PROJECT MANUAL

BUILDING #5 NEW ADA RAMP

1455 SOUTH 1700 EAST
SALT LAKE CITY, UTAH 84108

#506-7251

THE CHURCH OF
JESUS CHRIST
OF LATTER-DAY SAINTS

TRIO DESIGN INC. 4040 W. DAYBREAK PKWY. #110 SOUTH JORDAN, UT 84009

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BIDDING REQUIREMENTS

FOR SMALL PROJECTS (U.S.)

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INVITATION TO BID (U.S.)

1. CONTRACTORS INVITED TO BID THE PROJECT:

Dynamic Construction
Gines Construction
Hall Construction
RAM Construction

2. PROJECT:

Bldg. 5 ADA Ramp

3. LOCATION:

1455 S. 1700 E.
SLC, Ut 84108

4. OWNER:

Corporation of the Presiding Bishop of
The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole c/o

5. CONSULTANT:

Trio Design Inc.
4040 W. Daybreak Parkway #110
South Jordan, Utah 84009
(801) 417-9951

6. DESCRIPTION OF PROJECT:

A. Installation of new concrete ADA Ramp with corresponding landscape improvements.

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

8. TIME OF SUBSTANTIAL COMPLETION: The time limit for substantial completion of this work will be thirty (30) calendar days and will be as noted in the Agreement.

9. BID OPENING: Sealed bids will be received at (Monument Park Fork PM office) 1320 S. Wasatch Drive, SLC, UT 84108). Bids will be publicly opened at (10:00 am, 18 June 2019).

10. BIDDING DOCUMENTS:

A. Bidding Documents may be examined at the following plan room locations:
   1) Mountainlands Area Plan Room: 583 West 3560 South, Suite 4 SLC

   2) Dodge Data and Analytics

B. Bidding Documents are available to invited Contractors with a deposit of $0.00 per set. Deposit will be refunded if documents are returned complete and in good condition within five days of bid opening.

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

12. **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) Agreement Between Owner and Contractor for Small Project (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 Agreement Between Owner and Contractor for Small Project (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.
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 "Agreement Between Owner and Contractor for Small Project (U.S.)" provided by Owner.

7. MISCELLANEOUS:

A. Pre-Bid Conference. A pre-bid conference will be held at the job site: 1455 S. 1700 E. SLC, UT 84108, 7 June 2019 at 9 am.

B. Examination Schedule for Existing Building and Site
1) As required, contact Troy Anderson (Trio Design) with questions.

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BID FORM

FOR GENERAL CONTRACT WORK (U.S.)

PROJECT IDENTIFICATION:
Bldg. 5 ADA Ramp

OWNER:
Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-day Saints, a Utah corporation sole ("Owner")
Brian Childs, Facilities Manager

CONSULTANT:
Trio Design Inc., 4040 Daybreak Pkwy. #110, South Jordan Utah, 84009

BID

1. In submitting this Bid, Bidder represents that:
   a. If this Bid is accepted, Bidder will enter into an agreement with Owner to perform and furnish the Work described in the Bidding Documents for the Bid Price and within the Time of Substantial Completion indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.
   b. Bidder has carefully examined the Bidding Documents consisting of the Project Manual containing the Bidding Requirements, the Conditions of the Contract, and the Specifications, entitled _____, the Drawings entitled _____ and dated _____, and including sheets numbered _____, and addenda numbers _____.
   c. Bidder has examined the site of the work, existing conditions, and all other conditions affecting the work on the above-named Project.
   d. Bidder has carefully correlated the information known to Bidder and information and observations obtained from visits to the site with the Bidding Documents.
   e. Bidder is familiar with federal, State, and local laws and regulations applicable to Project.
   f. Bidder guarantees there will be no revisions or withdrawal of bid amount for forty-five (45) days after the bid opening.

2. Bidder hereby proposes to furnish all materials, labor, equipment, tools, transportations, services, licenses, fees, permits, etc., required by said documents to complete the Work described by the Contract Documents for the lump-sum of: _____ Dollars ($ _____).

3. Bid alternate #1:
   Modular concrete retaining wall, lump sum of:_____ Dollars ($_____).

4. Bidder agrees to achieve substantial completion of the Work within the number of days indicated in the Invitation to Bid.

RESPECTFULLY SUBMITTED:

_____
Signature

_____
Printed name

_____
Title

_____
Company name

_____
Business Address

_____ _____
Date City, State, and Zip Code

_____ _____
License No. Telephone Fax

_____
Contact Email Address

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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: Bldg. 5

Building Plan Type:

Building Address: 1455 S. 1700 E. SLC, UT 84108

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

Project Number: 506-7251

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

SUPPLEMENTARY CONDITIONS

FOR SMALL PROJECT AGREEMENT BETWEEN OWNER AND CONTRACTOR (U.S.)

ITEM 1 - GENERAL

1. Conditions of the Small Project Agreement Between Owner and Contractor (U.S.) 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 Small Project Agreement Between Owner and Contractor (U.S.), 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 and 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 Small Project Agreement Between Owner and Contractor (U.S.):

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 Small Project Agreement Between Owner and Contractor (U.S.):

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 Small Project Agreement Between Owner and Contractor (U.S.):

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 Small Project Agreement Between Owner and Contractor (U.S.) with the following:

5. <u>Payment</u>

a. If the Contractor's Bid Proposal Amount is over $100,000, 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. Work Covered By Contract Documents:
   1. 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.
   2. Comply with applicable laws and regulations.
B. Work By Owner:
   1. 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.
   2. 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.

SECTION 01 1200 MULTIPLE CONTRACT SUMMARY

A. Separate Contracts:
   1. Contracts may be issued by Owner for performance of certain construction operations at Project site.
   2. 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. Project Conditions:
   1. 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:
      a. Confine operations to areas within Contract limits shown on Drawings. Do not disturb portions of site beyond Contract limits.
      b. Do not allow alcoholic beverages, illegal drugs, or persons under their influence on Project Site.
      c. Do not allow use of tobacco in any form on Project Site.
      d. Do not allow pornographic or other indecent materials on site.

e. Do not allow work on Project Site on Sundays except for emergency work.
f. Refrain from using profanity or being discourteous or uncivil to others on Project Site or while performing The Work.
g. Wear shirts with sleeves, wear shoes, and refrain from wearing immodest, offensive, or obnoxious clothing, while on Project Site.
h. Do not allow playing of obnoxious and loud music on Project Site. Do not allow playing of any music within existing facilities.
i. Do not build fires on Project Site.
j. 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.

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

SECTION 01 3000 ADMINISTRATIVE REQUIREMENTS

A. Administrative Requirements:
   1. Coordination:
      a. Coordinate construction activities to ensure efficient and orderly installation of each part of the Work.
      b. Coordinate construction operations that are dependent upon each other for proper installation, connection, and operation.
      c. 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. Project Meetings And Conferences:
   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.
   2. Pre-Installation Conferences.
      a. Attend pre-installation conferences specified in Contract Document.

SECTION 01 3300 SUBMITTAL PROCEDURES

A. Submittal Procedure:
   1. Coordination: Coordination preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently before performance of related construction activities to avoid delay.
   2. Process Time: Allow sufficient review time so installation will not be delayed by time required to process submittals.
   3. Identification: Place permanent label or title block on each submittal for identification. Include name of entity that prepared each submittal on label or title block.
   4. Transmittal: Package each submittal appropriately for transmittal and handling.

B. Action Submittals:
   1. Product Data: Submit product data, as required by individual Sections of Specifications.
   2. Shop Drawings: Submit shop drawings for review and designate (stamp) approval of shop drawings.
   3. Samples: Samples used for comparison with actual component to be installed. Samples when accepted will be used for quality comparisons throughout course of construction.

C. Informational Submittals:
   1. Informational submittals are design data, test reports, certificates, manufacturer's instructions, manufacturer's field reports, and other documentary data affirming quality of products and installations.
      a. Return copies or PDF files marked with action taken and with corrections or modifications required.

D. Closeout Submittals:
   1. Submittals that occur during project closeout.

SECTION 01 3500 SPECIAL PROCEDURES

A. Quality Assurance:
   1. Hot Work Permit (Available from Owner's Representative):
      a. Required for doing hot work involving open flames or producing heat or sparks such as:
         1) Brazing.
         2) Cutting.
         3) Grinding.
         4) Soldering.
         5) Thawing pipe.
         6) Torch applied roofing.
         7) Welding.

SECTION 01 4000 QUALITY REQUIREMENTS

A. Administrative Requirements:
   1. Conflicting Requirements:
      a. 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.
   2. Minimum Quantity or Quality Levels:
      a. 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.
   3. 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.

B. Quality Assurance:
   1. 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.
   2. 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.
   3. Notify Owner immediately if asbestos-containing materials or other hazardous materials are encountered while performing the Work.

C. Quality Control:
   1. Quality Control Services:
      a. Quality Control will be sole responsibility of Contractor.
         1) 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.
            a) 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.
            b) Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
         2) 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.

D. 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. Administrative Requirements:
   1. 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.
   2. 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:
      a. Avoid use of tools and equipment that produce harmful noise.
      b. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near site.
      c. Protect the Work, materials, apparatus, and fixtures from injury due to weather, theft, and vandalism.
   3. 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.

B. Temporary Barriers And Enclosures:
   1. Protect existing trees and plants. Remove and replace vegetation that dies or is damaged beyond repair due to construction activities.
   2. Erect adequate barricades, warning signs, and lights necessary to protect persons from injury or harm.
   3. 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.
   4. 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:
      a. 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.

b. 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').
c. 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.
d. 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.
e. 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. Utilities:
1. Electrical Power: Owner will provide electric power for construction activities within limits available at existing facility.
2. Fire Protection: Exercise caution to avoid fire damage: Do not build fires on site.
3. Heating, Cooling, And Ventilation:
a. 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.
4. Lighting: Existing lighting system may be used by Contractor.
5. Water Service: Contractor will use existing water supply for construction purposes to extent of existing facilities.

SECTION 01 6100 COMMON PRODUCT REQUIREMENTS

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

B. Delivery, Storage, and Handling:
   1. Delivery and Acceptable 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.
   2. Storage and Handling Requirements:
      a. Store products at site in manner that will simplify inspection and measurement of quantity or counting of units.
      b. Store heavy materials away from Project structure so supporting construction will not be endangered.
      c. 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. Administrative Requirements:

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

B. Common Installation Provisions:
1. Provide attachment and connection devices and methods necessary for securing the Work:
   a. Secure the Work true to line and level.
   b. Allow for expansion and building movement.
2. Recheck measurements and dimensions before starting each installation.
3. 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.
4. 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.

C. Protection:
1. 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.

D. 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. Administrative Requirements:
1. Project Record Documents:
    a. Do not use record documents for construction purposes:
        1) Protect from deterioration and loss in secure, fire-resistive location.

2) Provide access to record documents for reference during normal Working hours.

b. 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:
   1) Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
   2) Mark new information that is important to Owner, but was not shown on Contract Drawings.
   3) Note related Change Order numbers where applicable.

2. As Built Record Drawings:
   a. Provide two full-size sets of prints and PDF file of As Built Record Drawings to Facilities Management Office, printed from the updated AutoCAD drawing files or updated Revit model files, as specified by Owner, that have been modified to show actual dimensions and location of equipment, material, utility lines, and other work as actually constructed, based upon information provided by Contractor. Architect will submit updated As Built Record Drawings in PDF (ISO32000 format) to Owner. In addition, Architect will submit to Owner updated AutoCAD as built record drawing files with associated plot style tables or the Revit as built record model files, as specified by Owner.

B. Operations And Maintenance Manual:
   1. General:
      a. Include closeout submittal documentation as required by Contract Documentation. Include only closeout submittals as defined in individual specification section.
      b. Submittal Format: Digital copies unless otherwise noted, required for each individual specification section that include 'Closeout Submittals'.
   2. Project Manual:
      c. 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.
         (2) Show substitutions, selection of options, and similar information, particularly on elements that are concealed or cannot otherwise be readily discerned later by direct observation.
   3. Maintenance Contracts: (digital format only).
   4. Operations and Maintenance Data (digital format only):
      a. Operations and maintenance submittals includies cleaning instructions, maintenance instructions, operations instructions, equipment list, and parts lists.
   5. Warranty Documentation: Digital format of final, executed warranties.
   6. Record Documentation:
      a. Documentation includes Certifications, color and pattern selections, Design Date, Geotechnical Evaluation Reports (soils reports), Manufacture Reports, Literature or cut sheets, Shop Drawings, Source Quality Control, Special Procedures, and Testing and Inspection Reports.
   7. Software: Audio and Video System software, programming and set-files.
   8. Irrigation Plan: Laminated and un-laminated reduced sized hard copies.
   9. 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.

C. 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.

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 03 3111: 'Cast-In-Place Structural Concrete' for:
      a. Tolerances for placing structural concrete.
      b. Pre-installation conference held jointly with other concrete related sections.
   2. Section 32 3213: Cast-In-Place Concrete Retaining Walls'.

1.2 REFERENCES

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

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conference as specified in Section 03 3111.
   2. In addition to agenda items specified in Section 01 3100 and 31 3111, review following:
      a. 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. 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.

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 (Slab on Grade):
   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. Concrete Formwork:
      a. Inspections are not required and will be performed at discretion of Architect.

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 1200: 'Multiple Contract Summary' for Owner Furnished Testing and Inspecting Services.
   2. Section 01 4523: ‘Testing and Inspecting Services’ for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   3. Section 03 1113: Structural Cast-In-Place Concrete Forming'.
   4. 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.
   5. Section 32 3213: Cast-In-Place Concrete Retaining Walls.

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 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. 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 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 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 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 of 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. Related Requirements:
   1. Section 01 1200: 'Multiple Contract Summary' for Owner Furnished Testing and Inspecting Services.
   2. Section 01 4523: ‘Testing and Inspecting Services’ for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   3. Section 03 1113: ‘Structural Cast-In-Place Concrete Forming’.
   4. Section 03 2116: ‘Epoxy-Coated Reinforcement Steel Bars'.
   5. Section 03 3517: ‘Concrete Sealer Finishing' for application of concrete sealers.
   6. Section 03 3923: ‘Membrane Concrete Curing' for quality of curing materials used.
   7. 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.
   8. Section 31 2213: ‘Rough Grading’ for rough grading and preparation of natural soil subgrades below fill and aggregate base materials.
   9. Section 31 2216: 'Fine Grading' for grading of subgrade below aggregate base and topsoil.
   10. Section 31 2323: 'Fill' for compaction procedures and tolerances.
   11. Section 32 3213: 'Cast-In-Place Retaining Walls'.
   12. Section 32 8423: 'Underground Sprinklers' for sleeves for underground irrigation system.

1.2 REFERENCES

A. Association Publications:
   1. American Concrete Institute, Farmington Hills, MI www.concrete.org. Abstracts of ACI Periodicals and Publications.
      a. 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’*.
   2. Cold Weather, as referred to in this Section, is four (4) hours with ambient temperature below 40 deg F (4.4 deg C) in twenty-four (24) hour period.
   3. Hot Weather, as referred to in this Section, is ambient air temperature above 100 deg F (38 deg C) or ambient air temperature above 90 deg F (32 deg C) with wind velocity 8 mph (12.9 kph) or greater.

