housing or covering, and heating. No salt, chemicals or other foreign materials shall be used in the mix to lower freezing point of concrete.

B. Curing compounds will not be permitted for slab and beams.
3.12 REMOVAL OF FORMWORK, SHORING AND RESHORING

A. Contractor shall be responsible for proper removal of formwork, shoring, and reshoring.

B. Forms shall be removed only after concrete has attained sufficient strength to support its shown weight, construction loads to be placed thereon and lateral loads, without damage to structure or excessive deflection.

3.13 REPAIRING AND FINISHING OF FORMED AND ARCHITECTURAL CONCRETE SURFACES

A. In accordance with the provisions of ACI 301, Chapter 10, all concrete shall have "smooth form finish".

B. Intent of this Specification is to require forms, mixtures of concrete, and workmanship so that concrete surfaces will require no patching, except for plugging of tie holes. However, where patching is acceptable to Designer, procedure described below shall be followed.

C. Defective concrete and honeycombed areas shall not be patched unless examined and approval is given by Designer. If such approval is received by Contractor, areas involved shall be chipped down square and at least one inch deep to sound concrete by means of cold chisels or pneumatic chipping hammers. If honeycomb exists around reinforcement, chip to provide clear space at least three-quarter inch wide all around steel to afford proper ultimate bond thereto. For areas less than one and one-half inches deep, patch shall be made in same manner as described above for filling unformed concrete surfaces, care being exercised to use crumbly-dry (non-trowelable) mixtures and to avoid sagging. Thicker repairs shall require build-up in successive days, each layer being applied as described. To aid strength and bonding of multiple layer repairs, non-shrink, non-metallic aggregate shall be used as an additive as follows:

<table>
<thead>
<tr>
<th>Materials</th>
<th>Volumes</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Non-Metallic Aggregate</td>
<td>0.15</td>
<td>0.25</td>
</tr>
<tr>
<td>Sand</td>
<td>1.5</td>
<td>1.55</td>
</tr>
</tbody>
</table>

After hardening, rub lightly as described above for form tie holes.

1. Mortar for patching shall be same mix as above except aggregate shall pass a No. 14 sieve.
2. For all concrete to receive "smooth" finish, remove formwork fins and clean entire surface of grease, form oil, laitance, dust, and other foreign matter.
3. "Smooth" finish shall consist of having all fins removed, joint marks smoothed off, blemishes removed, and surfaces left smooth and unmarred.
4. Begin finishing operations as soon as practicable after removal of forms, continue with curing operations after finishing is completed. After concrete has been well cured, carefully inspect surfaces. Remove any fins, rough spots, streaks, hardened mortar or grout and other foreign material. Patch defects with finishing mortar as specified above, to satisfaction of Designer.

D. Patches which become crazed, cracked, or sound hollow upon tapping shall be removed and replaced with new material at Contractor's expense.
3.14 FIELD QUALITY CONTROL

A. Independent Testing Agency: Cooperate with the Independent Testing Agency engaged by the Owner for field quality control activities for the Work of this Section.

B. Cooperate with field quality control personnel. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

C. Additional inspections and retesting of materials which fail to comply with specified material and installation requirements shall be performed at Contractor's expense.

3.15 CLEANING

A. Concrete surfaces shall be cleaned of objectionable stains as determined by the Designer. Materials containing acid in any form or methods which will damage "skin" of concrete surfaces shall not be employed, except where otherwise specified.

END OF SECTION
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. Non-load-bearing metal furred out wall framing at exterior perimeter walls of precast modular buildings as required for insulation and plywood panels as shown on the drawings.

B. Non-load-bearing metal furred out wall framing shall be installed at factory by Precast Concrete Building provider per Section 131200.

C. Related work:

1. Section 061000 ROUGH CARPENTRY plywood panels for interior wall finish.
2. Section 072200 THERMAL INSULATION for rigid insulation.
3. Section 099000 PAINTING AND COATING for painting of plywood panels

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design framing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As required by code.
2. Deflection Limits: Design framing systems to withstand design loads within deflections greater than the following:

a. Exterior Non-Load-Bearing Framing:

   1) Horizontal deflection of l/240 of the wall height for panel systems.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load, plus superimposed dead load, deflection of primary building structure.

C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

E. Qualification Data: For professional engineer.

F. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for
installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.


E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

2. Consolidated Fabricators Corp.; Building Products Division.
3. MarinoWARE; a division of Ware Industries.
4. Super Stud Building Products Inc.

2.2 MATERIALS

A. Recycled Content of Steel Products: Provide products with an 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 Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: As required by structural performance.
2. Coating: G90.

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90 (Z275).

2.3 NON-LOAD BEARING FURRED OUT WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base Metal Thickness: 0.0312 inch (20 gauge/30 mils, Color Reference: Pink).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs.

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Drywall Z-Furring channels:
   1. 2" Z-furring channels as indicated on the drawings.
   2. Product Data:
      a. Material: All Material: Grade 33ksi min. yield strength, G40 30mils: 20ga DW, 0.0312" Design Thickness, 0.0296" Min. Thickness.
      b. Dimensions: 3/4" leg x 1-1/4" leg x 2" deep.

E. Resilient Channels:
   1. Heavy-duty double-leg resilient channel.
   2. Product Data:
      a. Material: All Material: Grade 33ksi min. yield strength, G40 22mils.
      b. Dimensions: 2-1/2" x 1/2" deep.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.
2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, threaded carbon-steel bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.


D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035 or ASTM A 780.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

   1. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
3.4 NON-LOAD BEARING FURRED OUT WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:


C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

G. Z-Furring Channels – at 24” o.c secured to concrete walls; Resilient channels installed horizontally over the Z-furring.

3.5 FIELD QUALITY CONTROL

A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does 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.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.
SECTION 055100

EXTERIOR METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Galvanized steel tube guardrail system as shown on the drawings.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design 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. Related Work:

1. 033000 CAST-IN-PLACE CONCRETE for coordination and installation of anchor bolts.

1.3 SUBMITTALS

A. Product Data: For metal railings and the following:

1. Grout.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts specified for installation under other Sections.

C. Delegated-Design Submittal: For railings indicated to comply with performance requirements and design criteria, including structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

E. Qualification Data: For professional engineer.

1.4 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering
services of the kind indicated. Engineering services are defined as those performed for installations of metal railings that are similar to those indicated for this Project in material, design, and extent.

C. Installer Qualifications: Fabricator of products.

D. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.5 COORDINATION

A. Coordinate installation of anchorages for metal railings. 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.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 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.

C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. 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).

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION, GENERAL

A. 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.

B. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

C. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

D. Weld connections 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. Weld exposed corners and seams continuously, unless otherwise indicated.
5. 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.

E. 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.

F. Comply with “Guideline 1: Joint Finishes”, by National Ornamental & Miscellaneous Metals Association (NOMMA), as follows:

1. Typical Railing: Type 2 or better, unless otherwise indicated.

G. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 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. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is \( \frac{1}{4} \) inch or less.

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.

2.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal railings after assembly.

2.8 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
4. Handrails: Galvanizing shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of the railings.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal railings. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

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.

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 follows:

1. Anchor posts to steel by welding directly to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

3.3 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION
SECTION 061000
ROUGH CARPENTRY

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. Wood blocking, cants, and nailers.
2. Plywood panels for interior wall finish as shown on the drawings.
   a. Plywood panels to be factory installed over metal framing and rigid insulation by Precast Concrete Building provider per Section 131200.
   b. Plywood panels to be field painted.

B. Related work:

1. Section 054000 COLD-FORMED METAL FRAMING for non-load-bearing metal furred out wall framing.
2. Section 072200 THERMAL INSULATION for rigid insulation.
3. Section 099000 PAINTING AND COATING for painting of plywood panels.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

ROUGH CARPENTRY
061000 - 1
1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.
4. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

B. Plywood Panels:

1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
3. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.
C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete in exterior walls.

2.3 FIRE-RETARDANT-TREATED MATERIALS

   A. General: For all interior use materials, provide materials that are fire-retardant treated and comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
      1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
      2. Use treatment that does not promote corrosion of metal fasteners.

2.4 MISCELLANEOUS LUMBER

   A. General: Provide lumber for support or attachment of other construction, including the following:
      1. Blocking.
      2. Cants.
      4. Furring.
      5. Grounds.

   B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 15 percent moisture content.

2.5 PANEL PRODUCTS

   A. Miscellaneous Concealed Plywood: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch.

   B. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.6 FASTENERS

   A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
      1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5; except provide Type 304 stainless steel where in contact with pressure-preservative treated wood.

2.7 MISCELLANEOUS MATERIALS

A. Adhesive, Including Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

E. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.
F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION
SECTION 072100

THERMAL INSULATION

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. Rigid insulation at exterior perimeter walls of precast modular buildings as shown on the drawings.

B. Rigid insulation to be provided and installed at the factory by Precast Concrete Building provider per Section 131200.

C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 054000 – Cold-formed metal framing for furring at exterior walls.
2. Division 22 - PLUMBING for plumbing insulation.
3. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for mechanical insulation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For Installer of spray-applied products.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Installer Qualifications: A qualified installer who has been trained by and is acceptable to spray polyurethane foam insulation manufacturer to install manufacturer's products.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store in a dry and secure location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver materials to Project site before installation time.
3. Complete installation and concealment of materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 WALL INSULATION

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Atlas Roofing Corp.
2. Dow Chemical Company.
3. Rmax Inc.

B. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 or 2, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84; 25-psi minimum compressive strength.

2. R-Value: Minimum R-6.5/inch.
3. Wall insulation board 2" thick as indicated on the drawings.

C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

D. Joint Tape: Provide manufacturer's recommended foil tape, as approved by the Architect.

2.2 SPRAYED-FOAM INSULATION AT GAPS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Dow Chemical; GreatStuff Pro.
3. Foam-Tech Div. of H.C. Fennell; SuperGreen Foam.
4. Todol Products; Pur Fill 1G.

B. Zero VOC Product: Pro-Foam II by OSI, Henkel Corporation.
C. Sprayed-Foam Insulation: Water-cure closed cell polyurethane containing no urea-formaldehyde and no CFCs.

   1. Minimum density of 0.4 lb/cu. ft., thermal resistivity of 3.4 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.3 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer’s written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Miscellaneous Voids: Install spray polyurethane foam insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties (if applicable) and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated. Fill gaps with compatible insulating material.
3.5 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Attach vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints.
2. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.6 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION
SECTION 075400

THERMOPLASTIC MEMBRANE ROOFING

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. Adhered membrane-roofing system.
2. Cover board.
3. Roof insulation.
4. Vapor retarder.
5. Edge flashing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
2. Section 076200 - SHEET METAL FLASHING AND TRIM for metal roof penetration flashings, flashings, and counterflashings.
3. Section 079200 - JOINT SEALANTS for sealants.

1.3 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.

1.4 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. PVC membrane shall be separated by specified cover board from extruded polystyrene insulation.

C. Roofing System Design: Roofing system shall be designed to withstand loads indicated on Drawings, but not less than loads required by Code.
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. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Insulation fastening patterns.

C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

D. Qualification Data: For Installer and manufacturer.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   1. Submit evidence of complying with performance requirements.

F. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

G. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

H. Maintenance Data: For roofing system to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.

B. Roofing Inspector: Owner may engage a full-time roofing inspector during installation of the deck, insulation assembly, membrane, flashing and other appurtenances, and when a survey of the roof and roof drains is conducted. Cooperate with Owner's roofing inspector and allow unlimited access to roofing during construction.
C. Preinstallation 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.

1.7 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.

1.8 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.

1.9 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 20-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 20 years, from the date of final acceptance of the roofing system. The warranty shall be a 20-year no dollar limit (NDL), non-prorated total system labor and material warranty, for wind speed as required by Code or as indicated on the Drawings. 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.

PART 2 - PRODUCTS

2.1 PVC ROOFING MEMBRANE


1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Carlisle SynTec Incorporated.
   b. Duro-Last Roofing, Inc.
   c. Flex Roofing Systems
   d. GAF Materials Corporation.
   e. Sika Sarnafil Inc.

2. Thickness: 60 mils (1.5 mm), nominal.

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.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:

   a. Plastic Foam Adhesives: 50 g/L.
   b. Gypsum Board and Panel Adhesives: 50 g/L.
   c. Multipurpose Construction Adhesives: 70 g/L.
   d. Fiberglass Adhesives: 80 g/L.
   e. Single-Ply Roof Membrane Adhesives: 250 g/L.
f. Single-Ply Roof Membrane Sealants: 450 g/L.
g. Nonmembrane Roof Sealants: 300 g/L.
h. Sealant Primers for Nonporous Substrates: 250 g/L.
i. Sealant Primers for Porous Substrates: 775 g/L.
j. Other Adhesives and Sealants: 250 g/L.

B. Sheet Flashing: Manufacturer’s standard sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.

C. Bonding Adhesive: Manufacturer’s recommended bonding adhesive.

D. Metal Termination Bars: Manufacturer’s standard predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

E. 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.

F. 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: 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 of thicknesses indicated.

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:
   b. Carlisle SynTec Incorporated.
   c. Firestone Building Products Company.
   d. GAF Materials Corp.
   e. GenFlex Roofing Systems.
   f. Johns Manville International Inc.

2. Minimum insulation board thickness 3.5 “ (R 21.7).

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.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.
   1. Cover Board Adhesive: Manufacturer's cold fluid-applied adhesive formulated to adhere cover board to insulation substrate.

D. Cover Board: Provide one of the following, as required by roofing manufacturer to comply with performance requirements and provide specified warranty.

E. Expansion Joint Covers and Flashing.

2.6 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured vinyl walkway pads or rolls approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

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 minimum concrete drying period recommended by roofing system manufacturer has passed.
   4. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   5. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
   6. 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 VAPOR-RETARDER INSTALLATION

A. Self-Adhering Sheet Vapor Retarder: 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.

B. Completely seal vapor retarder at side laps, end laps, terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.4 INSULATION AND COVERBOARD INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install one or more layers of insulation under area of roofing to achieve required thickness. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
2. For insulation applied in multiple layers, loose-lay first layer and mechanically fasten top layer.

H. Mechanically Fastened Cover Boards: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and mechanically fasten to roof deck.

1. Mechanically fasten cover boards, unless otherwise indicated.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

I. Adhered Cover Boards: Install cover boards over mechanically-fastened insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Adhere cover boards to mechanically-fastened insulation in ribbons of bead-applied adhesive or full-spread adhesive, as required to comply with performance and warranty requirements.

1. Locations for Adhered Cover Board Installation: Provide under green roof areas and elsewhere, where indicated.
2. Adhere cover boards to resist uplift pressure at corners, perimeter, and field of roof.

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.

1. For PVC membrane, install sheet according to ASTM D 5036.

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.

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. 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 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 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.

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.

3.9 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
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. Sheet metal flashing and trim for the following applications:
   a. Formed low-slope roof flashing and trim.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
2. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for installing sheet metal flashing and trim integral with roofing membrane.
3. Section 079200 - JOINT SEALANTS for field-applied sheet metal flashing and trim sealants.

1.3 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 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.

1.4 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.

1.5 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.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
   1. Meet with the Owner, Architect and Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
   2. Review methods and procedures related to sheet metal flashing and trim.
   3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 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.

SHEET METAL FLASHING AND TRIM
076200 - 2
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.

1.7 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. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005. Thickness as specified in this Section. Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers’ written instructions.

   a. Fluoropolymer 3-Coat System: Manufacturer’s standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil; complying with AAMA 2605.

      1) Color: As selected by Architect from manufacturer’s full range.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, with No. 2D dull, cold-rolled finish. Thickness as specified in this Section.

C. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.

   1. Nonpatinated Exposed Finish: Mill.

2.2 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

2.3 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.

C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

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. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.


2.4 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.

   2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. 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.
F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. 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.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Furnish with 6-inch-wide joint cover plates.
   2. Fabricate from the following material:
      a. Aluminum: 0.050 inch (1.27 mm) thick.

B. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following material:
   1. Aluminum: 0.050 inch (1.27 mm) thick.

2.6 WALL SHEET METAL FABRICATIONS

A. Wall Flashing, Typical: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high end dams. Fabricate from the following material:
   1. Stainless Steel: 0.016 inch (0.40 mm) thick.

2.7 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 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.

3.2 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 isolation 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.

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 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. Aluminum: Use aluminum or stainless steel fasteners.
2. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 - JOINT SEALANTS.

I. Soldered Joints: 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.

1. Do not solder aluminum sheet.
2. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
3. 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.

J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 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.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.5 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 079200

JOINT SEALANTS

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. Joint sealants and fillers.
B. This Section includes joint sealants for the applications specified with the products in this Section and as indicated on Drawings.

1.3 PERFORMANCE REQUIREMENTS
A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS
A. Product Data: For each joint-sealant product indicated.
B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
C. Qualification Data: For Installer.
D. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: Manufacturer’s authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

JOINT SEALANTS
079200 - 1
C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: Provide colors as selected by the Architect from manufacturer’s full range of standard and custom colors; maximum of five colors, three standard colors and two custom colors.

2.2 JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Elastomeric sealants shall be nonstaining to porous substrates. Provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Single-Component Neutral-Curing Silicone Sealant:

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. Dow Corning Corporation; 790.
   b. GE Silicones; SilPruf LM SCS2700.
   c. Tremco Inc.; Spectrem 1.
   d. Pecora Corporation; 864.
   e. Bondaflex Technologies; Sil 290

2. Extent of Use: Joints in exterior vertical and soffit surfaces.

E. Multicomponent Pourable Urethane Sealant:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   b. Meadows, W. R., Inc.; POURTHANE.
   c. Pecora Corporation; Urexpan NR-200.
   d. Tremco Inc.; THC-901.
   e. Bondaflex Technologies; PUR 2 SL

2. Extent of Use: Joints in exterior horizontal surfaces.

F. Latex Sealant: Comply with ASTM C834, Type P, Grade NF.
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. Bostik Findley; Chem-Calk 600.
b. Pecora Corporation; AC-20+.
c. Sonneborn, BASF Building Systems; Sonolac.
d. Tremco Inc.; Tremflex 834.
e. May National Bondaflex Sil-A 700

2. Extent of Use: Non-moving joints at interior locations.

2.3 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include concrete, masonry and unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following metal, glass, porcelain enamel and glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION
SECTION 081110
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. All doors and door frames shown on the drawings shall be factory installed by Precast Concrete Building provider per Section 131200.

B. 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 with factory applied finish paint.
2. Standard hollow-metal steel frames with factory applied finish paint.

C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 087100 - DOOR HARDWARE for door hardware for steel doors.
2. Section 131200 - PRECAST CONCRETE BUILDING for coordination and installation in modular buildings.

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.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.
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. Qualification Data: For Installer.

E. 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, 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 and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

D. Fire-Rated, Borrowed-Light Assemblies (Including Sidelights and Transoms): Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

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. Ambico Limited.
2. Ceco Door Products; an ASSA ABLOY Group Company.
3. CURRIES Company; an ASSA ABLOY Group Company.
4. de LaFontaine
5. Mesker Door Inc.
7. Philipp Manufacturing 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 ASTM C 143/C 143M.

H. 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
HOLLOW METAL DOORS AND FRAMES

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.
   a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
   b. Thermal-Rated (Insulated) Exterior Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu when tested according to ASTM C1363.

3. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick end closures or channels of same material as face sheets.

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. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. 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.


1. Fabricate frames with full profile welded joints.
2. Frames for Level 3 Steel Doors: 0.067-inch-thick steel sheet.

flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
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. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. 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 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.9 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.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

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. Full Profile Welded Frames: Weld joints continuously; grind, fill, dress, and make smooth, flush, and not visible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as doorframe. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and Mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Two anchors per jamb up to 60 inches high.
      2) Three anchors per jamb from 60 to 90 inches high.
      3) Four anchors per jamb from 90 to 120 inches high.
      4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
   b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Three anchors per jamb up to 60 inches high.
      2) Four anchors per jamb from 60 to 90 inches high.
      3) Five anchors per jamb from 90 to 96 inches high.
      4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
   c. Compression Type: Not less than two anchors in each jamb.
   d. 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.
7. 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.
   b. Double-Door Frames: Drill stop in head jamb to receive two 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.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
   1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings, so that each glazed lite is capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
   4. Provide loose stops and moldings on inside of hollow metal work.
   5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.10 STEEL FINISHES

A. Factory applied paint finish: based on de la Fontaine powder coating, or approved equal.
   1. Polyurea polyaspartic direct-to metal coating for galvannealed steel.
   2. High quality baked-on coating that exceeds ANSI A250.3.
      a. Adhesion: 5B (ASTM D3359)
      b. Direct impact: 4 lb at 30°
   3. Solids by volume: 71% +/- 2%
   4. Hardness: 2H
   5. VOC: 262 g/L.
   6. Gloss: 35% at 60°.
   7. Corrosion and UV resistant.
B. Custom color as selected by the Architect from the 213 colors available in the Classic RAL color chart.

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. All doors and door frames shown on the drawings shall be factory installed by Precast Concrete Building provider per Section 131200.

B. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

C. 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 frames with removable glazing stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply isolation 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.


4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

9. 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.

D. 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.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

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. Finish-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas, and touchup with compatible air-drying, prime and finish coats as recommended by manufacturer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer’s written instructions.

END OF SECTION
SECTION 087100

DOOR HARDWARE

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. All door hardware shown on the drawings and as listed in this section shall be provided by and
factory installed by Precast Concrete Building provider and per Section 131200.

B. Work Included: Provide labor, materials and equipment necessary to complete the work of this
Section, including but not limited to the following:

1. Commercial door hardware.

C. Related Work: The following items are not included in this Section and are specified under the
designated Sections:

1. Section 081110 - HOLLOW METAL DOORS AND FRAMES for astragals provided as
part of a fire-rated labeled assembly and for door silencers provided as part of the frame.

1.3 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual
components and profiles, 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.

a. Organize door hardware sets in same order as in the Door Hardware Schedule at
the end of Part 3.

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 each 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.
h. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

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 by or under the supervision of supplier, detailing the Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

D. Product Certificates: Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements.

1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

1. Include lists of completed projects with project names and addresses of architects and owners, and other information specified.

F. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 01.

G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door 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.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Designer, and the Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

E. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with Massachusetts Architectural Access Board and the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," 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) Interior Hinged Doors: 5 lbf applied perpendicular to door.
      2) Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
      3) 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. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force not more than 15 lbf for not more than 3 seconds.
   c. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
   d. Thresholds: Not more than 1/2 inch high.

F. 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.

1. Test Pressure: Test at atmospheric pressure.

G. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to door hardware including, but not limited to, the following:

1. Inspect and discuss preparatory work performed by other trades.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

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 keys to manufacturer of key control system.

1.6 COORDINATION

A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Section 033000 - CAST-IN-PLACE CONCRETE.

B. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive the Owner of other rights the 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. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of operators and door hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

D. Warranty Period for Manual Closers: Ten years from date of Substantial Completion.
1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for the Owner’s continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Scheduled and acceptable manufacturers must provide all the functions and features of the specified product or it will not be approved.

<table>
<thead>
<tr>
<th>Item</th>
<th>Scheduled Manufacturer</th>
<th>Acceptable Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges</td>
<td>Ives (IVE)</td>
<td>McKinney, Hager</td>
</tr>
<tr>
<td>Locksets &amp; Deadlocks</td>
<td>Schlage (SCH)</td>
<td>Sargent, Best</td>
</tr>
<tr>
<td>Cylinders &amp; Keying</td>
<td>Schlage (SCH)</td>
<td>User Standard</td>
</tr>
<tr>
<td>Flush Bolts &amp; Coordinators</td>
<td>Ives (IVE)</td>
<td>Rockwood, Burns</td>
</tr>
<tr>
<td>Stops &amp; Holders</td>
<td>Ives (IVE)</td>
<td>Rockwood, Burns</td>
</tr>
<tr>
<td>Silencers</td>
<td>Ives (IVE)</td>
<td>Rockwood, Burns</td>
</tr>
<tr>
<td>Thresholds &amp; Weather-Stripping</td>
<td>National Guard (NGP)</td>
<td>Pemko, Reese</td>
</tr>
</tbody>
</table>

B. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

C. Where the hardware specified is not adaptable to the finished shape or size of the members requiring hardware, furnish suitable types having the same operation and quality as the type specified, subject to the Architect’s approval.

2.2 MATERIALS

A. Fasteners:

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.

2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

3. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent that no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is
exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely.

4. All hardware shall be installed with the fasteners provided by the hardware manufacturer.

B. Hinges:

1. The following is a guide for hinge type required for this specification:
   a. 1-3/4" thick doors up to and including 3'-0" wide:
      1) Exterior: standard weight, ball bearing, bronze/stainless steel, 4-1/2" high
      2) Interior: standard weight, ball bearing, steel, 4-1/2" high
   b. 1-3/4" thick doors over 3'-0" wide:
      1) Exterior: heavy weight, ball bearing, bronze/stainless steel, 5" high
      2) Interior: heavy weight, ball bearing, steel, 5" high

2. Provide 3 hinges per door leaf for doors 90 inches or less in height, and one additional hinge for each 30 inches of additional door height.

3. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins
   d. Interior Doors: Non-rising pins

4. The width of hinges shall be 4-1/2" or as required for clearance.

C. Flush Bolts:

1. Automatic and manual flush bolts shall have forged bronze faceplates with extruded brass levers and with wrought brass guides and strikes. Doors up to 7'-6" in height shall have 12" steel or brass rods. Manual flush bolts for doors over 7'-6" in height shall be increased by 6" for each additional 6" of door height. Provide dust-proof strikes where scheduled.

D. Coordinators:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide a bar-type coordinating device, surface applied to the underside of the stop at the frame head.

2. Finish of the coordinator to be prime coat to receive the same finish paint as the doorframe.

3. Provide a filler bar of the correct length for the unit to span the entire width of the opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factory-prep coordinators for vertical rod devices if required.

E. Mortise Locks:

1. Mortise locks shall be certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security, and shall be manufactured from heavy gauge steel, containing components of steel with
2.3 FINISHES

A. With the exception of all items listed below, the finish of all hardware shall be US26D - satin chrome or US32D - satin stainless steel.

B. Exceptions are as follows:

1. Door Closers: Aluminum powder coat finish.
2. Coordinators: Prime painted.
5. Silencers: Grey.

2.4 KEYING

A. Provide cores and cylinders matching the Owner's Existing key system. All keying information TBD by the Owner: GC shall provide temporary construction cores. Temporary cores will be replaced with final cores to be provided and installed by Newton's locksmith.

B. All locks and cylinders, except cylinders for keypad locks will be interchangeable core type.
C. Provide 3 keys per lock, 6 construction master keys, and a total of 6 master keys for each group.

D. All master keys shall be delivered directly to the Owner by the hardware supplier, who shall obtain a receipt for delivery of same.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

A. All doors and door frames shown on the drawings to be factory installed by Precast Concrete Building provider and per Section 131200.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
D. Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 079200 - JOINT SEALANTS.

3.4 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 compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:

1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
2. Consult with and instruct the Owner's personnel on recommended maintenance procedures.
3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 HARDWARE SET SCHEDULE

A. Refer to Drawings.

END OF SECTION
SECTION 089000
LOUVERS AND VENTS

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. All Louvers shown on the drawings and as listed in this section shall be provided and factory installed by Precast Concrete Building provider and per Section 131200.

B. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Fixed wind and rain resistant extruded-aluminum louvers and frames sizes as noted on the drawings.

C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 079200 - JOINT SEALANTS for sealants installed in perimeter joints between louver frames and adjoining construction.
2. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for louvers that are a part of mechanical equipment.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and wind loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers. Loads as required by Code.

B. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions as required by code.
C. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. 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.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.

1. For installed louvers indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: For each type of metal finish required.

D. Qualification Data: For professional engineer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:


1.7 PROJECT CONDITIONS

A. Field Measurements: Verify louver 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 louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.
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. Louvers and Vents:
   a. Airolite Company, LLC.
   b. Construction Specialties, Inc.
   c. Greenheck.
   d. Industrial Louvers, Inc.
   e. McDermott Metal Works Corporation
   f. Nystrom Building Products.
   g. Ruskin Company.

B. Product: Greenheck EHH Wind-Driven Rain Extruded Louver or equal as approved by the architect. Provide louvers sized and with free area as noted on the drawings.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

D. Include supports, anchorages, and accessories required for complete assembly.
E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Fully Recessed Mullions: Provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.

F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Storm-Resistant Louvers:

1. Louver Depth: 4 inches.
2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch.
3. Performance Requirements:
   a. Free Area: Comply with requirements indicated on the Drawings.
   b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rain fall rate of 3 inches per hour and a wind speed of 29 mph at a core area intake velocity of 300 fpm.

4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

B. High-Performance Organic-Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer Three-Coat Coating System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
   a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.5 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
D. Louver Screening for Aluminum Louvers:
   1. Bird Screening: Aluminum, 1/2-inch-square mesh, 0.063-inch wire.

2.6 BLANK-OFF PANELS

A. Insulated, Blank-off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with metal sheets.
   1. Thickness: 1 inch.
   2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
   3. Insulating Core: Rigid insulation board.
   4. Seal perimeter joints between panel faces and louver frames with 1/8-by-1-inch PVC compression gaskets.
   5. Panel Finish: Same finish applied to louvers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. All Louvers shown on the drawings and as listed in this section shall be provided and factory installed by Precast Concrete Building provider and per Section 131200

B. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

C. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

D. Form closely fitted joints with exposed connections accurately located and secured.

E. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

F. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

H. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 - JOINT SEALANTS for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

    1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION
SECTION 099000

PAINTING AND COATING

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. Field painting of exposed interior items and surfaces.
2. Field painting of exposed exterior items and surfaces.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 081110 - HOLLOW METAL DOORS AND FRAMES for factory applied powder coating of 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 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. 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 and interior 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.

C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:
   a. Finished mechanical and electrical equipment.
   b. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
   a. Foundation spaces.
   b. Furred areas.
   c. Ceiling plenums.
   d. Utility tunnels.
   e. Pipe spaces.
   f. Duct spaces.
   g. Elevator shafts.

3. Finished metal surfaces include the following:
   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper and copper alloys.
   e. Bronze and brass.

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 code-required labels or equipment name, identification, performance rating, or nomenclature 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 room or surface to represent surfaces and conditions for application of each type of coating and substrate.

a. Wall surfaces: Provide minimum 4’ x 8’ mock up samples for interior and exterior walls.

b. Small Areas and Items: Architect will designate items or areas required.

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 room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from benchmark samples.

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.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: Furnish two unopened gallons of each type of paint and coating work, in color and gloss as used for the Project.

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.

2. Colors: As selected by the Architect shall be custom colors that will match paint chip samples provided by the Architect.

C. VOC Content for Interior Paints and Coatings: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

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.
PAINTING AND COATING

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 and technical bulletins for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
   a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
   c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
   c. If transparent finish is required, backprime with spar varnish.
   d. Backprime panelling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
   e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. 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. Exterior Exposed Steel: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall
exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.

b. Interior Exposed Steel, in Humid Environments: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.

c. Interior Exposed Steel, in Dry Environments: Clean steel surfaces in accordance with SSPC-SP2 or SP3 Hand or Power Tool Cleaning.

5. Galvanized Surfaces: Clean galvanized surfaces in accordance with SSPC-SP16 Brush off Blast Cleaning of Galvanized Steel and NonFerrous Metals, to achieve a minimum 1 mil anchor profile.

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. 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.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

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. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors and doors in wet areas on tops, bottoms, and side edges the same as exterior faces.
9. Sand lightly between each succeeding enamel or varnish coat.
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.

D. 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.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. 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. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. 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.
H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. 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. Recote 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.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. 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. Testing agency will perform appropriate tests for the following characteristics as required by the Architect.
3. 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. Exterior Concrete, Painted Finish:
   
a. One Coat:
      
      1) Tnemec 156 Enviro-Crete at 6.0 to 10 mils DFT.
      2) Liquid Plastics Acrylic at 8.0 to 10.0 mils DFT.
      3) Dupont Tufcryl at 8.0 to 10.0 mils DFT.
      4) RD Coatings Elasto-Flex at 6.0 to 10.0 mils DFT.

b. And One Coat:
      
      1) Tnemec 156 Enviro-Crete at 8 to 10 mils DFT.
      2) Liquid Plastics Acrylic at 8.0 to 10.0 mils DFT.
      3) Dupont Tufcryl at 8.0 to 10.0 mils DFT.
      4) RD Coatings Elasto-Flex at 6.0 to 10.0 mils DFT.

C. Interior Paint Schedule:

1. Interior Plywood, Latex Paint Finish:

   a. One Coat, Primer:
      
      1) Moore Eco Spec WB Interior Latex Primer 372.
      2) Duron Genesis Latex Primer.
      4) PPG Pure Performance Latex Primer.
      5) California Paint Envirotech Zero VOC Primer 646.

   b. And Two Coats, Semi-Gloss:
      
      1) Moore Eco Spec WB Interior Latex Semi-Gloss 376.
      2) Duron Genesis Latex Semi-Gloss.
      4) PPG Pure Performance Latex Semi-Gloss.
      5) California Paint Envirotech Zero VOC Semi Gloss 663.

2. Concrete Floors, Sealer/Densifier/Hardener:

   a. Acceptable Manufacturer: L & M Construction Chemicals, Inc., 14851 Calhoun Road, Omaha, NE 68152 (800-362-3331); or approved equal.
b. Base: SEAL HARD; a solution of 100% active ingredient chemicals which penetrate concrete to seal, densify, dustproof and harden to resist water and oil penetration, and contamination.

1) Active ingredients: 100%
2) Type: Alkali Siliconate
3) Flash Point: None
4) Specific Gravity: 1.155
5) VOC: gm/L: 0
6) Solids minimum: 30%

END OF SECTION
SECTION 131200

PRECAST CONCRETE BUILDING

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. Pre-assembled precast concrete building(s) as shown on the drawings.

2. All items listed below are provided and installed by precast concrete building manufacturer at the factory as part of the pre-assembled precast buildings.
   a. Non-load-bearing metal furred out wall framing at exterior perimeter walls as shown on the drawings and as specified in Section 054000 COLD-FORMED METAL FRAMING
   b. Plywood panels at exterior perimeter walls as shown on the drawings and as specified in Section 061000 ROUGH CARPENTRY
   c. Rigid insulation at exterior perimeter walls as shown on the drawings and as specified in Section 072200 THERMAL INSULATION
   d. Doors and door frames at locations as shown on the drawings and as specified in Section 081110 HOLLOW METAL DOORS AND FRAMES
   e. Door hardware as shown on the drawings and as specified in Section 087100 DOOR HARDWARE
   f. Louvers installed in place as shown on the drawings and as specified in Section 089000 LOUVERS AND VENTS.
   g. HVAC units mounted in place as shown on the drawings and as specified in Section 230000 HEATING, VENTILATING AND AIR CONDITIONING.
   h. Coordinate, locate and provide all exterior and below grade electrical conduit penetrations as noted on the drawings and with Section 261000 ELECTRICAL and Section 334000 STORM DRAINAGE UTILITIES. Provide cores and sleeves as required.
   i. Wave guide entry panels at all locations noted on the drawings. Coordinate opening sizes and locations with Section 260000 ELECTRICAL and Communications Contractor’s requirements. Caulk per Section 079200 JOINT SEALANTS.

3. Coordination: GC is responsible for coordinating all items noted above with the building manufacturer.

4. The Building Manufacturer shall provide Submittals with Product Data for all items noted above.
5. The Building Manufacturer shall provide shop drawings locating and detailing as required, all items as shown on the drawings and listed in the specifications.

1.3 PERFORMANCE REQUIREMENTS

A. Design Loads:

1. Seismic Design Category ‘C’, Importance Factor 1
2. Standard Live Roof Load: 60 PSF
3. Standard Wind Loading: 130 MPH

1.4 SUBMITTALS

A. Delegated-Design Submittal: For precast concrete building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Product Data: For each type of precast concrete building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below:

   1. Concrete Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
   2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.

E. Qualification Data: For qualified erector, manufacturer and professional engineer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for concrete.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Fabricator must be a certified producer/member of The Precast/Prestressed Concrete Institute (PCI), National Precast Concrete Association (NPCA) or equal.

