STANDARD SPECIFICATIONS

All work on this project shall be constructed in accordance with the "Standard Specifications for Road and Bridge Construction", (most recent edition), adopted by the Department of Transportation (IDOT), State of Illinois, the most recent "Supplemental Specifications and Recurring Special Provisions" from IDOT, and the "Standard Specifications for Water and Sewer Main Construction in Illinois", ISPE, most recent edition – except where superseded by the following Supplementary Specifications.

SUPPLEMENTARY GENERAL CONDITIONS

The following Supplementary General Conditions Supplement the Standard Specifications and the General Conditions for Construction and Maintenance Work at Oakton Community College.

CONSTRUCTION STAKING

1.0 GENERAL

1.1 Line and grade staking: The CONTRACTOR shall be responsible for all construction staking, and shall provide such ordinary labor as may be required by the Engineer to check lines and grades and make other necessary measurements.

1.2 The frame elevations will be set based on actual finished elevation of the surrounding surface or other existing control and are subject to minor adjustment at no additional cost to the College.

1.3 The work shall be constructed to the lines, grades, and cross sections indicated on the Contract Drawings, unless otherwise directed by the Engineer. The Engineer reserves the right to make changes in the lines, grades and cross sections as may be deemed necessary during the progress of the work. Such minor changes in the line and grade shall not change the payment to the Contractor for such work.

1.4 All improvements shall be true both horizontally and vertically.

END

SUBMITTALS AND SUBSTITUTIONS

1.0 GENERAL

1.1 DESCRIPTION:

1.1.1 Work Included:

1.1.1.1 Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined by manufacturer's name and catalog number, referenced to recognized industry and government standards, or description of required attributes and performance.

1.1.1.2 To ensure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advance submittal of design data and for their review by the Engineer.

1.1.1.3 Make all submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.

1.2 QUALITY ASSURANCE:

1.2.1 Coordination of Submittals: Prior to each submittal, carefully review and coordinate all aspects of each item being submitted and verify that each item and the submittal for it conforms in all respects with the requirements of the Contract Documents. By affixing the Contractor's signature to each submittal, certify

that this coordination has been performed.

1.2.2 Certificates of Compliance:

1.2.2.1 Certify that all materials used in the work comply with all specified provisions thereof. Certification shall not be construed as relieving the contractor from furnishing satisfactory materials if, after tests are performed on selected samples, the material is found to not meet specified requirements.

1.2.2.2 Show on each certification the name and location of the work, name and address of Contractor, quantity and date or dates of the shipment or delivery to which the certificate applies, and name of the manufacturing or fabricating company. Certification shall be in the form of letter or company-standard forms containing all required data. Certificates shall be signed by an officer of the manufacturing or fabricating company.

1.3 REQUIRED SUBMITTALS:

1.3.1 Submit Shop Drawings and Manufacturer's Literature for each of the following:

1.3.1.1 Hot Mix Asphalt Mix Designs – As specified in contract documents
1.3.1.2 Concrete Mix Designs – As specified in contract documents
1.3.1.3 All other submittals as required in Special Provisions and Technical Specifications

END

TESTING LABORATORY SERVICES

1.0 GENERAL

1.1 DESCRIPTION:

1.1.1 Work Included: Throughout the construction the Project Engineer may require the Contractor to perform testing of various materials or installed items. The Contractor shall provide all material and assistance needed to perform inspection and testing required under pertinent other sections of these specifications.

1.1.2 Work included in this Section: The testing company must be approved by the Project Engineer. Hot Mix Asphalt nuclear density testing is required for all patching operations. It is anticipated that a testing company will need to be on-site for a few hours that day that patching operations are done. Plant testing of hot-mix asphalt materials will not be required (as long as the material is from an approved IDOT source). This testing shall be paid for by the contractor and is incidental to the pay items.

a) Asphalt Testing in accordance with IDOT specifications.

2.0 PROCEDURES

2.1 COOPERATION WITH TESTING LABORATORY: Representatives of the testing laboratory shall have access to the work at all times. Provide facilities for such access in order that the laboratory may properly perform its function.

2.2 CONDUCT OF INSPECTING:

2.2.1 Notification: To permit the Project Engineer to schedule testing services, notify the Project Engineer not less than 48 hours in advance when testing will be required.

2.2.2 Reimbursement of Testing Costs: When Project Engineer has dispatched personnel to witness inspection or testing, and the inspecting or testing has been delayed without proper notification to the Project Engineer, the contractor shall reimburse all associated costs arising by virtue of lack of notification.

END

SITE PROTECTION AND ACCESS

1.0 GENERAL

1.1 The proposed improvements have been located to facilitate access to the work and to prevent damage to planting and other areas outside the limits of work. The Contractor is not permitted to stockpile material or equipment in any area off the project site unless he has received approval to do so from the Project Engineer and property owners in writing.

1.2 All areas which have been disturbed during the construction, for which a specific proposal item has not been established, shall be incidental to the contract. All items to be replaced shall be replaced in similar kind to that which was removed.

1.3 All traffic controls, barricades, flagmen, or anything else necessary for construction of the improvements shall be provided by the Contractor and incidental to the contract. The following guidelines shall be adhered to by the Contractor unless written permission to deviate from these guidelines is secured in advance from the Project Engineer.

1.3.1 Twenty-four hours prior to closing or blocking any lanes or sidewalks, the Contractor shall notify Oakton Community College as to the schedule and duration of the restriction or closing.

1.3.2 At least one lane sufficient and appropriate for vehicular passage shall be maintained on all streets during working hours. All excavations, stockpiles, spoil piles, and equipment must be adequately protected by moveable barricades with operating flashing lights.

1.4 Access via local roadways is limited to loads permitted or posted. Use of these roadways shall be at direction of the Engineer and the City of Des Plaines.

1.5. Barricades, warning signs and flagged-off-areas must be established to warn individuals of the construction modifications. Alternative parking, drive and access must be provided by the Contractor prior to any closure during these site improvements.

1.6 All construction traffic must access the site via Golf Road.

END

CLEANING

1.0 GENERAL

1.1 SAFETY CLEANING:

1.1.1 Safety Cleaning: The contractor is responsible for safety cleaning, which includes but is not limited to the following:

1.1.1.1 Keep work areas free of dirt, rubbish, debris and scrap.

1.1.1.2 Backfill progressively after any underground utility installation.

1.1.1.3 Remove spills of oil, grease, or other liquids immediately or sprinkle with sand.

1.2 PROGRESS CLEANING:

1.2.1 The Contractor shall remove his rubbish and debris from site promptly upon its accumulation, and prior to general cleanup.