B. Reference Standards:

1. American Concrete Institute
   a. ACI 117-10 (R2015): ‘Specifications for Tolerances for Concrete Construction and Materials and Commentary'.
   b. ACI 305.1-14, ‘Specification for Hot Weather Concreting’.
   c. ACI 306.1-90 (R2002), ‘Standard Specification for Cold Weather Concreting’.
   d. ACI 318-14, ‘Building Code Requirements for Structural Concrete' (ACI 318) and 'Commentary on Building Code Requirements for Structural Concrete' (ACI 318R).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 01 3100 and held jointly with following sections:
      a. Section 03 1113: 'Structural Cast-In-Place Concrete Forming'.
      b. Section 03 2116: ‘Epoxy-Coated Reinforcement Steel Bars'.
      c. Section 32 3213: 'Cast-In-Place Concrete Retaining Walls'.
   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 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 and aggregate base requirements.
      h. Review formwork requirements.
      i. Review approved mix design requirements, mix designs and use of admixtures.
      j. Review reinforcing bar submittals.
      k. Review installation schedule and placement of reinforcing bars.
      l. Review placement, finishing, and curing of concrete, including cold and hot weather requirements.
      m. Review smooth rubbed concrete finish procedures and requirements (applied immediately after removing concrete formwork while concrete is 'green').
      n. Review concrete slab tolerances and corrective measures if tolerances not met.
      o. Review safety issues.
      p. 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. 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) Mix Type E:
a) Exterior concrete exposed to freeze/thaw cycles and deicing salts or where soils are 'corrosive'.
b) 4500 psi (31.03 MPa) minimum at twenty-eight (28) days.
c) Water / Cementitious Material: 0.40 maximum by weight.
d) Use twenty-five (25) percent Class F fly ash as part of cementitious material.
2) Air Entrainment: Six (6) percent, plus or minus 1-1/2 percent for exterior concrete and foundation walls exposed to freeze/thaw cycles.
3) 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.
b. Slump:
1) 4 inch (100 mm) slump maximum before addition of high range water reducer.
2) 8 inch (200 mm) slump maximum with use of high range water reducer.
3) Slump not required for Mix Type G.
c. Admixtures:
1) Mix design shall show proposed admixture, amount, usage instructions, and justification for proposed use. Do not use any admixture without Architect's written approval.

2) Fly ash: 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 cementations materials may used.
3) Chemical: Specified accelerator or retarder may be used if necessary to meet environmental conditions.
4) 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.

PART 2 - PRODUCTS

2.1 SYSTEM

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

B. Performance:
   1. Design Criteria: Conform to requirements of ASTM C94/C94M unless specified otherwise:
   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. Hydraulic Cement: Meet requirements of ASTM C150/C150M, Type E.
      a. Meet requirements of ASTM C595/C595M, Type E.
      b. Meet requirements of ASTM C1157/C1157M, Type E.
   2. Aggregates:
      a. General:
         1) Aggregates for all concrete shall come from a quarry that is DOT approved and meets or exceeds durability Class I aggregate. The quarry shall submit a letter to Engineer that certifies that all aggregate complies with DOT requirements for durability. Aggregate not meeting DOT durability requirements shall not be used.
      b. 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.

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

3. Water: Clear, apparently clean, and potable.
4. Admixtures And Miscellaneous:
a. Fly Ash:
1) 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.
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) 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) 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) 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) 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 GCP Applied Technologies.
(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) 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) 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) Equal as approved by Architect before use. See Section 01 6200.

2.2 ACCESSORIES

A. Formwork:
1. Meet requirements specified in Section 03 1113:

B. 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.

C. Finishing Material (Exposed Vertical Faces of 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.

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:
   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. 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.
      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) See ACI 306.1 'Standard Specification for Cold Weather Concreting' for additional requirements.
4. Hot Weather Concreting Procedures:
   a. General:
      1) Maximum concrete temperature allowed is 90 deg F (32 deg C) in hot weather.
      2) Cool aggregate and subgrades by sprinkling.
      3) Avoid cement over 140 deg F (60 deg C).
      4) Use cold mixing water or ice.
      5) Use fog spray or evaporation retardant to lessen rapid evaporation from concrete surface.
      6) See ACI 305.1 'Specification for Hot Weather Concreting' for additional requirements.

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.

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. 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.

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

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. 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) Control joints in Concrete Paving are specified in Section 32 1313.
      3) Depth of control joints shall be approximately one quarter of concrete slab thickness, but not less than one inch (25 mm).
      4) Control joints to be hand tooled in sidewalks, mow strips, and aprons.
4. 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.

B. Finishing:
1. Vertical Surfaces, Exposed Retaining Walls
   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. Exterior Concrete Sealer:
1. Exterior Concrete Sealer:
   a. Exterior concrete placed after about September 1 and located in areas of freeze/thaw cycles are to be sealed per Section 03 3517 ‘Exterior Concrete Sealer’.
   b. Apply product as specified in Section 03 3517.

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. Reinforcement Bars and Bolts:
   a. Testing Agency shall provide inspections will include following:
      1) Bolts:
         a) Inspection of bolts to be installed in concrete prior to and during placement of concrete.
         b) Periodic inspection of anchors installed in hardened concrete.
      2) Reinforcement Bars:
         a) Periodic inspection of reinforcement bars and placement prior to concrete placement to verify grade, size, cover, spacing, and position of reinforcing.
         b) Inspect that all reinforcement bars are be positively identified as to heat number and mill analysis.
         c) Confirm surface of reinforcing bars is free of form release oil or other deleterious substances.
3. Concrete:
   a. Testing Agency shall provide testing and inspection for concrete as per ASTM C1077.
   b. Testing and inspections, if performed, will include following:
      1) Periodic inspection verifying use of required design mix.
      2) Inspection of reinforcing bars and anchor bolts before placement of concrete for proper installation.
      3) Inspection at time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine temperature of concrete.
      4) Inspection of concrete placement for proper application techniques.
         a) Steel tools are not to be used on exterior concrete.
      5) Periodic inspection for maintenance of specified curing temperature and techniques:
         a) Steel tools are not to be used on exterior concrete. Bull floating and finish floating is to be performed with magnesium or wood floats.
      6) 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.
      7) Periodic inspection of concrete finishing operations for proper finishing techniques.
      8) Periodic inspection for placement of specified curing compounds.
   c. 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.
      2) Concrete floor flatness and floor levelness of interior slabs as per ASTM E1155.
      3) Concrete moisture and alkalinity testing. See Section 09 0503 Flooring Substrate Preparation.

d. 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.
e. Compressive Strength Tests: ASTM C39/C39M:
   1) Obtain one (1) composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd (4 cu m), but less than 50 cu. yd (38 cu m), plus one (1) set for each additional 50 cu. yd (38 cu m) or fraction thereof.
   2) 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.
   3) 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.
   4) 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).
f. Samples:
   1) Fresh Concrete: ASTM C172/C172M except modified for slump to comply with ASTM C94/C94M.
      a) Slump: ASTM C143/C43M, 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.
      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.

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.

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.

END OF SECTION

SECTION 03 3517

CONCRETE SEALER FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install Concrete Sealer on concrete surfaces as described in Contract Documents including:
      a. Concrete sealers are used on existing or new exterior concrete surfaces exposed to freeze/thaw cycles and deicing salts or where exterior concrete is placed after about September 1st or as otherwise desired by Project Manager or Facilities Manager.
         1) Concrete sealer on exterior concrete is not needed or used in areas not exposed to freeze/thaw cycles and deicing salts.

B. Related Requirements:
   1. Section 03 3111: 'Cast-In-Place Structural Concrete' for concrete mix information and use admixtures.
   2. Section 03 3923: 'Membrane Concrete Curing for curing application.

1.2 REFERENCES

A. Definitions:
   1. Concrete Sealers: As used in this specification, are sealers applied to concrete surfaces to protect from surface damage, corrosion, and staining. Sealers either block pores in concrete to reduce absorption of water and salts or form impermeable layer which prevents such materials from passing. Concrete sealer, when selected and applied properly, will prevent intrusion of water and deicers, minimizing freeze/thaw damage.

B. Reference Standards:
   1. American Association of State and Highway Transportation Officials:
      a. AASHTO T 259-02(2012), 'Standard Method of Test for Resistance of Concrete to Chloride Ion'.
      b. AASHTO T 260-97(2011), 'Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials'.
   2. ASTM International:
      a. ASTM C672/C672M-12 'Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals'.
   3. German Institute for Standardization (DIN Standards):
      a. DIN EN 1504-2,' Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 2: Surface protection systems for concrete (2005).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Schedule pre-installation conference for same time as application of mockup application.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:

a. Concrete Sealer:
1) Manufacturer's product literature or cut-sheets for specified products.
2) Manufacturer's LEED product literature for specified products.

B. Informational Submittals:
1. Manufacturer Instructions:
a. Concrete Sealer: Written preparation and application instructions.
2. Source Quality Control Submittals:
a. Provide protection plan of surrounding areas and non-work surfaces if requested by Architect/Owner's Representative.
3. Qualification Statements:
a. Applicator: Provide qualification documentation.

1.5 QUALITY ASSURANCE

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

B. Qualifications:
1. Applicator:
a. Applicator shall be acceptable to Manufacturer as applicator of its product.
b. Minimum five (5) satisfactorily completed installations of comparable quality, scope, similar size, and complexity in past two (2) years before bidding. Include contact information of person with oversight of each project.
c. Provide qualification documentation.

C. Mockup:
1. Required for all projects. Scheduled as per pre-installation conference.
2. Mockup shall be representative of work to be expected.
3. Mockup will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application.
4. Square footage or size of mock up is between Architect/Owner’s Representative and Concrete Sealer Applicator. Consider between 10 sq ft to 20 sq ft (0.93 to 1.86 sq m) for small projects and 100 sq ft to 200 sq ft (9.3 to 18.6 sq m) for larger areas.
5. Provide as many field mockups required to verify selections made under submittals and to demonstrate effects of concrete sealer. Approval does not constitute approval of deviations from Contract Documents, unless such deviations are specifically approved by Architect/Owner’s Representative in writing.
6. Install mockup in accordance with specification using same materials, staff and equipment.
7. Use same personnel that will be doing project, including Supervisor.
8. Approvals should be based on:
a. Compliance with approved submittals.
9. Approval from Architect/Owner's Representative is required BEFORE starting work on Project.
10. Allow twenty four (24) hours for inspection of mockup before proceeding with work.

1.6 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) or as directed by Manufacturer's instruction.

1.7 FIELD CONDITIONS

A. Ambient Conditions:
   1. Concrete Sealer:
      a. Follow printed Manufacturer's instruction for environmental hazards:
      b. Follow printed Manufacturer's instruction for ambient conditions for application of product including:
         1) Minimum and maximum application temperatures.
         2) Application precautions when rain is expected.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Exterior Concrete Sealer:
   1. Description:
      a. Concrete sealer that protects new and existing exterior concrete from freeze/thaw cycles and deicing salts.
   2. Design Criteria:
      a. General:
         1) Penetrating water repellent silane or linseed oil/mineral spirit concrete sealers are to be used.
         2) Siloxanes are not to be used to replace silane or linseed oil/mineral spirits sealers.
      b. Linseed Oil/Mineral Spirits Sealers:
         1) Protects concrete from freeze/thaw cycles and deicing salts.
         2) Resists penetration of water and deicing salts.
      c. Silane Based Sealers:
         1) Protects concrete from freeze/thaw cycles and deicing salts.
         2) Resists penetration of water and deicing salts.
         3) 100 percent silane active ingredient content.
         4) Penetrating sealer.
         5) Water repellant.
         6) Clear (colorless, non-yellowing). Surface appearance after application: unchanged.
   3. Limitations:
      a. VOC:
         1) If Low VOC product are required or desired, use only those products listed as ‘Low VOC’ in acceptable products below.
   4. Type One Acceptable Products. See Section 01 6200 for definition of Categories. Applicator Option:
      a. Linseed Oil/Mineral Spirits Sealers:
         1) Anti Spall J33 Concrete Sealer by Dayton Superior Corporation, Miamisburg, OH www.daytonsuperior.com.
            a) Low VOC.
         2) Equal product meeting design criteria requirements as approved by Architect/Owner’s Representative before BID. See Section 01 6200.
      b. Silane Based Sealers:
         1) MasterProtect H 1000 by BASF, Cleveland, OH www.master-builders-solutions.basf.us.
            a) Low VOC.
         2) Weather Worker J29A by Dayton Superior Corporation, Miamisburg. OH www.daytonsuperior.com.
         3) Baracade Silane 100 by Euclid, Cleveland, OH www.euclidchemical.com.
            a) Low VOC.
         4) Sikagard 705L by Sika Corporation, Lyndhurst, NJ www.usa.sika.com.
            a) Low VOC.
         5) TK-590-100 by TK Products, Minnetonka, MN www.tkproducts.com.
         6) Equal product meeting design criteria requirements as approved by Architect/Owner’s Representative before BID. See Section 01 6200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Verify concrete has properly cured.

3.2 PREPARATION

A. Surface Preparation:
   1. Concrete Sealer:
      a. Take necessary precautions to protect adjoining property.
      b. Do not contaminate any body of water by direct application, cleaning of equipment or disposal of wastes.
   2. Cleaning:
      a. Clean concrete surface of membrane curing and all dirt, mud spots, silt spots, loose material, vegetation, oil spots, and other objectionable and foreign material.
      b. Remove debris, sand, dirt, and dust from concrete surface.
      c. Power brooms, power blowers, air compressors, water flushing equipment, and blowers are acceptable equipment for cleaning concrete surface.

3.3 APPLICATION

A. Concrete Sealer:
   1. General:
      a. Apply concrete sealer after surface preparation has been completed as per Manufacturer’s recommendations.
      b. Follow Manufacturer's ambient conditions for minimum and maximum application temperatures and application precautions when rain is expected.
      c. Stir material thoroughly before and during application if required by Manufacturer.
      d. Do not apply sealer if standing water is visible on concrete surface to be treated.
      e. Apply even distribution of sealer.
      f. Do NOT over apply. All product should penetrate substrate with no surface build-up. Any excess or puddles of material must be removed.
   2. Apply Concrete Sealer:
      a. Linseed Oil/Mineral Spirits Sealers:
         1) For maximum protection, apply onto concrete surface before it is exposed to deicing salts.
         2) Do not apply in temperatures below 40 deg F (4.4 deg C).
         3) Apply first coat at 1 gallon (3.785 liters) per 350 sq ft (32.5 sq m).
         4) When first coat is dry to touch, apply second coat at 1 gallon (3.785 liters) per 600 sq ft (55.7 sq m).
         5) When second coat is totally dry, surface is ready for traffic.
         6) Texture and absorption of surface will influence final coverage rates.
         7) This application will turn concrete to dark amber color.
      b. Silane Based Sealers:
         1) Apply at rate of about 1 gallon (3.785 liters) per 300 sq ft (27.8 sq meters) or as per Manufacturer’s recommendations depending upon absorbency of concrete surface.
   3. Allow Concrete Sealer to dry as per Manufacturer’s recommendations.

3.4 CLEANING

A. General:
   1. Clean tools, equipment and spills as directed by Manufacturer's instructions.
   2. Clean drips and over spray while still wet.

B. Waste Management:
   1. Sterilant/Concrete Sealers:
      a. Follow Manufacturer's recommendations for approved disposal of product and containers.
         1) Do not reuse empty containers.

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.
   2. Section 03 3517: 'Concrete Sealer-Finishing' for application of concrete sealer.