   1. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Building shall comply with the following:
4. UL-752 test method level 4 for bullet resistance certified by an independent structural engineer.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Section 033000 - CAST-IN-PLACE CONCRETE.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Provide EASI-SET brand precast building as manufactured by Easi-Set Industries (ESI), Midland, Virginia, or licensed manufacturer of Easi-Set Buildings or equal as approved by architect.

2.2 MATERIALS

A. Concrete: Steel-reinforced, 5000 PSI minimum 28-day compressive strength, air-entrained per ASTM C260.

B. Reinforcing Steel: ASTM A615, grade 60 unless otherwise specified.

C. Post-tensioning Strand: Roof shall be post-tensioned in field after grout keyway is filled and has cured to required PSI strength. Post-tensioning cable shall be 41K polystrand CP50, 0.50", 270 KSI, 7-wire strand, enclosed within a greased plastic sheath per ASTM A416. There will be a minimum of three post-tensioning cables connecting roofs and floors together to provide a watertight joint.

D. Caulking: Joints between panels shall be caulked on the exterior and interior surface of the joints. Caulking shall be SIKAFLEX-1A elastic sealant or equal. Exterior caulk joint to be 3/8" x 3/8" square so that sides of joint are parallel for correct caulk adhesion. Back of joint to be taped with bond breaking tape to ensure adhesion of caulk to parallel sides of joint and not the back.

E. Panel Connections: Panels shall be securely fastened together with 3/8" thick steel brackets. Steel is to be of structural quality, hot-rolled carbon complying with ASTM A283, Grade C and hot dipped galvanized after fabrication. Fasteners to be 1/2" diameter bolts complying with ASTM A307 for low-carbon steel bolts. Cast-in anchors used for panel connections to be Dayton-Superior #F-63 or equal. Inserts for corner connections must be bolted directly to form before casting panels. No floating-in of connection inserts shall be allowed. Wall panels shall be connected to floor slab with 4" expansion anchors by manufacturer.
2.3 ROOF FABRICATION

A. Roof: Roof panel shall be level from edge to edge (the roof pitch will be provided with tapered insulation per Section 075400 THERMOPLASTIC MEMBRANE ROOFING). The roof shall extend beyond the wall panel as indicated on the Drawings and have a turndown design which extends 1/2" below the top edge of the wall panels to prevent water migration into the building along top of wall panels. Roof shall also have an integral architectural ribbed edge.

B. Keyway Roof Joints: Grout in keyways shall be polymer concrete placed after coating keyways with a methyl methacrylate resin and isocyanate resin. Top of keyway must be coated with primer followed by one coat of a polymeric joint sealant followed by a fiberglass resin fabric followed by a second coat of polymeric joint sealant.

2.4 FINISHES

A. Typical Locations: Smooth steel form finish on all surfaces.

PART 3 - EXECUTION

3.1 ACCESS

A. Provide a level unobstructed area large enough for a crane and a tractor-trailer to park adjacent to the pad. Crane must be able to place outriggers within 5'-0" of edge of pad, and truck and crane must be able to get side by side under their own power. No overhead lines may be within 75’ radius of center of pad. Firm roadbed with turns that allow 65’ lowbed tractor-trailer must be provided directly to site. No building shall be placed closer than 2'-0" to an existing structure.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing precast structure.
# SECTION 261000

## ELECTRICAL

### TABLE OF CONTENTS

#### PART 1 - GENERAL

1.1 FILING OF SUB-BIDS .............................................................. 1
1.2 SUMMARY .............................................................................. 1
1.3 REFERENCES .......................................................................... 3
1.4 QUALITY ASSURANCE ............................................................. 5
1.5 SUBMITTALS ........................................................................... 6
1.6 MANUALS AND INSTRUCTIONS ........................................... 7

#### PART 2 - PRODUCTS

2.1 IDENTIFICATION ...................................................................... 7
2.2 CONDUIT AND RACEWAYS .................................................. 9
2.3 OUTLET, PULL AND JUNCTION BOXES, AND FITTINGS ........... 9
2.4 CABLE TRAY .......................................................................... 11
2.5 WIRING DEVICES ................................................................... 12
2.6 DEVICE PLATES ....................................................................... 13
2.7 600V INSULATION COPPER WIRE AND CABLE .................... 13
2.8 PANELBOARDS - LIGHTING, POWER AND DISTRIBUTION ...... 14
2.9 DISCONNECT SWITCHES .......................................................... 15
2.10 FUSES .................................................................................. 15
2.11 EMERGENCY GENERATOR (PROPANE GAS) ......................... 16
2.12 SURGE PROTECTION DEVICES (SPD) .................................. 21
2.13 LIGHTING .............................................................................. 24
2.14 EMERGENCY BATTERY SYSTEM ........................................... 26
2.15 AUTOMATIC TRANSFER SWITCH ......................................... 26
2.16 TELECOMMUNICATIONS SYSTEMS PROVISIONS................. 31
2.17 ARC FLASH HAZARD ANALYSIS STUDY .............................. 31
2.18 ELECTRICAL CONNECTION TESTING ................................. 35
2.19 SEALS .................................................................................. 36
2.20 GROUNDING ....................................................................... 36
2.21 LIGHTNING PROTECTION SYSTEM ...................................... 37

#### PART 3 - EXECUTION

3.1 REFERENCE ............................................................................ 38
3.2 SPECIAL RESPONSIBILITIES .................................................. 38
3.3 ELECTRICAL DEMOLITION AND RENOVATION WORK ....... 39
3.4 MAIN ELECTRIC SERVICE ...................................................... 40
3.5 GROUNDING ......................................................................... 40
3.6 SLEEving AND BUSHINGS ...................................................... 42
3.7 WIRING METHODS ................................................................. 42
3.8 WIRE AND CABLES ............................................................... 43
3.9 UNDERGROUND RACEWAYS ............................................... 44
3.10 UNDERGROUND Wiring ......................................................... 46
3.11 PHASING AND COLOR CODING ............................................ 47
3.12 TELECOMMUNICATIONS AND EMPTY RACEWAYS ......... 48
3.13 INTERIOR GENERATOR AND ATS INSTALLATION ............ 49
3.14 TESTING AND INSPECTION .................................................. 49
3.15 ACCEPTANCE DEMONSTRATIONS ....................................... 50

---

**ELECTRICAL**

261000 – i

P:\B12\B121059000_Newton_Comm_Tower\DOCS\SPEC\October 3, 2014 - Bid Set261000 Electrical.doc
SECTION 261000
ELECTRICAL

PART 1 - GENERAL

1.1 FILING OF SUB-BIDS

A. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter. Ed.) Chapter 149, Sections 44A to 44I, inclusive, as amended. The time and place of submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.

B. Each sub-bid filed with the Awarding Authority shall be accompanied by a BID BOND, CASH, CERTIFIED CHECK, TREASURER’S CHECK, or CASHIER’S CHECK, issued by a responsible bank or trust company, and payable to ____________ in the amount of five percent (5%) of the bid amount. A bid accompanied by any other form of bid deposit will be rejected.

C. Each sub-bid submitted for the work of this Section shall be on a form furnished by the Awarding Authority, as required by Section 44F of Chapter 149, as amended.

D. The electrical work of Sections 26 10 00 are included under the Electrical Filed Sub-Bid.

E. Reference to Drawings: Work to be done under this Section is shown on the following Drawings:

E-1 – Electrical Legend & Abbreviations
E-2 – Electrical Plan
E-3 – Electrical Riser and Site Details

F. Sub-Sub-Bid Requirements: The Filed Sub-Bidder for the work under this Section shall, in Paragraph E of the “FORM FOR SUB-BID”, list the names and the bid prices for each person, firm, or corporation performing each class of work, or part thereof, for any of the below trades that may require such a listing. Unless forbidden in the Specifications, any Sub-Bidder may, without listing a bid price, list his own name in the aforementioned Paragraph E and perform that work with persons on his own payroll, so long as the Sub-Bidder, after Sub-Bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work, or part thereof, with persons on his own payroll and is qualified to do so. This Section of the Specification requires that the following classes of work be listed in Paragraph E of the “FORM FOR SUB-BID” under the conditions indicated herein.

CLASSES OF WORK  REFERENCE PARAGRAPHS

1.2 SUMMARY

A. The work of this Section is governed by the General Conditions, Supplementary Conditions, Sections in Division 1 of the Project Manual.

B. Perform work and provide materials and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide complete and fully functional systems’ installation.
C. Give notices, file plans, obtain permits and licenses, pay fees and backcharges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with the Contract Documents.

D. UL Listing:

1. Furnish UL listed and labeled equipment, devices, and materials. Where a UL listing is not available, submit the test reports of an independent testing engineer indicating that equipment is in conformance with local and state codes. Tests and inspections required for approval shall be performed at no additional cost to the Owner.

E. Commissioning

1. The work of this Section includes meeting the commissioning requirements as specified in Section 018100. The work includes producing start up documentation including pre-functional checklists, operation and maintenance documentation and the training required for the systems.

   a. In addition to the startup of equipment and systems, include the time required to be on site to perform functional testing of the equipment and systems being commissioned as specified in the Commissioning Specification in Section 018100.

F. In general the work of this Section shall include, but not be limited to:

3. Service Conduits and Cables.
5. Cable Tray.
7. Standby Gas Generator
8. Automatic Transfer Switch.
10. Wireways.
11. Outlets and Pull Boxes.
14. Power and alarm wiring including connections for heating, ventilating, and air conditioning system motors and equipment. All starters and line voltage thermostats will be furnished for installation (wiring, connecting, and mounting) under this Section.
15. Power, control, and alarm wiring, including connections for the Plumbing and Fire Protection Systems Equipment, shall be provided under this Section.
16. Electrical wiring and connections for Owner Furnished Equipment.
17. Devices and Device Plates.
18. Lighting Fixtures and Lamps.
20. Baseboard radiation
21. Interconnected single station fire alarm devices connected to owners security system.
22. Telecommunications Outlets.
23. Empty raceways for low voltage systems.

24. Record Drawings and Documentation.

25. Staging.


27. Supervision and approval of Excavation and Backfilling for this Section’s work.

28. Operation and Maintenance Instructions and Manuals for this Section’s work.

29. Nameplates, Labels, and Tags.

30. Testing and certifications.

31. Phasing of work, and maintenance of service, to existing and temporarily relocated items, owner equipment or workstations, etc., as required to meet the project schedule, including premium time.

32. Coordination with manufacturers, other trades, General Contractor, and Owner. Include costs associated with adjustments and changes resulting from coordination.

33. Training.

34. Costs associated with core drilling, cutting, and patching using appropriate and trained tradesmen approved by the General Contractor and the Architect.

G. Related work specified in other Sections includes, but is not necessarily limited to:

1. Cutting and Patching: Openings in masonry, concrete, tile, and other parts of structure, except for the following: drilling for hangers, providing holes and openings in metal decks, and core drilling.

2. Temporary Facilities and Controls: Temporary lighting and power for use during construction.


4. Metal Fabrications: Structural supports necessary to distribute loading from equipment to roof or floor.

5. Flashing and Sheet Metal: Flashing of penetrations.

6. Painting: Except as specified herein.

7. Metal Flashing and Sheet Metal: Roof and wall penetrations.

8. Section 200500 - Basic Mechanical and Electrical Requirements.

9. Section 200548 - Vibration Isolation and Seismic Restraints.

10. Mounting of mechanical equipment having electrical connections. Refer to work involving mechanical trades.

11. Excavation and backfill.

1.3 REFERENCES

A. All materials and work provided shall be in accordance with most recent editions of applicable standards and publications of the following organizations:


   b. C37.17 – Trip Devices For AC and General Purpose DC Low Voltage Power Circuit Breakers

   c. C37.90a – Surge Withstand Capability (SWC) Test

   d. C62.11 – Metal-Oxide Surge Arresters For AC Power Circuits

   e. C62.41 – Surge Voltages in Low-Voltage AC Power Circuits

   f. C62.45 – Low-Voltage AC Power Circuits, Guide on Surge Test

a. A525 – Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
b. A619 – Steel Sheet, Carbon, Cold-Rolled, Drawing Quality
c. B8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
d. B33 – Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes
e. D659 – Evaluating Degree of Chalking of Exterior Paints
f. D714 – Evaluating Degree of Blistering of Paints
g. D1654 – Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
h. D2247 – Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
i. D3359 – Standard Test Methods for Measuring Adhesion by Tape Test
j. G53 – Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials

3. Institute of Electrical and Electronic Engineers.
a. 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
b. 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
c. 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
d. 399 – Recommended Practice for Industrial and Commercial Power System Analysis
e. 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems
f. 1584 – Guide for Performing Arc-Flash Hazard Calculations

a. LS1 – Low Voltage Surge Protection Devices
b. MG1 – Motors and Generators
c. VE1 – Metallic Cable Tray Systems
d. WD1 – General Requirements for Wiring Devices

5. Underwriters Laboratories (UL).
a. No. 20 – General-Use Snap Switches
b. No. 50 – Enclosures for Electrical Equipment
c. No. 67 – Panelboards
d. No. 96a – Installation Requirements for Lightning Protection Systems
e. No. 268 – Smoke Detectors for Fire Protective Signaling Systems
f. No. 486a – Wire Connectors and Soldering Lugs for Use With Copper Conductors
g. No. 489 – Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
h. No. 498 – Attachment Plugs And Receptacles
i. No. 864 – Control Units for Fire-Protective Signaling Systems
j. No. 924 – Emergency Lighting and Power Equipment
k. No. 1008 – Transfer Switch Equipment
l. No. 1449 – Surge Protection Devices
m. No. 1479 – Fire Test of Through-Penetration Firestops
n. No. 1724 – Tests of Thermal Barrier Systems for Electrical System Components

   a. No. 70 – National Electrical Code
   b. No. 70E – Standard for Electrical Safety in the Workplace
   c. No. 72 – National Fire Alarm Code
   d. No. 90a – Installation of Air Conditioning and Ventilating Systems
   e. No. 101 – Life Safety Code
   f. No. 110 – Emergency and Standby Power Systems
   g. No. 780 – Lightning Protection

   a. TT-P-141B – Paint, Varnish, Lacquer, and Related Materials, Methods of Inspection, Sampling and Testing (S/S By FED STD No. 141)
   b. FED-STD-141 – Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling, and Testing
   c. W-S-896 – Switch, Toggle (Toggle and Lock), Flush Mounted (General Specification)
   d. W-C-596 – Connector, Electrical, Power, General Specification For
   e. W-C-375 – Circuit Breaker, Molded Case, Branch Circuit And Service
   f. W-P-115 – Panel, Power Distribution

8. Americans with Disabilities Act (ADA).


10. Insulated Cable Engineers Association (ICEA).
    a. S-66-524 – Cross-Linked-Thermosetting-Polyethylene-Insulated Wire & Cable

11. Electronic Industry Association / Telecommunications Industry Association (EIA/TIA).
    a. No. 607 – Commercial Building Grounding / Bonding / Requirement Standard

1.4 QUALITY ASSURANCE

A. Qualifications: Use adequate numbers of skilled, licensed workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1. The Installer (Firm and Employees) shall be experienced in the operations they are engaged to perform and have at least five years of continuous recent experience on similar projects. The Installer shall hold recent, up-to-date licenses, certifications, and training certificates in the area in which the project is located and for the equipment to be installed.
2. Provide a full time on-site foreman who personally has been certified as described above. Submit all documentation under this Section.

3. Each Foreman and Installer working on this project shall be trained by the Manufacturer whose equipment is being provided on the project. The training shall consist of a minimum of proper installation techniques of their specific equipment in order to have a complete operating system meeting or exceeding the requirements as specified herein. Each Foreman and Installer working on this project shall have documentation from the manufacturer indicating that they have been adequately trained prior to the start of the project. Only Foremen and Installers who have been properly trained and documented by the manufacturer whose equipment is being provided on this project shall be allowed to install same.

1.5 SUBMITTALS

A. Comply with the pertinent provision of Sections in Division 1 and Section 200500 Basic Mechanical and Electrical Requirements.

B. Qualifications: Submit qualifications as specified in this Section under Quality Assurance.

C. Organization of Shop Drawings: Submit shop drawings and product data submittals in bound packages organized and titled to match the Articles of Part 2 as specified in this Section.

D. Product Data: Submit catalog data sheets or other published materials showing appearances, electrical ratings characteristics and connection requirements, seismic certifications, performance characteristics, dimensions, weights, installation methods, and space requirements of electrical equipment and their accessories, as indicated in the submittal schedule.

E. Shop Drawings: Submit shop drawings indicating physical size and arrangement, (plans and elevations) construction details, provisions for conduits, access requirements for installation and maintenance, seismic certifications, finishes, and materials used in fabrication.

F. Subcontractors: Submit information about the following proposed Subcontractors for approval:

1. Arc Fault study

G. For equipment requiring utility company approval, provide a letter from local electrical utility company serving this building stating that the proposed equipment may be acceptable subject to final utility approval of shop drawings. Include Manufacturer’s signed statement indicating approval will be received from local electrical utility company serving this building even if other equipment must be substituted, and will be accomplished within the time frame as indicated in the specifications.

H. Equipment start-up and commissioning reports.

I. Submittal Schedule: Prepare and submit product data shop drawings, Operations and Maintenance (O&M) manuals and perform training as indicated on the following schedule:
<table>
<thead>
<tr>
<th>PRODUCTS</th>
<th>Product Data</th>
<th>Shop Dwgs</th>
<th>O&amp;M Man.</th>
<th>Spare Parts List</th>
<th>Demonstration / Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNDERGROUND SYSTEM</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONDUIT AND RACEWAYS</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUTLET, PULL AND JUNCTION BOXES, AND FITTINGS</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABLE TRAY</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WIRE AND CABLE</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PANELBOARDS - LIGHTING, POWER, AND DISTRIBUTION</td>
<td>X  X  X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIRE ALARM DEVICES AND CONNECTIONS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BASEBOARD RADIATION</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISCONNECT SWITCHES</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FUSES</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOGGLE, SWITCHES</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECEPTACLES</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEVICE PLATES</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIGHTING</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMERGENCY BATTERY SYSTEM</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>EMERGENCY GENERATOR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>AUTOMATIC TRANSFER SWITCH</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>ARC FAULT STUDY</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SURGE PROTECTION DEVICES</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>GROUNDING</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.6 MANUALS AND INSTRUCTIONS

A. Operation and Maintenance Manuals: Prepare manuals in compliance with the pertinent requirements of the Division 1 Section regarding Contract Close-Out Issues, Section 200500 - Basic Mechanical and Electrical Requirements, and the additional requirements of this Section. In addition to the requirements of other Sections, each manual shall include:

1. Product data cut sheets and approved shop drawings for equipment and materials as specified in this Section.
2. Lubrication and periodic maintenance instruction.
3. Equipment start-up and commissioning reports.

B. Instruction Seminar: Perform systems instruction seminar and walk-through with the Owner’s Representatives after preparation and review of the Operations and Maintenance Manuals.

C. Schedule Manufacturer’s factory representatives to perform equipment start-ups and instruction seminars as directed by Owner and as specified.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. All equipment and designated devices shall be properly identified by means of permanent, clear, and concise nameplates, tags, signs, or directories mechanically fastened or engraved on the item to be identified. Properly applied epoxy or super glue
adhesive may be accepted for device plate and nameplates only, with prior written approval of the Architect. Embossed adhesive labels are not acceptable for any identification required by the Drawings or Specifications.

B. Provide tags identifying each individual cable, wire, or group of wires comprising a circuit or feeder in all panelboards, switchboards, motor control centers, pull boxes, troughs, and terminal boxes through which such wires run and at the equipment at which they terminate. Tags shall be flameproof linen fiber or pressure sensitive type unless otherwise indicated. The circuit or feeder designation and tags shall be as approved by the Architect.

C. Provide mechanically fastened three ply black bake-lite nameplates with ¼” (6mm) high engraved white letters on the following equipment. Wording of the nameplates shall be in conformance with the respective schedules and notes on the Drawings.

1. Lighting, Power and Distribution Panelboards, Fire Alarm, and Telephone Terminal cabinets: Nameplates shall be provided on the exterior of each panel and terminal cabinet door identifying same. Nameplates shall read as indicated on the Drawings and shall be mounted on the exterior of the panel and terminal cabinet doors 1/3 of the way down from the top of same.

2. Nameplates shall be provided for each remote operating station, disconnect switch, starter, pilot light, and control device identifying the units controlled or protected.

3. All distribution equipment shall have an identification nameplate designating the short circuit rating.

D. Provide typewritten directories under transparent plastic on inside face of the doors on the panelboards.

E. Provide a nameplate at each switchboard, panelboard, motor control center, and terminal cabinet indicating the conductor, raceway, and outlet color codes used, the feeder conductor size, quantity per phase and insulation type, and if the panel is series rated. This nameplate shall also indicate the upstream equipment feeding this equipment and the location.

F. Color-Code junction boxes, raceway, and conductors as indicated in this specification.

G. Provide a placard at all service entrance equipment (main switchboard(s), switchgear, fire pump, etc.) and generator identifying the location of all the other service entrance equipment and generators. Provide white letters on red background. Minimum letter height ¼” (6.4mm).

H. Grounding or bonding conductors installed for Telecommunication Systems shall be labeled near their termination points. Labels shall be non-metallic and include the following:

"WARNING: If this connector or cable is loose or must be removed, please call the Building Telecommunications Manager."

I. Labels and installation shall meet the requirements of ANSI/TIA/EIA 606 and 607.
J. Provide additional warning signs, plaques, or directories as required by code, local authority, or as specified or indicated on the Drawings.

K. Identification materials shall be as manufactured by Seton Nameplate Company or approved equal by Dennison Manufacturing Company or Markem Company.

2.2 CONDUIT AND RACEWAYS

A. Galvanized rigid steel (RS) conduit shall be zinc-coated steel conforming to industry standards and specifications and as manufactured by Allied Tube & Conduit Corp., Republic Steel Corp., Wheatland Tube Co., or approved equal.

B. Electrical Metallic Tubing (EMT) shall be zinc coated steel conforming to industry standards and specifications and as manufactured by Allied Tube & Conduit Corp., Republic Steel Corp., Triangle/PWC, Inc., and Wheatland Tube Co.

C. Non-metallic conduit shall be Schedule 40 100% virgin polyvinyl chloride (PVC), 90°C UL-rated, and by Carlon or approved equal.

1. Conduit, fittings, and solvent cement shall be by single approved manufacturer.
2. Conduit shall meet NEMA requirements and shall be UL-listed as required by Article 347 of NEC.
3. Material shall have a minimum tensile strength of 7,000 psi at 73.4°F, a minimum flexural strength of 11,000 psi, and a minimum compressive strength of 8,600 psi.

D. Flexible metallic conduit shall be full thickness wall galvanized, spiral wrapped metallic conduit (Greenfield) or liquid-tight flexible metallic conduit as specified for specific equipment.

E. Conduit expansion fittings shall be threaded hot-dipped galvanized malleable iron with internal bonding assembly by O.Z./Gedney or approved equal.

F. Conduit fire seal fittings shall have heat-activated tumescent material for fire rating equal to or higher than that of floor or wall by O.Z./Gedney or approved equal.

G. Provide water-tight gland sealing assemblies with pressure bushings as required for penetrations.

H. Fittings for rigid steel and intermediate metal conduit shall be threaded malleable iron. Hubs shall be flame resistant insulated throat and be self-locking weatherproof type.

I. Fittings for electrical metallic tubing shall be set screw type. Compression fittings shall be watertight with positive ground. Connectors, couplings, and setscrews shall be galvanized steel with wall thickness equal to EMT. Setscrew connectors for tubing sizes larger than 2” (51mm) shall have minimum of four screws for couplings and two setscrews for connectors or fittings. Provide insulating inserts where required.

2.3 OUTLET, PULL AND JUNCTION BOXES, AND FITTINGS

A. Outlet, pull and junction boxes, and fittings for general use, flush mounted in concrete work and walls in normally dry locations, shall be manufactured by Steel City, Appleton, Raco, or approved equal. Outlet, pull and junction boxes, and fittings for normally wet locations, or surface or pendant mounted in all locations, shall be of the proper cast metal
type and shall be manufactured by Crouse-Hinds, Appleton, Red Dot, Russell and Stoll, or approved equal.

B. Provide as a part of the raceway system all outlet, pull, back and junction boxes and supports required for the proper installation of all components of the Electrical System.

C. Outlet boxes shall, in general, be as follows:

1. Outlet boxes shall be 4" (102mm) square minimum with plaster ring extension size for devices specified.
2. Exposed, surface, and pendant mounted outlet boxes, or outlet boxes installed in normally wet locations, shall be of the cast metal type with threaded hubs.
3. Recessed outlet boxes for dry locations shall be of the pressed sheet steel, zinc coated type.
4. Surface mounted boxes on existing concrete block walls shall be wiremold (for dry locations only) or cast boxes without knock-outs, suitable for painting. Device plates shall not overlap boxes. Surface boxes for fire alarm devices shall be red with sufficient size so that devices do not overlap boxes.
5. Outlet boxes shall not be less than 1-1/2" (38mm) deep unless shallower boxes are required by structural conditions and are specially approved by the Architect. Outlet boxes for telecommunications work shall be as indicated.
6. Ceiling and bracket outlet boxes shall not be less than 4" (102mm) octagonal except that smaller boxes may be used where required by the particular fixture to be installed. Flush or recessed fixtures shall be provided with separate outlet boxes where required by the fixture terminal temperature requirements.

D. Pull and junction boxes shall be as follows:

1. Pull and junction boxes less than 6" x 6" (152mm x 152mm) shall be as specified for outlet boxes.
2. Pull and junction boxes shall be constructed of code gauge galvanized sheet metal of not less than the minimum size required by the Electrical Code or other applicable Specification "Standards" and shall be furnished with screw fastened covers. Boxes exceeding 48" (1219mm) in any direction shall be properly reinforced with angle iron stiffeners.
3. Pull and junction boxes to be installed in normally wet location areas shall be of the cast type with threaded hub and gasketed cover plate.

E. Fittings shall, in general, be as follows:

1. Adequate expansion/compression fittings shall be used where crossing building expansion joints. Expansion fitting shall be multidirectional and have grounding jumpers, and shall be manufactured by O-Z Gedney, Crouse-Hinds, or approved equal.
2. Raceways shall have expansion fittings installed as recommended by the manufacturer. Provide a minimum of one expansion fitting per 100’ (30.5m) or fraction thereof for non-metallic raceways.

2.4 CABLE TRAY

A. Provide a complete system of cable trays as manufactured by Chaflant, B-Line, TJ Cope, Husky, or Mono-Systems.

B. All cable trays, fittings, and accessories shall be factory fabricated and shall have adequate mechanical strength and stability. The cable tray shall be provided with all tees, elbows, and similar fittings. The internal surfaces of all erected cable trays and fittings shall be smooth and free from defects.

C. Supports shall be rigid to prevent distortion of trays under any condition. Horizontal tray runs shall be supported by means of approved straps, hangers, etc. Vertical tray runs shall be fastened directly on the structure of the building. Supports for tray shall be spaced not more than 5’ (1524mm) apart. Each tray conjunction, each tee, elbow, and other fitting shall be suspended or secured completely. Cable trays and support materials shall be compatible to prevent electrolysis.

D. Material for construction shall be mill galvanized steel per ASTM A-525, G-90 coating.

E. Ladder Type

1. Cable tray structure shall consist of two (2) longitudinal side rails connected by individual transverse members (rungs). Rungs shall be welded to the side rail members and rest on lower flange of “Z” or channel side rails. Rungs shall not protrude below side rails. There shall be no drilling or punching of side rails except for splice plate holes.

2. The tray shall have a loading depth of 4” (102mm) and have an inside width between side rails as shown on the Drawings. Rung spacing shall be 9” (228mm) unless otherwise shown on the Drawings.

3. Splice plates shall have a minimum of 4 holes and shall be of the same material as the tray. Special truss type rib-neck bolts with flanged lock nuts. Nuts and bolts to be either electro-galvanized or cadmium plated.

4. A tray system longer than 200’ (61m) shall be provided with expansion splice plates for each 200’ (61m) of continuous tray.

5. Ladder rungs shall be channel shaped, of same material as sides, and not less than 1” (25mm) vertical height and 3/4” (19mm) wide, with the closed rounded-corner face uppermost.

6. Tray shall be free of sharp edges, burrs, or projections to prevent damage to cable insulation.

7. The cable tray shall be capable of carrying a load of 200 lb. per foot plus a 200 lb. concentrated load on any rung. Fittings shall be designed to provide the same load capacity as straight sections and are to be manufactured of same material with same overall dimensions. Radius of fittings shall be as required for cable bending.
1. Tray covers, where specified, shall be of same material as sides and not less than code gauge material.

2.5 WIRING DEVICES

A. Wiring devices shall be made by single manufactured; Hubbell Inc. Leviton, Pass and Seymour/Legrand, Cooper Wiring Devices, or approved equal.

B. Bodies shall be of thermoplastic compound, with faces of nylon supported by mounting yoke having plaster ears and shall be NEMA WD-1 heavy duty "Commercial Specification Grade" (Unless otherwise indicated on detail drawings / Symbol List). All devices shall be the grounding type and shall be connected to metal mounting yoke. A terminal shall be provided for the ground wire on all receptacles.

C. For vapor tight applications, wiring devices shall be enclosed in Crouse-Hinds FS or FD Condulet with vapor tight cover.

D. Wiring devices color shall be ivory

E. All receptacles unless specifically indicated otherwise shall be as follows:

1. Receptacles shall be side wired with two screws per terminal. Provide receptacles tested to UL 498, NEMA WD-1 heavy duty and Federal spec WC596 where applicable. Receptacles on individual branch circuits shall match the ampacity of the circuit.

2. Convenience receptacles - Duplex 20 ampere, 125 volts, 1 phase, 3 wire, U-Slot grounded type Hubbell CR5362 or equal.

F. Ground Fault Circuit Interrupter Receptacles

1. Ground fault interrupter type ‘GFCI”- Duplex 20 ampere, 125 volts, 1 phase, 3 wire U-Slot grounded type. Ground fault test function shall sense a ground fault and interrupt the circuit in an actual ground fault condition. (All “GFCI” devices shall meet the latest version of UL 943 and in keeping with this standard have a visual end of life indication). Receptacles shall be Hubbell GF20L or equal.

2. GFCI receptacles shall be provided with tamper proof feature.

G. Toggle Switches:

1. Toggle switches shall be of the totally enclosed, flush tumbler type of suitable capacity for the intended load and shall be "Specification Grade". Provide listed switches tested to UL 20, and Federal spec WS896E where applicable.

2. *Toggle switch bodies shall be NEMA WD-1 heavy-duty thermoplastic compound, quiet indicating type with screw type terminals. Provide grounding terminal.

3. General lighting switches shall be 1 pole, 2 pole, 3 way 4 way or Keyed with or without pilot light and be 20 ampere, 120/277 volts AC. Hubbell CS1221- Series & Hubbell HBL1221RK1 Locking Type or equal.
2.6 DEVICE PLATES

A. Wiring device plates shall be of the same manufacturer as the wiring devices.

B. Device plates of the one-piece type shall be provided for all outlets to suit the devices installed.

C. Plates on unfinished walls or fittings shall be of zinc-coated sheet metal with countersunk heads of the same finish as the plate.

D. Wiring device plate color shall be Stainless Steel.

E. Indicate panel and circuit number on wiring device plate by a permanent identification method.

F. Provide 0.040\" brushed stainless steel device plates on recessed devices or galvanized steel plates on surface receptacles.

G. Receptacle device plates for circuits other than 120 V, 2-wire, shall be engraved with ¼\" letters on red background, indicating voltage characteristics and circuit number of outlet.

2.7 600V INSULATION COPPER WIRE AND CABLE

A. Provide annealed copper wire and cable with insulation rated for 600V and 90°C of sizes specified and as manufactured by General Electric, Rome, Okonite, Essex, Southwire, or approved equal.

B. Wire and cable shall have copper conductors. Copper wires shall be soft drawn, annealed with 98% conductivity and insulated for 600V. All conductors #10 AWG and smaller shall be solid. All conductors larger than #10 AWG shall be stranded. Conductors shall be color coded as specified under Execution.

C. Service entrance conductors, and conductors installed underground in raceways other than sleeves, shall be dual rated type RHW-2/USE-2 with XLPE insulation. Conductors, other than service entrance, installed underground in raceways may also be type XHHW.

D. Fire-protective signaling wiring shall be in accordance with the Electrical Code, Article 760, Fire Prevention Systems for Building Fire Alarm Systems, and as indicated. All wires for the local fire alarm system shall be color-coded and the size and type as recommended by the manufacturer of the fire alarm system. Initiating circuits in multiplexed or addressable systems shall be shielded.

E. All circuit phases shall be color-coded as indicated herein, at terminations, splices, and pull boxes by colored insulation or electrical plastic vinyl tape such as 3M Scotch Brand No. 35 color-coding tape or equal.

F. Wire connectors for copper wire rated at 600V and lower (105°C rated and below), sizes #18 through #6 AWG, solid or stranded, shall be screw-on type pressure connectors (of the "SCOTCHLOK" type) incorporating a non-restricted, zinc coated spring and insulated with a vinyl jacket having a flexible skirt. Connectors for larger size wires shall be as manufactured by Thomas & Betts Co. or approved equal. Connectors shall be listed for use at 600V.
G. Wire connectors for copper wire 600V and below used in manholes and handholes shall be of the waterproof type and shall be made with 3M Scotch kit waterproof direct burial splice connectors.

H. Wire connectors used above grade in damp wet or exterior locations shall be filled with a waterproofing material and listed for the use.

2.8 PANELBOARDS - LIGHTING, POWER AND DISTRIBUTION

A. Panelboards shall be as manufactured by Square D, General Electric, Cutler-Hammer, or Siemens.

B. Panelboards shall be of the dead-front type suitable for 120/240V, single phase, three-wire operation and shall have a short circuit current rating equal to or greater than the integrated equipment rating as scheduled on the contract Drawings.

C. Panelboard cabinets shall be fabricated from code gauge galvanized sheet steel and furnished with either flush or surface trim. Trims shall be finished in gray enamel paint over a rust-inhibiting prime coat. A turned edge shall be provided around the front of the box for rigidity and attachment of the front. Trims shall be fitted with hinged doors having combination lock and latch, with all locks keyed alike. (Power and lighting panels shall have door in door type trim with heavy duty, continuous, section vertical hinging to box section for access to wiring gutters in addition to trim door. The inner door shall allow keyed access to CBs and the second door shall allow bolt access to tub interior wiring gutters). A directory holder with a clear plastic or glass plate and metal frame shall be mounted on the inside of each door. A neatly typed directory properly identifying each circuit shall be provided in the holder.

D. Interiors shall have copper bus bars with mains arranged for a grounded solid-neutral system with lugs only in the mains or main breakers as indicated. Panelboard shall be suitable for use with 75°C conductor ampacities.

E. Neutral bus shall be insulated from the panel enclosure, except provide bonded neutral only for service entrance equipment. Panelboards shall have a separate equipment ground bus and terminal strip.

F. Circuit breakers shall be molded case, thermal magnetic type with bolted connections to the bus and shall be single, double, and three-pole circuit breakers with interrupting ratings indicated on the Drawings. The design of the structure shall be such that the units may be removed without disturbing adjacent sections, bus structure, or insulation. Circuit breakers shall be labeled for use with 75°C conductor ampacities. Circuit breakers used for switching shall be type "SWD". Circuit breakers for HVAC equipment and any other equipment with multiple motors shall be type "HACR".

G. Automatic tripping shall be indicated by handle automatically assuming a position between the manual "OFF" and "ON" positions. The individual breakers shall be calibrated and sealed to eliminate tampering or unauthorized changes in calibration. Breakers shall be interchangeable and capable of being operated in any position. Two and three-pole breakers shall be common trip type so that an overload on one pole will trip all poles simultaneously. No handle bar ties will be allowed on multi-pole circuit breakers to accomplish either manual or automatic tripping. All circuit breakers with trip sizes larger than 100 Ampere rating shall have interchangeable trips.
H. Series rating of circuit breaker shall be acceptable. Series rated branch circuit breakers are acceptable where for the specific combination used. Submit listing of Series ratings. Main circuit breakers or circuit devices feeding a main lug only panel shall be fully rated. Provide labeling on inside of doors of series rated panelboards to designate series rated and list the AC rating and all combinations for series rating for that equipment.