1.2.2 The Contractor shall make daily cleaning of adjacent roadways before leaving the construction site at the end of each work day. Cleaning may be required more frequently if excessive mud buildup of over one-half inch (1/2") occurs. The Contractor must completely remove dirt from roadway and shall not simply push it to the shoulder or curb. IDOT Permit requirements and safety concerns may require more frequent cleaning.

1.3 DUST

1.3.1 If, during the process of work, the work areas become dusty due to vehicle traffic in these work areas, the Engineer may order the placement of calcium chloride or washing the street, or both. This activity is considered incidental to the contract work and is not an extra pay item.

1.4 FINAL CLEANING:

1.4.1 Immediately prior to substantial completion, the Contractor shall perform thorough cleaning so as to put all such work in a complete and finished condition ready for acceptance and the use intended.

END

PROJECT RECORDS

1.0 GENERAL

1.1 During progress of the work, the contractor shall maintain on the job site one (l) set of drawings upon which he shall keep an accurate record of final location of each completed part of the work. The Project Engineer will review this record set of drawings each week and will advise the Contractor if final positions are within the tolerance required for proper design.

1.2 Upon completion of all work called for herein, the Contractor's final marked set of prints shall be turned over to the Project Engineer with other drawings called for in the Contract Documents.

END

STORM WATER MANAGEMENT AND EROSION CONTROL PLAN

1.0 GENERAL

All areas of the site must drain freely during the project. Blockage of normal or emergency flow will not be permitted, although pumping of normal flow and groundwater is anticipated. The purpose of this provision is to avoid unnecessary property damage.

END

SPECIAL PROVISIONS

The following Special Provisions supplement the "Standard Specifications for Road and Bridge Construction", adopted January 1, 2012, the "Supplemental Specifications and Recurring Special Provisions", adopted January 1, 2012 (as indicated on the check sheet included herein) and the latest edition of the Illinois Manual on Uniform Control Devices for Streets and Highways", in effect on the date of invitation for proposals, and the current edition of the "Standard Specifications for Watermain and Sewer Construction in Illinois". These Special Provisions included herein apply to and govern the proposed improvement and, in case of conflict with any part or parts of said specifications, said special provisions shall take precedent and shall govern.

SPECIAL PROVISIONS

A. START OF CONSTRUCTION / CONSTRUCTION SCHEDULE

The construction schedule for the project will be as follows:
Notice to Proceed: September 20, 2023
Project Substantial Completion Date: May 1, 2023

B. TIME OF COMPLETION

Final completion dates for all work on this project has been specified as **June 1, 2023**

C. NOTIFICATION

The College requires 48 hours' notice in advance of any roadway or parking lot closures.

D. EXCESS SPOILS/DEMOLTION

The project will generate excess spoils that need to be removed from the site at the contractor's expense to an offsite location chosen and paid for by the contractor. The contractor is responsible for obtaining CCDD clearance for all spoils removed from the site. The College at the College's expense will retain a 3rd party soils consultant to perform the CCDD testing. For purposes of the base bid, the contractor can assume all of the spoils will meet CCDD guidelines for typical non-contaminated disposal. The bid sheet contains a line item for special disposal to a special waste handler for any contaminated spoils that may be encountered which will be paid on a CY basis.

As part of the demolition, all material generated including but not limited to existing paver blocks, concrete walks, concrete benches, landscaping, electrical components shall be removed from the site at the contractor's expense to an offsite location chosen and paid for by the contractor.

F. PLANS AND SPECIFICATIONS ATTACHED COVER THE SCOPE OF WORK

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

SECTION 015639

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:
   1. Construction Drawing Sheets
   2. Specifications:
      a. 31 10 00 “Site Clearing”
      b. 31 20 00 “Earth Moving”
      c. 32 93 00 “Exterior Plantings”

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at a height 6 inches (150 mm) above the ground for trees up to and including 4-inch (100-mm) size at this height and as measured at a height of 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.

B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape or the average of the smallest and largest diameters at a height 54 inches (1372 mm) above the ground line for trees with caliper of 8 inches (200 mm) or greater as measured at a height of 12 inches (300 mm) above the ground.

C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, other vegetation, or soil zones to be protected during construction and indicated on Drawings.

D. Tree-Protection Area: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
b. Arborist's responsibilities.
c. Quality-control program.
d. Coordination of Work and equipment movement with the locations of protection zones.
e. Trenching by hand or with air spade within protection zones.
f. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.7 QUALITY ASSURANCE

A. Arborist Qualifications: Licensed arborist in jurisdiction where Project is located.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

1.8 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Stockpiled soil mixed with planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

B. Organic Mulch: Free from deleterious materials and suitable as a temporary cover for exposed roots or heeled-in plant material, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.
3. Color: Natural.

C. Plant Protection Fence: Fencing fixed in position and meeting the following requirements:

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and weighing a minimum of 0.4 lb/ft. (0.6 kg/m);

remaining flexible from minus 60 to plus 200 deg F (minus 16 to plus 93 deg C); inert to most chemicals and acids; minimum tensile yield strength of 2000 psi (13.8 MPa) and ultimate tensile strength of 2680 psi (18.5 MPa); secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches (2400 mm) apart.

a. Height: 48 inches (1200 mm).
b. Color: Green, nonfading.

2. Gates: Double- swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 24 inches (610 mm).

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches (1372 mm) above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Landscape Architect. Install one sign spaced approximately every 20 feet (6 m) on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Maintain protection-zone fencing and signage in good condition as acceptable to Landscape Architect and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to plans.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. **Do not use** a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends.

3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible.

B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches (300 mm) outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

B. Unless otherwise directed by arborist and acceptable to Landscape Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

F. Chip removed branches and legally dispose of off-site.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Landscape Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 66 percent dead or in an unhealthy condition or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 4 inches (100 mm) or smaller in caliper size.
2. Large Trees: Provide two new tree(s) of 4-inch (100-mm) caliper size for each tree being replaced that measures more than 4 inches (100 mm) in caliper size.

    a. Species: As selected by Landscape Architect.

3. Plant and maintain new trees as specified in Section 329300 "Exterior Plantings."

C. Soil Aeration: Where directed by Landscape Architect, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch- (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 03 31 00

CAST-IN-PLACE CONCRETE FOR LANDSCAPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete required to complete the work indicated on all the project construction drawings.

B. Work includes:

1. Curbs
2. Footings

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans.

1.3 SUBMITTALS

A. Product Data: Submit preprinted data for each type of manufactured material and product demonstrating compliance requested by the Landscape Architect.