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) Clear Water Resin by Right Point, Dekalb, IL www.rightpointe.com.
            c) L&M Cure R by L&M Construction Chemicals, Inc. Omaha, NE www.lmcc.com.
            d) VOCOMP 20 (exterior concrete only, do not use when a concrete sealer will be applied in areas of freeze/thaw and deicer salts) by W.R. Meadows, Inc. Hampshire, IL www.wrmeadows.com.
            e) 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 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':
      a. Pre-installation conference held jointly with other landscape related sections.

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. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference for common earthwork sections:
      a. Schedule conference after completion of site clearing but before beginning grading work.
      b. Participate in pre-installation conference held jointly with following sections:

1) Section 03 3111: 'Cast-In-Place Structural Concrete'.
2) Section 31 1100: ‘Clearing and Grubbing’.
3) Section 31 2216: 'Fine Grading'.
4) Section 31 2316: ‘Excavation’.
5) Section 31 2323: ‘Fill’.

c. In addition to agenda items specified in Section 01 3100, review following:
1) Review Geotechnical Evaluation Report.
2) Review common earthwork schedule.
3) Review protection requirements.
4) Review cleaning requirements.
5) Review safety issues.
6) Review field tests and inspections requirements.

d. In addition to agenda items specified above, review following. These are items that will occur before pre-installation conference for landscape sections:
1) Review clearing and grubbing requirements.
2) Review topsoil stripping and stockpiling requirements.
3) Review landscape grading requirements.
4) Review landscape finish grade tolerance requirements.
5) Review landscape and plant tolerances.
6) Review surface preparation of landscape and planting areas.
7) Review additional agenda items as specified in related sections listed above.

2. Participate in pre-installation conference for landscape sections as specified in Section 32 9001:
a. Schedule pre-installation conference after completion of Fine Grading specified in Section 31 2216, but one (1) week minimum before beginning landscape work and held jointly with following sections:
1) Section 32 8423: ‘Underground Sprinklers’.
2) Section 32 9120: ‘Topsoil And Placement’.
3) Section 32 9122: ‘Topsoil Grading’.
4) Section 32 9223: ‘Sodding’.

b. In addition to agenda items specified in Section 01 3100 and Section 32 9001, review following that these items have been installed correctly:
1) Review topsoil placement requirements.
2) Review topsoil surface preparation requirements.
3) Review topsoil depth requirements.
4) Review landscape finish grade tolerance requirements.
5) Review surface preparation of landscape and planting areas.

B. Sequencing:
1. General Earthwork:
a. Excavation.
b. Rough Grading.
c. Fill.
d. Fine Grading.
e. Aggregate Base or Topsoil Grading.

1.4 QUALITY ASSURANCE

A. 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.
a. Owner will employ testing agencies to perform testing and inspection 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: 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 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 or fax within twenty-four (24) hours. Follow telephone or fax 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. Testing and inspection of earthwork operations is required.
   3. 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.

4. 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 1100

CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform clearing and grubbing as necessary to prepare site for rough grading and structure excavation as described in Contract Documents.

B. Related Requirements:
   1. Section 31 0501: Common Earthwork Requirements:
      a. General procedures and requirements for earthwork.
      b. Pre-installation conference held jointly with other common earthwork related sections.
      c. Pre-installation conference held jointly with other landscape related sections.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conferences as specified in Section 31 0501.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Root Removal:
   1. Do not pull up or rip out roots of trees and shrubs that are to remain. If excavation through roots is required, excavate by hand and cut roots with sharp axe. Make clean, smooth, sloping cuts.
   2. Cut roots 6 inches (150 mm) or larger in diameter only with Architect's written permission.

B. Grubbing:
   1. Entirely remove roots of plants that normally sprout from roots, as identified by Architect.

3.2 CLEANING

A. Remove from site vegetative layer, and surface debris and dispose of legally.

B. Do not bury cuttings, roots, and other vegetative matter or burnt waste material on site.

END OF SECTION

SECTION 31 2213

ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform rough grading work required to prepare site for construction as described in Contract Documents.

B. Related Requirements:
   1. Section 01 3100: 'Project Management and Coordination' for pre-installation conference.
   2. 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.
   3. Section 31 2216: 'Fine Grading' for grading of subgrade below aggregate base and topsoil.
   4. Section 31 2316: 'Excavation'.
   5. Section 31 2323: 'Fill' for compaction procedures and tolerances for base.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 31 0501:
   2. In addition to agenda items specified in Section 01 3100 and Section 31 0501, review following:
      a. Identify benchmark to be used in establishing grades and review Contract Document requirements for grades, fill materials, and topsoil.
      b. Examine site to pre-plan procedures for making cuts, placing fills, and other necessary work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials used for fill shall be as specified for backfill in Section 31 2323 'Fill'.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Verify elevations of rough grading are correct before compacted fill, fine grading, aggregate base or landscape grading are placed.

3.2 PERFORMANCE

A. Subgrade (Natural Soils):
   1. Subgrade beneath compacted fill or aggregate base shall be constructed smooth and even.

B. Special Techniques:
   1. Compact fills as specified in Section 31 2323 'Fill'.

2. If soft spots, water, or other unusual and unforeseen conditions affecting grading requirements are encountered, stop work and notify Architect.

C. Tolerances:
1. Maximum variation from required grades shall be 1/10 of one foot (28 mm).

END OF SECTION

SECTION 31 2216

FINE GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform fine grading of subgrade work required to prepare site for paving finish grading and for placement of topsoil as described in Contract Documents.
   2. Asphalt Paving:
      a. Prepare natural soil subgrade as described in Section 31 2213 'Rough Grading' or prepare fill subgrade as described in this specification section for asphalt paving.

B. Related Requirements:
   1. Section 01 1200: 'Multiple Contract Summary' for multiple contracts.
   2. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   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 2213: 'Rough Grading' for grading and preparation of natural soil subgrades below fill and aggregate base materials.
   5. Section 31 2316: 'Excavation'.
   6. Section 31 2323: 'Fill' for compaction procedures and tolerances for base.
   7. Section 32 9001: 'Common Planting Requirements'.
      a. Pre-installation conference held jointly with other common planting related sections.
   8. Section 32 9120: 'Topsoil And Placement' for topsoil evaluation and placement required for topsoil grading.
   9. Section 32 9122: 'Topsoil Grading' for preparation of topsoil and addition of amendments prior to landscaping.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 31 0501 and Section 32 9001.
   2. In addition to agenda items specified in Section 01 3100 and Section 31 0501, review following:
      a. Review backfill requirements.
      b. Review geotechnical report.
      c. 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 installation of fill / engineered fill to allow inspection.
   2. Allow special inspector to review all subgrades and excavations to determine if site has been prepared in accordance with geotechnical report prior to placing any fill, aggregate base or concrete.
   3. Allow inspection and testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after inspections and test results for previously compacted work comply with requirements.

1.3 SUBMITTALS

A. 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 Testing and Inspecting Reports of fill / engineered fill.

1.4 QUALITY ASSURANCE

A. 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 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: Not Used

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection Of In-Place Conditions: Protect utilities and site elements from damage.

3.2 PERFORMANCE

A. Interface With Other Work: Do not commence work of this Section until grading tolerances specified in Section 31 2213 are met.

B. General:
   1. Do not expose or damage existing tree roots.

C. Tolerances:
   1. Site Tolerances:
      a. Subgrade (material immediately below aggregate base):
         1) 0.00 inches (0.00 mm) high.
         2) Measure using string line from sidewalk to top of retaining wall.
      b. 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.

2. Site Preparation:
   a. Prior to placement of fill / engineered fill, inspector shall determine that site has been prepared in accordance with geotechnical report.
   b. Footing subgrade: At footing subgrades, Certified Inspector is to verify that soils conform to geotechnical report.
3. Fill / Engineered Fill:
   a. Testing Agency shall provide testing and inspection for fine grading.
   b. Number of tests may vary at discretion of Architect.
   c. Testing Agency is to provide one (1) moisture-maximum density relationship test for each type of fill material.

END OF SECTION

SECTION 31 2316

EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:
   1. 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.
   2. Section 31 1100: Clearing and Grubbing.
   3. Section 31 2213: 'Rough Grading' for rough grading and preparation of natural soil subgrades below fill and aggregate base materials.
   4. Section 31 2216: 'Fine Grading' for grading of subgrade below aggregate base and topsoil.
   5. Section 31 2323: 'Fill' for compaction procedures and tolerances for base.
   6. Performance of excavating 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 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 31 0501:
   2. In addition to agenda items specified in Section 01 3100 and Section 31 0501, review following:
      a. Review protection of existing utilities requirements.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Carefully examine site and available information to determine type soil to be encountered.
   2. Discuss problems with Architect before proceeding with work.

3.2 PREPARATION

A. Protection of Existing Utilities:
   1. Protect existing utilities identified in Contract Documents during excavation.
   2. If existing utility lines not identified in Contract Documents are encountered, contact Architect before proceeding.

3.3 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. Excavation:
   1. Footings:
      a. Bottom of excavations to receive footings shall be undisturbed soil.
   2. Miscellaneous Cast-In-Place Concrete:
      a. Excavate as necessary for proper placement and forming of concrete site elements. Remove vegetation and deleterious material and remove from site.
      b. Backfill over-excavated areas with compacted base material.
      c. Remove and replace exposed material that becomes soft or unstable.
   3. If unusual excavating conditions are encountered, stop work and notify Architect.

3.4 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.

3.5 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 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 1200: 'Multiple Contract Summary' for multiple contracts.
   2. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   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 1100: 'Clearing and Grubbing'.
   5. Section 31 2213: 'Rough Grading' for grading and preparation of natural soil subgrades below fill and aggregate base materials.
   6. Section 31 2216: 'Fine Grading' for grading of subgrade below aggregate base and topsoil.
   7. Section 31 2316: 'Excavation'.
   8. Section 32 9122: 'Topsoil Grading' for preparation of topsoil and addition of amendments prior to landscaping.
   9. 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.

C. Products Installed But Not Furnished Under This Section:
   1. Exterior Foundations:

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 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:

1. Participate in MANDATORY pre-installation conference as specified in Section 31 0501.
2. In addition to agenda items specified in Section 01 3100, Section 31 0501, and Section 31 2324 if Flowable Fill is included, review following:
   a. Review backfill requirements.
   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. Sequencing:
1. Before backfilling, show utility and service lines being covered on record set of Drawings. Do not backfill until utilities involved have been tested and approved by Architect and until instructed by Architect.

C. Scheduling:
1. Notify Testing Agency and Architect seventy-two (72) hours minimum before installation of fill / engineered fill to perform proctor and plasticity index tests on proposed fill or subgrade.
2. Notify Testing Agency and Architect twenty-four (24) hours minimum before installation of fill / engineered fill to allow inspection.
3. Allow special inspector to review all subgrades and excavations to determine if site has been prepared in accordance with geotechnical report prior to placing any fill (or concrete).
4. Allow inspection and testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after inspections and test results for previously compacted work comply with requirements.

1.4 SUBMITTALS

A. 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 Testing and Inspecting Reports of fill / engineered fill.

1.5 QUALITY ASSURANCE

A. 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 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’.

1.6 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. 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 Building Footprint: Fill 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-five (95) percent minimum of fill shall be smaller than 1-1/2 inch (38 mm) in any direction.
   2.

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 Building Slab:
      a. Scarify subgrade 6 inches (150 mm) deep, moisture condition to uniform moisture content of between optimum and four (4) percent over optimum, and mechanically tamp 6 inches (150 mm) deep to ninety-five (95) percent minimum of 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.
      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 Miscellaneous Concrete Site Elements:
            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.

3.3 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.
   2. Fill / Engineered Fill:
      a. Testing Agency shall provide testing and inspection for fill.
      b. Number of tests may vary at discretion of Architect.
      c. Testing Agency is to provide one (1) moisture-maximum density relationship test for each type of fill material.
      d. Prior to placement of engineered fill, inspector shall determine that site has been prepared in accordance with geotechnical report.
      e. Footing subgrade: At footing subgrades Certified Inspector is to verify that soils conform to geotechnical report.
      f. Testing Agency will test compaction of soils according to ASTM D1556/D1556M, ASTM D2167, and ASTM D6938, as applicable. Lift thicknesses shall comply with geotechnical report. Inspector shall determine that in-place dry density of engineered fill material complies with geotechnical report.
      g. Required verification and inspection of soils as referenced in 2015 IBC (or latest approved edition) Table 1704.7 'Required Verification And Inspection Of Soils'. Periodic and continuous inspections include:
         1) Verify materials below shallow foundations are adequate to achieve design bearing capacity (periodic).
         2) Verify excavations are extended to proper depth and have reached proper material (periodic).
         3) Perform classification and testing of compacted fill materials (periodic).
         4) Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill (continuous).
         5) Prior to placement of compacted fill, observe subgrade and verify that site has been prepared properly (periodic).

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

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:
      a. Tack coat: Application of asphaltic material to existing asphalt concrete or portland concrete surfaces before asphalt concrete pavement.
      b. Blotter materials and procedures for absorbing excess asphalt as required.
      c. Asphalt Paving Surface Treatment to be included with this project.
   2. Furnish and install materials and equipment for mixing Asphalt Reinforcement Fibers into Hot Mix Asphalt (HMA).

B. Related Requirements:
   1. Section 01 1200: 'Multiple Contract Summary' for multiple contracts.
   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 01 7800: 'Closeout Submittals'.
   7. 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.
   8. Section 31 2213: 'Rough Grading' for rough grading and preparation of natural soil subgrades below fill and aggregate base materials.
   9. Section 31 2216: 'Fine Grading' for grading of subgrade below aggregate base and topsoil.
   10. Section 31 2323: 'Fill' for compaction procedures and tolerances for base.
   11. 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'* (Sixth Edition, Reprinted 1997).
      b. MS-4, '*The Asphalt Handbook'* (Seventh Edition).
      c. MS-5, *Introduction to Asphalt'* (Eighth Edition, Reprinted 2001).
      d. MS-22, *'Construction of Hot Mix Asphalt Pvmts'* (Second Edition, 2001 Reprinting).
      e. SP-1 *'Superpave Perf. Graded Asphalt Binder Specification and Testing'* (Third Edition, Revised 2003).
      f. SP-2: '*Superpave Mix Design'* (Third Edition, Revised 2001).
      g. SW-1, '*Mix Design Program'* software that may be purchased to assist with conformance to Asphalt Institute SP-2 and MS-2 manuals and test procedures.
   2. Council of American Structural Engineers:
      a. CASE Form 101: *Statement of Special Inspections*. Washington, DC: CASE, 2001. (c/o American Council of Engineering Companies, 1015 15th St., NW, Washington, DC 20005; 202-347-7474; www.acec.org).
   3. Samples of Design Software Available:
      a. American Association of State and Highway Transportation Officials (AASHTO):

1) *'DARWin-ME'* www.aashtoware.org.
a) Comprehensive pavement design and analysis tool, capable of providing support and insights to highway decision-makers, academia and consultants through the entire pavement structure life cycle, from design through maintenance.
b. American Concrete Pavement Association (ACPA):
1) *'StreetPave'* www.acpa.org.
a) Engineering analyses for optimized concrete and asphalt pavement thicknesses for city, municipal, county, and state roadways.
2) *''WINPAS12'*:
a) Pavement thickness design according to 1993 AASHTO Guide for Design of Pavements Structures.
c. Plantmix Asphalt Industry of Kentucky (PAIKY):
1) HMA Thickness Design' www.paiky.org.
d. National Ready Mixed Concrete Association (NRMCA):
1) *'Concrete Pavement Analyst'* (CPA) www.nrmca.org.
a) Parking area concrete design and cost comparison software that compares total ownership costs for asphalt paving and concrete paving.
4. Federal Highway Administration (FHWA):
a. FHWA-NHI-131053, 'Superpave Fundamentals' (Training course to inform highway industry personnel of benefits of Superpave).
b. LTPP Bind:, Superpave (free) software for assisting in the selection of asphalt binder grades (available at http://www.fhwa.dot.gov/pavement/ltpp/bind/dwnload.cfm) or http://www.fhwa.dot.gov/pavement/ltpp/bind/dwnload.cfm or htpp://www.ltpp-products.com/OtherProducts/OtherProducts.aspx):
1) Ninety Eight (98) percent reliability is required.
5. International Code Council (IBC):
a. IBC Chapter 17, 'Structural Tests and Special Inspections'.
6. National Asphalt Pavement Association (NAPA):
a. IS 128, 'Pavement Mix Type Selection Guide'.
7. U.S. Army Corps of Engineers (COE):
a. COE CRD-C 649-95. 'Standard Test Method for Unit Weight, Marshall Stability, and Flow of Bituminous Mixtures' (Issued 1 Dec. 1995).
8. United States Department of Labor:
a. Occupational Safety & Health Administration (OSHA):
1) CFR 1910.7, Nationally Recognized Testing Laboratories'.
9. Utah Department of Transportation (UDOT): *2012 Standard Specification'* www.udot.utah.gov/main under Project Development - Standards and Specifications.
10. Utah Department of Transportation (UDOT): Materials Manual of Instruction (MOI) Part 8: www.udot.utah.gov/main under Project Development - Materials Project Management.
a. Section 960, 'Guidelines for Superpave Volumetric Mix Design and Verification' (Modified June 2008).
b. Section 981, 'Random Sampling and Testing' (Reference ASTM D3665).
c. Section 982, Aggregate Test Sample Size'.
d. Section 984, 'Sampling Methods'.
e. Section 988, 'Guidelines for Laboratory Mixing of HMA'.
f. Section 990, 'Method of Test for Hamburg Wheel Track Testing'.

