PROJECT MANUAL
including Specifications

(SIDEWALK REPLACEMENT)

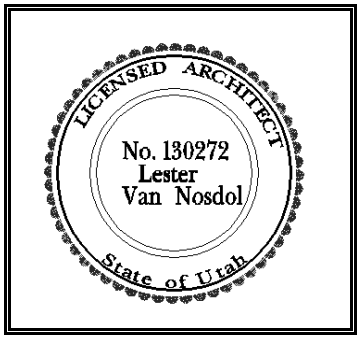
FOR

BONNEVILLE 1, 5, 7

85 South 900 East
Provo, UT 84601

Property No.
504916416030101

March 2017



Prepared By:

RVA ARCHITECTS, INC.

32 West Center St. Suite #203
Provo, Utah 84601
(801) 374-2100

PROJECT DIRECTORY

Owner:	Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-day Saints A Utah Corporation Sole 50 East North Temple Street Salt Lake City, UT 84150
Project Manager:	American Fork Project Management Office 110 E. Main St. American Fork, UT 84003 801-763-4520
Facilities Manager:	Provo South FM Group 1600 North 900 East Provo, UT 84603 801-370-6890
Architects:	RVA Architects, Inc. 32 West Center St. #203 Provo, UT 84601 801-374-2100

End of Project Directory

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INVITATION TO BID (U.S.)

1. **CONTRACTORS INVITED TO BID THE PROJECT:**

BC Builders	**Majestic Builders**
Broderick & Henderson	**SRFCO**
Dynamic Construction	**Warner Construction**
Gines Construction	

2. **PROJECT:**

   Bonneville 1, 5, 7 Sidewalks

3. **LOCATION:**

   85 South 900 East
   Provo, UT

4. **OWNER:**

   Corporation of the Presiding Bishop of
   The Church of Jesus Christ of Latter-day Saints,
   A Utah Corporation Sole
   50 East North Temple Street
   Salt Lake City, Utah 84150

5. **CONSULTANT:**

   RVA Architects, Inc.
   32 W. Center St. #203
   Provo, UT 84601
   801-374-2100

6. **DESCRIPTION OF PROJECT:**

   A. Repair or replace precast concrete sections, replace concrete stairs, and repoint brick on west elevation.

   B. Products or systems may be provided under a Value Managed Relationship (VMR) the Owner has negotiated with the supplier. VMR products and systems are indicated as such in the specifications.

7. **PRE-BID CONFERENCE**: A pre-bid conference will be held on **Thursday, March 30, 2017** @ **10:00 am** at the site located at 85 South 900 East Provo, UT.

8. **TYPE OF BID:** Bids will be on a lump-sum basis. Segregated bids will not be accepted.

9. **TIME OF SUBSTANTIAL COMPLETION:** The time limit for substantial completion of this work will be 45 calendar days and will be as noted in the Agreement.

10. **BID OPENING:** Sealed bids will be accepted until **2:30 pm, Thursday, April 13, 2017**. Bids will be publicly opened at that time at the American Fork PM office located at 110 East Main Street American Fork, UT.

11. **BIDDING DOCUMENTS:**

    A. Bidding Documents may be examined at the following plan room locations:

       1. **Mountainlands Area Plan Room**
          3560 South 583 West, Suite 4
          Salt Lake City, UT 84115
          801-288-1188
          www.mapronline.com

2. McGraw Hill/Dodge Area Plan Room
http://dodgeprojects.construction.com

12. BIDDER'S QUALIFICATIONS: Bidding by the Contractors will be by invitation only.

13. OWNER'S RIGHT TO REJECT BIDS: Owner reserves the right to reject any or all bids and to waive any irregularity therein.

END OF DOCUMENT

INSTRUCTIONS TO BIDDERS (U.S.)

1. DOCUMENTS:

A. Bidding Documents include Bidding Requirements and proposed Contract Documents. Proposed Contract Documents consist of:
   1) Contractor Bid Proposal and Project Agreement (U.S.)
   2) Other documents included by reference
   3) Addenda.

B. Bidding Requirements are those documents identified as such in proposed Project Manual.

C. Addenda are written or graphic documents issued prior to execution of the Contract which modify or interpret the Bidding Documents. They become part of the Contract Documents as noted in the Contractor Bid Proposal and Project Agreement (U.S.) upon execution of the Agreement by Owner.

2. BIDDER'S REPRESENTATIONS:

A. By submitting a bid proposal, bidder represents that
   1) Bidder has carefully studied and compared Bidding Documents with each other. Bidder understands the Bidding Documents and the bid is fully in accordance with the requirements of those documents,
   2) Bidder has thoroughly examined the site and any building located thereon, has become familiar with local conditions which might directly or indirectly affect contract work, and has correlated its personal observations with requirements of proposed Contract Documents, and
   3) Bid is based on materials, equipment, and systems required by Bidding Documents without exception.

3. BIDDING DOCUMENTS:

A. Copies
   1) Owner will provide the Bidding Documents as set forth in the Invitation to Bid.
   2) Partial sets of Bidding Documents will not be issued.

B. Interpretation or Correction of Bidding Documents
   1) Bidders will request interpretation or correction of any apparent errors, discrepancies, and omissions in the Bidding Documents.
   2) Corrections or changes to Bidding Documents will be made by written Addenda.

C. Substitutions and Equal Products
   1) Equal products may be approved upon compliance with Contract Document requirements.
   2) Base bid only on materials, equipment, systems, suppliers or performance qualities specified in the Bidding documents.
   3) Where a specified product is identified as a "quality standard", products of other manufacturers that meet the performance, properties, and characteristics of the specified "quality standard" may be used without specific approval as a substitute.

D. Addenda. Addenda will be sent to bidders and to locations where Bidding Documents are on file no later than one week prior to bid opening or by fax no later than 48 hours prior to bid opening.

4. BIDDING PROCEDURES:

A. Form and Style of Bids
   1) Use Owner's Bid Form titled "Contractor Bid Proposal and Project Agreement (U.S.)".
   2) Bid will be complete and executed by authorized representative of Bidder.
   3) Do not delete from or add to the information requested on bid form.

B. Submission of Bids
   1) Submit bid in sealed opaque envelope containing only bid form.
   2) It is bidder's sole responsibility to see that its bid is received at or before the specified time. Bids received after specified bid opening time may be returned to bidders unopened.
   3) No oral, facsimile transmitted, telegraphic, or telephonic bids, modifications, or cancellations will be considered.

C. Modification or Withdrawal of Bid
   1) Bidder guarantees there will be no revisions or withdrawal of bid amount for 45 days after bid opening.
   2) Prior to bid opening, bidders may withdraw bid by written request or by reclaiming bid envelope.
   3) Prior to bid opening, bidder may mark and sign on the sealed envelope that bidder acknowledges any or all Addenda.

5. CONSIDERATION OF BIDS:

A. Opening Of Bids - See Invitation to Bid.

B. Acceptance Of Bid
   1) No bidder will consider itself under contract after opening and reading of bids until Owner accepts Contractor's Bid Proposal by executing same.
   2) Bidder's past performance, organization, subcontractor selection, equipment, and ability to perform and complete its contract in manner and within time specified, together with amount of bid, will be elements considered in award of contract.

6. FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR:

A. Agreement form will be "Contractor Bid Proposal and Project Agreement (U.S.)" provided by Owner.

7. MISCELLANEOUS:

A. Pre-Bid Conference. A pre-bid conference will be held @10:00 am on Thursday, March 30, 2017 at the job site located at 85 South 900 East Provo, UT.

B. Examination Schedule for Existing Building and Site
   1) John Tolman 801-370-6890

END OF DOCUMENT

CONSTRUCTION MATERIAL ASBESTOS STATEMENT (U.S.)

PROJECTS FOR:
CORPORATION OF THE PRESIDING BISHOP OF
THE CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS

Building Name: Bonneville 1, 5, 7

Building Plan Type: Sidewalk Replacement

Building Address: 85 South 900 East Provo, UT

Building Owner: Corporation of the Presiding Bishop of The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole.

Project Number: 504916416030101

Completion Date:

As PROJECT CONSULTANT and principal in charge; based on my best knowledge, information, inspection, and belief; I certify that on the above referenced Project, no asbestos-containing building materials were specified in the construction documents or given approval in shop drawings or submittals.

Project Consultant and Principal in Charge (signature) _____ Date _____

Company Name _____

As GENERAL CONTRACTOR in charge of construction; based on my best knowledge, information, inspection, and belief; I affirm that on the above-referenced Project, no asbestos-containing building materials were used in the construction.

General Contractor (signature) _____ Date _____

Company Name _____

CONTRACTOR BID PROPOSAL AND PROJECT AGREEMENT (U.S.)

Corporation of the Presiding Bishop of The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole, ("Owner") and the undersigned Contractor ("Contractor") enter into this *Contractor Bid Proposal and Project Agreement (U.S.)* ("Agreement") and agree as follows:

1. **Property/Project.**

Property/Project Number:	504916416030101
Property Address ("Project Site"):	85 South 900 East Provo, UT
Project Type:	Sidewalk Replacement
Project Name ("Project"):	Bonneville 1, 5, 7
Stake Name:	Provo UT Bonneville Stake

2. **Scope of the Work.** Contractor will furnish all labor, materials, and equipment necessary to complete the Work in accordance with the Contract Documents. The Work is all labor, materials, equipment, construction, and services required by the Contract Documents.

3. **Contract Documents.** Contract Documents consist of:
   a. This Agreement;
   b. Supplementary Conditions for Bid Proposal and Project Agreement (U.S.);
   c. The Specifications (Division 01 and Divisions 02,03,04,05,07,09,31,32);
   d. Drawings entitled and dated Bonneville 1, 5, 7 Sidewalk Replacement;
   e. Addendum No. with date(s) _____; and
   f. All written Field Changes, written Construction Change Directives and written Change Orders when prepared and signed by Owner and Contractor.

4. **Compensation.** Owner will pay Contractor for performance of Contractor's obligations under the Contract Documents the sum of _____ Dollars ($_____). This is the Contractor's Bid Proposal Amount.

5. **Payment.**
   a. If the Contractor's Bid Proposal Amount is over $100,000 or if otherwise requested by Owner, Contractor will submit to Owner a schedule of values which allocates the Contractor's Bid Proposal Amount to various portions of the Work. This schedule, when accepted by Owner will be used as a basis for reviewing Contractor's payment requests.
   b. Not more than once each month, Contractor will submit a payment request to Owner. Owner will pay Contractor for work completed within thirty (30) days after Owner receives:
      1) Contractor's payment request for work to date;
      2) a certification by Contractor that Contractor has paid for all labor, materials, and equipment relating to the Work covered by prior payment requests and that Contractor will pay for all labor, materials, and equipment relating to the Work covered by the current payment request; and
      3) releases of all mechanics' liens and claims of subcontractors, laborers, or material suppliers who supplied labor and/or materials for the Work covered by the payment request.
      4) updated Construction Schedule.
   c. Owner may modify or reject the payment request if, in Owner's opinion, the Work for which payment is requested is not acceptable or is less complete than represented on the payment request.

6. **Extras and Change Orders.** Owner may order changes in the Work by altering, adding to, or deducting from the Work. In the event of such a change, Contractor's compensation and/or the time of completion will be adjusted to reflect the change. Contractor will not commence work on any change until either: (a) Contractor and Owner have agreed in writing to the amount of the adjustment resulting from the change; or (b) Owner has issued a written order for the change acknowledging that there is a dispute regarding the compensation adjustment relating to the change. If Contractor proceeds with a change in the Work without complying with the preceding sentence, Contractor agrees that it will not be entitled to any additional compensation for such change.

7. **Correction of Work.** Contractor will promptly correct, at its own expense,
   a. any portion of the Work which
      1) fails to conform to the requirements of the Contract Documents, or
      2) is rejected by the Owner as defective or because it is damaged or rendered unsuitable during installation or resulting from failure to exercise proper protection.
   b. any defects due to faulty materials, equipment, or workmanship which appear within a period of one year from the date of Substantial Completion or within such longer period of time as may be prescribed by law or the terms of any applicable special warranty required by the Contract Documents.

8. **Time of Completion.** Contractor will complete the Work and have it ready for Owner's inspection within Forty Five (45) calendar days from Notice to Proceed issued by Owner. Time is of the essence. If Contractor is delayed at any time in the progress of the Work by any act or neglect of Owner, or by changes in the Work, or by strikes, lockouts, unusual delay in transportation, unavoidable casualties, or acts of nature beyond Contractor's control, then the time for completion will be extended by the time that completion of the Work is delayed. However, Contractor expressly waives any damages for any such delays other than those delays willfully caused by Owner.

9. **Permits, Surveys, and Taxes.** Contractor will obtain and pay for all permits and licenses, and also pay any applicable taxes. Contractor will also obtain and pay for any surveys it needs to perform the Work. Contractor will conform to all ordinances and covenants governing the Project Site and/or Work.

10. **Compliance with Laws.** Contractor will comply with all applicable laws, ordinances, rules, regulations, and orders of any public authorities relating to performance of the Work.

11. **Payment of Subcontractors and Materialmen.** Contractor will promptly pay for all labor, materials, and equipment used to perform the Work.

12. **Contractor's Insurance.** Prior to performing any work, Contractor will obtain and maintain during the term of this Agreement the following insurance:
    a. Workers Compensation Insurance.
    b. Employers Liability Insurance with minimum limits of the greater of $500,000 E.L. each accident, $500,000 E. L. disease-each employee, $500,000 E.L. disease-policy limit or as required by the law of the state in which the Project is located.
    c. Commercial General Liability Insurance – ISO Form CG 00 01 (12/07) or equivalent Occurrence policy which will provide primary coverage to the additional insureds (the Owner and the Architect) in the event of any Occurrence, Claim, or Suit with:
       1) Limits of the greater of: Contractor's actual coverage amounts or the following:
          a) $2,000,000 General Aggregate;
          b) $2,000,000 Products - Comp/Ops Aggregate;
          c) $1,000,000 Personal and Advertising Liability;
          d) $1,000,000 Each Occurrence; and
          e) $50,000 Fire Damage to Rented Premises (Each Occurrence)
       2) Endorsements attached to the General Liability policy including the following or their equivalent:
          a) ISO Form CG-25-03 (05/09), Amendment of Limits of Insurance (Designated Project or Premises) describing the Agreement and specifying limits as shown above.
          b) ISO Form CG 20 10 (07/04), Additional Insured – Owners, Lessees, Or Contractors (Form B), naming Owner and Architect as additional insureds.
    d. Automobile Liability Insurance, with:
       1) Combined Single Limit each accident in the amount of $500,000 or Contractor's actual coverage, whichever is greater; and
       2) Coverage applying to "Any Auto" or its equivalent.

    Contractor will provide evidence of these insurance coverages to Owner by providing an ACORD 25 (2010/05) Form or its equivalent: (1) listing Owner as the Certificate Holder and Additional Insured on the general liability and any excess liability policies, (2) listing the insurance companies providing coverage (all companies listed must be rated in A.M. Best Company Key Rating Guide-Property-Casualty and each

company must have a rating of B+ Class VII or higher), (3) attaching the endorsements set forth above for the Certificate of Liability Insurance, and (4) bearing the name, address and telephone number of the producer and signed by an authorized representative of the producer. (The signature may be original, stamped, or electronic.) Notwithstanding the foregoing, Owner may, in writing and at its sole discretion, modify these insurance requirements.

13. **Independent Contractor Relationship.** The parties expressly agree that Contractor is not an agent or employee of Owner but is an independent contractor solely responsible for all expenses relating to Contractor's business.

14. **Comply with Intellectual Property Rights of Others.** Contractor represents and warrants that no Work (with its means, methods, goods, and services attendant thereto), provided to Owner will infringe or violate any right of any third party and that Owner may use and exploit such Work, means, methods, goods, and services without liability or obligation to any person or entity (specifically and without limitation, such Work, means, methods, goods, and services will not violate rights under any patent, copyright, trademark, or other intellectual property right or application for the same).

15. **Confidentiality / Property Rights.**
    a. Owner will retain ownership and intellectual property rights in all plans, designs, drawings, documents, concepts, and materials provided by or on behalf of Owner to Contractor and to all work products of Contractor for or relative to Work performed under this Agreement, such products, services, and Work of Contractor constituting works made for hire. Contractor will not reuse any portions of such items provided by Owner or developed by Contractor for Owner pursuant to this Agreement, or disclose any such items to any third party without the prior written consent of Owner. Owner may withhold its consent in its' absolute discretion.
    b. In addition, Contractor shall ensure that Contractor, Subcontractors, and the employees, agents and representatives of Contractor and its Subcontractors maintain in strict confidence, and shall use and disclose only as authorized by Owner all Confidential Information of Owner that Contractor receives in connection with the performance of this Agreement. Notwithstanding the foregoing, Contractor may use and disclose any information to the extent required by an order of any court or governmental authority, but only after it has notified Owner and Owner has had an opportunity to obtain reasonable protection for such information in connection with such disclosure. For purposes of this Agreement, "Confidential Information" means:
        1) The name or address of any affiliate, customer or contractor of Owner or any information concerning the transactions of any such person with Owner;
        2) Any information relating to contracts, agreements, business plans, budgets or other financial information of Owner to the extent such information has not been made available to the public by the Owner; and
        3) Any other information that is marked or noted as confidential by the Owner at the time of its disclosure.

16. **Ownership and Use of Renderings and Photographs.** Renderings representing the Work are the property of Owner. All photographs of the Work, whether taken during performance of the Work or at completion, are the property of the Owner. The Owner reserves all rights including copyrights to renderings and photographs of the Work. No renderings or photographs shall be used or distributed without written consent of the Owner.

17. **Public Statements Regarding Work or Property.** Contractor will not make any statements or provide any information to the media about the Work or Property without the prior written consent of Owner. If Contractor receives any requests for information from media, Contractor will refer such requests to Owner.

18. **No Commercial Use of Transaction or Relationship.**
    a. Without the prior written consent of Owner, which Owner may grant or withhold in its sole discretion, neither Contractor nor Contractor's affiliates, officers, directors, agents, representatives, shareholders, members, Subcontractors, or employees shall make any private commercial use of their relationship to Owner or the Work or Property, including, without limitation:
        1) By referring to this Agreement, Owner, or the Work or Property verbally or in any sales, marketing or other literature, letters, client lists, press releases, brochures or other written materials except as may

be necessary for Contractor to perform Contractor's obligations under the terms of this Agreement;

2) By using or allowing the use of any photographs of the Work or any part thereof, or of any service marks, trademarks or trade names or other intellectual property now or which may hereafter be associated with, owned by or licensed by Owner in connection with any service or product; or
3) By contracting with or receiving money or anything of value from any person or commercial entity to facilitate such person or entity obtaining any type of commercial identification, advertising or visibility in connection with the Work or Property.

b. Notwithstanding the foregoing, Contractor may include a reference to Owner and the services and equipment provided under this Agreement in a professional résumé or other similar listing of Contractor's references without seeking Owner's written consent in each instance; provided, that such reference to Owner, the services and equipment is included with at least several other similar references and is given no more prominence than such other references.

19. **Indemnity and Hold Harmless.**
    a. Contractor will indemnify and hold harmless Owner and Owner's representatives, employees, agents, architects, and consultants from and against any and all claims, damages, liability, demands, costs, judgments, awards, settlements, causes of action, losses and expenses (collectively "Claims" or "Claim"), including but not limited to attorney fees, consultant fees, expert fees, copy costs, and other costs and expenses, arising out of or resulting from performance of the Work, attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of real or personal property, including loss of use resulting therefrom, except to the extent that such liability arises out of the negligence of Owner, its representatives, agents, and employees. This indemnity includes, without limitation, indemnification of Owner from all losses or injury to Owner's property, except to the extent that such loss or injury arises out of the negligence of Owner, its representatives, agents, and employees. This indemnity applies, without limitation, to include Claims occurring both during performance of the Work and/or subsequent to completion of the Work. In the event that any Claim is caused in part by a party indemnified hereunder, that party will bear the cost of such Claim to the extent it was the cause thereof. In the event that a claimant asserts a Claim for recovery against any party indemnified hereunder, the party indemnified hereunder may tender the defense of such Claim to Contractor. If Contractor rejects such tender of defense and it is later determined that the negligence of the party indemnified hereunder did not cause all of the Claim, Contractor will reimburse the party indemnified hereunder for all costs and expenses incurred by that party in defending against the Claim. Contractor will not be liable hereunder to indemnify any party for damages resulting from the sole negligence of that party.
    b. In addition to the foregoing, Contractor will be liable to defend Owner in any lawsuit filed by any Subcontractor relating to the Project. Where liens have been filed against Owner's property, Contractor (and/or its bonding company which has issued bonds for the Project) will obtain lien releases and record them in the appropriate county and/or local jurisdiction and provide Owner with a title free and clear from any liens of Subcontractors. In the event that Contractor and/or its bonding company are unable to obtain a lien release, Owner in its absolute discretion may require Contractor to provide a bond around the lien or a bond to discharge the lien, at Contractor's sole expense.
    c. In addition to the foregoing, Contractor will indemnify and hold Owner harmless from any claim of any other contractor resulting from the performance, nonperformance or delay in performance of the Work by Contractor.
    d. The indemnification obligation herein will not be limited by a limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or a Subcontractor under worker's compensation acts, disability benefit acts, or other employee benefit acts.

20. **Resolution of Disputes.** In the event there is any dispute arising under the Contract Documents which cannot be resolved by agreement between the parties, either party may submit the dispute with all documentation upon which it relies to Director of Architecture, Engineering, and Construction, 50 East North Temple, Salt Lake City, Utah 84150, who will convene a dispute resolution conference within thirty (30) days. The dispute resolution conference will constitute settlement negotiations and any settlement proposal made pursuant to the conference will not be admissible as evidence of liability. In the event that the parties do not resolve their dispute pursuant to the dispute resolution conference, either party may commence legal action to resolve the dispute. Any such action must be commenced within six (6) months from the first day of the dispute resolution conference or be time barred. Submission of the dispute to the Director as outlined above

is a condition precedent to the right to commence legal action to resolve any dispute. In the event that either party commences legal action to adjudicate any dispute without first submitting the dispute to the Director, the other party will be entitled to obtain an order dismissing the litigation without prejudice and awarding such other party any costs and attorneys fees incurred by that party in obtaining the dismissal, including without limitation copy costs, and expert and consultant fees and expenses.

21. **Termination of Agreement by Contractor.** In the event Owner materially breaches any term of the Contract Documents, Contractor will promptly give Written Notice of the breach to Owner. If Owner fails to cure the breach within ten (10) days of the Written Notice, Contractor may terminate this Agreement by giving Written Notice to Owner and recover from Owner the percentage of the Contract Sum represented by the Work completed on the Project site as of the date of termination together with any out of pocket loss Contractor has sustained with respect to materials and equipment as a result of the termination prior to completion of the Work, less any offsets. Contractor will not be entitled to unearned profits or any other compensation or damages as a result of the termination and hereby waives any claim therefor. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Without limitation, Contractor's indemnities and obligations as well as all warranties relative to Work provided through the date of termination survive a termination hereunder.

22. **Termination of Agreement by Owner for Cause.** Should Contractor make a general assignment for the benefit of its creditors, fail to apply enough properly skilled workmen or specified materials to properly prosecute the Work in accordance with Contractor's schedule, or otherwise materially breach any provision of the Contract Documents, then Owner may, without any prejudice to any other right or remedy, give Contractor Written Notice thereof. If Contractor fails to cure its default within ten (10) days, Owner may terminate this Agreement by giving Written Notice to Contractor, take possession of the premises and all materials, tools, and appliances thereon, and finish the Work by whatever method Owner deems expedient. In such case, Contractor will not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Sum exceeds the expense of finishing the Work, including compensation for additional administrative, architectural, consultant, and legal services (including without limitation attorneys fees, expert fees, copy costs, and other expenses), such excess will be paid to Contractor, less any offsets and recoupment. If such expense exceeds the unpaid balance, Contractor will pay the difference to Owner. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Without limitation, Contractor's indemnities and obligations as well as all warranties relative to Work provided through the date of termination survive a termination hereunder.

23. **Termination of Agreement by Owner for Convenience.** Notwithstanding any other provision contained in the Contract Documents, Owner may, without cause and in its absolute discretion, terminate this Agreement at any time. In the event of such termination, Contractor will be entitled to recover from Owner the percentage of the Contract Sum equal to the percentage of the Work which Owner and/or its architect determines has been completed on the Project site as of the date of termination together with any out of pocket loss Contractor has sustained with respect to materials and equipment as a result of the termination prior to completion of the Work, less any offsets and recoupment. Contractor will not be entitled to unearned profits or any other compensation as a result of the termination and hereby waives any claim therefor. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Owner may, in Owner's sole discretion, take legal assignment of subcontracts and other contractual rights of Contractor. Without limitation, Contractor's indemnities and obligations as well as all warranties relative to Work provided through the date of termination survive a termination hereunder.

24. **Assignment of Contract.** The parties hereto will not assign any rights or obligations under this Agreement without the prior written consent of the other party.

25. **Integration Clause.** The Contract Documents reflect the full agreement of the parties with respect to the Project and the Work and supersede all prior discussions, agreements, and representations regarding the subject matter of the Contract Documents. The Contract Documents may be amended only in a written document signed by both parties hereto.

26. **Applicable Law.** The parties acknowledge that the Contract Documents have substantial connections to the State of Utah. The Contract Documents will be deemed to have been made, executed, and delivered in Salt Lake City, Utah. To the maximum extent permitted by law, (i) the Contract Documents and all matters related to their creation and performance will be governed by and enforced in accordance with the laws of the State of Utah, excluding conflicts of law rules, and (ii) all disputes arising from or related to the Contract Documents will be decided only in a state or federal court located in Salt Lake City, Utah and not in any other court or state. Toward that end, the parties hereby consent to the jurisdiction of the state and federal courts located in Salt Lake City, Utah and waive any other venue to which they might be entitled by virtue of domicile, habitual residence, place of business, or otherwise.

27. **Enforcement.** In the event either party commences legal action to enforce or rescind any term of the Contract Documents, the prevailing party will be entitled to recover its attorneys fees and costs, including without limitation all copy costs and expert and consultant fees and expenses, incurred in that action and on all appeals, from the other party.

28. **Bid Proposal/Agreement.** Contractor's submission to Owner of this agreement signed by Contractor will constitute Contractor's offer and bid proposal to perform the Work described in this agreement according to the terms thereof. Owner's signing of this agreement and delivery to Contractor of a signed copy will constitute acceptance of Contractor's offer and will convert this document to a binding agreement.

29. **Effective Date.** The effective date of this Agreement is the date indicated by the Owner's signature.

OWNER:	**CONTRACTOR:**
Corporation of the Presiding Bishop of The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole.	(company)
Signature:	Signature:
Print Name:	Print Name:
Title:	Title:
Address:	Address:
Telephone No:	Telephone No:
Facsimile No:	Facsimile No:
Email:	Email:
Effective Date:	Fed. I.D. or SSN:
	License No:
Reviewed By:	Date Signed:

S U P P L E M E N T A R Y C O N D I T I O N S

FOR CONTRACTOR BID PROPOSAL AND PROJECT AGREEMENT (U.S.)

ITEM 1 - GENERAL

1. Conditions of the Contract apply to each Division of the Specifications.

2. Provisions contained in Division 01 apply to all Divisions of the Specifications.

ITEM 2 - LIQUIDATED DAMAGES PAYABLE TO OWNER

This section may be included as a separate additional paragraph to the Bid Proposal and Project Agreement, at Owner's discretion:

Delay in Completion of the Work. For each day after the expiration of the designated Time of Completion that Contractor has not completed the Work, Contractor will pay Owner the amount of Two Hundred Fifty dollars ($250.00) per day as liquidated damages for Owner's loss of use and the added administrative expense to Owner to administer the Project during the period of delay. In addition, Contractor will reimburse Owner for any additional Architect's fees, attorneys' fees, expert fees, consultant fees, copy costs, and other expenses incurred by Owner as a result of the delay. Owner may deduct any liquidated damages or reimbursable expenses from any money due or to become due to Contractor. If the amount of liquidated damages and reimbursable expenses exceeds any amounts due to Contractor, Contractor will pay the difference to Owner within ten (10) days after receipt of a written request from Owner for payment.

ITEM 3 - STATE SPECIFIC SUPPLEMENTARY CONDITIONS

Utah

UTAH STATE SALES TAX:

Add the following to the Bid Proposal and Project Agreement:

1. Contractors should be exempt on purchases of material installed or converted into real property to be used by the Owner. The Contractor will furnish each vendor with a completed Exemption Certificate Form TC-721. The certificate will be prepared by the Contractor for each vendor in order to obtain the exemption.

2. The Owner's tax exempt number is 11871701-002-STC.

UTAH NOTICE OF INTENT TO OBTAIN FINAL COMPLETION:

Add the following to the Bid Proposal and Project Agreement:

A. Contractor shall file with the State Construction Registry, on its own behalf and/or on behalf of Owner, a notice of intent to obtain final completion at least 45 days before the day on which the Owner or Contractor files or could file a notice of completion under Utah Code Ann. Section 38-1a-506 if:
   1. The completion of performance time under the original contract for construction work is greater than 120 days;
   2. The total original construction contract price exceeds $500,000; and
   3. The original contractor or owner has not obtained a payment bond in accordance

with Utah Code Ann. Section 14-2-1.

UTAH NOTICE OF COMPLETION:

Add the following to the Bid Proposal and Project Agreement:

A. Within five (5) calendar days of final completion of the Project and in compliance with Section 38-1a-507 Utah Code Annotated, Contractor shall file with the State Construction Registry, and copy to Owner, a notice of completion which shall include, without limitation, the following:
    1. The name, address, telephone number, and email address of the person filing the notice of completion;
    2. The name of the county in which the Project and/or Project site is located;
    3. The date on which final completion is alleged to have occurred;
    4. The method used to determine final completion; and
    5. One of the following:
        a. The tax parcel identification number of each parcel included in the Project and/or Project site;
        b. The entry number of a preliminary notice on the same project that includes the tax parcel identification number of each parcel included in the Project and/or Project site; or
        c. The entry number of the building permit issued for the Project.

B. Notwithstanding any other provision of the Contract Documents to the contrary, Contractor and Owner agree that any breach or failure to comply with this Section by the Contractor will constitute a breach of contract and the Contractor will be liable for any direct, indirect, or consequential damages to the Owner flowing from this breach.

UTAH STATE PROGRESS PAYMENTS AND FINAL PAYMENT:

Replace paragraph 5 of the Bid Proposal and Project Agreement with the following:

5. <u>Payment</u>

a. If the Contractor's Bid Proposal Amount is over $100,000.00, Contractor will submit to Owner a schedule of values which allocates the Contractor's Bid Proposal Amount to various portions of the Work. This schedule, when accepted by Owner, will be used as a basis for reviewing Contractor's payment requests.

b. Progress Payments: Not more than once each month, Contractor will submit a payment request to Owner. Owner will pay Contractor progress payments for work completed within fifteen (15) days after Owner receives:
    1. Contractor's progress payment request for work to date;
    2. A certification by Contractor that Contractor has paid for all labor, materials, and equipment relating to the Work covered by prior payment requests and that Contractor will pay for all labor, materials, and equipment relating to the Work covered by the current payment request; and
    3. Conditional Waiver and Release Upon Progress Payment documents submitted by Contractor (in content complying with Utah Code § 38-1a-802) executed by each of the subcontractors performing work and/or providing materials covered by the Contractor's progress payment request.

c. Final Payment: Owner will make full and final payment of the Contract Sum due within thirty (30) days of the completion of all of the following requirements:
    1. Contractor has submitted its final payment request;
    2. Contractor has submitted a certification that Contractor has paid for all labor, materials, and equipment relating to the Work covered by prior payment requests and that Contractor will pay for all labor, materials, and equipment relating to the Work covered by the final payment request; and
    3. Contractor has submitted Waiver and Release Upon Final Payment documents (in content complying with Utah Code § 38-1a-802) executed by each of the subcontractors performing work and/or providing materials covered by the Contractor's final payment request.

Acceptance of final payment by Contractor or any Subcontractor will constitute a waiver of claims by the payee except for those claims previously made to Owner in writing and identified by Contractor in its affidavit as still pending.
If the aggregate of previous payments made by Owner exceeds the amount due Contractor, Contractor will reimburse the difference to Owner.

d. Owner may modify or reject any payment request if, in Owner's opinion, the Work for which payment is requested is not acceptable or is less complete than represented on the payment request.

e. Upon receipt of any payment from Owner, Contractor will pay to each Subcontractor the amount paid to Contractor on account of such Subcontractor's portion of the Work.

f. Contractor will maintain a copy of each payment request at the Project site for review by the Subcontractors.

g. No payment made, either in whole or in part, by Owner will be construed to be an acceptance of defective or improper materials or workmanship.

END OF DOCUMENT

DIVISION 01

SECTION 01 0000

GENERAL REQUIREMENTS: R&I PROJECT

SECTION 01 1000 SUMMARY

A. Provisions contained in Division 01 apply to all other sections and divisions of Specifications. All instructions contained in Specifications are directed to Contractor. Unless specifically provided otherwise, all obligations set forth in Specifications are obligations of Contractor.

B. Comply with applicable laws and regulations.

C. Owner may provide furnishings and/or equipment for Project. Contractor will receive, store, and protect such items on site until the date Owner accepts Project.

D. Work by Owner: Owner will furnish and install some portions of the Work with its own forces. Complete the Work necessary to accommodate the Work to be performed by Owner before scheduled date for performance of such Work.

SECTION 01 1200 MULTIPLE CONTRACT SUMMARY

A. Separate Contracts may be issued by Owner for performance of certain construction operations at Project site. Contractor will afford other contractors reasonable opportunity to place and store their materials and equipment on site and to perform their work and will properly connect and coordinate its work with theirs where applicable.

SECTION 01 1400 WORK RESTRICTIONS

A. During construction period, Contractor will have use of premises for construction operations. Contractor will ensure that Contractor, its employees, subcontractors, and employees comply with following requirements:
   1. Confine operations to areas within Contract limits shown on Drawings. Do not disturb portions of site beyond Contract limits.
   2. Do not allow alcoholic beverages, illegal drugs, or persons under their influence on Project Site.
   3. Do not allow use of tobacco in any form on Project Site.
   4. Do not allow pornographic or other indecent materials on site.
   5. Do not allow work on Project Site on Sundays except for emergency work.

6. Refrain from using profanity or being discourteous or uncivil to others on Project Site or while performing The Work.
7. Wear shirts with sleeves, wear shoes, and refrain from wearing immodest, offensive, or obnoxious clothing, while on Project Site.
8. Do not allow playing of obnoxious and loud music on Project Site. Do not allow playing of any music within existing facilities.
9. Do not build fires on Project Site.
10. Do not allow weapons on Project Site, except those carried by law enforcement officers and/or other uniformed security personnel who have been retained by Owner or Contractor to provide security services.

B. Existing Facilities:
   1. If Owner will occupy existing building, reasonably accommodate use of existing facilities by Owner.

SECTION 01 3000 ADMINISTRATIVE REQUIREMENTS

A. Coordinate construction activities to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations that are dependent upon each other for proper installation, connection, and operation. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

SECTION 01 3100 PROJECT MANAGEMENT AND COORDINATION

A. Multiple Contract Coordination:
   1. Contractor shall be responsible for coordination of Temporary Facilities and Controls, Construction Waste Management and Disposal services, and Final Cleaning for entire Project unless directed otherwise by Owner's Representative for those who perform work on Project from Notice to Proceed to date of Substantial Completion.

B. Preconstruction Conference:
   1. Attend preconstruction conference and organizational meeting scheduled by Architect or Owner Representative at Project site or other convenient location.
   2. Be prepared to discuss items of significance that could affect progress, including such topics as:
      a. Construction schedule, equipment deliveries, general inspection of tests, preparation of record documents and O&M manuals, project cleanup, security, shop drawings, samples, use of premises, work restrictions, and working hours.

SECTION 01 3300 SUBMITTAL PROCEDURES

A. Coordination preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently before performance of related construction activities to avoid delay.

B. Allow sufficient review time so installation will not be delayed by time required to process submittals.

C. Place permanent label or title block on each submittal for identification. Include name of entity that prepared each submittal on label or title block.

D. Package each submittal appropriately for transmittal and handling.

SECTION 01 3500 SPECIAL PROCEDURES

A. Hot Work Permit (Available from Owner's Representative):
   1. Required for doing hot work involving open flames or producing heat or sparks such as:
      a. Brazing.
      b. Cutting.
      c. Grinding.
      d. Soldering.
      e. Thawing pipe.
      f. Torch applied roofing.

g. Welding.

SECTION 01 4000 QUALITY REQUIREMENTS

A. Testing and inspecting services are used to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

B. Conflicting Requirements: If compliance with two or more standards is specified and standards establish different or conflicting requirements for minimum quantities or quality levels, comply with most stringent requirement.

C. Minimum Quantity or Quality Levels: Quantity or quality level shown or specified shall be the minimum provided or performed. Actual installation may comply exactly with minimum quantity or quality specified, or it may exceed minimum within reasonable limits.

D. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to verify compliance and guard against defects and deficiencies and substantiate that proposed construction will comply with requirements. Owner or Owner's designated representative(s) will perform quality assurance to verify compliance with Contract Documents.

E. Quality Control Services: Quality Control will be sole responsibility of Contractor. Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements performed by Contractor. They do not include inspections, tests or related actions performed by Architect or Owner Representative, governing authorities or independent agencies hired by Owner or Architect. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor:
   1. Where services are indicated as Contractor's responsibility, engage qualified Testing Agency to perform these quality control services:
      a. Contractor will not employ same testing entity engaged by Owner, without Owner's written approval.

F. Notify Owner immediately if asbestos-containing materials or other hazardous materials are encountered while performing the Work.

G. Submit to Owner permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records establishing compliance with standards and regulations bearing upon performance of the Work.

H. Repair And Protection:
   1. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   2. Protect construction exposed by or for Quality Assurance and Quality Control activities.
   3. Repair and protection are Contractor's responsibility, regardless of assignment of responsibility for Quality Assurance and Quality Control Services.

SECTION 01 4301 QUALITY ASSURANCE - QUALIFICATIONS

A. Qualifications: Qualifications in this Section establish minimum qualification levels required; individual Specification Sections specify additional requirements:
   1. Fabricator / Supplier / Installer Qualifications:
      a. Firm experienced in producing products similar to those indicated for this Project and with record of successful in-service performance, as well as sufficient production capacity to produce required units:
         1) Where heading *'VMR (Value Managed Relationship) Suppliers / Installers*' is used to identify list of specified suppliers or installers, Owner has established relationships that extend beyond requirements of this Project. No other suppliers / installers will be acceptable. Follow specified procedures to preserve relationships between Owner and specified suppliers / installers and advantages that accrue to Owner from those relationships.

2) Where heading 'Acceptable or Approved Suppliers / Installers / Fabricators' is used to identify list of specified suppliers / installers / fabricators, use only one of listed suppliers / installers / fabricators. No others will be acceptable.

2. Factory-Authorized Service Representative Qualifications:
   a. Authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
3. Installer Qualifications:
   a. Firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with record of successful in-service performance.
4. Manufacturer Qualifications:
   a. Firm experienced in manufacturing products or systems similar to those indicated for this Project and with record of successful in-service performance, as well as sufficient production capacity to produce required units.
5. Manufacturer’s Field Services Qualifications:
   a. Experienced authorized representative of manufacturer to inspect field-assembled components and equipment installation, including service connections.
6. Professional Engineer Qualifications:
   a. Professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated:
      1) Engineering services are defined as those performed for installations of system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
7. Specialists:
   a. Certain sections of Specifications require that specific construction activities will be performed by entities who are recognized experts in those operations:
      1) Specialists will satisfy qualification requirements indicated and will be engaged for activities indicated.
      2) Requirement for special will not supersede building codes and regulations governing the Work.
8. Testing Agency Qualifications:
   a. Independent Testing Agency with experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   b. Testing Laboratory:
      1) AASHTO Materials Reference Laboratory (AMRL) Accreditation Program.
      2) Cement and Concrete Reference Laboratory (CCRL).
      3) Nationally Recognized Testing Laboratory (NRTL): Nationally recognized testing laboratory according to 29 CFR 1910.7.
      4) National Voluntary Laboratory (NVLAP): Testing Agency accredited according to National Institute of Standards and Technology (NIST) Technology Administration, U. S. Department of Commerce Accreditation Program.

SECTION 01 4523 TESTING AND INSPECTION SERVICES

A. Submittals:
   1. Certificates: Testing Agency will submit certified written report of each inspection, test, or similar service.
   2. Tests and Evaluation Reports:
      a. Testing Agency or Agencies will prepare logs, test reports, and certificates applicable to specific tests and inspections and deliver copies to Owner’s Representative and to each of following if involved on project: Architect, Consulting Engineers (Engineer of Record), General Contractor, Authorities Having Jurisdiction (if required).
   3. Testing Agency:
      a. Qualifications of Testing Agency management, personnel, inspector and technicians designated to project.
      b. Provide procedures for non-destructive testing, equipment calibration records, personnel training records, welding inspection, bolting inspection, shear connector stud inspection, and seismic connection inspections.
B. Quality Assurance:

1. Owner or Owner's designated representative(s) will perform quality assurance. Owner's quality assurance procedures may include observations, inspections, testing, verification, monitoring and any other procedures deemed necessary by Owner to verify compliance with Contract Documents.
2. Owner will employ independent Testing Agencies to perform certain specified testing, as Owner deems necessary.
3. Certification:
   a. Product producers and associations, which have instituted approved systems of quality control and which have been approved by document approval agencies, are not required to have further testing.
   b. Concrete mixing plants, plants producing fabricated concrete and wood or plywood products certified by agency, lumber, plywood grade marked by approved associates, and materials or equipment bearing underwriters' laboratory labels require no further testing and inspection.
4. Written Practice for Quality Assurance:
   a. Testing Agency will maintain written practice for selection and administration of inspection personnel, describing training, experience, and examination requirements for qualification and certification of inspection personnel.
   b. Written practice will describe testing agency procedures for determining acceptability of structure in accordance with applicable codes, standards, and specifications.
   c. Written practice will describe Testing Agency inspection procedures, including general inspection, material controls, visual welding inspection, and bolting inspection.