B. Design Mixes: Submit design mix for each concrete mix. Include field test data used to establish the required average strength in accordance with ACI 301. Review of design mixes and field test data will be for general information only. Production of concrete to comply with specified requirements is the responsibility of the contractor. Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until each mix has been reviewed by the Engineer.

1. Indicate amounts of mix water to be withheld for later addition at Project site.

C. Shop Drawings:

1. Steel Reinforcement Shop Drawings: Submit details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

F. Publications: Comply with the latest edition of the following, except as modified by the Contract Documents. Maintain a copy of the latest edition of ACI 301, 117, 318, and 347 at the project site at all times. Where provisions of the above codes and standards are in conflict with the building code in force for the Project, the building code shall govern.

1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
2. ACI 301, "Standard Specification for Structural Concrete."
3. ACI 302, “Guide for Concrete Floor and Slab Construction.”
4. ACI 305, “Hot Weather Concreting”
5. ACI 306 , “Cold Weather Concreting”
6. ACI 308, “ Standard Practice for Curing Concrete”
7. ACI 318 “ Building Code Requirements for Structural Concrete”
8. ACI 347 “ Recommended Practice for Concrete Formwork”
9. ASTM C494 Standard Specification for Chemical Admixtures for Concrete
10. AWS D12.1 “Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction.”
11. CRSI “Manual of Standard Practice.”

G. Concrete Testing Service: The Owner will employ a testing laboratory to perform initial field quality control testing.

1. Materials and installed Work may require testing and retesting, at anytime during the progress of the Work. Allow free access to material stockpiles and facilities at all times. Tests, not specifically indicated to be done at the Owner's expense, including the retesting of rejected materials and installed Work, shall be done at the Contractor's expense.

H. Pre-Concrete Conference

1. Conduct a meeting to review the detailed requirements for preparing the concrete design mixes and to review the drawings, specifications, and the project.
2. Require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

a. Contractor’s superintendent
b. Laboratory responsible for the concrete design mix

c. Laboratory responsible for the field quality control
d. Concrete subcontractor
e. Landscape Architect
f. Boards Authorized Representative

3. Type and print minutes from the meeting and distributed to all parties within 5 days of the meeting.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Avoid damaging coatings on steel reinforcement.

1.6 PROJECT CONDITIONS

A. Before commencing work, examine all adjoining work on which this work is in any way dependent for proper installation and workmanship and report to the Contractor any condition which prevents performing first class work.

B. Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.

C. Protect adjacent finish materials against spatter during concrete placement.

D. Provide all barricades and safeguards at all pits, holes, shaft and stairway openings, and the like. Provide all safeguards as required by authorities having jurisdiction. Take full responsibility for safety precautions and methods.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Formed Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Rust-free metal.
2. Exterior-grade undamaged, unpatched plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.
b. Structural 1, B-B, or better, mill oiled and edge sealed.
c. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.

3. Architecturally Exposed Concrete: Medium-density overlay, class 1 or better, mill-release agent treated and edge sealed.

B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes. Construct paper of fiber tubes of laminated plies using

water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist plastic concrete loads imposed by concrete without deformation.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of the exposed concrete surface.
2. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Deformed-Steel Wire: ASTM A 496.

E. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A coated, plain-steel wire.

F. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

1. Welded wire fabric maybe used in lieu of carbon steel fibers for interior slabs on grade and interior elevated concrete topping on metal deck when acceptable to the Architect.

G. Epoxy-Coated Welded Wire Fabric: ASTM A 884/A 884M, Class A, plain steel.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
4. Do not use wood, masonry, concrete or other similar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

C. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars.

D. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 755M.

E. Mechanical Reinforcement Couplers: ASTM A-519, Minimum tensile strength 100,000 psi

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I. Type III cement may be used in lieu of Type I at Contractor's option, when acceptable to the Architect.

1. Use only one brand of cement throughout project, except as otherwise indicated.

B. Fly Ash: ASTM C618, Class C or F

C. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:

1. Class: Severe weathering region, but not less than 3S.
2. Nominal Maximum Aggregate Size: 3/4 inch (19 mm) unless otherwise indicated.

D. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride thiocyanates or admixtures containing more than 0.1 percent chloride ions.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F.

2.6 VAPOR RETARDERS

A. Vapor Retarder: ASTM E 1745, Class C, of one of the following materials; or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick. Use only materials which are resistant to decay when tested in accordance with ASTM E 154:

1. Nonwoven, polyester-reinforced, polyethylene coated sheet; 10 mils (0.25 mm) thick.
2. Three-ply, nylon- or polyester-cord-reinforced, laminated, high-density polyethylene sheet; 7.8 mils (0.18 mm) thick.

2.7 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Drinkable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.8 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm).

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5700 psi (39 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Provide a minimum 28 day compressive strength of 4000 psi (27.7 MPa) and a maximum water-cementitious material ratio of 0.44, unless otherwise indicated.

D. Curbs: Proportion normal-weight concrete mix as follows unless otherwise indicated:

1. Compressive Strength (28 Days): 4000 psi (27.6 MPa) with a maximum water cementitious material ratio of 0.44 (non air-entrained).
2. Maximum Slump at point of placement: 4 inches (100 mm).
3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches (200 mm) after admixture is added to concrete with 2- to 4-inch (50- to 100-mm) slump.

E. Cementitious Materials:

1. For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements.
2. For all other concrete, limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

a. Fly Ash: 25 percent by weight.

F. Air Content: Use air-entraining admixture in exterior exposed concrete. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:

1. Air Content: 6 percent for 3/4-inch (19-mm) nominal maximum aggregate size.

G. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

H. Steel-Fiber Reinforcement: Add to concrete mix, according to manufacturer's written instructions at a rate indicated on the drawings but not less than 25 lb/cu. yd.

I. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

J. Prepare design mixes for each type and strength of concrete by either laboratory trial batch of field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to the Architect for preparing and reporting proposed mix designs.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice." In the case of fabrication errors, do not re-bend or straighten reinforcement.

B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the Work:

1. Bar lengths, depths or bends exceeding specified fabrication tolerances.
2. Bends or kinks not indicated on the Drawings or final Shop Drawings
3. Bars with reduced cross section due to excessive corrosion or other cause.
4. Bars with damaged corrosion resistive coating (if specified).