I. Circuit breaker lockable devices suitable to lock breakers in the open or closed position shall be provided for the following:

1. Minimum of two pad lockable units per panelboard.
2. Fire alarm circuits.
3. Emergency lighting circuits.

J. Where panelboards are located at service entrance and/or indicated as service entrance equipment, they shall be UL listed as service entrance equipment.

2.9 DISCONNECT SWITCHES

A. Disconnect switches shall be manufactured by General Electric, Square D, Cutler-Hammer, or Siemens.

B. Disconnect switches shall be of the fusible or non-fusible type as indicated and equipped with an external lever or handle for manual operation. Each unit shall be enclosed in a code-gauge, sheet steel cabinet with hinged door and catches and suitable for surface mounting as indicated on the Drawings. Switches shall be horsepower rated, heavy-duty type in NEMA I enclosures of the size indicated on the Drawings or as required. NEMA Type 3R switches shall be provided where exposed to weather. Provide disconnect switches that are rated for use with E rated motors. Disconnect switches shall include arc containing shields.

C. Provide switches of the proper voltage rating and number of poles required for the use (1, 2, 3, 6 pole, etc.) Neutral conductors, where present, shall be unswitched. Fusible type disconnect switches shall have rejection type fuse clips. Disconnect switches shall have provisions to be pad locked in the open position.

D. A disconnect switch shall be provided for all power equipment as required by the Electrical Code, whether or not indicated on the Drawings.

2.10 FUSES

A. All secondary system fuses, rated at 600V or less, shall be manufactured by Bussman, Chase-Shawmut, or Littlefuse. Primary fuses shall be current limiting "E" Type as manufactured by Cutler-Hammer, General Electric, or Siemens approved equal.

B. Provide all fuses of the Ampere rating equal to the feeder rating for general-purpose circuits and as recommended by the manufacturer for equipment containing motors. Fuses for general-purpose circuits shall be current limiting, one time, rejection type, UL Class R, Type RK1 or RK5 with a short circuit rating of 200,000 amperes RMS. Fuses for motor circuits shall be dual element fuses, current limiting and time delay, cartridge type UL Class RK-5, with short circuit interrupting capacity of 200,000 amperes RMS.

C. Upon completion of construction and before final acceptance of the building, furnish to the Owner one complete set of three fuses for each type installed in the building under
this Contract. The spare fuses shall be turned over to an authorized representative of the Owner, designated by the Architect, upon completion of the Construction Program.

2.11 EMERGENCY GENERATOR (PROPANE GAS)

A. Each UL 2200 listed and labeled generating set shall be manufactured by Olympian, Katolight, or Generac. The supplier of the equipment shall provide, with no additional charge, the information or supervision required for the proper installation of the equipment and training of operating personnel. The equipment furnished under this Specification shall be new, unused, of the latest design, and covered by a full and complete two (2) year warranty. In no case shall the warranty be less than two (2) years from date of field test and approval of all test reports. Provide standby electric generating systems rated for continuous standby service 25 kW, 31.25kVA at 0.8 power factor. Voltage shall be 120/240V, single phase, 3 wire at 60Hz.

B. Generator supplier shall be responsible for filing and permitting of generator sets.

C. System provided shall be manufacturer’s low emissions engine that complies with industry standards. Generator set shall be certified and in compliance with Commonwealth of Massachusetts Emissions Regulations.

D. The engine and generator shall be the product of an ISO 9001 certified manufacturer. The design is based on a Caterpillar Olympian engine/generator set. Any changes to the design based on other manufacturers will be the responsibility of the installing contractor at no additional cost to the Owner. The naming of a specific manufacturer does not waive any requirements or performance of individual components described in this specification.

E. Substitutions to this specification shall include complete submittal data clearly identifying all deviations or exceptions and shall be submitted for approval a minimum of ten (10) days prior to the bid date.

F. The Generator Distributor shall have and ISO 9002 Certified Quality Program in order to be considered as an acceptable supplier. Details of the Quality Certification shall be included with the Approval Submittal Documentation.

G. Packaged generator set shall be EPA certified and in compliance with the Commonwealth of Massachusetts Emission regulations.

H. Each system shall be a package of new and current equipment consisting of:

1. A propane gas engine driven electric plant to provide emergency electric power.
2. Engine-mounted start-stop control system.
3. Automatic load transfer controls to provide automatic starting and stopping of the unit and switching of the loads.
4. Mounted accessories as specified and required.

I. This system shall be built, tested, and shipped by the manufacturer of the alternator so there is one source of supply and responsibility. The performance of the electric plant shall be certified by an independent testing laboratory as to the plant's full power rating, stability, and voltage and frequency regulation. Submit certificate of compliance with shop drawings. Furnish detailed summary of testing of unit of this rating in accordance with NFPA-110T. To insure system compatibility and one source of supply and responsibility. Provide automatic transfer switch.
J. The manufacturer of this equipment shall maintain a full-time “in-house” parts and service organization within 75 miles of the job site. The manufacturer of this set shall have a minimum of five (5) years of experience in building similar units. Equipment offered by those who do not have an “in-house” parts and service organization and who depend on others to provide services will not be considered. This supplier shall have his name, address, and telephone number clearly and visibly located on all equipment. Service shall be available on a 24-hour, 7-day week basis.

K. Submittal set shall be the following information:

1. Unit drawings of all major components showing exact dimensional data.
2. Catalog information on the engine, generator, battery charger, vibration isolators, exhaust silencer, flexible exhaust connector, and automatic transfer switch.
3. A complete bill of material indicating exactly what is to be provided.
4. A list of at least two similar installations using the same major components as specified herein.
5. Estimated time, in calendar days, for delivery after approval and release is received.
6. Furnish engine heat rejection data to jacket water, exhaust, and ambient and total DB measurement of engine, generator, and radiator measured at 23' (7m).
7. Complete engineering submittal, catalog cuts, wiring diagrams, interface drawings, unit drawings, AC & DC schematics, termination chamber drawings, terminal strip drawings, foundation plans, annunciator panel layout and wiring, etc., must accompany all shop drawings.
8. Furnish engine emissions data as required by permitting authority.

L. The operation of this unit shall be automatic. Upon the closing of a remote starting contact, the engine shall start and attain rated voltage and frequency within ten (10) seconds.

1. All necessary accessories shall be provided to assure starting within the time described above under the ambient conditions described herein.
2. Governor regulation, no load to full load, shall not exceed 1%. Steady state regulation shall not exceed plus or minus 0%. Governor shall be electronic isochronous type.

M. The propane gas engine shall be water-cooled, 4 cylinder, 4 cycle, a minimum displacement of 2.4 liters. The rating shall be for conditions of 29.92” (759.97mm) barometric pressure and 100°F air temperature. No two-cycle engines will be considered.

1. Lubrication shall be a full pressure system, using an engine-driven gear-type lube oil pump with replaceable element full flow lube oil filter. Lube oil cooler shall be provided.
2. The engine mounted fuel system shall include all equipment normally supplied and recommended by the generator set manufacturer for emergency generator service.

N. Governor: The engine shall be equipped with a electronic isochronous governor capable of maintaining the engine speed from no load to full load within plus or minus .25% of the synchronous speed.
O. The engine shall be a 12VDC starting system with starting motor and starter solenoid switch.

1. Batteries: One set of starting batteries with cables, steel battery rack, and heater shall be included for each starter. Batteries shall be sized for operation at -20°F.

2. Batteries shall be heavy-duty lead acid type

3. Batteries shall be capable of cranking generator a total of 2 minutes with 10 seconds on, one minute of cycles for a total of 12 cycles.

4. A float type battery charger shall maintain the starting batteries at full charge. The charger shall be suitable for wall mounting (or may be mounted in the generator control panel) and shall have a cranking disconnect relay or current limiting feature. The charger shall be Charles AE2420, Lamarche A46, or equal. The charger shall have high and low voltage alarm relays and a 20-amp output.

5. There shall be a belt-driven battery charging alternator with regulator and charge rate ammeter for charging the batteries while the engine is running.

P. Engine jacket water heater and thermostat shall be provided to maintain the engine jacket water at a temperature high enough to assure starting the engine and attaining rated voltage and frequency within 10 seconds. Ambient temperature of generator installation is 0°F (outdoor) or 55°F (indoor). The jacket heater shall be of the capacity recommended by the generator manufacturer to meet above conditions. Battery heater shall be thermostat controlled and shall keep battery at proper temperature.

Q. Engine shall be provided with 110°F ambient unit mounted radiator. Radiator shall have sufficient capacity to dissipate not less than total BTUs per hour rejected at 100% full load under the condition specified. Filler cap shall be designed for pressure relief.

1. Cooling system shall be provided with initial charge of permanent type anti-freeze solution containing rust inhibitor.

R. The engine shall be equipped with safety shutdown and or prealarm contacts for:

1. Low lube oil pressure: prewarn and shutdown.
2. High jacket water temperature: prewarn and shutdown.
3. Over speed.
4. Over crank.
5. Low water level: prewarn.
7. Low DC voltage.

S. The following engine instruments shall be included in the generator control panel:

1. Lube oil pressure.
2. Water temperature.
3. DC voltmeter.
4. Tachometer.
5. Other instruments considered necessary by the Manufacturer.

T. An exhaust silencer suitable for critical type silencing and complete with condensate drains shall be installed in the radiator air stream of the size recommended by the
generator set manufacturer, but in no case less than 14” (356mm). Silencer shall be equal to Maxim Model M51. An octane hand center frequency (in Hz) data sheet shall accompany all muffler shop drawings. Silencer shall include companion flanges, mats, boxes, and gaskets.

U. The engine and generator shall be close-coupled and mounted on a structural steel base designed to maintain proper alignment of the unit.

1. The unit shall be certified by the manufacturer to be free from any critical torsional vibrations within a range of plus or minus 10% of synchronous speed.

2. Vibration isolators of spring type shall be supplied with the unit. The number of isolators shall be required per requirements of Section 200548.

V. Generator shall be provided close coupled to engine and shall be built to the following standards:

1. Type shall be revolving field, 4 pole, single-bearing, drip-proof, permanent magnet type, with matching pitch characteristics for parallel operation.

2. Exciter shall be brushless, direct connected, fully tropicalized, SCR rectifiers, static voltage regulator, rheostat, with excellent motor starting capability

3. Voltage regulation shall be ±1% of any preset valve over the three-phase load range. Instantaneous voltage dip or rise when measured with an oscilloscope, shall not exceed 20% upon full load application or rejection, and will return to preset valve within 0.5 seconds. Voltage regulator shall be three phase sensing, provide V/Hz regulation, provide over voltage and under voltage protection, and shall include a solid-state circuit to remove excitation when generator is overloaded for more than 10 seconds.

4. Waveform shall be a deviation factor with an output voltage not exceeding 5% and the valve of any individual harmonic shall not exceed 2% of the fundamental harmonic when operating with an unbalanced load.

5. Temperature rise shall be temperature rise of any component will not exceed the rise permitted by NEMA and UL 2200 standards.

6. Rotor shall be one piece laminations welded and secured to shaft by a key and press fit. Amortisseur windings shall be installed and connected between poles as an aid to parallel operation and improve waveform during unbalanced loads. Field coil machine would on insulated pole body and securely braced. Rotor shall be statically and dynamically balanced.

7. Stator shall be one piece laminations welded together. Stator coils shall be form wound and placed in insulated slots. Stator shall be pressed and welded in a rigid steel frame.

8. Bearings shall be double sealed ball bearings, lubricated for life.

9. Insulation shall be NEMA Class H insulation.

10. Varnish shall be three coats modified polyester type and shall not support fungus growth.
11. Cooling shall be cast aluminum fan mounted on generator shaft.

12. Radio suppression shall be radiated or conducted radio interference shall not affect normal commercial apparatus.

13. Generator shall be built to handle a minimum of 50% harmonic loading from UPS, electronic ballasts, and variable frequency/soft start drives.

W. The engine generator set shall include an oversized terminal box and combination engine generator control panel which shall be shock mounted at the generator end of the unit. Control panel meters shall have ½% accuracy, .3 Hz accuracy, shall read true RMS, be solid state with digital readout, and have diagnostic capability. This unit mounted panel shall include (but not be limited to) the following:

1. Step Oil Protection.
2. Voltage adjusting rheostat, \( \pm 10\% \).
3. Start-Stop.
4. Electronic metering and current transformers with steppable outputs for frequency, volts, amperes, \( \text{kW} \), and \( \text{kVA} \).
5. Running elapsed time meter.
6. Automatic start/stop control.
7. Over crank protection (manual reset).
8. Safety shutdowns with indicating light and lamp test switch for:
   a. Low water temperature: amber prewarn.
   b. Low oil pressure: red shutdown, amber prewarn.
   c. High water temperature: red shutdown, amber prewarn.
   d. Over speed: red.
   e. Over crank: red.
   f. Low water level.
   g. Low DC voltage.
9. Selector Switch -"Off, auto, manual" with red pilot light to flash when selector switch is in "off" position.
10. Control power shall be from the engine start battery.
11. A communication adapter shall be provided to allow an RS232 device between generator remote PC, BMS, or other RS232 device. Device shall allow remote start, stop, operational parameters, and diagnostic codes to be accessed by a Windows based software package.

X. Preliminary start-up and operating tests of the generator system with a load bank shall be conducted for a one (1) hour duration to assure that the system is complete and in proper working order, that all adjustments have been made, and that all deficiencies have been corrected. Engine alarm and shutdown features shall be function tested, including low oil pressure, high water temperature, over speed, and low water level.

Y. Final tests, to be witnessed by the Architect and Engineer, shall be scheduled only after preliminary tests have been successfully completed. Testing shall be in accordance with NFPA 110. Readings shall be taken in fifteen (15) minute intervals and results issued to Engineer as follows:

1. Ambient temperature.
2. Engine jacket water temperature.
3. Generator temperature.
4. Oil pressure.
5. Battery charger rate.
6. AC volts (all legs).
7. AC amps (all legs).
8. Engine air exhaust temperature.
9. Decibel readings with sound meter at 50’ (15.24m) in all directions.

Z. Test loading shall be:

1. 25% rated for 15 minutes.
2. 75% rated for 30 minutes.
3. 100% rated for 15 minutes.

AA. Tests shall be made with the door to the enclosure or room in which the generator is located in the closed position. Generator start will be verified by simulated power failure by turning off main or generator ATS breaker. The test shall be made by use of a load bank sized at the full kilowatt rating of the generator system. This load bank shall be furnished by the supplier of the engine generator unit and shall be connected to the generator terminals as one complete and full unit of kilowatt load. This load bank shall be applied to the generator terminals only after the generator has reached its full voltage output. As part of generator test, transfer all ATS to emergency position and check that all devices connected to the generator are in proper working order.

BB. The supplier of this equipment shall provide lube oil in the engine, and also drain and refill the engine with new lube oil after the test run is completed. If the engine generator unit should fail the initial test run, as determined by the Engineer, a second similar test run shall be performed after the proper corrective measures have been implemented. Replace engine lube oil again after the second test. If any additional tests are required to prove the performance of the engine-generator, lube oil shall be replaced after each such test run.

1. The portable load bank shall be furnished for each additional test, should the initial test not be accepted.

CC. Deliver test reports, maintenance manuals and warranties to the Architect after the completion of a successful test.

2.12 SURGE PROTECTION DEVICES (SPD)

A. SPDs shall be supplied by a single manufacturer.

1. Acceptable manufacturers for service entrance (no substitutions):
   a. Interceptor II.
   b. LEA Corporation Powervantage.
   c. Current Technologies SEL Series.
   d. Manufacturer of distribution equipment for project where SPD is integral to equipment.

B. Provide labor, materials, equipment, services and transportation necessary for complete and operational systems as indicated on the Contract Drawings.
C. The SPD system shall utilize multiple bi-direction, replaceable protection modules per each mode of protection to suppress and divert transient voltages and surge currents. The system shall be designed to provide protection for sensitive electronic devices against the harmful effects of surges, transients and electrical line noise.

D. The SPD system shall comply generally with this specification and be tested and listed where applicable in accordance with the following specified standards:

1. ANSI/IEEE C62.41
2. ANSI/IEEE C62.45.
3. Military Standard 220A.
4. Underwriters Laboratory – UL 1449 Latest Edition with proper AIC rating
5. Underwriters Laboratory UL67.
6. Underwriters Laboratory UL847.

E. The SPD system shall be designed for operation in the following environmental conditions:

1. Operating Temperature -40°C to 60°C
2. Relative Humidity 0 – 95%, non-condensing
3. Operating Altitude 0 – 12,000’ (3658m)
4. Audible Noise Less than 35 DBA at 3’ (1m)

F. Submittal Data. The following information will be submitted for each device proposed:

1. UL-1449, Third Edition test information clearly showing the Voltage Protection Rating (VPR) and a nominal discharge rating of 20kA.
2. Maximum Surge Current test reports demonstrating that the SPD has been tested to a single pulse of 200kA. Reports will clearly demonstrate that the tests have been performed on a COMPLETE device including all necessary fusing, disconnects, monitoring systems, etc.
3. Repetitive Surge current Rating. Provide data demonstrating that the device is capable of surviving repetitive surges.
4. Test reports should be from an independent lab. Acceptable performance criteria will be based upon a deviation in VPR of ± 10%.
5. Short Circuit Current (AIC). Provide test reports demonstrating that the device has been tested to the specified AIC rating.
7. Full NEMA data package per the requirements of NEMA.
8. Provide a copy of the manufacturer’s instruction manual.

G. Panel SPD will be wired to the distribution panelboard through a 30A, 3-pole breaker provided by the equipment manufacturer once it is installed internally. Lead lengths shall be kept to an absolute minimum and all leads (including the neutral) shall be twisted together to minimize inductance.

H. Electrical Requirements

1. The Parallel Design SPD system shall have unlimited nominal current handling when installed in a parallel configuration.
2. The system voltage shall be as indicated on the drawings.
3. The Parallel Design SPD System shall be a three-stage (L—N, L—G, N—G) device for wye systems and two-stage (L—G, L—L) device for delta systems.
I. Semiconductor and Filtering Parameters

1. Each MOV shall be individually fused. The fusing system shall be of such size that the maximum surge current will pass through the SPD without causing the fusing system to open.

2. Each replaceable phase (A, B, C, or N) module or non-replaceable SPD assembly shall contain a status indicating light. This light indicates the status of the MOV’s fuses in the L G or the L N modes. The normal operation of the replaceable module shall provide positive indication utilizing the illuminated light. Failure of the module (blown MOV fuse) shall be designated by the absence of the status light. Indication of the module mode (L G or L N) failure is duplicated on the outside front door of the enclosure.

3. The SPD Product shall be provided with a Noise Filtering System capable of managing noise produced by electro-magnetic and radio frequency interference with amplitudes under the MOV’s Maximum Continuous Operating Voltage (MCOV) level. The Noise Filtering System shall reject a minimum of 50 dB at 100 KHz as measured by the 50-Ohm Insertion Loss Method (Military Standard 220A). The frequency bandwidth of all noise attenuation shall be from 10 KHz to 100 MHZ.

4. The SPD system utilizing capacitors shall be UL 1283 Listed for safety implying the use of bleed-off resistors and the proper clearances for capacitor application.

5. The SPD system’s capacitor filter shall be connected between each phase conductor and neutral (L → N) and not the ground (L → G) conductor.

6. The SPD semiconductor components shall be constructed in accordance with Table 12.1 under section 37.3 of UL 1449 Latest Edition. SPD short circuit rating shall be equal to or exceed that of the equipment (switchboard, panelboard, etc.) that it is directly connected to. Provide all fuses and components construction to meet this requirement. AIC ratings listed in this paragraph are minimum and higher ratings to match equipment SPD is connected to/integral with shall be provided.

7. UL 1449, Latest Edition Voltage protection Rating (VPR) values of the system shall be no greater than those shown as follows:

<table>
<thead>
<tr>
<th>Nominal RMS Voltage</th>
<th>Clamping Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>without disconnect</td>
</tr>
<tr>
<td>120 or 120/240 or 120/208</td>
<td>330</td>
</tr>
</tbody>
</table>

J. Cabinet Construction

1. The SPD cabinet enclosure shall be designed for wall mounting. The metal cabinet shall be connected to protected equipment by conduit nipple no longer than 5” in length.

2. The SPD Cabinet enclosure shall be NEMA (12) or (4). The cabinet shall be sized in accordance with the abnormal over voltage test of UL 1449 Latest Edition.

3. The service entrance SPD shall include an internal disconnect to allow connection directly to current carrying conductors.

K. Service Entrance SPD
1. Surge protection assembly shall have a maximum surge current rating of 200kA amps per mode, 400kA per phase.

2. The SPD shall be capable of surviving 15,000 repetitive ANSI/IEEE Category C3 impulses (10kA) without failure or performance degradation.

3. The SPD shall include a built-in, push-to-test feature that will test the integrity of each MOV/fuse pair. The SPD that performs this function with the use for an external test set will include the test set with the SPD.

4. The SPD shall be wired to the service entrance equipment through a 60A, 3-pole breaker provided by the equipment manufacturer. If the SPD can be wired directly to the equipment busbar, the SPD manufacturer will provide an integral disconnect. Devices that require a fused disconnect shall not be considered.

L. Monitoring Features

1. In addition to module status lights, provide an audible alarm on all service entrance SPD to sound in the event a protection replaceable module has failed. The audible alarm shall be silenced by pushing the illuminated alarm silence pushbutton on the front of the enclosure. Replacing the failed module with an appropriate operating module, shall silence alarm and reset light.

2. A summary contact shall be provided so that remote monitoring of the SPD system is possible. The "Form C" dry contacts can be connected in either the normally open or normally closed position.

3. The service entrance SPD system shall be equipped with a six-digit surge counter capable of counting individual transient events as they occur. The counter consists of a six-digit readout calibrated to count all relevant surges.

M. System Warranty

1. The SPD system manufacturer shall warrant the entire system against defective materials and workmanship for a period of ten years following delivery from the manufacturer.

2. The manufacturer shall have a nationwide network of factory-trained manufacturer representatives dedicated to repair and service of this product. The manufacturer shall have a dedicated 1-800 telephone number for service problems and questions. This number must be manned 24 hours a day, 365 days a year by a knowledgeable factory employee to ensure prompt response to any emergency situation, which may arise. The manufacturer is required to be able to service the equipment on a local basis without the requirement to return the product to the manufacturer for proper repair. There shall be no charge for the period of warrantee service.

2.13 LIGHTING

A. Provide all lighting fixtures and lamps complete with all accessories required for proper installation and operation.
B. The lighting fixtures scheduled on the Drawings are indicative of the type and characteristics required.

C. Fixtures submitted shall meet the requirements of utility incentive programs for energy efficiency. Contact utility company for information. Cooperate and coordinate with utility for incentive program. Incentives shall go to the Owner. Provide information and fill out forms as requested.

D. Assume all responsibility for checking Architectural Drawings, prior to ordering fixtures, and provide the specified recessed fixtures with proper mounting arrangement to be compatible with the type ceiling construction in which the fixture is to be mounted. Submit letter indicating verification was done.

E. Assume all responsibility for the safe handling of all lighting fixtures, accessories, and lamps until the final inspection has been made by the Architect and the installation accepted by the Owner.

F. Supply special fittings and materials that may be required to support fixtures as well as supports, spacers, or grounds required to secure surface or pendant mounted fixtures on suspended ceilings.

G. Fixtures, or parts thereof (including lamps), determined to be defective shall be replaced.

H. Recessed fixtures shall be supplied with trim gaskets as required to prevent light leaks on ceiling. Provide mounting support bars for all recessed fixtures as required.

I. Lamps of the proper type, wattage, and voltage rating shall be provided in each fixture as indicated on the fixture schedule.

J. Ballasts for fluorescent fixtures shall be high frequency electronic ballasts and be completely compatible with lamp types indicated and CBM listed. Ballasts shall be manufactured by Electronic Ballast Technology, Inc. (EBT), Osram/Sylvania, Motorola, or approved equal. Ballast performance (power input/lumen output, operating temperature levels and total harmonic content) shall be certified by independent laboratory tests.

1. Ballasts shall be non-PCB and RFI limited.

2. Ballasts shall have a high power factor UL listed for Class P, Sound Rated A, less than 20 percent total harmonic distortion.

3. Ballasts shall be high frequency (20KHz or greater) and operate without detectable flicker.

4. Ballast case operating temperature shall not exceed 35°C temperature rise.

5. Ballast shall have MOV (Metal Oxide Varistor) line transient protection suitable for ANSI/IEEE C62.41 installation category A.

6. Ballasts shall have a three-year written warranty from date of shipment against mechanical or electrical defects under normal conditions of use. The warranty shall include a per-ballast replacement labor allowance.

7. Ballast factor (BF) shall range from a minimum of 0.87 to maximum of 1.0.
8. Power factor (PF) shall be a minimum of 95%.

K. Fixtures to be located outdoors or indoors in ambient temperatures that may be below 60°F (16°C), shall have outdoor ballasts and lamps suitable for operation at 0°F (-18°C).

L. All ballasts shall be covered by a three-year warranty against defects and warranty shall include payment for labor costs of replacement of inoperative "in-warranty" ballasts.

2.14 EMERGENCY BATTERY SYSTEM

A. Provide a 12 Volt emergency battery system constructed in accordance with UL Standard 924 and installed in accordance with Article 700 of the Electrical Code in locations indicated on the Drawings.

B. Battery units and remote heads shall be as manufactured by Emergency Lighting and Systems, Inc. (ELS), Chloride, Inc., Dual light, or approved equal and shall be of the voltage, capacity and model indicated on the Drawings. Provide units with the capacities required to meet the number of lighting fixtures connected to each unit. Batteries shall be NRTL listed for carrying rated load for two hours.

C. Battery unit shall be arranged for 60 cycle input operation with AC voltage as indicated on the Drawings, including heavy gauge sheet cabinet, lead acid battery with fully automatic solid-state controlled charger. Unit shall be fully restorable in 12 hours or less and shall include Trickle charger, heavy duty two contact AC supervisory relay, voltmeter, ammeter, protection fuse, ready pilot light, charging pilot light, test switch, lamp switch, knockouts provided in housing for both AC input and DC output to remote heads. Unit shall be provided with wall-mounting hardware.

2.15 AUTOMATIC TRANSFER SWITCH

A. The automatic transfer switches shall be mechanically held and electrically operated by a single solenoid mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty and be inherently double throw. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency, and cannot be inadvertently connected together.

B. All main contacts shall be of silver composition. They shall be protected by arcing contacts. They shall be of the blow on configuration and of segmented or brush construction.

C. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

D. Automatic transfer switches utilizing components of molded case circuit breakers, contactors or parts thereof, which have not been intended for continuous duty or repetitive load transfer switching are not acceptable.

E. The automatic transfer switches shall conform to the requirements of NEMA Standard ICS 2-447 and Underwriters Laboratories, Incorporated UL-1008 and shall be NRTL listed as follows:

1. For use in emergency systems in accordance with Article 517 and 700 of the Electric Code.
2. Rated in amperes for total system transfer including control of motors, electric discharge, lamps, electric heating and tungsten filament lamp loads are referred to in Paragraph 30.9 of UL-1008.

3. Transfer switches rated 400 amperes and less shall be suitable for 100 percent tungsten-filament lamp load.

F. As a condition of approval, the manufacturer of the automatic transfer switches shall verify that their switches are listed by Underwriters Laboratories, Inc., Standard UL-1008 with 3 cycle short circuit closing and withstand as follows:

<table>
<thead>
<tr>
<th>Continuous Rating</th>
<th>Molded Case CB</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>10,000</td>
</tr>
</tbody>
</table>

1. During the 3 cycle closing and withstand tests, there shall be no contact welding or damage. The 3 cycle tests shall be performed without the use of current limiting fuses. The test shall verify that contacts separation has not occurred, and there is contact continuity across all phases. Test procedures shall be in accordance with UL-1008, and testing shall be certified by Underwriters Laboratories, Inc.

2. When conducting temperature rise tests to UL-1008, the manufacturer shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.

3. The microprocessor controller shall meet the following requirements:
   a. Storage conditions – 25°C to 85°C.
   b. Operation conditions – 20°C to 70°C ambient.
   c. Humidity 0 to 99% relative humidity, noncondensing.
   d. Capable of withstanding infinite power interruptions.

4. Manufacturer shall provide copies of test reports upon request.

G. All production units shall be subjected to the following factory tests:

1. The complete automatic transfer switch shall be tested to ensure proper operation of the individual components and correct overall sequence of operation.

2. All sensing relays shall be tested to ensure proper pick up and drop out.

3. Operating transfer time and time delay accessories shall be checked to ensure that requirements of the Specifications are met.

4. The complete automatic transfer switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.05.

5. The control panel shall meet or exceed the voltage surge withstand capability in accordance with IEEE Standard 492-1974 (ANSI C37.90a-1974) and the impulse
withstand voltage tests in accordance with the proposed NEMA Standard ICS 1-109.

H. General

1. The automatic transfer switch shall be furnished as shown on the drawings. Voltage and continuous current ratings and number of poles shall be as shown. Switches shall be generator manufacturer.

2. A 2-pole switch shall be supplied with poles mounted on a common shaft. The continuous current rating and the closing and withstand rating of the fourth pole shall be identical to the rating of the main poles.

3. The transfer switch shall be mounted in a NEMA 1 enclosure. Enclosures shall be fabricated from 12 gauge steel. The enclosure shall be sized to exceed minimum wire bending space required by UL-1008.

4. The transfer switch shall be equipped with an internal welded steel pocket, housing an operations and maintenance manual.

5. The transfer switch shall be top and bottom accessible.

6. All bolted bus connections shall have Belleville compression type washers.

7. Control components and wiring shall be front accessible. All control wires shall be multi-conductor, 18 gauge, 600V SIS switchboard type point-to-point harness. All control wire terminations shall be identified with tubular sleeve-type markers.

8. The switch shall be equipped with 90°C rated copper/aluminum solderless mechanical type lugs.

9. The complete transfer switch assembly shall be factory tested to ensure proper operation and compliance with the specification requirements. A copy of the factory test report shall be available upon request.

I. Automatic Transfer Switch Controls

1. The transfer switch shall be equipped with a microprocessor based control system, to provide all the operational functions of the automatic transfer switch. The controller shall have to asynchronous serial ports. The controller shall have a real time clock with NiCad battery backup.

2. The CPU shall be equipped with self-diagnostics which perform periodic checks of the memory I/O and communication circuits, with a watchdog, power fail circuit.

3. The controller shall use industry standard open architecture communication protocol for high speed serial communications via multidrop connection to other controllers and to master terminal with up to 4,000' (1219m) of cable, or further, with the addition of a communication repeater. The serial communication port shall be RS422/485 compatible.

4. The serial communication port shall allow interface to either the manufacturer’s or the Owner’s furnished remote supervisory control.
5. The controller shall have password protection required to limit access to qualified
and authorized personnel.

6. The controller shall include a 20-character LCD display with a keypad which
allows access to the system.

7. The controller shall include three phase over/under voltage, over/under
frequency, phase sequence detection and phase differential monitoring on both
normal and emergency sources.

8. The controller shall be capable of storing the following records in memory for
access either locally or remotely:
   a. Number of hours transfer switches in the emergency position (total since
      record reset).
   b. Number of hours emergency power is available (total since record reset).
   c. Total transfer in either direction (total since record reset).
   d. Date, time and description of the last four source failures.
   e. Date of the last exercise period.
   f. Date of record reset.

J. Sequence of Operation

1. When the voltage on any phase of the normal source drops below 80% or
   increases to 120%, the frequency drops below 90% or increases to 110%, or
   20% voltage differential between phases occurs, after a programmable time
delay period of 0-9999 seconds factory set at 3 seconds to allow for momentary
dips, the engine starting contacts shall close to start the generating plant.

2. The transfer switch shall transfer to emergency when the generating plant has
   reached specified voltage and frequency on all phases.

3. After restoration of normal power on all phases to a preset value of at least 90% 
of rated voltage, at least 95% of rated frequency, and a voltage differential of less
   than 20%, an adjustable time delay period of 0-9999 seconds (factory set at 300
   seconds) shall delay retransfer to allow stabilization of normal power. If the
   emergency power source should fail during this time delay period, the switch
   shall automatically return to the normal source.

4. After retransfer to normal, the engine generator shall be allowed to operate at no
   load for a programmable period of 0-9999 seconds, factory set at 300 seconds.

K. Automatic Transfer Switch Accessories

1. Programmable single phase sensing of the normal source set to pickup at 90%
   and dropout at 80% of rated voltage and over voltage to pickup at 120% and
   dropout at 110% of rated voltage. Programmable frequency pickup at 95% and
   dropout at 90% and over frequency to pickup at 110% and dropout at 105% of
   rated frequency. Programmable voltage differential between phases, set at 20%
   and phase sequence monitoring.

2. Programmable single phase sensing of the emergency source set to pickup at
   90% and dropout at 80% of rated voltage and over voltage to pickup at 120%
and dropout at 110% of rated voltage programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases set at 20% and phase sequence monitoring.

3. Time delay for override of momentary normal source power outage (delays engine start signal and transfer switch operation). Programmable 0-9999 seconds. Factory set at 3 seconds, if not otherwise specified.

4. Time delay to control contact transition time on transfer to either source. Programmable 0-9999 seconds, factory set at 3 seconds.

5. Time delay on retransfer to normal, programmable 0-9999 seconds, factory set at 300 seconds if not otherwise specified, with overrun to provide programmable 0-9999 second time delay, factory set at 300 seconds, unloaded engine operation after retransfer to normal.

6. Time delay on transfer to emergency, programmable 0-9999 seconds, factory set at 3 seconds.

7. A maintained type load test switch shall be included to simulate a normal power failure, keypad initiated.

8. A remote type load test switch shall be included to simulate a normal power failure, remote switch initiated.

9. A tie delay bypass on retransfer to normal shall be included. Keypad initiated.

10. Contact, rated 10 Amps, 30VDC, to close on failure of normal source for customer functions.

11. Contact, rated 10 Amps, 30VDC, to open on failure of normal source for customer functions.

12. Light emitting diodes shall be mounted on the microprocessor panel to indicate: switch is in normal position, switch is in emergency position and controller is running.

13. A plant exerciser shall be provided with (10) 7-day events, programmable in one minute increments, to automatically exercise generating plant. These events shall be programmable for any day of the week or month. The exerciser shall also be provided with (24) calendar events which shall be programmable for any month or day.. Also include selection of either “no load” (switch will not transfer) or “load” (switch will transfer) exercise period. Keypad initiated.

14. Provision to select either “no commit” or “commit” to transfer operation in the event of a normal power failure shall be included. In the “no commit position”, the load will transfer to the emergency position unless normal power returns before the emergency source has reached 90% of its rated values (switch will remain in normal). In the “commit position”, the load will transfer to the emergency position after any normal power failure. Keypad initiated.
15. A single-phase digital LCD voltage readout with 1% accuracy shall display all single separate phase to phase voltages simultaneously, for both the normal and emergency source.

16. A digital LCD frequency readout with 1% accuracy shall display frequency for both normal and emergency source.

17. An LCD readout shall display normal source and emergency source availability.

18. Elevator Control Transfer: A load control circuit consisting of two (2) sets of single pole, double throw contacts that operate 3 seconds before transfer in either direction. Contacts rated 3 ampere, 480VAC or 10 ampere, 32VDC, for signal to elevators of generator power available. Provide 2 #14 AWG in conduit and interlock wiring to elevator control panel(s) from each switch controlling elevator power.

L. The control of the transfer switches shall be electrically interlocked with the generator starting control panel so that after a predetermined time delay, failure of the normal source at the transfer switches will start the generator.

M. Upon request, the manufacturer shall provide a notarized letter to the Architect certifying compliance with all the requirements of this Specification. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the Specifications, other than those stipulated at the time of submittal, shall be included in the certification.