B. Definitions:
1. AASHTO: The American Association of State Highway and Transportation Officials. Organization of highway engineers from the 50 states that develops guides and standards.
2. Admixture: Material other than water, cement, and aggregates.
3. 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.

4. 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.
5. Ambient Temperature: Temperature of surrounding air.
6. Angular Aggregate: Aggregate possessing well-defined edges at intersection of roughly planar faces.
7. Anti-Stripping Agent: Chemicals added to bitumen to improve the adhesion of the bitumen to hydrophilic aggregates
8. Asphalt: "Dark brown to black cementitious material in which predominating constituents are bituminous which occur in nature or are obtained in petroleum processing". Asphalt is constituent in varying proportions of most crude petroleum.
9. 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.
10. Asphalt Cement: Asphalt that specially prepared in quality and consistency for use in manufacture of asphalt cement concrete (ACC). Heat is required to make it fluid.
11. Asphalt Cement Concrete (ACC): Controlled mix of aggregate and asphalt cement.
12. Asphalt Pavement: Pavements consisting of surface course of mineral aggregate coated and cemented together with asphalt cement on supporting courses such as asphalt bases, crushed stone, slag, or gravel.
13. Asphalt Reinforcement Fibers: Engineered fibers uniformly mixed and coated with asphalt at Hot Mix Asphalt (HMA) plant.
14. 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 (1/2 inch) nominal maximum size and performance grade asphalt binder designed to perform between temperatures of (158 deg F and -18.4 deg F).
15. Bitumen: Class of black or dark-colored (solid, semisolid, or viscous) cementitious substances, natural or manufactured, composed principally of high molecular weight hydrocarbons, of which Asphalts, tars, pitches, and asphaltites are typical.
16. Bituminous Pavement: Designed combination of graded crushed stone, filler, and bituminous cement mixed in a central plant, laid and compacted while hot.
17. Clay: Fine-grained soil that exhibits plasticity over a range of water contents, and that exhibits considerable strength when dry. Also, that portion of soil finer than 2 μm.
18. Compaction: Densification of soil or hot mix asphalt (HMA) by mechanical means.
19. Density: Ratio of mass to volume of substance. Usually expressed in kg/m³.
20. Emulsified Asphalt: Emulsion of asphalt cement and water which contains small amount of emulsifying agent. Water forms continuous phase of emulsion, and minute globules of asphalt form discontinuous phase.
21. 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. single-axle loads that are required to produce an equivalent effect.
22. ESAL (Equivalent Single Axle Loads): Measure of axle loads expressed relative to an 18,000 pound axle load.
    a. N_{des}: Design number of gyrations used for design of Hot Mix Asphalt (HMA).
23. Gradation: (grain-size distribution): Proportions by mass of soil or fragmented rock distributed by particle size.
24. Hot Mix Asphalt (HMA): High quality thoroughly controlled hot mixture of asphalt cement and well-graded, high quality aggregate. Form of Asphalt Cement Concrete that is mixed at contractor's Hot Mix Plant, transported to roadway in dump trucks, placed using paver, and compacted with Steel-wheel or Rubber-tired Rollers.
25. Lot: Quantity of material to be controlled. May represent specified mass, specified number of truckloads, or specified time period during production.
26. 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.

27. Pavement Preservation: Sum of all activities undertaken to provide and maintain serviceable roadways. This includes corrective maintenance and preventive maintenance, as well as minor rehabilitation projects.
28. Performance Graded (PG): Asphalt Binder grade designation used in Superpave™. Based on binder's mechanical performance at critical temperatures and aging conditions. Prefix followed by other numbers that designate asphalt binder designed to meet certain performance standards.
29. 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.
30. 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.
31. Preventive Maintenance (PM): Planned strategy of cost effective treatments that preserves and maintains or improves roadway system without substantially increasing structural capacity.
32. Reclaimed Asphalt Pavement (RAP): Existing asphalt mixture that has been pulverized, usually by milling, and is used like aggregate in recycling of asphalt pavements.
33. 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.
34. Superpave™ (*Su*perior *Per*forming Asphalt *Pav*ement): Trademark of Strategic Highway Research Program (SHRP). Superpave™ is product of SHRP asphalt research. Superpave™ system incorporates performance-based asphalt materials characterization with design environmental conditions to improve performance by controlling rutting, low temperature cracking and fatigue cracking. Three major components of Superpave™ are asphalt binder specification, mix design and analysis system, and computer software system.
35. Tack Coat: Very light application of liquid asphalt, or asphalt emulsion diluted with water.
36. Transverse Joint: Joint running across pavement.

C. Definitions (Following are specifically referenced for testing):
1. Accreditation: Process in which certification of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.
2. Approved: To authorize, endorse, validate, confirm, or agree to.
3. Compaction Test (moisture-density test): Laboratory compaction procedure in which soil of known water content is placed in specified manner into mold of given dimensions, subjected to compactive effort of controlled magnitude, and resulting density determined.
4. Field Quality Control: Testing, Inspections, Special Testing and Special Inspections to assure compliance to Contract Documents.
5. Inspection/Special Inspection: Inspection of materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards:
    a. Inspection: Not required by code provisions but may be required by Contract Documents.
    b. Special Inspection: Required by code provisions and by Contract Documents.
    c. Inspection-Continuous: Full-time observation of the Work requiring inspection by approved inspector who is present in area where the Work is being performed.
    d. Inspection-Periodic: Part-time or intermittent observation of the Work requiring inspection by approved inspector who is present in area where the Work has been or is being performed and at completion of the Work.
6. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor to perform particular construction operation, including installation, erection, application, and similar operations.
7. Mean of Deviations: Sum of absolute values of variance between each screen target value and each measured value divided by number of tests in Lot.

8. Non-Destructive Testing (NDT) – Testing methods usually performed on in-place construction materials that do not cause any damage to the materials being tested. In the context of pavement evaluation, NDT is Deflection testing, without destruction to the pavement, to determine pavement's response to pavement loading.
9. Observation: Visual observation of building / site elements or structural system by registered design professional for general conformance to approved construction documents at significant construction stages and at completion. Observation does not include or waive responsibility for performing inspections or special inspections.
10. Owner's Representative: Owner's Designated Representative (Project Manager or Facilities Manager) who will have express authority to bind Owner with respect to all matters requiring Owner's approval or authorization.
11. Preconstruction Testing: Tests and inspections that are performed specifically for Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
12. Product Testing: Tests and inspections that are performed by testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
13. Quality Assurance: Testing, Inspections, Special Testing and Special Inspections provided for by Owner.
14. Quality Control: Testing, Inspections, Special Testing and Special Inspections provided for by Contractor.
15. Service Provider: Agency or firm qualified to perform required tests and inspections.
16. Source Quality Control Testing: Tests and inspections that are performed at source, i.e., plant, mill, factory, or shop.
17. Special Inspection: See Inspection.
18. Special Inspector: Certified individual or firm that implements special inspection program for project.
19. Special Test: See Test.
20. Test/Special Test: Field or laboratory tests to determine characteristics and quality of building materials and workmanship.
    a. Test: Not required by code provisions but may be required by Contract Documents.
    b. Special Test: Required by code provisions and by Contract Documents.
21. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
22. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.
23. Verification: Act of reviewing, inspecting, testing, etc. to establish and document that product, service, or system meets regulatory, standard, or specification requirements.

D. Reference Standards:
1. American Association of State and Highway Transportation Officials:
    a. AASHTO M 320-10, 'Standard Specification for Performance Graded Asphalt Binder'.
    b. AASHTO M 323-13, 'Standard Specification for Superpave Volumetric Mix Design'.
    c. AASHTO R 28-12, 'Standard Practice for Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV)'.
    d. AASHTO T 48-06(2010), 'Standard Method of Test for Flash and Fire Points by Cleveland Open Cup'.
    e. AASHTO T 240-13, 'Standard Method for Test for Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin Film Oven Test) (ASTM D2872)'.
    f. AASHTO T 283-07 (2011), 'Standard Method of Test for Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage'.
    g. AASHTO T 301-13, 'Standard Method of Test for Elastic Recovery Test of Asphalt Materials by Means of a Ductilolmeter'.
    h. AASHTO T 304-11: 'Standard Method of Test for Uncompacted Void Content of Fine Aggregate'.
    i. AASHTO T 312-14: 'Standard Method of Test for Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor'.
    j. AASHTO T 313-12, 'Standard Method of Test for Determination the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR)'.
    k. AASHTO T 314-12, 'Standard Method of Test for Determination the Fracture Properties of Asphalt Binder in Direct Tension (DT)'.

l. AASHTO T 315-12, ‘Standard Method of Test for Determination the Rheological Properties of Asphalt Binder Using Dynamic Shear Rheometer (DSR)’.
m. AASHTO T 316-13, ‘Standard Method of Test for Viscosity Determination of Asphalt Binder Using Rotational Viscometer’.
n. 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.
o. AASHTO T 324-14: ‘Standard Method of Test for Hamburg Wheel-track Testing of Compacted Hot-Mix Asphalt (HMA)’.

2. ASTM International:
a. ASTM C29/C29M-09, ‘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-12, '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 D2397/D2397M, 'Standard Specification for Cationic-Emulsified Asphalt’.
l. ASTM D2419-14, ‘Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate'.
m. ASTM D2872-12, ‘Standard Test Method for Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test)’.
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 D5444-08, ‘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’.
z. ASTM E329-14a: ‘Standard Specification for Agencies Engaged in Construction Inspection and/or Testing'.
aa. ASTM E950/E950M-09, ‘Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference'.
bb. ASTM E1274-03(2012), ‘Standard Test Method for Measuring Pavement Roughness Using a Profilograph’.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
   1. Participate in pre-installation conference as specified in Section 31 0501:
   2. In addition to agenda items specified in Section 01 3100 and Section 31 0501, review following:
      a. Review surveying and staking of parking areas and installation of sleeves.
      b. Review proposed aggregate base schedule.
      c. Review rough grading elevations before placing paving fill.
      d. Review fine grading elevations of subgrade fine grading operations before placing aggregate base and paving.
      e. Review proposed asphalt paving schedule.
      f. Review asphalt paving mix design.
      g. Review pre-emergent herbicide protection of adjoining property and planting area on site requirements, schedule and application requirements.
      h. Review schedule of mandatory asphalt paving surface treatment to be applied after placement of asphalt paving.
      i. Review schedule of paint stripes to be applied after asphalt paving surface treatment.
      j. Review safety issues.
      k. 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 frequency of testing and inspections.

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

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Asphalt Reinforcement Fibers:
         1) Manufacturer's published product data on engineered fibers and certification that product supplied meets requirements of this specification.
      b. Pre-Emergent Herbicide:
         1) Manufacturer's published product data on pre-emergent herbicide.
   2. Samples:
      a. Asphalt Reinforcement Fibers:
         1) Manufacturer to provide statement certifying:
            a) Fiber material and mix rate meet requirements of this specification.

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 or his representatives. 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 (required).
         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 Engineer before product use.
   2. Design Data:
      a. Hot Mix Asphalt:
         1) Design mix submittal shall follow format as indicated in SP-2: ‘*Superpave Mix Design*’ Manual’.
         2) If Installer cannot provide asphalt mix design conforming to design requirements of this specification, submit to Architect equal or better asphalt mix design for approval three

(3) days minimum prior to bid. Proposed asphalt mix design is not acceptable without Architect's written approval prior to bid.

3) Within thirty (30) days prior to asphalt construction, submit actual design mix to Architect, Civil Engineering Consultant of Record and Independent Testing Laboratory for review and approval.
4) Submit certification that mix design conforms as specified in this specification (unless an alternate mix design is being used).
5) Mix designs over two (2) years old will not be accepted by Owner.
6) Mix design of asphalt paving mixture:
   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 (required).
   d) Mix design method used (required).
   e) Mix density.
   f) Design air voids (four (4) percent).
   g) Voids in mineral aggregate.
   h) Asphalt content in percent.
   i) Performance grade of asphalt binder.
   j) Nominal maximum size of aggregate.
   k) Aggregate source and gradation.
   l) Amount and type of asphalt reinforcement fibers provided.
   m) Mix properties and design parameters.
   n) Temperature of mix at plant and in the field for optimum field compaction.
   o) Amount of recycled asphalt pavement – RAP: Allowed up to fifteen (15) percent by weight with no change in specified binder grade.
   p) Mineral fillers, antistrip, and recycle agent percentages.
   q) Identify if warm mix technologies will be used.

b. Asphalt Reinforcement Fiber:
   1) Indirect Tensile (IDT) Strength Test results (AASHTO T 322 or D6932/D6932M) from minimum of three (3) separate laboratory trials:
      a) Tests must be performed by AASHTO Independent Testing Agency meeting qualifications as specified in Section 01 4301 and reviewed and approved by project engineer.
      b) Perform indirect tensile tests using the following protocol:
         (1) Specimen height range of 1.50 inches to 2.46 inches .
         (2) Specimen diameter range of 4.00 inches to 5.91 inches .
         (3) Actuator displacement rate of 2.0 inches/min (plus or minus 0.10 inches / minute).
         (4) Test temperature range 40 deg F to 77 deg F.
         (5) Other test parameters and methods as detailed in AASHTO T 322 or ASTM D6932/D6932M.
      c) Tests results shall include control and fiber reinforced mix. Fiber reinforced asphalt concrete (FRAC) mix shall be identical to control mix except for inclusion of fibers added at same dosage as proposed on Project.
      d) Indirect tensile test results from fiber specimens shall show average tensile strength increase of fifteen (15) percent over control specimen with no single result less than ten (10) percent increase of average tensile strength.
   2) Fiber extraction results from minimum of three (3) separate laboratory trials:
      a) Perform fiber extraction based on modified ASTM D2172/D2172M procedures.
      b) Samples must be obtained during production run of fiber reinforced asphalt concrete (FRAC) mixed at full-scale asphalt plant.
      c) Fiber extraction results should result in average extracted fiber content of not less than 0.007 percent by total sample weight with no individual result less than 0.005 percent of the total sample weight.