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads within acceptable deflection limits.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets,

chamfers, blocking, screeds, bulkheads, anchorages, ind inserts, and other features required.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3 mm), for surfaces predominantly exposed to public view.
2. Class B, 1/4 inch (6 mm), for course-textured concrete formed surfaces intended to receive plaster, stucco, or wainscoting.
3. Class C, 1/2 inch (13 mm). for all other surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete with ¾” x3/4” strips (unless otherwise indicated) accurately formed and surfaced to produce uniform straight lines and tight edges. Unexposed corners may be formed square or chamfered.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items, including those under separate prime contracts (if any).

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with non-staining, rust preventative form-release agent, according to manufacturer's written instructions, before placing reinforcement. Rust stained steel formwork is not acceptable.

M. Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces of accurate alignment, from irregularities and within allowable tolerances

N. Elevate formwork as required for anticipated deflections due to weight and pressures of fresh concrete, shortening of formwork system, and construction loads.

O. Carefully inspect falsework and formwork during and after concrete placement to determine abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimensions.

P. Form intersecting planes to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.

Q. Forms for exposed Concrete:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes.
2. Do not use metal cover plates for patching holes or defects in forms.
3. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersection.
4. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance of concrete. Do not use narrow strips of form material that will produce bow.
5. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required.
2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved 28-day design compressive strength.

C. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.

1. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

D. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

E. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions and as follows:

1. Use sheets as large as practical. Overlap minimum 6” and tape. Tape to perimeter and to projections.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. At a spacing not to exceed 4’-0” on center in either direction. For slabs on grade, use supports not to exceed 4’-0” o.c. with sand plates or horizontal runners where base material will not support chair legs.
2. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least two mesh spacings. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Landscape Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls at not more than 60 feet in any horizontal direction. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Pre-Placement Inspection:

1. Before concrete placement, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems. During concrete placement, check formwork and related supports to ensure that forms are not displaced and that completed Work will be within specified tolerances.
2. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts involved in ample time to permit the installation of their Work; cooperate with other trades in setting such Work, as required.
3. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.
4. Soil at bottom of foundation systems are subject to testing for soil bearing value by the testing laboratory, as directed by the Architect. Place concrete immediately after approval of foundation excavations.
5. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
6. Remove soil, debris, standing water, ice, snow, loose mill scale or coating and other foreign matter from formwork and metal deck.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless indicated on trip ticket.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
2. Do not apply rubbed finish to smooth-formed finish.

C. Rubbed Finish: Apply one of the following to finished concrete exposed to view including the backs of curb and gutters adjacent to bioretention areas:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part Portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 MISCELLANEOUS CONCRETE ITEMS

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

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

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

3.10 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301, ACI 306.1 for cold-weather protection, and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive resilient sheet floor coverings. Cure concrete surfaces to receive other floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.11 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval. Comply with ACI 301.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and

apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of five standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39

    a. Test two specimens at 7 days, two at 28 days and one at 56 days if 28-day compressive strength has not yet been obtained.
    b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

C. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

D. Test results shall be reported in writing to Landscape Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Landscape Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Landscape Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

G. Defective Work: Concrete work which does not conform to the specified requirements, including strength, tolerances, and finishes, shall be corrected at the Contractor's expense without extension of time . The contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

END OF SECTION

SECTION 055213

METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Tubular steel railings, posts, and frames,

B. Related Requirements:
1. Section 033100 Cast in Place Concrete for Landscape

1.3 COORDINATION

A. Prefabrication Meeting: contractor to engage in initial meeting with Engineer to determine sequencing of fabrication, installation, storage, delivery, welding and painting of all components to be reviewed and approved by the Engineer prior to fabrication.

B. Coordinate selection of primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that primers and topcoats are compatible with one another.

C. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

D. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Railing brackets, plates, rails, fasteners and anchors.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Contractor to provide full, complete coordinated railing shop drawings for all applications. Drawings to include all necessary plans, elevations, sections, details, attachments to other work and analysis data as per the drawings and specifications.

C. Samples: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including top rails, posts, and balusters.
2. Fittings and brackets.
3. Paint – include full color range available from manufacturer for selection including all finishes.
4. Assembled Sample of railing system, made from full-size components, including top rail, post, and infill. Sample need not be full height.

a. Show method of connecting and finishing members at intersections.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Mill Certificates: Signed by manufacturers of steel products certifying that products furnished comply with requirements.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

E. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

F. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Pipe and Tube Railings:

1. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces).

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with predrilled hole for exposed bolt anchorage.

2.4 STEEL AND IRON

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates Shapes, and Bars: ASTM A 36/A 36M.

D. Perforated Metal: Cold-rolled steel sheet, ASTM A 1008/A 1008M, or hot-rolled steel sheet, ASTM A 1011/A 1011M, commercial steel Type B, 0.25" thick, [with 3/8-inch holes 5/8 inch o.c. in staggered rows] .

2.5 FASTENERS

A. General: Provide the following:
   1. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

D. Post-Installed Anchors: Adhesive anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

   1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy [Group 1 (A1)] [Group 2 (A4)] stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Zinc Primer: Fast-curing, high solids, low VOC coating, primer and compatible with intermediate coat and topcoat.

   1. Use primer containing pigments that make it easily distinguishable from intermediate coating.

   2. Sherwin Williams: Zinc Clad II Plus applied per the manufacturers recommended installation instructions. See product info sheet enclosed.

C. Intermediate Epoxy Coating: Fast cure epoxy, high solids, coating compatible with primer and topcoat.

1. Use epoxy containing pigments that make it easily distinguishable from topcoating.

2. Sherwin Williams: Macropoxy 646 applied per the manufacturers recommended installation instructions. See product info sheet enclosed.

D. Polyurethane Topcoat: hi-solids polyurethane, two-component, low VOC aliphatic, acrylic polyurethane resin coating and compatible with intermediate coat and primer system.

1. Sherwin Williams: Hi-Solids Polyurethane coating applied per the manufacturers recommended installation instructions. See product info sheet enclosed.

E. Adhesive Anchoring System: Factory-packaged, nonstaining, noncorrosive, nongaseous complying with ASTM standards. Provide specifically recommended by manufacturer for exterior applications.
1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads].

B. Shop assemble railings and primer to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Form Changes in Direction as Follows:

1. As detailed by flush cuts or by radius bends to match boardwalk layout.

J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members as detailed.

L. Brackets, Flanges, Fittings, and Anchors: Provide brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.8 STEEL AND IRON FINISHES

A. Galvanized Railings:
1. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
2. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry. Delete first subparagraph below if only one shop primer for uncoated steel is specified.

E. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces in the shop after fabrication is completed. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for painting in the shop. Apply at spreading rates recommended by coating manufacturer.