2.16 TELECOMMUNICATIONS SYSTEMS PROVISIONS

A. Provide a telecommunications raceway system for telephone and data including all interior raceways, pull boxes, plywood backboards, outlets, fittings and all other appurtenances required, leaving the entire installation ready for installation of equipment and cables.

B. In general, the telecommunications system raceways, outlets and terminal backboard locations shall be as indicated on the Drawings.

C. All work and the entire installation of same shall be coordinated with the Architectural/Engineering Coordination Office of the Telephone Company, the Owner and the Telephone System, Video System and Data Installers before the start of the construction and shall be in full conformance with their requirements and recommendations.

D. Verify service point with utility, provide service raceways to meet the utility's requirements and as indicated on the Drawings and Specifications.

2.17 ARC FLASH HAZARD ANALYSIS STUDY

A. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E – Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70.
B. The scope of the studies shall include all new distribution equipment supplied by the equipment manufacturer under this contract as well as all existing distribution equipment at the customer facility.

C. Submittals for Construction

1. The results of the arc flash hazard analysis study along with the short circuit and protective device coordination study shall be summarized in a final report. Five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the calculations data. Additional copies of the short-circuit input and output data shall be provided on CD in PDF format.

2. For large system studies with more than 200 bus locations, the contactor is required to provide the study project files to the Owner in electronic format.

3. The report shall include the following sections:

   a. Executive Summary
   b. Descriptions, purpose, basis and scope of the study
   c. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit studies
   d. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection
   e. Fault current calculations including a definition of terms and guide for interpretation of the computer printout
   f. Details of the incident energy and flash protection boundary calculations
   g. Recommendations for system improvements, where needed
   h. One-line diagram

4. Arc flash labels shall be provided in hard copy and PDF electronic format.

D. Qualifications

1. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

2. The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or an approved engineering firm.

3. The Registered Professional Electrical Engineer shall have a minimum of ten (10) years of experience in performing power system studies.

4. The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in recent years.

E. Data Collection

1. Contractor shall furnish all data as required by the power system studies. The engineer performing the arc flash hazard analysis study shall furnish the
Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

2. Source combination may include present and future motors and generators.

3. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner or Contractor.

4. Include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data to satisfy the study requirements.

F. Arc Flash Hazard Analysis

1. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E.

2. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway, disconnect switches, splitters and any electrical equipment with access to the live buses) where work could be performed on energized parts.

3. The Arc-Flash Hazard Analysis shall include all significant locations in 240-volt and 208-volt systems fed from transformers equal to or greater than 125 kVA where work could be performed on energized parts.

4. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm².

5. The short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

6. The short circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the eclectic utility, where applicable.

7. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
a. Fault contribution from induction motors should not be considered beyond 3-5 cycles.

b. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

8. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

9. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

10. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

11. Arc flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

G. Report Sections

1. Incident Energy and Flash Protection Boundary Calculations

   a. Arcing fault magnitude
   b. Duration of arc
   c. Arc flash boundary
   d. Working distance
   e. Incident energy
   f. Hazard risk category
   g. Recommendations for arc flash energy reduction

H. Arc Flash Warning Labels

1. The contractor of the Arc Flash Hazard Analysis shall provide a 3.5 in. x 5 in. (or owner approved size) thermal transfer type label of high adhesion polyester for each work location analyzed.

2. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.

3. The label shall include the following information, at a minimum:
4. Labels shall be machine printed, with no field markings.

5. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

   a. For each 240 volt panelboard, one arc flash label shall be provided.

6. Labels shall be field installed by the equipment manufacturer under the Startup and Acceptance Testing contract portion or a qualified (certified) person employed or hired by the contractor.

7. The equipment manufacturer or the approve engineering firm shall be capable of offering additional services for the next five (5) years to modify the report as well as the calculations and produce new labels if any system changes, upgrades or modifications take place in the electrical system.

I. Arc Flash Training

   1. The contractor of the Arc Flash Hazard Analysis shall train the owner’s qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 2 hours).

2.18 ELECTRICAL CONNECTION TESTING

A. At the completion of the work and prior to final acceptance by the Owner, perform an infrared scan of all major electrical equipment connections to detect possible equipment high resistance connections.

B. This test shall be conducted with the system/equipment energized and operating under normal load utilizing a "Therm A Trace II" portable infrared scanning instrument and a photographic recording accessory that uses a Polaroid SX-70 camera to obtain an instant full color hard-copy for record and quantitative measurement evaluation using clear overlay print directly in degrees Celsius on a 100°C scale with 25°C background.

C. After the record measurements and hard-copy photographs have been analyzed, retorque any loose or defective connections or components and take a second recorded measurement to insure a satisfactory and acceptable installation.

D. After approximately nine months, when the building is operating at maximum load, perform a second infrared scan. Compare to the first scan. Perform maintenance and remedial work indicated by the scans and requested by the Owner or Architect. Submit report to the Architect.

E. Submit qualifications of testing firm for review by the Architect prior to performing testing.
2.19 SEALS

A. Water Tight Seals

1. Conduits entering from the exterior or below grade shall have water tight fittings on the outside and on the inside of the conduit.

   a. Fittings on the outside of the conduit shall be O-Z Gedney type FSK or approved equal. Provide type WSK if penetration is within 2' (610mm) of the high water table. Provide grounding attachment. Utilize like seals or equal for penetrations of existing foundations/slabs.

   b. Fittings on the inside of the conduit shall be O-Z Gedney type CSBI or approved equal. Provide type CSBG if penetration is within 2' (610mm) of the high water table. Provide a blank fitting to seal spare or empty conduits.

   c. O-Z Gedney type CSM fitting may be used when sealing within a sleeve or cored hole.

2. Submit on seals to be used.

2.20 GROUNDING

A. Provide grounding system and components that meet the Electrical Code and are NRTL listed for the purpose.

B. Provide copper clad steel ground rods 3/4" (19mm) diameter and 10' (3048mm) long unless otherwise indicated.

C. Grounding connections shall be made by means of approved and listed bronze clamps equal to Burndy type GBM, compression connections, or exothermic welding.

D. Provide grounding busses as follows (except when utility approval is required provide to meet utility requirements):

   1. Rooms as indicated on drawings:

      a. 1/4" x 2" x 24" (6mm x 50mm x 609mm) copper bus.

   2. Telecommunications Building Entrance Facility: Provide a Telecommunications Main Grounding Busbar (TMGB).

E. Bond Telecommunications Ground busses using a Telecommunications Bonding Backbone (TBB). TBB shall be an insulated multi-strand copper conductor. #4 AWG.

F. Ground conductors shall be of electrical grade copper except where otherwise indicated.

G. Grounding connector shall be uninsulated unless otherwise indicated.
2.21 LIGHTNING PROTECTION SYSTEM

A. All lightning protection material shall be of the latest approved design and manufactured by Thompson Lightning Protection, Inc., Harger, East Coast Lightning Equip Inc., Boston Lightning Rod Co., Advanced Lightning Protection or National Lightning Protection Inc.

B. The work covered by this Section of the Specifications consists of providing services of a qualified lightning protection engineer, labor and materials required for the design and installation of a functional and unobtrusive lightning protection system. System shall comply with the latest issue of Underwriters Laboratories, Incorporated Master Label Code 96A and NFPA Code No. 780 Lightning Protection Systems. At the completion of the installation an Underwriters Laboratories, Incorporated Master Label shall be furnished to the Owner.

C. Complete Product Data and Shop Drawings of an U.L. approved Master Labeled Lightning Protection System showing the type, size and locations of all equipment, rods, grounds, cable routings, etc., shall be submitted to the Architect for review prior to start of work. For each roof cable penetration, for ground down leads, detail type of fittings to be utilized and coordinate weatherproofing of all roof penetrations with roofing section. Samples shall be submitted to the Architect for review upon request.

D. Provide Class 1 materials for lightning conductors, air terminals, ground terminals, and associated fittings. Materials used for roof-mounted lightning conductors shall be aluminum. Materials used for ground conductors and down leads shall be copper. Copper shall not be connected to aluminum except by means of NRTL approved bimetal transition fitting. Air terminals shall be of solid rod, fully chromed, with cast bronze or aluminum cap that meets or exceeds OSHA’s guarded requirement to reduce the risk of impalement. Provide stainless steel air terminals in lieu of copper in corrosive atmospheres. Air terminals shall be extended at least 12” (304mm) above subject to be protected. Mount on suitable base. Provide blunt tip air terminals.

E. Lightning protection Installer shall ensure a sound bond to the main water service, interconnection with other building ground systems, including both telephone and electrical and ensure that proper lightning arresters have been installed on the electric, telephone and cable TV service.

F. Cables shall be run on roof side of parapet walls or on peaked walls and shall be fastened with approved screw fasteners. On flat roofs, fastener shall be fixed with adhesive approved by roofing manufacturer. Provide fasteners 3’ (.9mm) on center. Bond metallic objects within 6’ (1.8m) to system with approved cable and fitting. Provide lightning conductors for, and bond to, as required all mechanical equipment mounted on roof or penthouse. Down conductor cable that runs from ground through concrete structure shall be coursed in 1¼” (32mm) rigid steel conduit, provided under this Division as required by Lightning Protection provider. Conduits shall be encased in concrete structure, grounded at top and bottom and grounded to reinforcing approximately every 10” (3048mm). Where structural steel is used as down conductor provide a cadweld connection between conductor and steel.
G. Down conductors shall terminate on 5/8” x 10’ (16mm x 3048mm) copper-weld ground rods and on building #4/0 ground grid where provided under this contract. Ground rods shall be copper clad 3/4” x 10’ (19mm x 3048mm) minimum or Ground plates of high conductivity copper sheet, 20 gauge minimum, 18” (457mm) sq., three (3) required per down conductor, to achieve the (25) Ohm resistance grounding system requirement. Ground rods, ground plates, and ground loop conductors shall be installed a minimum of one 1’ (305mm) below grade and a minimum of 2’ (610mm) away from the foundation. A minimum of one (1) inspection well, rated for the traffic of the installation area, shall be installed.

PART 3 - EXECUTION

3.1 REFERENCE

A. Refer to Section 200500, Basic Mechanical and Electrical Requirements.

B. Refer to Section 200548, Vibration Isolation and Seismic Restraints.

3.2 SPECIAL RESPONSIBILITIES

A. Do not install equipment and materials, which have not been reviewed by the Architect. Equipment and materials, which are installed without the Architect’s review or without complying to comments issued with the review, shall be removed from the project when so instructed by the Architect. No payment will be made for the removal of unapproved materials or equipment if it is ordered removed. The Installer shall be responsible for any ancillary costs incurred because of its removal and the installation of the correct equipment and materials.

B. Request, in writing, that the General Contractor and each Trade prepare and submit to this Section a complete list of all equipment which they are supplying under their respective Sections which require electric power, electric connections, electric control wiring, or work under this Section.

C. Obtain detailed information on installation requirements from the manufacturers of all equipment to be furnished, installed, or provided. At the start of construction, check all Contract Documents, including all Drawings and all Sections of the specifications for equipment requiring electrical connections and service and verify electrical characteristics of equipment prior to roughing.

D. Request the General Contractor to provide, as soon as possible after approval, two copies of approved submittals of equipment which requires electric service, electric connections, or electric controls. Review these submittals for electric characteristics including voltage, amperes, wattage, and horsepower and return the submittals to the General Contractor noting any non-agreement within two weeks of receipt.

E. Equipment and systems shall not be installed without first coordinating the location and installation of equipment and systems with the Architectural drawings, General Contractor and all other Trades. Any and all material installed or work performed in violation of above requirements shall be re-adjusted and corrected by the Installer without charge.
F. Assure that all electrical equipment is accessible, such as junction boxes, pull boxes, panelboards, switches, controls, and such other apparatus as may require maintenance and operation from time to time. Provide necessary construction access panels sized to provide adequate and required access for installation by the General Contractor. Provide rated panel or door appropriate for the construction being installed into fire, smoke and/or acoustical construction.

G. After installation, electrical equipment shall be protected to prevent damage during the construction period. Openings in conduits and boxes shall be closed to prevent the entrance of foreign materials.

3.3 ELECTRICAL DEMOLITION AND RENOVATION WORK

A. Shut-off, disconnect, make safe and dismantle existing electrical systems to be demolished and leave electrical equipment and debris on floor for removal under Section 02070 - Selective Demolition. Disconnect existing electrical equipment to be demolished and identify items to be removed with orange spray paint for removal and disposal under Section 02070 - Selective Demolition.

B. Scope of demolition includes all existing electrical equipment located in the areas demolished under this Contract except existing electrical circuits passing through these areas and supplying electrical equipment in other areas of the existing building. This includes all existing conduit, wire, wiring devices, lighting fixtures, lighting panels, junction and pull boxes, etc., not being used under this Contract, unless otherwise indicated. Carefully examine the Drawings and visit the site to determine the extent of this work.

1. Identify, prior to demolition and work beginning, electrical work that is to remain and that which is to be removed. Use spray paint color code that does not conflict with the color code indicated under "IDENTIFICATION" or color code used by existing, otherwise, tie colored ribbon in lieu of paint. Post color code in conspicuous area. The location of existing work is approximate. Determine exact location prior to performing work.

2. Power to areas and equipment being demolished shall be disconnected and made safe.

3. Electrical items that are to be relocated shall be carefully examined and checked for defects prior to removal. Defects shall be brought to the immediate attention of the Architect. After equipment has been certified to be in good condition, it shall be relocated and cleaned. Failure to identify, in writing, to the Architect defective existing work, indicates all existing is in good condition. Equipment damaged in this process shall be replaced with new equipment or repaired to the satisfaction of the Architect.

4. Removed equipment, fixtures, and wire shall be offered to the Owner. Legally dispose of fixtures, equipment and material not retained by Owner.

5. Maintain the existing building in electrical operation at all times during the entire construction period. If it is necessary to have an electrical shutdown, a written request for approval shall be submitted in advance stating the estimated shutdown time. Work shall be planned to minimize shutdown. Shutdowns shall be at the convenience of the Owner and, if necessary, on premium time.
3.4 MAIN ELECTRIC SERVICE

A. Coordinate with Power Company customer service, engineering and metering departments for electric service. Obtain a copy of their latest standards. Provide work for utility service as required by the Power Company.

B. Secondary voltage characteristics for project shall be 120/240V, single phase, 3 wire, 60 cycle grounded.

C. Provide riser pole RS conduits, underground secondary service duct bank and grounding as required by the Power Company and in accordance with the Power Company’s requirements and standards.

D. All secondary work shall be provided under this Section.

E. Coordinate Power Company metering with Power Company. Provide meter socket. Locate meter socket outside or adjacent to electric room door in location agreed by Power Company.

F. Obtain from the Power Company backcharges to be assessed for the project. Power Company backcharges directly paid for by Owner.

3.5 GROUNDING

A. The electrical service and distribution systems, distribution panels, all electric circuits, raceways, cabinets, motors, boxes, devices, battery racks and non-current carrying metallic parts shall be grounded according to the Electrical Code.

B. A separate copper grounding conductor shall be installed with all feeders, and branch circuit wiring systems. The grounding conductor shall have insulation type to match that of the normal current carrying conductors and sized to comply with requirements of the Electrical Code and other governing agencies. The grounding conductor shall be properly identified with green tape or insulation where visible in boxes or outlets.

C. Grounding network for building shall comprise:

   1. Connection to all metallic building systems.
   2. Connection to building steel.
   3. Connection to #4/0 AWG copper ground in duct bank.
   4. #4/0 AWG copper ground loop connected to building steel.
   5. Driven ¾” x 10’-0” (19mm x 254mm) copperclad steel ground rods connected to copper ground loop.

D. System shall be measured to achieve 5 ohms when tested against a single ground rod. Provide additional drive ground rods, buried copper mesh, or copper plates to achieve 5 ohms.
E. Methods:

1. The ground connections of conductor system shall be made at the main service equipment and shall be extended to the point of the metallic water service. Main connections shall be made on the street side of any meters and flanged pipe. Provide bonding jumpers across meters and insulated flanges, as required, to maintain continuity. Connections shall be made readily accessible for inspection. No connections shall be made concealed in floors or walls.

2. All permanent grounding connections shall be exothermic welded connections as required by code using new and unused molds of the specific type for the connection to be made. "Cadweld" or "Thermoweld" processes are acceptable.

3. All bus connections shall be made suitable NEMA two hole type copper compression connectors.

4. All equipment connections shall be made with clamp type copper connectors.

5. Motor frames shall be grounded by the equipment grounding conductor run in the same raceway as the power leads.

6. Install ground rods vertically 24" (609mm) minimum below finished grade. Spacing between ground rods shall not be less than the length of the rod.

7. In new construction bond to masonry reinforcing bars.

F. Equipment Grounding:

1. The frames of all electrical equipment including motors, panels, and lighting fixtures shall be grounded to the equipment grounding conductor.

2. Raceways, devices and equipment that have friction grounds shall have the paint removed from the areas of contact.

3. Each panelboard shall be equipped with an insulated terminal strip for neutral conductors and an equipment grounding bus bonded to the panel case, each with sufficient terminals for the number of circuits. The equipment ground bus shall be connected directly to ground via a green grounding conductor. The point of grounding shall be at the point of supply, which may be distribution load center, the secondary of a lighting transformer, etc.

4. Where conduits are stubbed up out of the floor into a panel with no bottom, grounding bushings shall be used. The ground conductor connecting the bushings to the ground stub on the panel shall be sized per Electrical Code Table 250-95.

5. Provide continuous #6 AWG copper ground in each cable tray. Each length of cable tray shall have two mechanical ground connections to ground wire.

6. Lightning and surge arrestor grounding shall be installed in as short and direct a route as possible, avoiding sharp bends by using large radius bends. Multiple devices in one location shall be grounded to a copper bus and the bus shall be bonded the grounding electrode from each end so as to form a loop.
3.6 SLEEVING AND BUSHINGS

A. Raceways and openings shall be laid out in advance to permit their provision in the work. Sleeves and raceway shall be set before masonry is constructed. Any extra work, including coring, required where sleeves or raceways have been omitted or improperly placed shall be performed at the expense of the Installer who made the error or omission.

B. Provide sleeves for raceways, cable trays fire walls, or smoke partitions. Install approved material to provide for fire stop.

C. Provide waterproof seals inside and outside raceway when penetrating from the exterior or underground.

D. Provide acoustic sealer in sleeves between occupied spaces.

E. Provide sleeves in masonry construction and in full height (slab to slab) walls.

F. Provide sleeves for any openings requiring fireproofing.

3.7 WIRING METHODS

A. Generally, unless specified below and approved by the Authorities having jurisdiction, wiring shall consist of insulated conductors installed in rigid steel conduit with threaded connection. Electrical metallic conduit may be used as permitted by State or Local Codes for feeders, branch circuits, signal, instrumentation, and control circuits.

1. EMT may be used as permitted in ceiling or floor cavity spaces, void spaces of masonry walls, in equipment rooms, in mechanical chases, in electrical chases, in closets, in exposed locations 8' (2438mm) above finished floor and where not subject to accidental damage or abuse. Where subject to accidental damage or abuse, and/or where in wet or damp locations, install in rigid steel conduit.

B. Flexible metal conduit, 39” (1m) in length, shall be provided at all motors and equipment subject to vibration or movement. Liquid-tight flexible conduit shall be used in wet or damp locations. Refer to vibration isolation requirements.

C. All raceways shall be properly fastened in accordance with the applicable Articles of the Electrical Code. Spacing between supports shall not exceed 7’ (2m) unless specifically approved by the Architect. Raceways installed above suspended ceilings shall be supported from the building structure. Supports fastened to the roof decking shall not be allowed.

D. Conduit joints shall be cut square, threaded, reamed smooth, and drawn up tight. Bends or offsets shall be made with standard conduit ells; field bends shall be made with an approved bender or hickey. Pipe threads cut in the field for exterior or underground use shall be painted with red lead or a similar approved substance before being made up.

E. Minimum size conduit shall be ½” Other sizes shall be as indicated on the Drawings or as required by the Electrical Code for number and size of conductors installed.

F. No combining of branch circuit wiring beyond three phase wires, neutral wire(s) and grounding conductor shall be allowed, unless specifically indicated.
G. Conduit runs are shown diagrammatically. The exact routing and means of support shall be determined in the field. Exposed conduits shall be installed parallel with, or at right angles to, the building walls, structural members, or architectural features.

H. All conduit ends shall be plugged or capped as soon as they are installed to prevent entrance of moisture or other debris during construction.

I. All spare conduits shall have a nylon (200 lb. test) pull line inserted.

J. Connections between conduits of different types shall be made in an approved manner, using adapters or other materials and methods recommended or the purpose by the conduit manufacturers.

K. All raceways shall be mechanically complete, carefully cleaned, blown and swabbed dry inside before installation of wires and cables. The Architect reserves the right to have all wiring in a raceway or raceways removed for inspection should the presence of moisture or dirt be suspected in same at no additional expense to the Architect. If moisture or dirt is found in the raceway system during the inspection of same, it shall be thoroughly cleaned and dried to the complete satisfaction of the Owner at no additional expense.

L. All floor mounted equipment shall be mounted on 3” housekeeping pads.

M. Cable Trays:
   1. Cable trays shall be handled with suitable slings or devices to spread loading during lifting. Cable trays shall not be lifted by rungs.
   2. Horizontal and vertical tray supports shall provide at least 1-1/8” (26mm) bearing length for each rail and shall have provisions for hold down clamps and fasteners. The cable tray side rails shall bear on the supports. Rungs shall not bear on the supports.
   3. Cables in long vertical runs shall be supported by grips spaced in accordance with cable manufacturer’s recommendations. Hold down clamps shall be provided to prevent lateral or vertical displacement.
   4. Sway base supports shall be provided and shall support a 200 lb sideward thrust from either direction.

3.8 WIRE AND CABLES

A. No conductors shall be installed into any raceway system until it is complete in all details and weather tight.

B. Wires and cables shall be carefully handled during installation so as to avoid mechanical injury to the conductor, insulation, or covering.

C. Joints and splices shall be made in an approved manner and be at least equivalent electrically and mechanically to the conductor itself. Whenever the conductors is bared for splicing, it shall be taped with a good grade of rubber splicing compound and friction or plastic tape so as to form at least the equivalent of the original insulation and covering. Provide a heat or cold shrink insulating wrap equal to 3M or RayChem.
D. No splices or joints shall be permitted in either feeders or branch circuit conductors except at outlets or accessible junction boxes. Splices in wire #8 AWG and smaller shall be standard pigtail, made mechanically tight. Conductors for low voltage and life safety systems (including but not limited to Fire Alarm, Security, Sound, etc.) shall be terminated only on terminal strips in junction boxes in cabinets, no splices or joints will be allowed. Provide Sta-Kon or equal ring compression terminations.

E. Provide labels identifying conductor and termination point for all low voltage systems at all terminations.

F. Wire #6 AWG and larger shall be connected to panels and apparatus by means of approved lugs or connectors. Connectors shall be mechanical type, sufficiently large to enclose all strands of the conductor and be securely fastened. All solderless connections and lugs shall be by Trego, Inc., Burndy, T&B, or approved equal.

G. Splices and taps in wires #8 and larger shall be made with Burndy, Anderson, or Kearney solderless connectors designed for the purpose. The splices and taps shall be taped with approved tapes providing insulation not less than that of the conductor. Splices shall be mechanically and electrically secure.

H. Pressure connectors with "wrap caps" or insulating caps of a type approved by the local inspecting authorities may be used on branch circuits with conductor sizes up to and including #10 AWG. Connectors shall be manufactured by Buchanan, Eagle, Ideal, or approved equal. Provide caps suitable for use in wet conditions filled with insulating sealing compound for connections in wet, damp, or exterior locations.

I. Insulating compounds, unless indicated or specified otherwise, for cable joints, boxes, terminals and other similar items, shall have bituminous base and shall be free from granular content, creosote alkali, acid, sulfur, and water.

J. A lubricant manufactured by Ideal, General Electric, Dow Corning, or approval equal, shall be used when necessary for the pulling of conductors or cables into the raceway systems except that no pulling compound shall be used for isolated power system circuits.

K. Stranded conductors #10 AWG and smaller shall use compression type insulated ring or fork tongue crimp terminals.

L. Use ring tongue compression type terminations on screw type terminal blocks on Fire Alarm, Security System and low voltage wiring. Do not splice conductors. Label junction box and all wires.

M. Minimum wire size shall be #12 AWG for power and lighting circuits and #14 AWG for control wiring. 120-volt branch circuits of more than 100’ and 277-volt circuits of more than 150’ from center of load to panel shall be #10 AWG.

3.9 UNDERGROUND RACEWAYS

A. Application - Provide the following installation methods unless otherwise indicated or as required by local authority:

1. Conductors: concrete encased PVC Schedule 40 raceways (NSTAR generally requires type EB conduits). Provide rigid steel conduit pole risers to 10ft above finished grade and cable protector channel above 10ft.
2. Electric service entrance conductors - concrete encased PVC Schedule 40 raceways.
3. Site lighting circuits - direct buried PVC Schedule 40 raceways
4. Telephone Service - direct buried PVC Schedule 40 raceways concrete enclosed where crossing roadways, driveways, parking lots, and other areas subject to vehicular traffic). Provide rigid steel conduit pole risers to 10ft above finished grade and cable protector channel above 10ft
5. Risers to 10' (3m) above ground - rigid steel conduit.
6. Sweeps and bends from underground - rigid steel conduit.

B. The duct system shall consist of round bore raceways. The number and type of raceways in the duct shall be as indicated in the specifications and on the Drawings. Duct lines shall be laid to a minimum grade of 4" (102mm) per 100' (30m). Grade (pitch) may be from one manhole to the next, or both ways from a high point between manholes, depending on contour of the finish grade, so that all ducts shall empty out into the manholes. Ensure no water egress into building by sloping conduits entering building down away from building. Duct lines shall be installed so that the top of raceway is not more than 30” (762mm) below finished grade and not less than 18” (457mm), except 24” (610mm) in vehicular traffic areas, below finished grade at the high points.

C. Changes in direction of runs exceeding a total of 10˚ either vertically or horizontally, shall be accomplished by long sweep bends (in five degree increments) having a minimum radius of curvature of 25˚ (7.6m), except that manufactured bends may be used at ends of short runs of 100’ (30m) or less, and then only at, or close to, the end of the run. The long sweep bends may be made up of one or more curved or straight sections or combinations thereof. Bends shall have a minimum radius of ten times the conduit diameter.

D. Where it is necessary to cut the tapered end on a piece of conduit at the site, the cut and/or taper shall be made with a special tool or a lathe, so that the new taper matches the taper of the particular conduit being used.

E. Each single raceway of the duct bank shall be separated. Separators or spacing blocks shall be made of concrete, plastic, or other suitable non-metallic, non-decaying material placed on not greater than 4’ (1219mm) centers.

F. All raceways in the duct lines shall be securely anchored with non-metallic ties to prevent any movement during the pouring and spreading of concrete or backfill.

G. All non-metallic conduits shall be handled and stored in such a manner as to avoid warping, cracking, or deterioration. Provide solvent weld connections.

H. Where installed under the building support raceways from the building slab above at 6’ (1.8m) maximum intervals.

I. Backfill: The earth cover shall be void of all objects over 2” (50mm) in any direction or decomposable material. Provide 6" (152mm) of sand above and below direct buried (non-concrete encased) raceways or conductors.

J. Provide detectable type 6” (152mm) wide polyethylene/metallic warning tape 12” (305mm) above the entire length of underground raceway and cables, including under buildings.
K. For rigid steel conduit for risers and sweeps from underground including at service poles, transformers, equipment and through concrete slabs. Bond to ground. Provide expansion fittings with 4” (102mm) minimum movement between exit at ground and fixed terminus. Include bonding jumpers and sufficient cable slack for the required movement. Set expansion fitting per Manufacturer's recommendations for the ambient temperature at the time of installation.

L. Provide expansion fitting on risers from underground to compensate for any lifting or settling due to frost heaves.

M. Spare raceways shall be plugged and sealed watertight at all manholes, handholes, buildings, and structures.

N. Raceways with cables installed within shall be sealed watertight and gastight with appropriate fitting.

O. Using appropriate fittings, seal between raceways and walls or floors where the raceways enter the building.

P. Coordinate with other work including site, utility and landscaping work, electrical raceway and wiring work as necessary to interface installation of underground raceways, vaults, manholes and handholes with other work.

Q. Coordinate and verify that concrete work is performed as indicated herein and on the Drawings. All concrete installed shall be monolithic, laid continuously until complete. If it is impossible to have a monolithic installation, the end of the concrete duct bank installation shall be sloped at a 30 degree angle and shall have #4 rebar on 12” (304mm) centers and 3” (76mm) of cover, installed around the perimeter of the duct bank to tie into the next pour.

R. Underground raceways shall be encased in a concrete envelope. There shall be a minimum of 4” (102mm) of concrete on all sides and 3” (76mm) between raceways.

S. Raceway joints in concrete encasement may be placed side by side horizontally, but shall be staggered at least 6” (152mm) vertically.

T. Underground raceways crossing over pipe lines or under areas subject to high vehicular traffic shall be encased in a steel reinforced concrete envelope. There shall be a minimum of 4” (102mm) of concrete on all sides and 3” (76mm) between raceways. Steel reinforcing shall consist of No. 4 steel rod spaced 12” (304mm) on center each way, top and bottom and extend for 4’ (1220mm) beyond the affected area on each side.

3.10 UNDERGROUND WIRING

A. Generally underground wiring shall comply with Wire and Cables Section of this specification.

B. All splices and terminations shall be made up by qualified and certified cable splicers pre-approved by the Architect. Procedures and materials shall be in strict accordance with recommendations of the Cable Manufacturer and as defined in the contract specifications. A copy of the recommendations shall be furnished to the Architect for review.

C. Proper supports shall be provided at each splice.
D. Splices, when allowed, shall only be installed in handholes or manholes.

E. All pulling-in shall be done by use of factory installed pulling eyes and approved power units (push and pull).

F. Where pulling eyes are installed in the field, they shall be attached to all conductors which make up the cable, with suitable provisions made to protect the end or ends of the cable sheath from peeling or slipping.

G. The pulling cable shall be attached to a power winch of sufficient size to allow for a continuous pull of cable after the cable has entered the conduit. The mechanical stress placed upon the cable during installation shall not be such that the cable is excessively twisted, stretched, or flexed, and tension shall not exceed 90 percent of manufacturer's recommendations. Tension shall be measured by an dynamometer (strain gauge) on all cables. Hydraulic pressure gauges are not acceptable. Use a highest tensile indicating dynamometer. The dynamometer shall be used while pulling the cables to indicate the pulling tension on the cable and shall have a maximum tensile indicator which shall be sealed to prevent resetting. When more than one cable pull is to be made, a record shall be made and the dynamometer may be reset in the presence of the Owner's Representative who shall sign the recorded values of each pull. Pulling tension at no time shall exceed the manufacturer's recommendations. Replace cables that exceed the manufacturer's recommended pulling tensions during installation.

H. The length of cable left in manholes shall be sufficient to allow for racking the cable the long way around, testing and splicing. All splices shall be located between cable supports. Cables shall be offset when entering manholes so that when cable is racked in place in the manhole the cable is able to move in and out of the manhole, at the bell, due to contraction and expansion. Cables shall be trained in manholes and supported from cable racks.

I. All cables shall be tagged where they terminate, splice, tap, enter and leave vaults, manholes, handholes, switchgear, substations, or boxes. Tags shall be made of non-ferrous metal or fiber and shall be approximately 1-1/4” (32mm) square and 3/32” (2.4mm) thick. The marking shall identify the number and size of conductors in the cable, date and manufacturer circuit number, voltage and phase in minimum ¼” (6.4mm) indented lettering. The tags shall be fastened to the cable with non-ferrous metal bands approximately 3/8” (9.5mm) wide.

### 3.11 PHASING AND COLOR CODING

A. The insulation or covering of each wire or cable shall be color coded so as to provide for circuit identification as specified below.

<table>
<thead>
<tr>
<th>120/208 Volt</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>A</td>
</tr>
<tr>
<td>Red</td>
<td>B</td>
</tr>
<tr>
<td>White</td>
<td>Neutral</td>
</tr>
<tr>
<td>Green</td>
<td>Ground</td>
</tr>
</tbody>
</table>
Where multiple neutrals are installed in the same conduit they shall be identified at all visible locations, by a ½” (13mm) wide colored tape wrapped around the conductor that matches the color coding of the associated phase conductor, to ensure that the correct conductor associations are maintained. The color tape shall not obscure the fact that this is a neutral conductor.

B. Color coding shall be achieved by one of the following methods:

1. The insulation or covering shall be coded during manufacture by use of one of the following methods:
   a. Color compounds.
   b. Colored coatings.

2. When limited quantities of cable are involved, the Architect may permit the use of the following methods in lieu of cable manufacturer's color coding. Each cable must be coded at all terminal points, in all manholes, boxes, or other similar enclosures by:
   a. Spiral application of ¾” (19mm) wide, colored, pressure sensitive plastic tape, half-lapped for a distance of not less than 6” (152mm). To prevent unwinding, the last two wraps of tape shall be applied with no tension. The tape shall be applied so as not to obliterate identification markings on the cable.
   b. Application of three 3/16” (4.8mm) wide colored, fungus inert, self-extinguishing, self-locking, nylon cable ties spaced 3” (76mm) apart. The ties shall be snugly applied with a special tool or pliers, and any excess removed.

C. The same colored cable shall be connected to the same phase throughout the project.

D. In general, building load centers and panelboards shall be phased "A", "B", "C", either top to bottom or left to right when viewed from front of equipment. The neutral, although it may be in different locations for different equipment, shall be identified.

E. Installer shall be responsible to coordinate electrical phases "A", "B", "C", with the Utility Company at the point of connection with the Utility Company supply and shall thereafter be responsible to carry out and maintain this consistent system of color coding, phase identification and positioning in accordance with ANSI Standards.

3.12 TELECOMMUNICATIONS AND EMPTY RACEWAYS

A. Empty Raceways and Raceways installed for Telecommunications Systems including telephone, data, security, alarm, CATV, sound, video, low voltage conductors, etc. shall be installed as required by the Electrical Code, as required for raceways specified in this Section and as indicated herein.

B. Provide pull boxes each time raceway installation exceeds a 100’ (30.5m) section or a total of 180’ in bends and offsets between pull boxes. Do not install a pull box in lieu of a conduit bend. Align the corresponding conduits on opposite sides of pull box with each other.
C. Bends shall be large radius, not exceeding 90° and minimum size radius as follows:

1. 2” (50mm) trade size and less - 6 times conduit diameter.
2. 2-½” (64mm) trade size and larger - 10 times conduit diameter.
3. Conduits for fiber optics cabling - 10 times conduit diameter.

D. Raceways and outlets shall be separated from sources of EMI and RFI such as transformers, ballasts and power lines. Do not install raceways parallel to power raceways unless 4’ (1219mm) distance is maintained. Cross other raceways at 90 degrees. Maintain minimum 12” (305mm) clearance in all directions from lighting fixtures and power wiring rated over 20 A. Maintain a minimum 6” (153 mm) clearance elsewhere from raceways and outlets. Maintain 48” (1220 mm) clearance from transformers. Clearances are measured all around raceway and outlets including through walls and floors.

E. Provide conduit sleeves between stacked Telecommunication closets or rooms.

F. Align sleeves and conduits on opposite walls so there is a straight line, parallel or perpendicular to Building Structure, between corresponding openings.

3.13 INTERIOR GENERATOR AND ATS INSTALLATION

A. Contractor shall install all power and control wiring to provide a fully integrated emergency propane gas electric generating system. Coordinate installation of fuel supply system and associated electrical connections, operation of automatic dampers and exhaust system with the mechanical contractor and the equipment manufacturer.

B. Power wiring shall be provided as indicated on contract drawing riser diagrams. Provide branch circuit power to generator as follows from local emergency/normal panel:

1. Heaters on generator as specified and shown on manufacturer's shop drawings.
2. To generator control panel.
3. To and from battery charger and batteries.
4. Other power wiring as required by manufacturers shop drawings.