3. Test And Evaluation Reports:
   a. Hot Mix Asphalt:
      1) Copies of test results from tests conducted to assure compliance to Contract Document requirements.
   b. Asphalt Reinforcement Fiber:
      1) Provide Indirect Tensile (IDT) Strength Test results.

4. Manufacturer Instructions:
   a. Pre-Emergent Herbicide:
      1) Application instructions for pre-emergent herbicide.
   b. Asphalt Reinforcement Fibers:
      1) Hot Mix Asphalt Plant mixing instructions for asphalt reinforcement fibers.
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:
      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.
         2) Testing and Inspection Reports:
            a) Testing Agency Testing and Inspecting Reports of asphalt paving.

1.5 QUALITY ASSURANCE

A. Qualifications. Requirements of Section 01 4301 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.
   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.
   3. Testing Agency:
      a. Independent Testing Agency with experience and capability to conduct testing and inspecting indicated for in-place asphaltic cement concrete courses for compliance with requirements for thickness, compaction, and surface smoothness.
      b. Laboratory will hold certification of ASTM E329 issued by one of following accreditation agencies, and where required by authorities having jurisdiction, that is acceptable to authorities having jurisdiction (AHJ):
         1) Testing Laboratory:
            a) AASHTO Materials Reference Laboratory (AMRL) Accreditation Program.
            b) Nationally Recognized Testing Laboratory (NRTL): Nationally recognized testing laboratory according to 29 CFR 1910.7.
            c) 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.
            d) American Association of Laboratory Accreditation (A2LA.
         2) Test Results:
            a) Failing test results shall be provided immediately to Architect and Civil Engineer of Record.

B. Testing and Inspection:
   1. 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'.
      b. 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.

1) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.

1.6 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. Asphalt Reinforcement Fiber:
      a. Store fibers in dry environment.
      b. Do not allow contact with moisture.
      c. Keep sand and dust out of boxes.
   2. Pre-emergent herbicide:
      a. Do not freeze. Store in at temperatures above 41 deg F.
      b. Follow Manufacturer's storage and handling requirements.

1.7 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. 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 or will fall below 45 deg F during placement.
         2) Temperature of aggregate base below 50 deg F.
         3) Presence of free surface water or weather is unsuitable.
         4) Over-saturated aggregate base and subgrade materials.
         5) Wind or ground cools mix material before compaction.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. General:
   1. Follow Asphalt Institute SP-2: '*Superpave Mix Design'* for volumetric procedure.
   2. Paving to be designed for following loads for Smoother Surface Texture:
      a. Limit nominal maximum size aggregate to 9.5 mm (3/8 inch) and limit maximum size aggregate to 12.5 mm (1/2 inch). Gradation to meet Attachment **TABLE 1**.

         1) See Attachment **TABLE 1** for 'Master Grading Bands'.

B. Asphalt Mix Site Adapt Design:
1. Recycled Asphalt Pavement, RAP. Aggregate Restrictions include:
a. Allowed up to fifteen (15) percent by weight maximum providing grading, VMA and VFA are met with no change in specified binder grade.

C. Aggregate Within Asphalt Mix:
1. Aggregates:
a. Material:
1) Clean, hard, durable, angular, sound, consisting of crushed stone, crushed gravel, slag, sand, or combination.
2) Limit RAP per design criteria as specified in Part 1 of this specification.
b. Source: Use following requirements to determine suitability of aggregate source and not for project control:
1) Coarse Aggregate:
a) Angularity (fractured faces), ASTM D5821. At least one fracture as follows:
(1) Fifty five (55) percent minimum if ESAL's are less than 0.3 million.
(2) Eighty five (85) percent minimum if ESAL's are more than 0.3 million.
b) Hardness (toughness), ASTM C131/C131M: Retained above 2.36 mm sieve:
(1) Forty (40) percent maximum if ESAL's are less than 0.3 million.
(2) Thirty five (35) percent minimum if ESAL's are more than 0.3 million.
c) Flat and Elongated Particles, ASTM D4791:
(1) Twenty (20) percent maximum retained above 9.5 mm sieve has 3:1 length to width ratio.
2) Fine Aggregate:
a) Angularity, AASHTO T 304:
(1) Forty five (45) percent minimum uncompacted void content.
b) Friable Particles, ASTM C142:
(1) Two (2) percent maximum by weight passing 4.75 mm sieve.
c) Plasticity, ASTM D4318: (Aggregate passing 4.75 mm sieve is non-plastic even when filler material is added to aggregate):
(1) Liquid limit: 0.
(2) Plastic limit: 0.
2. Selection of Design Aggregate Structure:
a. Gradation: Maximum particle size is 1/4 compacted lift thickness:
1) Target Gradation Curve must lie within one of following Master Grading Bands:
a) Light: (ESAL <104 per year) N_{des} = 50:
(1) Class I: Parking lots, Driveways, light traffic residential streets, light traffic farm roads.
b) Medium: (ESAL between 104 and 106 per year) N_{des} = 75:
(1) Class II: Residential streets, rural farm and residential roads.
(2) Class III: Urban minor collector streets, rural minor collector roads.
2) If acceptable to Civil Engineer, use fractionalized proportioning to select or adjust gradation.

a) See Attachment **TABLE 1** for 'Master Grading Bands'.

b. Aggregate Blend:
1) Dry-Rodded Unit Weight:
a) Comply with ASTM C29/C29M: 75 lbs per cubic foot minimum.
2) Weight Loss (soundness):
a) Comply with ASTM C88: Sixteen (16) percent maximum using sodium sulfate.
3) Clay Content (cleanliness):
a) Comply with ASTM D2419: Sand equivalent value minimum of 45 after going through dryer or prior to drum mixer.
c. Admixture:
1) Antistrip: Heat stable, cement slurry, lime slurry, dry lime, or liquid antistrip.
a) Add if mix is moisture sensitive as determined by 'Moisture Susceptibility' paragraph below.
2) Mineral Filler: Comply with requirements of ASTM D242/D242M.
3) Recycle Agent: Comply with requirements of ASTM D4552/D4552M.

d. Reclaimed Asphalt Pavement (RAP). Aggregate: Restrictions include:
   1) Fifteen (15) percent by weight maximum providing grading, VMA and VFA are met.
   2) Greater than fifteen (15) percent requires separate mix design which includes binder design that indicates blend of RAP and Virgin binders that meet recommended SHRP binder grade specifications.
   3) Adjust pavement asphalt grade to account for RAP binder viscosity where greater than fifteen (15) percent RAP is used.

e. Selection of Mix Properties:
   1) Compaction:

      a) See Attachment **TABLE 2** for 'Compaction Parameters'.

3. Voids in mineral aggregate (VMA) at ^{N}design:

Nominal Maximum Size	Voids (VMA)
12.5 mm	14 – 16 percent
9.5 mm	15 percent minimum

4. Voids filled with asphalt (VFA) at ^{N}design:

20 Year Design ESAL's (million)	Voids Filled with Asphalt (VFA)
Less than 0.3	70 – 80 percent
0.3 to <3	65 – 78 percent

   a. For 9.5 mm nominal maximum size mixtures, specified VFA range is 73 percent to 76 percent for design traffic levels of 3 million ESAL's or greater.

5. Dust to Asphalt Ratio:
   a. 0.6 to 1.2 if aggregate gradation passes through or over restricted zone.
   b. 0.8 to 1.6 if aggregate gradation passes under restricted zone.
6. Moisture Susceptibility:
   a. Comply with AASHTO T 324 or AASHTO T 283 (tensile strength).
   b. Maximum rut depth is 15 mm at 10,000 passes.
   c. Tensile Strength Ratio (TSR) greater than 75 percent.

D. Asphalt Binder:
   1. Performance Graded Asphalt Binder:
      a. Meet requirements of Attachment – Table 3:

         1) See Attachment **TABLE 3** for 'Performance Grade Asphalt Binders'.

      b. As a rule of thumb, if two numbers in asphalt binder designation are added together and are greater than 90, then binder will most likely contain polymer or natural asphalt.

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

F. Asphalt Reinforcement Fiber:
   1. Description:
      a. High tensile strength synthetic fiber blend formulated to reinforce asphalt.
      b. By controlling thermal, reflective and fatigue cracking, as well as rutting, extends asphalt life.
      c. Used in all asphalt pavements including roadways and parking lots.
   2. Design Criteria - Comply with following fiber characteristics:
      a. Configuration:
         1) Fiber shall be a blend of fibrillated fibers and high-strength monofilament fibers.
      b. Chemistry:
         1) Fiber shall be made of aramid (monofilament) and polyolefin fibrillated fibers and other materials, known for their strength, durability, and binding properties.
      c. Contents:
         1) Fiber shall be used at minimum dosage rate of 1 lb per 1 ton of asphalt.

d. Correct Length:
1) Fiber length shall be 3/4 inch for surface course mixes.

3. Physical Properties:

a.	Materials	Polyolefin/Aramid.
b.	Length	3/4 inch Form Fibrillated and Monofilament Fibers.
c.	Color	Yellow, Black, Tan.
d.	Specific Gravity	0.91/1.44.
e.	Acid/Alkali Resistance	Inert.
f.	Tensile Strength	70,000 psi / 400,000 psi .
g.	Melting Temperature	212 deg F / 800 deg F.

4. Type One Acceptable Products:
a. FORTA-FI asphalt reinforcement fibers as manufactured by Forta Corporation, Grove City, PA www.forta-fi.com. Distributed by Alliance Geosynthetics, Inc.
1) Contact Information: phone (949) 610-6098, email - joseph@alliancegeo.com.
b. Equal as approved by Architect before installation. See Section 01 6200.

2.2 MATERIAL

A. 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.

B. Aggregate Base: Conform to applicable requirements as specified in Section 31 1123: 'Aggregate Base'.

C. Performance Graded Asphalt Binder:
1. Use PG XX-XX graded PGAB. Design Team to select Performance Grade Asphalt Binder to be used on Project.

D. 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.
1. Penetrating Seal as specified in Section 32 0113.01.

PART 3 - EXECUTION

3.1 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. Recompact 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. Pre-emergent herbicide:
a. Apply to prepared subgrade dispersed in liquid. Concentrate shall be such that Manufacturer's full recommended rate of chemical will be applied to every 1000 sq ft.
b. Application shall be no more than one (1) day before installation of granular road base.
4. Aggregate base:
a. Finish grade parking surface area to grades required by Contract Documents.
b. Compact aggregate base as specified in Section 31 1123.
c. Tolerances:
1) Elevation of aggregate base shall be 0.00 inches high and no more than 1/2 inch low.
2) Measure using string line from curb to curb, gutter, flat drainage structure, or grade break.
5. 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.
b. Cover all tacked surface areas with surfacing materials same day of application.
6. 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.

3.2 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. Soil Sterilant:
a. Asphalt paving areas:
1) Follow Manufacturer's printed application requirements:
2) 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 and liquid will penetrate minimum of 2 inches.
3) Application shall be no more than one (1) day before before installation of aggregate base.

C. Asphalt Reinforcement Fiber:
1. Batching and Mixing:
a. Follow Manufacturer's written instructions:
1) Add fiber manually or through specialized equipment that can accurately proportion or meter, by weight, proper amount per batch for batch plants, or continuously and in steady uniform manner for drum plants.
b. Batch Plant:

1) When batch plant is used, add fiber to aggregate in weigh hopper and increase both dry and wet mixing times.
2) Ensure that fiber is uniformly distributed before injection of asphalt cement into mixture.
3) Where warm mix technologies are used, remove fibers from bags.

c. Drum Plant:
1) When drum plant is used, inject fibers through RAP collar by placing 1 lbbags of fibers on RAP belt or by feeding them through blower tube.
2) Rate feeding of fibers with rate plant is producing asphalt mix.
3) For blower tube system, add fibers continuously in steady uniform manner. Provide automated proportioning devices and control delivery within plus or minus ten (10) percent of mass of fibers required. Perform equipment calibration to satisfaction of Fiber Manufacturer's Representative to show that fiber is being accurately metered and uniformly distributed into mix (visual inspection at discharge chute).
4) If there is evidence of clumps of fibers at discharge chute, increase mixing time and/or temperature or change angle of fiber feeder line to increase dry mixing time.

d. Have Fiber Manufacturer's Representative on site during first day of mixing and production. This requirement can be waived if fiber manufacturer and asphalt producer can supply evidence of manufacturer's brand of fiber having been successfully produced minimum of three (3) times at asphalt plant to be used for Project.

2. Fiber added at project site:
a. Follow Manufacturer's written instructions:
1) Add asphalt reinforcement fibers into hot mix asphalt concrete at rate of 1 lb per 1 ton of asphalt in accordance with manufacturer's recommendations.

D. 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.
2. Application rate. Typically as follows:
a. Emulsions, 0.08 to 0.15 gallons per sq yd 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.

E. Asphalt Paving:
1. General:
a. Paving adjacent to cast-in-place concrete site elements shall be between 1/4 inch 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.
d. Cross Slope: 1/4 inch in 10 feet perpendicular to centerline except at cross section grade breaks.
e. Grade: 1/8 inch in 10 feet 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 between 250 and 300 deg F with self-propelled laydown machine.

1) See Attachment **TABLE 4** for 'Minimum Temperature, Degrees'.

i. 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).
   1) Maximum total air voids in completed asphaltic concrete shall be eight (8) percent but more than three (3) percent as determined by ASTM D2041/D2041M (Rice Method - maximum theoretical density).
   2) Governing Standard of State where the Work is located.
b. Roll with powered equipment capable of obtaining specified density.
c. Begin breakdown rolling immediately after asphalt is placed when asphalt temperature is at maximum:
   1) Complete breakdown rolling before mix temperature drops below 240 deg F.
   2) Complete handwork compaction concurrently with breakdown rolling.
d. Complete intermediate rolling as soon as possible after breakdown rolling and before mix temperature drops below 185 deg F:
   1) Do not roll paving for compaction purposes after asphalt temperature falls below 185 deg F.
e. Execute compaction so visibility of joints is minimized:
   1) Complete finish rolling to improve asphalt surface as soon as possible after intermediate rolling and while asphalt paving is still warm.
   2) Do not use vibration for finish rolling.

3. Lift Thickness:
   a. Preferred Method:
      1) For pavements 3-1/2 inch or thinner apply asphalt paving in single lift.
      2) For pavements greater than 3-1/2 inch use alternate method below.
   b. Alternate Method:
      1) Asphalt paving may be applied in two (2) lifts, first 2 inches thick minimum and second 1 1/2 inches thick minimum following temperature recommendations of following paragraph.
      2) (Equipment, skill, and knowledge are required to place and compact asphalt before asphalt cools). Surface of first lift shall be clean and provide tack coat between first and second lifts, unless temperature of first lift is above 140 deg F. Maximum aggregate size is limited to 1/2 inch for this method.
      3) Asphalt must be placed quickly before it cools and cannot be compacted. Follow recommendations of Figure 9.4 'Time Allowed for Compaction, Based on Temperature and Thickness of Mat and Temperature of Underlying Base' on page 423 in MS-4, '*The Asphalt Handbook'*.
      4) Provide not less than 2 times maximum aggregate size in compacted asphalt concrete mixes.
   c. Provide not less than 4 times nominal maximum aggregate size in compacted Superpave™ mixes.
4. Roughness:

   a. See attachment **TABLE 5** for 'Roughness Tolerance'.