C. Quality Control:
1. Quality Control will be sole responsibility of Contractor. Contractor will be responsible for testing, coordination, start-up, operational checkout, and commissioning of all items of the Work included in Project. All costs for these services will be included in Contractor's cost of the Work.
2. Notify results of all Testing and Inspection performed by Contractor's independent Testing Agencies to Architect and/or Owner's Representative within 24 hours of test or inspection having been performed:
   a. Testing and Inspection Reports will be distributed as follows:
      1) 1 copy to Owner's Representative.
      2) 1 copy to Architect.
      3) 1 copy to Consulting Engineer(s) (Engineer of Record).
      4) 1 copy to Authorities Having Jurisdiction (if required).
3. Contractor's Responsibility:
   a. Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents.
   b. Tests and inspections that are not explicitly assigned to Owner are responsibility of Contractor.
   c. Cooperate with Testing Agency(s) performing required inspections, tests, and similar services and provide reasonable auxiliary services as requested. Notify Testing Agency before operations to allow assignment of personnel. Auxiliary services required include but are not limited to:
      1) Providing access to the Work and furnishing incidental labor, equipment, and facilities deemed necessary by Testing Agency to facilitate inspections and tests at no additional cost to Owner.
      2) Taking adequate quantities of representative samples of materials that require testing or helping Testing Agency in taking samples.
      3) Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
      4) Providing Testing Agency with preliminary design mix proposed for use for materials mixes that require control by Testing Agency.
   d. For any requested inspection, Contractor will complete prior inspections to ensure that items are ready for inspection.
   e. All Work is subject to testing and inspection and verification of correct operation.
   f. Comply:
      1) Upon completion of Testing Agency's inspection, testing, sample-taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
      2) Comply with Contract Documents in making such repairs.
   g. Data:
      1) Furnish records, drawings, certificates, and similar data as may be required by testing and inspection personnel to assure compliance with Contract Documents.
   h. Defective Work (Non-Conforming Work): Non-conforming Work as covered in General Conditions applies, but is not limited to following requirements Protection:

1) Where results of inspections, tests, or similar services show that the Work does not comply with Contract Document requirements, correct deficiencies in the Work promptly to avoid work delays.
2) Where testing personnel take cores or cut-outs to verify compliance, repair prior to acceptance.
3) Contractor will be responsible for any and all costs incurred resulting from inspection that was scheduled prematurely or retesting due to failed tests.
4) Remove and replace any Work found defective or not complying with contract document requirements at no additional cost to Owner.
5) Should test return unacceptable results, Contractor will bear all costs of retesting and re-inspection as well as cost of all material consumed by testing, and replacement of unsatisfactory material and/or workmanship.

i. Protection:
1) Protect construction exposed by or for quality assurance and quality control service activities, and protect repaired construction.

j. Scheduling: Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities:
1) Schedule testing and inspections in advance so as not to delay the Work and to eliminate any need to uncover the Work for testing or inspection.
2) Notify Testing Agency and Architect or Owner as noted in Sections in Division 01 thru Division 50 prior to any time required for such services.
3) Incorporate adequate time for performance of all inspections and correction of noted deficiencies.
4) Schedule sequence of activities to accommodate required services with minimum of delay.
5) Schedule sequence of activities to avoid necessity of removing and replacing construction to accommodate testing and inspections.

k. Test and Inspection Log:
1) Provide system of tracking all field reports, describing items noted, and resolution of each item. Prepare record of tests and inspections. Include following requirements:
(a) Date test or inspection was conducted.
(b) Description of the Work tested or inspected.
(c) Date test or inspection results were transmitted to Architect or Owner Representative.
(d) Identification of Testing Agency or inspector conducting test or inspection.
2) Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's or Owner's reference during normal working hours.

D. Tests And Inspections - General:
1. Testing specifically identified to be conducted by Owner, will be performed by an independent entity and will be arranged and paid for by Owner.
2. Individual Sections in Division 01 through Division 50 indicate if Owner will provide testing and inspection of the Work of that Section.
3. Owner may engage additional consultants for testing, air balancing, commissioning, or other special services:
a. Activities of any such Owner consultants are in addition to Contractor testing of materials or systems necessary to prove that performance is in compliance with Contract requirements.
b. Contractor must cooperate with persons and firms engaged in these activities.
4. Tests include but not limited to those described in detail in 'Field Quality Control' in Part 3 of Individual Sections in Divisions 01 through Division 50.
5. Taking Specimens:
a. Only testing laboratory shall secure, handle, transport, or store any samples and specimens for testing.
6. Scheduling Testing Agency:
a. Contractor will coordinate the Work and facilitate timeliness of such testing and inspecting services so as not to delay the Work.
b. Contractor will notify Testing Agency and Architect or Owner Representative to schedule tests and / or inspections.

E. Testing Agency Services And Responsibility:
1. Testing Agency, including independent testing laboratories, will be licensed and authorized to operate in jurisdiction in which Project is located:
a. Approved Testing Agency Qualifications: Requirements of Section 01 4301 apply.
2. Testing and Inspection Services:

a. Testing Agency will not release, revoke, alter, or increase Contract Document requirements or approve or accept any portion of the Work.
b. Testing Agency will not give direction or instruction to Contractor.
c. Testing Agency will have full authority to see that the Work is performed in strict accordance with requirements of Contract Documents and directions of Owner's Representative and/or Architect.
d. Testing Agency will not provide additional testing and inspection services beyond scope of the Work without prior approval of Owner's Representative and/or Architect.

3. Testing Agency Duties:
   a. Independent Testing Agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual specification Sections will cooperate with Architect or Owner Representative and Contractor in performance of its duties and will provide qualified personnel to perform required inspections and tests.
   b. Testing Agency will test or obtain certificates of tests of materials and methods of construction, as described herein or elsewhere in technical specification.
   c. Testing Agency will provide management, personnel, equipment, and services necessary to perform testing functions as outlined in this section.
   d. Testing Agency must have experience and capability to conduct testing and inspecting indicated by ASTM standards and that specializes in types of tests and inspections to be performed.
   e. Testing Agency will comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, ASTM C1093, ASTM D3666, ASTM D3740, and other relevant ASTM standards.
   f. Testing Agency must calibrate all testing equipment at reasonable intervals (minimum yearly) with accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.
   g. Welding Procedure Review: Testing Agency will provide review and approval or rejection of all welding procedures to be used and verify compliance with all reference standard requirements.
4. Testing and Inspection Reports:
   a. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
   b. Laboratory Reports: Testing Agency will furnish reports of materials and construction as required, including:
      1) Description of method of test.
      2) Identification of sample and portion of the Work tested:
         (a) Description of location in the Work of sample.
         (b) Time and date when sample was obtained.
         (c) Weather and climatic conditions at time when sample was obtained.
      3) Evaluation of results of tests including recommendations for action.
   c. Inspection Reports:
      1) Testing Agency will furnish "Inspection at Site" reports for each site visit documenting activities, observations, and inspections.
      2) Include notation of weather and climatic conditions, time and date conditions and status of the Work, actions taken, and recommendations or evaluation of the Work.
   d. Reporting Testing and Inspection (Conforming Work):
      1) Submit testing and inspection reports as required within twenty four (24) hours of test or inspection having been performed.
   e. Reporting Testing and Inspection Defective Work (Non-Conforming Work):
      1) Testing Agency, upon determination of irregularities, deficiencies observed or test failure(s) observed in the Work during performance of its services of test or inspection having been performed, will:
         (a) Verbally notify results to Architect, Contractor, and Owner's Representative within one hour of test or inspection having been performed (if Defective Work (Non-Conforming Work) is incorporated into project).
         (b) Submit written inspection report and test results as required within twenty four (24) hours of test or inspection having been performed.
   f. Final Report:
      1) Submit final report of tests and inspections at Substantial Completion, which identify unresolved deficiencies.

F. Architect's Responsibility:
   1. Architect Duties:
      a. Notify Owner's Representative before each test and/or inspection:

G. Field Quality Control:

1. Field Tests And Inspections:
   a. Field Test and Inspection requirements are described in detail in 'Field Quality Control' in Part 3 Execution' of individual Sections in Division 01 thru Division 49.

SECTION 01 5000 TEMPORARY FACILITIES AND CONTROLS

A. Owner will provide electric power for construction activities within limits available at existing facility.

B. Proprietary Camera Services: In its absolute discretion, and with or without notice to Contractor, Owner may provide from time to time, but is not obligated to provide, one or more cameras on or about Project site and/or signage or notices of the same:
   1. If provided by Owner, such camera(s) and/or signage and notices are solely for Owner's benefit and convenience and shall not be for benefit of Contractor, Subcontractor(s) or for any third person.
   2. Owner shall have no liability, obligation, or responsibility to Contractor, Subcontractors, or any third person relative to such camera(s), signage, or notices, or absence of camera(s), signage, or notices, including without limitation, installation, maintenance, operation, repair, testing, functionality, capacity, recording, monitoring, posting, etc., of the same (hereafter 'Proprietary Camera Services').
   3. Contractor, with Owner's prior consent (which shall not be unreasonably withheld), may relocate such camera(s), signage, or notices as necessary to not unreasonably, materially and physically interfere with work at Project Site.
   4. Contractor's obligations under Contract Documents, including but not limited to, Contractor's obligation for security of Project Site, are not modified by Owner's opportunity to provide, actually providing, or not providing Proprietary Camera Services and/or signage or notices regarding the same.
   5. This Specification Section does not preclude Contractor from providing its own camera(s), signage, or notices pursuant to terms and conditions of this Agreement. Neither does this Section reduce, expand or modify any other right or obligation of Owner pursuant to terms of this Agreement.

C. Exercise caution to avoid fire damage: Do not build fires on site.

D. Permanent mechanical system may be operated upon following conditions:
   1. Do not interfere with normal set-back temperature patterns except as approved by Project Manager.
   2. Do not operate system when the Work causing airborne dust is occurring or when dust caused by such Work is present without first installing temporary filtering system.

E. Existing lighting system may be used by Contractor.

F. Contractor will use existing water supply for construction purposes to extent of existing facilities.

G. Existing restroom facilities may be used by Contractor. Clean restrooms and portions of existing building used in accessing restrooms daily. If existing facilities are not usable, provide and maintain temporary sanitary toilet.

H. Erect adequate barricades, warning signs, and lights necessary to protect persons from injury or harm.

I. Contractor is responsible for security of materials, tools, and equipment. Do not permit others to use building keys provided by Owner. Safeguard building and contents while the Work is being performed and secure building when the Work is finished for day.

J. Protect existing trees and plants. Remove and replace vegetation that dies or is damaged beyond repair due to construction activities.

K. Provide temporary enclosures at exterior building openings for security and protection from weather, theft, and vandalism. Erect and maintain dust-proof partitions and enclosures as required to prevent spread of dust and fumes to occupied portions of building.

L. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and reduce possibility that air, waterways, and subsoil might be contaminated or polluted, or that other undesirable effects might result:
   1. Avoid use of tools and equipment that produce harmful noise.

2. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near site.
3. Protect the Work, materials, apparatus, and fixtures from injury due to weather, theft, and vandalism.

SECTION 01 6100 PRODUCT REQUIREMENTS

A. Provide products that comply with Contract Documents, are undamaged, and, unless otherwise indicated, are new and unused at time of installation. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and for intended use and effect.

SECTION 01 6200 PRODUCT OPTIONS

A. Product selection is governed by Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include:
   1. Substitutions And Equal Products:
      a. Generally speaking, substitutions for specified products and systems, as defined in Uniform Commercial Code, are not acceptable. However, equal products may be approved upon compliance with Contract Document requirements.
      b. Approved Products / Manufacturers / Suppliers / Installers:
         1) Category One:
            (a) Owner has established 'Value Managed Relationships' that extend beyond requirements of this Project. No substitutions or equal products will be allowed on this Project.
            (b) Follow specified procedures to preserve relationships between Owner and specified manufacturers / suppliers and advantages that accrue to Owner from those relationships.
         2) Category Two:
            (a) Owner has established National Contracts that contain provisions extending beyond requirements of this Project. No substitutions or equal products will be allowed on this Project.
            (b) Follow specified procedures to preserve relationships between Owner and specified manufacturers / suppliers and advantages that accrue to Owner from those relationships.
         3) Category Three:
            (a) Specified products are provided to Church Projects under a National Account Program. Use these products to preserve advantages that accrue to Owner from those programs. No substitutions or equal products will be allowed on this Project.
         4) Category Four:
            (a) Provide only specified products available from manufacturers listed. No substitutions, private-labeled, or equal products, or mixing of manufacturers' products is allowed on this Project.
            (b) In Sections where lists recapitulating Manufacturers previously mentioned in Section are included under heading '*Manufacturers*' or '*Approved Manufacturers*', this is intended as convenience to Contractor as listing of contact information only. It is not intended that all manufacturers in list may provide products where specific products and manufacturers are listed elsewhere in Section.
      c. Acceptable Products / Manufacturers / Suppliers / Installers:
         1) Type One: Use specified products / manufacturers unless approval to use other products / manufacturers has been obtained from Architect or Owner Representative by Addendum.
         2) Type Two: Use specified products / manufacturers unless approval to use other products and manufacturers has been obtained from Architect or Owner Representative in writing before installing or applying unlisted or private-labeled products.
         3) Use 'Equal Product Approval Request Form' to request approval of equal products, manufacturers, or suppliers before bidding or before installation, as noted in individual Sections.
      d. Quality / Performance Standard Products / Manufacturers:
         1) Class One: Use specified product / manufacturer or equal product from specified manufacturers only.
         2) Class Two: Use specified product / manufacturer or equal product from any manufacturer.
         3) Products / manufacturers used will conform to Contract Document requirements.

SECTION 01 6400 OWNER-FURNISHED PRODUCTS

A. Install items furnished by Owner or receive and store in safe condition items purchased directly by Owner according to requirements of Contract Documents.

SECTION 01 6600 DELIVERY, STORAGE, AND HANDLING REQUIREMENTS

A. Deliver, store, and handle products according to manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

B. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

C. Deliver products to site in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

D. Inspect products upon delivery to ensure compliance with Contract Documents, and to ensure that products are undamaged and properly protected.

E. Store products at site in manner that will simplify inspection and measurement of quantity or counting of units.

F. Store heavy materials away from Project structure so supporting construction will not be endangered.

G. Store products subject to damage by elements above ground, under cover in weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

SECTION 01 7000 EXECUTION REQUIREMENTS

A. Design, furnish, and install all shoring, bracing, and sheathing as required for safety and for proper execution of the Work and, unless otherwise required, remove same when the Work is completed.

B. Require installer of each major component to inspect both substrate and conditions under which the Work is to be done:
   1. Notify Owner in writing of unsatisfactory conditions.
   2. Do not proceed until unsatisfactory conditions have been corrected.

C. Provide attachment and connection devices and methods necessary for securing the Work:
   1. Secure the Work true to line and level.
   2. Allow for expansion and building movement.

D. Recheck measurements and dimensions before starting each installation.

E. Where mounting heights are not shown, install individual components at standard mounting heights recognized within industry or local codes for that application. Refer questionable mounting height decisions to Owner for final decision.

F. Cover and protect furniture, equipment, and fixtures from soiling and damage when demolition the Work is performed in rooms and areas from which such items have not been removed.

G. Completion Inspection:
   1. Upon 100 percent completion of Project, Contractor will request Substantial Completion Inspection.
   2. Owner will conduct Substantial Completion Inspection in presence of Contractor and furnish list of items to be corrected.
   3. Contractor will notify Owner in writing when items have been corrected.

SECTION 01 7400 CLEANING AND WASTE MANAGEMENT

A. Disposal Of Waste:
   1. Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in landfill or incinerator acceptable to authorities having jurisdiction:

   a. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   b. Remove and transport debris in manner that will prevent spillage on adjacent surfaces and areas.
2. Burning: Do not burn waste materials.
3. Disposal: Transport waste materials off Owner's property and legally dispose of them.

B. Progress Cleaning:
1. Keep premises broom-clean during progress of the Work.
2. During handling and installation, protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from soiling, damage, or deterioration until Substantial Completion.
3. Clean and maintain completed construction as frequently as necessary throughout construction period.
4. Remove waste materials and rubbish caused by employees, subcontractors, and contractors under separate contract with Owner and dispose of legally.

C. Final Cleaning:
1. Clean each surface or unit to condition expected in normal, commercial-building cleaning and maintenance program. Comply with manufacturer's instructions. Remove all rubbish from under and about building and leave building clean and habitable.
2. In addition to general cleaning noted above, perform cleaning for all trades at completion of the Work in areas where construction activities have occurred.
3. If Contractor fails to clean up, Owner may do so and charge cost to Contractor.

SECTION 01 7700 CLOSEOUT PROCEDURES

A. General:
1. Closeout process consists of three specific project closeout inspections. Contractor shall plan sufficient time in construction schedule to allow for required inspections before expiration of Contract Time.
2. Contractor shall conduct his own inspections of The Work and shall not request closeout inspections until The Work of the contract is reasonably complete and correction of obvious defects or omissions are complete or imminent.
3. Date of Substantial Completion shall not occur until completion of construction work, unless agreed to by Architect / Owner's Representative and included on Certificate of Substantial Completion.

B. Preliminary Closeout Review:
1. When Architect, Owner and Contractor agree that project is ready for closeout, Pre-Substantial Inspection shall be scheduled. Preparation of floor substrate to receive carpeting and any work which could conceivably damage or stain carpet must be completed, as carpet installation will be scheduled immediately following this inspection.
2. Prior to this inspection, completed test and evaluation reports for HVAC system and font, where one occurs, are to be provided to Project Manager, Architect, and applicable consultants.
3. Architect, Owner and Contractor review completion of punch list items. When Owner and Architect confirm that Contractor has achieved Substantial Completion of The Work, Owner, Architect and Contractor will execute Certificate of Substantial Completion that contains:
   a. Punch list of items requiring completion and correction will be created.
   b. Time frame for completion of punch list items will be established, and date for Substantial Completion Inspection shall be set.

C. Substantial Completion Inspection:
1. When Architect, Owner and Contractor agree that project is ready for Substantial Completion, an inspection is held. Punch list created at Pre-Substantial Inspection is to be substantially complete.
2. Prior to this inspection, Contractor shall discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups and similar elements.
3. Architect, Owner and Contractor review completion of punch list items. When Owner and Architect confirm that Contractor has achieved Substantial Completion of The Work, Owner, Architect and Contractor will execute Certificate of Substantial Completion that contains:
   a. Date of Substantial Completion.
   b. Punch List Work not yet completed, including seasonal and long lead items.
   c. Amount to be withheld for completion of Punch List Work.
   d. Time period for completion of Punch List Work.
   e. Amount of liquidated damages set forth in Supplementary Conditions to be assessed if Contractor fails to complete Punch List Work within time set forth in Certificate.

4. Contractor shall present Closeout Submittals to Architect and place tools, spare parts, extra stock, and similar items required by Contract Documents in locations as directed by Facilities Manager.

D. Final Acceptance Meeting:
1. When punch list items except for any seasonal items or long lead items which will not prohibit occupancy are completed, Final Acceptance Meeting is held.
2. Owner, Architect and Contractor execute Owner's Project Closeout - Final Acceptance form, and verify:
   a. All seasonal and long lead items not prohibiting occupancy, if any, are identified, with committed to completion date and amount to be withheld until completion.
   b. Owner's maintenance personnel have been instructed on all system operation and maintenance as required by the Contract Documents.
   c. Final cleaning requirements have been completed.
3. If applicable, once any seasonal and long lead items are completed, Closeout Inspection is held where Owner and Architect verify that The Work has been satisfactorily completed, and Owner, Architect and Contractor execute Closeout portion of the Project Closeout - Final Acceptance form.
4. When Owner and Architect confirm that The Work is satisfactorily completed, Architect will authorize final payment.

SECTION 01 7800 CLOSEOUT SUBMITTALS

A. Operations And Maintenance Data: Operations And Maintenance Manual that include:
1. Project Manual:
   a. Copy of complete Project Manual including Addenda, Modifications as defined in General Conditions, and other interpretations issued during construction:
      (1) Mark these documents to show variations in actual Work performed in comparison with text of specifications and Modifications. Show substitutions, selection of options, and similar information, particularly on elements that are concealed or cannot otherwise be readily discerned later by direct observation.
      (2) Note related record drawing information and Product Data.
2. Soils Report:
   a. Copy of Soils Report.
3. Operations and Data:
   a. Operations and maintenance submittals required by Contract Documents.
4. Warranty Documentation:
   a. Copies of warranties required by Contract Documents.
5. Record Documentation:
   a. Certifications required by Contract Documents.
   b. Documentation submittals required by Contract Documents.
   c. Testing and Inspection Reports required by Contract Documents.
6. Landscape Management Plan (LMP):
   a. Irrigation Section:
      (1) Documentation required by Sections under 32 8000 Heading: Irrigation.
   b. Landscaping Section:
      (1) Documentation required by Sections under 32 8000 Heading: Irrigation.

B. Warranties:
1. When written guarantees beyond one (1) year after substantial completion are required by Contract Documents, secure such guarantees and warranties properly addressed and signed in favor of Owner. Include these documents in Operations & Maintenance Manual(s) specified above.
2. Delivery of guarantees and warranties will not relieve Contractor from obligations assumed under other provisions of Contract Documents.

C. Project Record Documents:
1. Do not use record documents for construction purposes:
   a. Protect from deterioration and loss in secure, fire-resistive location.
   b. Provide access to record documents for reference during normal Working hours.
2. Maintain clean, undamaged set of Drawings. Mark set to show actual installation where installation varies from the Work as originally shown. Give particular attention to concealed elements that would be difficult to measure and record at later date.
   a. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.

b. Mark new information that is important to Owner, but was not shown on Contract Drawings.
c. Note related Change Order numbers where applicable.

END OF SECTION

SECTION 02 4113

SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Demolish and remove portions of existing site facilities as described in Contract Documents.

B. Related Requirements:
   1. New and replacement work specified in appropriate specification Sections.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling:
   1. Include on Construction Schedule specified in Section 01 3200 detailed sequence of individual site demolition operations.

1.3 SUBMITTALS

A. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Identify abandoned utility and service lines and capping locations on record drawings.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the site prior to bidding notify architect of any discrepancies or concerns. Items to examine are as follows:
   1. Pre-cast feature attachment to building.

3.2 PREPARATION

A. Notify corporations, companies, individuals, and local authorities owning conduits running to property.
   1. Protect and maintain conduits, drains, sewers, pipes, and wires that are to remain on the property.
   2. Arrange for removal of wires running to and on property. Remove pipes and sewers in accordance with instructions of above owners.

3.3 PERFORMANCE

A. Execute work in orderly and careful manner, with due consideration for neighbors and the public.

B. Carefully remove, disassemble, or dismantle as required, and store in approved location on site, existing items to be reused in completed work. Coordinate with Owner for equipment and materials to be removed by Owner.

C. Concrete And Paving Removal:
   1. Saw cut joints between material to be removed and material to remain to full depth.
   2. Hand-excavate trench 12 inches (300 mm) wide and 16 inches (400 mm) deep along concrete or paving to be removed. Cut roots encountered with saw, axe, or pruner. Do not cut roots with excavating equipment. Remove roots under concrete and paving to be replaced down to 12 inches (300 mm) below finish grade.

3.4 CLEANING

A. Keep streets and roads reasonably clean, and sweep daily.

B. Sprinkle demolition rubbish and debris as necessary to lay dust.

C. Promptly remove demolition materials, rubbish, and debris from property.

END OF SECTION

SECTION 03 1113

STRUCTURAL CAST-IN-PLACE CONCRETE FORMING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Design, construction, and safety of formwork.
   2. Furnish and install required formwork ready for placing of concrete.
   3. Strip and dispose of formwork.

B. Related Requirements:
   1. Section 01 0000: 'General Requirements':
   2. Section 03 3111: 'Normal Weight Structural Concrete'.
      a. Tolerances for placing normal weight structural concrete.

1.2 REFERENCES

A. Reference Standards:
   1. American Concrete Institute:
      a. ACI 318-14, 'Building Code Requirements for Structural Concrete and Commentary'.

1.3 SUBMITTALS

A. Informational Submittals:
   1. Manufacturer Instructions:
      a. Printed application instructions for form release agents.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Forms: Wood, metal, or plastic as arranged by Contractor:
   1. Forming material shall be compatible with specified form release agents and with finish requirements for concrete to be left exposed or to receive a smooth rubbed finish.

2.2 ACCESSORIES

A. Form Release Agents:
   1. Unexposed Surfaces Only: Contractor's option.

B. Form Release / Finish Agent:
   1. Vertical, Exposed Surfaces or Unexposed Surfaces:
      a. Chemically acting type.
      b. Type Two Acceptable Products.
         1) Crete-Lease 727 or 20-VOC by Cresset Chemical Co, Weston, OH www.cresset.com.
         2) Clean Strip (J-1 or J-3 VOC) by Dayton Superior Specialty Chemicals, Kansas City, KS www.daytonsuperiorchemical.com.
         3) E-Z Strip or DEBOND Form Coating by L & M Construction Chemicals, Omaha, NE www.lmcc.com.

4) Q-2 by Unitex, Kansas City, MO www.unitex-chemicals.com.
5) U S Spec SlicKote by U S Mix Products Co www.usspec.com.
6) Duogard or Duogard II by W R Meadows, Elgin, IL www.wrmeadows.com.
7) Equal as approved by Architect before use. See Section 01 6200.

C. Expansion / Contraction Joints:
1. 1/2 inch (13 mm) thick.
2. Manufactured commercial fiber type:
a. Meet requirements of ASTM D1751.
b. Type Two Acceptable Products:
1) Conflex by Knight-Celotex, Northfield, IL www.aknightcompany.com.
2) Sealtight by W R Meadows Inc, Hampshire, IL www.wrmeadows.com.
3) Equal as approved by Architect before installation. See Section 01 6200.
3. Recycled Vinyl:
a. Light gray color.
b. Type Two Acceptable Products:
1) Proflex by Oscoda Plastics Inc, Oscoda, MI www.oscodaplastics.com.
2) Equal as approved by Architect before Installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Forms:
1. Assemble forms so forms are sufficiently tight to prevent leakage.
2. Properly brace and tie forms.
3. Make proper form adjustments before, during, and after concreting.
4. Use new forms, or used forms that have been cleaned of loose concrete and other debris from previous concreting and repaired to proper condition. Use APA Plyform B-B Class I, or APA HDO Plyform B-B Class I, on exposed to view concrete that do not receive a smooth rubbed finish.
5. Use metal cold joint forms when unable to place concrete for footings, foundations, and slabs in continuous pours.

B. Accessories:
1. General:
a. Provide for installation of inserts, templates, fastening devices, sleeves, and other accessories to be set in concrete before placing.
b. Position anchor bolts for hold-down anchors and columns and securely tie in place before placing concrete.
2. Form Release / Finish Agents:
a. Film thickness shall be no thicker than as recommended by Manufacturer.
b. Allow no release / finish agent on reinforcing steel or footings.
3. Expansion Joints:
a. Install at joints between floor slab and foundation wall where shown on Drawings.

C. Form Removal:
1. Removal of forms can usually be accomplished in twelve (12) to twenty four (24) hours.
2. If temperature is below 50 deg F (10 deg C) or if concrete (stairs, beams, etc) depends on forms for structural support, leave forms intact for sufficient period for concrete to reach adequate strength.
3. For exposed to view surfaces that receive a smooth rubbed finish, remove forms while concrete is still “green”.
4. Metal bars or prys should not be used. Use wood wedges, tapping gradually when necessary.

3.2 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
   1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
      a. Quality Control is sole responsibility of Contractor.
         1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
            a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.

END OF SECTION

SECTION 03 1511

CONCRETE ANCHORS AND INSERTS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Cast-in anchors for concrete.
   2. Headed concrete anchor studs for concrete.
   3. Deformed bar anchors for concrete.
   4. Adhesive anchors and inserts for concrete.
   5. Drilled-in mechanical anchors for concrete.
   6. Screw anchors for concrete.
   7. Concrete anchors and inserts not specified elsewhere.

B. Related Requirements:
   1. Section 01 0000: ‘General Requirements’:
   2. Section 03 3111: ‘Cast-In-Place Structural Concrete’ for installation of cast-in-place anchors and inserts.

1.2 REFERENCES

A. Reference Standards:
   1. American Concrete Institute:
      a. ACI 355.4-11, 'Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary'.
      b. ACI 548.12-12, 'Specification for Bonding Hardened Concrete and Steel to Hardened Concrete with an Epoxy Adhesive'.
   2. American National Standards Institute / American Welding Society (Following are specifically referenced for Structural Steel testing):
      a. ANSI/AWS D1.1/D1.1M:2015, ‘Structural Welding Code - Steel’.
   3. ASTM International:
      a. ASTM A108-13, ‘Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished’.
      b. ASTM A307-14, 'Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength’.
      c. ASTM A563-15, 'Standard Specification for Carbon and Alloy Steel Nuts’.
      d. ASTM A706/A706M-16, ‘Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement’.
      e. ASTM A1064/A1064M-16a, 'Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete'.
      f. ASTM F1554-15, ‘Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength’.
      g. ASTM F3125/F3125-15a, ‘Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions'.
   4. International Code Council (IBC):
      a. IBC Chapter 17, ‘Structural Tests and Special Inspections’.
      b. ICC-ES Reports: 'ES Acceptance Criteria - Concrete Anchor Compendium':(ACC01, 2016).
         1) AC193, ‘Acceptance Criteria For Mechanical Anchors in Concrete Elements’ (approved Oct 2015).
         2) AC308 ‘Acceptance Criteria For Post-Installed Adhesive Anchors In Concrete Elements’ (approved Jan 2016).
      c. ICC/ESR-1056, ‘Titen HD Screw Anchors’ (reissued 03/2016).

d. ICC/ESR-1967, 'Hilti HIT HY 150 Max Adhesive Anchoring Systems' (reissued Jan 2013).

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's product literature for each item.

B. Informational Submittals:
   1. Test And Evaluation Reports:
      a. ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.
   2. Manufacturer's Instructions:
      a. Manufacturer's published installation recommendations for each item.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Having sufficient capacity to produce and deliver required materials without causing delay in work.
   2. Installer:
      a. Acceptable to Manufacturer, experienced in performing work of this section and has specialized in installation of work similar to that required for this project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
   1. Store materials protected from exposure to harmful weather conditions and as directed by Manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufactured Units:
   1. General:
      a. Use hot-dipped galvanized or stainless steel with matching nuts and washers in exterior and moist interior applications unless indicated otherwise on Contract Drawings.
      b. Install anchor bolts used to attach wood sill plates to foundation with 1/4 inch (6.4 mm) by 3 inch (76 mm) x 3 inch (76 mm) minimum adjustable plate washers and standard cut washers between wood sill plates and nuts.
      c. Nut: Conform to requirements of ASTM A563, Grade A, Hex.
      d. Conform to requirements of ASTM F3125/F3125 for chemical, physical and mechanical requirements for quenched and tempered bolts manufactured from steel and alloy steel.
   2. Threaded rod for adhesive anchors and cast-in anchors:
      a. Conform to requirements of ASTM A307, Grade A or ASTM F1554.
   3. Anchor Bolts:
      a. J-Bolts:

1) Non-headed type threaded 2 inches (50 mm) minimum conforming to requirements of ASTM F1554, Grade A.
2) Anchor hook to project 2 inches (50 mm) minimum including bolt diameter.

b. Headed Bolts:
1) Headed type threaded 2 inches (50 mm) minimum conforming to requirements of ASTM F1554, Grade A.

4. Headed Concrete Anchor Studs:
a. Composed of low carbon steel meeting requirements of ASTM A108.
b. Tensile Strength: 61,000 psi (420 MPa) minimum.
c. Yield Strength: 49,000 psi (340 MPa) minimum.

5. Deformed Bar Anchors:
a. Manufactured in accordance with requirements of ASTM A1064/A1064M.
b. Tensile Strength: 80,000 psi (552 MPa) minimum.
c. Yield Strength: 70,000 psi (485 MPa) minimum.

6. Rebar:
a. Composed of deformed carbon steel meeting requirements of ASTM A706/A706M, Grade 60.

7. Adhesive Anchors:
a. Cartridge Injection Adhesive Anchors.
b. Products shall have current ICC ES Evaluation report conforming to current ICC ES Acceptance Criteria AC308 for concrete.
c. Rod diameter and embedment length as indicated on Drawings.
d. Type Two Acceptable Products:
1) HIT-RE 500-SD Epoxy Adhesive by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.
2) PE1000+ by Powers Fasteners Inc., Brewster NY www.powers.com.
3) SET-XP Epoxy by Simpson Strong-Tie Co., Pleasanton, CA www.simpsonanchors.com.
4) Equal as approved by Architect before installation. See Section 01 6200.

8. Drilled-In Mechanical Anchors (Expansion Bolts):
a. Products shall have current ICC ES Evaluation report conforming to current ICC ES Acceptance Criteria AC193 for concrete.
b. Type Two Acceptable Products:
1) KWIK Bolt TZ Expansion Anchor by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.
2) KWIK-HUS EZ-I Internally Threaded Screw Anchor by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.
3) HSL-3 Heavy Duty Expansion Anchor by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.
4) HDA Undercut Anchor by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.
5) Power-Stud +SD1 by Powers Fasteners Inc., Brewster NY www.powers.com.
6) Strong-Bolt by Simpson Strong-Tie Co., Pleasanton, CA www.simpsonanchors.com.
7) Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
1. Embedded Items:
a. Identify position of reinforcing steel and other embedded items before drilling holes for anchors:
1) Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items.
2) Take precautions as necessary to avoid damaging pre-stressing tendons, electrical and telecommunications conduit, and gas lines.

b. Notify Architect if reinforcing steel or other embedded items are encountered during drilling.
2. Base Material Strength:
   a. Unless otherwise specified, do not drill holes in concrete until concrete has achieved full design strength.

3.2 PREPARATION

A. Surface Preparation:
   1. Clean surfaces prior to installation.
   2. Prepare surface in accordance with Manufacturer's written recommendations.

3.3 INSTALLATION

A. Drilled-In Anchors:
   1. General:
      a. Drill holes with rotary impact hammer drills using carbide-tipped bits or core drills using diamond core bits.
      b. Unless otherwise shown on Drawings, drill holes perpendicular to concrete surface.
      c. Where anchors are to be installed in cored holes, use core bits with matched tolerances specified by Manufacturer. Cores holes may only be used if acceptable to Manufacturer.
      d. Perform anchor installation in accordance with Manufacturer's published instructions.
   2. Adhesive Anchors:
      a. Clean holes in accordance with Manufacturer's published instructions before installation of adhesive:
         1) Follow Manufacturer's recommendations to ensure proper mixing of adhesive components.
      b. Adhesive:
         1) Inject adhesive into holes proceeding from bottom of hole and progressing toward surface so as to avoid introduction of air pockets into adhesive.
         2) Inject sufficient adhesive into hole to ensure that annular gap is filled to surface.
         3) Remove excess adhesive from surface.
      c. Shim anchors with suitable device to center anchor in hole. Do not disturb or load anchors before Manufacturer's specified cure time has elapsed.
      d. Temperature:
         1) Observe Manufacturer's recommendations with respect to installation temperatures for adhesive anchors.
         2) Base material temperatures must be maintained above minimum temperatures allowed by Manufacturer for full required epoxy cure time.
   3. Drilled-in Mechanical Anchors (Expansion Bolts):
      a. Protect threads from damage during anchor installation.
      b. Set anchors to Manufacturer's recommended torque, using a torque wrench. Following attainment of ten (10) percent of specified torque, one hundred (100) percent of specified torque shall be reached within 7 or fewer complete turns of nut. If specified torque is not achieved within required number of turns, remove and replace anchor, unless otherwise directed by Architect.
   4. Screw Anchors:
      a. Protect threads from damage during anchor installation.
      b. Set anchors to Manufacturer's recommended torque, using a torque wrench.

3.4 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Remove and replace misplaced or malfunctioning anchors.
   2. Fill empty anchor holes and patch failed anchor locations with high-strength, non-shrink, non-metallic grout acceptable to Architect.

3. Anchors that fail to meet proof load or installation torque requirements will be regarded as malfunctioning.
4. Repair damage to adjacent materials caused by product installation.

3.5 CLEANING

A. Waste Management:
   1. Disposal of rubbish, debris, and packaging materials.

3.6 PROTECTION

A. General:
   1. Protect installed products from damage during construction.

END OF SECTION

SECTION 03 2100

REINFORCEMENT BARS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install concrete reinforcement bars as described in Contract Documents.

B. Related Requirements:
   1. Section 01 0000: ‘General Requirements’:
      a. Section 01 1200: 'Multiple Contract Summary' for Owner Furnished Testing and Inspecting Services.
      b. Section 01 4523: ‘Testing and Inspecting Services’ for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   2. Section 03 2116: 'Epoxy-Coated Reinforcement Bars'.
   3. Section 03 3111: ‘Cast-In-Place Structural Concrete’ for:
      a. Reinforcement installed in concrete.
      b. Pre-installation conference held jointly with other concrete related sections.

1.2 REFERENCES

A. Association Publications:
   1. American Concrete Institute:
      a. ACI 'Detailing Manual' (2004 Edition).
   2. Concrete Reinforcing Steel Institute (CRSI):
      a. CRSI, 'Manual of Standard Practice' (2009 28th Edition).

B. Reference Standards:
   1. American Concrete Institute:
      a. ACI 117-10: ‘Specifications for Tolerances for Concrete Construction and Materials and Commentary’ (Reapproved 2015).
      b. ACI 318-14, ‘Building Code Requirements for Structural Concrete and Commentary'.
   2. ASTM International (Following are specifically referenced for reinforcement bars testing):
      a. ASTM A615/A615M-16, ‘Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
   1. Participate in pre-installation conference as specified in Section 03 3111.
   2. In addition to agenda items specified in Section 01 3100, and Section 03 3111, review following:
      a. Installation scheduling and reinforcing placement.
      b. Review Section 01 4523 for Testing and Inspection administrative requirements and responsibilities and Field Quality Control tests and inspections required of this section.
         1) Review requirements and frequency of testing and inspections.

B. Scheduling:
   1. Notify Testing Agency and Architect as directed in Section 03 3111.

1.4 SUBMITTALS

A. Informational Submittals:
   1. Certificates:
      a. Mill certificates for mill tests for reinforcing in accordance with ASTM A615/A615M.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Testing and Inspection Reports:
            a) Testing Agency Inspection Reports of reinforcement bars.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Comply with provisions of following codes and standards except where more stringent requirements are shown or specified:
      a. American Concrete Institute:
         1) ACI 318, ‘Building Code Requirements for Structural Concrete and Commentary'.
      b. Concrete Reinforcing Steel Institute:
         1) CRSI, 'Manual of Standard Practice'.

B. Qualifications:
   1. Throughout progress of the work of this section, provide at least one (1) person who shall be thoroughly familiar with Construction Documents and other applicable specified requirements, completely trained and experienced in necessary skills, and who shall be present at site and shall direct all work performed under this Section:
      a. In actual installation of the work of this Section, use adequate numbers of skilled workmen to ensure installation in strict accordance with approved design.
      b. In acceptance or rejection of work performed under this Section, no allowance will be made for lack of skill on part of workmen.

C. Testing And Inspection:
   1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
   2. Owner will provide Testing and Inspection for inspection of reinforcement bars:
      a. Owner will employ testing agencies to perform testing and inspection for inspection of reinforcement bars as specified in Field Quality Control in Part 3 of this specification:
         1) Owner’s employment of an independent Testing Agency does not relieve Contractor of Contractor’s obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
         2) See Section 01 1200: ‘Multiple Contract Summary’.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Deliver bars separated by size and tagged with manufacturer's heat or test identification number.
   2. Reinforcement bars shall be free of heavy rust scales and flakes, or other coating at time of delivery and placing.

B. Storage And Handling Requirements:
   1. Properly protect rebar on site after delivery.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Reinforcement Bars:
   1. Bars shall have grade identification marks and conform to ASTM A615/A615M:
      a. Grade 60 minimum, except dowels that are to be field bent, Grade 40 minimum.
   2. Bars shall be deformed type.
   3. Bars shall be free of heavy rust scales and flakes, or other bond-reducing coatings.

2.2 ACCESSORIES

A. Bar Supports:
   1. Concrete masonry units or bricks are not acceptable.
   2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CSRI, Class 2).
   3. Type Two Acceptable Products:
      a. Concrete 'dobies' or blocks wired to reinforcing.
      b. Manufactured chairs with 4 sq inch (25.8 sq cm) bearing surface on sub-grade, or other feature to prevent chair from being pushed into sub-grade or damaging vapor retarder under slabs on grade.
      c. Equals as approved by Architect before installation. See Section 01 6200.

2.3 FABRICATION

A. Fabricate reinforcement bars according to the Concrete Reinforcing Steel Institute (CRSI) 'Manual of Standard Practice' and details on Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Avoid cutting or puncturing vapor retarder during reinforcement placement and concrete operations.
   2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
   3. Blowtorch shall not be used to facilitate field cutting or bending or any other reinforcing work.
   4. Reinforcement shall not be bent after partially embedded in hardened concrete.

B. Placing Reinforcement:
   1. Comply with Concrete Reinforcing Steel Institute CRSI 'Manual of Standard Practice' recommended practice for 'Placing Reinforcing Bars' for details and methods of reinforcement placement and supports. and as herein specified.
   2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations:
      a. Locate and support reinforcing by chairs, runners, bolsters, bar supports, spacers, or hangers, as required as recommended by 'ACI Detailing Manual, except slab on grade work.
      b. Support bars in slabs on grade and footings with specified bar supports around perimeter and at 4-1/2 feet on center each way maximum to maintain specified concrete cover.
      c. Install bar supports at bar intersections.
   3. Bend bars cold.

4. Dowel vertical reinforcement for formed concrete columns or walls out of footing or structure below with rebar of same size and spacing required above.
5. Securely anchor and tie reinforcement bars and dowels before placing concrete. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

C. Splices:
1. Non-Concrete Structural System:
   a. Avoid splices of reinforcement bars at points of maximum stress. Lap bars 60 bar diameters minimum unless dimensioned otherwise on Drawings. Run reinforcement bars continuous through cold joints.
2. Concrete Structural System:
   a. In beams, slabs, and walls, avoid splices of reinforcement bars at points of maximum stress.
   b. Lap bars as follows:
      1) Compression Splices: 45 bar diameters minimum.
      2) Tension Splices: In accordance with ACI 318 Class B requirements.
      3) No splice shall be less than 20 inches (508 mm).
      4) For epoxy coated rebar, increase lap-splice lengths by 1.5 times those listed above.
   c. In columns, splices in vertical bars are permitted only at floor levels or points of lateral support and shall consist of 45 bar diameter laps.
   d. Run reinforcement bars continuous through cold joints.

D. Tolerances:
1. Provide following minimum concrete cover for reinforcement as per ACI 318 or ACI 318M. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations:
   a. Concrete cast against and permanently exposed to earth:
      1) Interior Slabs on Grade: 1 inches (25 mm). clear from top of slab at 4 inches (100 mm) slabs, 2 inches (50 mm) clear at 6 inches (150 mm) slabs.
      2) Sections other than Slabs: 3 inches (75 mm).
   b. Concrete Exposed to Earth or Weather:
      1) No. 6 and Larger Bars: 2 inches (50 mm).
      2) No. 5 and Smaller Bars, W31 and D31 Wire: 1-1/2 inches (38 mm).

3.2 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
   a. Quality Control is sole responsibility of Contractor.
      1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
         a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
2. Reinforcement Bars:
   a. Testing Agency shall provide inspection for Reinforcement Bars. See Section 03 3111 for Testing and Inspection requirements.

END OF SECTION

SECTION 03 2116

EPOXY - COATED REINFORCEMENT STEEL BARS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install epoxy coated reinforcement steel bars as described in Contract Documents.