C. Generator shall be grounded in accordance with NEC. Provide ground strap from building ground to generator frame.

D. During generator testing, provide hookup of load banks, provided by generator supplier as part of this contract and attendance to ensure operation of equipment as designed.

3.14 TESTING AND INSPECTION

A. Provide labor, installation, supervision, test equipment, material, power supplies, devices, etc. required to perform the work indicated.
B. Test and inspect all parts of the work provided under this Section and as required by Manufacturers, codes, standards, or authorities having jurisdiction. Conduct all tests and inspections to the complete satisfaction of the Architect and all authorities. Tests shall be completed and Electrical work 100 percent operational including any interfaces with other systems prior to performing Acceptance Demonstrations. Notify the Architect, the Owner via General Contractor, and all involved authorities at least one week (seven days) prior to testing or inspection. Do not cover work prior to testing or inspection. Testing shall be completed prior to Substantial Completion.

C. Prior to the date of Substantial Completion and Acceptance Demonstrations, furnish the Architect with certificates of testing and inspection for all systems furnished or installed under this Section indicating the approval of all authorities having jurisdiction, manufacturers and a letter from the installer stating conformance with all requirements of the Contract Documents.

D. All systems shall test free from short circuits and grounds, shall be free from mechanical and electrical defects, and shall show an insulation resistance between phase conductors and ground of not less than the values recommended by the manufacturers.

E. Test all circuits and receptacles for proper neutral and grounding connections.

F. Lighting fixtures shall be tested with specified lamps in place for not less than ten hours; the fixtures may be checked in sections.

G. Testing recommended by manufacturers shall be required; this requirement may be waived in writing by the Architect.

H. Failure or defects in workmanship or materials revealed by tests or inspection shall be corrected promptly and retested. Defective material shall be replaced at no additional expense to the Owner.

I. Provide all temporary connections, necessary testing equipment, labor and materials, required for the testing of the systems and equipment. All systems shall be prepared for testing and protected from damage. The cost of all tests shall be included in the contract price.

J. Verify and correct as necessary the following: voltages, tap settings, trip settings, and phasing on all equipment and devices furnished or installed. Secondary voltages shall be tested at the bus in the main switchboard, at panelboards, and at such other locations on the distribution systems as necessary. Secondary voltages shall be tested under no-load and full-load conditions.

3.15 ACCEPTANCE DEMONSTRATIONS

A. Systems installed under this Section shall be demonstrated to the Owner, Architect and Engineer. Demonstrations are in addition to necessary testing and training sessions. Notify all parties at least 7 days prior to the scheduled demonstration. Schedule demonstrations in cooperation with and at times convenient to all parties and so as to not disturb ongoing activities.

B. Systems shall be tested prior to the demonstrations and each system shall be fully operational and tested prior to arranging the Acceptance Demonstration. Final payments shall be withheld until a satisfactory demonstration is provided for all systems indicated or requested.
C. If the demonstration is not totally complete, performing all functions, features and connections or interfaces with other systems, or if there is a failure during the demonstration, additional demonstrations shall be arranged. Provide and pay for all costs, labor and expenses incurred for all attendees for each additional demonstration required for acceptance and demonstration of complete system operation.

D. Demonstrations shall be scheduled in ample time to complete all activities prior to final acceptance and Owner occupancy. Demonstrations shall take place at least 30 days prior to the scheduled project completion date and 30 days prior to Owner's use and occupancy.

E. As a minimum, provide demonstrations for systems indicated under "Work Included" under Part One of the Specifications. Provide demonstrations of additional systems as requested by the Owner, Architect, or Engineer.

END OF SECTION
SECTION 31 10 00

SITE CLEARING

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of 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. Site Clearing.
2. Topsoil Stripping.
3. Clearing and Grubbing.
4. Protection and Abandonment of Utilities

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 02 41 00 – DEMOLITION for items to be demolished.
2. Section 31 20 00 – EARTH MOVING for soil materials, excavating, backfilling, and site grading and removal of site utilities.
3. Section 31 25 00 – SEDIMENTATION AND EROSION CONTROL for required erosion and sedimentation control measures.

1.03 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.04 PHASING REQUIREMENTS

A. Phase 1: Installation of three new modular concrete buildings for new communications equipment to be serviced from the existing communications tower that is to remain. Work includes all site work for new construction, new foundations and retaining walls, new modular buildings and associated architectural work and mechanical and electrical work as indicated on the drawings.

1. New communications equipment work and hook up to the existing tower and disconnection of the old communication equipment in the existing building. This work will be done by the City of Newton’s Communications Contractor under a separate contract. Communications work will include providing all communications equipment, materials and labor to provide an operational communication service for the City of Newton in the new
modular buildings. After delivery of the new communication service the Communications Contractor shall disconnect the old communications equipment, salvage reusable equipment and make safe the remaining equipment ready for removal by the demolition contractor in Phase 2.

B. Phase 2: Commences only after the new communications equipment has been installed in the new modular building by the City of Newton’s Communications Contractor, and the communications services are operational. Phase 2 includes demolition of the old existing Communications Equipment Building including but not limited to: removal of non salvageable communications equipment; demolition and removal of existing building and foundation materials. All new Site Work as shown on the drawings including but not limited to: site demolition, excavation, fill and regrading, landscape materials and plantings, new fencing, new walkways and asphalt repairs.

PART 2 – PRODUCTS

(Not applicable to work of this section.)

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

3.2 SITE CLEARING

A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions, except for those indicated on the Contract Drawings to remain, interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated. Removal includes digging out stumps in their entirety and grubbing roots to at least 30 inches below existing grades shown on the Contract Drawings.

B. Carefully and cleanly cut roots and branches of existing trees indicated to remain and be protected, where such roots and branches obstruct new construction. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.

3.3 DISPOSAL OF WASTE MATERIALS

A. Removal from Owner’s Property: Remove waste materials and unsuitable and excess topsoil and dispose of offsite in a legal manner. Waste materials shall include but not be limited to timber, brush, refuse, stumps, roots, vines, debris and other objectionable matter.

1. Burning of cleared and grubbed materials, or other fires for any reason will not be permitted.

2. No rubbish or debris of any kind shall be buried on site.

3.4 STRIPPING (REMOVAL) OF TOPSOIL

A. Topsoil shall be carefully removed, to the depths directed, over all areas which are shown on the Contract Drawings to be excavated and/or filled, and over all other areas to be disturbed as a result of the Contractor’s operations in the performance of the Contract work. The topsoil shall be transported and deposited in storage piles convenient to the areas, which are subsequently to receive the application of topsoil, separate from other excavated materials and in approved locations. The topsoil shall be stockpiled free of roots, stones and other undesirable material. The Contractor shall take all necessary precautions to prevent other excavated material or other objectionable material from becoming intermixed with the topsoil, either before or after the
stripping and stockpiling operations. Stripping operations shall be completed prior to the start of excavation, trenching, or grading operations.

B. The Contractor shall take reasonable care to avoid creating unsightly or unsafe conditions and to avoid unnecessary damage or injury to surroundings.

3.5 STOCKPILING
A. The Contractor is responsible for all construction, protection, movement, and maintenance of stockpiles. Stockpiles shall be neatly trimmed and graded to provide proper drainage from their surfaces and maintained so as not to erode or pollute their surroundings.

3.6 EXCESS TOPSOIL
A. Topsoil which has been stripped and stockpiled, but is not needed after the completion of all final topsoil and grassing shall be disposed of offsite.

3.7 PROTECTION
A. Trees and other vegetation designated to remain shall be protected from damage by construction operations by erecting barriers, guards or enclosures. Conduct clearing operations in a manner to prevent falling trees from damaging trees and vegetation designated to remain, damaging the work being constructed, and to provide for the safety of employees and others.

B. Maintain the protection until all work in the vicinity of the work being protected has been completed.

C. Do not operate heavy equipment or stockpile materials within the branch spread of existing trees to remain.

D. Immediately repair any damage to existing tree crowns, trunks, or root systems. Roots exposed and/or damaged during execution of the work shall immediately be cut off cleanly inside the exposed or damaged area. Treat cut surfaces with a tree wound paint and spread topsoil over the exposed root area.

E. When work is completed, remove all dead and downed trees. Live trees shall be trimmed of all dead and diseased limbs and branches. All cuts shall be cleanly made at their juncture with the trunk or preceding branch without injury to the trunk or remaining branches. Cuts over 1-inch in diameter shall be treated with tree wound paint.

F. Restrict construction activities to those areas within the limits of construction, public rights-of-way, and easements designated on the Contract Drawings. Adjacent properties and improvements thereon, public or private, which become damaged by construction operations shall be promptly restored at the Contractor's expense to their original condition, and to the full satisfaction of the property owner.

3.08 SITE UTILITIES
A. The Contractor is responsible for coordinating and scheduling with the authorities having jurisdiction the removal and/or abandonment of existing gas, telephone, cable, and electric services, as required to complete the work.

B. Utility pipes to be abandoned shall be plugged at their ends with watertight brick masonry or cement mortar with a minimum thickness of 8 inches. Utility pipes designated to be removed shall include backfilling the voids with ordinary borrow.
C. All utility pipes designated to be abandoned and left in-place when cut or interrupted by new work shall be plugged at their ends. Plugs shall be watertight brick masonry or cement mortar with a minimum thickness of 8 inches.

D. Utility structures designated on the Contract Drawings to be removed shall consist of the removal and stacking of cast iron castings, plugging of inlet and outlet pipes, removal of the structure, and backfill and compaction of the void with ordinary borrow. When the void is within the footprint of the new building, gravel borrow shall be used to backfill the void.

E. Utility structures to be abandoned in place shall have their cast iron castings removed and disposed, inlet and outlet pipes plugged, the bottom of the bottoms shall be broken, the void of the structure shall be backfilled and compacted with ordinary borrow and the top of the structure shall be removed so that it is at least 30" below finished grade.

END OF SECTION
SECTION 312000

EARTH MOVING

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

1.02 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. Excavation of all types.
2. Sheeting, shoring and dewatering of trenches and excavations.
3. Providing, placing, and compacting fill materials.
4. Removal, hauling, stockpiling, rehandling, and placement of materials.
5. Off-site disposal of excess or unsuitable materials.
6. Rough grading.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 31 10 00, Site Preparation for site clearing and preparation.
2. Section 31 25 00, Sedimentation and Erosion Control for erosion and pollution control.
3. Section 01 22 00, Unit Prices for pricing of Rock Excavation for ledge.

1.03 SUBMITTALS AND TESTING

A. Refer to Division 1 General Requirements for submittal provisions and procedures.

1. Backfill Materials: Submit 50 pound sample for each backfill material from each proposed source including on-site materials. Submit a grain size analysis and distribution curve performed in accordance with ASTM D422 for each proposed backfill material for review by the Engineer. Additional samples and analysis shall be submitted if a change in material occurs at the borrow source.

2. Excavation and Excavation Support Plan: Submit at least 10 calendar days prior to the start of the work a detailed plan for the sequence of excavation, and methods to be used for excavation support and dewatering of excavations. Submit engineering calculation stamped by a Massachusetts Registered Professional Engineer and shop drawings for earth support systems to be used. Dewatering and groundwater control systems shall be designed to keep excavations free of water and to avoid disturbance of the subgrade.

3. Moisture-density curve indicating the maximum dry density and optimum moisture content as determined by ASTM D1557 for each proposed source of backfill.

4. Filter fabric: Submit the manufacturer's information and a one square foot representative sample of the filter fabric.

5. Within one week after making field adjustments, resubmit revised working drawings as necessary to reflect changes required by field conditions.

6. Obtain required permits for discharge of dewatering effluent. Submit two copies of all permits obtained at least one week prior to system installation.
7. A Soils Engineer/testing laboratory shall make such tests of materials and samples as necessary to ensure materials and compaction requirements are achieved and as directed by the Owner’s Representative. Costs for such tests shall be borne by the Contractor. Submit daily field reports from the geotechnical testing laboratory documenting all Earth Moving activity and field testing for each day. The field reports shall include a minimum the following:
   a. A description of the day’s activities, including specific procedures, methods, and materials.
   b. The results of in-place density testing including in-place dry density, moisture content, percent compaction, elevation of test and a description of the soil.
   c. A sketch indicating the extent of each day’s work and the location of testing.

8. Submit the qualifications of the independent geotechnical testing laboratory performing soil testing and inspection services during Earth Moving operations. The geotechnical testing laboratory must demonstrate that it has the experience and capability to conduct required field and laboratory geotechnical testing.

1.04 REFERENCE STANDARDS

A. The following standards are applicable to the work of this section to the extent referenced herein.


1.05 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.06 SUBSURFACE CONDITIONS

Reference available subsurface data and reports.

1.07 EXCAVATION CLASSIFICATIONS

A. Earth Excavation or "Excavation" consists of removal of materials encountered to the subgrade elevations indicated and subsequent reuse or disposal of the materials removed. All excavation is classified as earth excavation unless it otherwise meets the classifications provided below for unauthorized excavation, additional excavation, or rock excavation.

B. Unauthorized Excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Owner’s Representative. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor’s expense.

1. Under footings, foundations, concrete slabs, retaining walls or other structures, fill unauthorized excavations to the proper elevations with gravel borrow. Elsewhere, backfill and compact unauthorized excavations as specified for excavations of the same class, unless otherwise directed.

C. Additional Excavation:
1. When excavation has reached required subgrade elevations, notify the Owner's Representative who will review subgrade conditions.
2. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace excavated material as directed.
3. Removal of unsuitable material and its replacement as directed will be paid on the basis of contract conditions relative to changes in work or as provided for under the unit rates for this classification.

D. Rock Excavation:

1. Rock excavation in trenches includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42-inch wide bucket on medium-size track-mounted hydraulic excavator equivalent to Caterpillar Model 215, rated at not less than 90HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10-feet in width are classified as open excavation.
2. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted heavy-duty hydraulic excavating equipment without drilling or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170HP flywheel power and developing 40,000-lb. breakout force (measured in accordance with SAE J732C). No blasting is allowed on site.
3. Determination of rock excavation classification will be made by the Owner's Representative. Typical of materials classified as rock are boulders 3.0 cubic yards or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits. Intermittent drilling or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation. Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by the Owner's Representative. Visual observation of the completed excavation may be made by the Owner's Representative to modify the excavation classifications. Removal of rock excavation prior to classification by the Owner's Representative shall be considered as earth excavation unless accepted by the Owner's Representative in writing. Such excavation will be paid on the basis of contract unit rates for this classification.
4. Rock payment lines (if applicable) are limited to the following:
   a. Two feet outside of concrete work for which forms are required.
   b. One foot outside of the vertical walls of utility structures.
   c. In pipe trenches, depth limits shall be 6 inches below the bottom of the pipe:

<table>
<thead>
<tr>
<th>Depth From Ground Surface to Invert of Pipe</th>
<th>Pay Width (Pipe ID)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 12'</td>
<td>5'-0&quot;</td>
</tr>
<tr>
<td>12' to 20'</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>Over 20'</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td></td>
<td>Pipe I.D. +3'-0&quot;</td>
</tr>
<tr>
<td></td>
<td>Pipe I.D. +7'-0&quot;</td>
</tr>
</tbody>
</table>

   d. Rock sloping across the width of trench shall have the top of rock established at the rock elevation over the centerline of the pipe.
5. Unit Pricing:
   a. Estimated quantity 50 cubic yards.
   b. See Section 01 22 00 for Unit Pricing requirements
6. Prior to ledge removal, the contractor shall engage a professional land surveyor to survey any exposed ledge, to establish quantities to be removed.

EARTH MOVING
312000 - 3
1.08 EXCAVATION

A. The Contractor shall perform all excavations and of whatever materials encountered, in a manner as required to allow for placing of temporary earth support, forms, installation of pipe and other work, and to permit access for the purpose of observing the work. Excavations shall be to such widths as will give suitable space for the required work. Bottoms of trenches and excavations shall be protected from frost and shall be firm, dry and in an acceptable condition to receive the work. Work shall not be placed on frozen surfaces nor shall work be placed on wet or unstable surfaces.

B. All excavations made in open cut will be controlled by the conditions existing at that location. In no case shall earth be excavated or disturbed by machinery so near to the finished subgrade for structures and pipelines as to result in the disturbance of the earth below the subgrade. The final excavation to subgrade should be accomplished with a smooth faced bucket or by hand.

1.09 TEMPORARY EARTH SUPPORT

A. The Contractor shall furnish, place and maintain such sheeting, shoring, and bracing at locations necessary to support the sides of excavations to prevent danger to persons or damage to adjacent pavements, facilities, utilities, or structures; to prevent injurious caving or erosion or the loss of ground; and to maintain pedestrian and vehicular traffic as required by the Contract Documents, the Contractor's sequence of construction, and as directed by the Owner's Representative.

B. In all sheeting, shoring and bracing operations, care shall be taken to prevent collapse of excavations, injury to persons or damage to adjacent structures, facilities, utilities and services. Any injuries to persons shall be the responsibility of the Contractor; and any damage to the work occurring as a result of settlement, water or earth pressure, or other causes due to inadequate bracing or other construction operations of the Contractor shall be satisfactorily repaired and made good by the Contractor, at no additional expense to the Owner.

C. Where sheeting is to be used, it shall be driven ahead of excavation operations to the extent practicable so as to avoid the loss of material from behind the sheeting; where voids occur outside of the sheeting, they shall be filled immediately with ordinary fill, thoroughly compacted.

D. The Contractor shall leave in place all sheeting and bracing at the locations and within the limits ordered by the Owner's Representative in writing. The Contractor shall cut off the sheeting at elevations as indicated on the Contract Drawings or to be determined with the approval of the Owner's Representative.

E. The Contractor shall comply with all federal, state, and local safety regulations, and requirements.

1.10 GROUNDWATER CONTROL

A. The Contractor shall provide, at his own expense, adequate pumping and drainage facilities to maintain the excavated area sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction procedures nor cause excessive disturbance of underlying natural ground. The flows of all water resulting from pumping shall be managed so as not to cause erosion, siltation of drainage systems, or damage to adjacent property.

B. Any damage resulting from the failure of the dewatering operations of the Contractor, and any damage resulting from the failure of the Contractor to maintain all the areas of work in a suitable dry condition, shall be repaired by the Contractor, as directed by the Engineer, at no additional expense to the Owner. The Contractor's pumping and dewatering operations shall be carried out in such a manner as to prevent damage to the Contract work and so that no loss of ground will result from
these operations. Precautions shall be taken to protect new work from flooding during storms or from other causes. Pumping shall be continuous to protect the work and/or to maintain satisfactory progress.

C. All pipelines or structures not stable against uplift during construction or prior to completion shall be thoroughly braced or otherwise protected. Water from the trenches, excavations, and stormwater management operations shall be disposed of in such a manner as to avoid public nuisance, injury to public health or the environment, damage to public or private property, or damage to the work completed or in progress.

D. The Contractor shall control the grading in the areas surrounding all excavations so that the surface of the ground will be properly sloped to prevent water from running into the excavated area. Where required, temporary ditches shall be provided to control drainage. Upon completion of the work and when directed, all areas shall be restored by the Contractor in a satisfactory manner and as directed.

1.11 BLASTING
A. Blasting shall not be permitted without the written approval of the Owner’s Representative.

1.12 PERMITS, CODES, AND SAFETY REQUIREMENTS
A. Comply with all rules, regulations, laws and ordinances of the municipality, the Commonwealth of Massachusetts, and other authorities having jurisdiction over the project site or work. All labor, materials, equipment and services necessary to make the work comply with these requirements shall be provided by the Contractor without additional cost to the Owner.

B. Comply with the provisions of the Manual for Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration, United States Department of Labor.

C. The Contractor shall obtain and pay for all permits and licenses required to the complete work specified herein and shown on the Contract Drawings.

D. The Contractor shall not close or obstruct any street, sidewalk, or passageway without written permission from authorities having jurisdiction unless otherwise indicated on the Contract Drawings. The Contractor shall conduct his operations as to minimize interference with the use of roads, driveways, or other facilities near enough to the work to be affected by the work.

E. The Contractor shall notify “Dig Safe” at 1-888-DIG-SAFE prior to commencing any excavation work.

F. The Contractor shall provide police details when working in roadways as required by local jurisdictional authorities. The Contractor shall pay for any and all details.

1.13 PROTECTION OF EXISTING CONDITIONS
A. All work shall be executed in such a manner as to prevent any damage to existing buildings, streets, curbs, paving, service utility lines, structures and adjoining property.

B. Locate and mark underground utilities to remain in service before beginning the work. Protect all existing utilities to remain in service during operations. Do not interrupt existing utilities except when authorized in writing by authorities have jurisdiction unless otherwise indicated on the Contract Drawings.
C. When an active utility line is exposed during construction its location and elevation shall be recorded on the Record Drawings by the Contractor and both the Engineer and the Utility Owner shall be notified in writing. Active utilities existing on the site shall be carefully protected from damage or relocated as required by the work.

D. Inactive or abandoned utilities encountered during construction operations shall be removed, plugged, capped or filled. The location of such utilities shall be recorded on the Record Drawings.

E. Provide barricades, fences, lights, signs, and all other safety devices required to protect the public against injury.

F. In case of any damage or injury caused in the performance of the work the Contractor shall, at his own expense make good such damage or injury to the satisfaction of, and without cost to, the Owner. Existing streets, sidewalks and curbs damaged during the project work shall be repaired or replaced to their condition prior to commencement of Earth Moving operations.

G. Acceptance of any of the Contractor’s plans, design calculations and methods of construction by the Designer shall not relieve the Contractor of the responsibility for the adequacy of the excavation lateral support system; preventing damage to existing or new structures, utilities and streets adjacent to excavations; the safety of persons working within excavated areas and the public at large; and excavation dewatering.

1.14 DISPOSAL

A. All excess and unsuitable excavated soil shall be removed from the site and legally disposed off-site by the Contractor at no additional cost to the Owner.

1.15 PHASING REQUIREMENTS

A. Phase 1: Installation of three new modular concrete buildings for new communications equipment to be serviced from the existing communications tower that is to remain. Work includes all site work for new construction, new foundations and retaining walls, new modular buildings and associated architectural work and mechanical and electrical work as indicated on the drawings.

1. New communications equipment work and hook up to the existing tower and disconnection of the old communication equipment in the existing building. This work will be done by the City of Newton’s Communications Contractor under a separate contract. Communications work will include providing all communications equipment, materials and labor to provide an operational communication service for the City of Newton in the new modular buildings. After delivery of the new communications service the Communications Contractor shall disconnect the old communications equipment, salvage reusable equipment and make safe the remaining equipment ready for removal by the demolition contractor in Phase 2.

B. Phase 2: Commences only after the new communications equipment has been installed in the new modular building by the City of Newton’s Communications Contractor, and the communications services are operational. Phase 2 includes demolition of the old existing Communications Equipment Building including but not limited to: removal of non-salvageable communications equipment; demolition and removal of existing building and foundation materials. All new Site Work as shown on the drawings including but not limited to: site demolition, excavation, fill and regrading, landscape materials and plantings, new fencing, new walkways and asphalt repairs.
PART 2 – PRODUCTS

2.01 BACKFILL MATERIALS

A. Backfill materials shall conform to the following material descriptions and gradation requirements.

B. Ordinary Borrow: Ordinary borrow shall be well-graded, natural inorganic soil containing no stone greater than 6 inches maximum dimension. The materials shall be free of trash, ice, snow, tree stumps, roots and other organic and deleterious materials. It shall be free of highly plastic clays, of all materials subject to decay or other materials that will corrode piping or metals. Ordinary borrow shall have a maximum dry density of not less than 110 pounds per cubic foot. It shall be of such a nature and character that it can be compacted to the specified densities. Topsoil shall not be considered ordinary borrow.

C. Existing available fill materials from on-site excavations may be reused as ordinary borrow if it meets the above requirements.

D. Gravel Borrow: Gravel borrow shall consist of inert material that is hard, durable stone and sand, free from loam and clay, surface coatings, and deleterious materials. Gravel borrow shall conform to the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Finer by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2-inch</td>
<td>50-85(1)</td>
</tr>
<tr>
<td>No. 4</td>
<td>40-75</td>
</tr>
<tr>
<td>No. 50</td>
<td>8-28</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10</td>
</tr>
</tbody>
</table>

(1) Maximum size of stone in gravel shall be three-inches.

E. Crushed Stone: Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following requirements.

<table>
<thead>
<tr>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Size</td>
</tr>
<tr>
<td>3/4-inch Stone</td>
</tr>
<tr>
<td>1/2-inch Stone</td>
</tr>
<tr>
<td>1-inch</td>
</tr>
<tr>
<td>3/4-inch</td>
</tr>
<tr>
<td>5/8-inch</td>
</tr>
<tr>
<td>1/2-inch</td>
</tr>
<tr>
<td>3/8-inch</td>
</tr>
</tbody>
</table>
F. Dense Graded Crushed Stone: Dense graded crushed stone shall consist of angular material derived from a stone quarry that is hard, durable and free of deleterious materials. Material shall be free from clay, loam or other plastic material.


<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing By Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-inch</td>
<td>100</td>
</tr>
<tr>
<td>1½-inch</td>
<td>70-100</td>
</tr>
<tr>
<td>¾ -inch</td>
<td>50-85</td>
</tr>
<tr>
<td>No. 4</td>
<td>30-55</td>
</tr>
<tr>
<td>No. 50</td>
<td>8-24</td>
</tr>
<tr>
<td>No. 200</td>
<td>3-10</td>
</tr>
</tbody>
</table>

G. Sand: Sand shall consist of clean inert, hard, durable grains of quartz or other hard durable rock, free from clay, organics, surface coatings or other deleterious material. Sand shall conform to the following gradation:


<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2-inch</td>
<td>100</td>
</tr>
<tr>
<td>3/8-inch</td>
<td>85-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>60-100</td>
</tr>
<tr>
<td>No. 16</td>
<td>35-80</td>
</tr>
<tr>
<td>No. 50</td>
<td>10-55</td>
</tr>
<tr>
<td>No. 100</td>
<td>2-10</td>
</tr>
</tbody>
</table>

H. Dumped Riprap: Stone used for dumped riprap shall be hard, durable, angular in shape stones, resistant to weathering and shall meet the gradation requirement specified. Neither breadth nor thickness of a single stone should be less than one-third its length. Rounded stone or boulders will not be accepted unless authorized by the Engineer. Stone shall be free from overburden, spoil, shale, and organic material and shall conform to the following gradation:
<table>
<thead>
<tr>
<th>Weight of Stone (lbs.)</th>
<th>Maximum Percent of Total Weight Smaller than Given Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>100</td>
</tr>
<tr>
<td>300</td>
<td>50</td>
</tr>
<tr>
<td>200</td>
<td>30</td>
</tr>
<tr>
<td>25*</td>
<td>10</td>
</tr>
</tbody>
</table>

No more than 5% by weight shall pass a 2-inch sieve

Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified.

I. Stone for Pipe Ends: Stone for pipe ends shall be sound, durable rock which is angular in shape. Rounded stones, boulders, sandstone or similar stone or relatively thin slabs will not be acceptable. Each stone shall weigh not less than 50 pounds but not more than 125 pounds and at least 75 percent of the volume shall consist of stones weighing not less that 75 pounds each. The remainder of the stones shall be graded that when placed with the larger stones the entire mass will be compact.

J. Filter Fabric: Filter Fabric used, as a drainage medium shall consist of a non-woven fabric made from polypropylene or polyethylene filaments or yarns. The fabric shall be inert to organic chemicals commonly encountered in the soil. The fabric shall conform to the following recommended property tests:

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>Test Method</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>oz/sq yd</td>
<td>ASTM D-3776-84</td>
<td>4.5</td>
</tr>
<tr>
<td>Grab Strength</td>
<td>lbs</td>
<td>ASTM D-4632-86</td>
<td>120</td>
</tr>
<tr>
<td>Grab Elongation</td>
<td>percent</td>
<td>ASTM D-4632-86</td>
<td>55</td>
</tr>
<tr>
<td>Trapezoid Tear Strength</td>
<td>lbs</td>
<td>ASTM D-4533-85</td>
<td>50</td>
</tr>
<tr>
<td>Mullen Burst Strength</td>
<td>psi</td>
<td>ASTM D-3786-80</td>
<td>210</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>lbs</td>
<td>ASTM D-4833-88</td>
<td>70</td>
</tr>
<tr>
<td>Apparent Opening Size (AOS)</td>
<td>U.S. std. Size Sieve</td>
<td>ASTM D-4751-87</td>
<td>70</td>
</tr>
</tbody>
</table>

K. Edges of filter fabric shall overlap a minimum of one foot.
PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. The Contract Drawings indicate the proposed finish alignment, elevation, and grade of the work. Establish the line and grade in close conformity with the Contract Drawings. The Owner's Representative, however, may make minor adjustments in the field as necessary due to conditions encountered.

B. The Contractor is responsible for establishing construction phasing, means, and methods and interim grading and temporary conditions required to attain the finish product required by the Contract Documents. The Contractor is responsible for all construction, protection, movement, and maintenance of stockpiles. Establish and maintain suitable benchmarks and grade control to accurately perform the work.

C. All excavation shall be performed in the dry. Excavation and dewatering shall be accomplished by methods, which preserve the undisturbed state of the subgrade soils.

D. No excavation will be permitted below a line drawn downwards at 2 horizontal to 1 vertical from the underside of the closest edge of any in-place footing or utility at a higher elevation without providing adequate sheeting and bracing to prevent movement of the in-place footing or utility.

E. When excavations have reached the prescribed depths, the condition of the bottom of the trench or hole shall be inspected by the Owner’s Representative. After inspection the Contractor will receive approval to proceed if conditions meet project requirements.

F. No excavation shall be deposited or stockpiled at any time to endanger portions of new or existing structures, either by direct pressure or indirectly by overloading banks contiguous to the operation. Material, if stockpiled, shall be stored so as not to interfere with the established sequence of the construction. If there is not sufficient area available for stockpiling within the limits of the project, the Contractor will be required to furnish his own area for stockpiling.

G. When the plans require excavation in areas in close proximity to existing buildings, roads, structures and utilities it shall be the responsibility of the Contractor at his expense to use satisfactory means and methods to protect and maintain the stability of such roads, and structures located immediately adjacent to but outside the limits of excavations.

H. Temporary ditches shall be made as needed to drain off surface water to avoid damaged to areas of cut or fill. Such ditches shall be maintained as required for efficient operations, at no additional cost to the Owner.

I. Provide shoring, sheeting, and/or bracing at excavations, as required, to assure complete safety against collapse of earth at the side of excavations. Provide shoring of public utility lines where exposed in the excavations in accordance with rules and regulations of the local authorities, as no additional cost to the Owner.

3.02 FILLING AND BACKFILLING

A. Subgrade Preparation: The subgrade shall be shaped to line, grade, and cross-section, and be thoroughly compacted in accordance with the requirements of paragraph 3.03. This operation shall include any required reshaping and wetting to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material from excavation or borrow. The resulting area, and all other low sections, holes, or depressions shall be brought to the required grade with accepted material and the entire subgrade shaped to line, grade and cross-section and thoroughly compacted.
1. Before surface or base materials are spread, the subgrade shall be shaped to an accurate and true surface conforming to the line and grades indicated on the Contract Drawings. All surface irregularities shall be filled with suitable material or removed and such areas recompacted until the surface is properly shaped and properly compacted. A tolerance of 3/8-inch in paved areas and 1/2-inch in non-paved areas above or below the finished subgrade elevation will be allowed provided that this dimension above or below grade is not maintained for a distance longer than 50-feet and that the required crown is maintained in the subgrade. Any portion, which is not accessible to a roller, shall be thoroughly compacted by other mechanical or manual methods.

2. All fills shall be placed in horizontal layers. Fill shall not be placed following the natural contours of the ground. Fill shall be placed starting in the lowest areas working up to finish grades in horizontal layers in the manner specified herein. Each layer of fill shall be benched into the existing slope in order to avoid the formation of a shear plane.

B. Backfill Material: Unless otherwise specified or directed, material used for filling and backfilling shall meet the material requirements specified herein. In general, the material used for backfilling utility trench excavations shall be material removed from the excavations provided that the reuse of these materials result in the required trench compaction and meets the requirements specified for ordinary borrow. All backfill placed within the building limits shall be gravel borrow unless otherwise specified. In areas where the bottom of the excavation is in fine sand and silt, and is below the groundwater table, the first lift of backfill shall be 12-inches of 3/4-inch maximum crushed stone to provide a working mat and drainage layer. Place backfill to a maximum loose lift thickness of 12-inches. Maintain backfill material with a uniform moisture content, with no visible wet or dry streaking, between plus two percent and minus three percent of optimum moisture content. The final filled soil mass shall be as uniform as possible in lift thickness, moisture content, and effort required to compact soil mass.

C. Trench Backfill:

1. After the utility pipe installation has been inspected and approved, trenches shall be backfilled as soon as practicable with specified material. All trench backfilling shall be done with special care.

2. Backfill material for pipe bedding shall be deposited in the trench, uniformly on both sides of the pipe, for the entire width of the trench to the springline of the pipe. The backfill material shall be placed by hand shovels, in layers not more than 8-inches thick in loose depth, and each layer shall be thoroughly and evenly compacted by tamping on each side of the pipe to provide uniform support around the pipe, free from voids.

3. The balance of backfill shall be spread in layers not exceeding 12-inches in loose depth. Each layer shall be thoroughly compacted by mechanical methods and shall contain no rock, stones or boulders larger than 4 inches in their greatest dimension.

4. All trench backfilling shall be done with special care and must be carefully placed so as not to disturb the work at any time; if necessary, a timber grillage or other suitable method shall be used to break the fall of the material. The moisture content of the backfill material shall be such that proper compaction will be obtained. Puddling of backfill with water will not be permitted. Backfill within areas to receive topsoil or pavement construction shall be made to grades required to establish the proper subgrade for the placement of topsoil or pavement base courses.

5. In backfilling trenches, each layer of backfill material shall be moistened and compacted to a density at least equal to that of the surrounding undisturbed earth, and in such a manner as to permit the rolling and compaction of the filled trench or excavation with the adjoining earth to provide the required bearing value, so that paving of the excavated and disturbed areas, where required, can proceed immediately after backfilling is completed.

6. Any trenches or excavations improperly backfilled or where settlement occurs shall be reopened, to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and condition, at no additional expense to the Owner.
7. During filling and backfilling operations, pipelines will be checked by the Owner's Representative to determine whether any displacement of the pipe has occurred. If the observation of the pipelines shows poor alignment, displaced pipe or any other defects they shall be remedied in a manner satisfactory to the Owner's Representative at no additional cost to the Owner.

D. Backfilling Against Structures:

1. Backfilling against masonry or concrete shall not be done until permitted by the Owner's Representative. 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 satisfactorily completed and approved, special leakage tests of the structures shall be made by the Contractor, as required by the Owner's Representative. After the satisfactory completion of leakage tests and the satisfactory completion of any other required work in connection with the structures, the backfilling around the structures shall proceed using suitable and approved excavation material. The best of the backfill material shall be used for backfilling within 2-feet of the structure. Just prior to placing backfill, the areas shall be cleaned of all excess construction material and debris and the bottom of excavations shall be in a thoroughly compacted condition.

2. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures. During backfilling operations, care shall be exercised that the equipment used will not overload the structures in passing over and compacting these fills. Except as otherwise specified or directed, backfill shall be placed in layers not more than 12-inches in loose depth and each layer of backfill shall be compacted thoroughly and evenly using approved types of mechanical equipment. Each pass of the equipment shall cover the entire area of each layer of backfill.

3. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures due to passage of heavy equipment over, or adjacent to, structures, and any damage thereto shall be made good by the Contractor at no additional expense to the Owner.

E. After backfilling trenches and excavations, the Contractor shall maintain the surfaces of backfill areas in good condition so as to present a smooth surface at all times level with adjacent surfaces. Any subsequent settling over backfilled areas shall be repaired by the Contractor immediately, and such maintenance shall be provided by the Contractor for the life of this Contract, at no additional expense to the Owner.

F. The completed and approved subgrades upon which topsoil is to be placed, or pavements are to be installed, shall not be disturbed by traffic of other operations and shall be maintained in a satisfactory condition until the base and finished courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.