F. 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.
   1. Penetrating Seal as specified in Section 32 0113.01.

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

3.3 FIELD QUALITY CONTROL

A. Field Tests (Provided by Contractor):
   1. General:
      a. Quality Control is sole responsibility of Contractor as specified in Section 01 4523 'Testing And Inspection Services'.

b. 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.

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 or minus two (2) percent. Determine percent compaction by ASTM D2950/D2950M.
   d. 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.
3. Thickness Tests:
   a. Determine thickness of paving being placed, no less than one (1) test per 10,000 sq. ft. of paving or portion thereof, three (3) tests minimum.

B. Field Tests And Inspections (Provided by Owner):
1. General:
   a. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor:
      1) 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. or part thereof.
   f. Sub lot size: 5,000 sq. ft.or part thereof.
2. At Site Testing and Inspection:
   a. General:
      1) Sampling: One (1) random sample per sample per 10,000 sq. ft. 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 Fin 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 straight edge, surface of completed work shall not contain irregularities in excess of 1/4 inch.
         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. Select test locations by ASTM D3665 and sample per ASTM D979/D979M before compaction. Minimum of three (3) tests required.Asphalt paving shall be

compacted to ninety four (94) percent of Theoretical Maximum Specific Gravity (Rice) plus or minus two (2) percent.

d) 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.

e) Determine thickness of paving being placed, no less than one (1) test per 10,000 sq. ft. 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. or part there of.Minimum of three (3) tests required if under 30,000 sq. ft. .
         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 per ASTM D2041/2041M:

         See attachment **TABLE 6** for 'Compaction Pay Factors'.

   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. Minimum of three (3) tests required if under 30,000 sq. ft. .
         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 at fifty (50) percent. If not, remove and replace at no additional cost to the Owner.
         c) Thickness Pay Factor:

            See attachment **TABLE 7** for 'Thickness Pay Factors'.

   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.
   f. Dust to asphalt ratio.
   g. Asphalt Content, Aggregate Gradation:
      1) Lot is acceptable if test deviations are within pay factor 1.00 limits.
      2) At Civil Engineer's discretion, a Lot with sub-lot test deviation greater than pay factor 0.85 limits may stay in place at fifty (50) percent cost.
      3) See following table for pay factors for non-complying materials:

         See Attachment **TABLE 8** for 'Pay Factors for Non-Complying Materials'.

C. 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.

3.4 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.

3.5 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

ATTACHMENTS

PART 4 - ATTACHMENTS

4.1 TABLE 1

A. Master Grading Bands:

TABLE 1 – MASTER GRADING BANDS			
Sieve Size (mm)		Aggregate Grade	
		12.5	9.5
Control Sieves	37.5	-	-
	25	-	-
	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

NOTES:
1. Gradation in percent passing by weight, ASTM D4759.
2. It is assumed fine and coarse aggregate have same bulk specific gravity.
3. Percentage of fines passing 0.075 mm control sieve determined by washing per ASTM C117.

Less than 0.3 = parking lots, light traffic, residential streets
0.3 to 3 = collector roads (most county roads)

4.2 TABLE 2

A. Compaction Parameters:

TABLE 2 – COMPACTION PARAMETERS			
20 Year design ESAL's (Million)	**$N_{initial}$/ % of G_{mm}**	**N_{design}/ % of G_{mm}**	**N_{max}/ % of G_{mm}**
Less than 0.3	6 / ≤ 91.5	50 / 96	75 / ≤ 98
0.3 to <3	7 / ≤ 90.5	75 / 96	115 / ≤ 98

NOTES:

(a) N = Number of gyrations.
(b) Gmm = maximum specific gravity of mix, ASTM D2041/D2041M (Rice method)
(c) Specific gravity of specimen: AASHTO T 312.
(d) 20 year design ESAL's defined as follows:
Less than 0.3 = parking lots, light traffic, residential streets
0.3 to 3 = collector roads (most county roads)
(e) Design paving in parking areas for forty (40) year (minimum) service life.

TABLE 3

A. Performance Grade Asphalt Binder PG 58-22:

PG58-22		
ORIGINAL BINDER		AASHTO M 320
Dynamic Shear Rheometer, AASHTO T 315	@ 58º C, G*, kPa	1.00 kPa min.
	@ 58º C, phase angle, degrees	74.0 max.
Rotational Viscometer, AASHTO T 316	@ 135º C, Pa.s	3.0 Pa.s max.
Flash Point, AASHTO T 48	ºC	230 ºC min.
Rolling Thin Film Oven (RTFO) Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@ 58º C, G*, sinō, kPa	2.20 kPa min.
Elastic recovery, AASHTO T 301 mod	%	65 min.
Pressure Aging Vessel (PAV) Residue, 20 hours, 2.10 100º C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@ 22º C, kPa	5000 kPa max.
Bending Beam Rheometer, AASHTO T 313	@ -12º C, S, MPa	300 MPa max.
	@ -12º C, m-value	0.300 min.
Direct tension Test, AASHTO T 314	@ -12º C, Failure Stress, %	1.5 min.
	@ -12º C, Failure Stress (a) MPa	4.0 MPa min.
(a) No allowances will be given for passing at colder grade.		

B. Performance Grade Asphalt Binder PG 58-28:

PG58-28		
ORIGINAL BINDER		AASHTO M 320
Dynamic Shear Rheometer, AASHTO T 315	@ 58º C, G*, kPa	1.00 kPa min.
	@ 58º C, phase angle, degrees	74.0 max.
Rotational Viscometer, AASHTO T 316	@ 135º C, Pa.s	3.0 Pa.s max.
Flash Point, AASHTO T 48	ºC	230 ºC min.
Rolling Thin Film Oven (RTFO) Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@ 58º C, G*, sinō, kPa	2.20 kPa min.
Elastic recovery, AASHTO T 301 mod	%	65 min.
Pressure Aging Vessel (PAV) Residue, 20 hours, 2.10 100º C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@ 19º C, kPa	5000 kPa max.
Bending Beam Rheometer, AASHTO T 313	@ -18º C, S, MPa	300 MPa max.
	@ -18º C, m-value	0.300 min.
Direct tension Test, AASHTO T 314	@ -18º C, Failure Stress, %	1.5 min.
	@ -18º C, Failure Stress (a) MPa	4.0 MPa min.
(b) No allowances will be given for passing at colder grade.		

C. Performance Grade Asphalt Binder PG 58-34 Table:

PG58-34		
ORIGINAL BINDER		AASHTO M 320
Dynamic Shear Rheometer, AASHTO T 315	@ 58º C, G*, kPa	1.30 kPa min.
	@ 58º C, phase angle, degrees	74.0 max.
Rotational Viscometer, AASHTO T 316	@ 135º C, Pa.s	3.0 Pa.s max.
Flash Point, AASHTO T 48	ºC	260 ºC min.
Rolling Thin Film Oven (RTFO) Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@ 58º C, G*, sinō, kPa	2.20 kPa min.
Elastic recovery, AASHTO T 301 mod	%	65 min.
Pressure Aging Vessel (PAV) Residue, 20 hours, 2.10 100º C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@ 16º C, kPa	5000 kPa max.
Bending Beam Rheometer, AASHTO T 313	@ -24º C, S, MPa	300 MPa max.
	@ -24º C, m-value	0.300 min.
Direct tension Test, AASHTO T 314	@ -24º C, Failure Stress, %	1.5 min.
	@ -24º C, Failure Stress (a) MPa	4.0 MPa min.
(c) No allowances will be given for passing at colder grade.		

D. Performance Grade Asphalt Binder PG 64-22 Table:

PG64-22		
ORIGINAL BINDER		AASHTO M 320
Dynamic Shear Rheometer, AASHTO T 315	@ 64º C, G*, kPa	1.30 kPa min.
	@ 64º C, phase angle, degrees	74.0 max.
Rotational Viscometer, AASHTO T 316	@ 135º C, Pa.s	3.0 Pa.s max.
Flash Point, AASHTO T 48	ºC	260 ºC min.
Rolling Thin Film Oven (RTFO) Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@ 64º C, G*, sinō, kPa	2.20 kPa min.
Elastic recovery, AASHTO T 301 mod	%	65 min.
Pressure Aging Vessel (PAV) Residue, 20 hours, 2.10 100º C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@ 25º C, kPa	5000 kPa max.
Bending Beam Rheometer, AASHTO T 313	@ -12º C, S, MPa	300 MPa max.
	@ -12º C, m-value	0.300 min.
Direct tension Test, AASHTO T 314	@ -12º C, Failure Stress, %	1.5 min.
	@ -12º C, Failure Stress (a) MPa	4.0 MPa min.
(d) No allowances will be given for passing at colder grade.		

E. Performance Grade Asphalt Binder PG 64-28 Table:

PG64-28		
ORIGINAL BINDER		AASHTO M 320
Dynamic Shear Rheometer, AASHTO T 315	@ 64º C, G*, kPa	1.30 kPa min.
	@ 64º C, phase angle, degrees	74.0 max.
Rotational Viscometer, AASHTO T 316	@ 135º C, Pa.s	3.0 Pa.s max.
Flash Point, AASHTO T 48	ºC	260 ºC min.
Rolling Thin Film Oven (RTFO) Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@ 64º C, G*, sinō, kPa	2.20 kPa min.
Elastic recovery, AASHTO T 301 mod	%	65 min.
Pressure Aging Vessel (PAV) Residue, 20 hours, 2.10 100º C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@ 22º C, kPa	5000 kPa max.
Bending Beam Rheometer, AASHTO T 313	@ -18º C, S, MPa	300 MPa max.
	@ -18º C, m-value	0.300 min.
Direct tension Test, AASHTO T 314	@ -18º C, Failure Stress, %	1.5 min.
	@ -18º C, Failure Stress (a) MPa	4.0 MPa min.
(e) No allowances will be given for passing at colder grade.		

F. Performance Grade Asphalt Binder PG 70-28 Table:

PG70-28		
ORIGINAL BINDER		AASHTO M 320
Dynamic Shear Rheometer, AASHTO T 315	@ 70º C, G*, kPa	1.30 kPa min.
	@ 70º C, phase angle, degrees	74.0 max.
Rotational Viscometer, AASHTO T 316	@ 135º C, Pa.s	3.0 Pa.s max.
Flash Point, AASHTO T 48	ºC	260 ºC min.
Rolling Thin Film Oven (RTFO) Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@ 70º C, G*, sinō, kPa	2.20 kPa min.
Elastic recovery, AASHTO T 301 mod	%	65 min.
Pressure Aging Vessel (PAV) Residue, 20 hours, 2.10 100º C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@ 25º C, kPa	5000 kPa max.
Bending Beam Rheometer, AASHTO T 313	@ -18º C, S, MPa	300 MPa max.
	@ -18º C, m-value	0.300 min.
Direct tension Test, AASHTO T 314	@ -18º C, Failure Stress, %	1.5 min.
	@ -18º C, Failure Stress (a) MPa	4.0 MPa min.
(f) No allowances will be given for passing at colder grade.		

4.3 TABLE 4

A. Minimum Temperature, Degrees:

TABLE 4 – 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

4.4 TABLE 5

A. Roughness Tolerance:

TABLE 5 – ROUGHNESS TOLERANCE					
	Profile Roughness Index (PRI) Inches / Mile				
	IRI		PI		
Speed and Traffic Class	Min	Max	Min	Max	

0 to 29 mph 0 to 46 kph	I or II	---	---	---	---	0.4
	III or IV	129	177	46	66	0.4
30 to 44 mph 48 to 71 kph	I or II	90	115	35	50	0.4
	III or IV	70	90	21	35	0.4
45 mph 72 kph	All Classes	---	70	---	21	0.3

Notes:

(a) Use a zero blanking band.
(b) As a minimum, trace right wheel path in direction of travel.
(c) Traffic class is defined in Table 1 of this Section
(d) IRI (International Roughness Index), ASTM E950/E950M.
(e) PI (Profile Index), ASTM E1274.

4.5 TABLE 6

A. Compaction Pay Factors:

TABLE 6 – COMPACTION PAY FACTORS (Theoretical Maximum Specific Gravity (Rice) as per ASTM D2041/D2041M)		
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: a. 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.. Sub-lot will be accepted if average rut depth is less than 10 mm at 20,000 passes.		

4.6 TABLE 7

A. Thickness Pay Factors:

TABLE 7 – 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

4.7 TABLE 8

A. Pay Factors for Non-Complying Materials:

TABLE 8 – PAY FACTORS FOR NON-COMPLYING MATERIALS

Criteria	Pay Factor	Range of Mean of Deviations of Tests Results from Design Mix Target in Percentage Points			
		500 Tons (508 Metric Tonne)	**1,000 Tons** (1,016 Metric Tonne)	**1,500 Tons** (1,524 Metric Tonne)	**≥ 2,000 Tons** (2,032 Metric Tonne)
Asphalt Content	1.00	0.0 – 0.7	0.0 – 0.54	0.0 – 0.46	0.0 – 0.41
	0.975	0.71 – 0.8	0.55 – 0.61	0.47 – 0.52	0.42 – 0.46
	0.95	0.81 – 0.9	0.62 – 0.68	0.53 – 0.58	0.47 – 0.52
	0.90	0.9 – 1.0	0.69 – 0.75	0.59 – 0.64	0.53 – 0.56
	0.85	1.01 – 1.1	0.76 – 0.82	0.65 – 0.69	0.57 – 0.61
≥ 12.5 mm Sieve	1.00	0.0 – 10.0	0.0 – 7.3	0.0 – 6.3	0.0 – 0.56
	0.975	11.0 – 12.0	7.4 – 8.3	6.4 – 7.1	5.7 – 6.3
	0.95	13.0 – 13.9	8.4 – 9.3	7.2 – 7.9	6.4 – 7.0
	0.90	14.0 – 14.9	9.4 – 10.3	8.0 – 8.7	7.1 – 7.7
	0.85	15.0 – 16.0	10.4 – 11.3	8.8 – 9.5	7.8 – 8.4
9.5 mm Sieve	1.00	0.0 – 9.9	0.0 – 6.9	0.0 – 5.9	0.0 – 5.3
	0.975	10.0 – 10.9	7.0 – 7.8	6.0 – 6.6	5.4 – 5.9
	0.95	11.0 – 11.9	7.9 – 8.7	6.7 – 7.3	6.0 – 6.6
	0.90	12.0 – 13.9	8.8 – 9.6	7.4 – 8.0	6.7 – 7.2
	0.85	14.0 – 15.0	9.7 – 10.5	8.1 – 8.9	7.3 – 7.9
4.75 mm Sieve	1.00	0.0 – 9.9	0.0 – 6.7	0.0 – 5.7	0.0 – 5.2
	0.975	10.0 – 10.9	6.8 – 7.6	5.8 – 6.3	5.3 – 5.8
	0.95	11.0 – 11.9	7.7 – 8.5	6.4 – 6.9	5.9 – 6.4
	0.90	12.0 – 12.9	8.6 – 9.4	7.0 – 7.5	6.5 – 7.0
	0.85	13.0 – 14.0	9.5 – 10.2	7.6 – 8.0	7.1 – 7.6
2.36 mm Sieve	1.00	0.0 – 7.9	0.0 – 5.6	0.0 – 4.8	0.0 – 4.3
	0.975	8.0 – 8.9	5.7 – 6.3	4.9 – 5.4	4.4 – 4.8
	0.95	9.0 – 9.9	6.4 – 7.0	5.5 – 6.0	4.9 – 5.3
	0.90	10.0 – 10.9	7.1 – 7.7	6.1 – 6.6	5.4 – 5.8
	0.85	11.0 – 12.0	7.8 – 8.5	6.7 – 7.2	5.9 – 6.4
0.075 mm Sieve	1.00	0.0 – 3.0	0.0-2.4	0.0 – 2.0	0.0 – 1.8
	0.975	3.1 – 3.5	2.5 – 2.7	2.1 – 2.2	1.9 – 2.0
	0.95	3.6 – 4.0	2.8 – 3.0	2.3 – 2.4	2.1 – 2.2
	0.90	4.1 – 4.5	3.1 – 3.3	2.5 – 2.7	2.3 – 2.4
	0.85	4.6 – 5.0	3.4 – 3.6	2.8 – 3.0	2.5 – 2.6

NOTES:

(a) Test bitumen content using a burn-off oven as per ASTM D6307.
(b) Test aggregate gradation of each sub-lot as per ASTM D5444.
(c) Mean of deviations is defined as sum of absolute values of deviations divided by number of tests performed for lot.
(d) If mean of deviations of test results for lot is greater than 0.85 pay factor, pay factor is 0.50. This applies only if Civil Engineer does not order removal of material.