B. Related Requirements:
   1. Section 01 0000: ‘General Requirements’:
      a. Section 01 1200: 'Multiple Contract Summary' for Owner Furnished Testing and Inspecting Services.
      b. Section 01 4523: ‘Testing and Inspecting Services’ for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   2. Section 03 2100: 'Reinforcement Bars'.
   3. Section 03 3111: ‘Cast-In-Place Structural Concrete’ for:
      a. Reinforcement installed in concrete.
      b. Pre-installation conference held jointly with other concrete related sections.

1.2 REFERENCES

A. Association Publications:
   1. American Concrete Institute:
      a. ACI 'Detailing Manual' (2004 Edition).
   2. Concrete Reinforcing Steel Institute (CRSI):
      a. CRSI, 'Manual of Standard Practice' (2009 28th Edition).

B. Reference Standards:
   1. American Concrete Institute:
      a. ACI 117-10: ‘Specifications for Tolerances for Concrete Construction and Materials and Commentary’ (Reapproved 2015).
      b. ACI 318-14, ‘Building Code Requirements for Structural Concrete and Commentary'.
   2. ASTM International (Following are specifically referenced for reinforcement bars testing):
      a. ASTM A615/A615M-16, ‘Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement'.
      b. ASTM A775/A775M-16, 'Standard Specification for Epoxy-Coated Reinforcing Bars'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
   1. Participate in pre-installation conference as specified in Section 03 3111.
   2. In addition to agenda items specified in Section 03 3111, review following:
      a. Installation scheduling and reinforcing placement.
      b. Review Section 01 4523 for Testing and Inspection administrative requirements and responsibilities and Field Quality Control tests and inspections required of this section.
         1) Review requirements and frequency of testing and inspections.

B. Scheduling:
   1. Notify Testing Agency and Architect as directed in Section 03 3111.

1.4 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Reinforcing placement drawings.

B. Informational Submittals:
   1. Certificates:
      a. Mill certificates certifying mill tests for reinforcing in accordance with ASTM A775/A775M.
         1) Mill test is to be approved before fabrication begins.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Testing and Inspection Reports:
            a) Testing Agency Inspection Reports of reinforcement bars.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Comply with provisions of following codes and standards except where more stringent requirements are shown or specified:
      a. American Concrete Institute:
         1) ACI 318, ‘Building Code Requirements for Structural Concrete and Commentary'.
      b. Concrete Reinforcing Steel Institute:
         1) CRSI, 'Manual of Standard Practice'.

B. Qualifications:
   1. Throughout progress of the work of this section, provide at least one (1) person who shall be thoroughly familiar with Construction Documents and other applicable specified requirements, completely trained and experienced in necessary skills, and who shall be present at site and shall direct all work performed under this Section:
      a. In actual installation of the work of this Section, use adequate numbers of skilled workmen to ensure installation in strict accordance with approved design.
      b. In acceptance or rejection of work performed under this Section, no allowance will be made for lack of skill on part of workmen.

C. Testing And Inspection:
   1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
   2. Owner will provide Testing and Inspection for reinforcement bars:
      a. Owner will employ testing agencies to perform testing and inspection for reinforcement bars as specified in Field Quality Control in Part 3 of this specification:
         1) Owner’s employment of an independent Testing Agency does not relieve Contractor of Contractor’s obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
         2) See Section 01 1200: ‘Multiple Contract Summary’.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Deliver bars separated by size and tagged with manufacturer's heat or test identification number.
   2. Reinforcement steel bars shall be free of abrasions or other penetrations of epoxy-coating at time of delivery and placing.

B. Storage And Handling Requirements:
   1. Properly protect rebar on site after delivery.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Epoxy Coated Reinforcement Steel Bars:
   1. Bars shall have grade identification marks and conform to ASTM A615/A615M with coating conforming to ASTM A775/A775M and comply with requirements of ACI 318.21.2.5:
      a. Bar supports shall be completely coated with epoxy or vinyl, compatible with both concrete and epoxy coating on bars. Coating shall be at least 1/8 inch thick at tips.
      b. Tie wire shall be nylon coated.
   2. Actual yield strength based on mill tests does not exceed specified yield strength by more than 18,000 psi and Ratio of actual ultimate stress (at breaking point) to actual tensile yield stress shall not be less than 1.25.
      a. Grade 60 minimum, except dowels that are to be field bent, Grade 40 minimum.
   3. Bars shall be deformed type.
   4. Bars shall be free of heavy rust scales and flakes, or other bond-reducing coatings.

2.2 ACCESSORIES

A. Bar Supports:
   1. Concrete masonry units or bricks are not acceptable.
   2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CSRI, Class 2).
   3. Type Two Acceptable Products:
      a. Concrete 'dobies' or blocks wired to reinforcing.
      b. Manufactured chairs with 4 sq inch (25.8 sq cm) bearing surface with sub-grade, or other feature to prevent chair from being pushed into sub-grade or damaging vapor retarder under slabs on grade.
      c. Equals as approved by Architect before installation. See Section 01 6200.

2.3 FABRICATION

A. Fabricate reinforcement bars according to the Concrete Reinforcing Steel Institute (CRSI) 'Manual of Standard Practice' and details on Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
   2. Blowtorch shall not be used to facilitate field cutting or bending or any other reinforcing work.
   3. Reinforcement shall not be bent after partially embedded in hardened concrete.

B. Placing Reinforcement:
   1. Comply with Concrete Reinforcing Steel Institute CRSI 'Manual of Standard Practice' recommended practice for 'Placing Reinforcing Bars' for details and methods of reinforcement placement and supports. and as herein specified.
   2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations:
      a. Locate and support reinforcing by chairs, runners, bolsters, bar supports, spacers, or hangers, as required as recommended by 'ACI Detailing Manual, except slab on grade work.

b. Support bars in slabs on grade and footings with specified bar supports around perimeter and at 4-1/2 feet on center each way maximum to maintain specified concrete cover.
c. Install bar supports at bar intersections.

3. Bend bars cold.
4. Dowel vertical reinforcement for formed concrete columns or walls out of footing or structure below with rebar of same size and spacing required above.
5. Securely anchor and tie reinforcement bars and dowels before placing concrete. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

C. Splices:
1. Non-Concrete Structural System:
a. Avoid splices of reinforcement bars at points of maximum stress. Lap bars 60 bar diameters minimum unless dimensioned otherwise on Drawings. Run reinforcement bars continuous through cold joints.
2. Concrete Structural System:
a. In beams, slabs, and walls, avoid splices of reinforcement bars at points of maximum stress.
b. Lap bars as follows:
1) Compression Splices: 45 bar diameters minimum.
2) Tension Splices: In accordance with ACI 318 Class B requirements.
3) No splice shall be less than 20 inches (508 mm).
4) For epoxy coated rebar, increase lap-splice lengths by 1.5 times those listed above.
c. In columns, splices in vertical bars are permitted only at floor levels or points of lateral support and shall consist of 45 bar diameter laps.
d. Run reinforcement bars continuous through cold joints.

D. Tolerances:
1. Provide following minimum concrete cover for reinforcement as per ACI 318 or ACI 318M. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations:
a. Concrete cast against and permanently exposed to earth:
1) Exterior Slabs on Grade (where shown): 2 inches (50 mm).
2) Sections other than Slabs: 3 inches (75 mm).
b. Concrete Exposed to Earth or Weather:
1) No. 6 and Larger Bars: 2 inches (50 mm).
2) No. 5 and Smaller Bars, W31 and D31 Wire: 1-1/2 inches (38 mm).

3.2 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
a. Quality Control is sole responsibility of Contractor.
1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
2. Reinforcement Bars:
a. Testing Agency shall provide inspection for Reinforcement Bars. See Section 03 3111 for Testing and Inspection requirements.

END OF SECTION

SECTION 03 3111

CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install concrete work as described in Contract Documents including:
      a. Quality of concrete used on Project but furnished under other Sections.
      b. Concrete mix information and use admixtures.
      c. Field Quality Control Testing and Inspection requirements for concrete.
      d. Pre-installation conference held jointly with other concrete related sections.
      e. Sealants and curing compounds used with concrete.
      f. Compact aggregate base for miscellaneous cast-in-place concrete.
      g. Miscellaneous cast-in-place concrete and equipment pads.

B. Products Installed But Not Furnished Under This Section:
   1. Concrete accessories.
   2. Detectable warning panels.
   3. Inserts, bolts, boxes, templates, and fastening devices for other work, including those for bases only for Mechanical and Electrical.
   4. Membrane Concrete Curing.

C. Related Requirements:
   1. Section 01 0000: ‘General Requirements’:
      a. Section 01 1200: 'Multiple Contract Summary' for Owner Furnished Testing and Inspecting Services.
      b. Section 01 3100: ‘Project Management and Coordination’ for pre-installation conference.
      c. Section 01 4000: ‘Quality Requirements’ for administrative and procedural requirements for quality assurance and quality control.
      d. Section 01 4301: ‘Quality Assurance – Qualifications’ establishes minimum qualification levels required.
      e. Section 01 4523: ‘Testing and Inspecting Services’ for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   2. Section 01 3100: ‘Project Management and Coordination’ for pre-installation conference.
   3. Section 01 4000: ‘Quality Requirements’ for administrative and procedural requirements for quality assurance and quality control.
   4. Section 01 4301: ‘Quality Assurance – Qualifications’ establishes minimum qualification levels required.
   5. Section 01 4523: ‘Testing and Inspecting Services’ for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   6. Section 03 1511: ‘Concrete Anchors and Inserts’.
   7. Section 03 2100: ‘Reinforcement Bars’.
   8. Section 03 2116: ‘Epoxy-Coated Reinforcement Steel Bars'.
   9. Section 03 3923: ‘Membrane Concrete Curing' for quality of curing materials used.
   10. Section 03 4800: ‘Precast Concrete Specialties’ for quality of detectable warning panels.
   11. Section 05 1223: 'Structural Steel For Buildings' for :
      a. Furnishing of pipe for pipe bollards.
   12. Section 07 9213: 'Elastomeric Joint Sealant' for quality of sealants.
   13. Section 31 0501: ‘Common Earthwork Requirements’ for:
      a. General procedures and requirements for earthwork.
      b. Pre-installation conference held jointly with other common earthwork related sections.
   14. Section 31 1123: 'Aggregate Base' for aggregate base under miscellaneous cast-in-place concrete and exterior slabs, under interior slabs-on-grade concrete, and asphalt paving.
   15. Section 31 2323: 'Fill' for compaction procedures and tolerances.

16. Section 32 8423: 'Underground Sprinklers' for sleeves for underground irrigation system.
17. Furnishing of items to be embedded in concrete specified in Section involved.

1.2 REFERENCES

A. Association Publications:
1. American Concrete Institute, Farmington Hills, MI www.concrete.org. Abstracts of ACI Periodicals and Publications.
   a. ACI 214.3R-88(97), *'Recommended Practice for Evaluation of Strength Test Results of Concrete*.
   b. ACI 224R-01, '*Control of Cracking in Concrete Structures*'.
   c. ACI 224.1R-07, '*Causes, Evaluation, and Repair of Cracks in Concrete Structures*'.
   d. ACI 224.2R-92(R2004): '*Cracking of Concrete Members in Direct Tension*'.
   e. ACI 224.3R-95(R2013), '*Joints in Concrete Construction*'.
   f. ACI 224.4R-13, *'Guide to Design Detailing to Mitigate Cracking'*.
   g. ACI 302.1R-15: '*Guide for Concrete Floor and Slab Construction'*.
   h. ACI 304R-00, *'Guide for Measuring, Mixing, Transporting and Placing Concrete*'.
   i. ACI 304.6R-09, *'Guide for the Measure of Volumetric-Measuring & Continuous-Mixing Concrete Equipment*'.
   j. ACI 305R-10, '*Guide to Hot Weather Concreting'*.
   k. ACI 306R-10, *'Guide to Cold Weather Concreting'*.
   l. ACI 309.1R-08, '*Report on Behavior of Fresh Concrete During Vibration'.*
   m. ACI 311.4R-05, *'Guide for Concrete Inspection'*.
   n. ACI 347R-14, *'Guide to Formwork for Concrete'*.
   o. Certifications:
      1) ACI CP-1(16), *'Technical Workbook for ACI Certification of Concrete Field Testing Technician-Grade 1*'.
      2) ACI CP-10(10), *'Craftsman Workbook for ACI Certification of Concrete Flatwork Technician/Finisher'*.
      3) ACI CP-19(16), *'Technical Workbook for ACI Certification of Concrete Strength Testing Technician'*.

B. Definitions:
1. Cementitious Materials: Portland cement alone or in combination with one or more of following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
2. Floor Flatness (FF): Rate of change in elevation of floor over a 12 inches (305 mm) section.
3. Floor Levelness (FL): Measures difference in elevation between two points which are 10 feet (3.05 m) apart.

C. Reference Standards:
1. American Association of State and Highway Transportation Officials:
   a. AASHTO M 213-01 (2015), 'Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)' (ASTM Designation D1751).
   b. AASHTO T 318-15, 'Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying'.
2. American Concrete Institute
   a. ACI 117-10 (R2015): 'Specifications for Tolerances for Concrete Construction and Materials and Commentary'.
   b. ACI 211.1-91(R2009), 'Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete'.
   c. ACI 301-16, 'Specification for Structural Concrete for Buildings'.
   d. ACI 305.1-14, 'Specification for Hot Weather Concreting'.
   e. ACI 306.1-90 (R2002), 'Standard Specification for Cold Weather Concreting'.
   f. ACI 308.1-11, 'Standard Specification for Curing Concrete'.
   g. ACI 318-14, 'Building Code Requirements for Structural Concrete' (ACI 318) and 'Commentary on Building Code Requirements for Structural Concrete' (ACI 318R).
3. ASTM International:

a. ASTM A706/A706M-16, ‘Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement)’.
b. ASTM C31/C31M-15, ‘Standard Practice for Making and Curing Concrete Test Specimens in the Field'.
c. ASTM C33/C33M-16, ‘Standard Specification for Concrete Aggregates'.
d. ASTM C39/C39M-15a, ‘Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens'.
e. ASTM C94/C94M-16, 'Standard Specification for Ready-Mixed Concrete'.
f. ASTM C140/C140M-16, ‘Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units'.
g. ASTM C143/C143M-15, 'Standard Test Method for Slump of Hydraulic-Cement Concrete'.
h. ASTM C150/C150M-16, 'Standard Specification for Portland Cement'.
i. ASTM C172/C172M-14a, ‘Standard Practice for Sampling Freshly Mixed Concrete'.
j. ASTM C173/C173M-16, ‘Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method'.
k. ASTM C192/C192M-16a, ’Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory'.
l. ASTM C231/C231M-14, ‘Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method'.
m. ASTM C260/C260M-10a, ‘Standard Specification for Air-Entraining Admixtures for Concrete'.
n. ASTM C330/C330M-14, 'Standard Specification for Lightweight Aggregates for Structural Concrete'.
o. ASTM C494/C494M-15a, 'Standard Specification for Chemical Admixtures for Concrete.
p. ASTM C496/C496M-11, ‘Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens’.
q. ASTM C567/C567M-14, ‘Standard Test Method for Determining Density of Structural Lightweight Concrete'.
r. ASTM C595/C595M-16, ‘Standard Specification for Blended Hydraulic Cements'.
s. ASTM C618-15, 'Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete'.
t. ASTM C1077-16, 'Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation'.
u. ASTM C1157/C1157M-11, ‘Standard Performance Specification for Hydraulic Cement'.
v. ASTM C1688/C1688M-14a, ‘Standard Test Method for Density and Void Content of Freshly Mixed Pervious Concrete’.
w. ASTM D1751-04(2013), 'Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)'.
x. ASTM E329-14a: ‘Standard Specification for Agencies Engaged in Construction Inspection and/or Testing'.
y. ASTM E1155-14, 'Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers’.

4. Corps of Engineers:
   a. CRD-C 508 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.
5. International Code Council (IBC) (2015 or latest approved edition):
   a. IBC Chapter 17, ‘Special Inspections And Tests’.
      1) Section 1704, 'Special Inspections And Tests, Contractor Responsibility And Structural Observations'.
      2) Section 1705, ‘Required Special Inspection And Tests’.
         a) Section 1705.2, 'Steel Construction'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conference as specified in Section 01 3100 and held jointly with following sections:
      a. Section 03 2100: ‘Reinforcement Bars’.

b. Section 03 2116: 'Epoxy-Coated Reinforcement Steel Bars'.

2. Schedule pre-installation conference prior to placing of footings, installation of foundation forms and reinforcing steel, and installation of anchors, dowels, inserts, and block outs in foundation walls and slabs.
3. In addition to agenda items specified in Section 01 3100, review following:
   a. Set up concrete placement pour card system and verify that all relevant trades have signed off prior to concrete placement.
   b. Obtaining trade sign-offs on each pour card will be responsibility of General Contactor's foreman or whoever is in charge of ordering concrete.
   c. Pour cards will be turned in to Quality Assurance representative after the work has been completed so that they can be reviewed and filed.
   d. Review installation scheduling, coordination, placement of building concrete, and placement of items installed in and under concrete.
   e. Review concrete installation scheduling, coordination and placement of site concrete and of items installed in concrete.
   f. Review 'Verification of Conditions' requirements.
   g. Review requirements for preparation of subgrade.
   h. Review aggregate base requirements.
   i. Review formwork requirements.
   j. Review approved mix design requirements and use of admixtures.
   k. Review reinforcing bar submittals.
   l. Review installation schedule and placement of reinforcing bars.
   m. Review placement, finishing, and curing of concrete including cold and hot weather requirements.
   n. Review joint layout plan for control and expansion joints fillers for sidewalks, curbs, and gutters:
      1) Review jointing requirements.
      2) Joint layout for concrete paving is specified in Section 32 1313.
   o. Review smooth rubbed concrete finish procedures and requirements (applied immediately after removing concrete formwork while concrete is 'green').
   p. Review layout plan, scheduling, coordination, and placement requirements of detectable warning panels.
   q. Review concrete slab tolerances and corrective measures if tolerances not met.
   r. Review safety issues.
   s. Review Section 01 4523 for Testing and Inspection administrative requirements and responsibilities and Field Quality Control tests and inspections required of this section.
      1) Review requirements and frequency of testing and inspections.

B. Scheduling:
   1. Notify Testing Agency and Architect twenty four (24) hours minimum before placing concrete.

1.4 SUBMITTALS

A. Action Submittals:
   1. Joint layout plan for control and expansion joints for sidewalks, curbs, and gutters for written approval before starting work on this Section.
   2. Detectable warning panels:
      a. Layout plan and joints location for written approval before starting work on this Section.
   3. Shop Drawings:
      a. Show dimensioned locations of anchor bolts for hold-down anchors and columns.
      b. Show reinforcement and all necessary bending diagrams and reinforcing steel list, and construction joint locations.
      c. Provide bar schedules and bending details.
      d. Reinforced concrete walls shall be shown in scale elevation (scale at least one quarter inch to one foot). Details shall be in accordance with ACI rules.
      e. Show all formwork for concrete surfaces which are to remain exposed in the finished work.

B. Informational Submittals:
   1. Certificates:

a. Installers:
   1) Certification for National Ready Mixed Concrete Association (NRMCA).
   2) Certification for ACI-certified Flatwork Finishers and Technicians.

2. Design Data:
   a. Mix Design:
      1) Furnish proposed mix design to Architect for review prior to commencement of Work.
         a) Include density (unit weight) and void content determined per ASTM C1688/C1688M for fresh mixed properties and per ASTM C140/C140M for hardened concrete properties.
         b) Mix design shall show proposed admixture, amount, usage instructions, and justification for proposed use.
   b. Ready-Mix Supplier:
      1) Require mix plant to furnish delivery ticket for each batch of concrete. Keep delivery tickets at job-site for use of Owner or his representatives. Tickets shall show following:
         a) Name of ready-mix batch plant.
         b) Serial number of ticket.
         c) Date and truck number.
         d) Name of Contractor.
         e) Name and location of Project.
         f) Specific class or designation of concrete conforming to that used in Contract Documents.
         g) Amount of concrete.
         h) Amount and type of cement.
         i) Total water content allowed by mix design.
         j) Amount of water added at plant.
         k) Sizes and weights of sand and aggregate.
         l) Time loaded.
         m) Type, name, manufacturer, and amount of admixtures used.
         n) Design Data.
      2) Provide certificates with supporting testing reports verifying compliance with Contract Document requirements and that materials provided are from single source for following:
         a) Cement.
         b) Aggregate.
         c) Fly Ash.

3. Source Quality Control Submittals:
   a. Concrete mix design: Submit mix designs to meet following requirements:
      1) Proportions:
         a) Mix Type F:
            (1) 4500 psi (31.03 MPa) minimum at twenty eight (28) days.
            (2) Water **/** Cementitious Material: 0.40 maximum by weight.
            (3) Use twenty five (25) percent Class F fly ash as part of cementitious material.
            (4) Mix Type F should be used for all exterior concrete exposed to freeze/thaw cycles and deicing salts, unless dictated otherwise by site conditions.
            (5) For concrete paving, use mix design based upon use of 1-1/2 inches (38 mm) coarse aggregate (about 15 percent).
         b) Mix Type G - Self-Consolidating Concrete (SCC). Contractor's option to use this mix type:
            (1) Self-consolidating concrete may be used for all architectural concrete, heavily reinforced concrete, concrete for structural repairs, and other members as described in contract documents.
            (2) All self-consolidating concrete shall contain high-range water-reducing admixture and viscosity-modifying admixture where required.
            (3) Minimum flow of 20 inches (508 mm) – 30 inches (762 mm) or as required by successful test placement.
            (4) Workability, pumpability, finishability, and setting time of mix design shall be verified with successful test placement onsite.
            (5) Viscosity Modifying Admixture (VMA) shall be used to optimize viscosity of Self-Consolidating Concrete (SCC) at dosage rates per manufacturer's recommendation.

c) Air Entrainment: Six (6) percent, plus or minus 1-1/2 percent for exterior concrete and foundation walls exposed to freeze/thaw cycles.
d) Do not add water any time during mixing cycle above amount required to meet specified water / cement ratio. No reduction in amount of cementitious material is allowed.

2) Slump:
a) 4 inch (100 mm) slump maximum before addition of high range water reducer.
b) 8 inch (200 mm) slump maximum with use of high range water reducer.
c) Slump not required for Mix Type F.

3) Admixtures:
a) Mix design shall show proposed admixture, amount, usage instructions, and justification for proposed use. Do not use any admixture without Architect's written approval.
b) Mineral: An amount of specified Class F (or Class C where Class F is not available) fly ash not to exceed twenty five (25) percent of weight of cement may be substituted for cement. If substituted, consider fly ash with cement in determining amount of water necessary to provide specified water / cement ratio.
c) Chemical: Specified accelerator or retarder may be used if necessary to meet environmental conditions.
d) Chemical: Special additives to promote rapid drying concrete may be used in interior concrete slabs on grade if necessary to meet construction schedules.

C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Record Documentation:
1) Pour Reports:
a) Provide report that records following information:
b) Date and time of start of pour, Date and time of end of pour, and Date and time of end of finishing procedures.
c) Temperature at start of pour, Temperature at end of Pour, and Maximum temperature during performance of finishing procedures.
d) Wind speed at start of pour, Wind speed at end of pour, and Maximum wind speed during performance of finishing procedures.
e) Humidity at start of pour, Humidity at end of pour, and High and low humidity during performance of finishing procedures.
f) Cloud cover at start of pour, Cloud cover at end of pour, and High and low cloud cover during performance of finishing procedures.
g) Screeding method and equipment used.
h) Saw cut method and equipment used.
2) Testing and Inspection Reports:
a) Testing Agency Testing and Inspecting Reports of concrete.

1.5 QUALITY ASSURANCE

A. Qualifications: Requirements of Section 01 4301 applies, but is not limited to following:
1. Installers and Installation Supervisor:
a. ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
2. Ready-Mix Supplier:
a. Comply with ASTM C94/C94M requirements and be certified according to NRMCA's 'Certification of Ready Mixed Concrete Production Facilities'.
3. Testing Agencies:
a. Independent agency qualified according to ASTM C1077 and ASTM E329.
1) Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technicians, Grade I according to ACI CP-1 or equivalent certification program.
2) Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be ACI-certified Concrete Laboratory Testing Technician - Grade II.

B. Testing And Inspection:
1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
2. Owner will provide Testing and Inspection on concrete:
a. Owner will employ testing agencies to perform testing and inspection on concrete as specified in Field Quality Control in Part 3 of this specification:
1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
2) See Section 01 1200: 'Multiple Contract Summary'.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Expansion Joint Filler Material:
a. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage And Handling Requirements:
1. Expansion Joint Filler Material:
a. Store materials in a clean, dry area in accordance with manufacturer's instructions.
b. Protect materials during handling and application to prevent damage.

1.7 FIELD CONDITIONS

A. Ambient Conditions:
1. For Cold Weather and Hot Weather Limitations, see Preparation in Part 3 of this specification.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
1. Manufacturer Contact List:
a. BASF (Construction Chemicals Division), Cleveland, OH www.master-builders-solutions.basf.us/en-us.
b. Bonsal American, Charlotte, NC www.bonsal.com.
c. Dayton Superior Specialty Chemicals, Kansas City, KS www.daytonsuperiorchemical.com.
d. Euclid Chemical Company, Cleveland, OH www.euclidchemical.com.
e. Fritz-Pak Concrete Admixtures, Dallas, TX www.fritzpak.com.
f. Grace Construction Products, Cambridge, MA www.graceconstruction.com and Grace Canada Inc, Ajax, ON (905) 683-8561.
g. L & M Construction Chemicals, Omaha, NE www.lmcc.com.
h. Larsen Weldcrete by Larsen Products Corp, Rockville, MD www.larsenproducts.com.
i. Sika Corporation, Lyndhurst, NJ www.sikaconstruction.com and Sika Canada, Pointe Claire, QC www.sika.ca.
j. Unitex, Kansas City, MO www.unitex-chemicals.com.
k. U S Mix Products Co, Denver, CO www.usspec.com.
l. W R Meadows, Hampshire, IL www.wrmeadows.com.

B. Performance:
1. Design Criteria: Conform to requirements of ASTM C94/C94M unless specified otherwise:
1) Class 5 Floor:
a) Final finish: Hard steel-troweled finish.
2. Capacities:

a. For testing purposes, following concrete strengths are required:
   1) At 7 days: 70 percent minimum of 28 day strengths.
   2) At 28 days: 100 percent minimum of 28 day strengths.

C. Materials:
1. Table One:

Portland Cement / Blended Hydraulic Cement Equivalencies		
ASTM C150/C150M (Low Alkali)	ASTM C595/C595M	ASTM C1157/C1157M
Type I	IP	GU
Type II	IP (MS)	MS
Type III		HE
Type V		HS

2. Hydraulic Cement: Meet requirements of ASTM C150/C150M, Type <**Insert Type**>.
   a. Meet requirements of ASTM C595/C595M, Type <**Insert Type**>.
   b. Meet requirements of ASTM C1157/C1157M, Type <**Insert Type**>.
3. Aggregates:
   a. Coarse:
      1) Meet requirements of ASTM C33/C33M or nonconforming aggregate that by test or actual service produces concrete of required strength and conforms to local governing codes.
      2) Aggregate shall be uniformly graded by weight as follows:

         a) Table Two:

Aggregates - Flat Work No. 67			
Sieve	Percent Passing	Sieve	Percent Passing
One Inch	100	25 mm	100
3/4 Inch	90 - 100	19 mm	90 - 100
3/8 Inch	20 - 55	9 mm	20 - 55
No. 4	0 - 10	4.75 mm	0 - 10
No. 8	0 - 5	2.36 mm	0 - 5

         b) Table Three:

Aggregates - All Other, Size No. 57			
Sieve	Percent Passing	Sieve	Percent Passing
1-1/2 Inch	100	38 mm	100
One Inch	95 - 100	25 mm	95 - 100
1/2 Inch	20 - 60	12 nm	25 - 60
No. 4	0 - 10	4.75 mm	0 - 10
No. 8	0 - 5	2.36 mm	0 - 5

   b. Fine:
      1) Meet requirements of ASTM C33/C33M.
      2) Aggregate shall be uniformly graded by weight as follows:

         a) Table Four:

Aggregates - Uniformly Graded by Weight			
Sieve	Percent Passing	Sieve	Percent Passing

3/8 Inch	100	9 mm	100
No. 4	95 - 100	4.75 mm	95 - 100
No. 8	80 - 100	2.36 mm	80 - 100
No. 16	50 - 85	1.18 mm	50 - 85
No. 30	25 - 60	0.60 mm	25 - 60
No. 50	10 - 30	0.30 mm	10 - 30
No. 100	2 - 10	0.15 mm	2 - 10

4. Water: Clear, apparently clean, and potable.
5. Admixtures And Miscellaneous:
   a. Mineral:
      1) Fly Ash: Meet requirements of ASTM C618, Class F (or Class C where Class F is not available) and with loss on ignition (LOI) of three (3) percent maximum.
   b. Chemical:
      1) No admixture shall contain calcium chloride nor shall calcium chloride be used as an admixture. All chemical admixtures used shall be from same manufacturer and compatible with each other.
      2) Air Entraining Admixture:
         a) Meet requirements of ASTM C260/C260M.
         b) Type Two Acceptable Products:
            (1) MasterAir VR 10 (formally MB-VR), Master AE 90 (formally MB-AE) or MasterAir AE 400 (formally EverAir Plus) by BASF.
            (2) Air Mix 200 Series or AEA-92 Series by Euclid.
            (3) Air Plus or Super Air Plus by Fritz-Pak.
            (4) Sika Air by Sika.
            (5) Daravair or Darex Series AEA by W R Grace.
            (6) Equal as approved by Architect before use. See Section 01 6200.
      3) Water Reducing Admixture:
         a) Meet requirements of ASTM C494/C494M, Type A and containing not more than 0.05 percent chloride ions.
         b) Type Two Acceptable Products:
            (1) MasterPozzolith (formerly Pozzolith) Series by BASF.
            (2) Eucon WR 75 or Eucon 91 by Euclid.
            (3) FR-2 or FR-3 by Fritz-Pak.
            (4) Plastocrete 160 by Sika.
            (5) Daracem, WRDA, or MIRA Series by W R Grace.
            (6) Equal as approved by Architect before use. See Section 01 6200.
      4) Water Reducing, Retarding Admixture:
         a) Meet requirements of ASTM C494/C494M, Type D and contain not more than 0.05 percent chloride ions.
         b) Type Two Acceptable Products:
            (1) MasterPozzolith (formerly Pozzolith) Series by BASF.
            (2) Eucon Retarder 75 by Euclid.
            (3) FR-1 or Modified FR-1 by Fritz-Pak.
            (4) Plastiment by Sika.
            (5) Daratard Series or Recover by W R Grace.
            (6) Equal as approved by Architect before use. See Section 01 6200.
      5) High Range Water Reducing Admixture (Superplasticizer):
         a) Meet requirements of ASTM C494/C494M, Type F or G and containing not more than 0.05 percent chloride ions.
         b) Type Two Acceptable Products:
            (1) MasterRheobuild 1000 (formerly Rheobuild 1000) or MasterGlenium (formerly Glenium) Series by BASF.
            (2) Eucon 37 or Eucon 537 by Euclid.
            (3) Supercizer 1 through 7 by Fritz-Pak.
            (4) Sikament 300 by Sika.
            (5) Daracem or ADVA Series by W R Grace.
            (6) Equal as approved by Architect before use. See Section 01 6200.
      6) Non-Chloride, Non-Corrosive Accelerating Admixture:

a) Meet requirements of ASTM C494/C494M, Type C or E and containing not more than 0.05 percent chloride ions.
b) Type Two Acceptable Products:
(1) MasterSet AC 534 (formerly Pozzolith NC 534) or MasterSet AC 122 (formerly Pozzolith122HE) or MasterSet FP 20 (formerly Pozzutec 20+) by BASF.
(2) Accelguard 80 by Euclid.
(3) Daraset, Polarset or Lubricon by W R Grace.
(4) Equal as approved by Architect before use. See Section 01 6200.

7) Corrosion Inhibiting Admixture:
a) Liquid admixture to inhibit corrosion of steel reinforcement in concrete by introducing proper amount of anodic inhibitor. Admixture shall contain thirty (30) percent calcium nitrite solution and shall be used where called for in specifications or on drawings.
b) Type Two Acceptable Products:
(1) Eucon CIA by Euclid.
(2) DCI or DCI-S by W R Grace.
(3) Equal as approved by Architect before use. See Section 01 6200.

8) Alkali-Silica Reactivity Inhibiting Admixture:
a) Specially formulated lithium nitrate admixture for prevention of alkali-silica reactivity (ASR) in concrete. Admixture must have test data indicating conformance to ASTM C1293.
b) Type Two Acceptable Products:
(1) Eucon Integral ARC by Euclid.
(2) RASIR by W R Grace.
(3) Equal as approved by Architect before use. See Section 01 6200.

9) Viscosity Modifying Admixture (VMA):
a) Liquid admixture used to optimize viscosity of Self-Consolidating Concrete (SCC). Subject to compliance with requirements, provide following at dosage rates per manufacturer's recommendation.
b) Type Two Acceptable Products:
(1) Visctrol by Euclid.
(2) VMAR3 by W R Grace.
(3) Equal as approved by Architect before use. See Section 01 6200.

10) Shrinkage Reducing Admixture (SRA):
a) Liquid admixture specifically designed to reduce drying shrinkage and potential for cracking.
b) Type Two Acceptable Products:
(1) Eucon SRA by Euclid.
(2) Eclipse 4500 (exterior concrete) by W R Grace.
(3) Eclipse Floor 200 (interior concrete) by W R Grace.
(4) Equal as approved by Architect before use. See Section 01 6200.

11) Rapid Drying Admixture in Interior Concrete Slabs on Grade:
a) Admixture specifically designed to promote rapid drying of concrete.
b) Type Two Acceptable Products:
(1) Concure Systems Admixture by Consure Systems.
(2) Aridus Admixture by US Concrete.
(3) Equal as approved by Architect before use. See Section 01 6200.

2.2 ACCESSORIES

A. Bonding Agents:
1. Type Two Acceptable Products:
a. Acrylic Additive by Bonsal American.
b. Day Chem Ad Bond (J-40) by Dayton Superior.
c. Flex-Con by Euclid Chemical Co.
d. Larsen Weldcrete by Larsen Products Corp.
e. Everbond by L & M Construction Chemicals.
f. MasterEmaco A 660 (formally Acryl 60) by BASF.

g. U S Spec Multicoat by U S Mix Products.
h. Intralok by W R Meadows.
i. Equal as approved by Architect before use. See Section 01 6200.

B. Evaporation Retardant:
1. Type Two Acceptable Products:
a. MasterKure ER 50 (Formerly Confilm) by BASF.
b. Sure Film J-74 by Dayton Superior.
c. Eucobar By Euclid Chemical Co.
d. E-Con by L & M Construction Chemicals.
e. Pro Film by Unitex.
f. U S Spec Monofilm ER by U S Mix Products.
g. Equal as approved by Architect before use. See Section 01 6200.

C. Expansion Joint Filler:
1. Expansion Joint Filler Material:
a. Design Criteria:
1) Resilient, flexible, non-extruding, expansion-contraction joint filler meeting requirements of ASTM D1751 and AASHTO M 213.
2) 1/2 inch (12.7 mm) thick.
3) Resilience:
a) When compressed to half of original thickness, recover to minimum of seventy (70) percent of original thickness.
b. Type Two Acceptable Products:
1) Fiber Expansion Joint by W R Meadows, Hampshire, IL www.wrmeadows.com.
2) Equal as approved by Architect before installation. See Section 01 6200.

D. Finishing Material (Exposed Vertical Faces of Foundation and Retaining Walls):
1. Finishing Material available in multiple concrete shades to closely match concrete surface.
2. Type Two Acceptable Products:
a. Mixture of 1 part cement (using same cement as used in concrete foundations), 1 part sand with 95 percent passing #50 sieve.
b. RapidSet WunderFixx by CTS Cement Manufacturing Corporation, Cypress, CA www.rapidset.com.
c. Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
1. Concrete Forms:
a. Verify dimensions and spot elevations for locations of forms for concrete footings, stem walls, building slabs, curbs, gutters, walkways, and drainage systems are correct before concrete is placed.
1) Notify Architect of incorrect dimensions or spot elevations in writing.
2) Do not place concrete until corrections are made and verified.
2. Detectable Warning Panels:
a. Examine substrate and verify substrate is suitable for installation of detectable warning panels:
1) Notify Architect of unsuitable conditions in writing.
2) Do not install detectable warning panels over unsuitable conditions.
3) Commencement of Work by installer is considered acceptance of substrate.

3.2 PREPARATION

A. Concrete Mixing:
1. General:
   a. All concrete shall be machine mixed.
   b. Water gauge shall be provided to deliver exact predetermined amount of water for each batch.
   c. Reliable system must be employed to insure that no less than predetermined amount of cement goes into each batch.
   d. Re-tempering partly set concrete will not be permitted.
2. Transit Mix: Mix:
   a. Transit mix concrete may be used provided it conforms to Specifications and tests herein described and ASTM C94/C94M.
   b. Central plant producing concrete and equipment transporting it are suitable for production and transportation of controlled concrete and plant is currently approved by local state DOT.
   c. Maximum elapsed time between time of introduction of water and placing shall be one (1) hour.
   d. Minimum time of mixing shall be one (1) minute per cubic yard after all material, including water, has been placed in drum, and drum shall be reversed for an additional two (2) minutes.
   e. Mixing water shall be added only in presence of Inspecting Engineer or inspector employed by Testing Agency.
   f. Trucks shall not be overloaded in excess of rated capacity as recommended by manufacturer.
3. Cold Weather Concreting Procedures:
   a. See ACI 306.1 'Standard Specification for Cold Weather Concreting' for additional requirements.
   b. General Requirements:
      1) Materials and equipment required for heating and protection of concrete shall be approved and available at Project site before beginning cold weather concreting.
         a) Heating devices used to maintain specified temperatures shall have baffle plate above, of sufficient size, and sand bed below, in order to distribute heat.
         b) Heating devices shall be so operated that temperature of air immediately below slab forms shall not exceed 100 deg F (37.8 deg C). Provide sufficient and suitable thermometers to verify compliance.
      2) Forms, reinforcement, metallic embedments, and fillers shall be free from snow, ice, and frost. Surfaces that will be in contact with newly placed concrete, including sub-grade materials, shall be 35 deg F (2 deg C) minimum at time of concrete placement.
      3) Thaw sub-grade 6 inches (150 mm) deep minimum before beginning concrete placement. If necessary, re-compact thawed material.
      4) Use no frozen materials or materials containing ice.
      5) No salt or other chemical may be used for such protection.
      6) Only specified non-corrosive non-chloride accelerator shall be used. Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.
   c. Requirements When Average twenty four (24) Hour Temperature, midnight to midnight, Is Below 40 deg F (4.4 deg C):
      1) Temperature of concrete as placed and maintained shall be 55 deg F (13 deg C) minimum and 75 deg F (27 deg C) maximum.
      2) Heat concrete for seventy two (72) hours minimum after placing if regular cement is used; for 48 hours if high early strength cement is used; or longer if determined necessary by Architect.
         a) During this period, maintain concrete surface temperature between 55 and 75 deg F (13 and 27 deg C).
      3) Vent flue gases from combustion heating units to outside of enclosure to prevent carbonation of concrete surface.
      4) Prevent concrete from drying during heating period. Maintain housing, insulation, covering, and other protection twenty four (24) hours after heat is discontinued.
      5) After heating period, if temperature falls below 32 deg F (0 deg C), protect concrete from freezing until strength of 2000 psi (13.79 MPa) minimum is achieved.

a) Protect flatwork exposed to melting snow or rain during day and freezing during night from freezing until strength of 3500 psi (24.13 MPa) minimum is achieved.

d. Requirements When Average twenty four (24) Hour Temperature, midnight to midnight, Is Above 40 deg F (4.4 deg C), but when temperature falls below 32 deg F (0 deg C):
   1) Protect concrete from freezing for seventy two (72) hours after placing, or until strength of 2000 psi (13.79 MPa) is achieved, whichever is longer.
   2) Protect flatwork exposed to melting snow or rain during day and freezing during night from freezing until strength of 3500 psi (24.13 MPa) minimum is achieved.

e. Protect soil supporting concrete footings from freezing under any circumstances.

4. Hot Weather Concreting Procedures:
   a. See ACI 305.1 'Specification for Hot Weather Concreting' for additional requirements.
   b. Maximum concrete temperature allowed is 90 deg F (32 deg C) in hot weather.
   c. Cool aggregate and subgrades by sprinkling.
   d. Avoid cement over 140 deg F (60 deg C).
   e. Use cold mixing water or ice.
   f. Use fog spray or evaporation retardant to lessen rapid evaporation from concrete surface.

B. Surface Preparation:
   1. Earthwork Preparation:
      a. Aggregate base and subgrade:
         1) Prepare aggregate base as specified in Section 31 1123.
         2) Prepare natural soil subgrade as specified in Section 31 2213.
         3) Prepare fill subgrade as specified in Section 31 2323.
   2. Concrete Slab Thickness:
      a. Increase thickness of concrete beneath detectable warning panels one inch (25 mm).
   3. Inserts, bolts, boxes, templates, pipes, conduits, and other accessories required by Divisions 22, 23, and 26 shall be installed and inspected before placing concrete.
   4. Install inserts, bolts, boxes, templates, pipes, conduits, and other accessories furnished under other Sections to be installed as part of work of this Section:
      a. Tie anchor bolts for hold-down anchors and columns securely to reinforcing steel.

C. Removal:
   1. Remove water and debris from space to be placed:

3.3 INSTALLATION

A. Placing Concrete:
   1. General:
      a. Place as soon after mixing as possible.
      b. Deposit as nearly as possible in final position.
      c. No concrete shall be deposited in water.
      d. Placing of concrete shall be continuous until panel or section is complete.
      e. In order to avoid overloading of forms and ties, observe following rate of filling for various air temperatures:
         1) Table Five:

Placing Concrete Rate			
Temperature	Rate of Fill per Hour	Temperature	Rate of Fill per Hour
40 deg F	2 feet	4.4 deg C	600 mm
50 deg F	3 feet	10 deg C	900 mm
60 deg F	4 feet	15.6 deg C	1 200 mm
70 deg F	5 feet	21 deg C	1 500 mm

      f. Compact concrete in forms by vibrating and other means where required.
         1) Thoroughly consolidate concrete around reinforcing bars (Consolidation not required in concrete around reinforcing bars with Mix Type G).
         2) Use and type of vibrators shall conform to ACI 309.

g. Form vertical surfaces full depth. Do not allow concrete to flow out from under forms in any degree into landscaped areas.
h. Consolidate concrete thoroughly.
i. Do not embed aluminum in concrete.
j. Do not use contaminated, deteriorated, or re-tempered concrete.
k. Avoid accumulation of hardened concrete.