1. Color: As selected by Engineer from manufacturer's full range. Submit samples for review.
2. Finish: As selected by Engineer as either High Gloss or Semi-Gloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine to verify that locations of reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 9 inches beyond joint on either side, fasten internal sleeve securely.

3.4 ANCHORING POSTS

A. Use metal anchor rods anchored into concrete for installing posts in concrete. Fill annular space between bolt and concrete with adhesive system placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 6 inches deep. Clean holes of loose material, insert bolts, and fill annular space between bolt and concrete with adhesive system placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

D. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

E. Anchor posts to metal surfaces with floor type as required by conditions, connected to posts and to metal supporting members as follows:
   1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

1. Per drawings and specifications.

3.6 PAINTING

A. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces in the shop after fabrication is completed. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for painting in the field or shop. Apply at spreading rates recommended by coating manufacturer.

3.7 ADJUSTING AND CLEANING

A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint.

3.8 PROTECTION

3.9 Protect finishes of railings from damage during construction period with temporary protective coverings approved by Owners Rep. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 05 73 16
CABLE RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Steel railings with cable infill and stainless steel toprail.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.

B. American Welding Society (AWS):
   1. AWS Specifications for Welding Rods and Bare Electrodes.

C. ASTM International (ASTM):
   1. ASTM A36 - Carbon Structural Steel.
   2. ASTM A47 - Specification for Ferritic Malleable Iron Castings.
   3. ASTM A48 - Specification for Gray Iron Castings.
   4. ASTM A53 - Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless.
   5. ASTM A269 - Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   6. ASTM A276 - Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
   7. ASTM A312 - Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
   8. ASTM A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   9. ASTM A512 - Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing.
   10. ASTM A525 - Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
   11. ASTM A526 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
   12. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   13. ASTM A1264-1 - Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems
   14. ASTM B221 Specification for Aluminum-Alloy Bars, Rods, Wires, Shapes and Tubes.
   15. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
   16. ASTM E894 - Standard Test Methods for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
   17. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

18. ASTM E985 - Specification for Permanent Metal Railing Systems and Rails for Buildings.

D. International Code Council (ICC):
1. International Building Code (IBC).

1.3 DEFINITIONS

A. Refer to definitions in ASTM E985 for railing-related terms that apply to this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General: Handrails and railings shall withstand structural loading as determined by allowable design working stresses of materials.

B. Structural Performance: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections.
1. Components and installation shall be in accordance with state and local code authorities.
2. Components and installation shall follow current ADA and ICC/ANSI A117.1 guidelines.
3. Top Rail: Shall withstand the following loads.
a. Concentrated load of 200 lb (0.89 kN) applied at any point and in any direction.
b. Uniform load of 50 lb/ft. (0.07 kN-m) applied horizontally and concurrently with uniform load of 100 lb/ft. (0.14 kN-m) applied vertically downward.
c. Concentrated and uniform loads above need not be assumed to act concurrently.
4. Handrails Not Serving as Top Rails: Shall withstanding the following loads.
a. Concentrated load of 200 lb (0.89 kN) applied at any point and in any direction.
b. Uniform load of 50 lb/ft. (0.07 kN-m) applied in any direction.
c. Concentrated and uniform loads above need not be assumed to act concurrently.
5. Guard Infill Area: Shall withstand the following loads.
a. Concentrated horizontal load of 200 lb (0.89 kN) applied to 1 square foot (0.09 m2) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Loads need not be assumed to act concurrently with loads on top rails in determining stress on guard.

C. Thermal Movements: Handrails and railings shall allow for movements resulting from 120 deg F (49 deg C) changes in ambient and 180 deg F (82 deg C) surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

D. Corrosion Resistance: Separate incompatible materials to prevent galvanic corrosion.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's data sheets on each product to be used, including, but not limited to, the following:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Grout, anchoring cements and paint products.

B. Shop Drawings: Submit shop drawings showing fabrication and installation of handrails and railings. Include plans, elevations, sections, details, and attachments to other work.
   1. Provide setting diagrams for installation of anchors, location of pockets, weld plates for attachment of rails to structure, and blocking for attachment of wall rail.
   2. Indicate all required field measurements to be held.
   3. Indicate materials, sizes, styles, fabrication, anchorage and installation details for railing system and infill.

C. Certifications:
   1. Furnish certification that all components and fittings are furnished by the same manufacturer or approved by the primary component manufacturer.
   2. Furnish certification that components were installed in accordance to the manufacturer's engineering data to meet the specified design loads.

D. Samples:
   1. Post and rail sections, minimum 4 inch (100 mm) long piece of each type.
   2. lnfill Cable: Minimum 8 inch (200 mm) long piece with end fittings.
   3. Verification Samples: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
      a. 6 inches (152 mm) long sections of each different linear railing member, including handrails and top rails.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of aluminum handrails and railings of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 5 years.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Installer Qualifications: Minimum 2 years experience installing similar systems.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Install one complete railing including infill panel at location selected by Engineer.
   2. Obtain Engineer’s approval prior to installing additional railings.
   3. Refinish mock-up area as required to produce acceptable work.

4. Approved sample may remain as part of completed work.

E. Pre-Installation Meeting:
1. Prior to the beginning of work, conduct a pre-job conference at the job site.
2. Provide seven calendar days advance written notice ensuring the attendance by competent authorized representatives of the fabricator, building owner's representative, architect and subcontractors whose work interfaces with the work of this section.
3. Review the specifications to determine any potential problems, changes, scheduling, unique job site conditions, installation requirements and procedures and any other information pertinent to the installation.
4. Record the results of the conference and furnish copies to all participants.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 WARRANTY

A. Special Warranty: Provide manufacturer's standard form outlining the terms and conditions of their standard Limited Warranty:
1. Cable and Connectors: 10 year limited warranty against defects in materials and workmanship.
2. Paint Finish on Steel Components: 10 year limited warranty against cracking, flaking, blister, and peeling.

B. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.10 EXTRA MATERIALS

A. Provide one approximately 3 ounce (85 grams) can, of touch-up paint per 100 feet (30.5 m) of each color of railing as applicable.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Stainless Cable & Railing Inc., which is located at: 4055 S. Grant St.; Washougal, WA 98671; Toll Free Tel: 888-686-7245 (RAIL); Fax: 888-686-7245; Email: james.andrews@stainlesscablerailing.com , or approved equal.