G. Uniformly shape the surfaces of all areas to be graded, to the lines and grades indicated on the Contract Drawings, and as directed, including excavated and filled sections, embankments and adjacent transition areas, and all areas disturbed as a result of the Contractor's operations. The finished surfaces shall be reasonably smooth, compacted and free from surface irregularities.

H. The Contractor is responsible to provide the finish grades as shown on the Contract Drawings. The Contractor shall provide temporary erosion control throughout the construction period to maintain all constructed lawns, and to protect all existing drains, catch basins, swales, from any debris or soil entering from excavation, backfill, or erosion. Contractor shall take whatever precautions are necessary to accomplish this temporary erosion control such as haybales, silt fence, erosion control fabric, or pumping, at no additional cost to the Owner.
3.03  COMPACTION

A. Compaction Requirements: The degree of compaction is expressed as a percentage of the maximum dry density of the material at optimum moisture content as determined by ASTM Test D1557, Method C. The compaction requirements are as follows:

<table>
<thead>
<tr>
<th>Area</th>
<th>ASTM Density Degree of Compaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below footings</td>
<td>95%</td>
</tr>
<tr>
<td>Below slabs</td>
<td>95%</td>
</tr>
<tr>
<td>Pavement base course</td>
<td>95%</td>
</tr>
<tr>
<td>Pavement subgrade</td>
<td>95%</td>
</tr>
<tr>
<td>General fill below pavement subbase</td>
<td>95%</td>
</tr>
<tr>
<td>Trench backfill - below pavements</td>
<td>95%</td>
</tr>
<tr>
<td>- below landscaped areas</td>
<td>92%</td>
</tr>
<tr>
<td>- below structures</td>
<td>95%</td>
</tr>
<tr>
<td>All other areas</td>
<td>90%</td>
</tr>
</tbody>
</table>

B. Moisture Control:

1. Fill that is too wet for proper compaction shall be disced, harrowed, or otherwise dried to a proper moisture content to allow compaction to the required density. If fill cannot be dried within 24 hours of placement, it shall be removed and replaced with drier fill.

2. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.

C. Unfavorable Conditions:

1. In no case shall fill be placed over material that is frozen. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.

2. In freezing weather, a layer of fill shall not be left in an uncompacted state at the close of the day's operations. Prior to terminating work for the day, the final layer of compacted fill shall be rolled with a smooth wheeled roller to eliminate ridges of soil left by compaction equipment.

D. Compaction Control:

1. In-place density tests shall be made in accordance with ASTM D1556, D2922, or D2167 as the work progresses, to determine the degree of compaction being attained by the Contractor. 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 the Owner. In-place density testing shall be made at the Contractor's expense by the geotechnical testing laboratory.

2. In-place density tests shall be performed at a minimum according to the following:
a. A minimum of one per trench.
b. One test per lift for each parking lot and sidewalk subgrade area.

E. Erosion control

1. The work of the Section consists of all sedimentation and erosion control related items as indicated on the Contract Drawings and/or specified herein and includes but is not limited to the following:
   a. Silt fence.
   b. Hay bale barriers.
   c. Temporary covers for drainage structures.
   d. Temporary protective soil coverings.

2. The Contractor shall install all measures needed to control sediment and erosion as required by the Contractor and Sub-contractor’s construction methods and operations, the weather conditions, and as directed by the Engineer.

END OF SECTION
SECTION 312500

SEDIMENTATION AND EROSION CONTROL

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

1.02 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. The work of the Section consists of all sedimentation and erosion control, and related items as indicated on the Contract Drawings and/or specified herein and includes but is not limited to the following:
   a. Silt fence.
   b. Straw bale barriers.
   c. Temporary covers for drainage structures.
   d. Temporary protective soil coverings.

2. The Contract Drawings indicate the minimum requirements for sedimentation control. The Contractor shall install all measures needed to control sediment and erosion as required by the Contractor and Sub-contractor’s construction methods and operations, the weather conditions, and as directed by the Engineer.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 312000 – EARTH MOVING for excavation, backfill and compaction requirements.
2. Section 334000 – STORM DRAINAGE UTILITIES for drainage systems requirements.

1.03 SUBMITTALS

A. Refer to SECTION 013300-SUBMITTALS for submittal provisions and procedures.

1. At least 20 days prior to the start of the project, the Contractor shall submit a Stormwater Pollution Prevention Plan (SWPPP) indicating project phasing. Contractor operation areas, work areas, stockpile locations, construction staging/sequencing, and sedimentation/erosion control measures to be used. The SWPPP shall be prepared to meet the requirements of the United States Environmental Protection’s (EPA) National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges From Construction Activities (GCP). The Contractor shall also submit the EPA “Notice of Intent for Stormwater Discharges Associated with CONSTRUCTION ACTIVITY Under a NPDES General Permit.” (NOI) form. This form shall be submitted to the EPA at least 14 days prior to the start of any construction activity and placing a signed copy along with proof of mailing in the SWPPP.

2. As part of the Contract Closeout procedures, the Contractor is responsible for filing a Notice of Termination with the EPA once the project has been completed and is permanently stabilized. Stabilization is complete when all temporary stormwater and erosion controls have been removed, all permanent stormwater and erosion controls are in place and functional.
3. The Contractor shall provide the following samples and/or submittals for approval. Do not order materials until approval of samples, certifications or test results has been obtained. Delivered materials shall closely match the approved samples.
   a. Siltation Fence: Submit manufacturer's literature, material specification, and installation instructions.
   b. Mulch Material: Submit one cubic foot sample(s).
   c. Mesh or Blanket Matting: submit one square foot sample(s) and manufacturer's literature, material specification, and installation instructions.

4. The Contractor shall install and maintain sedimentation control devices during construction to prevent the movement of sediment from the construction site to off site areas, into adjacent water bodies via surface runoff or into underground drainage systems. Measures to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at no additional cost to the Owner.

1.04 QUALITY ASSURANCE

A. Comply with all applicable requirements of governing authorities having jurisdiction. The specifications and drawings are not represented as being comprehensive, but rather convey the intent to provide complete slope protection and erosion control for both the Owner’s and adjacent property.
   1. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to a sediment and erosion control plan specific to the site, which complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

B. Erosion control measures shall be established at the beginning of construction and maintained during the entire period of construction. On-site areas which are subject to severe erosion, and off-site areas which are especially vulnerable to damage from erosion and/or sedimentation, are to be identified and receive special attention.

C. The Contractor shall install and maintain sedimentation control devices during construction to prevent the movement of sediment from the construction site to off site areas, into adjacent water bodies via surface runoff or into underground drainage systems. Measures to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at no additional cost to the Owner.

D. All land-disturbing activities are to be planned and conducted to minimize the size of the area to be exposed at any one time, and the length of time of exposure.

E. Surface water runoff originating upgrade of exposed areas shall be controlled to reduce erosion and sediment loss during the period of exposure.

F. When the increase in the peak rates and velocity of stormwater runoff resulting from a land-disturbing activity is sufficient to cause accelerated erosion of the receiving stream bed, provide measures to control both the velocity and rate of release so as to minimize accelerated erosion and increased sedimentation of the stream.

G. All land-disturbing activities are to be planned and conducted so as to minimize off-site sedimentation damage.
H. The Contractor is responsible for cleaning out and disposing of all sediment once the storage capacity of the sediment facility is reduced by one-half.

I. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

1.05 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein:


1.06 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.07 PERMITS, CODES AND REGULATIONS

A. Comply with all rules, regulations, laws and ordinances of the City and State, and all other authorities having jurisdiction over the project site. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided by the Contractor without additional cost to the Owner.

B. Comply with all applicable regulations of the Commonwealth of Massachusetts Department of Environmental Protection (DEP) and the EPA.

C. The Contractor shall comply with the requirements of the NPDES GCP for this project.

1.08 PHASING REQUIREMENTS

A. Phase 1: Installation of three new modular concrete buildings for new communications equipment to be serviced from the existing communications tower that is to remain. Work includes all site work for new construction, new foundations and retaining walls, new modular buildings and associated architectural work and mechanical and electrical work as indicated on the drawings.

1. New communications equipment work and hook up to the existing tower and disconnection of the old communication equipment in the existing building. This work will be done by the City of Newton’s Communications Contractor under a separate contract. Communications work will include providing all communications equipment, materials and labor to provide an operational communication service for the City of Newton in the new modular buildings. After delivery of the new communication service the Communications Contractor shall disconnect the old communications equipment, salvage reusable equipment and make safe the remaining equipment ready for removal by the demolition contractor in Phase 2.
B. Phase 2: Commences only after the new communications equipment has been installed in the new modular building by the City of Newton’s Communications Contractor, and the communications services are operational. Phase 2 includes demolition of the old existing Communications Equipment Building including but not limited to: removal of non-salvageable communications equipment; demolition and removal of existing building and foundation materials. All new Site Work as shown on the drawings including but not limited to: site demolition, excavation, fill and regrading, landscape materials and plantings, new fencing, new walkways and asphalt repairs.

PART 2 - PRODUCTS

2.1 SILTATION FENCE

A. Siltation fence shall consist of the following elements:

1. Fabric for siltation fence shall be a minimum width of 3 feet and conforming to the following criteria:

   **MINIMUM ACCEPTABLE**

<table>
<thead>
<tr>
<th>Fabric Properties</th>
<th>Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile Strength (lbs)</td>
<td>124</td>
<td>ASTM D 4632</td>
</tr>
<tr>
<td>Elongation of Failure (%)</td>
<td>15</td>
<td>ASTM D 4632</td>
</tr>
<tr>
<td>Mullen Burst Strength (PSI)</td>
<td>300</td>
<td>ASTM D 3786</td>
</tr>
<tr>
<td>Puncture Strength (lbs)</td>
<td>65</td>
<td>ASTM D 4833</td>
</tr>
<tr>
<td>Flow Rate (gal/min/sf)</td>
<td>10</td>
<td>ASTM D 4491</td>
</tr>
<tr>
<td>Apparent Opening Size (sieve)</td>
<td>30</td>
<td>ASTM D 4751</td>
</tr>
<tr>
<td>Ultraviolet Radiation (% strength retained)</td>
<td>70</td>
<td>ASTM D 4355</td>
</tr>
</tbody>
</table>

2. Use only commercially available fabric that is certified in writing by the manufacturer for the purpose intended.

3. Acceptable fabric materials include “Mirafi Envirofence” by TC Mirafi, “Style 2130” by Amoco Fabrics Co., and “FX-55” by Carthage Mills, or approved equal by the Engineer.

4. Silt fence posts: Posts may be wood or metal. Wood post shall be a minimum 1¼ inch by 1¼ inch by 5 feet long hardwood stakes commonly used to support siltation fabric. Metal posts shall be a minimum of 1 inch wide and 5 feet long. Posts shall be spaced at a maximum distance of 8 feet on center.

5. Provide suitable heavy nylon cord for securing abutting silt fence posts.

2.2 CRUSHED STONE

A. Crushed stone shall be as specified in Section 312000, Earth Moving.

2.3 STRAW BALES

A. Straw bales shall be of wire or nylon bound bales of straw.

B. Stakes for bales shall be one of the following materials. Lengths shall be approximately three feet (3’).

1. Wood stakes of sound hardwood, one inch by one inch (1” x 1”) in size.
2. Steel reinforcing bars of at least No. 4 size.

2.4 TEMPORARY COVERS FOR DRAINAGE STRUCTURES
A. Filter fabric for use as temporary covers for drainage structures shall be the same as noted above for siltation fence.

B. Wire mesh for use at temporary drainage structure covers shall be 6" x 6", W2.9 welded wire mesh.

C. Crushed stone shall be as specified herein before.

D. Silt-Sac, Hydro-FloGard + Plus Catch basin Insert, Ultra-DrainGuard Insert, or approved equal, may be used in lieu of hay bales and filter fabric at catch basins.

2.5 TEMPORARY PROTECTIVE COVERINGS

A. During establishment of vegetative covers, provide temporary protective coverings on ground areas subject to erosion of one of the following protective measures, as directed by the Engineer:

1. Straw temporary mulch, 100 pounds per 1,000 square feet.
2. Wood fiber cellulose temporary mulch, 35 pounds per 1,000 square feet.
3. Tackafier for anchoring mulch or straw shall be a non-petroleum based liquid bonding agent specifically made for anchoring straw.
4. Temporary vegetative cover for graded areas shall be undamaged, air dry threshed straw free of undesirable weed seed.
5. Mesh or Blanket Matting: Matting for erosion control on seeded or hydroseeded slopes, on planted surfaces, drainage swales, and on temporary or permanent slopes shall be:
   a. Biodegradable straw, excelsior wood, or coconut fiber and photodegradable netting sewn together with cotton thread.
   b. A flexible three-dimensional web of bonded polypropylene or PVC monofilaments.
   c. Heavy jute mesh shall be of a uniform open plain weave of unbleached singe jute yarn.
   d. Use only commercially available blanket mattings that are designed specifically for the intended use and certified in writing by the manufacturer for the purpose intended.
   e. Erosion control matting shall be "Soil Saver" manufactured by Jim Walls Co., Dallas, TX; "Heavy Duty Jute Mesh" manufactured by Lewis International Corp., Springfield, NJ or approved equal.
6. Note that wire staples and non-biodegradable coverings shall not be used for any area that will be mown turf.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. The Contractor shall provide suitable and adequate means of sedimentation and erosion control during construction. Control measures shall prevent all erosion, siltation and sedimentation of waterways, drainage systems, construction areas, adjacent areas and off-site areas. Work shall be accomplished on and/or adjacent to the following work areas:

1. Earthwork stockpiles and on-site storage and staging areas.
2. Cut and fill slopes and other stripped and exposed graded areas.
3. Constructed and existing swales and ditches.
4. Unestablished lawns and seeded embankments.

B. Means of protection as noted on the Contract Drawings indicate the minimum provisions necessary. Additional means of protection shall be provided by the Contractor as required for continued or unforeseen erosion problems, at no additional expense to the Owner.

C. Periodic maintenance of all sediment control installations shall be provided to ensure intended
purposes are accomplished. Sediment control measures shall be in working condition at the end of each day.

D. After any significant rainfall, sediment control devices shall be inspected for integrity. Any damaged device shall be corrected immediately.

E. The Contractor shall provide adequate means of control of runoff, as to not detrimentally impact downstream conditions during construction. The Contractor shall plan his operations so that permanent drainage mitigation systems such as detention/retention/infiltration basins and chambers are in place and properly functioning prior to connecting upland drainage flows to these systems. The Contractor shall plan his operations such that downstream drainage mitigation measures are in place and functioning before attempting to tie in upgradient drainage systems.

F. In the event that the Contractor is unable to sequence the work so that construction of the permanent drainage mitigation systems precedes the upland work, then the Contractor shall submit a plan indicating his proposed methods of otherwise controlling runoff from the site.

G. The "Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas" should be consulted as a guide for the selection and installation of Best Management Practices to suit the conditions encountered.

3.2 SILTATION FENCE

A. Install silt fence, well-staked at maximum eight-foot intervals in locations as shown on Contract Drawings and as directed. Staking shall occur on the disturbed area side.

B. Secure fabric to posts on upstream side and bury fabric end within a 6-inch wide by 6-inch deep cut-in trench. Wrap the fabric bottom around the inside of the trench and backfill excavated soil into the fabric pocket to anchor the fence fabric.

C. Inspect siltation fence after major storm events and periodically and remove accumulated sediment and debris. If a breach or failure of the siltation fence occurs, the fence shall immediately be restored.

3.3 STRAW BALE BARRIERS

A. Install Straw bales in location as shown on Contract Drawings and as directed.

1. Bales shall be placed in a row with ends tightly abutting the adjacent bales.
2. Each bale shall be embedded in the soil a minimum of four inches (4”).
3. Bales shall be securely anchored in place by stakes or re-bars driven through the bales and a minimum eighteen inches (18”) into the soil. The first stake in each bale shall be angled toward the previously laid bale to force bales together.

B. Inspection shall be frequent and repair or replacement shall be made as needed.

C. Bales shall be removed when they have served their usefulness so as not to block or impede stormwater flows or drainage.

3.4 STABILIZED CONSTRUCTION ENTRANCE AND STONE BERMS

A. Stone size: Use ASTM designation C-33, size No. 2 (1-1/2” to 2-1/2”). Use crushed stone.

B. Length: As effective, but not less than 50 feet.
C. Thickness: Not less than eight inches.

D. Width: Not less than full width of all points on ingress or egress, but not less than 25 feet.

E. Washing: When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch, or watercourse through the use of sand bags, gravel boards or other approved methods.

F. Maintenance: The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spoiled, dropped, washed or tracked onto public rights-of-way must be removed immediately.

G. Place crushed stone berms in locations required and as directed. Berms shall have side slopes of 1:3 or less.

H. Inspect stone berms periodically and replace and/or regrade crushed stone as required.

3.5 TEMPORARY COVERS FOR DRAINAGE STRUCTURES

A. Install temporary covers at drainage structure locations that may be subject to erosion infiltration and as directed by the Engineer.

B. Inspect drainage structures periodically. Remove sediment accumulation and regrade or replace materials as required.

3.6 TEMPORARY PROTECTIVE COVERINGS

A. Place temporary soil coverings to control erosion and sedimentation on all disturbed or graded areas as required by the construction methods employed and as directed by the Engineer. Erosion control matting shall be installed in all areas seeded or hydroseded with slopes of one vertical foot to three foot horizontal, or steeper, immediately after such areas have been seeded and a hay mulch applied as follows:

1. The area to receive matting shall have been recently seeded and shall have a smooth surface free from stones, clods or depressions.
2. Roll out of the matting perpendicular to the slope, do not stretch the fabric. In drainage swales, center the fabric along the flow line. Install the matting in a check slot at the top and bottom of the slope and at the edges of the area to be covered. Check slots shall be six inches deep and six inches wide. Fabric shall extend down one wall of the check slot and across the full width of the base. Overlap edges of matting rolls four (4) inches minimum and overlap the ends eighteen (18) inches minimum.
3. Install staples in check slots, edges, center and ends of rolls by driving specified steel staples two feet on center over the entire area to be covered except at check slots and ends of rolls, where staples shall be placed six inches on center. All staples shall be driven below finished grade.
4. Fill check slots with loam and tamp firmly.
5. Reseed check slots and all disturbed areas per Specifications.
6. Following matting installation, roll the entire area with a smooth drum roller weighing between fifty and seventy-five (50-75) pounds per linear foot of roller. The finished installation of matting shall be firmly in contact with the seeded area and provide a smooth, finished
appearance free from lumps or depressions.

B. Install erosion control matting as a temporary ground cover in all disturbed or graded areas subject to erosion and as directed by the Engineer. The temporary ground cover shall protect the site from erosion until a full permanent lawn can be installed. Install and anchor in place temporary erosion control matting in accordance with manufacturer's printed instructions or as directed by the Engineer and remove all temporary erosion control matting prior to installation of a permanent lawn.

C. Inspect protective coverings periodically and reset or replace materials as required.

3.7 EROSION CONTROL GRASSING

A. Grassing shall be applied according to State of Massachusetts Highway Department Standard Specifications.

3.8 DUST CONTROL

A. Throughout the construction period the Contractor shall carry on an active program for the control of fugitive dust within all site construction zones, or areas disturbed as a result of construction. Control methods shall include the following: Apply calcium chloride at a uniform rate of one and one-half (1 ½) pounds per square yard in areas subject to blowing. For emergency control of dust apply water to affected areas. The source of supply and the method of application for water are the responsibility of the contractor.

B. The frequency and methods of application for fugitive dust control shall be as directed by the Architect with concurrence by the Owner’s representative.

3.9 TEMPORARY PROTECTIVE COVERINGS (AFTER GROWING SEASON)

A. Place temporary covering for erosion and sedimentation control on all areas that have been graded and left exposed after October 30. Contractor shall have the choice to use either or both of the methods described herein.

B. Hay or straw shall be anchored in-place by one of the following methods and as approved by the Architect with concurrence by the Owner’s representative: Mechanical “crimping” with a tractor drawn device specifically devised to cut mulch into top two inches of soil surface or application of non-petroleum based liquid tackifier, applied at a rate and in accordance with manufacturer’s instructions for specific mulch material utilized.

C. Placement of mesh or blanket matting and anchoring in place shall be in accordance with manufacturer’s printed instructions.

D. Inspect protective coverings periodically and reset or replace materials as required.

3.10 REMOVAL AND FINAL CLEANUP

A. Once the site has been fully stabilized against erosion, and with the approval of the Owner’s Representative remove sediment control devices and all accumulated silt. Dispose of silt and waste materials offsite. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated.

END OF SECTION
SECTION 321000
BASES, BALLASTS, AND PAVING

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

1.02 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. Bituminous Concrete Pavements.
2. Crack Sealing.
3. Cold-planing of pavements.
4. Installing Pavement Markings.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 312000, Earth Moving.
2. Section 033000, Cast-In-Place Concrete.

1.03 SUBMITTALS

A. Refer to Section 013300 - Submittals for submittal provisions and procedures.

1. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.
2. Submit shop drawings for curbing items.

1.04 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein:

1. Commonwealth of Massachusetts, Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges, latest English Edition with amendments, hereinafter referred to as the “Standard Specifications.” All references to method of measurement, basis of payment and payment items in the Standard Specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications shall include all related articles mentioned therein.
3. AASHTO: American Association of State Highway and Transportation Officials.
4. ACI: American Concrete Institute.

1.05 EXAMINATION OF SITE AND DOCUMENTS
A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.06 WEATHER CONDITIONS

A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50°F (10°C), and when temperature has not been below 35°F (1°C) for 12 hours immediately prior to application. Do not apply when base surface is wet or contains an excess of moisture.

B. Spread asphalt concrete courses when atmospheric temperature is above 40°F (4°C), and when base surface is dry. Base course may be placed when air temperature is above 30°F (-1°C) and rising.

1.07 PHASING REQUIREMENTS

A. Phase 1: Installation of three new modular concrete buildings for new communications equipment to be serviced from the existing communications tower that is to remain. Work includes all site work for new construction, new foundations and retaining walls, new modular buildings and associated architectural work and mechanical and electrical work as indicated on the drawings.

1. New communications equipment work and hook up to the existing tower and disconnection of the old communication equipment in the existing building. This work will be done by the City of Newton’s Communications Contractor under a separate contract. Communications work will include providing all communications equipment, materials and labor to provide an operational communication service for the City of Newton in the new modular buildings. After delivery of the new communication service the Communications Contractor shall disconnect the old communications equipment, salvage reusable equipment and make safe the remaining equipment ready for removal by the demolition contractor in Phase 2.

B. Phase 2: Commences only after the new communications equipment has been installed in the new modular building by the City of Newton’s Communications Contractor, and the communications services are operational. Phase 2 includes demolition of the old existing Communications Equipment Building including but not limited to: removal of non-salvageable communications equipment; demolition and removal of existing building and foundation materials. All new Site Work as shown on the drawings including but not limited to: site demolition, excavation, fill and regrading, landscape materials and plantings, new fencing, new walkways and asphalt repairs.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Subgrade base course material shall conform to the applicable subsections of Section 312000, Earth Moving of this Specification.

B. Bituminous Concrete Base Course shall conform to the applicable subsections of Section 420, Class I Bituminous Concrete Base Course, Type I-1 of the “Standard Specifications”.

C. Bituminous Concrete Pavement shall conform to the applicable subsections of Section 460, Class I

BASES, BALLASTS, AND PAVING

321000-2
Bituminous Concrete Pavement, Type I-1 of the "Standard Specifications."

D. Lane Marking Paint: Fast Drying White Water-borne Traffic Paint and Fast Drying Yellow Water-borne Traffic Paint as specified in the "Standard Specifications" under Sections M7.01.23, and M7.01.24, respectively.

2.02 RECLAIMED BASE COURSE

A. The work under this item shall consist of scarifying and pulverizing in place the existing asphalt pavement and underlying material, mixing and blending the material, and spreading and compacting the mixture to the lines and grades shown on the Contract Drawings.

B. Equipment such as rear-mounted ripper crushers and cold planing/milling equipment will not be permitted to perform the work under this item.

C. Prior to scarifying and pulverizing the pavement, the Contractor shall locate, protect, or remove all drainage and utility structure castings. All lowered structures shall be protected and covered by a steel plate and all watergates shall be covered as well to prevent any materials from falling into the bottom sections. All materials that fall into any structures as a result of the Contractor's operations shall be removed by the Contractor at no additional cost.

D. The existing full bituminous pavement structure and underlying base materials shall be simultaneously crushed, pulverized, and blended into a homogenous material to create the following gradation:

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-inch</td>
<td>100</td>
</tr>
<tr>
<td>1½-inch</td>
<td>70-100</td>
</tr>
<tr>
<td>½-inch</td>
<td>50-85</td>
</tr>
<tr>
<td>No. 4</td>
<td>30-60</td>
</tr>
<tr>
<td>No. 50</td>
<td>8-28</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10</td>
</tr>
</tbody>
</table>

E. The construction operation shall be performed in such a manner as to allow for continuous vehicular access as required by the project schedule. Emergency vehicular access shall be maintained at all times.

2.03 BITUMINOUS CONCRETE CURB

A. Bituminous concrete curb shall conform to Section 501.64 of the Standard Specifications for Class 1 Bituminous Concrete Curb, Type-2 and Type-3 and shall meet the dimensions as shown on the Contract Drawings.

B. Bituminous concrete shall meet the requirements of Dense Mix as specified in the Standard Specifications under Section M3.12.00.

2.04 EXPANSION JOINT FILLER AND SEALANT

A. Expansion joint filler strips shall conform to the requirements of AASHTO M-33.

B. Joint sealant shall be a self-leveling, gun-grade, non-staining, polyurethane-based material which cures at ambient temperature to a firm flexible tear resistant rubber made specifically for its intended use. The color shall be concrete gray.
2.05 AUXILIARY MATERIALS


B. Slip-Resisting Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Pavement-Marking Paint: Acrylic/latex type, low VOC, water-borne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
   1. Color: As indicated.

PART 3 – EXECUTION

3.01 GENERAL

A. Subbase under paving shall be compacted as described in Section 312000, Earth Moving. Add material meeting the requirements of ordinary borrow to bring the subgrade to the required grade as necessary before placing base course.

B. The gravel base course shall be spread in layers upon the prepared subgrade conforming to the required line and grade. Gravel shall be placed in compacted layers not more than 4 inches thick compacted to not less than 95 percent of the maximum dry density of the material. Any stone greater than 3 inches in size shall be removed. Compaction shall continue until the surface is even and true to line and grade.

C. Gravel base course shall be placed on backfilled and compacted trenches to proper grade before placement of pavement.

D. The edges of existing pavement that is to remain shall be saw cut to an even, straight edge using a power-driver rotary saw; use of a jackhammer is unacceptable. This includes road, parking lot, sidewalk, and utility trench edges.

E. Bituminous concrete courses shall be spread and compacted to the finished thicknesses as shown on the Contract Drawings. A smooth even surface shall be produced.

F. Any joints at junctions of old and new pavements shall be sealed with a hot poured rubber asphalt sealer and covered with sand.

3.02 COLD-PLANING

A. This work consists of removing bituminous or cement concrete pavements by use of a cold planer in areas designed on the Contract Drawings. The cold planer must be equipped with an elevating device capable of loading planed material directly into dump trucks while operative. It shall have all the necessary safety devices, such as reflectors, headlights, taillights, flashing lights, and backup signals so as to operate safely in traffic both day and/or night.

B. The cold planer shall be designed and built for planing flexible pavements and possess the ability to plane cement concrete patches when encountered in bituminous pavement. It shall be self-propelled and have the means for planing without tearing or gouging the underlying surface. Variable lacing patterns shall be provided to permit a rough grooved or smooth surface as directed.

C. The cold planer shall be able to make up to a 3 inch cut or any specified lesser depth may be required.
in one pass. The minimum width of pavement planed in each pass shall be 6 feet, except in areas to be trimmed and edged. The machine shall be adjustable as to crown and depth and meet the standards set by the Air Quality Act for noise and air pollution.

D. The planed surface shall conform to the grade and cross-slope required. The surface shall not be torn, gouged, shoveled, broken, or excessively grooved. It shall be free of imperfections in workmanship that prevent resurfacing after this operation. Surface texture shall be as specified by the Engineer and excess material shall be removed so the surface is acceptable to traffic if required.

3.03 CURBING AND EDGING

A. Construct curbing and edging of the type and at the locations shown on the Contract Drawings.

B. Construct curbing and edging in accordance with the details shown on the Contract Drawings.

   1. The foundation for curb and edging shall consist of gravel spread upon the subgrade and after being thoroughly compacted shall be 6 inches in depth. The bottom of the curbstones shall be fully seated and supported on the compacted subgrade.

   2. The joints between curbstones shall be carefully filled with cement mortar and neatly pointed on all exposed surfaces.

   3. After pointing, the curbstones shall be cleaned of all excess mortar.

C. After curbing and edging is in place at the line and grade shown on the Contract Drawings backfill and compact equally on both sides with subbase course material as specified in Section 312000, Earth Moving. Compaction shall be by vibratory, hand-operated equipment and shall achieve the same density as specified for subbase course in Section 312000, Earth Moving.

3.04 SURFACE PREPARATION

A. Proof Roll the prepared subbase. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.

3.05 PLACING MIX

A. General: Spread bituminous concrete mixture on prepared surface, spread and strike-off. Spread mixture at minimum temperature of 225°F (107°C). Place inaccessible and small areas by hand. Place each course to required grade, cross-section, and compacted thickness. Protect all adjacent construction from staining with mix or damage by mechanical equipment. Clean, repair or replace any construction stained or damaged at no additional cost to the Owner.

B. Paver Operation: Spread bituminous in strips not less than 10-feet wide, unless otherwise acceptable to Engineer. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.

C. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of bituminous concrete course. Clean contact surfaces and apply Hot Poured Rubberized Asphalt Sealer.

D. Coat surfaces of watergate covers, gas gate covers, manhole covers and catch basin grates with a release agent to prevent bond with asphalt pavement.

E. The equipment for spreading bituminous concrete shall be mechanical, self-powered pavers capable of spreading and finishing the mixture true to line, grade, width, and crown by means of fully automated controls for both longitudinal and transverse slope.
F. The pavers shall operate while bituminous mixture is being spread at a speed that will produce a uniform surface texture free of any rippling or unevenness.

G. The mixtures shall be placed and compacted only at such times as to permit the proper inspection and checking by the Engineer or Owner’s Representative.

H. The mixtures shall only be placed in the work when they can be efficiently and satisfactorily placed by the methods stipulated herein. Unless otherwise permitted by the Engineer or Owner’s Representative for special conditions, only machine methods of placing shall be used.

I. No mixture shall be placed unless the breakdown and intermediate rolling can be completed by the time the material has cooled to 170°F and provided that the density of the completed pavement attains at least 95 percent of the laboratory compacted density.

J. The mixtures shall be placed only upon approved surfaces that are clean from foreign materials and dry and when weather conditions are suitable. The Engineer or Owner’s Representative may, however, at the entire responsibility of the Contractor, permit work to continue when overtaken by sudden rain, but only with material that may be in transit from the plant at the time and then only when the temperature of the mixture is within the temperature limits specified and the existing surface on the roadway is not excessively wet.

K. The bituminous concrete shall be placed in course depths as shown in the Contract Drawings, as specified and as directed by the Engineer.

L. When an existing surface or new base upon which the bottom course is to be placed contains unsatisfactory irregularities, in the Engineer’s or Owner’s Representative’s judgment, such irregularities shall be eliminated by an adequate placing and compaction of mixture so as to furnish a surface with true contour and grade before placing any specified course of mixture.

M. Special attention shall be given to proper testing of the surface of each course with a straightedge. The finished surfaces shall be even and uniform throughout.

N. Any mixture that becomes loose or broken, mixed with dirt, or in any way defective shall be removed and replaced with new mixture that shall be compacted to conform to the surrounding area. Areas of one square foot or more showing an excess of bitumen shall be removed and replaced.

O. Immediately after any course is screened and before roller compaction is started, the surface shall be checked, any irregularities adjusted, any accumulation from the screed removed by rake or lute, and all fat spots in any course removed and replaced with satisfactory material. Irregularities in alignment and grade along outside edges shall be corrected by the addition or removal of mixture before the edges are rolled. Indiscriminate casting of mix on the new screened surface, where irregularities are not evident, shall not be permitted.

P. Spreading by hand methods will be permitted only for particular locations in the work that, because of irregularity, inaccessibility, or other unavoidable obstacles, do not allow mechanical spreading and finishing.

3.06 ROLLING

A. General: Begin rolling when mixture will bear roller weight without excessive displacement.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and
filling, if required, with hot material.

D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut-out such areas and fill with fresh, hot bituminous concrete. Compact by rolling to match the surrounding surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked by wheel traffic.

I. After the paving mixture has been properly spread, initial compaction shall be obtained by the use of power rollers. The rollers shall be steel wheeled supplemented with pneumatic-tired rollers where required or where permitted by the specifications, vibratory rollers.

J. Steel wheel rollers for initial and intermediate rolling shall have a weight of not less than 240 pounds per inch width of tread.

K. Each roller shall be operated by a competent, experienced roller operator and shall be kept in as nearly continuous operation as practicable while work is underway. The mixture shall be rolled longitudinally, diagonally, and transversely as may be necessary to produce the required contour for surface. Longitudinal rolling shall start at the side and proceed toward the center of the pavement, except on superelevated pavements where the rolling shall begin on the low side and progress to the high side, overlapping on successive trips by at least 12 inches. The rolling shall be continued and so executed that all roller marks, ridges, porous spots, and impressions are eliminated and the resulting surface has the required grade and contour. The motion of the rollers shall at all times be slow enough to avoid any displacement of the hot mixture. Any displacement or marring of the surface occurring as a result of reversing the direction of the rollers, or from any other cause, shall be corrected. To prevent adhesion with the mixture, the wheels of the steel rollers shall be kept lightly moistened with water, but excess water will not be permitted. The use of oil for this purpose will not be allowed.

L. Along curbs, structures, and all places not accessible with a roller, the mixture shall be thoroughly compacted with mechanical tamping devices. The surface of the mixture after compaction shall be smooth and true to the established line and grade.

M. Placing of the mixture shall be as nearly continuous as possible and the roller shall pass over the unprotected end of the newly placed mixture only when the placing of the course is to be discontinued for such length of time as would permit the mixture to attain initial stability. In all such cases, including the formation of joints, provision shall be made for proper bond with the new surface for the full specified depths of the courses.

N. The maximum length of longitudinal joint shall be such that the temperature of the mixture of the joint shall be not less than 200°F when abutting mixture is placed.

O. If the paving sequence or other conditions cause the joint temperature to fall below 200°F, the joint shall be treated prior to laying the next lane of bituminous concrete as follows:
1. The joint shall be coated with a hot poured rubberized asphalt sealant meeting the requirements of Federal Specification SS-S-1401 or SS-S-164.

P. Longitudinal and transverse joints shall be made in a careful manner, well bonded and sealed, and true to line and grade.

Q. In making joints along any adjoining edge, such as curb, gutter, or an adjoining pavement, and after the mixture is placed by the mechanical spreader, just enough of the hot material shall be placed by hand method to fill any space left open. These joints shall be properly "set-up" with the back of a rake at the proper height and level to receive the maximum compaction. The work of "setting-up" these joints shall be performed only by competent workmen.

R. Where and as directed, the first width of any course shall be placed not less than 1 foot wider than the first width of top course and successive widths of top and as any other courses shall be so placed that there will be at least a 1-foot overlap between the joints in the top course and the other course.

S. The rolling of the successive widths of courses shall overlap and shall be performed so as to leave smooth, uniform joints and cross-sections.

3.07 PORTLAND CEMENT CONCRETE WALKWAYS

A. Areas to be paved shall be brought to subgrade elevation in accordance with the requirements of Section 312000, Earth Moving. The gravel borrow base course shall be placed and compacted in accordance with the requirements of Section 312000, Earth Moving to the compacted depth as indicated on the Contract Drawings. The base course shall be inspected and approved by the Owner's Representative before placement of concrete paving.

B. Edge forms and transverse forms shall be clean, smooth, free from warp, of sufficient strength to resist bowing out of shape, and of a depth equal to the thickness of the paving. Stake the forms in place to the proper alignment and grade. Clean forms after each use and coat with a release agent.