2. Footings:
   a. Level top of finish footing and leave rough.
   b. Where joints are required, bulkhead, key horizontally, and dowel with two No. 5 reinforcing bars, 48 inches (1 200 mm) long.
3. Foundations And Walls: Leave steel projecting where required for floor tie.
4. Exterior Slabs:
   a. Dusting with cement not permitted.
   b. For continuous placing and where shown on Drawings, saw cut one inch (25 mm) deep control joints before shrinkage occurs (2 inches at 6 inch slabs) (50 mm at 150 mm slabs).
5. Miscellaneous Concrete Elements:
   a. Detectable Warning Panels:
      1) Follow Manufacturer's recommendations on following:
         a) Temperature requirements.
         b) Expansion and control joint requirements.
         c) Installation of panels.
         d) Curing of panels.
   b. Sidewalks, Exterior Stairs, And Landings:
      1) Slope with cross slope of 1/8 to 1/4 inch per ft (3 to 6 mm per 300 mm) (one to two percent) in direction of intended drainage.
      2) Slope away from building 1/8 to 1/4 inch per ft (3 to 6 mm per 300 mm) (one to two percent) minimum.
      3) Do not dust with cement.
      4) Concrete walks shall be screeded to bring surface to grades and lines as indicated. Surface shall be floated with wood float with no coarse aggregate showing and then given broom finish before concrete sets.
6. Joints:
   a. Control Joints (Contraction Joints):
      1) Form control joints with early-entry, dry-cut saws as soon as final trowel operations are complete and joints can be cut without raveling.
      2) Depth of control joints shall be approximately one quarter of concrete slab thickness, but not less than one inch (25 mm).
      3) Control joints to be hand tooled in sidewalks, curbs and gutters, mow strips, and aprons.
      4) Table Six:

Concrete Control Joint On-Center Spacing (+/-)		
Sidewalks	4 feet to 6 feet	12 meters to 18 meters
Curbs and Gutters	10 feet	3.0 meters
Mow Strips	3 feet to 5 feet	0.90 meters to 1.50 meters
Flat Drainage Structures	10 feet	3 meters
Retaining Walls w/guardrails	Align with posts	
Retaining Walls w/chain link fencing	Align with posts	

   b. Expansion Joints (Isolation Joints):
      1) Expansion joints in Concrete Paving are specified in Section 32 1313.
      2) Install so top of expansion joint material is 1/4 inch (6 mm) below finished surface of concrete.
      3) No expansion joint required between curbs and sidewalks parallel to curb.
      4) Provide expansion joints at ends of exterior site concrete elements that are perpendicular to and terminate at curbs, building foundations or other concrete elements (i.e. sidewalks, mow strips, aprons).

5) Provide expansion joints between sidewalks that are parallel, and adjacent, to storage building or main building.
6) Provide expansion joints around perimeter of concrete slab on grade at mechanical enclosure, around perimeter of slab on grade at dumpster enclosure and at top and bottom of exterior stairs.
7) Table Seven:

Concrete Expansion Joint (Isolation) On-Center Spacing (+/-)		
Sidewalks, Curbs and Gutters	40 feet to 100 feet	12 meters to 30 meters
Mow Strips and Aprons	20 feet to 40 feet	6 meters to 12 meters
Flat Drainage Structures	50 feet	15 meters
Retaining Walls w/guardrails	36 feet	11 meters
Retaining Walls w/chain link fencing	50 feet	15 meters

8) Seal expansion joints as specified in Section 07 9213 for following areas:
   a) Between entryway slabs and building foundations.
   b) Between sidewalks and building foundations.
   c) Within curbs and gutters.
   d) Within flat drainage structures and at joints between flat drainage structures and other concrete elements.
9) Expansion joints are not required to be sealed for following areas:
   a) Within aprons and where apron abuts sidewalks.
   b) Within mow strips and where mow strip abuts building foundation and sidewalks.
   c) Within sidewalks.

7. Bonding Fresh And Hardened Concrete:
   a. Re-tighten forms.
   b. Roughen surfaces.
   c. Clean off foreign matter and laitance.
   d. Wet but do not saturate.
   e. Slush with neat cement grout or apply bonding agent.
   f. Proceed with placing new concrete.
8. Anchor Bolts:
   a. Place anchor bolts not tied to reinforcing steel immediately following leveling of concrete. Reconsolidate concrete around bolt immediately after placing bolt.
   b. Do not disturb bolts during finishing process.

B. Finishing:
1. Interior Concrete Flatwork:
   a. Screed Concrete.
   b. Float Finish:
      1) Float as soon after screeding as possible.
      2) Consolidate surface with power-driven floats with exception of areas inaccessible to power-driven floats, which may be hand-floated.
      3) Re-straighten, cutting down high spots and filling low spots.
      4) Repeat float passes and re-straightening until surface has uniform, smooth, granular texture.
   c. Rough:
   d. Trowel Finish:
      1) Steel trowel slab after concrete has set enough to avoid bringing water and fines to surface.
      2) Perform troweling with power-driven trowels with exception of areas inaccessible to power-driven trowels, which may be hand-troweled.
      3) Continue troweling passes and re-straightening with 10 foot (3 meter) highway straightedge until surface is free of trowel marks and uniform in texture and appearance.
      4) Apply burnished, burned-out trowel finish.
2. Exterior Concrete Flatwork:
   a. Curb, Gutter Sidewalks, Mow Strips, Flat Drainage Structures, Stairs, And Miscellaneous:

1) After completion of floating, performed immediately after screeding and when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
   a) Provide fine hair finish where grades are less than 6 percent 1-1/4 inch (32 mm).
   b) Provide rough hair finish where grades exceed 6 percent 1-1/4 inch (32 mm).
   c) Broom finish, by drawing broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide fine line texture acceptable to Architect. At curb and gutter, apply broom finish longitudinal to curb and gutter flowline.
   d) On inclined slab surfaces, provide coarse, non-slip finish by scoring surface with stiff-bristled broom, perpendicular to line of traffic. At curb and gutter, apply broom finish longitudinal to curb and gutter flowline.
   e) Do not remove forms for twenty four (24) hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.
   f) Round edges exposed to public view to 1/2 inch (13 mm) radius, including edges formed by expansion joints.
   g) Remove edger marks.

3. Vertical Surfaces (Exposed To View Vertical Surfaces, Exposed Retaining Walls, Exposed Foundation Walls, Concrete Piers, and etc.):
   a. General:
      1) Finishing Material to fill and smooth interior and exterior concrete surface defects such as spalls, gouges, cracks, dents, chips, bug holes, stone pockets, honeycombs, voids and other defective areas.
      2) Chamfer lines shall be finished.
   b. Surface Preparation:
      1) Formwork shall be stripped from concrete while concrete is still 'green'.
      2) Concrete surface to be finished immediately after formwork has been removed.
         a) Immediately after removing forms, remove joints, marks, bellies, projections, loose materials and other irregularities, and cut back metal ties from surfaces to be exposed.
         b) Repair defective areas and voids or stone pockets with Finishing Material and smooth to even surface matching surrounding undamaged area.
   c. Smooth Rubbed Finish:
      1) Thoroughly wet with water, apply Finishing Material in thin layer, rub in circular motion to smooth uniform finish.
      2) Entire surface shall be protected from rapid drying for not less than three (3) days.
      3) Surfaces shall be cleaned of drip marks and discolorations.
      4) Concrete surface shall be left with clean, neat, uniform finish, free from form markings and shall be uniform in color and texture.

C. Curing:
   1. Membrane Concrete Curing:
      a. As specified in Section 09 3923 'Membrane Concrete Curing'.
      b. Follow Manufacturer's written instructions for preparation, application rates, placement, and cleanup:
         1) Apply as soon as troweling on interior concrete is complete.
         2) Apply as soon as brooming or finishing of exterior concrete is complete.
         3) Spraying application is required.
         4) Do not dilute or thin product.
         5) Do not apply when temperature of concrete is less than 40 deg F (4.4 deg C).
         6) Apply uniformly without puddles or ponding.
         7) Do not apply before bleed water has dissipated.
         8) Do not apply over standing water.

D. Tolerances:
   1. General:
      a. Tolerances shall conform to requirements of ACI 117 or CSA A23.1/A23.2, except where specified differently:
      b. Maximum Variation Tolerances:

1) Table Eight:

Maximum Variation Tolerances		
Thickness, standard	plus 3/8 inch, minus 1/4 inch	plus 9.5 mm, minus 3 mm
Thickness, footings	minus 0 inch	minus 0 mm
Plan, 0 - 20 feet	1/2 inch	12.7 mm
Plan, 40 feet or greater	3/4 inch	19 mm
Plan, footings	plus 1/2 inch	plus 12.7 mm
Eccentricity, footings	2 inch max. standard, 1/2 inch at masonry	50 mm max. standard, 12.7 mm at masonry
Openings, size	minus 1/4 inch, plus One inch	minus 6 mm, plus 25.4 mm
Openings, location	plus / minus 1/2 inch at center	plus / minus 12.7 mm at center
Plumb	1/2 inch max.	12.7 mm max.
Consecutive Steps, treads	1/4 inch	6 mm
Consecutive Steps, risers	1/8 inch	3 mm
Flight of Stairs, treads	1/4 inch in total run	6 mm in total run
Flight of Stairs, risers	1/8 inch in total height	3 mm in total height

3.4 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
   a. Quality Control is sole responsibility of Contractor:
      1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
         a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
2. Concrete:
   a. Testing Agency shall provide testing and inspection for concrete as per ASTM C1077.
   b. Testing Agency will sample and test for quality control during placement of concrete as directed by Architect.
   c. Testing and inspections, if performed, will include following:
      1) Periodic inspection verifying use of required design mix.
      2) Inspection at time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine temperature of concrete.
      3) Inspection of concrete and shotcrete placement for proper application techniques.
      4) Periodic inspection for maintenance of specified curing temperature and techniques.
      5) Periodic inspect of formwork for shape, location and dimensions of concrete member being formed:
         a) Certified Inspector shall inspect forms for general location, configuration, camber, shoring, sealing of form joints, correct forming material, concrete accessories, and form tie locations.
      6) Concrete floor flatness and floor levelness of interior slabs as per ASTM E1155.
      7) Concrete moisture and alkalinity testing. See Section 09 0503 Flooring Substrate Preparation.
   d. Testing Agency will sample and test during placement of concrete as directed by Architect and may include following:
      1) Sampling Fresh Concrete: ASTM C172/C172M, except modified for slump to comply with ASTM C94/C94M:
         a) Slump: ASTM C143/C143M, test each time set of compressive specimens are made.
         b) Air Content: ASTM C173/C173M, volumetric method for lightweight or normal weight concrete: ASTM C231/C231M, pressure method for normal weight concrete each time set of compression test specimens are made.
         c) Concrete Temperature: Test each time set of compressive specimens are made.

d) Unit Weight: ASTM C567/C567M, Test each time set of compressive specimens are made.

e. Compression Test Specimen: ASTM C31/C31M; one (1) set of four (4) standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

f. Compressive Strength Tests: ASTM C39/C39M: Provide three (3) random sets for site cast concrete (sidewalks, curbs, gutters, etc). Testing of concrete for Building is not required and will be performed at discretion of Architect:

1) If sets are taken, one (1) specimen tested at seven (7) days, two (2) specimens tested at twenty eight (28) days, and one (1) specimen retained in reserve for later testing if required.

2) If strength of field-cured cylinders is less than eighty five (85) percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing in-place concrete.

3) Strength level of concrete will be considered satisfactory if averages of sets of three (3) consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi (3.45 MPa).

3. Reinforcement Bars and Bolts:
   a. Inspection of Reinforcement Bars and Bolts is not required for Project.

B. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.

3.5 CLEANING

A. General:
   1. Curing:
      a. Clean tools, equipment as directed by Manufacturer's instructions.
   2. Detectable Warning Panels:
      a. Clean panel(s) in accordance with Manufacturer’s cleaning instruction.

3.6 PROTECTION

A. Concrete:
   1. Protect concrete that has not received its initial set from precipitation to avoid excess water in mix and unsatisfactory surface finish.
   2. Do not allow materials resulting from construction activities, which will affect concrete or application of finish floor systems adversely, to come in contact with interior concrete slabs.
   3. Protect interior concrete floors from stains, paint, mortar and other construction activities.

B. Curing:
   1. Restrict foot or vehicle traffic as curing membrane dries as recommended be Manufacturer.

C. Detectable Warning Panels:
   1. Protect installed panels from damage and until completion of project.
   2. Protect installed panels from traffic until desired concrete strength is achieved.

END OF SECTION

SECTION 03 3923

MEMBRANE CONCRETE CURING

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Quality of membrane concrete curing as described in Contract Documents.

B. Related Requirements:
   1. Section 03 3111: 'Cast-In-Place Structural Concrete' for application of membrane concrete curing.

1.2 REFERENCES

A. Definitions:
   1. Curing: Process by which hydraulic-cement concrete matures and develops hardened properties, over time, as result of continued hydration of cement in presence of sufficient water and heat. Also used to describe action taken to maintain moisture and temperature conditions in freshly placed concrete.

B. Reference Standards:
   1. American Association of State and Highway Transportation Officials:
      a. AASHTO M 148-05, ‘Standard Specification for Liquid Membrane-Forming Compounds for Curing’.
   2. ASTM International:
      a. ASTM C309-11, 'Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete'.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's product data.
      b. Material Safety Data Sheets (MSDS.

B. Informational Submittals:
   1. Manufacturer Instructions:
      a. Printed installation instructions.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Comply with applicable VOC standards and other local requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:

1. Follow Manufacturer's written instructions for handling and storage of product:
   a. Store in unopened containers in clean, dry area between 35 deg F (2 deg C) and 110 deg F (43 deg C) (Keep from freezing) or as directed by Manufacturer's instruction.
2. Shelf Life: Do not use curing compound that is over one (1) year from manufacturer date.

1.6 FIELD CONDITIONS

A. Ambient Conditions:
   1. Do not apply curing compound when temperature of concrete is less than 40 deg F (4.4 deg C).

PART 2 - PRODUCTS

2.1 MATERIALS

A. Membrane Concrete Curing:
   1. Description:
      a. Clear water-based, ready-to use, dissipating membrane curing agent that cures freshly placed concrete, forming effective barrier against moisture loss from concrete surface.
   2. Design Criteria:
      a. VOC-compliant compound.
      b. Meet requirements of ASTM C309 and AASHTO M 148, Type 1 or 1-D, Class B.
      c. Interior concrete: containing no mineral spirits, naptha, or other components detrimental to finish flooring installation.
      d. Maintain ninety five (95) percent of mix water present in concrete mass after application.
      e. Gradually dissipate after twenty eight (28) days without leaving stain or discoloring concrete surface.
   3. Horizontal and Vertical Cast-In-Place Structural Concrete:
      a. Type One Acceptable Products.
         1) Exterior and Interior Concrete:
            a) Clear Cure J7WB by Dayton Superior Corporation, Miamisburg. OH www.daytonsuperior.com.
            b) L&M Cure R by L&M Construction Chemicals, Inc. Omaha, NE www.lmcc.com.
            c) Clear Water Resin by Right Point, Dekalb, IL www.rightpointe.com.
            d) 1100-Clear by W. R. Meadows, Inc. Hampshire, IL www.wrmeadows.com.
      b. Equal product meeting design criteria requirements as approved by Architect/Owner's Representative before BID. See Section 01 6200.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 03 4800

PRECAST CONCRETE SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install precast concrete elements as described in Contract Documents including but not limited to the following:
      a. Splash blocks.

B. Products Furnished But Not Installed Under This Section:
   1. Detectable warning panels.

C. Related Requirements:
   1. Section 03 3111: 'Cast-In-Place Structural Concrete' for installation of detectable warning panels.
   2. Section 07 9213: 'Elastomeric Joint Sealants'.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM A615/A615M-14, 'Standard Specification for Deformed and Plain Steel Bars for Concrete Reinforcement'.
      b. ASTM A1064/A1064M-14, 'Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete'.
      c. ASTM C33/C33M-13, 'Standard Specification for Concrete Aggregates'.
      d. ASTM C150/C150M-12, 'Standard Specification for Portland Cement'.
      e. ASTM C260/C260M-10a, 'Standard Specification for Air-Entraining Admixtures for Concrete'.
      f. ASTM C494/C494M-13, 'Standard Specification for Chemical Admixtures for Concrete'.
      g. ASTM C496/C496M-11, 'Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens'.
      h. ASTM C672/C672M-12, 'Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals'.
      i. ASTM C779/C779M-12, 'Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces'.
      j. ASTM C947-03(2009), 'Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam With Third-Point Loading)'.
      k. ASTM C979/C979M-10, 'Standard Specification for Pigments for Integrally Colored Concrete'.
      l. ASTM C1645/C1645M-11, 'Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units'.
   2. ASTM International (following are referenced specifically for detectable warning panels):
      a. ASTM C39/C39M-14a, 'Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens'.
      b. ASTM C140-14b, 'Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units'.
      c. ASTM C293/C293M-10, 'Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading)'.
      d. ASTM C418-12, 'Standard Test Method for Abrasion Resistance of Concrete by Sandblasting'.

e. ASTM C1262-10, 'Standard Test Method for Evaluating the Freeze-Thaw Durability of Dry-Cast Segmental Retaining Wall Units and Related Concrete Units'.

1.3 SUBMITTALS

A. Action Submittals:
1. Product Data:
a. Manufacturer product literature for each type of product indicated.
2. Shop Drawings:
a. Precast concrete elements:
1) Detail fabrication and installation of architectural precast concrete units.
2) Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
3) Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners.
a) Indicate separate face and backup mixture locations and thicknesses.
4) Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
5) Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
6) Include plans and elevations showing unit location and sequence of erection for special conditions.
7) Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
8) Indicate relationship of architectural precast concrete units to adjacent materials.
9) Indicate locations and details of stone facings, anchors, and joint widths.
b. Detectable warning panels:
1) Detail fabrication details and installation of detectable warning panels.
2) Indicate locations on site, plans, dimensions, shapes, and cross sections of each unit.
3) Indicate joints locations and placement.
3. Samples:
a. Detectable warning panels.
1) Provide 4 inch (100 mm) by 4 inch (100 mm) minimum sample of detectable warning panel representing actual finish, color, texture, and patterns.

B. Informational Submittals:
1. Certificates:
a. Precast concrete elements:
1) Material Certificates: For the following items, signed by manufacturers:
a) Admixtures.
b) Bearing pads.
c) Brick units and accessories.
d) Cementitious materials.
e) Reinforcing materials.
2. Design Submittals:
a. Precast concrete elements:
1) Design Modifications:
a) If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings.
b) Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
3. Test And Evaluation Reports:
a. Material Test Reports:
1) Detectable warning panels:
a) Test reports from qualified independent testing laboratory indicating that material proposed for use meets physical properties indicated herein.
2) Precast concrete units:
a) Aggregates.
4. Manufacturer's Instructions:
a. Detectable warning panels:

1) Cleaning and maintenance instructions.
2) Preparation and installation instructions.
3) Storage and handling requirements.

5. Source Quality Control Submittals.
   a. Precast concrete units:
      1) Control test reports.
      2) Precast Concrete mix design: Submit compressive strength and water-absorption tests for each precast concrete mix design.
6. Qualification Statements:
   a. Precast concrete units:
      1) Installer and Fabricator:
         a) Letter certifying level of training and experience of Installer and Fabricator.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Detectable Warning Panels: Maintenance instructions.
      b. Warranty Documentation:
         1) Detectable Warning Panels: Final, executed copy of Warranty.
      c. Record Documentation:
         1) Manufacturers documentation:
            a) Detectable Warning Panels: Manufacturer's literature or cut sheet.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Americans with Disabilities Act – 28 CFR Part 35 Title II and 28 CFR 36 Title II:
      a. Comply with requirements of detectable warning surfaces.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Check, carefully unload, and deliver material to site in such manner as to avoid soiling and damaging.
   2. Detectable warning panels:
      a. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
   1. Store material on planks clear of ground and protect from damage.
   2. Detectable warning panels:
      a. Store pallets on supported flat surface. Do not double stack pallets.

1.6 WARRANTY

A. Manufacturer Warranty:
   1. Detectable Warning Panels:
      a. Provide Manufacturer Five (5) Year limited Warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Materials:
   1. Design Criteria:

a. Precast Concrete:
   1) Air Entrainment: Wet cast mixture maintains 5 to 7 percent air entrainment where surfaces are exposed to freeze-thaw. Admixture conforms to ASTM C260.
   2) Aggregates: ASTM C33/C33M.
   3) Cement: ASTM C150/C150M, Type II.
   4) Compressive Strength: 4500 psi (31.03 MPa) concrete minimum.
   5) Water: Potable water free from impurities.
b. Reinforcing:
   1) Bars: ASTM A615/A615M, Grade 60.
   2) Reinforcing Mesh: ASTM A1064/A1064M.
c. Concrete Elements:

2.2 ACCESSORIES

A. Sealant: As specified in Section 07 9213: 'Elastomeric Joint Sealants'.

B. Detectable Warnings Panels:
   1. ADA compliant.
   2. Cementitious high strength reinforced concrete panel.
   3. Meet requirements of following:
      a. ASTM C39/C39M or ASTM C140 for compressive strength requirements.
      b. ASTM C140 for water absorption requirements.
      c. ASTM C293 or ASTM C947 for flexural strength requirements.
      d. ASTM C418 or C779 for abrasion resistance requirements.
      e. ASTM C1262 for freeze thaw requirements.
   4. Dome spacing: standard spacing approved by code.
   5. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
      a. TekWay Dome Tiles by StrongGo Industries, Tucson, AZ www.stronggo.com.
      b. CASTinTACT by Masons Supply Co., Portland OR www.masco.net/castintactweb.

2.3 FABRICATION

A. General:
   1. Chamfered edges.
   2. Smooth finish free from pits and rock pockets.

B. Splash Blocks:
   1. 16 inches (400 mm) wide by 24 inches (600 mm) long by 3 inches (75 mm) high.
   2. Formed water trough.
   3. Cast in reinforcing mesh.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Detectable warning panels:
   1. Follow Manufacturers installation instructions.

END OF SECTION

SECTION 04 0121

UNIT MASONRY REPOINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Remove existing mortar to specified depth, clean joints, and tuck-point as described in Contract Documents.
   2. Remove, clean, and reinstall existing masonry units as described in Contract Documents.
   3. Remove existing masonry units and replace with new masonry units as described in Contract Documents.

B. Related Requirements:
   1. Section 04 0513: 'Cement and Lime Masonry Mortaring'.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM C150/C150M-16, 'Standard Specification for Portland Cement'.
      b. ASTM C207-06(2011), 'Standard Specification for Hydrated Lime for Masonry Purposes'.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Materials:
   1. Design Criteria:
      a. Hydrated Lime: Meet requirements of ASTM C207, Type S.
      b. Portland Cement: Meet requirements of ASTM C150/C150M-09, Type II, White (non-staining).
      c. Aggregate:
         1) Match existing as much as possible.
         2) Generally, sand with rounded edges is preferred.
   2. Color:
      a. Match existing mortar color unless otherwise agreed to.
      b. This will generally require fresh mortar to be slightly darker than existing to compensate for natural bleaching with age.
   3. Water: Clean, drinkable.

B. Mixes:
   1. Pointing mortar shall be softer or no harder than existing mortar. Unless agreed to otherwise, mix may be one part lime and 2 parts sand. Portland cement may be added up to 20 percent of total lime and sand. Use no admixtures.
   2. Mix dry ingredients, then add about half water and mix for five minutes. Add additional water slowly until proper consistency is reached. Use mortar within 30 minutes. Do not re-temper.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Interface With Other Work: Coordinate work of this Section with general masonry cleaning so all, except final pointing, is completed before general masonry cleaning, if any.

B. Remove mortar from joint 2-1/2 times deeper than joint width or one inch, whichever is greater, with hammer and cold chisel or other suitable hand tools. Do not use power tools unless it can be demonstrated to Architect's satisfaction that masonry surfaces will not be damaged.

C. Remove masonry from designated areas, if any, and clean mortar from salvageable removed units and from surrounding units in wall. Re-lay masonry units in wall leaving raked joint to approximate depth of existing joints prepared for repointing. Mortar for re-laying shall be as specified in Section 04 0513.

D. Clean joints with combination of water flushing and brushing with bristle brush.

E. Work fresh mortar from 'hawk' to joint with jointing tool. First fill recessed areas, which are deeper than standard chiseled depth, and then proceed to fill raked joint using several layers of mortar and working tool in one direction only. Each layer of mortar shall be thumbprint hard before succeeding layer is applied. Where corners of face brick have eroded, it may be necessary to recess mortar to some degree in order to maintain consistent visual width of joints.

F. Perform final tooling when mortar is thumbprint hard.

3.2 CLEANING

A. Clean face of masonry one to two hours after mortar has set.
   1. Use plain stiff bristle brush.
   2. If mortar has become too hard, use brush and plain water and wooden paddle or, if necessary, a chisel.
   3. If harsher cleaning methods are required, allow mortar to cure thirty (30) days before commencing.

END OF SECTION

SECTION 04 0144

STONE RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Stone restoration as described in Contract Documents.

1.2 SUBMITTALS

A. Action Submittals
   1. Product Data:
      a. Manufacturer's technical data for each product indicated including recommendations for application and use.
      b. Include test reports and certifications substantiating products comply with requirements.
   2. Samples:
      a. For verification purposes before erection of mock-up, samples of:
         1) Each type of adhesive.
         2) Each type of anchor.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Restoration process shall comply with recommendations of National Building Granite Quarries Association.

B. Qualifications:
   1. Installers:
      a. Work shall be performed by firm having ten years minimum successful experience in comparable stone restoration projects employing personnel skilled in restoration processes and operations indicated and having practical working knowledge of U.S. Department of the Interior's 'Standards for Rehabilitation'.

C. Field Samples:
   1. Before start of masonry restoration, prepare sample panels on building and obtain Architect's acceptance of visual qualities before proceeding with work.
   2. Retain acceptable panels in undisturbed condition, suitably marked, during construction as standard for completed work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Carefully pack, handle, and ship masonry units and accessories strapped together in suitable packs or pallets or in heavy cartons. Unload and handle to prevent chipping and breakage.
   2. Deliver other materials to site in Manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.

B. Storage And Handling Requirements:
   1. Protect masonry restoration materials during storage and construction from wetting by rain, snow or ground water, and from staining or intermixture with earth or other types of materials.
   2. Protect grout, mortar, and other materials from deterioration by moisture and temperature.

a. Store in dry location or in waterproof containers.
b. Keep containers tightly closed and away from open flames. Protect liquid components from freezing.
c. Comply with Manufacturer's recommendations for minimum and maximum temperature requirements for storage.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Design Criteria:
1. Obtain materials for masonry restoration from single source for each type material required (cement, sand, anchors, adhesive, etc.) to ensure match of quality, color, pattern, and texture.

B. Materials:
1. Stone:
a. Finished and installed to match existing adjacent stones, including color, surface finish, and sizes.
b. Finish stone cut to best advantage in duplicating historical finishes.
c. Free from defects such as vents, cracks, fissures, sand or clay holes.

C. Mixes:
1. Bedding and Rebuilding Mortar (Type N):
a. One part white Portland cement.
b. One part lime screened through very fine sieve to exclude lumps
c. Two parts clean white fine sand
d. Mineral pigment proportioned to produce color to match existing.
2. Patching Mortar for Stone:
a. Mix composed of white and gray cement combined with lime and selected aggregates to produce color-matching color of existing stone.
b. Proportion mix specified above with two parts cement, two parts lime, and six parts clean white sand.

2.2 ACCESSORIES

A. Stone-to-Stone Adhesive:
1. Two-part polyester resin stone adhesive with 15 to 30 minute cure at 70 deg F (21 deg C), in formulation (knife or flowing grade) recommended by adhesive manufacturer for type of stone repair indicated, and in color indicated to match stone and as selected by Architect from tinted or standard colors available from adhesive manufacturer.
2. Type One Acceptable Manufacturers:
a. 'Akemi' Adhesives, Nuremburg, Germany.
b. Equal approved by Architect before bidding. See Section 01 6200.

B. Mortar-to-Stone Adhesive.
1. High modulus, high strength, moisture insensitive epoxy adhesive with pot life of 30 minutes at 40 deg F (4 deg C).
2. Type One Acceptable Manufacturers:
a. 'Sikadur Hi-Mod Epoxy, Sikastix 370' by Sika Corp, Lyndhurst, NJ www.sikaconstruction.com.
b. Equal approved by Architect before bidding. See Section 01 6200.

C. Stone Anchors:
1. Type and size shown on Drawings or to match existing in size and type.
2. Fabricate anchors and dowels from AISI Type 302 / 304 stainless steel.

D. For Rebuilding Stone Stairs:
   1. Dampproofing: Non-staining, asphalt emulsion dampproofing or cement base masonry dampproofing compound.
   2. Setting Bed:
      a. Mix one 94 lb (42.6 kg) bag of cement to cu ft (cu meter) of damp, loose sand.
      b. Use only enough water produce moist surface when setting bed is ready for setting of stone.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Before dismantlement, photograph existing conditions and numerically document location and position of each unit to be removed to assure proper reassembly.

3.2 PREPARATION

A. Protection Of In-Place Conditions:
   1. Exercise caution in performing Work to not damage adjacent masonry to remain in place.
   2. Protect masonry from mechanical damage due to scaffolding, equipment, and restoration operation.
   3. If masonry elements are damaged by execution work of this section, including kerf over-cutting of joints, spalling, cracking, dislocation, chipping, etc, replace damaged units at no additional cost to Owner.

B. Removal:
   1. Using hand techniques, carefully remove stones shown on Drawings to be removed.
      a. Removal process shall be in reverse construction order, i e, from top to bottom.
      b. Utilize existing lewis holes and other hoisting holes as appropriate.
      c. Damaged stones should be carefully removed, in manner to not damage surrounding pieces, including chipping, spalling nor dislocation.
      d. Methods causing damaging vibrations are not to be used.
      e. Handle stone to prevent shipping, breakage, soiling or other damage.
      f. Do not use pinch or wrecking bars without protecting edges of adjacent stone.
      g. Lift with side-belt type slings wherever possible. Do not use wire rope or ropes containing tar or other substances before might cause staining.
      h. If required, use wood rollers and provide cushion at end of wood slides.
   2. Support and protect masonry indicated to remain surrounding removal area.
   3. Salvage whole undamaged units.
   4. Remove mortar, loose particles and soil from stones by cleaning with brushes and water.
   5. Store stone on wood skids or pallets, covered with non-staining, waterproof membrane.
      a. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones.
      b. Protect stored stone from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around stones.
   6. Clean stone units remaining in place by removing mortar, dust and loose debris in preparation for resetting.

3.3 INSTALLATION

A. Sequencing:
   1. Perform masonry restoration work in following sequence.
      a. Repair existing stone, masonry, and concrete door surrounds.
      b. Carefully remove existing mortar from joints to be repointed without damaging masonry.
      c. Repoint existing mortar joints indicated to be restored.

d. Spot clean existing masonry surfaces.
e. Clean all masonry surfaces.

B. Setting:
1. Install new and salvaged stone to replace removed stone. Fit replacement units into bonding and coursing pattern of existing in original location, laid and reset plumb and true to lines.
2. Maintain original bed joints and head joints. Butter vertical joints for full width before setting and set units in full bed of mortar.
3. Lay stone to be laid with natural bed horizontal and to be visually congruent with surrounding stones. Face is to be finished to match surrounding stones and, if necessary, artificially weathered.
4. Repoint new mortar joints to comply with requirements for repointing existing masonry, except rake out joints 5/8 inch (16 mm) before mortar sets.

C. Stone
1. Carefully remove and disassemble loose stone fragments in areas that are indicated for repair.
a. Reuse fragmentary pieces of stone as 'dutchmen' that are in sound condition in indicated areas.
b. Install pinned 'dutchmen' of reused or new granite cut in place with clean, sharp 'invisible' edges in a manner so as not to damage adjacent stonework.
2. Remove soil, loose stone particles, mortar, and other debris and foreign material from surfaces to be bonded using natural fiber stiff brush.
3. 'Invisibly' pin in 'dutchmen' to form whole masonry units by drilling 5/16 inch (8 mm) diameter holes at 45 degree angle and installing 1/4 inch (6 mm) diameter stainless steel rods set in adhesive.
a. Center and space anchor rods not more than 5 inches 125 mm nor less than 3 inch (76 mm) apart and not less than 2 inches (50 mm) from any edge.
b. Insert rods 4 inches (100 mm) minimum into each stone.
4. Anchor fragments of stones in place by countersinking 1/4 inch (6 mm) diameter plain stainless steel rods set into 1/4 inch (6 mm) diameter holes.
a. Center and space anchor rods not more than 5 inch (125 mm) nor less than 3 inch (76 mm) apart and not less than 2 inches (50 mm) from any edge.
b. Countersink at least 3/4 inch (19 mm) from exposed face of stone.
c. Provide 'invisible' epoxy plug to cover anchor head.
5. Apply adhesive in compliance with Adhesive Manufacturer's recommendations.
a. Coat bonding surface of building stone with stone-to-stone adhesive completely filling voids and covering surfaces.
b. Fit stone fragments onto building stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured.
6. Clean residual adhesive from edges.
a. Wet stone and fill any chipped areas and drill holes with patching mortar.
b. Do not featheredge.
c. Furnish patched areas to match texture of, and be level with adjoining surrounding stone surfaces.
d. Keep patching mortar damp for 72 hours.

D. Stone Patching:
1. Remove loose particles, soil, debris, oil and other contaminants from existing stone units at locations indicated by cleaning with stiff natural fiber brush.
2. Brush coat stone surfaces with mortar-to-stone adhesive to comply with manufacturer's directions.
3. Place patching mortar in layers no thicker than 2 inches (50 mm). Roughen surface of each layer to provide key for next.
4. Keep each layer damp for 72 hours or until mortar has set.
5. Unacceptable patches are defined as those with hairline cracks or showing separation from stone at edges. Remove patches and refill to provide patches free of those defects.

E. Rebuilding Stone Stairs:
1. Carefully disassemble existing stones in reverse construction order.

a. Save original anchors and store stones on wood studs or pallets, covered with non-staining, waterproof membrane.
b. Distribute weight evenly, preventing cracking and breakage as required.
c. Repair masonry units by pinning together broken pieces.

2. Repair existing concrete foundation or install new as indicated on Drawings. Repair foundation by removing loose material to solid surface and installing new concrete capping to provide solid uniform sub-base for consistent alignment of stairs.
3. Clean sub-base to remove dirt, dust, debris and loose particles. Wash and rinse with clean water.
4. Paint foundation with specified dampproofing.
5. Apply slush coat of cement grout over surface of concrete sub-base about 15 minutes before placing setting bed.
   a. Limit area of slush coat to avoid drying out before placement of setting bed and apply by trowel or brush.
   b. Do not exceed 1/16 inch (1.6 mm) thickness for cement slush coat.
6. Setting Bed:
   a. Spread and screed to uniform thickness, except for minor variations required to provide true surface, level in plane or uniformly sloped for drainage as shown.
   b. Mix and place only amount that can be covered with stone prior to initial set of bed.
   c. Cut back, level edge, remove and discard setting bed material that has reached initial set prior to placing stone.
7. Wet stone thoroughly before setting.
8. Reset stone before initial set of bed occurs.
   a. Do not set stone on dry bed.
   b. Apply thin layer of neat cement paste 1/32 to 1/16 inch (0.8 to 1.6 mm) thick by brushing or troweling over setting bed, or apply 1/32 inch (0.8 mm) thick to bottom of stone.
   c. Provide complete contact between stone and setting bed.
   d. Provide new anchorages where missing.
   e. Set and level each unit immediately.
   f. Set stone in exact original position with uniform joints of original width.
9. Point joints as soon as possible after initial set of setting bed.
   a. Force pointing mortar into joints, strike flush and tool slightly concave.
   b. Wet joint surfaces, if dry, before pointing.
   c. Calk top horizontal joints to match adjoining.
10. Remove spillage from face of stone as work progresses.

3.4 CLEANING

A. After mortar has fully hardened, clean exposed masonry surfaces of excess mortar and foreign matter using stiff nylon or bristle brushes and clean water, spray applied at low pressure. Do not use metal scrapers, metal brushes, acid cleaning agents, or alkali cleaning agents.

3.5 PROTECTION

A. Do not permit traffic on horizontal stone stair surfaces during setting or for at least 24 hours after setting of units.

END OF SECTION

SECTION 04 0148

STONE CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Cleaning of exterior stone as described in Contract Documents.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's technical data for application and use of products used.
      b. Include test reports and certifications substantiating that products comply with requirements.
   2. Samples:
      a. Detergent.
      b. Spot cleaners.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Comply with requirements of EPA, State, and local governing agency for proper handling or disposal of cleaning materials and runoff solutions. Do not allow runoff solutions to remain on site or to enter City sewer system unless approval has been granted in advance.

B. Qualifications:
   1. Installers:
      a. Work shall be performed by a company having 10 years minimum of verified successful experience in at least ten comparable masonry cleaning projects.
      b. Personnel shall be skilled and trained in restoration procedures and operations specified and have practical working knowledge of U.S. Department of Interior's 'Standards for Rehabilitation.'

1.4 FIELD CONDITIONS

A. Ambient Conditions:
   1. Clean surfaces only when air temperature is above 40 deg F (4 deg C) and will remain so until masonry has dried, but for not less than 7 days after completion of cleaning.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Materials:
   1. Water: Clean, potable, free of oils, acids, alkalis, salts and organic matter.
   2. Cleaning detergents, cleaning compounds, liquid solutions, and soap powders
      a. Subject to approval of Owner.
      b. Do not use acidic, alkaline, and other ingredients, which independently or in combination in compound, fluid, or solution, will damage masonry.

c. Mechanical cleaning by grit blasters, grinders, or sanding discs or other means using abrasives is not permitted.

3. Brushes: Natural fiber-bristle only. No nylon or metal bristle brushes.
4. Spot Cleaners:
   a. Standard strength masonry restoration cleaners applied for use on specific stains by paste application:
      1) Organic Stains: (Wood, leaves, paper, bird droppings, etc.) pinkish brown stains by hydrogen peroxide (5 to 10 percent strength).
      2) Iron Stains: One part sodium citrates in six parts water, mixed with equal volume of glycerine.
      3) Copper Or Bronze Stains: One part ammonium chloride mixed dry with four parts powdered talc. Mild solution of ammonia may be added to form paste.
      4) New Oil Stains: Solution of benzol or unleaded gasoline mixed with hydrated lime or marble dust to make paste.
      5) Linseed Oil Stains: Paste compound of one part trisodium phosphate, one part sodium perborate and three parts powdered talc mixed with strong soap solution.
      6) Paints, Including Graffiti:
         a) Benzol as 1/2 inch (13 mm) thick poultice.
         b) Lye, caustic soda, or methylene chloride.
      7) Proprietary preparations of paste recommended by stone industry in accordance with Manufacturer's published instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection Of In-Place Conditions:
   1. Protect persons, motor vehicles, adjacent surfaces, site, and surrounding buildings from injury, dust, spray, or noise resulting from masonry cleaning work.
   2. Prevent solutions from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other surfaces that could be injured by contact.
   3. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
   4. Erect adequate barrier and enclosure to protect pedestrians and landscaping from blowing water and cleaning solutions. Erect other temporary protection barriers as required by authorities having jurisdiction.
   5. Comply with recommendations of manufacturers of cleaners for protection against damage from exposure to their products.
   6. Protect glass, unpainted metal trim and wood from contact with cleaners by covering them with polyethylene film and waterproof masking tape.

3.2 APPLICATION

A. Interface With Other Work: Perform stone cleaning after stone and concrete repair has been completed and after stone restoration and stone tuckpointing have been completed.

B. Proceed with cleaning in orderly manner from top to bottom.
   1. Use only suitable combination of scrubbing, paste application, and water soaking / spray methods and those cleaning methods specified for masonry.
   2. Perform cleaning methods in manner which results in uniform coverage of surfaces, including corners, moldings, interstices and which produces even effect without streaking or damage to masonry surfaces.
   3. Rinse off residue and soil by working upwards from bottom to top of each treated area. Dirt and foreign material shall be washed away by water.
   4. Workmanship:

a. Finished work shall show no signs of stains, scratches, streaks or runs of discoloration, mortar damage, or other like defects from use of cleaners.
b. Leave all surfaces neat and clean.

C. Scrubbing:
1. Scrubbing methods for cleaning dirt as approved by Owner includes following:
a. Scrubbing by hand, using suitable brushes and liquid coat solution or boiled soap powder, then rinsing stone with clean water.
b. Scrubbing with power-driven, rotating brushes of proper material and suitable cleaning compound or solution.
2. Brushes shall be of stiff natural fiber bristles and be selected for efficiency in cleaning with least possible injury to surface.
3. Cleaning shall commence at top and continue progressively down face.

D. Paste Application:
1. Apply paste for removal of stains and discolorations over entire stained surface and allow to dry.
2. Commence cleaning at top and continue progressively down face.
3. Paints, Including Graffiti:
a. Use razor blade to remove paint drips and remove paint staining by either of following methods:
1) Apply benzol as 1/2 inch (13 mm) thick poultice.
a) Let dry and remove.
b) Bleach remaining color, rinse and repeat as required.
2) Apply lye, caustic soda, or methylene chloride remover over stain.
a) Remove and scrub with bristle brush.
b) Bleach remaining color and use oil solvent for remaining oil stain.
c) Rinse with solvent for remaining oil stain.
d) Rinse with neutralizing wash to prevent buildup of salts.
4. Repeat operation as necessary to remove stain.

E. Water Soaking / Spray Method:
1. Soak masonry surfaces by nebulization (low pressure, low volume) spraying continuously for minimum of 10 hours to soften and remove surface dirt, grease, soot, dust, carbon deposits, bird feces, and salt deposits.
2. Direct spray heads at angle for efficiency cleaning.
3. Rinse surfaces with 200 to 600 psi (1.38 to 4.2 MPa) spray so as not to damage joints.
4. Monitor water spray for penetration into interior spaces.

3.3 CLEANING

A. Waste Management: Dispose of runoff from cleaning operations by legal means and in manner which prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

END OF SECTION

SECTION 04 0513

CEMENT AND LIME MASONRY MORTARING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of masonry mortar used on Project.

B. Related Requirements:
   1. Section 01 0000: 'General Requirements':
      a. Section 01 4000: 'Quality Requirements' for administrative and procedural requirements for quality assurance and quality control.
      b. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.

1.2 REFERENCES

A. Definitions:
   1. Mortar: Plastic mixture of cementitious materials, fine aggregate and water. See ASTM C270.

B. Reference Standards:
   1. ASTM International:
      a. ASTM C144-11, 'Standard Specification for Aggregate for Masonry Mortar'.
      b. ASTM C150/C150M-16, 'Standard Specification for Portland Cement'.
      c. ASTM C207-06(2011), 'Standard Specification for Hydrated Lime for Masonry Purposes'.
      d. ASTM C270-14a, 'Standard Specification for Mortar for Unit Masonry'.