2.2 STEEL RAILINGS WITH CABLE INFILL

A. Steel Railings with Cable Infill.
1. Mounting: Top (Deck) Mounted Posts.

2. Rail Height: 42 inches (1067 mm).
3. Cable Railing System: Horizontal.
4. Posts: Flat Stock
5. Top Rail Type: Stainless Steel Round.

B. Steel Components: Provide manufacturer's standard components as follows:
1. Material: Carbon steel for posts and base plate
2. Material: Stainless Steel: Type 316.
3. Cable Grommets:
a. Material: Ultraviolet-resistant Delrin or equivalent.
b. Prevent abrasion of intermediate posts, end posts, and cable braces bored for cables.
c. Color: Black.

C. Steel Material:
1. Pipe: ASTM A53.
2. Tubing: ASTM A500.
3. Tubing: ASTM A501.
4. Tubing: ASTM A512.
5. Bars and Shapes: ASTM A36.
6. Castings: Malleable Iron ASTM A47 or A48.
7. Castings: Ductile Iron ASTM A47 or A48.
8. Castings: Grey Iron ASTM A47 or A48.

D. Steel Finish: NAAMM/NOMMA Metal Finishes Manual.
1. Surface Preparation: Remove mill scale, rust and dirt following SSPC SP2 for hand cleaning.
2. Surface Preparation: Remove mill scale, rust and dirt following SSPC SP3 for power tool cleaning.
3. Hot Dipped Galvanizing: Sheet products shall be galvanized in accordance with ASTM A525 and ASTM A526.
a. Touch up for Galvanized Surfaces: Use paint primer FS-TT-P-645.
4. Zinc Rich Primer: Minimum one coat of rust-inhibitive primer FS-TT-P-641 Zinc Dust-Zinc Oxide Primer Coating (for Galvanized Surfaces).
5. Primer: Minimum one coat of rust-inhibitive primer FS-TT-P-645 Alkyd Type, Zinc Chromate, Paint Primer.
6. Painted finish shall be as selected by Landscape Architect from manufacturers standard colors.

E. Stainless Steel Finish: NAAMM/NOMMA Metal Finishes Manual.
1. Stainless Steel: No. 4 satin finish.

2.3 CABLE RAILING COMPONENTS

A. Cables:
1. Material: 1 x 19, Type 316 stainless steel strand, left-hand lay, per dimensional properties contained in MIL-DTL-87161.
2. Finish: Mill.
3. Diameter: 1/8 inch (3 mm), minimum breaking strength of 1,780 pounds.
4. Diameter: 3/16 inch (5 mm), minimum breaking strength of 4000 pounds.
5. Diameter: 1/4 inch (6 mm), minimum breaking strength of 6,900 pounds.
6. Diameter: 5/16 inch (8 mm), minimum breaking strength of 10,600 pounds.

7. Diameter: 3/8 inch (10 mm), minimum breaking strength of 14,800 pounds.
8. Spacing: As indicated on Drawings.
9. Cable Hardware Components:
    a. Material: Stainless steel, ASTM A276 and A479, SAE/AMS QQ-S-763, Type 316.
    b. Include washers, nuts, end caps and any accessory items as recommended by manufacturer for installation conditions or as shown on Drawings.
    c. Type: Use swageless hardware wherever practical.
    d. Type: Use hardware substantially concealed inside end posts wherever practical.
    e. Type: Use most economical combinations of fittings practical.
    f. Type: Use fittings as indicated on Drawings.
    g. Factory Assembly: Factory Threaded Tensioner/Factory. Threaded Terminal/Acorn Nut, Hex Nut, & Stainless Washer or Cable Quick Nut & Cover.
    h. Field Assembly: Field Threaded Tensioner/Field. Threaded Terminal/Acorn Nut, Hex Nut, & Stainless Washer or Cable Quick Nut & Cover.
    i. Cable Quick Lock Swageless Assembly Type 1: Field Threaded Tensioner/Cable Quick Lock Swageless Receiver/Cable Quick Nut Connector/Cable Quick Nut & Cover.
    j. Cable Quick Lock Swageless Assembly Type 2: Cable Quick Lock Swageless Receiver/Terminal Hex Bolt/Cable Quick Receiver & Stud.
    k. Low Profile Assembly: Cable Quick Terminal/Terminal Hex Bolt/Cable Quick Receiver & Stud.
    l. Fine-Line Ball Assembly: Fine-Line Ball Turnbuckle/Swage Ball End.
    m. Fine-Line Button Assembly: Fine-Line Button Turnbuckle/Swage Ball End.
    n. Fine-Line Lag Assembly: Fine-Line Lag Turnbuckle/Swage Lag End.
    o. Fine-Line Jaw-Wood Assembly: Fine-Line Jaw Turnbuckle/Fixed Jaw Clevis.
    p. Fine-Line Jaw-Metal Assembly: Fine-Line Jaw Turnbuckle/Fixed Jaw Clevis/Threaded Eye.
    q. Fine-Line Jaw-Eye Assembly: Fine-Line Jaw Turnbuckle/Fixed Jaw Clevis/Surface Mount Eye.
    r. Fine-Line Drill & Tap Assembly: Fine-Line Jaw Turnbuckle/Swage Stud.
    s. Classic Ball Assembly: Classic Ball Turnbuckle/Swage Ball End.
    t. Classic Button Assembly: Classic Button Turnbuckle/Swage Button End.
    u. Classic Jaw Assembly: Classic Jaw Turnbuckle/Swage Jaw End.
    v. Surface Mount Toggle Assembly: Surface Mount Toggle Turnbuckle/Surface Mount Toggle End
    w. European Jaw Assembly: European Jaw Turnbuckle/European Jaw End

B. Handrail Brackets
    1. Stainless Steel; cast

C. Fasteners:
    1. Handrail Anchors: Select fasteners of type, grade and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.

2. Handrail and Railing Component Anchors: Use fasteners fabricated from same basic metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
   a. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are standard fastening method for handrail and railing indicated.
   b. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
3. Cast-in-Place and Post Installed Anchors: Provide anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four items the load imposed when installed in concrete, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
   a. Cast-in-place anchors.
   b. Chemical anchors.
   c. Expansion anchors.

D. Grout and Anchoring Cement:
1. Non-Shrink, Non-Metallic Grout: Provide premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
2. Interior Anchoring Cement: Provide factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at project site to create pourable anchoring, patching and grouting compound. Use for interior applications only.

2.4 FABRICATION

A. Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

B. Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

C. Provide inserts and other anchorage devices to connect handrails and railings to concrete or masonry. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

D. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

E. Cut, reinforce, drill, and tap components as indicated on the Drawings to receive finish hardware, screws, and similar items.