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.
         2) Testing and Inspection Reports:
            a) Reports showing compliance.

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 or above115 deg F.
    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 and rising.
        c. Temperature shall not drop below 50 deg F 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 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) Dry-through (early washout) for Type II only.
h) Flexibility.
i) Freeze/thaw stability.
j) Heat-shear stability.
k) Scrub resistance.
l) Skinning.
m) Titanium dioxide content.
n) 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. Plus or minus 1/4 inch variance on straight segments.
      b. Plus or minus 1/2 inch 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 – NO CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install landscape 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 32 9001: 'Common Planting Requirements'.
      a. Pre-installation conference held jointly with other common planting related sections.
   6. Section 32 9120: ‘Topsoil And Placement’ for topsoil evaluation and placement required for topsoil grading.
   7. Section 32 9122: ‘Topsoil Grading’ for preparation of topsoil and addition of amendments prior to landscaping.
   8. Section 32 9223: 'Sodding'.
   9. Section 32 9300: 'Plants'.

1.2 REFERENCES

A. Definitions:
   1. Dielectric Fittings: Special type of fitting used between dissimilar metals to prevent galvanic action from causing corrosion failure.
   2. High Wind Area: As defined in this specification, area with average sustained wind speed of over 7.5 mph (12 km/hr).
   3. 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.
   4. Lateral Line: Downstream from electric control valves to application devices, heads and emitters. Piping or tubing is under pressure during flow. In areas where potable or secondary water are used, line shall be white. In areas where non-potable or reclaimed water are used, line shall be purple.
   5. 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, line shall be white. In areas where non-potable or reclaimed water are used, line shall be purple.
   6. 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.
   7. Plant Establishment Period: See Section 32 9001 for definition.
   8. Point of Connection: Location where water enters irrigation system.
   9. Static Water Pressure: Pressure at point of connection when system is not operable.
   10. Source Pressure Test: Test to determine water source pressure.
   11. System Pressure Test: Test to evaluate system when pressurized.
   12. 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 Landscape Architect or designated Representative(s), plan and provide walk through after completion of irrigation system.
d. Landscape Final Acceptance: Inspection, no less than thirty (30) days following substantial completion, when all work has been completed, demonstrated, and approved by Landscape Architect. Coordinate with Section 32 8466 and Section 32 9000.

B. Pre-Installation Conference:
1. Participate in pre-installation conference as specified in Section 32 9001 held jointly with following sections:
a. Section 32: 8466: 'Underground Sprinklers: Controllers'.
2. Schedule pre-installation conference before irrigation system installation begins:
a. In addition to agenda items specified in Section 01 3100, review following:
1) Review mockup requirements.
2) Review required tests and inspections and submittal requirements.

C. Sequencing:
1. Install sleeves and conduit 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. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Submittal Format: Digital format only.
b. Record Documentation:
1) Provide manufacturer's printed literature and cut sheets for each element of system.
2) Certificates:
a) Irrigation System Approval.
b) Training Acknowledgement.
3) Testing and Inspection Reports:
a) System Pressure Test.
4) Irrigation Record Drawings. As installation occurs, prepare accurate record drawing to be submitted before final inspection, including:
a) Detail and dimension changes made during construction. Record at time of installation.
b) Significant details and dimensions not shown in original Contract Documents.
c) Field dimensioned locations of valve boxes.
d) Take dimensions from permanent constructed surfaces or edges located at or above finish grade.
e) Take and record dimensions at time of installation.
5) Photographs: Provide photographs prior to burial of key elements including but not limited to:
a) Valves.
2. Irrigation Drawings:

a. Irrigation Plan:
1) Laminated reduced size:
a) Size: 11 by 17 inches (275 by 425 mm).
b) Show color key circuits and laminated both sides with 5 mil thick or heavier plastic.
c) Mount on 12 by 18 inch (300 by 450 mm) hard board drilled with two (2) 1/2 inch (13 mm) holes at top of board.
d) Hang on hooks in Custodial Room or location designated by Owner's Representative.

3. 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. 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.

C. Mockups:
1. Provide Mockups of each detail within valve box at staging area for review by Landscape Architect prior to installation of irrigation system.
2. These mockups may be installed with or without solvent weld cement so that they can later be used in field.
3. Mockups shall include complete installation including weed barrier fabric, gravel sump, equipment assembly, and valve box placement and branding in conformance with these specifications.

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. In addition to standard one (1) year guarantee stipulated in General Conditions Article 12.2., warranty shall include:

1) Filling and repairing depressions and replacing plantings due to settlement of irrigation system trenches.

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. Carson by Oldcastle Enclosure Solutions, Auburn, WA www.oldcastleenclosures.com.
   d. Nibco Inc, Elkhart, IN www.nibco.com.
   e. Paige Electric, Union, NJ www.paigewire.com.
   f. Rain Bird Sprinkler Manufacturing Corp, Glendora, CA www.rainbird.com.
   g. T. Christy Enterprises, Inc. (Christy's), Anaheim, CA www.tchristy.com.
   h. VAF Filtration Systems, Arvada, CO www.vafusa.com.
   i. Wilkins a Zurn Company, Paso Robles, CA www.zurn.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, Section 32 9121, 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 shown on Contract Drawings are minimum. Larger sizes may be substituted at no additional cost to Owner.
   b. Piping:
      1) Main Line: Existing schedule 40 PVC.
      2) Lateral Lines: Schedule 40 PVC.
   c. Fittings: Same material as pipe, except where detailed otherwise.
      1) Use dielectric union fittings between dissimilar metal pipes and fittings.
   d. Sleeves:
      1) Schedule 40 PVC Pipe.
      2) Sleeve diameter shall be two (2) times larger than pipe installed in sleeve.
8. Sprinkler Heads:
   a. Each type of head shall be product of single manufacturer.
   b. Rotor Pop-ups:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Rainbird: 5000/5000 plus MPR series (25'-35').
9. Sprinkler Risers:
   a. Rotor Pop-Up Sprinklers (Pre-Manufactured Assemblies):
      1) Type Two Acceptable Products:

a) 3/4 inch (19 mm) rotor pop-up sprinklers shall have an adjustable pre-assembled swing assembly riser. Swing assemblies shall be 3/4 inch x 12 inch (19 mm x 300 mm) and shall be threaded both ends. Swing assemblies shall be:
(1) Rain Bird: Model TSJ-12075.
(2) Hunter: SJ-712 12 inch (305 mm) thread.
2) Equal as approved by Architect before installation:
b. Rotor Pop-Up Sprinkler Heads (Field Manufactured Assemblies):
1) Pop-up rotor sprinkler heads shall have adjustable riser assembly, three (3) ell swing joint assembly, unless detailed otherwise on Contract Drawings:
a) These swing joint fittings shall be of schedule 40 PVC plastic and nipples schedule 80 gray PVC unless otherwise designated on Contract Drawings.
b) Horizontal nipple parallel to side of lateral line shall be 8 inches (200 mm) long minimum.
c) All other nipples on swing joint riser shall be of length required for proper installation of sprinkler heads.
c. Backflow Preventer: Existing
10. Drip System:
a. 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 required).
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.
b. Drip Emitters:
1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) Rainbird: XBT Series and PCT Series (2, 5, 7, 10 gph emitters).
11. 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.
12. Other Components:
a. Weed Barrier:
1) Type Two Acceptable Products:
a) DeWitt 4.1 oz (116 g) 20 year woven polypropylene weed barrier
b) Hanes Pro-Platinum 4.1 oz (116 g) 20 year woven polypropylene weed barrier.
c) Equal as approved by Landscape Architect before bidding. See Section 01 6200.
b. Recommended by Manufacturer and subject to Architect's review and approval before installation.
c. Provide components necessary to complete system and make operational.

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. 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, Section 32 9121 and Section 32 9122.
   4. Do not cover pressure main, irrigation pipe, or fittings until Architect has inspected and approved system.

B. Sleeving:
   1. Sleeve water lines under walks. Extend sleeves 6 inches (150 mm) minimum beyond walk or pavement edge. Cover sleeve ends until pipes 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. Installation of Pipe:

1. Install pipe in manner to provide for expansion and contraction as recommended by Manufacturer.
2. Install lateral lines, including those connecting drip tubing, with minimum of 12 inches (300 mm) of cover based on finish grade.
3. Locate pipe so no sprinkler head will be closer than 12 inches (300 mm) from building foundation.
4. Cut plastic pipe square. Remove burrs at cut ends before installation so unobstructed flow will result.
5. 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.
6. Tape threaded connections with teflon tape.

D. Sprinkler Heads And Rotor Pop-ups:
1. Set sprinkler heads 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.

E. 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. 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.
6. 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.

F. 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. Irrigation System:
   a. System Pressure Test:
2. 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 Landscape 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.

3. Irrigation Approval:
a. Irrigation will be approved 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.
a. Describe difference between plant establishment schedule and long-term maintenance schedule.
b. Describe annual and regular filter maintenance.

B. Winterization and Spring Start-Up:
1. During first year of operation, Installer shall shut-down irrigation system prior to freezing temperatures and re-start irrigation system at beginning of growing season:
a. Winter Shut-Down is intended to remove all potentially damaging water from irrigation system. Perform following as well as any other efforts necessary to properly winterize system:
1) Turn off water source at point of connection.
2) Blow out system with pressurized air, turning on each valve until water is cleared out of system. Run through system twice. Only blow out components suitable to receive pressurized air. Hydrometers, for instance, should not be blown out. Do not use excessive air pressure that will damage pipes and parts.
3) Turn controller off.
4) Open all manual drain valves.
5) Drain, wrap, protect, or remove any backflow device exposed to freezing temperatures using manufacturer’s recommendations and best practices. Coordinate method with Owner’s Representative.
6) Drain and remove pumps for Owner’s Representative storage.
7) Drain filters using manufacturer’s recommendations.
8) Check sprinkler heads to make sure they are below sidewalk and curb levels and not vulnerable to snowplow damage. Lower heads to proper elevation.
9) Notify Owner’s Representative when system has been turned off.
b. Spring start-up shall include following:
1) Close all manual valves.

2) Clean pump filters and replace if necessary.
3) Remove freeze protection as required.
4) Turn on water source at point of connection.
5) Verify that controller(s) and rain sensor are properly operating. Change battery in controller(s) and sensor(s) as required.
6) Flush entire system. Run each valve for two (2) minutes to check for damage, leaks, and coverage.
7) Repair and adjust system as needed. Fine tune heads for efficient coverage.
8) Notify Owner's Representative when system has been charged and is in full repair.

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. Pre-Installation conferences held jointly with Section 32 9001 as described in Administrative Requirements on Part 1 of this specification section:
   2. Section 01 4301: 'Quality Assurance – Qualifications'.
   3. Section 31 0501: ‘Common Earthwork Requirements’.
   4. Section 31 1100: ‘Clearing and Grubbing’.
   5. Section 31 2213: ‘Rough Grading’.
   6. Section 31 2216: 'Fine Grading'.
   7. Section 31 2316: ‘Excavation’.
   8. Section 31 2323: ‘Fill’.
   9. Section 32 8423: 'Underground Sprinklers'.
   10. Section 32 9120: ‘Topsoil And Placement’.
   11. Section 32 9122: ‘Topsoil Grading’.
   12. Section 32 9223: 'Sodding'.
   13. Section 32 9300: 'Plants'.

1.2 REFERENCES

A. Definitions:
   1. Landscape Final Acceptance: Inspection, no less than (30) days following substantial completion, when all work has been completed, demonstrated, and approved by the Landscape Architect. Coordinate with Sections 32 8423 and Sections under 32 9000 ‘Planting’.
   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 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference and held jointly with following sections:
      a. Section 32 8423: 'Underground Sprinklers'.
      b. Section 32 9120: ‘Topsoil And Placement’.
      c. Section 32 9122: ‘Topsoil Grading’.
      d. Section 32 9223: 'Sodding'.
      e. Section 32 9300: 'Plants'.
   2. In addition to agenda items specified in Section 01 3100, review the following:
      a. Site Visits:
         1) Landscape Architect to visit site five (5) times during project construction.
         2) If site conditions necessitate additional visits, Landscape Architect can schedule addition site visits with approval from Architect prior to bid.
         3) During construction, addition site visits may be approved in writing by Architect or Owner for special considerations before commencement.

4) Site visits caused by lack of work progress by Landscape Subcontractor shall reimburse Landscape Architect amount determined by Architect or Owner for additional site visits.

b. Coordination:
1) Landscape Subcontractor and Landscape Architect to coordinate site visits and include Architect and General Contractor in communications.

c. Landscape Maintenance:
1) Establish responsibility for maintenance of new landscaping during all phases of construction period.

d. Percolation Test:
1) Prepare two (2) typical landscape planting excavations and conduct percolation test to verify that water drains away within two (2) hours.
2) Discuss results of percolation tests with Architect and Owner's Representative.

e. Review additional agenda items as specified in related sections listed above.