1.3 SUBMITTALS

A. Informational Submittals:
   1. Source Quality Control Submittals:
      a. If pre-mixed wet mortar or pre-blended dry mortar mix are to be used, provide certification from Manufacturer or Supplier verifying that mixes meet specification requirements.
      b. If site mixed / blended mortar is to be used, provide written description of proposed method of measuring and mixing of materials.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Performance:
   1. Minimum Compressive Strength at 28 Days:
      a. Type S: 1800 psi (12.4 MPa).

B. Materials:
   1. Portland Cement:
      a. Meet requirements of ASTM C150/C150M, Type II Low Alkali unless approved otherwise in writing by Architect.
   2. Hydrated Lime:
      a. Meet requirements of ASTM C207, Type S.

3. Aggregate:
   a. Standard Mortar:
      1) Natural or manufactured sand meeting requirements of ASTM C144 and following:
         a) Fineness modulus: 1.6 to 2.5 percent.
         b) Water demand, ratio by weight: 0.65 percent maximum.
         c) Grading:

Sieve	Sieve	Percent Passing	
		Natural Sand	Manufactured Sand
No. 4	4.750 mm	100	100
No. 8	2 360 mm	95 to 100	95 to 100
No. 16	1.191 mm	70 to 100	70 to 100
No. 30	0.594 mm	40 to 75	40 to 75
No. 50	0.297 mm	10 to 35	20 to 40
No. 100	0.150 mm	2 to 15	10 to 25
No. 200	0.075 mm	none	0 to 10

   b. Stone Unit Masonry Mortar:
      1) White Mortar Aggregates:
         a) Natural white sand or ground white stone.
      2) Colored Mortar Aggregates:
         a) Ground marble, granite, or other sound stone, as required to match Architect's sample.

      3) Grading requirements for joints narrower than 1/4 inch (6 mm):

Sieve	Sieve	Percent Passing	
		Natural Sand	Manufactured Sand
No. 8	2.360 mm	100	100
No. 16	1.191 mm	95 to 100	95 to 100
No. 30	0.594 mm	40 to 75	40 to 75
No. 50	0.297 mm	10 to 35	20 to 40
No. 100	0.150 mm	2 to 15	10 to 25
No. 200	0.075 mm	none	0 to 10

      4) Grading requirements for pointing mortar:

Sieve	Sieve	Percent Passing	
		Natural Sand	Manufactured Sand
No. 16	1.191 mm	100	100
No. 30	0.594 mm	40 to 75	40 to 75
No. 50	0.297 mm	10 to 35	20 to 40
No. 100	0.150 mm	2 to 15	10 to 25
No. 200	0.075 mm	none	0 to 10

4. Water:
   a. Clean and free of acids, alkalis, and organic materials.
5. Admixtures:
   a. Use no admixtures, except for color pigments specified below, without Architect's written permission. Use of any admixture to meet cold weather requirements and admixtures that increase air entrainment are expressly forbidden under all circumstances.

C. Mixes:
   1. General:

a. Heat water and sand to 140 deg F (60 deg C) maximum if temperature is below 40 deg F (4.4 deg C).

2. Unit Masonry Mortar: Type 'N':
   a. Parts by Volume:

Portland Cement	1
Hydrated Lime	1/2
Damp Loose Sand:	2-1/4 minimum to three maximum, times sum of volumes of cement and lime used. Maintain sand piles in damp, loose condition.

3. Unit Masonry Mortar: Type 'S':
   a. Parts by Weight:

Portland Cement	94 lbs	43 kg
Hydrated Lime	20 lbs	9 kg
Dry Sand	360 lbs min. to 480 lbs max.	163 kg min. to 218 kg max.

4. Stonework Mortar:
   a. One part Portland cement to three parts of sand.
   b. Mix in water until it will retain its form when compressed in hand.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 05 0503

SHOP-APPLIED METAL COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of factory or shop-applied priming applied to steel supplied to Project without finish coat.
   2. Quality of and procedures for field touch-up and repair of factory-applied priming and galvanizing.

B. Related Requirements:
   1. Sections under 09 9000 heading: Finish painting.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM A780/A780M-09(2015), ‘Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings'.
      b. ASTM B695-04(2009), 'Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conference.
   2. In addition to requirements of Section 01 3100, review following:
      a. Meet with Architect before commencing repair of galvanized surfaces to establish extent of repairs required and, if applicable, choice of methods to be used.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Product data and samples, if requested by Architect.

PART 2 - PRODUCTS

2.1 FINISHES

A. Factory And Shop-Applied Primer:
   1. Compatible with and of equal or better quality than finish paint system to be applied by Sections under 09 9000 heading.
   2. Primer on unexposed, unfinished surfaces may be fabricator's standard shop coat.

B. Repairs To Primed Surface:

C. Unless otherwise specified, use primer which matches characteristics of original primer and is compatible with and of equal or better quality than finish paint system to be applied by Sections under 09 9000 heading.

D. Material For Repairs Of Galvanized Surfaces:
   1. Non-Structural, Non-Load-Bearing Items Not Exposed To Weather:
      a. Zinc-Rich Paints:
         1) Zinc-Dust Content: Dried film shall contain 94 percent minimum of zinc-dust by weight.
         2) Type One Acceptable Manufacturers:
            a) Galvax by Alvin Products Inc, Everett, MA www.alvinproducts.com.
            b) ZRC Galvilite by ZRC Worldwide, Marshfield, MA www.zrcworldwide.com.
            c) Equal as approved by Architect before bidding. See Section 01 6200.
   2. Structural, Load-Bearing Items And Items Exposed To Weather:
      a. Zinc-Based Solders, Powder, Or Rod:
         1) Zinc-Cadmium solder with liquidus temperature range from 518 to 527 deg F (270 to 275 deg C), or
         2) Zinc-Tin-Lead alloy with liquidus temperature range from 446 to 500 deg F (230 to 260 deg C).
      b. Sprayed Zinc: Wire, ribbon, or powdered zinc suitable for process.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation:
   1. General:
      a. Clean, grind, or otherwise prepare welds in steel that is to be coated within limits acceptable to welder responsible for structural integrity.
      b. Surfaces to be coated shall be clean, dry and free of oil, grease, and corrosion products.
   2. Preparation Of Primed, Ungalvanized Surfaces:
      a. Clean welds and grind serious abrasions.
   3. Preparation Of Galvanized Surfaces:
      a. Follow requirements of ASTM A780/A780M and following:
      b. For Repair Using Zinc-Rich Paints:
         1) Blast clean surfaces to near-white metal, in accordance with SSPC-SP10 (1 to 2 mil anchor pattern), as minimum.
         2) Where circumstances do not allow blast cleaning, power disk sand to bright metal finish.
         3) Extend surface preparation into undamaged galvanized area.
         4) Remove flux residue and weld spatter from welded areas.
      c. For Repair Using Zinc-Based Alloys:
         1) Clean surface to be reconditioned using wire brush, light grinding action, or mild blasting.
         2) Extend surface preparation into surrounding, undamaged galvanized areas.
         3) Remove flux residue and weld spatter from welded areas.
         4) Preheat cleaned area to at least 600 deg F (316 deg C).
            a) Do not overheat surface beyond 750 deg F (400 deg C) or allow surrounding galvanized coatings to be burned.
            b) Wire brush surface during preheating.
      d. For Repair Using Sprayed Zinc (Metallizing):
         1) Blast clean surfaces to near-white metal, in accordance with SSPC-SP5 as minimum.
         2) Extend surface preparation into undamaged galvanized area.
         3) Remove flux residue and weld spatter from welded areas.

3.2 REPAIR / RESTORATION

A. Repairs To Primed, Ungalvanized Surfaces:
   1. Thoroughly clean metal and give one (1) prime coat of specified material, well-worked into metal joints and open spaces. Match existing primed finish as required.
      a. Do not apply primer at temperatures below 45 deg F (7 deg C).

b. Protect un-primed machine-finished surfaces against corrosion by priming.

B. Repairs To Galvanized Surfaces:
1. Non-Structural, Non-Load-Bearing Items Not Exposed To Weather:
a. Repair Using Zinc-Rich Paints: Spray- or brush-apply zinc-rich paint to prepared area. Apply paint in single application employing multiple spray passes to achieve dry film thickness of 2 mils.
2. Structural, Load-Bearing Items And Items Exposed To Weather:
a. Repair Using Zinc-Based Alloys:
1) Rub cleaned, pre-heated areas with repair stick to deposit evenly distributed layer of zinc alloy. If powdered zinc alloys are used, sprinkle powder on surface and spread out with spatula or similar tool.
2) Remove flux residue by rinsing with water or wiping with damp cloth.
b. Repair Using Sprayed Zinc (Metallizing): Apply 2 mil minimum coating by means of metal-spraying pistols fed with either zinc wire or zinc powder in accordance with requirements of ASTM B695, Type I.
3. All Items:
a. Apply repair materials immediately after surface preparation is complete.
b. Take thickness measurements, with either magnetic or electromagnetic gauge, to ensure applied coating is as specified or agreed to.

END OF SECTION

SECTION 05 0523

METAL FASTENING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of structural metal-to-metal, wood-to-metal, and wood-to-wood bolts used on Project.
   2. Requirements and standards for site welded metal-to-metal connections.

B. Related Requirements:
   1. Section 03 1511: Cast-in-place and drilled-in anchor bolts.
   2. Furnishing and installing of structural bolts specified under Section concerned.
   3. Performance of welding specified under Section concerned.

1.2 REFERENCES

A. Reference Standards:
   1. American National Standards Institute / American Welding Society:
      a. ANSI/AWS D1.1/D1.1M:2010, ‘Structural Welding Code - Steel’.
      b. ANSI/AWS D1.3/D1.3M:2010, ‘Structural Welding Code - Sheet Steel’.
   2. ASTM International:
      a. ASTM A36/A36M-08, ‘Standard Specification for Carbon Structural Steel'.
      b. ASTM A307-10, ‘Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength'.
      c. ASTM A325-10, ‘Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength'.

1.3 QUALITY ASSURANCE

A. Qualifications: Requirements of Section 01 4301 applies, but not limited to the following:
   1. Welders shall be certified 30 days minimum before beginning work on Project. If there is doubt as to proficiency of welder, Architect may require welder to take another test, at no expense to Owner. Certification shall be by Pittsburgh Laboratories or other authority approved by Architect.

B. Certifications:
   1. Maintain welder's certifications on job-site.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Materials:
   1. Bolts And Threaded Fasteners:
      a. Bolts: Conform to requirements of ASTM A307, Grade A.

2.2 ACCESSORIES

A. Arc-Welding Electrodes: Type E70XX AWS Iron and Steel Arc-welding electrodes and meeting current AISC Specifications.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Welding shall meet requirements of ANSI / AWS D1.1 and D1.3.

B. Minimum weld sizes, unless detailed otherwise.
   1. Weld pipe columns to base plates and top plates with 1/4 inch (6 mm) fillet weld all around.

END OF SECTION

SECTION 05 5215

STAINLESS STEEL HANDRAILS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install stainless steel pipe handrails as described in Contract Documents.

B. Products Furnished But Not Installed Under This Section:
   1. Anchoring sleeves in concrete for stainless steel pipe handrails.

C. Related Requirements:
   1. Section 03 3111: 'Normal-Weight Structural Concrete' for installation of anchoring sleeves cast into concrete.
   2. Section 05 0523: 'Metal Fastening' for quality of welding.

D. Related Requirements:
   1. Section 03 1511: ‘Concrete Anchors And Bolts’ for Rostrum Riser Handrail base plate expansion bolts as shown on Contract Drawings.

1.2 REFERENCES

A. Definitions:
   1. Non-magnetic Stainless Steel: Austenitic grade of stainless steel with low magnetic permabilities and shows almost no response to a magnet when in annealed condition.
   2. Non-shrink Grout: Structural grout used for filling voids between elements that is formulated with cement, fine aggregates and admixtures. Admixtures are used to provide expansive properties of the material during curing. This expansion counteracts the natural tendency of cement grouts to shrink during curing.
   3. Peened: Nonslip textured gripping surface that is much easier to hold on to.
   4. Stainless Steel: Stainless steels are alloys of iron to which at least 10 percent chromium has been added to increase corrosion resistance and will not rust when exposed to weather. To obtain greater corrosion resistance, more nickel and chromium are added to the alloy. Along with iron and chromium, all stainless steels contain some carbon to make it stronger.
      a. Austenitic Stainless Steel: Most popular of the stainless steels because of their ductility, ease of working and good corrosion resistance.
      b. Stainless Steel Alloys:
         1) Type 304 (UNS S30400): Austenitic stainless steel with non-magnetic properties in annealed condition that provide good corrosion resistance to both chemical and atmospheric exposures, with high resistance to oxidations. Most common and widely used stainless steel.

B. Reference Standards:
   1. ASTM International:
      a. ASTM C1107/C1107M-14, ‘Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)'.

1.3 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Show fabrication and installation of handrails and railings including floor plans, elevations, sections, details of components, and attachments to other elements of The Work.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Materials:
   1. Handrails And Railings:
      a. 1-1/2 inch (38 mm) outside diameter non-magnetic satin finish 16 gauge (0.063) (1.6002 mm) type 304 stainless tubing.
      b. Sizes and configurations as indicated on Contract Drawings.
   2. Pipe Sleeves: 2 inch (50 mm) diameter by 6 to 9 inch (150 to 225 mm) long non-magnetic stainless steel.

B. Fabrication:
   1. Preassemble railing systems in shop to greatest extent possible to minimize field splicing and assembly.
   2. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
   3. Grind smooth welded joints and buff welds to same appearance as remainder of railing.
   4. Form curves by bending pipe in jigs to produce uniform curvature for each configuration required. Maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
   5. Return pipe ends of wall mounted handrails into wall.
   6. Welded Connections:
      a. Fabricate railing system and handrail connections by welding.
      b. Weld corners and seams continuously to comply with following:
         1) Use materials and methods that minimize distortion and develop of metals.
         2) At tee and cross intersections, notch ends of intersecting members to fit contour of pipe to which end is joined and weld all around.
         3) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and so contours of welded surfaces match adjacent surfaces.

2.2 ACCESSORIES

A. Rail Setting Grout:
   1. Commercial non-shrink grout conforming to requirements of ASTM C1107, Type B or Type C.
   2. Type Two Acceptable Manufacturers:
      a. Normal Construction Grout A by Bonsal American, Charlotte, NC www.bonsal.com.
      b. Advantage 1107 Grout by Dayton Superior Specialty Chemicals, Kansas City, KS www.daytonsuperiorchemical.com.
      c. NS Grout by Euclid Chemical Co, Cleveland, OH www.euclidchemical.com
      d. 5 Star Special Grout 110 by Five Star Products Inc, Fairfield, CT www.fivestarproducts.com.
      e. Duragrout by L&M Construction Chemicals Inc, Omaha, NE www.lmcc.com.
      f. Sonneborn / BASF Building Systems, Shakopee, MN www.chemrex.com.
      g. Tamms Grout 621 by TAMMS Industries, Mentor, OH www.tamms.com.
      h. U S Spec MP Grout by U S Mix Products Co, Denver, CO www.usspec.com.
      i. CG-86 Grout by W R Meadows, Hampshire, IL www.wrmeadows.com.
      j. Equal as approved by Architect before use. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Touch up field welds to match finished material.

END OF SECTION

SECTION 07 9213

ELASTOMERIC JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install sealants not specified to be furnished and installed under other Sections.
   2. Quality of sealants to be used on Project not specified elsewhere, including submittal, material, and installation requirements.

B. Related Requirements:
   1. Removing existing sealants specified in Sections where work required.
   2. Furnishing and installing of sealants is specified in Sections specifying work to receive new sealants.

1.2 REFERENCES

A. Definitions:
   1. Sealant Types and Classifications:
      a. ASTM Specifications:
         1) Type:
            a) Type S: Single-component sealant.
            b) Type M: Multi-component sealant.
         2) Grade:
            a) Grade P: Pourable or self-leveling sealant used for horizontal traffic joints.
            b) Grade NS: Non-sag or gunnable sealant used for vertical and non-traffic joints.
         3) Classes: Represent movement capability in percent of joint width.
            a) Class 100/50: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand of at least 100 percent increase and decrease of at least 50 percent of joint width as measured at time of application.
            b) Class 50: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand increase and decrease of at least 50 percent of joint width as measured at time of application.
            c) Class 25: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand increase and decrease of at least 25 percent of joint width as measured at time of application.
            d) Class 12: Sealant that, when tested for adhesion and cohesion under cyclic movement shall withstand increase and decrease of at least 12 percent of joint width as measured at time of application.
         4) Use:
            a) T (Traffic): Sealant designed for use in joints in pedestrian and vehicular traffic areas such as walkways, plazas, decks and parking garages.
            b) NT (Non-Traffic): Sealant designed for use in joints in non-traffic areas.
            c) I (Immersion): Sealant that meets bond requirements when tested by immersion (Immersion rated sealant applications require primer).
            d) M (Mortar): Sealant that meets bond requirements when tested on mortar specimens.
            e) G (Glass): Sealant that meets bond requirements when tested on glass specimens.
            f) A (Aluminum): Sealant that meets bond requirements when tested on aluminum specimens.
            g) O (Other): Sealant that meets bond requirements when tested on substrates other than standard substrates, being glass, aluminum, mortar.

b. Federal Specifications:
   1) Type:
      a) Type I: Self-leveling, pour grade.
         (1) Compound which has sufficient flow to give smooth level surface when applied in horizontal joint at 40 deg F (4.4 deg C).
      b) Type II: Non-sag, gun grade
         (1) Compound which permits application in joints on vertical surfaces without sagging (slumping) at temperatures 40 deg F (4.4 deg C) and 122 deg. F (50 deg. C).
      c) Type NS: Non-sag, gun grade.
         (1) Non-sag shall be a compound which permits application in joints on vertical surfaces without sagging (slumping) at temperatures between -20 deg F and 122 deg. F (- 29 and 50 deg. C).
   2) Class:
      a) Class A: Compounds resistant to 50 percent total joint movement (includes Type I and Type II).
         (1) Capable of resisting compression-extension cycling of plus and minus 25 percent of nominal half inch width.
      b) Class B: Compounds resistant to 25 percent total joint movement (includes Type I and Type II).
         (1) Capable of resisting compression-extension cycling of plus and minus12 1/2 percent of nominal half inch width.

2. Silicone: Any member of family of polymeric products whose molecular backbone is made up of alternating silicon and oxygen atoms and which has pendant hydrocarbon groups attached to silicon atoms. Used primarily as a sealant. Offers excellent resistance to water and large variations in temperature (minus 100 deg F to + 600 deg F) (minus 73.3 deg C to + 316 deg C).

B. Reference Standards:
1. American Association of State and Highway Transportation Officials:
   a. AASHTO T 132-87(2013), ‘Standard Method of Test for Tensile Strength of Hydraulic Cement Mortars’.
2. ASTM International:
   a. ASTM C639-15, 'Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants'.
   b. ASTM C661-15, 'Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer'.
   c. ASTM C679-15, ‘Standard Test Method for Tack-Free Time of Elastomeric Sealants’.
   d. ASTM C719-14, ‘Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)’.
   e. ASTM C793-05(2010), 'Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants’.
   f. ASTM C794-15a, 'Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants'.
   g. ASTM C920-14a, ‘Standard Specification for Elastomeric Joint Sealants’.
   h. ASTM C1135-15, 'Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants'.
   i. ASTM C1184-14, 'Standard Specification for Structural Silicone Sealants'.
   j. ASTM C1193-16, ‘Standard Guide for Use of Joint Sealants’.
   k. ASTM C1248-08(2012), 'Standard Test Method for Staining of Porous Substrate by Joint Sealants'.
   l. ASTM C1330-02(2013), ‘Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants’.
   m. ASTM C1481-12 'Standard Guide for Use of Joint Sealants with Exterior Insulation & Finish Systems (EIFS)'.
   n. ASTM D412-15a, ‘Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension’.
   o. ASTM D2202-00(2014), 'Standard Test Method for Slump of Sealants'.
   p. ASTM D2240-15, ‘Standard Test Method for Rubber Property-Durometer Hardness’.
   q. ASTM D5893-10, ‘Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements’.

r. ASTM E119-16a, ‘Standard Test Methods for Fire Tests of Building Construction and Materials’.

3. Federal Specifications:
   a. Federal Specification TT-S-001543A (CON-NBS), 'Sealing Compound: Silicone Rubber Base (for Calking, Sealing & Glazing in Buildings and Other Structures)' (9 Jun 1971).
   b. TT-S-00230C (CON-NBS), ‘Sealing compound: Elastomeric Type, Single Component (For Calking, Sealing, And Glazing In Buildings And Other Structures.’ (2 Feb 1970).
4. Government Services Administration (GSA), Commercial Item Descriptions (CID):
   a. GSA CID A-A-272A, ‘Sealing Compound: Silicone Rubber Base (For Caulking, Sealing, and Glazing in Buildings and Other Structures)’.
   b. GSA CID A-A-1556, ‘Sealing Compound Elastomeric Type, Single Component (For Caulking, Sealing, and Glazing in Buildings and Other Structures)’.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Scheduling:
   1. Schedule work so waterproofing, water repellents and preservative finishes are installed after sealants, unless sealant manufacturer approves otherwise in writing.
   2. Ensure sealants are cured before covering with other materials.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
      b. Manufacturer's literature for each Product.
      c. Schedule showing joints requiring sealants. Show also backing and primer to be used.

B. Informational Submittals:
   1. Certificates:
      a. Manufacturer's Certificate:
         1) Certify products are suitable for intended use and products meet or exceed specified requirements.
         2) Certificate from Manufacturer indicating date of manufacture.
   2. Manufacturers’ Instructions:
      a. Manufacturer's installation recommendations for each Product.
      b. Manufacturer's installation for completing sealant intersections when different materials are
      c. Manufacturer's installation for removing existing sealants and preparing joints for new sealant.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten (10) years documented experience.
   2. Applicator Qualifications:
      a. Company specializing in performing work of this section.
      b. Provide if requested, reference of projects with minimum three (3) years documented experience, minimum three (3) successfully completed projects of similar scope and complexity, and approved by manufacturer.
      c. Designate one (1) individual as project foreman who shall be on site at all times during installation.

B. Preconstruction Testing:

1. Pre-construction testing is not required when sealant manufacturer can furnish data acceptable to Architect based on previous testing for materials matching those of the Work.

C. Mockups:
1. Provide mockups including sealant and joint accessories to illustrate installation quality and color if requested by Architect or Project Manager.
a. Incorporate accepted mockup as part of Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
1. Deliver and keep in original containers until ready for use.
2. Inspect for damage or deteriorated materials.

B. Storage and Handling Requirements:
1. Handle, store, and apply materials in compliance with applicable regulations and material safety data sheets (MSDS).
2. Handle to prevent inclusion of foreign matter, damage by water, or breakage.
3. Store in a cool dry location, but never under 40 deg F (4 deg C) or subjected to sustained temperatures exceeding 90 deg F (32 deg C) or as per Manufacturer's written recommendations.
4. Do not use sealants that have exceeded shelf life of product.

1.7 FIELD CONDITIONS

A. Ambient Conditions:
1. Do not install sealant during inclement weather or when such conditions are expected. Allow wet surfaces to dry.
2. Follow Manufacturer’s temperature recommendations for installing sealants.

1.8 WARRANTY

A. Manufacturer Warranty:
1. Signed warranties against adhesive and cohesive failure of sealant and against infiltration of water and air through sealed joint for period of three (3) years from date of Substantial Completion.
a. Manufacturer's standard warranty covering sealant materials.
b. Applicator’s standard warranty covering workmanship.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:
1. Manufacturer Contact List:
a. Dow Corning Corp., Midland, MI www.dowcorning.com.
b. Franklin International, Inc. Columbus, OH www.titebond.com.
c. GE Sealants & Adhesives (see Momentive Performance Materials Inc.).
d. Laticrete International Inc., Bethany, CT www.laticrete.com.
e. Momentive Performance Materials Inc. (formally GE Sealants & Adhesives), Huntersville, NC www.ge.com/silicones.
f. Sherwin-Williams, Cleveland, OH www.sherwin-williams.com.
g. Sika Corporation, Lyndhurst, NJ www.sikaconstruction.com or Sika Canada Inc, Pointe Claire, QC www.sika.ca.

h. Tremco, Beachwood, OH www.tremcosealants.com or Tremco Ltd, Toronto, ON (800) 363-3213.

B. Materials:
1. Design Criteria:
a. Compliance: Meet or exceed requirements of these standards:
1) ASTM C920: Elastomeric joint sealant performance standard.
2) ASTM C639 or ASTM D2202: Flow (sag or slump).
3) ASTM C661 or ASTM D2240: Durometer hardness (shore A).
4) ASTM C679 or ASTM C794: Tack free time (peel strength).
5) ASTM C719: Joint movement capability.
6) ASTM C793: Effects of accelerated weathering.
7) ASTM C1135 or ASTM D412: Tensile adhesion strength.
8) ASTM C1184: Structural silicone sealants.
9) ASTM C1248: Staining.
10) ASTM D412: Modulus.
11) ASTM D5893: Silicone Joint Sealant for Concrete Pavements.
12) Federal Specification TT-S-001543A.
13) Federal Specification TT-S-00230C.
14) GSA CID A-A-272A.
15) GSA CID A-A-1556.
b. Comply with Manufacturer's ambient condition requirements.
c. Sealants must meet Manufacturer's shelf-life requirements.
d. Sealants must adhere to and be compatible with specified substrates.
e. Sealants shall be stable when exposed to UV, joint movements, and particular environment prevailing at project location.
f. Primers (Concrete, stone, masonry, and other nonporous surfaces typically do not require a primer. Aluminum and other nonporous surfaces except glass require use of a primer. Installer Option to use Adhesion Test to determine if primer is required or use primer called out in related sections):
1) Adhesion Test:
a) Apply silicone sealant to small area and perform adhesion test to determine if primer is required to achieve adequate adhesion. If necessary, apply primer at rate and in accordance with Manufacturer's instructions. See 'Field Quality Control' in Part 3 of this specification for Adhesive Test.
2) If Primer required, shall not stain and shall be compatible with substrates.
3) Allow primer to dry before applying sealant.
2. Sealants At Exterior Building Elements:
a. Description:
1) Weathersealing expansion, contraction, perimeter, and other movement joints which may include all or part of the following for project:
a) Aluminum entrance perimeters and thresholds.
b) Columns.
c) Connections.
d) Door frames.
e) Joints and cracks around windows.
f) Masonry.
g) Wall penetrations.
h) Other joints necessary to seal off building from outside air and moisture.
b. Design Criteria:
1) Meet following standards for Sealant:
a) ASTM C920: Type S, Grade NS, Class 50 Use NT, M, G, A.
2) Limitations:
a) Do not use below-grade applications.
b) Do not use on surfaces that are continuously immersed or in contact with water.
c) Do not use on wet, damp, frozen or contaminated surfaces.
d) Do not use on building materials that bleed oils, plasticizers or solvents, green or partially vulcanized rubber gaskets or tapes.
3) Color:
a) Architect to select from Manufacturer's standard colors.

b) Match building elements instead of window (do not use white that shows dirt easily).

c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
1) Dow Corning:
a) Primer: 1200 Prime Coat.
b) Sealant: 791 Silicone Weatherproofing Sealant.
2) Momentive Performance Materials (formerly, GE Sealants & Adhesives):
a) Primer: SS4044 Primer.
b) Sealant: GE SCS2000 SilPruf Silicone Sealant & Adhesive.
3) Tremco:
a) Primer:
(1) Metal surface: No. 20 primer.
(2) Porous surfaces: No. 23 primer.
b) Sealant: Spectrum 1 Silicone Sealant.

3. Sealants At Exterior Sheet Metal And Miscellaneous:
a. Description:
1) Weathersealing expansion, contraction, perimeter, and other movement joints which may include all or part of the following for project:
a) Flashings.
b) Gutters.
c) Penetrations in soffits and fascias.
d) Roof vents and flues.
e) Lightning protection components.
b. Design Criteria:
1) Meet following standards for Sealant:
a) ASTM C920: Type S Grade NS, Class 25 (min) Use NT, M, G, A and O.
2) Limitations:
a) Do not use below-grade applications.
b) Do not use on surfaces that are continuously immersed or in contact with water.
c) Do not use on wet, damp, frozen or contaminated surfaces.
d) Do not use on building materials that bleed oils, plasticizers or solvents, green or partially vulcanized rubber gaskets or tapes.
c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
1) Dow Corning: 790 Silicone Building Sealant.
2) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS2350 Silicone Elastomeric Sealant.
3) Tremco: Tremsil 600 Silicone Sealant.

4. Sealants At Expansion Joints in Exterior Concrete:
a. Expansion Joints:
1) Design Criteria:
a) Meet following standards for Sealant:
(1) ASTM C920: Type S, Grade NS, Class 100/50 Use T, NT, M, G, A, and O.
2) Sealant required at expansion for following areas:
a) Between entryway slabs and building foundations.
b) Between sidewalks and building foundations.
c) Miscellaneous vertical applications.
3) Sealant NOT required at expansion joints for following areas:
a) Within aprons and where aprons abut building foundations and sidewalks.
b) Within mowstrips and where mowstrips abut building foundations and sidewalks.
c) Within sidewalks.
4) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) Dow Corning:
(1) Primer: 1200 Prime Coat.
(2) Sealant: 790 Silicone Building Sealant.
b) Sika:
(1) Primer: Sikasil Primer-2100.
(2) Sealant: Sikasil-728 NS Non-Sag Silicone Sealant.
b. Penetrations thru Concrete Walls:
1) Design Criteria:
a) Meet following standards for Sealant:

(1) ASTM C920: Type S, Grade NS, Class 100/50 Use T, NT, M, G, A, and O.
2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) Dow Corning:
(1) Primer: 1200 Prime Coat.
(2) Sealant: 790 Silicone Building Sealant.
b) Sika:
(1) Primer: Sikasil Primer-2100.
(2) Sealant: Sikasil-728 NS Non-Sag Silicone Sealant.

5. Sealants At Flat Drainage Exterior Concrete Structures:
a. Expansion Joints and Control Joints:
1) Description:
a) One component (part) self-leveling silicon material that cures to ultra-low modulus silicone rubber upon exposure to atmospheric moisture.
b) Cured silicone rubber remains flexible over entire temperature range expected in pavement applications.
2) Design Criteria:
a) Sealant is required at following areas:
(1) Within flat drainage structures and at joints between flat drainage structures and other concrete elements.
b) Meet following standards for Sealant: Self-leveling: ASTM D-5893; ASTM C-920, Type S, Grade P, Class 100/50; Use T, M, G, A, O.
3) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) Dow Corning:
(1) Primer: 1200 Prime Coat.
(2) Sealant: 890-SL Silicone Building Sealant.
b) Sika:
(1) Primer: Primer: Sikasil Primer-2100.
(2) Sealant: Sikasil-728 SL Self-leveling Silicone Sealant.

6. Sealants At Curbs And Gutters:
a. Expansion Joints and Control Joints:
1) Description:
a) Effective for sealing transverse contraction and expansion joints, longitudinal, center line and shoulder joints in Portland cement concrete.
b) One component (part) non-sag silicone material that cures to low modulus, silicone rubber upon exposure to atmospheric moisture. May be applied over wide temperature range.
2) Design Criteria:
a) Expansion joint sealant is required in following areas:
(1) Within curbs and gutters at approved layout locations.
b) Meet following standards for Sealant: Non-sag: ASTM C-920: Type S, Grade NS, Class 100/50, Use T, NT.
3) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) Dow Corning:
(1) Primer: 1200 Prime Coat.
(2) Sealant: 888 Silicone Joint Sealant.
b) Sika:
(1) Primer: Primer: Sikasil Primer-2100.
(2) Sikasil-728 NS Non-Sag Silicone Sealant.

7. Sealants At Precast Concrete Cap and Joint Covers (if Contractor Option ONE was selected in Section 03 4800):
a. Description:
1) Soft lead strip, when set and bedded in sealant, form cap which assures permanent elastic seal for any masonry joint as specified in Section 03 4800.
b. Design Criteria:
1) Meet following standards for Sealant:
a) ASTM C920: Type S, Grade NS, Class 50 Use A, G, M.
b) Strips should be of sufficient size to cover the joint width, plus percentage allowance for anticipated joint movement, plus 1/4 inch (6.4 mm).
c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
1) Dow Corning:

a) Primer: 1200 Prime Coat.
b) Sealant: 791 Silicone Weatherproofing Sealant.

2) Momentive Performance Materials (formerly, GE Sealants & Adhesives):
a) Primer: SS4044 Primer.
b) Sealant: GE SCS2000 SilPruf Silicone Sealant & Adhesive.

3) Sika:
a) Primer: Sikasil Primer-2100.
b) Sealant: Sikasil-728 NS Non-Sag Silicone Sealant.

4) Tremco:
a) Primer:
(1) Metal surface: No. 20 primer.
(2) Porous surfaces: No. 23 primer.
b) Sealant: Spectrum 1 Silicone Sealant.

2.2 ACCESSORIES

A. Bond Breaker Tape:
1. Pressure sensitive tape as by Sealant Manufacturer to suit application.
2. Provide tape to prevent adhesion to joint fillers or joint surfaces at back of joint and allow sealant movement.

B. Joint Backing:
1. Comply with ASTM C1330.
2. Flexible closed cell, non-gassing polyurethane or polyolefin rod or bond breaker tape as recommended by Sealant Manufacturer for joints being sealed.
3. Oversized 25 to 50 percent larger than joint width.

C. Joint Cleaner:
1. Non-corrosive and non-staining type as recommended by Sealant Manufacturer, compatible with joint forming materials.

D. Masking Tape:
1. Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
1. Examine substrate surfaces and joint openings are ready to receive Work.
a. Verify each sealant is compatible for use with joint substrates.
b. Verify joint surfaces are clean and dry.
c. Ensure concrete surfaces are fully cured.
2. Sealants provided shall meet Manufacturer's shelf-life requirements.
3. Notify Architect of unsuitable conditions in writing.
a. Do not proceed until unsatisfactory conditions are corrected.
4. Commencement of Work by installer is considered acceptance of substrate.

3.2 PREPARATION

A. Surface Preparation:
1. Remove existing joint sealant materials where specified.
a. Clean joint surfaces of residual sealant and other contaminates capable of affecting sealant bond to joint surface using manufacturer’s recommended joint preparation methods.

b. Repair deteriorated or damaged substrates as recommended by Sealant Manufacturer to provide suitable substrate. Allow patching materials to cure.

2. Surfaces shall be clean, dry, free of dust, oil, grease, dew, frost or incompatible sealers, paints or coatings that may interfere with adhesion. Prepare substrates in accordance with Manufacturer's instructions:
   a. Porous surfaces: Clean by mechanical methods to expose sound surface free of contamination and laitance followed by blasting with oil-free compressed air.
   b. Nonporous surfaces: Use two-cloth solvent wipe in accordance with ASTM C1193. Allow solvent to evaporate prior to sealant application.
   c. High-pressure water cleaning: Exercise care that water does not enter through failed joints.
   d. Primers:
      1) Primers enhance adhesion ability.
      2) Use of primers is not a substitution for poor joint preparation.
      3) Primers should be used always in horizontal application where there is ponding water.
3. Field test joints in inconspicuous location.
   a. Verify joint preparation and primer required to obtain optimum adhesion of sealants to joint substrate.
   b. When test indicates sealant adhesion failure, modify joint preparation primer, or both and retest until joint passes sealant adhesion test.
4. Masking: Apply masking tape as required to protect adjacent surfaces and to ensure straight bead line and facilitate cleaning.

B. Joints:
1. Prepare joints in accordance with ASTM C1193.
   a. Clean joint surfaces of contaminates capable of affecting sealant bond to joint surface using Manufacturer's recommended instructions for joint preparation methods.
   b. Remove dirt, dust, oils, wax, paints, and contamination capable of affecting primer and sealant bond.
   c. Clean concrete joint surfaces to remove curing agents and form release agents.

C. Protection:
1. Protect elements surrounding the Work of this section from damage or disfiguration.

3.3 APPLICATION

A. General:
1. Apply silicone sealant in accordance with Manufacturer's instructions.
2. Do not use damaged or deteriorated materials.
3. Install primer and sealants in accordance with ASTM C1193 and Manufacturer's instructions.
4. Apply primer where required for sealant adhesion.
5. Install sealants immediately after joint preparation.
6. Do not use silicone sealant as per the following:
   a. Apply caulking/sealant at temperatures below 40 deg F (4 deg C).
   b. Below-grade applications.
   c. Brass and copper surfaces.
   d. Materials bleeding oils, plasticizers, and solvents.
   e. Structural glazing and adhesive.
   f. Surfaces to be immersed in water for prolonged time.

B. Joint Backing:
1. Install joint backing to maintain sealant joint ratios recommended by Manufacturer.
2. Install without gaps, twisting, stretching, or puncturing backing material. Use gage to ensure uniform depth to achieve correct profile, coverage, and performance.
3. Rod for open joints shall be at least 1-1/2 times width of open joint and of thickness to give solid backing. Backing shall fill up joint so depth of sealant bite is no more than 3/8 inch (9.5 mm) deep.

C. Bond Breaker:

1. Install bond breaker where joint backing is not used or where backing is not feasible.
   a. Apply bond-breaker tape in shallow joints as recommended by Sealant Manufacturer.

D. Sealant:
1. Apply sealant with hand-caulking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint. Apply sealants in vertical joints from bottom to top.
2. Fill joint opening to full and proper configuration.
3. Apply in continuous operation.
4. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface. Tool joints in opposite direction from application direction, i.e., in vertical joints, from the top down. Do not 'wet tool' sealants.
5. Depth of sealant bite shall be 1/4 inch (6 mm) minimum and 1/2 inch (12.7 mm) maximum, but never more than one half or less than one fourth joint width.

E. Caulk gaps between painted or coated substrates and unfinished or pre-finished substrates. Caulk gaps larger than 3/16 inch (5 mm) between painted or coated substrates.

3.4 TOLERANCES

A. Provide joint tolerances in accordance with Manufacturer’s printed instructions.

3.5 FIELD QUALITY CONTROL

A. Adhesion Test (Installer Option to use adhesion test to determine if primer is required).
1. Perform adhesion tests in accordance with Manufacturer’s instructions and ASTM C1193, Method A, Field-Applied Sealant joint Hand-Pull Tab:
   a. Perform five (5) tests for first 1,000 linear feet (300 meters) of applied silicone sealant and one (1) test for each 1,000 linear feet (300 meters) seal thereafter or perform one (1) test per floor per building elevation minimum.
   b. For sealants applied between dissimilar materials, test both sides of joints.
2. Sealants failing adhesion test shall be removed, substrates cleaned, sealants re-installed, and re-testing performed.
3. Maintain test log and submit report to Architect indicating tests, locations, dates, results, and remedial actions.

3.6 CLEANING

A. Remove masking tape and excess sealant.

B. Clean adjacent materials, which have been soiled, immediately (before setting) as recommended by Manufacturer.

C. Waste Management: Dispose of products in accordance with manufacturer’s recommendation.

END OF SECTION

SECTION 09 9001

COMMON PAINTING AND COATING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Common procedures and requirements for field-applied painting and coating.

B. Related Requirements:
   1. Section 05 0503: 'Shop-Applied Metal Coatings' for quality of shop priming of steel and iron.
   2. Section 07 9213: 'Elastomeric Joint Sealants' for quality of Elastomeric Joint Sealants.
   3. Sections under 09 9000 heading ‘Paints and Coatings’.
      a. Pre-Installation conferences held jointly with Section 09 9001.

1.2 REFERENCES

A. Definitions:
   1. Damage Caused By Others: Damage caused by individuals other than those under direct control of Painting Applicator (MPI(a), PDCA P1.92).
   2. Gloss Levels:
      a. Specified paint gloss level shall be defined as sheen rating of applied paint, in accordance with following terms and values, unless specified otherwise for a specific paint system.

Gloss Level ‘1’	Traditional matte finish - flat	0 to 5 units at 60 degrees to 10 units maximum at 85 degrees.
Gloss Level ‘2’	High side sheen flat - 'velvet-like' finish	10 units maximum at 60 degrees and 10 to 35 units at 85 degrees.
Gloss Level ‘3’	Traditional 'eggshell-like finish	10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
Gloss Level ‘4’	'Satin-like' finish	20 to 35 units at 60 degrees and 35 units minimum at 85 degrees.
Gloss Level ‘5’	Traditional semi-gloss	35 to 70 units at 60 degrees.
Gloss Level ‘6’	Traditional gloss	70 to 85 units at 60 degrees.
Gloss Level “7’	High gloss	More than 85 units at 60 degrees.

   3. Properly Painted Surface:
      a. Surface that is uniform in appearance, color, and sheen and free of foreign material, lumps, skins, runs, sags, holidays, misses, strike-through, and insufficient coverage. Surface free of drips, spatters, spills, and overspray caused by Paint Applicator. Compliance will be determined when viewed without magnification at a distance of 5 feet (1.50 m) minimum under normal lighting conditions and from normal viewing position (MPI(a), PDCA P1.92).
   4. Latent Damage: Damage or conditions beyond control of Painting Applicator caused by conditions not apparent at time of initial painting or coating work.

B. Reference Standards:
   1. The latest edition of the following reference standard shall govern all painting work:
      a. MPI(a), 'Architectural Painting Specification Manual' by Master Painters Institute (MPI), as issued by local MPI Accredited Quality Assurance Association having jurisdiction.
      b. MPI(r), 'Maintenance Repainting Manual' by Master Painters Institute (MPI), as issued by local MPI Accredited Quality Assurance Association having jurisdiction.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
   1. Schedule painting pre-installation conference after delivery of paint or coatings and before or at same time as application of field samples.
      a. Coordinate pre-installation conferences of all related painting and coating Sections under 09 9000 heading ‘Paints and Coatings’.
      b. Schedule conference before preparation of control samples as specified in Sections under 09 9000 heading ‘Paints and Coatings’.
      c. Conference to be held at same time as Section 09 2900 to review gypsum board finish preparation.
   2. In addition to agenda items specified in Section 01 3100, review following:
      a. Review Quality Assurance for Approval requirements.
      b. Review Quality Assurance Field Sample requirements.
      c. Review Submittal requirements for compliance for MPI Approved Products.
      d. Review Design Criteria requirements.
      e. Review Cleaning requirements.
      f. Review painting schedule.
      g. Review safety issues.
   3. Review additional agenda items from Sections under 09 9000 heading ‘Paints and Coatings’.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Include following information for each painting product, arranged in same order as in Project Manual.
         1) Manufacturer's cut sheet for each product indicating ingredients and percentages by weight and by volume, environmental restrictions for application, and film thicknesses and spread rates.
         2) Provide one (1) copy of ‘MPI Approved Products List’ showing compliance for each MPI product specified.
            a) MPI Information is available from MPI Approved Products List using the following link: http://www.paintinfo.com/mpi/approved/index.shtml.
         3) Confirmation of colors selected and that each area to be painted or coated has color selected for it.

B. Informational Submittals:
   1. Manufacturer Instructions:
      a. Manufacturer's substrate preparation instructions and application instruction for each painting system used on Project.
   2. Qualification Statement:
      a. Applicator:
         1) Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturer’s documentation:
            a) Manufacturer's cut sheet for each component of each system.
            b) Schedule showing rooms and surfaces where each system was used.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approval:
   1. Conform to work place safety regulations and requirements of those authorities having jurisdiction for storage, mixing, application and disposal of all paint and related hazardous materials.