F. Close exposed ends of railing members with prefabricated end fittings.

G. Provide mounted handrail wall returns at wall ends unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch

(6 mm) or less.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
   1. Examine substrates to receive anchors verifying that locations of concealed reinforcements have been clearly marked for the Installer. Locate reinforcements and mark locations if not already done.
   2. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchors, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the Project site.

3.3 INSTALLATION

A. General: Install components in accordance with manufacturer's instructions and in proper relationship with adjacent construction.
   1. Fitting: Fit exposed connections together to form tight, hairline joints.
   2. Cutting and Placement: Set handrails and railings accurately in location, alignment, and elevation measured from established lines and levels and free from rack.
      a. Do not weld, cut, or abrade coated or finished surfaces of railing components that are intended for field connection by mechanical or other means without further cutting or fitting.
      b. Align rails so variations from level or parallel alignment do not exceed 1/4 inch in 12 feet (1.6 mm per m).
      c. Provide manufacturer's proprietary system to evacuate entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources, in order to prevent water from entering the concrete slab. In lieu of the manufacturer's proprietary system, if acceptable to the Architect, provide another means to evacuate the entrapped water, i.e., a weep hole and epoxy fill system ("drill-and-fill").
      d. Anchor posts in concrete with pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, solidly fill annular space between post and sleeve with non-metallic, non-shrink grout, mixed and placed to comply with anchoring material manufacturer's directions.
      e. Anchor posts in concrete by forming or core drilling holes not less than 5 inches (127 mm) deep and 3/4 inch (19 mm) greater than outside diameter of post. Clean holes of loose material, insert posts, and fill

annular space between post and concrete with non-metallic, non-shrink grout, mixed and placed to comply with anchoring material manufacturer's directions.

f. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8 inch (3 mm) buildup, sloped away from post.

g. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

h. Adjusting: Adjust handrails and railings before anchoring to ensure alignment at abutting joint's space posts at interval indicated, but not less than required to achieve structural loads.

i. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

B. Non-Welded Railings Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.

C. Metal Interaction:

1. When aluminum components come into contact with dissimilar metals, surfaces shall be kept from interacting through painting the dissimilar metal with a heavy coat of a proper primer. The use of plastic grommets and/or PVC sleeves is encouraged to prevent contact between stainless steel cables and aluminum hole edges.
2. When aluminum components come into contact with cement or lime mortar, exposed aluminum surfaces shall be painted with water-white methacrylate lacquer.

3.4 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, and abraded areas of shop paint, and appoint exposed areas with same material.

B. Passivation: Immediately after erection, spray passivation solution on stainless steel frame pieces and cables to restore protective layer. Use Rust Rescue in marine environments for additional protection.

C. Cleaning: Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit or provide new units.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the Installer that shall ensure that the aluminum handrails and railings shall be without damage at time of Substantial Completion.

B. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

C. Protect stainless steel from corrosion and staining by applying passivation solution

following installation and periodically thereafter. Use Rust Rescue in addition to passivator in marine environments.

D. Protect wood products from fading, checking, splitting, etc. with proper end grain sealant and oil treatment.

END OF SECTION

SECTION 061064

EXTERIOR CARPENTRY – WOOD SEATS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wooden Seats

B. Related Sections:
1. Section 31 36 00 “Gabion Baskets”

1.3 DEFINITIONS

A. Boards: Lumber of less than 2 inches nominal (38 mm actual) in thickness and 2 inches nominal (38 mm actual) or greater width.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NLGA: National Lumber Grades Authority.
2. WCLIB: West Coast Lumber Inspection Bureau.
3. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For boards and lumber.

B. Material Certificates:

1. Mechanical Certification: A test report from an independent U.S. testing laboratory indicating conformance to mechanical properties in accordance to the procedures outlined in ASTM Test Method D143 shall be submitted with the material bid.

C. Certificates of Inspection: A certificate of grade and inspection from an independent third party inspection and grading agency, Mallinckrodt or preapproved equal, indicating compliance with material specifications as to producing mill, FEQ grade, species, dimensions, quantity, condition, packaging, and documentation. Inspection will include the physical examination of 100% of the timber produced against the buyer’s order, piece by piece, prior to packaging.

Inspections are to take place at the mill throughout production and the certificate is to be submitted with the material prior to delivery.

1.5 QUALITY ASSURANCE

A. Forest Certification: Provide lumber products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Forest Stewardship Council Endorsed Third Party Certification: In an effort to promote sustainable forest management, the supplier will provide proof of Chain of Custody Certification status in an FSC endorsed certification program as an example: *Rainforest Alliance SmartWood© Program* or equal.

C. Certificate of Environmental Compliance: A Certificate of Environmental Compliance from an independent third party inspection and grading agency, Mallinckrodt or preapproved equal. A certificate shall be submitted prior to delivery confirming that the woods supplied were produced from legally harvested logs, and were supplied in compliance with all foreign and domestic laws and regulations pertaining to the harvest and trade of timber products.

D. Certificates of Origin: To avoid forest products originating from forest types and regions identified as imperiled, the material supplier will supply an Official Export "Certificate of Origin" indicating species supplied and country of origin with their invoices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Wood supplied shall be partially air dried lumber. Material should be stored out of direct sunlight and be allowed to acclimate and stabilize to the installation environment humidity levels before installation. When installing there should be a minimum 1/16" gap between deck boards to aid in air circulation and drainage.

B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

C. Breather Sticks: All lumber is to be stacked with evenly spaced stickers between each layer of boards, to promote proper drying and reduce the possibility of water stain.

D. Bundles: lumber shall be packaged in bundles of equal length pieces not to exceed 1200 lbs each. These bundles are to be individually strapped using the highest strength nylon strapping available with a minimum of 4 straps per bundle to eliminate the possibility of strap stain.

E. Crating: All crates are to be clearly marked with Order and Crate number. Bundles are to be combined into units of equal length pieces not to exceed 4600 lbs. The top of each unit is to be covered with wood boards to protect against UV and water discoloration. Units are to be individually strapped to wood pallets using high strength steel or nylon strapping, with a minimum of 4 straps per crate. Boards will be used to protect against direct contact between the steel strapping and the lumber to protect against strap stain. Units are to be crated using wood boards on four sides to prevent fork lift and transportation damage.

PART 2 - PRODUCTS

2.1 LUMBER

A. Sources: Cecco Trading, Inc. Milwaukee, WI. Phone 414/445-8989, Fax: 414/445-9155, or approved equal.

B. Lumber: Lumber shall be Ipe (Tabebuia Spp. Lapacho Group).

C. Surface: all lumber to be supplied S4S-E4E (surfaced four sides-eased four edges). Edges shall be eased to a radius of 1/8".