C. Deposit and spread concrete in a continuous operation between transverse joints. Concrete shall be placed in an alternate, every-other panel between transverse joints. Consolidate concrete with mechanical vibrating equipment supplemented by hand-spading, rodding, and tamping.

D. Screed surfaces with a straightedge and strike-off. Commence initial floating to form an open-textured and uniform surface plane.

E. Finish floating and troweling shall only be done after the bleed-water and water sheen have disappeared and the concrete surface has sufficiently stiffened. Tool edges of pavement at curbline and expansion joints with an edging tool with a radius of ⅛-inch.

F. After final floating steel trowel surface to true line and grade, all surface shall receive a light-to-medium broom finish perpendicular to the direction of travel.

G. Use an evaporation retarder if weather conditions are hot, dry, or windy. Surfaces shall be cured by completely covering with curing paper or with an application of a curing compound.

H. Expansion joint shall be located at 30-foot intervals perpendicular to the direction of travel and around all castings, fire hydrants, walls, buildings, and light pole bases within the walkway. Expansion joints shall be made with ⅜-inch-thick preformed filler material and sealed at the surface with light-gray colored joint sealant.

I. Control joints shall be spaced at 6-foot intervals to a depth of one quarter of the thickness of the concrete slab. Form joints with power-driven saws.
J. Construction joints shall be placed whenever placing on concrete is suspended for more than 30 minutes.
   1. Butt joint with dowels or thickened edge joint shall be used if construction joints occur at location of control joint.
   2. Keyed joints with tiebars shall be used if the joint occurs at any other location.

3.08 PAVEMENT MARKINGS

A. The work under this Item shall be in conformance with Section 860 of the Standard Specifications and the Manual on Uniform Traffic Control Devices, current edition.

B. Cleaning: Sweep and clean surface thoroughly to remove loose material and dust. Markings shall be placed no earlier than 48 hours after the placement of the bituminous concrete top course and at temperatures above 45° F.

C. Apply paint with mechanical equipment to produce uniform straight edges. Lines to be applied at the width and color designated in the Contract Drawings. The Contractor shall establish reference lines for the proper layout of all markings. Apply in two coats at manufacturer's recommended rates. Furnish and place all barricades necessary to prevent tracking of wet paint by vehicles and pedestrians.

D. While the paint is still wet reflectorized glass beads shall be evenly applied at the rate of 6 pounds per gallon of paint.

3.09 FIELD QUALITY CONTROL

A. Test in-place asphalt and cement concrete courses for compliance with tolerance requirements. Repair or remove and replace unacceptable paving as directed by Engineer or Owner's Representative. In-place surfaces will not be acceptable if exceeding the allowable variation from the following required tolerances:
   2. Sidewalk Elevation: ⅛-inch, plus or minus.
   3. Roadway Elevation: ¼-inch, plus or minus.
   5. Surface: Gap below 10-foot-long straightedge, ⅛-inch.

B. The Contractor is responsible for ensuring that the grade at accessible curb cuts, sidewalks, and parking spaces does not exceed Massachusetts Architectural Access Board requirements CMR 521.

C. Compaction
   1. The bituminous mixture shall be compacted to at least 95% of the density achieved on the laboratory testing of the design mix for the project.
   2. Density will be checked by the Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods, ASTM 2950 at the Contractor's expense.

D. Guarantee: During the one year guarantee period, the Contractor shall maintain the surfacing and shall promptly fill with similar material in compliance with the above specifications, any depressions and holes that may occur so as to keep the surfacing in a safe and satisfactory condition for traffic.

END OF SECTION 321000
SECTION 321243
POROUS ASPHALT

PART 1 - GENERAL

1.01. 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 Specifications.

1.02. DESCRIPTION OF WORK

A. Include all labor, material, transportation and services to complete installation of the permeable aggregate base and the porous asphalt paving as shown on the plans.

B. This specification is intended to be used for porous asphalt pavement in parking lot, fire lane, and pedestrian access applications. Stormwater management functions of porous asphalt installations include water quality treatment, peak flow reduction, storm volume reduction via groundwater recharge, and increased time lag in flow.

C. The work of this Section includes subgrade preparation, installation of the underlying porous media beds, and porous asphalt mix (mix) design, production, and installation. Porous media beds refer to the beds underlying the porous asphalt pavement. Porous asphalt pavement refers to the compacted mix of modified asphalt binder and aggregate.


E. Related Work: The following items are not included in this Section and will be performed under the designated Sections.

   1. Section 31 20 00, Earth Moving for excavation, backfill and compaction requirements
   2. Section 33 40 00, Storm Drainage Utilities

1.03. SUBMITTALS AND TESTING

A. Submit a list of materials proposed for work under this Section including the name and address of the materials producers and the locations from which the materials are to be obtained.

B. Submit certificates, signed by the materials producers and the relevant subcontractors, stating that materials meet or exceed the specified requirements, for review and approval by the Engineer.

C. Submittal requirements for samples and certificates are summarized in Table 1 and discussed in further detail in the Materials section.
Table 1. Submittal requirements

<table>
<thead>
<tr>
<th>Material or Pavement Course*</th>
<th>Properties to be Reported on Certificate**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porous Asphalt</td>
<td>Porous asphalt composition including aggregate sieve analysis and asphalt composition</td>
</tr>
<tr>
<td>Binder</td>
<td>PGAB certification</td>
</tr>
<tr>
<td>Course Aggregate</td>
<td>Gradation, wear, fractured faces, fractured and elongation</td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>Gradation, plasticity index</td>
</tr>
<tr>
<td>Silicone</td>
<td>Manufacturer’s certification</td>
</tr>
<tr>
<td>Fibers (optional)</td>
<td>Manufacturer’s certification</td>
</tr>
<tr>
<td>Mineral Filler (optional)</td>
<td>Manufacturer’s certification</td>
</tr>
<tr>
<td>Fatty amines (optional anti-stirp)</td>
<td>Manufacturer’s certification</td>
</tr>
<tr>
<td>Hydrated lime</td>
<td>Manufacturer’s certification</td>
</tr>
<tr>
<td>Choker Course</td>
<td>Gradation, max. wash loss, min. durability index, max. abrasion loss</td>
</tr>
<tr>
<td>Filter Course</td>
<td>Gradation</td>
</tr>
<tr>
<td>Filter Blanket</td>
<td>Gradation</td>
</tr>
<tr>
<td>Reservoir Course</td>
<td>Gradation, max. wash loss, min. durability index, max. abrasion loss; air voids</td>
</tr>
<tr>
<td>Geotextile Filter Fabric</td>
<td>Manufacturer's certification</td>
</tr>
</tbody>
</table>

*Samples of each material shall be submitted to the Engineer (or QA inspector for mix).
**At a minimum; more material properties may be required (refer to Materials section).

1.04. QUALITY ASSURANCE

A. Manufacturer's/Plant's Qualifications: Firms regularly engaged in manufacture of porous asphalt, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications: Firm with at least three years of successful installation experience on projects with porous asphalt similar to that required for this project.

C. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this section.

D. Codes and Standards - All materials, methods of construction and workmanship shall conform to applicable requirements of AASHTO and ASTM Standards or other standards as specified.

E. Quality Assurance requirements for production of mix are discussed in the Materials section, and for construction of the porous media beds and paving in the Execution section.

1.05. REFERENCE STANDARDS
A. The following standards are applicable to the work of this section to the extent referenced herein.

1. Commonwealth of Massachusetts, Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges, latest English Edition with amendments, hereinafter referred to as the “Standard Specifications.” All references to method of measurement, basis of payment and payment items in the Standard Specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications shall include all related articles mentioned therein.

2. Commonwealth of Massachusetts, Massachusetts Highway Department, Construction Standards, latest Edition with amendments, hereinafter referred to as the “Construction Standards.”


1.06. EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

C. Site Assessment should be performed per the steps outlined in IS 131 (NAPA, 2003).

D. Construction Phasing should be performed as outlined in IS 131 (NAPA, 2003).

E. Protection of Existing Improvements

1. Protect adjacent work from splashing of pavement materials. Remove all stains from exposed surfaces of pavement, structures, and grounds. Remove all waste and spillage.

2. Proper erosion and sediment control practices shall be provided in accordance with existing regulations and Stormwater Pollution Prevention Plan. Do not damage or disturb existing improvements or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.

3. Restore damaged improvements, including existing pavement on or adjacent to the site that has been damaged as a result of construction work, to their original condition or repair as directed to the satisfaction of the Engineer or Owner’s Representative at no additional cost.

F. Safety and Traffic Control

1. Notify and cooperate with local authorities and other organizations having jurisdiction when construction work will interfere with existing roads and traffic.
2. Provide temporary barriers, signs, warning lights, flaggers, and other protections as required to assure the safety of persons and vehicles around the construction area and to organize the smooth flow of traffic.

G. Weather Limitations

1. Open graded friction course shall not be placed between November 15 and March 15, or when the ambient air temperature at the pavement site in the shade away from artificial heat is below 16 °C (60 °F) or when the actual ground temperature is below 10 °C (50 °F). Only the Engineer may adjust the air temperature requirement or extend the dates of the pavement season.

2. The Contractor shall not pave on days when rain is forecast for the day, unless a change in the weather results in favorable conditions as determined by the Engineer.

1.07 PHASING REQUIREMENTS

A. Phase 1: Installation of three new modular concrete buildings for new communications equipment to be serviced from the existing communications tower that is to remain. Work includes all site work for new construction, new foundations and retaining walls, new modular buildings and associated architectural work and mechanical and electrical work as indicated on the drawings.

1. New communications equipment work and hook up to the existing tower and disconnection of the old communication equipment in the existing building. This work will be done by the City of Newton's Communications Contractor under a separate contract. Communications work will include providing all communications equipment, materials and labor to provide an operational communication service for the City of Newton in the new modular buildings. After delivery of the new communication service the Communications Contractor shall disconnect the old communications equipment, salvage reusable equipment and make safe the remaining equipment ready for removal by the demolition contractor in Phase 2.

B. Phase 2: Commences only after the new communications equipment has been installed in the new modular building by the City of Newton's Communications Contractor, and the communications services are operational. Phase 2 includes demolition of the old existing Communications Equipment Building including but not limited to: removal of non-salvageable communications equipment; demolition and removal of existing building and foundation materials. All new Site Work as shown on the drawings including but not limited to: site demolition, excavation, fill and regrading, landscape materials and plantings, new fencing, new walkways and asphalt repairs.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Porous Media Infiltration Beds

1. The porous media infiltration beds include, as indicated in the detail, from top (directly below porous asphalt) to bottom:
   a. 4" thick layer of **choker course** of crushed stone.
   b. 12" minimum thickness layer of **filter course** of poorly graded sand (a.k.a. bankrun gravel).
   c. 3" minimum thickness **filter blanket** that is an intermediate setting bed (pea gravel).
   d. **Reservoir Course**. The thickness of the reservoir course is dependant on the required storage.
   e. Nonwoven **geotextile filter fabric** (geotextile) is used only for stabilizing the sloping sides of the porous asphalt excavation and not to be used on the bottom of the system unless needed for structural reasons.

2. **Choker Course** shall meet the following crushed stone criteria:
a. Gradation for AASHTO No. 57 as specified in Table 1 below.
b. Maximum Wash Loss of 0.5%.
c. Minimum Durability Index of 35.
d. Maximum Abrasion Loss of 10% for 100 revs. and max. of 50% for 500 revs.

3. **Filter Course** shall meet the following criteria:
   a. Meet the gradation for Bank Run Gravel (NHDOT 304.2)
      
      | Sieve Size | Percent Passing by Weight |
      |------------|---------------------------|
      | 6 inch     | 100                       |
      | #4         | 25-70                     |
      | #200       | 0-12 Fraction passing the No. 4 sieve |

   b. Have a hydraulic conductivity (also referred to as coefficient of permeability) of 10 to 60 ft/day at 92% compaction unless otherwise approved by the Engineer. Great care needs to be used to not over-compact materials due to loss of infiltration capacity. In order to select an appropriate gradation, coefficient of permeability may be estimated through an equation that relates gradation to permeability, such as described in *Correlations of Permeability and Grain Size* (Shepherd, 1989) or in *Section 8.7 Estimation of Saturated Hydraulic Conductivity* (Freeze and Cherry, 1979). Coefficient of permeability for the selected filter course material shall be measured by ASTM D5084 and reported to the Engineer.

4. **Filter Blanket** shall meet the follow criteria:
   a. Gradation of the **Filter Blanket** shall be an intermediate size between the finer **Filter Course** above, and the coarser **Reservoir Course** below, for the purpose of preventing the migration of a fine setting bed into the coarser reservoir material. An acceptable gradation shall be calculated by the Contractor based on selected gradations of the **Filter Course** and **Reservoir Course** using criteria outlined in the HEC 11 (Brown and Clyde, 1989). A typical double washed 3/8" to ½" crushed stone free of particles, fines, and dust or a pea-gravel with a median particle diameter of 3/8" is typically used as the **Filter Blanket**.

5. **Reservoir Course** shall meet the following criteria:
   a. Shall have the gradation of AASHTO No. 3 as specified in Table 1. If the AASHTO No. 3 gradation cannot be met, AASHTO No. 5 is acceptable with approval of the Engineer.
   b. Shall Maximum Wash Loss of 0.5%.
   c. Minimum Durability Index of 35.
   d. Maximum Abrasion Loss of 10% for 100 revs. and max. of 50% for 500 revs.
   e. Reservoir course depth shall meet depth on plan but shall have a 4" minimum thickness of Reservoir Course shall be installed as a capillary barrier for frost heave protection at interface between subbase and native materials.
   f. Underlying native materials are either well drained (Hydrologic Group A and B soils) or subdrains should be installed to insure subbase is well drained.
   g. Subdrains, if included, are elevated at minimum 4" from bottom to provide storage and infiltration for 1" water quality volume.

Table 1. Gradients of **Choker Course**, **Filter Course**, and **Reservoir Course** materials

<table>
<thead>
<tr>
<th>U.S. Standard Sieve Size</th>
<th>Choker Course (AASHTO No. 57)</th>
<th>Filter Course (NHDOT 304.2)</th>
<th>Reservoir Course (AASHTO No. 3)</th>
<th>Res. Course Alt.* (AASHTO No. 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6” (150mm)</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

POROUS PAVING
321243-5
6. Non-woven geotextile filter fabric for the sloping sides only shall be Mirafi 160N, or approved equal and shall conform to Table 2. Mirafi ® 160N is a non-woven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. 160N is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids.

Table 2. Non-woven geotextile filter fabric properties.

<table>
<thead>
<tr>
<th>Mechanical Properties</th>
<th>Test Method</th>
<th>Unit</th>
<th>Min Avg Roll Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MD</td>
<td>CD</td>
</tr>
<tr>
<td>Grab Tensile Strength</td>
<td>ASTM D 4632</td>
<td>kN (lbs)</td>
<td>0.71 (160)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.71 (160)</td>
</tr>
<tr>
<td>Grab Tensile Elongation</td>
<td>ASTM D 4632</td>
<td>%</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Trapezoid Tear Strength</td>
<td>ASTM D 4533</td>
<td>kN (lbs)</td>
<td>0.27 (60)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.27 (60)</td>
</tr>
<tr>
<td>Mullen Burst Strength</td>
<td>ASTM D 3786</td>
<td>kPa (psi)</td>
<td>2100 (305)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>ASTM D 4833</td>
<td>kN (lbs)</td>
<td>0.42 (95)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apparent Opening Size (AOS)</td>
<td>ASTM D 4751</td>
<td>mm (U.S. Sieve)</td>
<td>0.212 (70)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permeability</td>
<td>ASTM D 4491</td>
<td>cm/sec</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow Rate</td>
<td>ASTM D 4491</td>
<td>lpm/m2 (gpm/ft2)</td>
<td>4477 (110)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UV Resistance (at 500 hours)</td>
<td>ASTM D 4355</td>
<td>% strength</td>
<td>retained</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical Properties</th>
<th>Test Method</th>
<th>Unit</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>ASTM D5261</td>
<td>g/m2 (oz/yd2)</td>
<td>217 (6.4)</td>
</tr>
<tr>
<td>Thickness</td>
<td>ASTM D 5199</td>
<td>mm (mils)</td>
<td>1.9 (75)</td>
</tr>
<tr>
<td>Roll Dim. (width x length)</td>
<td>-</td>
<td>m (ft)</td>
<td>4.5 x 91 (15 x 300)</td>
</tr>
<tr>
<td>Roll Area</td>
<td>-</td>
<td>m2 (yd2)</td>
<td>418 (500)</td>
</tr>
<tr>
<td>Estimated Roll Weight</td>
<td>-</td>
<td>kg (lb)</td>
<td>99 (217)</td>
</tr>
</tbody>
</table>

7. Alternative materials for the porous media beds, filter blanket, and geotextile may be substituted at the discretion of the Engineer

B. Porous Asphalt Mix

1. Mix materials consist of Open-Graded Friction Course (OGFC) or modified performance grade asphalt binder (PGAB), coarse and fine aggregates, and optional additives such as silicone, fibers, mineral fillers, fatty amines, and hydrated lime. Materials shall meet the requirements of the Commonwealth of Massachusetts, Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges, latest English Edition with amendments for OGFC or
the requirements of the NAPA’s *Design, Construction, and Maintenance of Open-Graded Friction Courses, Information Series 115 (2002)* for PGAB, except where noted otherwise below or approved in writing by the Engineer.

2. **Open Graded Friction Course (OGFC).** The porous asphalt shall meet MHD material specification for Open-Graded Friction Course (OGFC) - M3.11.03 Table B.

3. **Polymer Modified PGAB.** The asphalt binder shall be a polymer modified Performance Graded asphalt binder (PGAB) used in the production of Superpave Hot Mix Asphalt (HMA) mixtures. In general, PGAB shall be two grades stiffer than that required for dense mix asphalt (DMA) parking lot installations, which is often achieved by adding a polymer. The polymer modified binder for this project shall be a PG 76-22 SBS or a PG 76-22 SBR (i.e. the PGAB binder may be a 64-28 that is modified with either SBS or SBR to meet the PG 76-22 specification). The binder shall meet the requirements of AASHTO M320.

   - **Pre-Blended PG 76-22 SBS** will be supplied by an approved PGAB supplier holding a Quality Control Plan approved by the state MHD. A Bill of Lading (BOL) will be delivered with each transport of PG 76-22 SBS. A copy of the BOL will be furnished to the QA inspector at the Plant.

   - **Post-Blended PG 76-22 SBR** will be supplied by a HMA plant approved to perform in-line blending or blending by injection into the pugmill. A Post-Blended SBR Binder Quality Control Plan (Table 3 will be submitted to the Engineer for approval at least 10 working days prior to production.

   - Quality control plans may be altered at the discretion of the Engineer and based on feasible testing as suggested by the asphalt producer. Certain QC testing requirements during production may not be feasible for small projects in which limited asphalt is generated. Some testing methods cannot be completed during the time needed during small batch production. The feasibility should be assessed with the Engineer and producer.

4. **Anti-Stripping Mix Additives.**

   The mix shall be tested for moisture susceptibility and asphalt stripping from the aggregate by AASHTO T283. If the retained tensile strength (TSR) < 80% upon testing, a heat stable additive shall be furnished to improve the anti-stripping properties of the asphalt binder. Test with one freeze-thaw cycle (rather than five recommended in *NAPA IS 115*). The amount and type of additive (e.g. fatty amines or hydrated lime) to be used shall be based on the manufacturer’s recommendations, the mix design test results, and shall be approved by the Engineer.

   Silicone shall be added to the binder at the rate of 1.5 mL/m3 (1 oz. per 5000 gal).

   Fibers may be added per manufacturer and *NAPA IS 115* recommendation if the draindown requirement cannot be met (<0.3% via ASTM D6390) provided that the air void content requirement is met (>18%, or >16% as tested with CoreLok device).

   Additives should be added per the relevant MHD specification and *NAPA IS 115*. 
Table 3 Post-Blended SBR Binder QC Plan requirements

<table>
<thead>
<tr>
<th>The QC Plan will contain:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Company name and address</td>
</tr>
<tr>
<td>2. Plant location and address</td>
</tr>
<tr>
<td>3. Type of Facility</td>
</tr>
<tr>
<td>4. Contact information for the Quality Control Plan Administrator</td>
</tr>
<tr>
<td>5. QC Tests to be performed on each PGAB</td>
</tr>
<tr>
<td>6. Name(s) of QC Testing Lab to perform QC and Process Control testing.</td>
</tr>
<tr>
<td>7. Actions to be taken for PG Binders and SBR in Non compliance</td>
</tr>
<tr>
<td>8. List of mechanical controls (requirements below)</td>
</tr>
<tr>
<td>9. List of process controls and documentation (requirements below)</td>
</tr>
</tbody>
</table>

List of Mechanical Controls:

1. Liquid SBR no-flow alert system with an “alert” located in the control room and automatic documentation of a no flow situation on the printout

2. Provide means of calibrating the liquid SBR metering system to a delivery tolerance of 1%.

3. A batching tolerance at the end of each day’s production must be within 0.5% of the amount of SBR solids specified.

4. Mag-flow meter (other metering system may be considered)

5. Method of sampling liquid SBR

List of Process Controls and Documentation:

1. Printouts of liquid SBR and PG binder quantities must be synchronized within one minute of each other

2. SBR supplier certification showing the percent of SBR solids in liquid SBR

3. Test results of a lab sample blended with the specified dosage of SBR. At a minimum, provide the name of the PGAB and liquid SBR suppliers, and PGAB information such as grade and lot number, and SBR product name used for the sample.

4. MSDS sheet for liquid SBR

5. Handling, storage, and usage requirements will be followed as required by the liquid SBR manufacturer

6. At a minimum, provide a table showing proposed rate of SBR liquid (L/min.) in relation to HMA production rate (tons per hour, TPH) for the % solids in liquid SBR, quantity of SBR specified for HMA production, and the specific gravity of the SBR.

7. QCT or QC Plan Administrator must be responsible for documenting quantities, ensuring actual use is within tolerance, etc. All printouts, calculations, supplier certifications etc. must be filed and retained as part of the QCTs daily diary/reports.

8. Method and Frequency of testing at the HMA plant, including initial testing and specification testing.
*This Plan shall be submitted to the Engineer 10 days before production

5. Coarse Aggregate. Coarse aggregate shall be that part of the aggregate retained on the No. 8 sieve; it shall consist of clean, tough, durable fragments of crushed stone, or crushed gravel of uniform quality throughout.

Coarse aggregate shall be crushed stone or crushed gravel and shall have a percentage of wear as determined by AASHTO T96 of not more than 40 percent. In the mixture, at least 75 percent, by mass (weight), of the material coarser than the 4.75 mm (No. 4) sieve shall have at least two fractured faces, and 90 percent shall have one or more fractured faces (ASTM D5821). Coarse aggregate shall be free from clay balls, organic matter, deleterious substances, and a not more then 8.0% of flat or elongated pieces (>3:1) as specified in ASTM D4791.

6. Fine Aggregate. The fine aggregate shall be that part of the aggregate mixture passing the No. 8 sieve and shall consist of sand, screenings, or combination thereof with uniform quality throughout. Fine aggregate shall consist of durable particles, free from injurious foreign matter. Screenings shall be of the same or similar materials as specified for coarse aggregate. The plasticity index of that part of the fine aggregate passing the No. 40 sieve shall be not more than 6 when tested in accordance with AASHTO T90. Fine aggregate from the total mixture shall meet plasticity requirements.

7. Porous Asphalt Mix Design. The Contractor shall submit a mix design at least 10 working days prior to the beginning of production. The Contractor shall make available samples of coarse aggregate, fine aggregate, mineral filler, fibers and a sample of the PGAB that will be used in the design of the mixture. A certificate of analysis (COA) of the PGAB will be submitted with the mix design. The COA will be certified by a laboratory meeting the requirements of AASHTO R18. The Laboratory will be certified by the state MHD, regional equivalent (e.g. NETTCP), and/or qualified under ASTM D3666. Technicians will be certified by the regional certification agency (e.g. NETTCP) in the discipline of HMA Plant Technician.

The mixture will be designed according to the NAPA IS 131, with the exception of testing for air void content. Bulk specific gravity (SG) used in air void content calculations shall not be determined and results will not be accepted using AASHTO T166 (saturated surface dry), since it is not intended for open graded specimens (>10% AV). Bulk SG shall be calculated using AASHTO T275 (paraffin wax) or ASTM D6752 (automatic vacuum sealing, e.g. CoreLok). Air void content shall be calculated from the bulk SG and maximum theoretical SG (AASHTO T209) using ASTM D3203.

The materials shall be combined and graded to meet the composition limits by mass (weight) as shown in Table 4

<table>
<thead>
<tr>
<th>Sieve Size (inch/mm)</th>
<th>Percent Passing (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75/19</td>
<td>100</td>
</tr>
<tr>
<td>0.50/12.5</td>
<td>85-100</td>
</tr>
<tr>
<td>0.375/9.5</td>
<td>55-75</td>
</tr>
<tr>
<td>No.4/4.75</td>
<td>10-25</td>
</tr>
<tr>
<td>No.8/2.36</td>
<td>5-10</td>
</tr>
<tr>
<td>No.200/0.075 (#200)</td>
<td>2-4</td>
</tr>
</tbody>
</table>

Table 4 Porous asphalt mix design criteria.
Binder Content (AASHTO T164) | 6.0-6.5%
---|---
Air Void Content by Corelok (ASTM D6752)* | 16.0-20.0%
Air Void Content by Paraffin wax (AASHTO T275 )* | 18.0-22.0%
Draindown (ASTM D6390)** | <= 0.3 %
Retained Tensile Strength (AASHTO 283)*** | >= 80 %

* Either method is acceptable
**Cellulose or mineral fibers may be used to reduce draindown.
***If the TSR (retained tensile strength) values fall below 80% when tested per NAPA IS 131 (with a single freeze thaw cycle rather than 5). Step 4, the contractor shall employ an antistrip additive, such as hydrated lime (ASTM C977) or a fatty amine, to raise the TSR value above 80%.

8. Porous Asphalt Mix Production

a. Mixing Plants. Mixing plants shall meet the requirements of hot mix asphalt plants as specified in the state MHD or regional equivalent unless otherwise approved by the Engineer (e.g. Section 401- Plant Mix Pavements – General for Quality Assurance specifications in the Standard Specifications for Road and Bridge Construction – State of New Hampshire DOT, 2006).

b. Preparation of Asphalt Binder. The asphalt material shall be heated to the temperature specified in the state MHD specification (if using a MHD spec for the mix) in a manner that will avoid local overheating. A continuous supply of asphalt material shall be furnished to the mixer at a uniform temperature.

c. Preparation of Aggregates. The aggregate for the mixture shall be dried and heated at the mixing plant before being placed in the mixer. Flames used for drying and heating shall be properly adjusted to avoid damaging the aggregate and depositing soot or unburned fuel on the aggregate.

Mineral filler, if required to meet the grading requirements, shall be added in a manner approved by the Engineer after the aggregates have passed through the dryer.

The above preparation of aggregates does not apply for drum-mix plants.

d. Mixing. The dried aggregate shall be combined in the mixer in the amount of each fraction of aggregate required to meet the job-mix formula and thoroughly mixed prior to adding the asphalt material.

The dried aggregates shall be combined with the asphalt material in such a manner as to produce a mixture that when discharged from the pugmill is at a target temperature in the range that corresponds to an asphalt binder viscosity of 700 to 900 centistokes and within a tolerance of ± 11 °C (± 20 °F).

The asphalt material shall be measured or gauged and introduced into the mixer in the quantity determined by the Engineer for the particular material being used and at the temperature specified in the relevant specification.

After the required quantity of aggregate and asphalt material has been introduced into the mixer, the materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the asphalt material throughout the aggregate is
secured. The mixing time will be regulated by the Engineer, and a suitable locking means shall be provided for these regulations.

All plants shall have a positive means of eliminating oversized and foreign material from being incorporated into the mixer.

e. Quality Assurance During Production

The mixing plant shall employ a Quality Control Technician (QCT). The QCT will perform Quality Assurance testing and will be certified in the discipline of HMA Plant Technician by the relevant certifying agency (e.g. NETTCP in New England). The Contractor, at their expense, shall sample, test and evaluate the mix in accordance with the methods and minimum frequencies in Table 5 and the Post-Blended SBR Binder Quality Control Plan (if applicable).

Table 5. Quality Assurance testing requirements during production.

<table>
<thead>
<tr>
<th>Test</th>
<th>Min. Frequency</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature in Truck at Plant</td>
<td>6 times per day</td>
<td>AASHTO T30</td>
</tr>
<tr>
<td>Gradation</td>
<td>greater of either (a) 1 per 500 tons, (b) 2 per day, or (c) 3 per job</td>
<td>AASHTO T30</td>
</tr>
<tr>
<td>Binder Content</td>
<td>greater of either (a) 1 per 500 tons, (b) 2 per day, or (c) 3 per job</td>
<td>ASTM T164</td>
</tr>
<tr>
<td>Air Void Content</td>
<td>greater of either (a) 1 per 500 tons, (b) 2 per day, or (c) 3 per job</td>
<td>ASTM D6752</td>
</tr>
<tr>
<td>Binder Draindown</td>
<td>greater of either (a) 1 per 500 tons, (b) 1 per day, or (c) 1 per job</td>
<td>ASTM D6390</td>
</tr>
</tbody>
</table>

If an analyzed sample is outside the testing tolerances immediate corrective action will be taken. After the corrective action has been taken the resulting mix will be sampled and tested. If the re-sampled mix test values are outside the tolerances the Engineer will be immediately informed. The Engineer may determine that it is in the best interest of project that production is ceased. The Contractor will be responsible for all mix produced for the project.

Testing Tolerances During Production. Testing of the air void content, binder draindown, and TSR shall be within the limits set in Table 4 or MHD M3.11.03 Table B. The paving mixture produced should not vary from the design criteria for aggregate gradation and binder content by more than the tolerances in Table 6.

Table 6. Quality Assurance testing tolerances during production

<table>
<thead>
<tr>
<th>Sieve Size (inch/mm)</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75/19</td>
<td>-</td>
</tr>
<tr>
<td>0.50/12.5</td>
<td>±6.0</td>
</tr>
<tr>
<td>0.375/9.5</td>
<td>±6.0</td>
</tr>
<tr>
<td>No.4/4.75</td>
<td>±5.0</td>
</tr>
<tr>
<td>No.8/2.36</td>
<td>±4.0</td>
</tr>
<tr>
<td>No.200/0.075 (#200)</td>
<td>±2.0</td>
</tr>
<tr>
<td>%PGAB</td>
<td>+0.4, -0.2</td>
</tr>
</tbody>
</table>

POROUS PAVING
321243-11
Should the paving mixture produced vary from the designated grading and asphalt content by more than the above tolerances, proper changes are to be made until it is within these tolerances.

Samples of the mixture when tested in accordance with AASHTO T164 and T30 shall not vary from the grading proportions of the aggregate and binder content designated by the Engineer by more than the respective tolerances specified above and shall be within the limits specified for the design gradation.

Plant Shutdown and Rejection of Mix. Should the mix not meet the tolerances specified above upon repeat testing, the Engineer may reject further loads of mix. Mix that is loaded into trucks during the time that the plant is changing operations to comply with a failed test shall not be accepted, and should be recycled at the plant.


PART 3 - EXECUTION

3.01 GENERAL

A. Existing subgrade under paving/porous media beds shall not be excessively compacted. Add material meeting the requirements of ordinary borrow and having a minimum infiltration rate of between 10 to 30 inches per hour to bring the existing subgrade to the required grade as necessary before placing reservoir course.

INSTALLATION

A. Porous Media Beds

1. Grade Control
   a. Establish and maintain required lines and elevations. The Engineer shall be notified for review and approval of final stake lines for the work before construction work is to begin. Finished surfaces shall be true to grade and even, free of roller marks and free of low spots to form puddles. All areas must drain.
   b. If, in the opinion of the Engineer, based upon reports of the testing service and inspection, the quality of the work is below the standards which have been specified, additional work and testing will be required until satisfactory results are obtained.

2. The Engineer shall be notified at least 24 hours prior to all porous media bed and porous pavement work.

3. Subgrade preparation
   a. Existing subgrade under bed areas shall NOT be compacted or subject to excessive construction equipment traffic prior to geotextile and stone bed placement.
   b. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material shall be removed with light equipment and the underlying soils scarified to a minimum depth of 6 inches with a York rake or equivalent and light tractor.
   c. Bring subgrade of stone porous media bed to line, grade, and elevations indicated. Fill and lightly regrade any areas damaged by erosion, ponding, or traffic compaction before the placing of stone. All bed bottoms are level grade.

4. Porous Media Bed Installation
   a. Upon completion of subgrade work, the Engineer shall be notified and shall inspect at his/her discretion before proceeding with porous media bed installation.
   b. Geotextile and porous media bed aggregate shall be placed immediately after approval of subgrade preparation. Any accumulation of debris or sediment which has taken place
after approval of subgrade shall be removed prior to installation of geotextile at no extra cost to the Owner.

c. Place geotextile in accordance with manufacturer’s standards and recommendations. Adjacent strips of geotextile shall overlap a minimum of sixteen inches (16”). Secure geotextile at least four feet (4’) outside of bed and take any steps necessary to prevent any runoff or sediment from entering the storage bed.

d. Install coarse aggregate in 8-inch maximum lifts. Lightly compact each layer with equipment, keeping equipment movement over storage bed subgrades to a minimum. Install aggregate to grades indicated on the drawings.

e. Install choker base course (see Materials section) aggregate evenly over surface of stone bed, sufficient to allow placement of pavement, and notify Engineer for approval. Choker base course shall be sufficient to allow for even placement of asphalt but no less than 1-inch in depth.

f. Following placement of bed aggregate, the geotextile shall be folded back along all bed edges to protect from sediment washout along bed edges. At least a four-foot edge strip shall be used to protect beds from adjacent bare soil. This edge strip shall remain in place until all bare soils contiguous to beds are stabilized and vegetated. In addition, take any other necessary steps to prevent sediment from washing into beds during site development. When the site is fully stabilized, temporary sediment control devices shall be removed.

5. Quality Assurance requirements for Porous Media Bed Construction.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor to notify Engineer for approval</td>
<td>24 hours in advance of start of work</td>
</tr>
<tr>
<td>Contractor to notify Owner and/or Owner’s Representative</td>
<td>24 hours in advance of start of work</td>
</tr>
<tr>
<td>Contractor to notify Owner’s Testing Firm</td>
<td>24 hours in advance of start of work</td>
</tr>
<tr>
<td>Contractor to notify Engineer and Owner (or Owner’s Representative) for approval</td>
<td>after subgrade preparation, before construction of porous media bed</td>
</tr>
<tr>
<td>Contractor to notify Engineer and Owner (or Owner’s Representative) for approval</td>
<td>after reservoir course before filter blanket</td>
</tr>
<tr>
<td>Contractor to notify Engineer and Owner (or Owner’s Representative) for approval</td>
<td>after filter course and before choker course</td>
</tr>
<tr>
<td>Contractor to notify Engineer and Owner (or Owner’s Representative) for approval</td>
<td>after choker course placed, before placement of pavement</td>
</tr>
</tbody>
</table>

B. Porous Asphalt Pavement Installation

1. The mixing plant, hauling and placing equipment, and construction methods shall be in conformance with NAPA IS 131 and applicable sections of the MHD’s specification for asphalt mixes.

2. The use of surge bins shall not be permitted.
3. Hauling Equipment. Trucks used for hauling asphalt mixture shall have tight, clean, smooth metal bodies. The Contractor shall apply a thin coat of a non-petroleum based or soap solution to prevent the mixture from adhering to the bodies.

Each truck shall have a cover of canvas or other suitable material of such size sufficient to protect the mixture from the weather. When necessary to ensure delivery of material at the specified temperature, truck bodies shall be insulated, and covers shall be securely fastened.