2. Paint and painting materials shall be free of lead and mercury, and have VOC levels acceptable to local jurisdiction.
3. Master Painters Institute (MPI) Standards:
   a. Products: Comply with MPI standards indicated and listed in 'MPI Approved Products List'.
   b. Preparation and Workmanship: Comply with requirements in 'MPI Architectural Painting Specification Manual' for products and coatings indicated.

B. Qualifications:
1. Applicator: Requirements of Section 01 4301 applies, but not limited to following:
   a. Minimum five (5) years experience in painting installations.
   b. Minimum five (5) satisfactorily completed projects of comparable quality, similar size, and complexity in past three (3) years before bidding.
   c. Maintain qualified crew of painters throughout duration of the Work.
   d. Upon request, submit documentation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Deliver specified products in sealed, original containers with Manufacturer's original labels intact on each container.
2. Deliver amount of materials necessary to meet Project requirements in single shipment.

B. Storage And Handling Requirements:
1. Store materials in single place.
2. Keep storage area clean and rectify any damage to area at completion of work of this Section.
3. Maintain storage area at 55 deg F (13 deg C) minimum.

1.7 FIELD CONDITIONS

A. Ambient Conditions:
1. Perform painting operations at temperature and humidity conditions recommended by Manufacturer for each operation and for each product for both interior and exterior work.
2. Apply painting systems at lighting level of 540 Lux (50 foot candles) minimum on surfaces to be painted.
   a. Inspection of painting work shall take place under same lighting conditions as application.
   b. If painting and coating work is applied under temporary lighting, deficiencies discovered upon installation of permanent lighting will be considered latent damage as defined in MPI Manual, PDCA P1-92.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Performance:
1. Design Criteria:
   a. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   b. All materials, preparation and workmanship shall conform to requirements of 'Architectural Painting Specification Manual' by Master Painters Institute (MPI).
   c. All paint manufacturers and products used shall be as listed under Approved Product List section of MPI Painting Manual.
   d. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.
   e. Where specified paint system does not have Premium Grade, provide Budget Grade.

f. Provide products of same manufacturer for each coat in coating system.
g. Where required to meet LEED (Leadership in Energy and Environmental Design) program requirements, use only MPI listed materials having an “L” rating designation.

B. Materials:
1. Materials used for any painting system shall be from single manufacturer unless approved otherwise in writing by painting system manufacturers and by Architect. Include manufacturer approvals in Product Data submittal.
2. Linseed oil, shellac, turpentine, and other painting materials shall be pure, be compatible with other coating materials, bear identifying labels on containers, and be of highest quality of an approved manufacturer listed in MPI manuals. Tinting color shall be best grade of type recommended by Manufacturer of paint or stain used on Project.

PART 3 - EXECUTION

3.1 APPLICATORS

A. Approved Applicators:
1. Meet Quality Assurance Applicator Qualifications as specified in Part 1 of this specification.

3.2 EXAMINATION

A. Verification Of Conditions:
1. Directing applicator to begin painting and coating work will indicate that substrates to receive painting and coating materials have been previously inspected as part of work of other Sections and are complete and ready for application of painting and coating systems as specified in those Sections.

B. Pre-Installation Testing:
1. Before beginning work of this Section, examine, and test surfaces to be painted or coated for adhesion of painting and coating systems.
2. Report in writing to Architect of conditions that will adversely affect adhesion of painting and coating work.
3. Do not apply painting and coating systems until party responsible for adverse condition has corrected adverse condition.

C. Evaluation And Assessment:
1. Report defects in substrates that become apparent after application of primer or first finish coat to Architect in writing and do not proceed with further work on defective substrate until such defects are corrected by party responsible for defect.

3.3 PREPARATION

A. Protection Of In-Place Conditions:
1. Protect other finish work and adjacent materials during painting. Do not splatter, drip, or paint surfaces not intended to be painted. These items will not be spelled out in detail but pay special attention to the following:
a. Do not paint finish copper, bronze, chromium plate, nickel, stainless steel, anodized aluminum, or monel metal except as explicitly specified.
b. Keep cones of ceiling speakers completely free of paint. In all cases where painting of metal speaker grilles is required, paint without grilles mounted to speakers and without grilles on ceiling.
c. On existing work where ceiling is to be painted, speakers and grilles are already installed, and ceiling color is not being changed, mask off metal grilles installed on ceiling speakers. If

ceiling color is being changed, remove metal grilles and paint, and mask off ceiling speakers.

B. Surface Preparation:
   1. Prepare surfaces in accordance with MPI requirements and requirements of Manufacturer for each painting system specified, unless instructed differently in Contract Documents. Bring conflicts to attention of Architect in writing.
   2. Fill minor holes and cracks in wood surfaces to receive paint or stain.
   3. Surfaces to be painted shall be clean and free of loose dirt. Clean and dust surfaces before painting or finishing.
   4. Do no exterior painting while surface is damp, unless recommended by Manufacturer, nor during rainy or frosty weather. Interior surfaces shall be dry before painting. Moisture content of materials to be painted shall be within tolerances acceptable to Paint Manufacturer.
   5. Sand woodwork smooth in direction of grain leaving no sanding marks. Clean surfaces before proceeding with stain or first coat application.

3.4 APPLICATION

A. Interface With Other Work:
   1. Coordinate with other trades for materials and systems that require painting before installation.
   2. Schedule painting and coating work to begin when work upon which painting and coating work is dependent has been completed. Schedule installation of pre-finished and non-painted items, which are to be installed on painted surfaces, after application of final finishes.

B. Paint or finish complete all surfaces to be painted or coated as described in Contract Documents.

C. Apply sealant in gaps 3/16 inch (5 mm) and smaller between two substrates that are both to be painted or coated. Sealants in other gaps furnished and installed under Section 07 9213.

D. On wood to receive a transparent finish, putty nail holes in wood after application of stain using natural colored type to match wood stain color. Bring putty flush with adjoining surfaces.

E. In multiple coat paint work, tint each succeeding coat with slightly lighter color, but approximating shade of final coat, so it is possible to check application of specified number of coats. Tint final coat to required color.

F. Spread materials smoothly and evenly. Apply coats to not less than wet and dry film thicknesses and at spreading rates for specified products as recommended by Manufacturer.

G. Touch up suction spots after application of first finish coat.

H. Paint shall be thoroughly dry and surfaces clean before applying succeeding coats.

I. Use fine sandpaper between coats as necessary to produce even, smooth surfaces.

J. Make edges of paint adjoining other materials or colors clean, sharp, and without overlapping.

K. Finished work shall be a 'Properly Painted Surface' as defined in this Section.

3.5 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Correct deficiencies in workmanship as required to leave surfaces in conformance with 'Properly Painted Surface,' as defined in this Section.
   2. Correction of 'Latent Damage' and 'Damage Caused By Others,' as defined in this Section, is not included in work of this Section.

3.6 CLEANING

A. General:
   1. As work proceeds and upon completion of work of any painting Section, remove paint spots from floors, walls, glass, or other surfaces and leave work clean, orderly, and in acceptable condition.

B. Waste Management:
   1. Remove rags and waste used in painting operations from building each night. Take every precaution to avoid danger of fire.
   2. Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be disposed of subject to regulations of applicable authorities having jurisdiction.
   3. Remove debris caused by work of paint Sections from premises and properly dispose.
   4. Retain cleaning water and filter out and properly dispose of sediments.

END OF SECTION

ATTACHMENTS

PART 4 - PAINT COLOR SCHEDULE

A. Related Requirements:
   1. Exterior Painted Ferrous Metal.

B. Colors:
   1. Exterior:
      a. Class One Color Quality Standards. See Section 01 6200:
         1) Exterior Metal:
            a) Match existing color and manufacturer.
         2) Exterior Wood:
            a) Match existing color and manufacturer.

   2. Exterior:
      a. Exterior Metal:
         1) Class One Color Quality Standard.
      b. Exterior Wood:
         1) Class One Color Quality Standard.

SECTION 09 9112

EXTERIOR PAINTED FERROUS METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Preparing and painting new exterior ungalvanized iron and steel surfaces as described in Contract Documents.
   2. Preparing and painting following existing exterior ungalvanized iron and steel surfaces as described in Contract Documents:
      a. Awning posts and trim.

B. Related Requirements:
   1. Section 09 9001: 'Common Painting And Coating Requirements':
      a. Pre-installation conference for Sections under 09 9000 heading ‘Paints and Coatings’.
      b. 'Attachment: Paint Color Schedule' for O&M / R&I Projects.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Category Four Approved Products and Manufacturers. See Section 01 6200 for definitions of Categories:
      a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved.

B. Description:
   1. New Surfaces: Use MPI(a) EXT 5.1M Waterborne Light Industrial Coating system .
   2. Previously Finished Surfaces: Use MPI(r) REX 5.1K Waterborne Light Industrial Coating.

C. Design Criteria:
   1. Systems specified are in addition to prime coats provided under other Sections of Project Manual.
   2. Finish Requirements: Use MPI Premium Grade finish requirements for work of this Section.
   3. Gloss / Sheen Level Required: Gloss Level 5.

D. Materials:
   1. All paints and coatings.
      a. Primer Coat: MPI Product 107, ‘Primer, Rust-Inhibitive, Water Based’.
      b. Finish Coats: MPI Product 163, ‘Light Industrial Coating, Exterior, Water Based, Semi-Gloss (MPI Gloss Level 5).

PART 3 - EXECUTION

3.1 APPLICATION

A. General: See appropriate paragraphs of Section 09 9001.

B. New Surfaces: Clean metal to be painted of rust, mill scale, grease, oil, and welding spatters, burrs, flux, slag, and fume. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying primer coat.

C. Existing Painted Surfaces:
   1. Remove deteriorated and chalked existing paint and rust down to sound substrate by scraping or power tools.
   2. Clean existing sound painted surfaces as well as scraped and sanded existing painted surfaces as recommended by Paint Manufacturer. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying primer coat.
   3. Spot prime bare metal surfaces followed by a prime coat over entire surface to be painted.
   4. Lightly sand entire surface.
   5. Clean surface as recommended by Paint Manufacturer.
   6. Apply specified finish coats.

END OF SECTION

SECTION 31 0501

COMMON EARTHWORK REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited to:
   1. General procedures and requirements for earthwork.

B. Related Requirements:
   1. Section 01 1200: 'Multiple Contract Summary' for multiple contracts.
   2. Pre-Installation conferences held jointly with Section 31 0501 as described in Administrative Requirements on Part 1 of this specification section:
   3. Section 32 9001: 'Common Planting Requirements':

1.2 REFERENCES

A. Definitions:
   1. Aggregate Base: Layer of granular material immediately below concrete and asphalt paving or miscellaneous site concrete (sidewalks, curbs, etc) and below interior concrete slabs on grade.
   2. Base: See aggregate base.
   3. Building Grading: sloping of grounds immediately adjacent to building. Proper grading causes water to flow away from a structure. Grading can be accomplished either with machinery or by hand.
   4. Compacted Fill: Placement of soils on building site placed and compacted per Contract Documents. Used to replace soils removed during excavation or to fill in low spot on building site.
   5. Excavation: Removal of soil from project site or cavity formed by cutting, digging or scooping on project site.
   6. Fine Grading (FG): Preparation of subgrade preceding placement of surfacing materials (aggregate base, asphalt or concrete paving, and topsoil) for contour of building site required. Fine Grading is conducted to ensure that earth forms and surfaces have been properly shaped and subgrade has been brought to correct elevations. It is performed after rough grading and placement of compacted fill but before placement of aggregate base or topsoil.
   7. Finish Grading: Completed surface elevation of landscaping areas for seeding, sodding, and planting on building site.
   8. Natural Grade: Undisturbed natural surface of ground.
   9. Rough Grading (RG): Grading, leveling, moving, removal and placement of existing or imported soil to its generally required location and elevation. Cut and fill is part of rough grading.
   10. Subgrade (definition varies depending upon stage of construction and context of work being performed):
       a. Prepared natural soils on which fill, aggregate base, or topsoil is placed.
          or
       b. Prepared soils immediately beneath paving or topsoil.
   11. Topsoil Placement and Grading: Topsoil placement and finish grading work required to prepare site for installation of landscaping.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
   1. General Earthwork:
      a. Excavation.
      b. Rough Grading.
      c. Fill.

d. Fine Grading.
e. Aggregate Base or Topsoil Grading.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
1. Forty eight (48) hours minimum before performing any work on site, contact Blue Stakes, Utility Locating Service to arrange for utility location services.
2. Perform minor, investigative excavations to verify location of various existing underground facilities at sufficient locations to assure that no conflict with the proposed work exists and sufficient clearance is available to avoid damage to existing facilities.
3. Perform investigative excavating ten (10) days minimum in advance of performing any excavation or underground work.
4. Upon discovery of conflicts or problems with existing facilities, notify Architect by phone within twenty four (24) hours. Follow telephone notification with letter and diagrams indicating conflict or problem and sufficient measurements and details to evaluate problem.

3.2 PREPARATION

A. Protection:
1. Spillage:
a. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways.
b. Remove spillage and sweep, wash, or otherwise clean project, streets, and highways.
2. Dust Control:
a. Take precautions necessary to prevent dust nuisance, both on-site and adjacent to public and private properties.
b. Correct or repair damage caused by dust.
3. Existing Plants And Features:
a. Do not damage tops, trunks, and roots of existing trees and shrubs on site that are intended to remain.
b. Do not use heavy equipment within branch spread.
c. Interfering branches may be removed only with permission of Architect.
d. Do not damage other plants and features that are to remain.

3.3 REPAIR / RESTORATION

A. Adjust existing covers, boxes, and vaults to grade.

B. Replace broken or damaged covers, boxes, and vaults.

C. Independently confirm size, location, and number of covers, boxes, and vaults that require adjustment.

3.4 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':

a. Quality Control is sole responsibility of Contractor. Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform The Work or Contractors own Testing and Inspection services.

2. Field Tests and Laboratory Tests:
   a. Owner reserves right to require additional testing to re-affirm suitability of completed work including compacted soils that have been exposed to adverse weather conditions.
3. Field Inspections:
   a. Notify Architect forty eight (48) hours before performing excavation or fill work.
   b. If weather, scheduling, or any other circumstance has interrupted work, notify Architect twenty four (24) hours minimum before intended resumption of grading or compacting.

B. Non-Conforming Work:
1. If specified protection precautions are not taken or corrections and repairs not made promptly, Owner may take such steps as may be deemed necessary and deduct costs of such from monies due to Contractor. Such action or lack of action on Owner's part does not relieve Contractor from responsibility for proper protection of The Work.

END OF SECTION

SECTION 31 1123

AGGREGATE BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install the following as described in Contract Documents:
      a. Aggregate Base:
         1) Miscellaneous exterior concrete (including equipment pads).
         2) Asphalt paving.

B. Related Requirements:
   1. Section 01 0000: ‘General Requirements’:
      a. Section 01 1200: ‘Multiple Contract Summary’ for multiple contracts.
      b. Section 01 3100: ‘Project Management and Coordination’ for pre-installation conference.
      c. Section 01 4000: ‘Quality Requirements’ for administrative and procedural requirements for quality assurance and quality control.
      d. Section 01 4301: ‘Quality Assurance – Qualifications’ establishes minimum qualification levels required.
      e. Section 01 4523: ‘Testing and Inspecting Services’ for testing and inspection, and testing laboratory services for materials, products, and construction methods.
      f. Section 01 6200: 'Product Options' for administrative and procedural requirements for product options.
      g. Section 01 7800: ‘Closeout Submittals’.
   2. Section 03 3111: 'Cast-In-Place Structural Concrete'.
   3. Section 31 0501: ‘Common Earthwork Requirements’ for:
      a. General procedures and requirements for earthwork.
      b. Pre-installation conference held jointly with other common earthwork related sections.
   4. Section 31 2323: 'Fill' for compaction procedures and tolerances.
   5. Section 32 1216: 'Asphalt Paving'.

1.2 REFERENCES

A. Definitions:
   1. Aggregate (Asphalt Paving):
      a. Aggregate: A hard inert mineral material, such as gravel, crushed rock, slag, or sand.
      b. Coarse Aggregate: Aggregate retained on No. 8 (2.36 mm) sieve.
      c. Dense-Graded Aggregate: Aggregate that is graded from maximum size down through filler with object of obtaining an asphalt mix with controlled void content and high stability.
      d. Fine Aggregate: Aggregate passing No. 8 (2.36 mm) sieve.
      e. Reclaimed Asphalt Pavement (RAP): Existing asphalt mixture that has been pulverized, usually by milling, and is used like an aggregate in recycling of asphalt pavements.

B. Reference Standards:
   1. ASTM International:
      a. ASTM C131/C131M-14, 'Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine’.
      b. ASTM D1556/D1556M-15, ‘Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method’.
      c. ASTM D1557-12, ‘Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))’.
      d. ASTM D1883-16, 'Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils.

e. ASTM D2167-15, ‘Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method’.
f. ASTM D2419-14, ‘Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate’.
g. ASTM D4318-10, ‘Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils'.
h. ASTM D6938-10, 'Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)’.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
1. Aggregate Base:
a. Install aggregate base at location shown in Contract Drawings.
2. Concrete Slab is installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Materials shall be delivered in original, unopened packages with labels intact.

1.5 FIELD CONDITIONS

A. Ambient Conditions:
1. Do not perform work during unfavorable conditions as specified below:
a. Aggregate Base:
1) Presence of free surface water.
2) Over-saturated sub base materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate Base:
1. Exterior Concrete (Section 03 3111 'Cast-In-Place Structural Concrete'):
a. New Aggregate Base:
1) Road Base to conform to State DOT Specifications.
2. Asphalt Paving (Section 32 1216 'Asphalt Paving'):
a. New Aggregate Base:
1) Road Base to conform to 1-1/2 inches (38 mm) minus State DOT Specifications and Gradations.
2) Aggregate base shall be nonplastic.

PART 3 - EXECUTION

3.1 PREPARATION

A. Stockpiles:
1. Provide area for each stockpile of adequate size, reasonably uniform in cross-section, well drained, and cleared of foreign materials.
2. Locate piles so that there is no contamination by foreign material and no intermingling of aggregates from adjacent piles. Do not use steel-tracked equipment on stockpiles.

3. Do not store aggregates from different sources, geological classifications, or of different gradings in stockpiles near each other unless bulkhead is placed between different materials.
4. Do not use washed aggregates sooner than twenty four (24) hours after washing or until surplus water has drained out and material has uniform moisture content.
5. Do not stockpile higher than 15 feet (4.57 m). Cover or otherwise protect stockpiles for use in HMA to prevent buildup of moisture.

B. Surface Preparation (Miscellaneous Exterior Concrete):
1. Subgrade:
   a. Finish grade to grades required by Contract Documents.
   b. Compact subgrade as specified in Section 31 2323.

C. Surface Preparation (Asphalt Paving):
1. Subgrade:
   a. Finish grade parking surface area to grades required by Contract Documents.
   b. Aggregate base and paving must be placed before any moisture or seasonal changes occur to subgrade that would cause compaction tests previously performed to be erroneous. Recompact and retest subgrade soils that have been left exposed to weather.

3.2 INSTALLATION

A. Aggregate Base:
1. General:
   a. Do not place aggregate base material when subgrade is frozen or unstable.
   b. Spread aggregate base material with equipment except in limited or restricted areas where use of hand spreading is allowed.
   c. Spread aggregate base material in manner that does not break down material and eliminates segregation, ruts, and ridges.
   d. Correct damage to aggregate base caused by construction activities, and maintain corrected aggregate base until subsequent course is placed.
   e. Do not allow traffic on aggregate base.
   f. Remove all standing storm water.
2. Miscellaneous exterior concrete aggregate base:
   a. Except under mow strips, place 4 inches (100 mm) minimum of aggregate base, level, and compact as specified in Section 31 2323.
3. Asphalt paving aggregate base:
   a. 6 inches (150 mm) thick minimum after compaction in accordance with Contract Drawings.
   b. If roller is smaller than 8 ton (7260 kg), lay aggregate base and compact in two courses.
   c. Compact as specified in Section 31 2323.
   d. Priming: Prime aggregate base with application of 0.2 to 0.5 gallons (2 to 5 liters) of asphalt cement primer per square yard (meter) if pavement will be laid more than three days after compaction of aggregate base, or if precipitation is anticipated between completion of compaction of aggregate base and laying of asphalt paving.
   e. Recompact unprimed aggregate base if it receives precipitation before pavement is laid.
   f. Remove or repair improperly prepared areas as directed by Architect.

B. Tolerances:
1. Asphalt Paving Areas:
   a. Aggregate base:
      1) 0.00 inches (0.00 mm) high.
      2) Measure using string line from curb to curb, gutter, flat drainage structure, or grade break.
      3) Finished base course shall be true to line and grade within plus or minus 1/4 inch in 10 feet (6 mm in 3 meters).
      4) Maximum variation from required grades shall be 1/10 of one foot (28 mm).

3.3 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
   1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
      a. Quality Control is sole responsibility of Contractor.
         1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
            a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.

END OF SECTION

SECTION 31 2323

FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform Project backfilling and compacting as described in Contract Documents, except as specified below.
   2. Procedure and quality for backfilling and compacting performed on Project under other Sections unless specifically specified otherwise.

B. Related Requirements:
   1. Section 01 0000: 'General Requirements':
      a. Section 01 1200: 'Multiple Contract Summary' for multiple contracts.
      b. Section 01 3100: 'Project Management and Coordination' for pre-installation conference.
      c. Section 01 4000: 'Quality Requirements' for administrative and procedural requirements for quality assurance and quality control.
      d. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
      e. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
      f. Section 01 7800: 'Closeout Submittals'.
   2. Section 31 0501: 'Common Earthwork Requirements' for:
      a. General procedures and requirements for earthwork.
   3. Section 31 1123: 'Aggregate Base' for aggregate base requirements.
   4. Section 32 9122: 'Topsoil Grading' for preparation of topsoil and addition of amendments prior to landscaping.
   5. Division 32: Compaction of subgrade under walks and paving.
   6. Performance of backfilling and compacting inside and outside of building required for electrical and mechanical work is responsibility of respective Section doing work unless arranged differently by Contractor.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International (Following are specifically referenced for fill and aggregate base testing):
      a. ASTM D698-12, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))'.
      b. ASTM D1556/D1556M-15, 'Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method'.
      c. ASTM D1557-12, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))'.
      d. ASTM D2167-15, 'Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method'.
      e. ASTM D2487-11, 'Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)'.
      f. ASTM D6938-15, 'Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)'.

1.3 QUALITY ASSURANCE

A. Testing and Inspection:

1. Owner will provide Testing and Inspection for fill / engineering fill:
    a. Owner will employ testing agencies to perform testing and inspection for fill / engineering fill as specified in Field Quality Control in Part 3 of this specification.
        1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
        2) See Section 01 1200: 'Multiple Contract Summary'.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Site Material:
    1. Existing excavated material on site is suitable for use as fill and backfill to meet Project requirements.

B. Imported Fill / Backfill:
    1. Well graded material conforming to ASTM D2487 free from debris, organic material, frozen materials, brick, lime, concrete, and other material which would prevent adequate performance of backfill.
        a. Under Landscaped Areas:
            1) Fill more than 36 inches (900 mm) below finish grade shall comply with soil classification groups GW, CL, GP, GM, SW, SP, or SM. Fill may not contain stones over 6 inches (150 mm) diameter and ninety (90) percent minimum of fill shall be smaller than 1-1/2 inch (38 mm) in any direction.
            2) Fill less than 36 inches (900 mm) below finish grade shall comply with soil classification groups SW, SP, SM, or SC. Fill may not contain stones larger than 1-1/2 inches (38 mm) in any direction and ninety (90) percent minimum of fill shall be smaller than 3/8 inch (4.7 mm) in any direction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before placing fill, aggregate base, or finish work, prepare existing subgrade as follows:
    1. Do not place fill or aggregate base over frozen subgrade.
    2. Under Miscellaneous Concrete Site Elements And Outside Face of Foundation Walls
        a. Scarify subgrade 6 inches (150 mm) deep, moisture condition to uniform moisture content between optimum and four (4) percent over optimum, and mechanically tamp to ninety five (95) percent minimum of relative compaction.
    3. Landscape Areas:
        a. Compact subgrade to eighty five (85) percent relative compaction.

3.2 PERFORMANCE

A. Interface With Other Work:
    1. Section 31 2213: 'Rough Grading' for rough grading and preparation of natural soil subgrades below fill and aggregate base materials.
    2. Section 31 2216: 'Fine Grading' for grading of subgrade below aggregate base and topsoil.

B. Fill / Backfill:
    1. General:
        a. Around Buildings And Structures: Slope grade away from building as specified in Section 31 2216. Hand backfill when close to building or where damage to building might result.

b. Site Utilities:
   1) In Landscape Areas: Use backfill consisting of on-site soil.
   2) Under Pavement and Concrete Site Elements: Extend excavatable flowable fill / backfill to elevation of subgrade. Do not place aggregate base material until excavatable flowable fill / backfill has cured seventy two (72) hours.
c. Do not use puddling or jetting to consolidate fill areas.

2. Compacting:
   a. Fill / Backfill And Aggregate Base:
      1) All fill material shall be well-graded granular material with maximum size less than 3 inch (76 mm) and with not more than fifteen (15) percent passing No. 200 sieve.
      2) Under Driveways And Parking Areas:
         a) Place in 8 inch (200 mm) maximum layers, dampen but do not soak, and mechanically tamp to ninety five (95) percent minimum of maximum laboratory density as established by ASTM D1557.
      3) Under Miscellaneous Concrete Site Elements And Outside Face of Foundation Walls:
         a) Place in 8 inch (200 mm) maximum layers, dampen but do not soak, and mechanically tamp to ninety five (95) percent minimum of maximum laboratory density as established by ASTM D1557.
      4) Landscape Areas:
         a) Compact fill to eighty five (85) percent minimum relative compaction.
      5) Other Backfills: Place other fills in 12 inch (300 mm) layers and compact to ninety five (95) percent relative compaction.
      6) Loose material from compacted subgrade surface shall be immediately removed before placing compacted fill or aggregate base course.

3.3 REPAIR / RESTORATION

A. Repair damage to other portions of the Work resulting from work of this Section at no additional cost to Owner. On new work, arrange for damage to be repaired by original installer.

3.4 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
   1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
      a. Quality Control is sole responsibility of Contractor:
         1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
            a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.

3.5 CLEANING

A. Debris and material not necessary for Project are property of Contractor and are to be removed before completion of Project. However, if material necessary for Project is hauled away, replace with specified fill / backfill material.

END OF SECTION

SECTION 32 1216

ASPHALT PAVING: Superpave Method

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install asphalt concrete paving in driveways and parking areas as described in Contract Documents including the following, but not limited to:
   a. Asphalt Mix Design Criteria Summary:

1)	Asphalt Binder:	PG 64-22
2)	Nominal maximum size aggregate (Nmas):	9.5 mm (3/8 inch)
3)	Maximum size aggregate:	12.5 mm (1/2 inch)
4)	Mix Designator (compaction effort); Ndesign:	50
5)	Antistrip Agent:	If required by supplier's mix design (use 1 percent or greater lime slurry when required
6)	Asphalt Fibers:	Yes (provide alternate bid for product)
7)	Reclaimed Asphalt Pavement (RAP):	Allowed up to 25 percent. Asphalt binder shall be one grade softer when more than 15 percent RAP is used
8)	ROSP	Not allowed.
9)	Warm Mix Additive	If required by supplier's mix design
10)	Recycle Agent:	If required by supplier's mix design

   b. Tack coat: Application of asphaltic material to existing asphalt concrete or portland concrete surfaces before asphalt concrete pavement.
   c. Blotter materials and procedures for absorbing excess asphalt as required.

B. Related Requirements:
1. Section 01 0000: 'General Requirements':
   a. Section 01 1200: 'Multiple Contract Summary' for multiple contracts.
   b. Section 01 3100: 'Project Management and Coordination' for pre-installation conference.
   c. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
   d. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   e. Section 01 7800: 'Closeout Submittals'.
2. Section 31 0501: 'Common Earthwork Requirements' for:
   a. General procedures and requirements for earthwork.
3. Section 31 1123: 'Aggregate Base' for compaction of aggregate base.
4. Section 31 2213: 'Rough Grading' for rough grading and preparation of natural soil subgrades below fill and aggregate base materials.
5. Section 31 2216: 'Fine Grading' for grading of subgrade below aggregate base and topsoil.
6. Section 31 2323: 'Fill' for compaction procedures and tolerances for base.
7. Section 32 1723: 'Pavement Markings'.

1.2 REFERENCES

A. Association Publications:
1. Asphalt Institute, 2696 Research Park Dr., Lexington, KY www.asphaltinstitute.org:
   a. MS-2, *'Mix Design Methods'* (7th Edition 2015).

B. Definitions:
1. Aggregate: Hard inert mineral material, such as gravel, crushed rock, slag, or sand.

a. Coarse Aggregate: Aggregate retained on or above No. 4 (4.75 mm) sieve.
b. Coarse-Graded Aggregate: Aggregate having predominance of coarse sizes.
c. Dense-Graded Aggregate: Aggregate that is graded from maximum size down through filler with object of obtaining an asphalt mix with controlled void content and high stability.
d. Fine Aggregate: Aggregate passing No. 4 (4.75 mm) sieve.
e. Fine-Graded Aggregate: Aggregate having predominance of fine sizes.
f. Mineral Filler: Fine mineral product at least 70 percent of which passes a No. 200 (75µm) sieve.

2. Air Voids: Total volume of small air pockets between coated aggregate particles in asphalt cement concrete (ACC); expressed as percentage of bulk volume of compacted paving mixture.
3. Anti-Stripping Agent: Chemicals added to bitumen to improve the adhesion of the bitumen to hydrophilic aggregates
4. Asphalt Binder: Asphalt cement or modified asphalt cement that binds aggregate particles into dense mass.
   a. Asphalt Cement used in paving applications that has been classified according to the Standard Specification for Performance Graded Asphalt Binder, AASHTO Designation MP 320. It can be either unmodified or modified Asphalt Cement, as long as it complies with specifications.
5. Asphalt-Aggregate Designator: Alpha-numeric code that indicates nominal maximum size of aggregate, and type and grade of asphalt in aggregate-asphalt mix.
   a. Example: “12.5 PG70-28” means aggregate asphalt mix shall be composed of aggregate gradation with 12.5 mm (1/2 inch) nominal maximum size and performance grade asphalt binder designed to perform between temperatures of 70 deg C and -28 deg C (158 deg F and -18.4 deg F).
6. Equivalent Single Axle Load (ESAL): Effect on pavement performance of any combination of axle loads of varying magnitude equated to number of 18,000-lb. (80-kN) single-axle loads that are required to produce an equivalent effect.
7. Maximum Size (Superpave): One sieve larger than the nominal maximum size.
8. Ndesign (Superpave): Design number of gyrations used for design of Hot Mix Asphalt (HMA).
9. Nominal Maximum Size: One sieve size larger than first sieve size retaining more than 10 percent of Sample. Nominal maximum size sieve will retain minimum of 0 and maximum of 10 percent of sample. Maximum size is one sieve size larger than nominal maximum size.
10. Performance Graded Asphalt Binder (PGAB): Asphalt binder designed to produce HMA that meets certain performance standards. Designations for performance-graded asphalt binders are prefixed with PG. Each grade designation also includes two sets of numbers that denote temperature range. This is a range of climate temperatures to which road may be exposed and still be expected to give superior performance. PG numbers do not indicate viscosity as in conventional liquid asphalt designations.
11. Pre-emergent Herbicide: Chemical that is applied before weeds emerge. It acts by killing weed seedlings and /or establishing layer of chemical on or near soil surface that is toxic to germinating seeds and young seedlings.
12. Reclaimed Asphalt Pavement (RAP): Existing asphalt mixture that has been pulverized, usually by milling, and is used like aggregate in recycling of asphalt pavements.
13. Subgrade (definition varies depending upon stage of construction and context of work being performed):
    a. Prepared natural soils on which fill, aggregate base, or topsoil is placed.
    or
    b. Prepared soils immediately beneath paving.
14. Tack Coat: Very light application of liquid asphalt, or asphalt emulsion diluted with water.

C. Reference Standards:
   1. American Association of State and Highway Transportation Officials:
      a. AASHTO T 304-11: ‘Standard Method of Test for Uncompacted Void Content of Fine Aggregate’.
      b. AASHTO T 322-07(2011), ‘Standard Method of Test for Determining the Creep Compliance and Strength of Hot-Mix Asphalt (HMA) Using the Indirect Tensile Test Device.
   2. ASTM International:
      a. ASTM C29/C29M-16, ‘Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate'.

b. ASTM C88-13, ‘Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate'.
c. ASTM C117-13, ‘Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing'.
d. ASTM C131/C131M-14, 'Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine’.
e. ASTM C142/C142M-10, ‘Standard Test Method for Clay Lumps and Friable Particles in Aggregates'.
f. ASTM D242/D242M-09(2014), ‘Standard Specification for Mineral Filler For Bituminous Paving Mixtures'.
g. ASTM D977-13, 'Standard Specification for Emulsified Asphalt’.
h. ASTM D979/D979M-15, 'Practice for Sampling Bituminous Paving Mixtures'.
i. ASTM D2041/D2041M-11, 'Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures’.
j. ASTM D2172/D2172M-11, ‘Standard Test Methods for Quantitative Extraction of Bitumen From Bituminous Paving Mixtures’.
k. ASTM D2256/ D2256M-10, ‘Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method’.
l. ASTM D2397/D2397M, 'Standard Specification for Cationic-Emulsified Asphalt’.
m. ASTM D2419-14, ‘Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate'.
n. ASTM D2950/D2950M-14, ‘Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods'.
o. ASTM D3203/D3203M-11, ‘Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures'.
p. ASTM D3549/D3549M-11, ‘Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens’.
q. ASTM D3665-12, ‘Standard Practice for Random Sampling of Construction Materials’.
r. ASTM D4318-10, ‘Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils'.
s. ASTM D4552/D4552M-10, ‘Standard Practice for Classifying Hot-Mix Recycling Agents'.
t. ASTM D4759-11, ‘Standard Practice for Determining the Specification Conformance of Geosynthetics'.
u. ASTM D4791-10, ‘Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
v. ASTM D5444-15, ‘Standard Method for Mechanical Size Analysis of Extracted Aggregate'.
w. ASTM D5821-13, ‘Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate’.
x. ASTM D6307-10, ‘Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method'.
y. ASTM D6932/D6932M-08(2013), ‘Standard Guide for Materials and Construction of Open-Graded Friction Course Plant Mixtures’.

1.3 SUBMITTALS

A. Action Submittals:
1. Product Data:
a. Pre-Emergent Herbicide:
1) Manufacturer's published product data on pre-emergent herbicide.

B. Informational Submittals:
1. Certificates:
a. Require mix plant to furnish delivery/load tickets for each batch of asphalt. Keep delivery tickets at job-site for use of Owner’s Representative. Tickets shall show following:
1) Name of mix plant.
2) Date.
3) Name of contractor.
4) Name and location of Project.
5) Serial number of ticket.

6) Asphalt mix type.
7) Time loaded.
8) Identity of truck.

b. Installer to provide Manufacturer's Certificate of Compliance stating material authenticity and properties for review and acceptance by Architect before product use.

2. Design Data:
   a. Hot Mix Asphalt:
      1) Design Criteria:
         a) Develop mix design according to current Asphalt Institute MS-2 'Asphalt Mix Design Methods' for Superpave Method.
         b) Submittal format:
            (1) Design mix submittal shall follow format as indicated in current Asphalt Institute MS-2*, 'Mix Design Methods.*
      2) Mix design of asphalt paving must meet Design Criteria minimum requirements and show conformance to the following:
         a) Location and name of hot mix asphalt concrete production facility.
         b) Date of mix design. If older than two (2) years, recertify mix design.
         c) Asphalt mix type.
         d) Mix design method used.
         e) Mix density.
         f) Design air voids (three and one half (3.5) percent.
         g) Asphalt content in percent.
         h) Performance grade of asphalt binder.
         i) Nominal maximum size of aggregate.
         j) Maximum size of aggregate.
         k) Aggregate source and gradation.
         l) Mix properties and design parameters.
         m) Temperature of mix at plant and in the field for optimum field compaction.
         n) Amount of recycled asphalt pavement (RAP).
         o) Mineral fillers, antistrip, and recycle agent percentages.
         p) Identify if warm mix technologies will be used and how much warm mix additive will be used.
      3) Within thirty (30) days prior to asphalt construction, submit actual design mix to Architect for review and approval.
3. Test And Evaluation Reports:
   a. Hot Mix Asphalt:
      1) Copies of test results from tests conducted to assure compliance to Contract Document requirements.
4. Manufacturer Instructions:
   a. Pre-Emergent Herbicide:
      1) Application instructions for pre-emergent herbicide.
5. Qualification Statement:
   a. Installer:
      1) Provide Qualification documentation if requested by Owner's Representative.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800 'Closeout Submittals':
      a. Record Documentation:
         1) Manufacturer's documentation:
            a) Pre-emergent herbicide documentation.
            b) Asphalt paving design.
            c) Test reports.
            d) Certificates from mix plant of delivery/load tickets.
            e) Manufacturer's Certificate of Compliance.
         2) Testing and Inspection Reports:
            a) Testing Agency Testing and Inspecting Reports of asphalt paving.

1.4 QUALITY ASSURANCE

A. Qualifications. Requirements of Section 01 4301 'Quality Assurance - Qualifications' applies but not limited to following:
   1. Asphalt Paving:
      a. Foreman of asphalt paving crew has completed at least three (3) projects of similar size and nature.
      b. Upon request, submit documentation.
   2. Pre-emergent herbicide:
      a. Applicator:
         1) Pre-emergent herbicide shall be applied by applicator certified by State in which Project is located as an applicator of agricultural chemicals.

B. Testing and Inspection:
   1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
   2. Owner will provide Testing and Inspection for asphalt paving:
      a. Owner will employ testing agencies to perform testing and inspection for asphalt paving as specified in Field Quality Control in Part 3 of this specification.
         1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
         2) See Section 01 1200: 'Multiple Contract Summary'.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Asphalt Material:
      a. Each shipment must:
         1) Be uniform in appearance and consistency.
         2) Show no foaming when heated to specified loading temperature.
      b. Do not supply shipments contaminated with other asphalt types or grades than those specified:
         1) Do not use petroleum distillate as a release agent.
   2. Pre-emergent herbicide:
      a. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
   1. Pre-emergent herbicide:
      a. Do not freeze. Store in at temperatures above 41 deg F (5 deg C).
      b. Follow Manufacturer's storage and handling requirements.

1.6 FIELD CONDITIONS

A. Ambient Conditions:
   1. Pre-emergent herbicide:
      a. Follow printed Manufacturers instruction for environmental hazards:
      b. Follow printed Manufacturers instruction ambient conditions for application of product.
   2. Tack Coat:
      a. Apply only when air and roadbed temperatures in shade are greater than 40 deg F (4.4 deg C). Temperature restrictions may be waived only upon written authorization from Architect or Civil Engineer.
      b. Do not apply to wet surfaces.
      c. Do not apply when weather conditions prevent tack coat from adhering properly.
   3. Asphalt paving:
      a. Do not perform work during following conditions:
         1) Ambient temperature is below 45 deg F (7.2 deg C) or will fall below 45 deg F (7.2 deg C) during placement.

2) Temperature of aggregate base below 50 deg F (10 deg C).
3) Cold Weather Asphalt Paving Plan: If asphalt pavement is placed outside of these temperature limits or those identified in MINIMUM Temperature Degrees, a plan is required which includes:
   a) Haul times.
   b) Placement details.
   c) Compaction aids used in production.
   d) Owner does not assume responsibility for asphalt when placed outside temperature limits.
4) Presence of free surface water or weather is unsuitable.
5) Wind or ground cools mix material before compaction.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. General:
   1. Follow current Asphalt Institute MS-2 'Asphalt Mix Design Methods' for Superpave Method.

B. Asphalt Mix:
   1. Asphalt Binder:
      a. Performance Graded Asphalt Binder:
         1) Use performance graded asphalt binder identified under Asphalt Mix Design Criteria.
   2. Aggregates:
      a. Use clean, hard, durable, angular, sound, consisting of crushed stone, crushed gravel, slag, sand, or combination.
      b. Use nominal maximum size aggregate and maximum size aggregate per Asphalt Mix Design Criteria. Aggregate gradation to meet **Table 1** - **MASTER GRADING BANDS** requirements:

Table 1 - MASTER GRADING BANDS

Sieve (mm)		Nominal Maximum Aggregate Size	
		12.5 mm	9.5 mm
Control Sieves	19	100	-
	12.5	100	100
	9.5	< 90	90 – 100
	4.75	--	< 90
	2.36	28 – 58	32 – 60
	0.075	2 – 10	2 – 10
Restricted Zone	2.36	39.1	47.2
	1.18	25.6 – 31.6	31.6 – 37.6
	0.6	19.1 – 23.1	23.5 – 27.5
	0.3	15.5	18.7

NOTES:
1. It is assumed fine and coarse aggregate have same bulk specific gravity.
2. Gradation is expressed in percent passing by weight, ASTM C136. Percentage of fines passing 0.075 mm control sieve determined by washing, ASTM C117.

      c. Provide aggregate material properties to meet **Table 2 – AGGREGATE PHYSICAL PROPERTIES** requirements:

Table 2 –AGGREGATE PHYSICAL PROPERTIES					
Property		**ASTM**	**ESAL**	**Min**	**Max**
Coarse Aggregate (does not pass No. 4 sieve)					
Angularity (fractured faces), percent		D5821	less than 0.3	55	--
			0.3 to 3.0	75	--
			greater than 3.0	85/80	--
Wear (hardness or toughness), percent		C131/C131M	less than 0.3	--	40
			0.3 to 3.0	--	35
			greater than 3.0	--	35
Flats or elongates (3:1 length to width), percent, maximum		D4791	--	--	20
Fine Aggregate (passing No. 4 sieve)					
Angularity (uncompacted void content), percent (AASHTO T304)		--	less than 0.3	--	--
			0.3 to 3.0	40	--
			greater than 3.0	45	--
Sand equivalent, percent		D2419	less than 0.3	40	--
			0.3 to 3.0	40	--
			greater than 3.0	45	--
Friable particles, percent		C142	--	--	2
Plastic limit, maximum	Liquid limit	D4318	--	--	25
	Plastic limit	D4318	--	--	6

Notes:
1. ESAL in millions.
2. Angularity by weight retained above 9 mm sieve, with at least one fractured face. 85/80 denotes 85 percent coarse aggregate has one fractured face and 80 percent has two or more fractured faces.
3. Wear of aggregate retained above 2.36 mm sieve unless specific aggregates have higher values are known to be satisfactory.
4. Flats or elongates retained above 4.75 mm sieve.
5. Friable particles passing No. 4.75 mm sieve.
6. Plasticity, passing No. 4.75 sieve. Aggregate is no-plastic even when filler material is added to aggregate.