3. Approved Site Visits:
a. Site Visit No. 1:
1) Description:
a) Landscape pre-installation Conference.
2) Schedule: Conduct pre-installation conference after completion of Fine Grading specified in Section 31 2216, but one (1) week minimum before beginning landscape work.
3) Required Attendees:
a) Project Manager, Facilities Manager, Architect, General Contractor, Landscape Subcontractor, Excavator, and Landscape Architect.
b) Include Landscaping Subcontractor Foreman and those responsible for installation of landscaping to be in attendance.
4) Related Sections:
a) Section 31 0501: 'Common Earthwork Requirements'.
b) Section 32 8423: 'Underground Sprinklers'.
c) Section 32 9120: ‘Topsoil And Placement’.
d) Section 32 9122: ‘Topsoil Grading’.
e) Section 32 9223: 'Sodding'.
f) Section 32 9300: 'Plants'.
5) Notes:
a) Verify project site conditions and review scope of work before installation begins.
b) Verify appropriate sub-grades have been established.

b. Site Visit No. 2:
1) Description:
a) Valve inspection.
2) Schedule: Conduct site visit one (1) week minimum after notification before beginning irrigation system pressure test.
3) Required Attendees:
a) General Contractor, Landscape Subcontractor, Landscape Architect.
4) Recommended Attendees:
a) Project Manager, Facilities Manager.
5) Related Sections:
a) Section 32 8423: 'Underground Sprinklers'.
b) Section 32 9120: ‘Topsoil And Placement’.
c) Section 32 9122: ‘Topsoil Grading’.
6) Notes:
a) Verify finish grading in preparation for planting.

c. Site Visit No. 3:
1) Description:
a) Inspect and approve plant quality, plant quantity, plant pits, plant pit backfill, planting depths, and removal of packaging/distribution materials, wire, and ties.
2) Schedule: Conduct site visit one (1) week minimum after notification from Contractor before beginning site visit no. 3.
3) Required Attendees:
a) General Contractor, Landscape Subcontractor, Landscape Architect.
4) Recommended Attendees:
a) Project Manager, Facilities Manager.
5) Related Sections:

a) Section 32 9300: 'Plants'.
6) Notes:
a) Inspect irrigation system installation, inspect weed barrier fabric.
d. Site Visit No. 4:
1) Description:
a) Comprehensive Substantial Completion inspection prior to beginning thirty (30) day Landscape Subcontractor maintenance period.
2) Schedule: Conduct site visit one (1) week minimum after notification before beginning site visit no. 4.
3) Required Attendees:
a) Project Manager, Facilities Manager, Architect, General Contractor, Landscape Subcontractor, Landscape Architect.
4) Related Sections:
a) Section 32 8423: 'Underground Sprinklers'.
b) Section 32 9300: 'Plants'.
5) Notes:
a) Verify contract requirements have been followed including but not limited to: planting compliance, irrigation system coverage and irrigation system operation.
e. Site Visit No. 5:
1) Description:
a) At the end of thirty (30) day Landscape Subcontractor maintenance period, verify deficient items have been corrected and verify no others exist.
2) Schedule: Conduct site visit one (1) week minimum after notification before beginning site visit no. 5.
3) Required Attendees:
a) Project Manager, Facilities Manager, Architect, General Contractor, Excavation Subcontractor, Landscape Subcontractor, Landscape Architect.
4) Related Sections:
a) Section 32 8423: 'Underground Sprinklers'.
b) Section 32 9300: 'Plants'.

1.4 SUBMITTALS

A. Informational Submittals:
1. Special Procedure Submittals:
a. Installer to provide two (2) copies of following recommendations to be included in Closeout Submittals:
1) Landscape maintenance recommendations.
2) Individual landscape maintenance recommendations.
3) Plant establishment maintenance recommendations.
4) Post-plant establishment maintenance recommendations.
2. 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 certificate for 'Plant Establishment Period' acknowledgement.
2) Submit one (1) copy of recommendations specified in Special Procedure Submittals.
3) 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.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Post-Emergent Weed Control:
      a. Products shall be recognized for intended use by AHJ.
   2. Invasive and Non-native plants:
      a. Comply with all applicable laws governing invasive and non-native plants.

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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage 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 for 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 damaged plantings within (10) days of notification at no additional cost to Owner.
   2. Repair damage to irrigation, ground lighting, utilities, paving, 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 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 for thirty (30) continuous days minimum after Substantial Completion. If maintenance period is interrupted by non-growing season or irrigation winter shut-down, begin maintenance period after start of growing season as agreed with Architect, and continue one (1) continuous month therefrom.
   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 being 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 9122.

C. Shrubs, And Plants:
   1. Maintain by pruning, cultivating, and weeding as required for healthy growth.
   2. Restore planting basins.
   3. .
   4. Spray as required to keep 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. Includes But Not Limited To:
   1. Perform topsoil evaluation and placement required prior to topsoil grading 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':
      a. Pre-installation conference held jointly with other common planting related sections.
   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))’.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 32 9001.
   2. In addition to agenda items specified in Section 01 3100 and Section 32 9001, review following:
      a. Review finish grade elevation and tolerance requirements.
      b. Review surface preparation requirements including disking, tilling, ripping, or aerating.

1.4 SUBMITTALS

A. Informational Submittals:
   1. Testing And Evaluation Reports:
      a. Use ‘Topsoil Testing Report’ attachment to this specification for Topsoil Testing as specified in 'Field Quality Control' in Part 3 of this specification for imported and site topsoil and account of recent use:
         1) Owner will pay for one (1) final test.
         2) Additional test(s) if necessary will be paid by Contractor.
         3) Submit two (2) copies of Final ‘Topsoil Testing Report’ approved by Landscape Architect to be included with Closeout Submittals.
   2. Field Quality Control Submittals:
      a. Submit report stating location of source of imported topsoil and account of recent use.
      b. Submit delivery slips indicating amount of physical amendments delivered to Project site.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Submit one (1) copy Final approved ‘Topsoil Testing Report’.

2) Provide report stating location of source of imported topsoil and account of recent use.

PART 2 - PRODUCTS

2.1 MATERIALS 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 9121 'Physical Preparation' and Section 32 9122 ‘Topsoil Grading’ and if required by these specifications prior to placement.
   3. Receive approval from Landscape Architect of subgrade elevations prior to commencement of this Work.

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 soil amendments required in Section 32 9121 'Topsoil Physical Preparation' and in Section 32 9122 ‘Topsoil Grading’. Installer of this section responsible for providing sufficient topsoil material.

C. 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.

D. 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.

E. 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

ATTACHMENTS

Topsoil Testing Report

Project	Name		Property Number
	Site Street Address, City, State/Province		
Person Submitting Test	Name	Date Requested	Phone
	Address, City, State/Province		Fax
Soil Testing Laboratory	Name	Date Submitted	Phone
	Address, City, State/Province		Fax

General

1. Owner will pay for pre-bid testing and one (1) final topsoil test.

Landscape Architect Instructions

1. Landscape Architect shall determine by investigation quality and quantity of topsoil on site before landscape design. Add physical and fertility recommendations from laboratory recommendations to relevant Church specifications.

Contractor Instructions

1. Test installed topsoil. Installed topsoil shall comply with Project Specifications.
2. If installed topsoil does not comply, Contractor will enhance and test at no cost to Owner until installed topsoil complies with Project Specifications.

Testing Instructions

1. Collect at least two (2) samples of on-site topsoil and each anticipated topsoil source. If site soil profile or borrow pit are not uniform, additional samples shall be taken. Uniform composite samples may also be used if properly acquired and documented.
2. Submit required soil samples to soil testing laboratory along with all required (for this report and laboratory) information.

Soil Testing Laboratory Instructions

1. This report must be completely filled out and provide soil interpretation and amendment, fertilizer, and soil conditioner recommendations for use by Landscape Architect. These recommendations should consider lawn areas, tree and shrub areas, and native plant areas.
2. Provide appropriate times for fertilizing.
3. Return completed Topsoil Testing Report to person submitting the test.

SOIL SAMPLE LOG		
Soil Sample No.	Description of location where sample was taken	History of use of the soil

Existing Conditions Test Report

("Acceptable Levels" refers to the allowable soil specifications prior to being amended)

SOIL TEST DATA												
Sample No.	pH(1)	EC[1] Mmhos/cm	SAR[1]	% Sand	% Silt	% Clay	Text[2] Class	%[3] OM	NO3-N[4] ppm	P[5] ppm	K[5] ppm	Fe[5] Ppm
Acceptable Level(s)	5.5 - 8.4	<3.0	<6.0	15-60	10-60	5-30	(2)	>1.0	>20	>11	>130	>10

[1] Saturated soil paste 1:1 soil:water method (please Indicate)

[2] Hydrometer method (Acceptable soil- sand:15-60 percent, silt:10-60 percent, clay-5-30 percent)

[3] Potassium dichromate method (Walkey-Black) or loss of ignition

[4] Chromotropic acid method

[5] AB-DTPA method

If other methods are used for NO3-N, P, K, and Fe, then note.

ROCKS (Coarse Fragments)		
Sample No.	Percent > 1/4 inch (6.4 mm)	Rocks Present ≥ 1.5 inch (38 mm) Indicate as present or not present
	percent	
	percent	
Acceptable Level	≤ 5.0 percent	< 1.5 inch (38 mm)

Landscape Area Description

Lawn Areas: Receive 5 inch (125 mm) topsoil plus recommended amendments and fertilizers.

Shrub/Tree Areas: Unless otherwise indicated, plant pits are to be backfilled with three (3) parts native soil and one part compost or other recommended amendments. Additionally, contractor will add recommended fertilizer.

Native Grass/Shrub/Tree Areas: Planting to receive minimum recommended amendments and fertilizers for establishment.

INFILTRATION RATE	
Documented Infiltration rate of test sample(s) based on texture at 90 percent relative density (to nearest 1/10th of an inch)	
Sample No.	Rate
	Inches/Hour
	Inches/Hour

Interpretation Summary of Test Results:

Soil Amendments, Fertilizer and Soil Conditioner – Recommendations:

Lawn Areas

Shrub/Tree Areas

Native Grass/Shrub/Tree Areas

Long Term (5 Year) Fertilizer and Soil Conditioner – Recommendations:

Lawn Areas

Shrub/Tree Areas

Native Grass/Shrub/Tree Areas

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':
      a. Pre-installation conference held jointly with other common planting related sections.
   4. Section 32 9120: ‘Topsoil And Placement’ for topsoil evaluation and placement required for topsoil grading.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 32 9001.
   2. In addition to agenda items specified in Section 01 3100, review the following:
      a. Review compost requirements to be within acceptable range as per Attachment 'Compost Quality Guidelines For Landscaping' and 'Compost Verification Report' in this specification.
      b. Review soil fertility amendments and fertilizer requirements as per Attachment 'Topsoil Testing Report' in Section 32 9120.

1.3 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

2.1 MATERIALS

A. Soil Amendments:
1. Incorporate following soil amendments into topsoil used for Project:
a. Acceptable Soil Amendments And Application Rates.
1) 'Compost': Apply an organic material (compost, etc.) at 5 cu yds/1000 sq ft for every 5" of topsoil depth. Incorporate well. See the Compost Quality Guidelines for Landscaping, attached. Or, apply a similar product at label rate following manufacturer's recommendation for soil preparation.

2.2 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'.

2.3 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 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.
2. Addition of Soil Amendments:
a. Apply an organic material (compost, etc.) at 5 cu yds/1000 sq ft for every 5" of topsoil depth. Incorporate well. See the Compost Quality Guidelines for Landscaping, attached. Or, apply a similar product at label rate following manufacturer's recommendation for soil preparation.

2.4 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. Sodded Areas: 2 inches (50 mm) below.
   b. 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.

2.5 PROTECTION

A. After landscape areas have been prepared, take no heavy objects over them except lawn rollers.

END OF SECTION

ATTACHMENTS

COMPOST QUALITY GUIDELINES FOR LANDSCAPING

[Source: Von Isaman MS, President of QA Consulting and Testing LLC, Dr. Rich Koenig, USU Cooperative Extension Soils Specialist, and Dr. Teresa Cerny, USU Cooperative Extension Horticulturalist, 3 March 2003]

Category	pH[a]	Soluble Salts[a] dS/m or mmho/cm	Sodium Adsorption Ratio[a] (SAR)	Carbon Nitrogen Ratio[b] (C:N)	Percent Moisture[c]	≥ 98 percent Coarse Material Passing (dry wt basis)
Ideal	6 to 8	≤ 5	< 10	≤ 20:1	25 to 35	3/8 inch (9.5 mm)
Acceptable	5-6, 8-9	≤ 10	≤ 20	21:1 to 30:1	< 25, > 35	3/4 inch (19 mm)
Suspect	< 5, > 9	> 10	> 20	<10:1, > 30:1	< 20, > 50	< 98 percent 3/4 inch (19 mm)

[a] 1.5 Compost: Water Slurry on Coarse Material passing 3/8 inch (9.5 mm).
[b] on Coarse Material passing 3/8 inch (9.5 mm).
[c] on Total Sample

For composts with biosolid feedstocks, biosolids must meet EPA 503 Class A standard.

Acceptable level Soluble Salts and/or SAR composts should not exceed 3 cu yds (2.29 cu m) /1,000 sq ft (93 sq m) for every 3 inches (76 mm) of soil depth.

COMPOST VERIFICATION REPORT

	pH[a]	Soluble Salts[a] dS/m or mmho/cm	Sodium Adsorption Ratio[a] (SAR)	Carbon Nitrogen Ratio[b] (C:N)	Percent Moisture[c]	≥ 98 percent Coarse Material Passing (dry wt basis)
Results						

See Compost Quality Guidelines for Landscaping for footnote references.

I hereby certify that the Compost meets Ideal or Acceptable requirements as set forth in COMPOST QUALITY GUIDELINES FOR LANDSCAPING as listed with the COMPOST VERIFICATION STATEMENT. If Compost does not fall within this range, explain why and justify.

_____

_____

_____

_____

Signature: _____ Printed Signature: _____

Date: _____

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. 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.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conference as specified in Section 32 9001.

1.4 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Approval 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:
      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’.
   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 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. Plant Establishment Period: See Section 32 9001 for definition.
   5. 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’.
   2. American National Standard Institute / Tree Care Industry Association (TCIA):
      a. ANSI A300 (Part 1)-2017 Pruning, ‘American National Standard for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning)’.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 32 9001.

1.4 SUBMITTALS

A. Action Submittals:
   1. Samples:
      a. Top dressing mulch for approval before delivery to site.

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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Deliver shrubs 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 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 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 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.

1.6 WARRANTY

A. Special Warranty:
   1. Provide written warranties as follows:
      a. Warranty will extend thirty (30) continuous days minimum after Substantial Completion. If a continuous first thirty (30) days of the warranty period is interrupted by non-growing season or irrigation winter shut-down, begin warranty period after start of growing season as agreed on with Architect. Thereafter, continue warranty per the period described herein.
      b. Warranty shrubs to live and remain in strong, vigorous, and healthy condition for 90 days minimum from date of Substantial Completion and meet or exceed material standards set forth in Materials heading of Part 2 of this specification.

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 prior to delivery.
   c. Plant materials shall be subject to approval by Landscape Architect as to size, health, quality, and character.
   d. 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. Where caliper or other dimensions of plant materials are omitted from Plant List, plant materials shall be normal stock for type listed.
   e. 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, or other amendment recommended in 'Topsoil Testing Report'.

B. 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.

C. Weed Barrier:
   1. Type Two Acceptable Products:
      a. DeWitt 4.1 oz (116 g) 20 year woven polypropylene weed barrier.
      b. Hanes Pro-Platinum 4.1 oz (116 g) 20 year woven polypropylene weed barrier.
      c. Equal as approved by Landscape Architect before bidding. See Section 01 6200.

D. Bark Or Wood Top Dressing Mulch:
   1. Type Two Acceptable Products:
      a. Shredded pine bark.
      b. 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. Remove and replace tree plant material if roots are loose, significantly circling, significantly asymmetrical or damaged.

B. Layout individual tree and shrub locations and areas for multiple plantings:
   1. Stake locations and outline areas.
   2. Secure Landscape Architect's approval 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 r 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. Fill landscape excavations with tamped planting mix:
a. Compact in 6 inch (150 mm) lifts.
b. Settle by watering to ensure top of root ball is one inch (25 mm) higher for shrubs than surrounding soil following compaction and settling.
6. Do not use muddy soil for backfilling.
7. Make adjustments in positions of plants as directed by Landscape Architect.
8. Thoroughly water shrubs immediately after planting.

D. Shrub Pruning:
1. Prune shrubs to remove dead, broken, and split branches in conformance with ANSI A300 (Part 1) Pruning.

E. 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 Landscape Final Acceptance.

F. 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.

G. 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