4. Placing Equipment. The paver shall be a self-propelled unit with an activated screed or strike-off assembly, capable of being heated if necessary, and capable of spreading and finishing the mixture without segregation for the widths and thicknesses required. The screed shall be adjustable to provide the desired cross-sectional shape. The finished surface shall be of uniform texture and evenness and shall not show any indication of tearing, shoving, or pulling of the mixture. The machine shall, at all times, be in good mechanical condition and shall be operated by competent personnel.

Pavers shall be equipped with the necessary attachments, designed to operate electronically, for controlling the grade of the finished surface.

The adjustments and attachments of the paver will be checked and approved by the Engineer before placement of asphalt material.

Pavers shall be equipped with a sloped plate to produce a tapered edge at longitudinal joints. The sloped plate shall be attached to the paver screed extension.

The sloped plate shall produce a tapered edge having a face slope of 1:3 (vertical: horizontal). The plate shall be so constructed as to accommodate compacted mat thickness from 35 to 100 mm (1 1/4 to 4 inches). The bottom of the sloped plate shall be mounted 10 to 15 mm (3/8 to 1/2 inch) above the existing pavement. The plate shall be interchangeable on either side of the screed.

Pavers shall also be equipped with a joint heater capable of heating the longitudinal edge of the previously placed mat to a surface temperature of 95 °C (200 °F), or higher if necessary, to achieve bonding of the newly placed mat with the previously placed mat. This shall be done without undue breaking or fracturing of aggregate at the interface. The surface temperature shall be measured immediately behind the joint heater. The joint heater shall be equipped with automated controls that shut off the burners when the pavement machine stops and reignite them with the forward movement of the paver. The joint heater shall heat the entire area of the previously placed wedge to the required temperature. Heating shall immediately precede placement of the asphalt material.

5. Rollers. Rollers shall be in good mechanical condition, operated by competent personnel, capable of reversing without backlash, and operated at speeds slow enough to avoid displacement of the asphalt mixture. The mass (weight) of the rollers shall be sufficient to compact the mixture to the required density without crushing of the aggregate. Rollers shall be equipped with tanks and sprinkling bars for wetting the rolls.

Rollers shall be two-axle tandem rollers with a gross mass (weight) of not less than 7 metric tons (8 tons) and not more than 10 metric tons (12 tons) and shall be capable of providing a minimum compactive effort of 44 kN/m (250 pounds per inch) of width of the drive roll. All rolls shall be at least 1 m (42 inches) in diameter.

A rubber tired roller will not be required on the open graded asphalt friction course surface.

6. Conditioning of Existing Surface. Contact surfaces such as curbing, gutters, and manholes shall be painted with a thin, uniform coat of Type RS-1 emulsified asphalt immediately before the asphalt mixture is placed against them.

7. Spreading and Finishing. The asphalt mixture, at the time of discharge from the haul vehicle, shall be within 6 °C (10 °F) of the compaction temperature for the approved mix design.
Porous Asphalt shall be placed in a single application at 4 inches thick. The Contractor shall protect all exposed surfaces that are not to be treated from damage during all phases of the pavement operation. The asphalt mixture shall be spread and finished with the specified equipment. The mixture shall be struck off in a uniform layer to the full width required and of such depth that each course, when compacted, has the required thickness and conforms to the grade and elevation specified. Pavers shall be used to distribute the mixture over the entire width or over such partial width as practical. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture shall be spread and raked by hand tools.

No material shall be produced so late in the day as to prohibit the completion of spreading and compaction of the mixture during daylight hours, unless night paving has been approved for the project.

No traffic will be permitted on material placed until the material has been thoroughly compacted and has been permitted to cool to below 60 °C (140 °F). The use of water to cool the pavement will not be permitted. The Engineer reserves the right to require that all work adjacent to the pavement, such as guardrail, cleanup, and turf establishment, is completed prior to placing the wearing course when this work could cause damage to the pavement. On projects where traffic is to be maintained, the Contractor shall schedule daily pavement operations so that at the end of each working day all travel lanes of the roadway on which work is being performed are paved to the same limits. Suitable aprons to transition approaches where required shall be placed at side road intersections and driveways as directed by the Engineer.

8. Compaction. Immediately after the asphalt mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling.

The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving.

The number, mass (weight), and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. Generally, one breakdown roller will be needed for each paver used in the spreading operation.

To prevent adhesion of the mixture to the rolls, rolls shall be kept moist with water or water mixed with very small quantities of detergent or other approved material. Excess liquid will not be permitted.

Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot or lightly oiled hand tampers, smoothing irons or with mechanical tampers. On depressed areas, either a trench roller or cleated compression strips may be used under the roller to transmit compression to the depressed area.

Other combinations of rollers and/or methods of compacting may be used if approved in writing by the Engineer, provided the compaction requirements are met.

Unless otherwise specified, the longitudinal joints shall be rolled first. Next, the Contractor shall begin rolling at the low side of the pavement and shall proceed towards the center or high side with lapped rollings parallel to the centerline. The speed of the roller shall be slow and uniform to avoid displacement of the mixture, and the roller should be kept in as continuous operation as practical. Rolling shall continue until all roller marks and ridges have been eliminated.

Rollers will not be stopped or parked on the freshly placed mat.

It shall be the responsibility of the Contractor to conduct whatever process control the Contractor deems necessary. Acceptance testing will be conducted by the Engineer or Owner’s Representative using cores provided by the Contractor.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture. The mixture shall be compacted to conform to the
surrounding area. Any area showing an excess or deficiency of binder shall be removed and replaced. These replacements shall be at the Contractor's expense.

Vibratory rollers shall not be used.

If the Engineer determines that unsatisfactory compaction or surface distortion is being obtained or damage to highway components and/or adjacent property is occurring using vibratory compaction equipment, the Contractor shall immediately cease using this equipment and proceed with the work in accordance with the fourth paragraph of this Subsection.

The Contractor assumes full responsibility for the cost of repairing all damages that may occur to roadway or parking lot components and adjacent property if vibratory compaction equipment is used. After final rolling, no vehicular traffic of any kind shall be permitted on the surface until cooling and hardening has taken place, and in no case within the first 48 hours. Provide barriers as necessary at no extra cost to the Owner to prevent vehicular use; remove at the discretion of the Engineer.

9. Joints. Joints between old and new pavements or between successive day's works shall be made to ensure a thorough and continuous bond between the old and new mixtures. Whenever the spreading process is interrupted long enough for the mixture to attain its initial stability, the paver shall be removed from the mat and a joint constructed.

Butt joints shall be formed by cutting the pavement in a vertical plane at right angles to the centerline, at locations approved by the Engineer. The Engineer will determine locations by using a straightedge at least 4.9 m (16 feet) long. The butt joint shall be thoroughly coated with Type RS-1 emulsified asphalt just prior to depositing the pavement mixture when pavement resumes.

Tapered joints shall be formed by tapering the last 450 to 600 mm (18 to 24 inches) of the course being laid to match the lower surface. Care shall be taken in raking out and discarding the coarser aggregate at the low end of the taper, and in rolling the taper. The taper area shall be thoroughly coated with Type RS-1 emulsified asphalt just prior to resuming pavement. As the paver places new mixture on the taper area, an evenly graduated deposit of mixture shall complement the previously made taper. Shovels may be used to add additional mixture if necessary. The joint shall be smoothed with a rake, coarse material discarded, and properly rolled.

Longitudinal joints that have become cold shall be coated with Type RS-1 emulsified asphalt before the adjacent mat is placed. If directed by the Engineer, joints shall be cut back to a clean vertical edge prior to applying the emulsion.

10. Surface Tolerances. The surface will be tested by the Engineer or Owner's Representative using a straightedge at least 4.9 m (16 feet) in length at selected locations parallel with the centerline. Any variations exceeding 3 mm (1/8 inch) between any two contact points shall be satisfactorily eliminated. A straightedge at least 3 m (10 feet) in length may be used on a vertical curve. The straightedges shall be provided by the Contractor.

11. Work shall be done expertly throughout, without staining or injury to other work. Transition to adjacent impervious asphalt pavement shall be merged neatly with flush, clean line. Finished pavement shall be even, without pockets, and graded to elevations shown on drawing.

12. Porous pavement beds shall not be used for equipment or materials storage during construction, and under no circumstances shall vehicles be allowed to deposit soil on paved porous surfaces.

13. Repair of Damaged Pavement. Any existing pavement or adjacent to the site has been damaged as a result of construction work shall be repaired to the satisfaction of the Engineer or Owner's Representative without additional cost to the Owner.

14. Striping Paint
   a. Sweep and clean surface to eliminate loose material and dust.
b. Paint 4 inch wide parking striping and traffic lane striping in accordance with layouts of plan. Apply paint with mechanical equipment to produce uniform straight edges. Apply in two coats at manufacturer's recommended rates. Provide clear, sharp lines using white traffic paint, installed in accordance with VAOT Specifications.

c. Color for Handicapped Markings: Blue

C. Quality Assurance for Paving Operations

1. The full permeability of the pavement surface shall be tested by application of clean water at the rate of at least 5 gpm over the surface, using a hose or other distribution devise. Water used for the test shall be clean, free of suspended solids and deleterious liquids and will be provided at no extra cost to the Owner. All applied water shall infiltrate directly without large puddle formation or surface runoff, and shall be observed by the Engineer or Owner’s Representative.

2. Testing and Inspection: Employ at Contractor's expense an inspection firm acceptable to the Engineer to perform soil inspection services, staking and layout control, and testing and inspection of site grading and pavement work. Inspection and list of tests shall be reviewed and approved in writing by the Engineer prior to starting construction. All test reports must be signed by a licensed Engineer.

3. Test in-place base and surface course for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable work as directed by the Engineer.
   b. Roadway Elevation: ¼-inch, plus or minus.
   c. Sidewalk Elevation: ⅛-inch, plus or minus.

4. Surface Smoothness: Test finished surface for smoothness even drainage, using a ten-foot to centerline of paved area. Surface will not be accepted if gaps or ridges exceed 3/16 of an inch.

5. Quality Assurance requirements during paving are summarized in Table 8.

Table 8. Quality Assurance requirements during paving.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Schedule/Frequency</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect truck beds for pooling (draindown)</td>
<td>every truck</td>
<td>NA</td>
</tr>
<tr>
<td>Take surface temp. behind joint heater</td>
<td>each pull</td>
<td>6°C (10°F) of compaction temp</td>
</tr>
<tr>
<td>Consult with Engineer to determine locations of butt joints</td>
<td>as needed</td>
<td>NA</td>
</tr>
<tr>
<td>Test surface smoothness &amp; positive drainage with a 10 ft straightedge</td>
<td>after compaction</td>
<td>4.5 mm (3/16&quot;)</td>
</tr>
<tr>
<td>Consult with Engineer to mark core locations for QA testing</td>
<td>after compaction</td>
<td>NA</td>
</tr>
<tr>
<td>Hose test with at least 5 gpm water</td>
<td>after compaction</td>
<td>immediate infiltration, no puddling</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 329200

TURF AND GRASSES

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of Specifications.

1.02 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. Topsoiling, fertilizing, seeding or sodding and other appurtenant work in accordance with the Contract Drawings and these specifications.
2. Limits of lawn and grass are shown on the Contract Drawings.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections.

1. Section 31 10 00- Site Clearing for stripping, stockpiling, and respreading topsoil.
2. Section 31 20 00- Earthwork for excavation, backfill and compaction requirements.

1.03 SUBMITTALS

A. Refer to Section 013000-Submittals for submittal provisions and procedures.

1. Submit samples of all materials for inspection and approval. The manufacturer, dealer or testing laboratory, whichever is appropriate, shall certify analyses. Samples shall include the following:

   Commercial fertilizer 1 lb. bag showing analysis
   Ground limestone 1 lb. bag showing analysis
   Topsoil 1 pint/test lot showing analysis and amendment recommendations

2. The Engineer reserves the right to test and reject any material not meeting these specifications by utilizing tests in accordance with methods adopted by the Association of Official Agricultural Chemists. The Contractor shall pay the costs for these tests.

1.04 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein:

1. Commonwealth of Massachusetts, Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges, latest English Edition with amendments, hereinafter referred to as the “Standard Specifications.” All references to method of measurement, basis of payment and payment items in the Standard Specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications are hereby deleted.
Specifications shall include all related articles mentioned therein.

2. Commonwealth of Massachusetts, Massachusetts Highway Department, Construction Standards, latest Edition with amendments, hereinafter referred to as the “Construction Standards.”

1.05 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.06 QUALITY ASSURANCE

A. During the one year guarantee period, the Contractor shall guarantee that the soil remains free from erosion and the grass cover shall remain in good condition for one (1) year after completion of the Contract, and guarantees for that one year period to maintain the slopes and grass cover at his own expense when notified by the Engineer in writing to do so. All repair work shall be done to the satisfaction of the Engineer. A Certificate of Substantial Completion shall be issued upon acceptance of this work.

1.07 PHASING REQUIREMENTS

A. Phase 1: Installation of three new modular concrete buildings for new communications equipment to be serviced from the existing communications tower that is to remain. Work includes all site work for new construction, new foundations and retaining walls, new modular buildings and associated architectural work and mechanical and electrical work as indicated on the drawings.

1. New communications equipment work and hook up to the existing tower and disconnection of the old communication equipment in the existing building. This work will be done by the City of Newton’s Communications Contractor under a separate contract. Communications work will include providing all communications equipment, materials and labor to provide an operational communication service for the City of Newton in the new modular buildings. After delivery of the new communication service the Communications Contractor shall disconnect the old communications equipment, salvage reusable equipment and make safe the remaining equipment ready for removal by the demolition contractor in Phase 2.

B. Phase 2: Commences only after the new communications equipment has been installed in the new modular building by the City of Newton’s Communications Contractor, and the communications services are operational. Phase 2 includes demolition of the old existing Communications Equipment Building including but not limited to: removal of non-salvageable communications equipment; demolition and removal of existing building and foundation materials. All new Site Work as shown on the drawings including but not limited to: site demolition, excavation, fill and regrading, landscape materials and plantings, new fencing, new walkways and asphalt repairs.
PART 2 – PRODUCTS

2.01 MATERIALS

A. Topsoil required to complete the work of this section shall be from on-site stockpiles augmented by topsoil furnished by the Contractor. Topsoil shall be a natural, fertile, friable loam, typical of cultivated topsoils of the locality, containing not less than 4 percent or more than 20 percent decayed organic matter in that portion of the sample which passes a 1/4-inch sieve when determined by the wet combustion method on a sample dried at 105 degrees C. The pH value for topsoil to be used in areas to be seeded and sodded shall be within a range of 6 to 7. Topsoil shall be mechanically screened with one hundred percent of topsoil by weight shall pass a ¾-inch opening sieve and 97 to 100 percent shall pass a 1/4-inch sieve. In the latter material there shall be not less than 20 percent or more than 65 percent passing a 200-mesh sieve as determined by a wash test made in accordance with the standard test ASTM D1140. All topsoil shall be of good, rich, uniform grade without admixture of subsoil material. It shall be free from hard clods, stiff clay, hardpan, sods, large stones, lime, cement, bricks, coal ashes, cinders, slag, concrete, tar or its residue, tarred paper, boards, sticks, roots or other deleterious material.

B. Before any topsoil is delivered, the Contractor shall submit a sample of 1 cubic foot of topsoil from each source of supply including on-site stockpiles for the Engineer’s inspection and approval. Delivery may begin upon such approval. The approved sample shall be stored on the site until the supply from its source is exhausted or until no more topsoil is required.

C. Samples of topsoil from each source shall be tested by a qualified, independent testing laboratory. Soil analysis shall include sieve analysis, percentage of organic matter, pH, and nutrient content. Nutrient analysis shall include measurement of nitrogen, phosphorus, potassium, calcium, magnesium, aluminum, micronutrient, and lead levels. Test analysis shall be accompanied by the Laboratory’s recommendations for amending the topsoil. Topsoil shall be tested in conformance with the Standards of the Association of Official Agricultural Chemists.

1. Based on this analysis, the soils report shall evaluate the suitability of topsoil for growth of lawn and state recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to soil mix to provide for optimal growth of lawns.

D. No topsoil shall be delivered in a frozen or muddy condition.

E. Commercial fertilizer shall be complete fertilizer and shall be a standard product complying with State and United States fertilizer laws. Fertilizer shall be delivered to the site in the original unopened containers, which shall bear the manufacturer’s name and guaranteed statement of analysis. At least 40 percent by weight of the nitrogen content of the fertilizer shall be derived from organic materials. Fertilizer for lawn areas shall contain not less than 8 percent nitrogen, 6 percent phosphorus and 4 percent potash by weight of ingredients or as otherwise indicated by topsoil test results.

F. Superphosphate shall be finely ground phosphate rock as commonly used for agricultural purposes and shall contain not less than 20 percent available phosphoric acid.

G. Ground limestone shall contain not less than 85 percent total carbonates and shall be ground to such fineness that 50 percent will pass through a 100 mesh sieve and 90 percent will pass through a 20 mesh sieve. Coarser material will be accepted provided the specified rates of application are increased proportionately on the basis of quantities passing the 100 mesh sieve.

H. Water shall be furnished by the Contractor and shall be suitable for irrigation and free from ingredients harmful to plant life. Hose and other watering equipment required for the work shall
also be furnished by the Contractor.

I. Lawn seed mixture shall be a fresh, clean, new crop seed. Seed may be mixed by an approved method on the site or may be mixed by the dealer. If the seed is mixed on the site, each variety shall be delivered in the original containers bearing the dealer's guaranteed analysis. If the seed is mixed by the dealer, the Contractor shall furnish to the Engineer the dealer's guaranteed statement of the composition of the mixture and the percentage of purity and germination of each variety.

J. Lawn seed shall be purchased from a recognized distributor and shall be composed of the following varieties mixed in the percentages indicated. Seed shall test to minimum percentages of purity and germination specified.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>By Weight (%)</th>
<th>Purity (%)</th>
<th>Germination (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Festuca arundinacea</td>
<td>&quot;Clemfine&quot;</td>
<td>60</td>
<td>97</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Clemfine Tall Fescue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poa pratensis</td>
<td>Nassau</td>
<td>15</td>
<td>90</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Kentucky Bluegrass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lolium perenne</td>
<td>&quot;Palmer&quot;</td>
<td>10</td>
<td>98</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Perennial Ryegrass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agrostis alba</td>
<td>Red top</td>
<td>10</td>
<td>92</td>
<td>90</td>
</tr>
<tr>
<td>Festuca longifolia</td>
<td>&quot;Reliant&quot;</td>
<td>5</td>
<td>96</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Hard Fescue</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

K. Fiber mulch shall be composed of wood cellulose fiber containing no germination or growth inhibiting factors. The fiber shall be colored green to allow visual metering during application, have the properties of even dispersal and suspension when agitated in water and, when uniformly sprayed on soil surface, form an absorbent cover allowing percolation of water to underlying soil.

L. All materials shall be delivered to the site in original unopened packages, showing weight, manufacturer's name and guaranteed analysis. Materials shall be stored in such a manner that their effectiveness and usability will not be diminished or destroyed and shall be uniform in composition, dry, unfrozen and free flowing.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All work under this section shall be performed by workmen experienced in lawn installation under the full-time supervision of a qualified foreman.

B. After acceptance of subgrade work performed under other sections, whatever additional grading is necessary shall be performed to bring the subgrade to a true, smooth slope parallel to and except where otherwise indicated, 6-inches below grade of all areas to receive topsoil. Furnish and install grade stakes sufficiently spaced to insure correct line and grade of subgrade and finished grade. Immediately before placing topsoil, loosen the surface of the subgrade. In areas that have been severely compacted, scarify to a depth of 12-inches by approved methods.
C. Place and spread topsoil to a depth sufficiently greater than the depth required for lawn areas so that after natural settlement and compaction, the complete work will conform to the lines, grades and elevations indicated. After topsoil has been spread, prepare it carefully by scarifying or harrowing and hand raking. Remove all large stiff clods, lumps, brush, roots, stumps, litter and other foreign material and stones over 1-inch in diameter and dispose of legally off site.

D. Apply commercial fertilizer and work thoroughly into the topsoil in two applications. The first application shall be within one week before the seeding or sodding, at the rate of 35 lbs per thousand square feet, harrowed into the top 2-inches of topsoil. The second application shall be as determined by the test results.

E. Apply ground limestone at the rate recommended by the testing laboratory and after topsoil has been spread and graded.

F. Incorporate superphosphate into the topsoil with the first application of commercial fertilizer at the rate of 20 lbs per thousand square feet or at the rate determined from the test results.

G. The season for the seeding shall be from April 1 to May 31 and from August 15 to October 15. The actual planting of lawns shall be done, however, only during periods within this season, which are normal for such work as determined by weather conditions and by accepted practice in this locality. At option of and on responsibility of the Contractor, planting of grass may be done under unseasonable conditions without additional compensation, subject to approval as to time of work and methods of operation.

H. Seeding shall consist of soil preparation, seeding, raking, rolling, weeding, watering and otherwise providing all labor and materials necessary to secure the establishment of acceptable turf.

I. Immediately before any seed is sown, the ground shall be scarified, harrowed, raked and broomed until the surface is smooth, friable and of uniformly fine texture. No seeding shall be done during windy weather. Seed shall be sown in two directions at right angles to each other. Sow the seed evenly by hand or with an approved seeding device in the proportions and at the rate of 5 lbs. per 1,000 square feet of area. The seed shall be covered with a thin layer of topsoil by light raking or other approved method, rolled in both directions with a hand roller weighing not more than 100 lbs per foot of width, and watered with a fine spray. Necessary precautions shall be taken to keep the area undisturbed until the grass comes up.

J. All slopes 3:1 or steeper shall be overseeded with Annual Ryegrass, 98 percent purity, 90 percent germination, at the rate of 1 lb. per 1,000 square feet, in addition to the specified seed mix. This shall be a separate sowing executed after the sowing of the regular mixture and before the raking and rolling operations. All areas disturbed by the work of this contract and not required to be developed otherwise shall be seeded except as otherwise noted on the Drawings.

K. Hydoseeding: At his option, the Contractor may accomplish seeding by use of approved hydoseeding equipment designed specifically for this work. Mix seed, fertilizer, wood cellulose fiber mulch and non asphaltic-fiber binder in required amount of water to produce a homogeneous slurry. Add fiber mulch after seed, water, and fertilizer have been thoroughly mixed and apply at the rate of 200 pounds per acre dry weight. The slurry shall be applied within 30 minutes of mixing to prevent burning of the seed by fertilizer. Immediately following the application of the slurry mix, make separate application of fiber mulch and fiber binder at the rate of 1,000 pounds, dry weight, per acre except where erosion control blanket is applied immediately. When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Cover shall allow rainfall or applied water to percolate to underlying soil.

3.02 MAINTENANCE
A. Maintenance shall begin immediately after each portion of lawn is planted and the Contractor shall be responsible for maintenance of the lawn including watering, weeding, fertilization, mowing and replanting as necessary to establish a uniform stand of the specified grasses and until final acceptance. Scattered bare spots, none of which are larger than 72 square inches, will be allowed in seeded areas up to a maximum of 2 percent of any lawn area. After the grass has started, all areas and parts of areas, which fail to show a uniform stand of grass, for any reason whatsoever, shall be reseeded and such areas and parts of areas shall be reseeded repeatedly until all areas are covered with a satisfactory growth of grass. At time of first cutting, keep mower blades not less than 2 1/2-inches high. Contractor is responsible for lawn maintenance until final acceptance or two cuttings, whichever is longer.

B. Prior to acceptance, any damage resulting from erosion, gulleys, washouts or other causes shall be repaired by filling with topsoil, tamping, refertilizing and resodding or reseeding.

C. Lawn areas shall be protected against trespassing and damage as required to insure satisfactory growth acceptable to the Engineer. Any means of protection shall require the approval of the Engineer prior to its erection.

3.03 CLEANUP

A. After completion of the work, the Contractor shall remove all debris, materials, rubbish, etc. from the site. He shall dispose of them in a manner satisfactory to the Engineer. The premises shall be left clean.

3.04 INSPECTION FOR ACCEPTANCE

A. Upon written request by the Contractor, the Engineer shall inspect all lawn areas to determine completion of contract work. This request must be submitted at least 10 days prior to the anticipated date. The lawns will become acceptable if they show a uniform, thick well-developed stand of grass that may be occupied by the Owner for their intended use. When acceptance is made in writing to the Contractor, the Contractor's responsibility for maintenance shall terminate.

B. The Contractor shall furnish to the Owner complete written instructions for maintenance of all lawn areas at time of acceptance.

C. Acceptance of the lawn area shall not occur before acceptance of the entire facility.

END OF SECTION
SECTION 334000
STORM DRAINAGE UTILITIES

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

1.02 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. Polyvinyl chloride pipe.
2. Corrugated polyethylene pipe.

B. Related Work: The following items are noted and included in this Section and will be performed under the designated sections:

1. Section 31 20 00 – EARTH MOVING for excavation, backfill, & compaction requirements.

1.03 SUBMITTALS

A. Refer to Section 01 33 00 – SUBMITTAL PROCEDURES, for submitted provisions and procedures.

1. Product Data: Submit manufacturer's technical product data and installation instructions for storm drain system materials and products. Descriptive literature showing pipe dimensions, pipe and joint materials and dimensions, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.

2. Submit shop drawings for storm drain systems, showing piping and manhole materials and sizes. Submit shop drawings of complete layout of detention/retention structures, including all fittings and appurtenances.

3. The precast concrete structure shop drawing submittals for the manholes, catch basins, vaults, and tanks shall contain erection drawings showing connections, cast-in items, waterproofing details, lifting hooks, and production drawings showing elevations, sections and details indicating sizes and quantities of reinforcement.

4. For manholes, clock diagrams shall be submitted indicating orientation, size, and elevation of openings for each manhole structure.

5. Submit shop drawings for structure frames, grates, and covers.

6. Filter fabric: Submit the manufacturer's information and a one square foot representative sample of the filter fabric.

7. The Contractor shall submit buoyancy calculations for storm drainage structures prepared and sealed by a professional Civil Engineer and licensed in the state of Massachusetts.

8. Record Drawings: Prior to the acceptance of the storm drainage system, the Contractor shall submit to the Engineer, for review and approval, As-Built Drawings that indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built Drawings shall include a minimum of three (3) ties to each structure from fixed permanent objects. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor and
1.04 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein:

3. AASHTO: American Association of State Highway and Transportation Officials.
4. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), Formerly Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.
5. Commonwealth of Massachusetts, Massachusetts Highway Department, Construction Standards, latest Edition with amendments, hereinafter referred to as the "Construction Standards."
7. Environmental Compliance: Comply with applicable portions of local Environmental Agency regulations pertaining to storm drain systems.
8. City/Town Regulations.

1.05 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturing of storm drain system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications: Firms with at least three years of successful installation experience on projects with storm drain work similar to that required for the project.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate with interior building storm drain system piping.

B. Coordinate with other utility work.

C. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.
D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

1.08 PHASING REQUIREMENTS

A. Phase 1: Installation of three new modular concrete buildings for new communications equipment to be serviced from the existing communications tower that is to remain. Work includes all site work for new construction, new foundations and retaining walls, new modular buildings and associated architectural work and mechanical and electrical work as indicated on the drawings.

1. New communications equipment work and hook up to the existing tower and disconnection of the old communication equipment in the existing building. This work will be done by the City of Newton’s Communications Contractor under a separate contract. Communications work will include providing all communications equipment, materials and labor to provide an operational communication service for the City of Newton in the new modular buildings. After delivery of the new communication service the Communications Contractor shall disconnect the old communications equipment, salvage reusable equipment and make safe the remaining equipment ready for removal by the demolition contractor in Phase 2.

B. Phase 2: Commences only after the new communications equipment has been installed in the new modular building by the City of Newton’s Communications Contractor, and the communications services are operational. Phase 2 includes demolition of the old existing Communications Equipment Building including but not limited to: removal of non-salvageable communications equipment; demolition and removal of existing building and foundation materials. All new Site Work as shown on the drawings including but not limited to: site demolition, excavation, fill and regrading, landscape materials and plantings, new fencing, new walkways and asphalt repairs.

PART 2 – PRODUCTS

2.1 CORRUGATED POLYETHYLENE PIPE

A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.

1. Corrugated polyethylene pipe shall have an interior surface that is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. Pipe shall conform to AASHTO M-294, AASHTO M252, or AASHTO MP6, Type S depending on the diameter of the pipe required.

2. Pipe and fittings shall be high-density polyethylene meeting the requirements of ASTM D3350.

3. Pipe units shall have a minimum laying length of 20-feet except as otherwise indicated or allowed by the Engineer.

4. Pipe shall be installed with a minimum 12-inch cover for AASHTO H-20 loading.

B. Joints on Corrugated Polyethylene Pipe.

1. The pipe and fitting joints shall be bell-and spigot with watertight gaskets.

2. Pipe entrances at catch basins shall be made with a mortar made with Type II cement. Mortar mixture shall follow instructions provided by cement manufacturer. Pipe connections at drain manholes and water quality structures shall be made with integral flexible rubber sleeves and Corrugated Pipe Adapters designed for use with the pipe and sleeves.
2.2 IDENTIFICATION

A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils minimum thickness, with continuously printed caption in black letters "CAUTION - xxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

<table>
<thead>
<tr>
<th>Color</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Red</td>
<td>Electric</td>
</tr>
<tr>
<td>High Visibility Safety Yellow</td>
<td>Gas, Oil, Steam</td>
</tr>
<tr>
<td>Safety Alert Orange</td>
<td>Telephone, Communications, Cable Television</td>
</tr>
<tr>
<td>Safety Precaution Blue</td>
<td>Water System, Irrigation</td>
</tr>
<tr>
<td>Safety Green</td>
<td>Sanitary Sewer, Storm Sewer</td>
</tr>
<tr>
<td>White</td>
<td>Proposed Excavation</td>
</tr>
</tbody>
</table>

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

A. General: General Locations and Arrangements: Contract Drawings indicate the general location and arrangement of the underground storm drainage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical. Any modifications to the layout of the storm drainage system shall be submitted to the Engineer for review and approval at least five days prior to the start of the affected work.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations, accepted practices, and utility owner's requirements. Maintain swab or drag in line and pull past each joint as it is completed. All pipe shall be laid in the dry.

C. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited without the written approval of the Engineer.

D. Install piping pitched down in direction of flow as indicated on the Contract Drawings.

E. Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

F. Acceptance of Pipe: Acceptance will be on the basis of tests specified herein before. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.

G. Pipe Storage: Pipe sections shall not be stored on areas over the newly laid pipe or other pipelines
which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.

H. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.

I. Laying Pipe: Except where a concrete cradle or envelope is required, the pipe shall be laid in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.

J. Jointing Pipe: After the pipe are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.

K. Alignment and Placement: All pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.

1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.
2. The Contractor shall establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stake as a check point between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.

L. Cleaning: Care shall be taken to prevent earth, water and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water and debris from entering any existing Drain.

1. Place plugs in end of uncompleted conduit at end of day or whenever work stops.
2. Flush lines between manholes if required to remove collected debris.

M. Review of Completed Storm Drain System: The completed drain system shall be visually inspected by the Owner’s Representative. If the visual observation of the completed drain or any part thereof shows any pipe, manhole, or joint to be of defective work or material, the defect shall be replaced or repaired as directed by the Engineer or the Owner’s Representative. The Contractor shall coordinate and provide site access for inspection.

3.2 PVC PIPE

A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

B. PIPE HANDLING

1. All pipe and fittings shall be carefully handled from the truck onto the ground and into the trench or excavation so as to prevent damage to the pipe. Pipes shall be kept free of dirt and foreign material especially on the inside. Joint ends of pipe shall especially be kept clean.
2. Pipe stored on site shall be protected from heat and direct sun light and shall be suitably ventilated.
3. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.

C. ALIGNMENT AND PLACEMENT OF PVC PIPE

1. Bedding material for the pipe must be installed with care in the area around the pipe. Bedding
material must be placed to provide uniform and adequate support under pipe. Do not use blocking to bring pipe up to grade.

2. Provide bell holes at each joint to permit joint to be assembled properly while maintaining uniform pipe support.

3. Place and consolidate the bedding material under the pipe haunch to provide adequate side support while avoiding both vertical and lateral displacement of pipe.

4. Initial backfill must be completed to a point at least 12-inches over the top of the pipe and be hand placed. Use little or no tamping of initial backfill directly over the top of pipe. Compaction methods may be utilized during final backfilling.

5. When jointing PVC conduit pipe, it shall be cut square, conduit ends cleaned, an even coating of solvent cement applied to the pipe end and socket, and the conduit firmly pushed together until the conduit bottoms in the socket. The conduit shall be rotated 1/4 turn immediately after bottoming in the socket to ensure even spread of the cement.

6. Detectable warning tape shall also be installed 2-feet below the existing ground surfaces for later use in locating the pipe’s exact position.

3.3 INSTALLATION OF CORRUGATED POLYETHYLENE PIPE AND PIPE FITTINGS

A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

B. Acceptance of Pipe: Acceptance will be on the basis of tests specified hereinbefore. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.

C. Pipe Storage: Pipe sections shall not be stored on areas over the newly placed pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.

D. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.

E. Placing Pipe: Except where a concrete cradle or envelope is required, the pipe shall be placed in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be “pulled” or “cramped” without approval of the Engineer.

F. Jointing Pipe: After the pipe are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.

G. Alignment and Placement: All pipe shall be placed with extreme care as to grade and alignment. Each pipe shall be so placed as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.

1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.

2. The Contractor shall establish centerline and offset stakes at each manhole, plus intermediate centerline and offset stake as needed to ensure proper alignment and grade between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.
H. Cleaning: Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water, and debris from entering any existing Drain.

1. Place plugs in end of uncompleted conduit at end of day or whenever work stops.
2. Flush lines between manholes to remove collected debris.

I. Review of Completed Corrugated Polyethylene Pipe System: If the visual observation of the completed drain or any part thereof shows any pipe, manhole, or joint to be of defective work or material the defect shall be replaced or repaired as directed. The visual observation shall be conducted by the Engineer and any defects shall be as identified by such. The Contractor shall coordinate and provide site access for the Owner.

3.4 FIELD TESTING OF CORRUGATED POLYETHYLENE PIPING:

A. The pipe shall be cleaned and visually inspected for offsets and obstructions prior to testing.

B. The total length of each pipe installed on the project shall be tested or inspected for deflection. Conveyance pipes connecting at both ends to concrete drainage structures (catch basins, manholes, outlet control structures, water quality structures, etc.) shall be mandrel tested. Deflection of pipes used for stormwater detention/retention/infiltration systems, and pipes connecting to wye connections, building connections, trench drains, and other connections that do not allow mandrel testing shall be verified by visual inspection by the Owner’s Representative during installation.

C. Mandrel tests shall be performed by the Contractor and observed by the Owner’s Representative not sooner than 20 days after completion of installation and compaction of backfill. Testing for pipes greater than 24-inch in diameter shall be tested prior to the installation of drainage structure cone and frame.

D. Installed pipe shall be tested to ensure that the maximum deflection of the pipe does not exceed 7.5 percent of its base inside diameter. The base inside diameter is defined as the specified nominal diameter minus the allowable inside diameter tolerance of 1.5% but not more than 1/2 inch.

E. A mandrel shall be pulled through the pipe by hand to ensure that maximum allowable deflections have not been exceeded. The mandrel diameter shall be verified and approved by the Owner’s Representative prior to use. Use of an unapproved mandrel will invalidate the test. If the mandrel fails to pass through the pipe, the pipe will be deemed to be over-deflected.

F. The mandrel shall be a rigid device, with an odd number of legs (9 legs minimum) having an effective length not less than its nominal diameter. The mandrel shall be fabricated of steel with pulling rings at each end.

G. The minimum diameters at any point along the full length are as follows:

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Minimum Mandrel Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>5.3&quot;</td>
</tr>
<tr>
<td>8&quot;</td>
<td>7.0&quot;</td>
</tr>
<tr>
<td>10&quot;</td>
<td>8.8&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>10.6&quot;</td>
</tr>
<tr>
<td>15&quot;</td>
<td>13.2&quot;</td>
</tr>
<tr>
<td>18&quot;</td>
<td>15.8&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>21.1&quot;</td>
</tr>
</tbody>
</table>

END OF SECTION