Blended Physical Properties				
Dry-rodded unit weight, lb/ft^3, minimum	C29/C29M	-	75	--
Weight loss (soundness), percent, maximum	C88		--	16
Clay content or cleanliness (sand equivalent), percent	D2419	less than 0.3	45	--
		more than 0.3	60	--

Notes:
1. Weight loss using sodium sulfate.
2. Sand equivalent value is after going through dryer or before drum mixer. The sand equivalent requirement is waived for RAP aggregate but applies to remainder of aggregate blend.
3. Friable particles of clay lumps, shale, wood, mica, and coal passing 4.75 sieve.

3. Admixture:
   a. Antistrip: Heat stable, cement slurry, lime slurry, dry lime, or liquid antistrip:
      1) Add if mix is moisture sensitive as determined by 'Moisture Susceptibility' paragraph below.
   b. Mineral Filler: Comply with requirements of ASTM D242/D242M.
   c. Recycle Agent: Comply with requirements of ASTM D4552/D4552M.

2.2 MATERIAL

A. Aggregate Base: Conform to applicable requirements as specified in Section 31 1123: 'Aggregate Base'.
B. Asphalt Paving Surface Treatment:
   1. Include mandatory Asphalt Paving Surface Treatment to be applied no sooner than thirty (30) days or no later than eighteen (18) months of placing Asphalt Paving to be included with this project:

C. Pre-Emergent Herbicide:
   1. Design Criteria:
      a. Selective type pre-emergence control chemical containing forty (40) percent Trifluralin minimum for control of annual grasses and broadleaf weeds.
      b. Non-oil based sterilant.
      c. Labeled for under-pavement use.
   2. Type Two Acceptable Products:
      a. Treflan E.C. by Monterey AgResources, Fresno, CA www.montereyagresources.com (available in western United States).
      b. Trust 4EC by WinField Solutions LLC (Agrilsolutions), St Paul, MN www.agrisolutionsinfo.com (available in United States).
      c. Equal as approved by Architect before installation. See Section 01 6200.

D. Reclaimed Asphalt Pavement (RAP). Aggregate: Restrictions include:
   1. Allowed up to 25 percent. Asphalt binder shall be one grade softer when more than 15 percent RAP is used.

E. Tack Coat:
   1. Emulsified asphalt meeting requirements of ASTM D977, Grade SS-1H, CQS-1H, or ASTM D2397/D2397M, Grade CSS-1H.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Approved Applicators. See Section 01 4301 'Quality Assurance - Qualifications':

3.2 PREPARATION

A. General:
   1. Aggregate base and paving must be placed before any moisture or seasonal changes occur to subgrade that would cause compaction tests previously performed to be erroneous. Re-compact and retest subgrade soils that have been left exposed to weather.

B. Protection Of In-Place Conditions:
   1. Pre-emergent herbicide:
      a. Take necessary precautions to protect adjoining property and areas designated for planting on building site.
      b. Do not contaminate any body of water by direct application, cleaning of equipment or disposal of wastes.
   2. Asphalt Paving:
      a. Protect all structures, including curb, gutter, sidewalks, guard rails and guide posts.
      b. Protect neighborhood, storm drains and down-stream fish habitat.

C. Surface Preparation:
   1. Survey and stake parking surfaces to show grading required by Contract Documents.
   2. Subgrade (soil below aggregate base):

a. Prepare natural soil subgrade as specified in Section 31 2213 'Rough Grading' or prepare fill subgrade as described in Section 31 2216 'Fine Grading'.

3. Aggregate base:
   a. Finish grade parking surface area to grades required by Contract Documents.
   b. Compact aggregate base as specified in Section 31 1123 'Aggregate Base'.
   c. Tolerances:
      1) Elevation of aggregate base shall be 0.00 inches (0.00 mm) high and no more than 1/2 inch (12.7 mm) low.
      2) Measure using string line from curb to curb, gutter, flat drainage structure, or grade break.
4. Tack coat:
   a. Clean surface of all materials such as mud, dirt, leaves, etc. that prevent tack from bonding to existing surfaces.
      1) If flushed, allow surface to dry.
5. Asphalt paving:
   a. Area shall be clean and tack coat applied before placing of asphalt paving.
      1) Remove all moisture, dirt, sand, leaves, and other objectionable material from prepared surface before placing asphalt.
      2) Locate, reference, and protect all utility covers, monuments, curb, and gutter and other components affected by asphalt paving operations.
      3) Allow sufficient cure time for tack coat before placing asphalt.

3.3 APPLICATION

A. Interface With Other Work:
   1. Section 31 1123: 'Aggregate Base' for compaction of aggregate base.
   2. Section 31 2213: 'Rough Grading' for rough grading and preparation of natural soil subgrades below fill and aggregate base materials.
   3. Section 31 2216: 'Fine Grading' for grading of subgrade below aggregate base and topsoil.
   4. Section 31 2323: 'Fill' for compaction procedures and tolerances.

B. Pre-Emergent Herbicide:
   1. Asphalt paving areas:
      a. Follow Manufacturer's printed application requirements:
      b. Apply to prepared subgrade dispersed in liquid. Concentrate shall be such that Manufacturer's full recommended amount of chemical will be applied to every 1000 sq ft (93 sq m) and liquid will penetrate minimum of 2 inches (50 mm).
      c. Application shall be no more than one (1) day before installation of aggregate base.

C. Tack Coat:
   1. General:
      a. Tack coat vertical surfaces or existing asphalt cement concrete or portland cement concrete that will be in contact with asphalt paving.
      b. Use tack coat diluted to a 2:1 (concentrate water) ratio.
      c. Use pressure distributor to apply in uniform, continuous spread.
      d. Cover all tacked surface areas with surfacing materials same day of application.
   2. Application rate. Typically as follows:
      a. Emulsions, 0.08 to 0.15 gallons per sq yd (0.303 to 0.679 L per sq m) of diluted material:
         1) Apply sufficient to achieve ninety five (95) percent or better coverage of existing surfaces.
         2) Above application rates may vary according to field conditions. Obtain approval from Civil Engineer for quantities, rate of application, temperatures, and areas to be treated before any application.

D. Asphalt Paving:
   1. General:
      a. Paving adjacent to cast-in-place concrete site elements shall be between 1/4 inch (6 mm) higher than concrete.
      b. Surface texture of hand worked areas shall match texture of machine-laid areas.

c. Surface shall be uniform with no 'birdbaths'. Leave finished surfaces clean and smooth. Variations from specified grades shall not exceed 1/2 inch (12.7 mm).
d. Cross Slope: 1/4 inch (6 mm) in 10 feet (3.0 m) perpendicular to centerline except at cross section grade breaks.
e. Grade: 1/8 inch (3 mm) in 10 feet (3.0 m) parallel to centerline.
f. Do not place on frozen aggregate base or during adverse climatic conditions such as precipitation or when roadway surface is icy or wet.
g. Uniformly mix materials so aggregate is thoroughly coated with asphalt.
h. Place at temperatures established by the mix design with self-propelled laydown machine.
i. Use **Table 3 – MINIMUM TEMPERATURE, DEGREES** as guide:

Table 3 – MINIMUM TEMPERATURE, DEGREES

Ambient Air Temperature Deg F.	Ambient Air Temperature Deg C.	Compacted Paving Mat Thickness					
		3/4" (19 mm)	1" (25 mm)	1 1/2" (38 mm)	2" (50 mm)	3" (75 mm)	4" + (100 mm) +
45 – 50	7 – 10	---	---	---	---	280	265
50 – 59	10 – 15	---	---	---	280	270	255
60 – 69	16 – 20	---	---	285	275	265	250
70 – 79	21 – 79	285	285	280	270	265	250
80 - 89	27 - 31	280	275	270	265	260	250
90+	32+	275	270	265	260	250	250

j. Longitudinal bituminous joints shall be vertical and properly tack coated if cold. Transverse joints shall always be tack coated.

2. Compaction:
   a. Compact asphalt paving to ninety four (94) percent plus or minus two (2) percent of theoretical maximum specific gravity, ASTM D2041/D2041M (Rice Method - maximum theoretical density).
   b. Roll with powered equipment capable of obtaining specified density while providing required smoothness.
   c. Begin breakdown rolling immediately after asphalt is placed when asphalt temperature is at maximum.
   d. Complete handwork compaction concurrently with breakdown rolling.
   e. Execute compaction so visibility of joints is minimized:
   f. Complete finish rolling to improve asphalt surface as soon as possible after intermediate rolling and while asphalt paving is still warm.
   g. Do not use vibration for finish rolling.
3. Lift Thickness:
   a. Preferred Method:
      1) For pavements 3-1/2 inch (89 mm) or thinner apply asphalt paving in single lift.
      2) For pavements greater than 3-1/2 inch (89 mm), use alternate method below.
   b. Alternate Method:
      1) Asphalt paving may be applied in two (2) lifts, first 2 inches (50 mm) thick minimum and second 1 1/2 inches (38 mm) thick minimum following temperature recommendations of following paragraph.
      2) Surface of first lift shall be clean and provide tack coat between first and second lifts.
      3) Provide not less than two (2) times maximum aggregate size in compacted asphalt concrete mixes.

E. Asphalt Paving Surface Treatments:
1. Apply mandatory Asphalt Paving Surface Treatment no sooner than thirty (30) days or no later than eighteen (18) months of placing Asphalt Paving to be included with this project. Do not apply prior to asphalt curing (refer to 'Asphalt, Concrete and Pervious Concrete Maintenance Guidelines'):

F. Paint Stripes:
1. Apply paint stripes after asphalt paving surface treatment has been applied to asphalt paving.

3.4 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
   a. Quality Control is sole responsibility of Contractor:
      1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
         a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
      2) Contractor bears full responsible for compliance with all contract requirements and quality control on project and will be responsible for quality of asphalt mixture and asphalt installation.

B. Field Tests (Provided by Contractor):
1. General:
   a. Contractor bears full responsibility for compliance with all contract requirements and quality control on project and will be responsible for quality of asphalt mixture and asphalt installation.
   b. Testing and Inspection Reports to be distributed as specified in Section 01 4523 'Testing And Inspection Services'.
2. Compaction Tests:
   a. Contractor to provide compaction tests of asphalt being placed to establish rolling patterns and installation procedures.
   b. Compaction tests by Contractor are independent of compaction tests being provided by Owner. See Section 01 4523 'Testing And Inspection Services'.
   c. Asphalt paving shall be compacted to ninety four (94) percent of Theoretical Maximum Specific Gravity (Rice) plus three (3) percent or minus two (2) percent. Determine percent compaction by ASTM D2041/D2041M.
3. Thickness Tests:
   a. Determine thickness of paving being placed, no less than one (1) test per 10,000 sq. ft. (930 sq. m) of paving or portion thereof, three (3) tests minimum.

C. Field Tests And Inspections (Provided by Owner):
1. General:
   a. Compaction tests provided by Owner will be used to validate or determine discrepancies with testing by Contractor.
   b. Civil engineer applies pay factor for Gradation/Asphalt Content, In-Place Density. Civil engineer computes pay factor for each lot.
   c. Opening paved surface to traffic does not constitute acceptance.
   d. Asphalt-aggregate mix sampling as per ASTM D979/D979M.
      1) Test for:
         a) Air voids as per ASTM D3203/D3203M.
         b) Asphalt binder content as per ASTM D6307.
         c) Aggregate gradation as per ASTM D5444.
   e. Lot size: 10,000 sq. ft. (930 sq. m) or part thereof.
   f. Sub lot size: 5,000 sq. ft. (465 sq. m) or part thereof.
2. At Site Testing and Inspection:
   a. General:
      1) Sampling: One (1) random sample per sample per 10,000 sq. ft. (930 sq. m): Locations as follows:
         a) Behind paver before compaction.
            or
         b) Where sub-lot exhibits non-uniform appearance.
   b. Asphalt Paving:
      1) Testing Agency shall provide full time nuclear density testing and inspection for asphalt paving during asphalt paving operations (nuclear density testing is informational testing only and does not constitute acceptance by Owner).
      2) Inspection to include:
         a) Aggregate coating.

b) Compaction control and effort required.
c) Suitability of spreading and asphalt paving equipment.
d) Temperature of mix as delivered and placed.
(1) Reject mixes exceeding 325 deg F (163 deg C) in transport vehicle as required in Non-Conforming Work below.
(2) Dispose of cold mix in paver hopper as thin spread underlay.

3) Field Tests:
a) When tested with 10 foot (3 meter) straight edge, surface of completed work shall not contain irregularities in excess of 1/4 inch (6 mm).
b) Determine percent compaction per ASTM D2950/D2950M unless other nondestructive nonnuclear methods such as sonar are used.
c) Provide written nuclear density testing, or other nondestructive nonnuclear methods such as sonar, of asphalt paving at minimum rate of one (1) per 2,500 sq. ft. (232 sq. m). Select test locations by ASTM D3665 and sample per ASTM D979/D979M before compaction. Minimum of three (3) tests required.
d) Compact asphalt paving to ninety four (94) percent of Theoretical Maximum Specific Gravity (Rice) plus three (3) percent or minus two (2) percent.
e) Maximum average total air voids in completed hot mix asphalt shall be eight (8) percent but more than three (3) percent as determined by ASTM D2041/D2041M.
f) Determine thickness of paving being placed, no less than one (1) test per 10,000 sq. ft. (930 sq. m) of paving or portion thereof, three (3) tests minimum.

3. At Laboratory Testing:
a. General:
1) Provide at least one (1) laboratory test series for every 10,000 sq. ft. (930 sq. m) or part thereof (minimum of one (1) test):
a) Test reports will show compliance with Contract Documents regarding type and depth of aggregate base, depth and density of asphalt paving, asphalt content, aggregate gradation, flow and stability, bulk specific gravity and maximum specific gravity.
b) Reports will also give test procedures used by testing laboratory.

b. Compaction and Final Density:
1) Pavement thickness and final density to be determined by results of coring. Provide one (1) core per 10,000 sq. ft. (930 sq. m) or part thereof. Minimum of three (3) tests required if under 30,000 sq. ft. (2 787 sq. m).
a) Based upon core samples, compaction is acceptable if test deviations are within pay factor 1.00 limits.
b) At Project Manager's discretion, after consulting with Design Team, a Lot with a sub-lot test deviation greater than Reject may stay in place at fifty (50) percent cost.
c) Select test locations by ASTM D3665 and sample per ASTM D979/D979M after compaction.

c. Compaction Pay Factor:
1) Based upon core samples, compaction is acceptable if test deviations are within pay factor 1.00 limits.
2) At Project Manager's discretion, after consulting with design team, a Lot with a sub-lot test deviation greater than Reject may stay in place at fifty (50) percent cost.
3) Average Density, in percent as shown in **Table 4 – COMPACTION PAY FACTORS**:

Table 4 – COMPACTION PAY FACTORS (94 percent of theoretical maximum specific gravity – Superpave (Rice) (ASTM D2041/D2041M plus three (3) or minus two (2) percent)		
Pay Factor	Density, in Percent	
	Average	Lowest Test
0.70	More than 96	---
1.00	92 to 96	89 or Greater
0.90	92 to 96	Less than 89
Reject	Less than 92	---
Notes: 1. At Contractor's discretion and expense, do Hamburg wheel track test (AASHTO T 304) on 3 additional random core samples from non-complying sub-lot of 5,000 sq. ft. (465 sq. m). Sub-lot will be accepted if average rut depth is less than 10 mm at 20,000 passes.		

d. Pavement Thickness:
   1) Pavement thickness and final density to be determined by results of coring. Provide one (1) core per 10,000 sq. ft. (930 sq. m) or part thereof. Minimum of three (3) tests required if under 30,000 sq. ft. (2 787 sq. m).
      a) Acceptance will be based on the average of all thickness tests.
      b) At Project Manager's discretion, after consulting with design team, payment may be made for areas deficient in thickness by more than 0.75 inches (19.05 mm) at fifty (50) percent. If not, remove and replace at no additional cost to the Owner as shown in **Table 5 – THICKNESS PAY FACTORS**:

Table 5 – THICKNESS PAY FACTORS	
Pay Factors	Thickness Deficiency, in Inches (ASTM D3549/D3549M)
1.00	0.00 to 0.25
0.90	0.26 to 0.50
0.70	0.51 to 0.75
Reject	0.76 to 1.00

e. Air Voids:
   1) Basis of evaluation is laboratory compacted samples (not field compacted samples).
   2) Air voids will be mix design target plus or minus one (1) percent.
   3) If test results are not within this Section's limits, options include correction of production procedures or alternate mix design acceptable to Civil Engineer.

D. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Asphalt Paving:
      a. Deficient asphalt paving thickness:
         1) Place additional material over deficient areas. Do not skin patch. Mill for inlay if necessary. Correct deficient asphalt paving thickness at no additional cost to the Owner.
      b. Rejection and Removal of Asphalt Paving:
         1) Remove asphalt paving found defective after installation and install acceptable product at no additional cost to the Owner.
      c. Removal of Asphalt Paving:
         1) Remove spatter, over-coat, or mar at no additional cost to the Owner.
         2) Remove asphalt from borrow pits or gutters at no additional cost to the Owner.
      d. Repair of Asphalt Paving:

1) Repair or replace defective joints, seams, edges at no additional cost to the Owner.

3.5 PROTECTION

A. Tack Coat:
   1. Protect all surfaces exposed to public view from being spattered or marred. Remove any spattering, over-coating, or marring at no additional cost to Owner.
   2. Traffic:
      a. Do not permit traffic to travel over tacked surface until tack coat has cured and dried.

B. Asphalt Paving:
   1. Protect hot mixed asphalt (HMA) pavement from traffic until mixture has cooled enough not to become marked.

3.6 CLEANING

A. Waste Management:
   1. Pre-emergent herbicide:
      a. Follow Manufacturer's recommendations for disposal of product at approved waste disposal facility.
         1) Do not reuse empty containers.

END OF SECTION

SECTION 32 1723

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish acrylic paint and apply pavement and curb markings as described in Contract Documents including:

1.2 REFERENCES

A. Reference Standards:
   1. Federal Specifications and Standards:
      a. FED-STD-595C, 'Federal Standard: Colors Used in Government Procurement' (16 Jan 2008).
      b. FED TT-P-1952F, 'Paint, Traffic and Airfield Marking, Waterborne' (17 Feb 2015).
   2. U.S. Department of Transportation Federal Highway Administration:
      a. FHWA MUTCD-10, 'Manual on Uniform Traffic Control Devices'.

1.3 SUBMITTALLS

A. Action Submittal:
   1. Product Data:
      1) Manufacturer's published product data and certification that product supplied meets requirements of this specification.

B. Informational Submittal:
   1. Test And Evaluation Reports:
      a. Acrylic Paint:
         1) Provide reports showing compliance to FED TT-P-1952F.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturer's Documentation:
            a) Product data.
            b) Specification compliance documentation.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Paint must meet requirements of FED TT-P-1952-F and local regulations for VOC.
   2. Paint handicap spaces to conform to ADA Standards and local code requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Materials shall be delivered in original, unopened containers with labels intact.
      a. Labels to include:
         1) Manufacturer's name and address.

2) TT-P-1952F reference.
3) Classification Type.
4) Color.

B. Storage And Handling Requirements:
1. Follow Manufacturer's storage and handling requirements.
2. Protect stored material from freezing at temperatures above 35 deg F (2 deg C) or above 115 deg F (46.1 deg C).
3. Do not invert or roll containers.

1.6 FIELD CONDITIONS

A. Ambient Conditions:
1. Acrylic Paint:
a. Apply only on dry clean surfaces, during favorable weather (not excessively windy, dusty, or foggy), and when damage by rain, fog, or condensation not anticipated.
b. Paving surface and Ambient temperature shall be minimum 50 deg F (10 deg C) and rising.
c. Temperature shall not drop below 50 deg F (10 deg C) within twenty four (24) hour period following application.
d. Acetone based paints that are one hundred (100) percent acrylic shall not drop below 32 deg F (0 deg C) within twenty four (24) hour period following application.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Acrylic Paint:
1. Description:
a. Low VOC, ready-mixed, one- component, acrylic waterborne traffic marking paint suitable for application on concrete, asphalt, sealers, and previously painted areas of these surfaces.
2. Design Criteria:
a. General:
1) Traffic Paint.
2) Non-volatile portion of vehicle for all classification types shall be composed of one hundred (100) percent acrylic.
3) Meet FED TT-P-1952F specification requirements.
4) Fast drying when applied at ambient conditions requirement.
5) Low VOC.
6) Non-Reflectorized.
7) Traffic paints not intended for use as floor paints. Do not use on pedestrian walkways or large surfaces such as ramps, floors and stairs which may become slippery when wet.
b. Classification:
1) Type I for use under normal conditions.
c. Composition:
1) Non-volatile portion for all types shall be composed of one hundred (100) percent acrylic polymer as determined by infrared spectral analysis.
2) Prohibited material:
a) Product does not contain mercury, lead, hexavalent chromium, toluene, chlorinated solvents, hydrolysable chlorine derivatives, ethylene-based glycol ethers and their acetates, nor any carcinogen.
d. Qualitative Requirements:
1) Meet FED TT-P-1952F requirements for:
a) Abrasion resistance.
b) Accelerated package stability.
c) Accelerated weathering.

d) Appearance.
e) Color requirements:
(1) Color Match (all colors except white and yellow).
(2) Daylight directional reflectance.
(3) Yellow color match.
f) Condition in container.
g) Flexibility.
h) Freeze/thaw stability.
i) Heat-shear stability.
j) Scrub resistance.
k) Skinning.
l) Titanium dioxide content.
m) Water resistance.

e. Quantitative requirements:
1) Meet FED TT-P-1952F requirements (Table 1).
2) Acetone based paints that are one hundred (100) percent acrylic and have exempt status under Federal law are exempt from meeting FED TT-P-1925F requirements.

3. Colors:
a. General:
1) Traffic Paint will be furnished in white and any Federal Standard 595 color in accordance to FED-STD-595C:
a) Yellow: 33538.
b) Blue: 35180.
c) Red: 31136.
b. White (Yellow may be used at Owner Representative's discretion):
1) Lane lines, edge lines, transverse lines, arrows, words, symbol markings, speed bump markings, parking space markings.
c. Yellow:
1) Cross-hatching in medians, cross hatching in safety zones separating opposing traffic flows, crosswalk stripes, safety markings, centerlines, edge lines along left edge of one-way roadway or one way ramp.
d. Blue And White:
1) In parking spaces specifically designated as reserved for disabled.
e. Red:
1) Fire lanes, no parking zones, special raised pavement markers that are placed to be visible to "wrong-way" drivers.

4. Type Two Acceptable Products:
a. Any product meeting design criteria of this specification as approved by Architect/Owner's Representative before application. See Section 01 6200.

PART 3 - EXECUTION

3.1 PREPARATION

A. Acrylic Paint:
1. Asphalt Surfaces:
a. Do not apply paint until asphalt has cooled.
b. Allow new seal coated surfaces to cure for at least twenty four (24) hours before applying paint.
2. Concrete Surfaces:
a. Do not apply paint to new concrete surfaces until concrete has cured seven (7) days minimum.

B. Surfaces shall be dry and free of grease and loose dirt particles.

C. Perform layout with chalk or lumber crayon only.

3.2 APPLICATION

A. General:
   1. Mix in accordance and apply as per Manufacturer's instructions.
   2. Apply at locations and to dimensions and spacing as shown on Contract Drawings.

B. Tolerances:
   1. General: Make lines parallel, evenly spaced, and with sharply defined edges.
   2. Line Widths:
      a. Four inches (4”) plus or minus 1/4 inch (6 mm) variance on straight segments.
      b. Four inches (4”) plus or minus 1/2 inch (13 mm) variance on curved alignments.

C. Coverage:
   1. Paint stripes added to new asphalt and concrete surfaces:
      a. Apply single coat.
   2. Apply traffic paint at rate of 13 to 15 mils minimum wet thickness, 8 to 9 mils dry thickness. Application at more than 15 mils may result in extended dry times and may cause lifting or cracking on some asphalt surfaces.

3.3 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Replace or correct defective material not conforming to requirements of this specification or any work performed that is of inferior quality at no cost to Owner.

3.4 CLEANING

A. General:
   1. Remove drips, overspray, improper markings, and paint material tracked by traffic by sand blasting, wire brushing, or other method approved by Architect/Owner’s Representative before performance.

B. Waste Management:
   1. Remove debris resulting from work of this Section. Dispose of or recycle all trash and excess material in manner conforming to current EPA regulations and local laws.

END OF SECTION

SECTION 32 8423

UNDERGROUND SPRINKLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install planting irrigation system as described in Contract Documents complete with accessories necessary for proper function.

B. Related Requirements:
   1. Section 01 4301: 'Quality Assurance – Qualifications'.
   2. Section 31 2213: 'Rough Grading'.
   3. Section 31 2216: 'Fine Grading'.
   4. Section 31 2316: ‘Excavation’.
   5. Section 31 2323: 'Fill' for trench compaction.
   6. Section 32 9120: ‘Topsoil And Placement’ for topsoil evaluation and placement required for topsoil grading.
   7. Section 32 9300: 'Plants'.

1.2 REFERENCES

A. Definitions:
   1. Automated Self Flushing Filter: Filter located immediately downstream from point of connection in-lieu of backflow prevention device for irrigation systems that utilize non-potable, secondary and/or reclaimed water that is automatically self flushing to control unwanted debris from infiltrating remaining irrigation system.
   2. Dielectric Fittings: Special type of fitting used between dissimilar metals to prevent galvanic action from causing corrosion failure.
   3. High Wind Area: As defined in this specification, area with average sustained wind speed of over 7.5 mph (12 km/hr).
   4. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
   5. Landscape Management Plan (LMP): See Section 32 9001 for definition.
   6. Lateral Line: Downstream from electric control valves to pop-up spray heads and drip valve assemblies to emitters. Piping or tubing is under pressure during flow. In areas where potable or secondary water are used, pressure supply line shall be white. In areas where non-potable or reclaimed water are used, pressure supply line shall be purple.
   7. Main Line: Downstream from point of connection to electric control valves. Piping is under water-distribution-system pressure when activated by master valve or hydrometer. In areas where potable or secondary water are used, pressure supply line shall be white. In areas where non-potable or reclaimed water are used, pressure supply line shall be purple.
   8. Peak Flow: Maximum required flow for given month based on six (6) day week, nine (9) hour day watering window to be used for irrigation system design and to be used in hydraulic analysis.
   9. Plant Establishment Period: See Section 32 9001 for definition.
   10. Point of Connection: Location where meter for irrigation system is located.
   11. Smart Controller: Irrigation clocks that automatically adjust irrigation run times in response to environmental changes using sensors and weather information to manage watering times and frequency. As environmental conditions vary, controller will increase or decrease irrigation. Smart controllers have ability to turn off sprinklers automatically during rain, high wind or low temperature.
   12. Static Water Pressure: Pressure at point of connection when system is not operable.
   13. Source Pressure Test: Test to determine water source pressure.
   14. System Pressure Test: Test to evaluate system when pressurized.

15. Two Wire Path: Conducts power to solenoid valves, and also conducts communications signals from Controller to each device on system. Sensors receive instructions to take readings, transmit data and perform other tasks; solenoid valves and other devices also receive commands from controller over same wires used to carry power to valves.
16. Working Pressure: Pressure at point of connection when system is operable.

B. Reference Standards:
   1. ASTM International:
      a. ASTM D2564-12, 'Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems'.
      b. ASTM F656-15, 'Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Provide Coordination for required tests and inspections as described under Field Quality Control in Part 3 EXECUTION for following:
      a. Manufacturer's Field Service: Provide necessary manufacturer's field service.
      b. Pressure Test: In presence of Landscape Architect or designated Representative(s), provide pressure test.
      c. Substantial Completion Walkthrough: In presence of the Owner or designated Representative(s), plan and provide walk through after completion of irrigation system.
      d. Irrigation Final Acceptance: In presence of designated Representative(s), plan and provide final walk through after completion of all work listed on Substantial Completion walk through list provided by Architect.

B. Sequencing:
   1. Install sleeves before installation of cast-in-place concrete site elements and paving.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's cut sheets for each element of system.

B. Informational Submittals:
   1. Certificates:
      a. Irrigation System Acceptance:
         1) Upon acceptance of irrigation system, Landscape Architect will provide signed certificate:
            a) Certificate will include name and signature of Landscape Architect, Landscape Architect's company, Landscape Architect's telephone number, and date of review.
            b) Certificate will state to best of Landscape Architect's knowledge that the system is in full compliance with Contract Documents.
      b. Establishment Period Acknowledgement (coordinate with 32 9000 sections):
         1) Establishment Period begins at date of Substantial Completion. Landscape Architect will provide certificate acknowledging Establishment Period commencement:
            a) Certificate will include name and signature of Installer, Installer's company, Installer's telephone number, and date.
            b) Certificate will include name and signature of Owner's Representative, Owner's Representative Group name, Owner's Representative Group telephone number, and date.
            c) Certificate will acknowledge date when Establishment Period begins and that it extends one (1) year from that time.
      c. Training Acknowledgement:
         1) Landscape Architect will provide certificate acknowledging training has been performed:

a) Certificate will include name and signature of Installer, Installer's company, Installer's telephone number, and date.
b) Certificate will include name and signature of Owner's Representative, Owner's Representative Group name, Owner's Representative Group telephone number, and date.
c) Certificate will acknowledge Owner's Representative has been trained in operation and maintenance of system.
d) Certificate will acknowledge Owner's Representative has been trained in the operation and the smart controller.

2. Special Procedure Submittals:
3. Qualification Submittals:
   a. Irrigation Subcontractor:
      1) Provide documentation if requested by Architect.
   b. Irrigation Installer:
      1) Provide documentation if requested by Architect.

C. Closeout Submittals:
   1) Record Drawings: As installation occurs, prepare accurate record drawing to be submitted before final inspection, including:
      a) Detail and dimension changes made during construction.
      b) Significant details and dimensions not shown in original Contract Documents.
      c) Field dimensioned locations of valve boxes, manual drains, quick-coupler valves, control wire runs not in mainline ditch, soil moisture sensors (if soil moisture sensor technology is selected for site) and both ends of sleeves.
      d) Take dimensions from permanent constructed surfaces or edges located at or above finish grade.
      e) Take and record dimensions at time of installation.
   2) Photographs: Provide photographs prior to burial of key elements including but not limited to:
      a) Valves.
      b) Drains.
      c) Hydrometers.
2. Final payment for system will not be authorized until Closeout Submittals are received and accepted by Architect and Landscape Architect.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. General:
      a. Work and materials shall be in accordance with latest rules and regulations, and other applicable state or local laws.
      b. Nothing in Contract Documents is to be construed to permit work not conforming to these codes.

B. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
   1. Irrigation Subcontractor:
      a. Company specializing in performing work of this section.
      b. Minimum five (5) years experience in irrigation sprinkler installations.
      c. Minimum five (5) satisfactorily completed irrigation sprinkler installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
      d. Use trained personnel familiar with required irrigation sprinkler procedures and with Contract Documents.
      e. Foreman or supervisor required to attend pre-installation conference.
      f. Agree to use only approved installers for smart controller technology.
      g. Upon request, submit documentation.
   2. Irrigation Installer:
      a. Perform installation under direction of foreman or supervisor.

b. Minimum three (3) years experience in irrigation sprinkler installations similar in size, scope, and complexity.
c. Upon request, submit documentation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:
1. Protect materials from damage and prolonged exposure to sunlight.

1.7 WARRANTY

A. Warranty:
1. Irrigation System:
a. Warranty irrigation system repair for period of one (1) year from date of Final Acceptance. As part of warranty, Installer shall perform following:
1) Filling and repairing depressions and replacing plantings due to settlement of irrigation system trenches.
2) Repairing faulty equipment, wiring and pipe installations.
3) Repairing equipment and pipe not properly winterized.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
1. Manufacturer Contact List:
a. 3M, Austin, TX www.3m.com/elpd.
b. Action Machining Inc, Bountiful, UT www.actionfilters.com.
c. Amiad www.amiadusa.com.
d. Apollo Valves by Conbraco Industries, Matthews, NC www.apollovalves.com.
e. Carson Industries LLC, Glendora, CA www.carsonind.com.
f. GPH Irrigation Products, Fontana, CA www.gphirrigation.com.
g. Harrington Corporation (Harco), Lynchburg, VA www.harcofittings.com.
h. Hunter Industries, San Marcos, CA www.hunterindustries.com.

B. Materials:
1. Rock-Free Soil:
a. For use as backfill around PVC pipe.
2. Native Material:
a. Soil having rocks no larger than 1/2 inch (13 mm) in any dimension.
3. Pea Gravel:
a. For use around drains, valves, and quick couplers.
b. 1/2 inch (13 mm) maximum dimension, washed rock.
4. Sand: Fine granular material naturally produced by rock disintegration and free from organic material, mica, loam, clay, and other deleterious substances.
5. Native Material: Soil native to project site free of wood and other deleterious materials and rocks over 1-1/2 inches (38 mm).
6. Topsoil:
a. Use soil as described in Section 32 9120, and Section 32 9122.
b. Achieve depths as described in Section 32 9122.
7. Pipe, Pipe Fittings, And Connections:
a. General:
1) Pipe shall be continuously and permanently marked with Manufacturer's name, size, schedule, type, and working pressure.
2) Pipe sizes for repair are to be the same size or larger than existing. Larger sizes may be substituted at no additional cost to Owner.

b. Piping:
   1) Main Line: Schedule 40 PVC.
   2) Lateral Lines: Schedule 40 PVC.
   3) Backflow Assembly Piping: Galvanized steel.
   4) Quick Coupler Piping: Galvanized steel.
c. Fittings: Same material as pipe, except where detailed otherwise.
   1) Fittings 3 inch (76 mm) or larger: Harco or Leemco of matching size.
   2) Use dielectric union fittings between dissimilar metal pipes and fittings.
d. Sleeves:
   1) Under Parking Area And Driveway Paving: Schedule 40 PVC Pipe.
   2) All Other: Class 200 PVC Pipe.
   3) Sleeve diameter shall be two (2) times larger than pipe installed in sleeve.

8. Sprinkler Heads:
   a. Each type of head shall match existing manufacturer.
   b. Heads in Lawn Areas to match existing.

9. Valves:
   a. Manual Drain Valves, Automatic Valves, Isolation Valves and Backflow Preventer to match existing.
10. Valve Accessories:
   a. Valve manifolds:
      1) Type Two Acceptable Products.
         a) Action Machining: 1800 Series, Models 18001, 18001-1-5, and 18001-2.0, 1, 1-1/2, and 2 inch (25, 38, and 50 mm) sizes.
         b) Hydro-Rain: HRM Series.
         c) Equals as approved by Architect before use. See Section 01 6200.
   b. Valve Boxes And Extensions:
      1) Lid Colors:
         a) Green: Lawn areas (potable and secondary water).
         b) Tan: Bare soil and rock areas (potable and secondary water).
         c) Purple: Reclaimed water.
      2) Type Two Acceptable Products:
         a) Carson Industries:
            (1) 12 Inch (300 mm) Model 1419-12.
            (2) 10 Inch (255 mm) Model 0910.
         b) Equal as approved by Architect before use. See Section 01 6200.
   c. Valve ID tags:
      1) Type Two Acceptable Products:
         a) Christy's: Stamped ID tag: 2.25"x2.7" yellow plastic tag with alpha-numeric labeling matching zone. Contact Christy's for local supplier.
         b) Equal as approved by Architect before use. See Section 01 6200.
   d. Valve Box Supports:
      1) Standard size fired clay paving bricks without holes.
      2) Standard size 6 inch x 8 inch x 16 inch (150 mm x 200 mm x 400 mm) CMU Block.
11. Drip System:
   a. Drip Valve Assembly:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Hunter: PCZ 101 Series, ICZ 101 Series.
         b) Netafim:
            (1) Over 5 GPM: LVCZ10075-HF.
            (2) Under 5 GPM: LVCZ10075-LF.
         c) Rainbird:
            (1) Over 15 GPM: XCZ-150-PRB-COM series (15-40 gpm). Does not include ball valve. Automatic valve will operate in some dirty water conditions.
            (2) Over 3 GPM: XCZ-100-B COM series (3-20 gpm). Automatic valve will operate in some dirty water conditions.
            (3) Under 3 GPM: XCZ-075-PRF series.
         d) Toro:
            (1) Over 8 GPM: DZK-700-1-MF.
            (2) Under 8 GPM: DZK-700-1-LF.

b. Distribution Tubing (from lateral lines to emitter):
   1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a) GPH: GPST IH Series, pre-assembled flexible riser w/fittings (size as requried).
      b) Salco: IH Series, pre-assembled flexible riser with fittings (size as required).
      c) Rainbird: SPX swing pipe with barbed fittings.
      d) Hunter: SJ Series with barbed fittings.

c. Drip Emitters:
   1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a) GPH: GPST-CV Series (2, 4, 6, 8, 10 gph emitters).
      b) Rainbird: XBT Series and PCT Series (2, 5, 7, 10 gph emitters).
      c) Salco: PST-CV Series (2, 4 gph emitters).

d. Indicator Emitter:
   1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a) Tree drip indicator:
         (1) Rainbird: XB-10PC with barbed fittings, DBC-025 diffuser cap,TS-025 stake, and XQ 1/4 inch (6.4 mm) tubing.

e. Distribution Tubing (from lateral lines to in-line emitter tubing).
   1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a) Flexible polyethylene pipe.

f. In-Line Emitter Tubing:
   1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a) Hunter: PLD Series air/vacuum relief valves, barb shut-off valves, and 17 mm barbed fittings.
      b) Rainbird: XFCV or XFS drip line, 1/2 inch (12.7 mm) air relief valves, flush valves, and XF series insert fittings.
      c) Netafim: Techline CV tubing, flush valves, and fittings.

g. Valve Boxes and Extensions:
   1) Lid Colors:
      a) Green: Lawn areas (potable and secondary water).
      b) Tan: Bare soil and rock areas (potable and secondary water).
      c) Purple: Reclaimed water.
   2) Type Two Acceptable Products:
      a) Carson Industries.
         (1) 15 inch (380 mm) Model 1320-15 Super Jumbo.
         (2) 12 Inch (300 mm) Model 1220-12 Jumbo.
         (3) 12 Inch (300 mm) Model 1419-12.
         (4) 10 Inch (255 mm) Model 0910.
      b) Equal as approved by Architect before use. See Section 01 6200.

h. Valve ID Tags:
   1) Type Two Acceptable Products:
      a) Christy's: Stamped ID tag: 2.25"x2.7" yellow plastic tag with alpha-numeric labeling matching zone. Contact Christy's for local supplier.
      b) Equal as approved by Architect before use. See Section 01 6200.

i. Valve Box Supports:
   1) Standard size fired clay paving bricks without holes.
   2) Standard size 6 inch x 8 inch x 16 inch (150 mm x 200 mm x 400 mm) CMU Block.

12. Solvent Cement:
   a. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Primer:
         a) Meet ASTM F656 standard and applicable sections of latest edition of *'Uniform Plumbing Code'.*
         b) Meet NSF/ANSI standard for use on potable water applications.
         c) Low VOC emissions and compliant with LEED.
         d) Product: Weld-On P-70 primer by IPS.
      2) PVC Solvent Cement:
         a) Heavy bodied, medium setting, high strength:
            (1) Meet ASTM D2564 standard and applicable sections of latest edition of *'Uniform Plumbing Code'.*
            (2) Meet NSF/ANSI standard for use on potable water applications.

(3) Meet CSA standards for use in pressure and non-pressure potable water applications.
(4) Low VOC emissions and compliant with LEED.
(5) Product: Weld-On 711 Low VOC PVC Cement by IPS.

b) Flexible, medium bodied, fast setting, high strength (flexible pipe only):
(1) Meet ASTM D2564 standard and applicable sections of latest edition of *'Uniform Plumbing Code'.*
(2) Meet NSF/ANSI standard for use on potable water applications.
(3) Low VOC emissions and compliant with LEED.
(4) Product: Weld-On 795 Low VOC Flex PVC Cement by IPS.

13. Other Components:
a. Recommended by Manufacturer and subject to Architect's review and acceptance before installation.
b. Provide components necessary to complete system and make operational.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Approved Applicators. See Section 01 4301 'Quality Assurance - Qualifications':

3.2 EXAMINATION

A. Verification Of Conditions:
1. Perform source pressure test at stub-out on main water line provided for irrigation system, or at near-by fire hydrant.
2. Notify Architect if pressures over 70 psi (480 kPA) or under 55 psi (379 kPA) are found to determine if some re-design of system is necessary before beginning work on system.

3.3 PREPARATION

A. Protection:
1. Protection Of In-Place Conditions:
a. Repair or replace work damaged during course of Work at no additional cost to Owner. If damaged work is new, installer of original work shall perform repair or replacement.
b. Do not cut existing tree roots measuring over 2 inches (50 mm) in diameter in order to install irrigation lines.

B. Surface Preparation:
1. Layout of Irrigation Heads:
a. Location of heads and piping shown on Contract Drawings is approximate. Actual placement may vary slightly as is required to achieve full, even coverage without spraying onto buildings, sidewalks, fences, etc.
b. During layout, consult with Architect to verify proper placement and make recommendations, where revisions are advisable.
c. Minor adjustments in system layout will be permitted to avoid existing fixed obstructions.
d. Make certain changes from Contract Documents are shown on Record Drawings.

3.4 INSTALLATION

A. Trenching And Backfilling:
1. Pulling of pipe is not permitted.
2. Excavate trenches to specified depth. Remove rocks larger than 1-1/2 inch (38 mm) in any direction from bottom of trench. Separate out rocks larger than 1-1/2 inch (38 mm) in any

direction uncovered in trenching operation from excavated material and remove from areas to receive landscaping.

3. Cover pipe both top and sides with 2 inches (50 mm) of rock-free soil or sand as specified under PART 2 PRODUCTS. Remainder of backfill to topsoil depth as specified in Section 32 9122 using native material as specified under PART 2 PRODUCTS and topsoil as specified in Section 32 9120, and Section 32 9122.

B. Sleeving:
   1. Sleeve water lines and control wires under walks and paving. Extend sleeves 6 inches (150 mm) minimum beyond walk or pavement edge. Cover sleeve ends until pipes and wires are installed to keep sleeve clean and free of dirt and debris.
   2. Position sleeves with respect to buildings and other obstructions so pipe can be easily removed.

C. Grades And Draining:
   1. In localities where winterization is required, grade piping so system can be completely drained or blown out with compressed air. If system is not designed to be blown out with compressed air:
      a. Slope pipe to drain to control valve box where possible.
      b. Where this is not possible, slope pipe to minimum number of low points. At these low points, install:
         1) 3/4 inch (19 mm) brass ball valve for manual drain. Do not use automatic drain valves.
         2) Install 2 inch (50 mm) Class 200 PVC pipe over top of drain and cut at finish grade.
         3) Provide rubber valve cap marker.
         4) Provide one cu ft (0.03 cu m) pea gravel sump at outlet of each drain.
      c. Slope pipes under parking areas or driveways to drain outside these areas.
      d. Provide and install quick-coupling valve or valves in location for easy blowout of entire system. Install quick coupler valves with 2 lineal feet (0.60 m) minimum of galvanized pipe between valve and main line.

D. Installation of Pipe:
   1. Install pipe in manner to provide for expansion and contraction as recommended by Manufacturer.
   2. Unless otherwise indicated on Contract Drawings, install main lines with minimum cover of 18 inches (450 mm) based on finished grade. Install lateral lines, including those connecting drip tubing, with minimum of 12 inches (300 mm) of cover based on finish grade.
   3. Install pipe and wires under driveways or parking areas in specified sleeves 18 inches (450 mm) below finish grade or as shown on Contract Drawings.
   4. Locate pipe so no sprinkler head will be closer than 12 inches (300 mm) from building foundation.
   5. Cut plastic pipe square. Remove burrs at cut ends before installation so unobstructed flow will result.
   6. Make solvent weld joints as follows:
      a. Do not make solvent weld joints if ambient temperature is below 35 deg F (2 deg C).
      b. Clean mating pipe and fitting with clean, dry cloth and apply one (1) coat of primer to each surface.
      c. Apply uniform coat of solvent cement to outside of pipe.
      d. Apply solvent cement to fitting in similar manner.
      e. Insert pipe completely into fitting.
      f. Give pipe or fitting quarter turn to insure even distribution of solvent and make sure pipe is inserted to full depth of fitting socket.
      g. Allow joints to set at least twenty four (24) hours before applying pressure to PVC pipe.
   7. Tape threaded connections with teflon tape.
   8. Isolation Valves:
      a. Install as detailed and per Manufacturers recommendations.
   9. If pipe is larger than 3 inches (75 mm), install joint restraints wherever change of direction occurs on PVC main lines.

E. Control Valves And Control Valve Wiring:
   1. Install valves in plastic boxes with reinforced heavy duty plastic covers. Locate valve boxes within 12 inches (300 mm) to 24 inches (600 mm) of sidewalks and shrub bed edges with tops at finish grade. Do not install more than two (2) valves in single box.

2. Place 3 inches (75 mm) minimum of pea gravel below bricks supporting valve boxes to drain box. Set valve boxes over valve so all parts of valve can be reached for service. Set cover of valve box even with finish grade. Valve box cavity shall be reasonably free from dirt and debris.
3. Wiring:
   a. For traditional wiring, tape control wire to side of main line every 10 feet (3.050 m). Where control wire leaves main or lateral line, enclose it in gray conduit.
   b. Use waterproof wire connectors consisting of properly-sized wire nut and grease cap at splices and locate all splices within valve boxes.
   c. Use white or gray color for common wire and other colors for all other wire. Each common wire may serve only one (1) controller.
   d. Run one (1) spare control wire from panel continuously from valve to valve throughout system similar to common wire for use as replacement if wire fails:
      1) Run spare wire to each branch of system.
      2) Spare wire shall be different color than other wires. Use of green wire is not acceptable.
      3) Mark spare control wire visibly within valve box as an 'Un-Connected Wire'. Extend spare control wires 24 inches (600 mm) and leave coiled in each valve box. Mark spare wire visibly within controller as 'Un-Connected Wire'.

F. Sprinkler Heads And Rotor Pop-ups:
1. Set sprinkler heads and quick-coupling valves perpendicular to finish grade.
2. Do not install sprinklers using side inlets. Install using base inlets only.
3. Heads immediately adjacent to mow strips, walks, or curbs shall be one inch (25 mm) below top of mow strip, walk, or curb and have one inch (25 mm) to 3 inch (75 mm) clearance between head and mow strip, walk, or curb.
4. Set sprinkler heads at consistent distance from walks, curbs, and other paved areas and to grade by using specified components or other method demonstrated in Pre-Construction Conference.

G. Drip Assembly:
1. Install pipe providing for expansion and contraction as recommended by Manufacturer.
2. Cut tubing square and remove burrs at cut ends.
3. Distribution tubing shall be between 14 inches (350 mm) minimum and 48 inches (1 200 mm) maximum long. Layout PVC lateral lines as necessary to keep distribution tubing lengths within specified tolerances.
4. Locate drip emitter on uphill side of plant within rootball zone.
5. Layout in-line tubing for trees as indicated on Contract Drawings. Layout in-line tubing for shrubs and groundcovers so plants receive water within rootball zones.
6. Locate in-line tubing on top of soil but under bark mulch and weed barrier fabric.
7. Staple in-line tubing to ground at 6 foot (1 800 mm) maximum intervals and within 12 inches (300 mm) of ends and intersections.
8. Assembly Using Solvent Weld Joints:
   a. Do not make solvent weld joint if ambient temperature is below 35 deg F (2 deg C).
   b. Clean mating pipe and fitting with clean, dry cloth.
   c. Apply uniform coat of PVC solvent cement to outside of pipe and inside socket of fitting.
   d. Insert pipe completely into fitting.
   e. Give pipe or fitting quarter turn to insure even distribution of solvent and make sure pipe is inserted to full depth of fitting socket.
   f. Allow joints to set twenty four (24) hours minimum before applying pressure to pipe.
9. Assembly Using 'Funny Pipe' Type Joints:
   a. Connect distribution tubing to lateral line using barbed ell fitting.
   b. Connect fitting to distribution tubing using straight barbed fitting with 1/2 inch (13 mm) threaded end.

H. Before installation of sprinkler heads and drip emitters, open control valves and use full head of water to flush out system.

I. Arrange valve stations to operate in an easy-to-view progressive sequence around building. Tag valves with waterproof labels showing final sequence station assignments.

3.5 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
   1. Substantial Completion Walkthrough:
      a. Landscape Architect or designated representative(s) will inspect site and create list of non-conforming items to be resolved prior to Irrigation Final Acceptance. Date on this list will act as date of Landscape Substantial Completion.
      b. Installations completed after water source has been turned off for season, as determined by Landscape Architect, will be inspected following spring after system can be checked for proper operation.
   2. Irrigation Final Acceptance:
      a. Irrigation Final Acceptance will be awarded when all non-conforming work is brought into conformance.

B. Non-Conforming Work: Non-conforming work as covered in General Conditions applies, but is not limited to following:
   1. Underground Sprinkler System:
      a. Correct any work found defective or not complying with Contract Document requirements at no additional cost to Owner.

3.6 ADJUSTING

A. Sprinkler Heads:
   1. Adjust sprinkler heads to proper grade when turf is sufficiently established to allow walking on it without appreciable harm. Such lowering and raising of sprinkler heads shall be part of original contract with no additional cost to Owner.
   2. Adjust sprinkler heads for proper distribution and trim so spray does not fall on building.

B. Watering Time:
   1. Adjust watering time of valves to provide proper amounts of water to plants.

3.7 CLOSEOUT ACTIVITIES

A. Training:
   1. After system is installed and approved, instruct Owner's designated personnel in complete operation and maintenance procedures using Landscape Management Plan (LMP).
      a. Describe difference between plant establishment schedule and long term maintenance schedule.
      b. Describe annual and regular filter maintenance.

END OF SECTION

SECTION 32 9001

COMMON PLANTING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Common procedures and requirements for landscaping work.
   2. Provide maintenance for new landscaping as described in Contract Documents.

B. Related Requirements:
   1. Section 01 4301: 'Quality Assurance – Qualifications'.
   2. Section 31 0501: ‘Common Earthwork Requirements’:
   3. Section 31 2213: ‘Rough Grading’.
   4. Section 31 2216: 'Fine Grading'.
   5. Section 31 2323: ‘Fill’.
   6. Section 32 8423: 'Underground Sprinklers'.
   7. Section 32 9120: ‘Topsoil And Placement’.
   8. Section 32 9122: ‘Topsoil Grading’.
   9. Section 32 9223: 'Sodding'.
   10. Section 32 9300: 'Plants'.

1.2 REFERENCES

A. Definitions:
   1. Landscape Management Plan (LMP): LMP is an Owner’s Representative’s quick reference maintenance document. It is a combination of Irrigation Sections from 32 8000 and Planting Sections from 32 9000. The LMP document is created from Operations and Maintenance Data, Warranty Documentation, and Record Documentation
   2. Plant Establishment Period: Time required for plants to successfully develop root systems into surrounding soil. Following this period, irrigation run times are typically modified. For purposes of this contract, the plant establishment period is assumed to be one (1) year from date of Substantial Completion.

1.3 SUBMITTALS

A. Informational Submittals:
   1. Qualification Statement:
      a. Landscape Subcontractor:
         1) Provide Qualification documentation if requested by Landscape Architect or Owner.
      b. Installer:
         1) Provide Qualification documentation if requested by Landscape Architect or Owner.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800 (combine with sections of 32 8000 and sections of 32 9000 if applicable):
      a. Record Documentation:
         1) Submit one (1) copy of recommendations specified in Special Procedure Submittals.
         2) Record Drawings:
            a) As installation occurs, prepare accurate record drawings. Submit one (1) full size copy prior to final inspection. Drawing shall include:
               (1) Detail and dimension changes made during construction.

(2) Take dimensions from permanent constructed surfaces or edges located at or above finish grade.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Post-Emergent Weed Control:
      a. Products shall be recognized for intended use by AHJ.

B. Qualifications:
   1. Landscape Subcontractor. Requirements of Section 01 4301 applies, but not limited to following:
      a. Company specializing in performing work of this section.
      b. Minimum five (5) years experience in landscaping installations.
      c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
      d. Upon request, submit documentation.
   2. Installer:
      a. Planting shall be performed under direction of foreman or supervisor with minimum three (3) years experience in landscape installations similar in size, scope, and complexity.
      b. Foreman or supervisor required to attend pre-installation conference.
      c. Use trained personnel familiar with required planting procedures and with Contract Documents.
      d. Upon request, submit documentation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Handling Requirements:
   1. Deliver packaged materials in containers showing weight, analysis, and name of Manufacturer.
   2. Deliver sod, plants, trees, and shrubs in healthy and vigorous condition.
   3. Protect materials from deterioration during delivery.

B. Storage And Handling Requirements:
   1. Store in location on site where they will not be endangered and where they can be adequately watered and kept in healthy and vigorous condition.
   2. Protect materials from deterioration while stored at site.

PART 2 - PRODUCTS

2.1 POST-EMERGENT WEED CONTROL

A. Type Two Acceptable Products:
   1. Enide by Upjohn.
   2. Dymid by Elanco.
   3. Treflan or Surflan by Dow Agrosciences.
   4. Eptan by Syngenta.
   5. Equal as approved by Architect before use. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.2 EXAMINATION

A. Verification Of Conditions:
   1. Inspect site and Contract Documents to become thoroughly acquainted with locations of irrigation, ground lighting, and utilities.

3.3 PREPARATION

A. Before proceeding with work, verify dimensions and quantities. Report variations between Drawings and site to Architect before proceeding with landscape work.
   1. Plant totals are for convenience of Contractor only and are not guaranteed. Verify amounts shown on Drawings.
   2. All planting indicated on Contract Documents is required unless indicated otherwise.

B. Protection:
   1. Take care in performing landscaping work to avoid conditions that will create hazards. Post signs or barriers as required.
   2. Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.
   3. Keep site well drained and landscape excavations dry.

3.4 INSTALLATION

A. Interface With Other Work:
   1. Do not plant trees and shrubs until major construction operations are completed. Do not commence landscaping work until work of Section 31 2216 and Section 32 8423 has been completed and approved.

B. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

C. Hand excavate as required.

D. Maintain grade stakes until parties concerned mutually agree upon removal.

E. When conditions detrimental to plant growth are encountered, such as rubble fill or adverse drainage conditions, notify Architect before planting.

3.5 FIELD QUALITY CONTROL

A. Field Inspection:
   1. Landscape Architect will inspect landscaping installation at Substantial Completion.

B. Non-Conforming Work. Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Replace landscaping that is dead or appears dead as directed by Landscape Architect within ten (10) days of notification and before Substantial Completion at no additional cost to Owner.
   2. Replace damaged plantings at no additional cost to Owner.
   3. Repair damage to irrigation, ground lighting, utilities, asphalt paving, concrete paving, concrete sidewalks, concrete curb and gutters and other items adjacent to landscaping caused by work of this Section or replace at no additional cost to Owner.

3.6 CLEANING

A. Waste Management:

1. Immediately clean up soil or debris spilled onto pavement and dispose of deleterious materials.

3.7 CLOSEOUT ACTIVITIES

A. Instruction Of Owner:
   1. Include following training:
      a. Review Landscape Management Plan (LMP):
         1) Review maintenance recommendations.
      b. Review Maintenance as specified at the end of this specification.
   2. Establishment Period Acknowledgement (coordinate with 32 8000 section):
      a. Landscape Architect will acknowledge Establishment Period commencement.

3.8 PROTECTION

A. Protect planted areas against traffic or other use immediately after planting is completed by placing adequate warning signs and barricades.

B. Provide adequate protection of planted areas against trespassing, erosion, and damage of any kind. Remove this protection after Architect has accepted planted areas.

3.9 MAINTENANCE

A. General:
   1. Before beginning maintenance period, plants shall be in at least as sound, healthy, vigorous, and in approved condition as when delivered to site, unless accepted by Architect in writing at final landscape inspection.
   2. Maintain landscaping from completion of landscape installation to thirty (30) days after Substantial Completion Meeting. Areas sodded or seeded after November 1st will accepted following spring approximately one (1) month after start of growing season, May 1st or as determined by Architect, if specified conditions have been met.
   3. Replace landscaping that is dead or appears unhealthy or non-vigorous as directed by Architect before end of maintenance period. Make replacements within ten (10) days of notification. Lawn that does not live and has to be replaced shall be guaranteed and maintained an additional thirty (30) days from date of replacement.

B. Sodded Lawn:
   1. Maintain sodded lawn areas until lawn complies with specified requirements and throughout maintenance period.
   2. Water sodded areas in sufficient quantities and at required frequency to maintain sub-soil immediately under sod continuously moist 3 to 4 inches (75 to 100 mm) deep.
   3. Cut grass first time when it reaches 3 inches (75 mm) high. Continue to mow at least once each week throughout maintenance period. Remove clippings.
   4. Apply weed killer as necessary to maintain weed-free lawn. Apply weed killer in accordance with manufacturer's instructions during calm weather when air temperature is between 50 and 80 deg F (10 and 27 deg C).
   5. At end of thirty (30) day maintenance period, fertilize lawns as recommended in Section 32 9113.

C. Trees, Shrubs, And Plants:
   1. Maintain by pruning, cultivating, and weeding as required for healthy growth.
   2. Restore planting basins.
   3. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical positions as required.
   4. Spray as required to keep trees and shrubs free of insects and disease.
   5. Provide supplemental water by hand as needed in addition to water from sprinkling system.

END OF SECTION

SECTION 32 9120

TOPSOIL AND PLACEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:
1. Section 31 0501: 'Common Earthwork Requirements':
2. Section 31 2216: 'Fine Grading' for landscaping and planting areas.
3. Section 32 9001: 'Common Planting Requirements':
4. Section 32 9122: 'Topsoil Grading' for preparation of topsoil and addition of amendments prior to landscaping.

1.2 REFERENCES

A. Reference Standards:
1. ASTM International:
a. ASTM D1557-12, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))'.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:
1. Design Criteria:
a. Topsoil used in landscaped areas, whether imported, stockpiled, or in place, shall be weed free, fertile, loose, friable soil meeting following criteria:
1) Chemical Characteristics:
a) pH 5.5 to 8.0.
b) Soluble Salts: less than 3.0 mmhos/cm.
c) Sodium Absorption Ratio (SAR): less than 6.0.
d) Organic Matter: greater than one percent.
2) Physical Characteristics:
a) Gradation as defined by USDA triangle of physical characteristics as measured by hydrometer.
(1) Sand: 15 to 60 percent.
(2) Silt: 10 to 60 percent.
(3) Clay: 5 to 30 percent.
b) Clean and free from toxic minerals and chemicals, noxious weeds, rocks larger than or equal to 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.
c) Soil (Coordinate screening as specified in Section 31 1413 'Topsoil Stripping And Stockpiling' to meet these characteristics):
(1) Soil shall not contain more than five (5) percent by volume of rocks measuring over 1/4 inch (6 mm) in largest size.
(2) Soil shall be topsoil in nature.
(3) Soil resembling road base or other like materials are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Do not commence work of this Section until grading tolerances specified in Section 31 2216 are met.
   2. Do not commence work of this Section until coordination with Section 32 9122 ‘Topsoil Grading’ and if required by these specifications prior to placement.

3.2 PREPARATION

A. Protection Of In-Place Conditions:
   1. Protect utilities and site elements from damage.

B. Surface Preparation:
   1. Surfaces to receive Imported and Stockpiled Topsoil:
      a. Disk, till, rip, or aerate with approved agricultural aerator to depth of 6 inches (150 mm).
      b. Place specified and approved topsoil on prepared surface.

3.3 PERFORMANCE

A. General:
   1. After Surface Preparation requirements are completed, limit use of heavy equipment to areas no closer than 6 feet (1.80 meter) from building or other permanent structures. Use hand held tillers for preparation of subsoil in areas closer than 6 feet (1.80 m).
   2. Do not expose or damage existing shrub or tree roots.

B. Topsoil Depth/Quantity:
   1. Total topsoil depth of 5 inches (125 mm) minimum in lawn and groundcover planting areas.
   2. No topsoil as defined in this Section is required over tree and shrub planting areas or native grass, shrub, or tree areas as long as what is in place is not excessively rocky or otherwise unfavorable to healthy plant growth.
   3. Provide no less than quantity required to achieve tolerance described in Section 32 9122 'Topsoil Grading' along with additional physical soil amendments required in Section 32 9121 'Topsoil Physical Preparation'. Installer of this section responsible for providing sufficient topsoil material.

C. Imported Topsoil:
   1. Place tested and approved topsoil:
      a. Before placing topsoil, remove organic material, rocks and clods greater than 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.
      b. Do not place topsoil whose moisture content makes it prone to compaction during placement process.
      c. Do not place topsoil when subgrade is either wet or frozen enough to cause clodding.

D. Stockpiled Topsoil:
   1. Redistribute tested and approved existing topsoil stored on site as result of work of Section 31 1413 'Topsoil Stripping And Stockpiling'.
      a. Before placing topsoil, remove organic material, rocks and clods greater than 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.
      b. Do not place topsoil whose moisture content makes it prone to compaction during placement process.
      c. Do not place topsoil when subgrade is either wet or frozen enough to cause clodding.

E. In Place Topsoil:

1. At locations where topsoil can remain in place and has been tested and approved, perform the following:
   a. Remove existing vegetation as required in preparation for new landscaping.
   b. Remove vegetative layer, roots, organic material, rocks and clods greater than 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.

F. Grading:
1. Slope grade away from building for 12 feet (3.60 m) minimum from walls at slope of 1/2 inch in 12 inches (13 mm in 300 mm) minimum unless otherwise noted.
   a. High point of finish grade at building foundation shall be 6 inches (150 mm) minimum below finish floor level.
   b. Direct surface drainage in manner indicated on Contract Documents by molding surface to facilitate natural run-off of water.
   c. Fill low spots and pockets with topsoil and grade to drain properly.

3.4 FIELD QUALITY CONTROL

A. Testing And Inspections:
1. Topsoil Testing:
   a. Test topsoil for project suitability using Owner supplied 'Topsoil Testing Report,' attachment to this specification:
      1) Testing requirements:
         a) If testing report shows topsoil does not meet topsoil Design Criteria and 'Topsoil Testing Report: Soil Test Data' requirements, topsoil is non-conforming. Corrections and re-testing are required until topsoil meets requirements.
         b) Use new 'Topsoil Testing Report', each time topsoil is tested.
         c) After topsoil testing is approved by Landscape Architect, submit two (2) copies of Final 'Topsoil Testing Report as specified in Part 1 'Submittals' of this specification.

B. Non-Conforming Work:
1. If topsoil does not meet topsoil Design Criteria and 'Topsoil Testing Report: Soil Test Data' requirements topsoil will be re-tested at no cost to Owner.
   a. Correction procedures:
      1) Topsoil not meeting specified physical characteristics of sand, silt, and clay shall be removed from site.
      2) Topsoil not meeting specified organic or fertility specifications may be amended in place with materials recommended in Topsoil Testing Report.
      3) If amendments are necessary, submit proposed amendments and application rates required to bring topsoil up to minimum specified requirements.
      4) Re-test topsoil and remove and amend as required until it meets minimum specified requirements.
   b. Submit report to Landscape Architect for approval.
   c. Receive approval from Landscape Architect prior to planting.

END OF SECTION

SECTION 32 9122

TOPSOIL GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform topsoil grading required to prepare site for installation of landscaping as described in Contract Documents.
   2. Perform topsoil placement and finish grading work required to prepare site for installation of landscaping as described in Contract Documents.
   3. Furnish and apply soil amendments as described in Contract Documents.

B. Related Requirements:
   1. Section 31 0501: 'Common Earthwork Requirements':
   2. Section 31 2216: 'Fine Grading' for landscaping and planting areas.
   3. Section 32 9001: 'Common Planting Requirements':
   4. Section 32 9120: 'Topsoil And Placement' for topsoil evaluation and placement required for topsoil grading.

1.2 SUBMITTALS

A. Action Submittals:
   1. Material Data:
      a. Soil Amendments and Fertilizer:
         1) Product literature and chemical / nutrient analysis of soil amendments and fertilizers.
         2) Proposed application rates necessary to bring topsoil up to specified requirements.
         3) Source location of products.
         4) Submit to Landscape Architect for approval prior to installation.
   2. Samples:
      a. Soil Fertility Amendments and Fertilizer:
         1) Soil conditioner sample for approval before delivery to site.
         2) Product analysis.

B. Informational Submittals:
   1. Testing And Evaluation Reports:
      a. 'Compost Verification Report':
         1) Provide signed copy certifying that compost meets requirements of this specification.
   2. Field Quality Control Submittals:
      a. Soil Fertility Amendments and Fertilizer:
         1) Delivery slips indicating amount of soil amendments, compost, conditioner, and fertilizer delivered to Project site.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Submit 'Compost Verification Report'.
         2) Submit delivery slips indicating amount of physical amendments delivered to Project site.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Do not commence work of this Section until imported, stockpiled and in place topsoil are placed as specified in Section 32 9120 'Topsoil And Placement'.

3.2 PREPARATION

A. Protection Of In-Place Conditions:
   1. Protect utilities and site elements from damage.

B. Surface Preparation:
   1. Surfaces that meet specified topsoil elevations.
      a. Seven (7) days maximum before beginning seeding and planting:
         1) Loosen topsoil 6 inch (150 mm) deep, dampen thoroughly, and cultivate to properly break up clods and lumps.
         2) Rake area to remove clods, rocks, weeds, roots, debris or other material 1-1/2 inches (38 mm) or more in any dimension.
         3) Grade and shape landscape area to bring surface to true uniform planes free from irregularities and to provide drainage and proper slope to catch basins.
      b. Roto-till or otherwise mix soil amendments evenly into topsoil.

3.3 PERFORMANCE

A. General:
   1. Limit use of heavy equipment to areas no closer than 6 feet (1.80 meter) from building or other permanent structures. Use hand held tillers for preparation of subsoil in areas closer than 6 feet (1.80 m).
   2. Do not expose or damage existing shrub or tree roots.

B. Finish Grade Tolerances (As shown on General Planting Details in Contract Documents):
   1. Finish topsoil grade of planting areas before planting and after addition of soil additives shall be specified distances below top of adjacent pavement of any kind:
      a. Ground Cover Areas: 2 inches (50 mm) below.
      b. Seeded Areas: One inch (25 mm) below.
      c. Sodded Areas: 2 inches (50 mm) below.
      d. Tree and Shrub Areas (not individual trees): 4 inches (100 mm) below.

C. Placed Topsoil:
   1. At locations where topsoil has been placed as per Section 32 9120 'Topsoil And Placement', perform the following:
      a. Remove existing vegetation as required in preparation for new landscaping.
      b. Remove organic material, rocks and clods greater than 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.

D. Grading:
   1. Coordinate grading as described in Section 32 9120 'Topsoil And Placement'.

E. Immediately before planting lawn and with topsoil in semi-dry condition, roll areas that are to receive lawn in two directions at approximately right angles with water ballast roller weighing 100 to 300 lbs (45 to 135 kg), depending on soil type.

F. Rake or scarify and cut or fill irregularities that develop as required until area is true and uniform, free from lumps, depressions, and irregularities.

3.4 PROTECTION

A. After landscape areas have been prepared, take no heavy objects over them except lawn rollers.

END OF SECTION

SECTION 32 9223

SODDING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install sodded lawn as described in Contract Documents.

B. Related Requirements:
   1. Section 32 8423: Irrigation system.
   2. Section 32 9001: Common Planting Requirements:
      a. Pre-installation conference held jointly with other common planting related sections.
   3. Section 32 9120: 'Topsoil And Placement'.
   4. Section 32 9122: 'Topsoil Grading'.

1.2 REFERENCES

A. Definitions:
   1. Crop Coefficients and Hydro-Zones: Crop coefficients (Kc) are used with ETo to estimate specific plant evapotranspiration rates. The crop coefficient is a dimensionless number (between 0 and 1.2) that is multiplied by the ETo value to arrive at a plant ET (ETc) estimate. Plants grouped by water needs, organized into one irrigation zone.
   2. Eco-Region Irrigation Design: A bio-regional approach to irrigation and planting design that is relevant to the geographic area for which the planting plan and irrigation system is designed. These geographic areas are defined by the Environmental Protection Agency and have been modified by the LDS church into 15 geographical areas throughout North America, and the Hawaiian Islands.
   3. Hardiness Zone: A hardiness zone is a more precisely geographically-defined zone within an Eco-Region in which a specific category of plant life is capable of growing, as defined by temperature hardiness, or ability to withstand the minimum temperatures of the zone. Hardiness Zones may be defined by one of two sources:
      a. Sunset Western Garden Book Maps.
      b. USDA Hardiness Zone Map.

      Plant Hardiness zone sources shall be listed by the architect through the planting and irrigation design process.
   4. Hydro-Zone: Plants grouped by water needs (similar Crop Coefficients (Kc), organized into one irrigation zone.
   5. Reference Evapotranspriation (ETo): The total water lost from the soil (evaporation) and from the plant surface (transpiration) over some period.

1.3 SUBMITTALS

A. Informational Submittals:
   1. Certificates:
      a. Written certification confirming sod seed mix and quality:
         1) Include all species used.
         2) Include name and contact information of supplier.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Submit one (1) copy certificate for sod seed quality and mix.

b. Landscape Management Plan (LMP):
1) Landscape Section:
a) Submit one (1) copy certificate for sod seed quality and mix.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Harvest, deliver, store, and handle sod in accordance with requirements of Turfgrass Producers International (TPI) (formally American Sod Producers Association) Specifications for Turfgrass Sod Materials and Transplanting / Installing.
2. Schedule deliveries to coincide with topsoil operations and laying. Keep storage at job site to minimum without causing delays.
a. Deliver, unload, and store sod on pallets within 24 hours of being lifted.
b. Do not deliver small, irregular, or broken pieces of sod.

B. Storage And Handling Requirements:
1. Cut sod in pieces approximately 3/4 to one inch (19 to 25 mm) thick. Roll or fold sod so it may be lifted and handled without breaking or tearing and without loss of soil.
2. During wet weather, allow sod to dry sufficiently to prevent tearing during lifting and handling.
3. During dry weather, protect sod from drying before installation. Water as necessary to insure vitality and to prevent excess loss of soil in handling. Sod that dries out before installation will be rejected.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description:
1. Superior sod grown from certified, high quality, seed of known origin or from plantings of certified grass seedlings or stolons:
a. Assure satisfactory genetic identity and purity.
b. Assure over-all high quality and freedom from noxious weeds or an excessive amount of other crop and weedy plants at time of harvest.
2. Sod shall be composed of three varieties minimum of Kentucky Bluegrass.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work:
1. Do not commence work of this Section until work of Sections 32 9122 and 32 9300 has been completed and approved.

B. Tolerances:
1. Final grade of soil after sodding of lawn areas is complete shall be one inch (25 mm below top of adjacent pavement of any kind.

C. Laying of Sod:
1. Lay sod during growing season and within 48 hours of being lifted.
2. Lay sod while top 6 inches (150 mm) of soil is damp, but not muddy. Sodding during freezing temperatures or over frozen soil is not acceptable.
3. Lay sod in rows perpendicular to slope with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with a sharp knife.

4. Lay sod flush with adjoining existing sodded surfaces.
5. Do not sod slopes steeper than 3:1. Consult with Architect for alternate treatment.

D. After Laying of Sod Is Complete:
1. Roll horizontal surface areas in two directions perpendicular to each other.
2. Repair and re-roll areas with depressions, lumps, or other irregularities. Heavy rolling to correct irregularities in grade will not be permitted.
3. Water sodded areas immediately after laying sod to obtain moisture penetration through sod into top 6 inches (150 mm) of topsoil.

3.2 FIELD QUALITY CONTROL

A. Field Inspection:
1. Sodded areas will be accepted at Project closeout if:
   a. Sodded areas are properly established.
   b. Sod is free of bare and dead spots and is without weeds.
   c. No surface soil is visible when grass has been cut to height of 2 inches (50 mm).
2. Sodded areas have been mowed a minimum of twice.

END OF SECTION

SECTION 32 9300

PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install landscaping plants as described in Contract Documents.

B. Related Requirements:
   1. Section 32 8423: 'Underground Sprinklers' for irrigation system.
   2. Section 32 9001: 'Common Planting Requirements' for:
   3. Section 32 9120: ‘Topsoil And Placement’.
   4. Section 32 9122: ‘Topsoil Grading’.
   5. Section 32 9223: 'Sodding'.

1.2 REFERENCES

A. Definitions:
   1. Crop Coefficients and Hydro-Zones: Crop coefficients (Kc) are used with ETo to estimate specific plant evapotranspiration rates. Crop coefficient is dimensionless number (between 0 and 1.2) that is multiplied by ETo value to arrive at plant ET (ETc) estimate. Plants grouped by water needs, organized into one irrigation zone.
   2. Eco-Region Irrigation Design: Bio-regional approach to irrigation and planting design that is relevant to geographic area for which planting plan and irrigation system is designed. These geographic areas are defined by Environmental Protection Agency and have been modified by the LDS Church into 15 geographical areas throughout North America, and Hawaiian Islands.
   3. Hardiness Zone: Hardiness zone is more precisely geographically-defined zone within an Eco-Region in which specific category of plant life is capable of growing, as defined by temperature hardiness, or ability to withstand minimum temperatures of zone. Hardiness Zones may be defined by one of two sources:
      a. Sunset Western Garden Book Maps.
      b. USDA Hardiness Zone Map.

      Plant Hardiness zone sources shall be listed by Landscape Architect through planting and irrigation design process.
   4. Hydro-Zone: Plants grouped by water needs (similar Crop Coefficients (Kc), organized into one irrigation zone.
   5. Landscape Management Plan (LMP): See Section 32 9001 for definition.
   6. Plant Establishment Period: See Section 32 9001 for definition.
   7. Reference Evapotranspriation (ETo): Total water lost from the soil (evaporation) and from plant surface (transpiration) over some period.

B. Reference Standards:
   1. American Nursery & Landscape Association / American National Standards Institute:
      a. ANLA / ANSI Z60.1-2004, 'American Standard for Nursery Stock.'

1.3 SUBMITTALS

A. Informational Submittals:
   1. Special Procedural Submittals:
      a. Installer to provide written instructions covering Owner maintenance requirements during 'Plant Establishment Period'.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations And Maintenance Data:
         1) Submit one (1) copy of recommendations specified in Special Procedure Submittals.
      b. Warranty Documentation:
         1) Include written warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately.
   2. Do not prune before delivery, except as approved by Landscape Architect.
   3. Protect bark, branches, and root systems from sun scald, drying, whipping, and other handling and tying damage.
   4. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape.
   5. Provide protective covering during delivery.

B. Storage And Handling Requirements;
   1. Handle balled stock by root ball or container. Do not drop trees and shrubs during delivery.
   2. If planting is delayed more than six hours after delivery, set planting materials in shade and protect from weather and mechanical damage.
   3. Set balled stock on ground and cover ball with soil, saw dust, or other acceptable material approved by Landscape Architect.
   4. Do not remove container-grown stock from containers before time of planting.
   5. Do not store plant material on pavement.
   6. Water root systems of trees and shrubs stored on site with fine spray. Water as often as necessary to maintain root systems in moist condition. Do not allow plant foliage to dry out.

1.5 WARRANTY

A. Special Warranty:
   1. Provide written warranties as follows:
      a. Warranty shrubs, ground covers, and vines to live and remain in strong, vigorous, and healthy condition for 90 days minimum from date of Final Acceptance and meet or exceed material standards set forth in Materials heading of Part 2 of this specification.
      b. Warranty trees to live and remain in strong, vigorous, and healthy condition and meet or exceed material standards set forth in Materials heading of Part 2 of this specification for one year from date of Final Acceptance.
      c. When trees are completely accepted at end of warranty period, remove staking.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plants:
   1. Conform to requirements of Plant List and Key on Contract Documents and to ANLA / ANSI Z60.1.
   2. Nomenclature:
      a. Plant names used in Plant List conform to 'Standardized Plant Names' by American Joint Committee on Horticultural Nomenclature except in cases not covered. In these instances, follow custom of nursery trade. Plants shall bear tag showing genus, species, and variety of at least 10 percent of each species delivered to site.
   3. Quality:

a. Plants shall be sound, healthy, vigorous, free from plant disease, insect pests or their eggs, noxious weeds, and have healthy, normal root systems. Container stock shall be well established and free of excessive root-bound conditions.
b. Do not prune plants or top trees prior to delivery.
c. Plant materials shall be subject to approval by Landscape Architect as to size, health, quality, and character.
d. Bare root trees are not acceptable.
e. Provide plant materials from licensed nursery or grower.

4. Measurements:
a. Measure height and spread of specimen plant materials with branches in their normal position as indicated on Contract Documents or Plant List.
b. Measurement should be average of plant, not greatest diameter. For example, plant measuring 15 inches (375 mm) in widest direction and 9 inches (225 mm) in narrowest would be classified as 12 inch (300 mm) stock.
c. Plants properly trimmed and transplanted should measure same in every direction.
d. Measure caliper of trees 6 inches (150 mm) above surface of ground.
e. Where caliper or other dimensions of plant materials are omitted from Plant List, plant materials shall be normal stock for type listed.
f. Plant materials larger than those specified may be supplied, with prior written approval of Landscape Architect, and:
1) If complying with Contract Document requirements in all other respects.
2) If at no additional cost to Owner.
3) If sizes of roots or balls are increased proportionately.

5. Shape and Form:
a. Plant materials shall be symmetrical or typical for variety and species and conform to measurements specified in Plant List.
b. Well grown material will generally have height equal to or greater than spread. However, spread shall not be less than 2/3's of height.

2.2 ACCESSORIES

A. Planting Mix:
1. Mixture of three (3) parts excavated soil and one part well rotted composted manure, approved commercial mix.

B. Tree Stakes:
1. Type Two Acceptable Products:
a. 2 inch (50 mm) diameter Lodgepole Pine, Douglas Fir, White Fir, or Hemlock Fir.
b. Equal as approved by Landscape Architect before installation. See Section 01 6200.

C. Tree Staking Ties:
1. Type Two Acceptable Products:
a. 32 inch (800 mm) Cinch-Tie tree ties by V.I.T. Products Inc, Escondido, CA www.vitproducts.com.
b. Equal as approved by Landscape Architect before installation. See Section 01 6200.

D. Tree Guys:
1. Type Two Acceptable Products:
a. Duckbill Model 68DTS guying kit.
b. Equal as approved by Landscape Architect before installation. See Section 01 6200.

E. Pre-Emergent Herbicide:
1. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
a. Chipco Dimension Granular by The Andersons Inc, Maumee, IL www.andersonsinc.com.
b. Elanco XL2G granular by Crop Data Management Systems, Marysville, CA www.cdms.net.
c. Ronstar G granular by Bayer Crop Science, Monheim, Germany www.bayercropscience.com.
d. Surflan AS liquid by United Phosphorous Inc, Trenton, NJ www.upi-usa.com.

e. Oryzalin 4 A.S. liquid by FarmSaver, Seattle, WA www.farmsaver.com.

F. Weed Barrier:
1. Type Two Acceptable Products:
a. DeWitt 4.1 oz (121 ml) 20 year woven polypropylene weed barrier.
b. Equal as approved by Landscape Architect before bidding. See Section 01 6200.

G. Bark Or Wood Top Dressing Mulch:
1. Type Two Acceptable Products:
a. Medium size Fir bark.
b. Medium or large size Redwood bark.
c. Shredded pine bark.
d. Shredded Cedar.
e. Equal as approved by Landscape Architect before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Evaluation And Assessment:
1. Before proceeding with work, check and verify dimensions and quantities. Report variations between Drawings and site to Landscape Architect before proceeding with work of this Section.
2. Plant totals are for convenience only and are not guaranteed. Verify amounts shown on Contract Documents. All planting indicated on Contract Documents is required unless indicated otherwise.
3. Do not commence with this Work until grading tolerances specified in Section 32 9122 'Topsoil Grading' are met.

3.2 PREPARATION

A. Plant Approval:
1. Compliance:
a. Prior to any plant installation, evaluate plants for compliance with material standards.
b. Remove plants from site that do not comply.
2. Inspection:
a. Prior to any tree installation, inspect one (1) extra deciduous tree and one (1) extra evergreen tree for root health.
b. In presence of Landscape Architect or by video recording, remove root container/packing material and inspect root balls for soil depth, firmness and root structure by washing soil off of roots.
c. If delivered plants exhibit soil 1 inch (25 mm) or more above root collar, demonstrate that all trees have had excess soil removed prior to planting or that they meet standard.
d. If roots are loose, significantly circling, significantly asymmetrical or damaged, all tree plant material to be removed from site and replaced.
e. Continue inspection process until trees meet standard.

B. Layout individual tree and shrub locations and areas for multiple plantings:
1. Stake locations and outline areas.
2. Secure Landscape Architect's acceptance before planting.
3. Make minor adjustments as may be requested.

3.3 INSTALLATION

A. Interface With Other Work:
1. Do not commence work of this Section until work of Section 32 9122 has been completed and approved.

B. Excavation:
1. If underground construction work or obstructions are encountered in excavation of planting holes, Landscape Architect will select alternate locations.
2. Plant Excavation Size:
   a. Diameter: Twice diameter of root ball or container minimum.
   b. Depth: Equal to container or rootball depth.
3. Unless excavated material meets topsoil requirements as specified in Section 32 9113, remove from landscape areas and do not use for landscaping purposes.
4. Roughen sides and bottoms of excavations.
5. With approval of Landscape Architect, select five (5) typical planting excavations throughout site for drainage testing.
   a. Fill selected excavations with water and verify that water drains away at rate of 3 inches (75 mm) per hour minimum. Inform Landscape Architect in writing of excavations where water does not drain properly.
   b. Select three (3) excavations approximately 5 feet (1 500 mm) away from each non-draining excavation and repeat tests. Continue testing process until non-draining areas have been identified.
   c. In excavations located in identified non-draining areas, auger 6 inch (150 mm) diameter hole 4 feet (1 200 mm) deep in low point of each excavation and fill with tamped planting mix.
   d. Do not plant trees or shrubs in holes that do not properly drain.

C. Planting:
1. Removing Binders And Containers:
   a. Remove top one / third of wire basket and burlap binders.
   b. Remove plastic and twine binders from around root ball and tree trunk.
   c. Remove plastic containers.
   d. Remove wood boxes from around root ball. Remove box bottoms before positioning plant in hole. After plant is partially planted, remove remainder of box without injuring root ball.
2. Plant immediately after removing binding material and containers:
   a. Place tree and shrub root balls on undisturbed soil.
   b. After watering and settling, top of tree root balls shall be approximately two inches (50 mm) higher than finished grade and trunk flare is visible.
   c. Shrub root balls shall be approximately one inch (25 mm) higher than finished grade.
3. Properly cut off broken or frayed roots.
4. Center plant in hole, remove remaining wire basket and burlap taking care not do damage root ball:
   a. Replace damaged material.
   b. Backfill with specified planting mix.
   c. Except in heavy clay soils, make ring of mounded soil around hole perimeter to form watering basin.
5. Add fertilizer in plant pit during proper season.
6. Fill landscape excavations with tamped planting mix and recommended fertilizer:
   a. Compact in 6 inch (150 mm) lifts.
   b. Settle by watering to ensure top of root ball is 2 inches (50 mm) higher for trees and one inch (25 mm) higher for shrubs than surrounding soil following compaction and settling.
7. Do not use muddy soil for backfilling.
8. Make adjustments in positions of plants as directed by Landscape Architect.
9. Thoroughly water trees and shrubs immediately after planting.
10. At base of each tree, leave 36 inch (900 mm) diameter circle free of any grass.

D. Supports for New Trees:
1. Provide new supports for trees noted on Contract Documents to be staked.
   a. Remove nursery stakes delivered with and attached to trees.
   b. Support shall consist of at least two (2) tree stakes driven into hole base before backfill so roots are not damaged. Place stakes vertically and run parallel to tree trunk. Install stakes so 3 feet (900 mm) of stake length is below finish grade.
   c. Deciduous Trees:
      1) Place tree ties 6 to 12 inches (150 to 300 mm) below crotch of main tree canopy. Second set of tree ties may be required 18 to 24 inches (450 to 600 mm) above finish grade, if directed by Landscape Architect.

2) Remove tops of tree stakes so top of stake is 6 inches (150 mm) below main tree canopy to prevent damage to tree branches and canopy growth.

d. Evergreen Trees:

1) Place tree ties 2/3's of height of tree up from root ball.

2. Provide root guying kits to support 24 inch (600 mm) box, 3 inch (75 mm) caliper and larger trees.
3. Staking and guying should allow some tree movement.

E. Vines:

1. Remove from stakes, untie, and securely fasten to wall or fence next to which they are planted.

F. Ground Covers:

1. Container-grown unless otherwise specified on Contract Documents. Space evenly to produce a uniform effect, staggered in rows and intervals shown.

G. Post Planting Weed Control:

1. Apply specified pre-emergent herbicide to shrub and ground cover planting areas and grass-free areas at tree bases after completion of planting.
2. Areas shall be weed free prior to final acceptance.

H. Weed Barrier Fabric:

1. After planting and application or herbicide in shrub beds, apply covering of specified weed barrier fabric.
2. Achieve 100 percent coverage over ground areas while allowing space for growth from root ball.
3. Overlap seams 6 inches (150 mm) minimum.
4. Staple at 5 feet (1500 mm) on center each way and within 3 inches (75 mm) of edge of shrub bed, with two (2) at each corner.

I. Mulching:

1. After application of herbicide, mulch shrub and ground cover planting areas with 3 inches (75 mm) deep layer of specified top dressing or rock mulch.
2. Cover grass-free area at tree bases with 3 inches (75 mm) of top dressing mulch or rock mulch.
3. Place mulch to uniform depth and rake to neat finished appearance.

END OF SECTION