D. Moisture Content: lumber shall be partially air dried to a moisture content of 15%-25%.

E. Dimension Tolerance: lumber shall be supplied at plus or minus .06" in both width and thickness, measured at 30% moisture content.

F. Description: All lumber shall be specified in actual or net dimensions, (Finished Thickness x Finished Width x Finished Length). Example: NET 1.5" x 5.5" x 12'.

G. Overlength: All lumber shall be supplied 2 inches over the specified length, to allow for final trim and proper fit in the field.

H. End Coating: All lumber are to be supplied with the end sealed with Mobil CER-M, or equal aqueous wax log end sealer.

I. Grade: Premium Selected Clear All Heart: All lumber shall be third party graded and inspected to (Premium Select Clear All Heart) grading rules, defined as follows:

1. Lumber shall be graded four faces, and four edges.

2. Lumber shall be straight grained and parallel cut without heart center.

3. Lumber shall be all heartwood, no sapwood allowed.

4. Lumber shall be in sound condition, free from worm holes or knots.

5. Allowable Imperfections defined as - Small drying cracks, small end splits (less than 5/32 inches in width), that do not impair the strength of the material or fastening, Discoloration caused by weathering or chemical reaction, Bow or twist which can be removed using normal installation methods and tools, Roey/Scale grain (one face only).

6. Not Allowable Imperfections defined as - Longitudinal heart cracks, Internal cracks, Firm or soft sap wood, Fungi Affects - (blue to gray, brown to red, white to yellow, or incipient decay), Bow or twist which cannot be removed by normal installation methods and tools.

J. Mechanical Properties: The lumber supplied shall meet or exceed mechanical properties as defined by U.S. Forest Product Laboratories testing methods. The values for mechanical properties based on the 2" standard are as follows:

1. OPTION A: IPE (Tabebuia Spp.Lapacho Group)

M.C.	Bending Strength	Modulus of Elasticity	Max. Crush Strength
12%	25,400 psi	3,140,000 psi	13,010 psi

Janka side hardness is 3,680 lb. at 12% M.C.

Average air dry density is 66 to 75 pcf.

Basic specific gravity is 0.85-0.97

K. Fire Rating: lumber supplied shall be naturally fire resistant without the use of any fire resistant preservatives to meet NFPA Class A and UBC Class I.

L. Coefficient of Friction: lumber supplied shall meet or exceed the ADA (Americans with Disabilities Act) Minimum Standard for Walking Surfaces: Coefficient of Friction - 0.60 Static Coefficient of Friction for both neolite rubber and leather shoe soles in accordance with ASTM Test Method C1028-89.

SHOE MATERIAL	WET
Neolite	.69
Leather	.79

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture. Provide screws or fasteners as specified of sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. Use stainless steel unless otherwise indicated.
2. For wood decking, use stainless-steel fasteners.
3. Due to the intensity of selected wood species, premium carbide tipped sawblades and high quality drill bits are required for smooth cuts. Predrill board ends when using all types of fasteners to reduce splitting. Predrill and countersink when using screws.

B. Power-Driven Fasteners: NES NER-272.

C. Wood Screws: ASME B18.6.1.

D. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).

E. Carbon-Steel Bolts: ASTM A 307 (ASTM F 568M) with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers all hot-dip zinc coated.

F. Stainless-Steel Bolts: ASTM F 593, Alloy Group 1 or 2 (ASTM F 738M, Grade A1 or A4); with ASTM F 594, Alloy Group 1 or 2 (ASTM F 836M, Grade A1 or A4) hex nuts and, where indicated, flat washers.

G. Postinstalled Anchors: Stainless-steel, chemical or torque-controlled expansion anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Stainless-steel bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

A. Set exterior rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit exterior rough carpentry to other construction; scribe and cope as needed for accurate fit.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction" unless otherwise indicated.

C. Install wood decking with crown up (bark side down).

D. Secure decking to framing with concealed decking fasteners.

E. Install metal framing anchors to comply with manufacturer's written instructions.

F. Do not splice structural members between supports unless otherwise indicated.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
4. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
5. Table R602.3(1), "Fastener Schedule for Structural Members" and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and 2-Family Dwellings.

J. Use stainless steel wood screws to fasten lumber members, unless other fasteners are specified. Nailing of members will not be allowed.

K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

3.4 SEALING AND STAINING

A. Seal all lumber members upon installation to assist in the acclimation process and reduce the potential for surface checking.
   1. Use a penetrating oil based sealers with pigmentation and UV inhibitors.
   2. Do not over apply sealers. Excessive application of oil based sealers may create a sticky surface and will not extend their performance.
   3. Use sealer as recommended by manufacturer.

END OF SECTION 061064

SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes site furnishings as indicated in plans including:

1. Benches

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Maintenance Data: To include in maintenance manuals. Include manufacturer's recommended methods for repairing damage to the finish. Include cleaning procedures or products that may be detrimental to surface finish.

PART 2 - PRODUCTS

2.1 BENCHES

A. Product: Knight Bench, FSC 100% Ipe Hardwood slats, 6 foot, backed, two-armed, surface mounted bench by Forms + Surfaces.

1. Model: SBKNI-072B-2A-SFM-TD
2. As supplied by: Forms + Surfaces. Contact Shawn Davison, territory manager, 1(800)451-0410, shawn.davidson@forms-surfaces.com.

B. Mounting:

1. For locations with concrete paving: Surface mount to concrete paving per manufacturer’s recommendation with stainless steel, tamper-proof hardware.
2. For locations in unit paving, mulch/planting beds: Surface mount to concrete piers per manufacturer’s recommendation with stainless steel, tamper-proof hardware.

C. Quantity: see bid forms

D. Assemble and install in locations shown on plan.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated in the Drawings.

D. Fit exposed connections accurately together to form tight, hairline joints.

E. Perform cutting, drilling, and fitting required for installation of site furnishings.

F. Set work accurately in location, alignment and elevation plumb, level, true, non-rocking and free of rack, measured from established lines and levels. Do not weld, cut, or abrade surfaces of components which have been coated or finished after fabrication, and are intended for field connection by mechanical means without further cutting or fitting.

3.3 ADJUSTMENT AND CLEANING

A. Protect finishes of all items from damage during construction by use of temporary protective coverings approved by manufacturers. Remove protective covering immediately before Preliminary Acceptance / Substantial Completion.

1. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units as required.

END OF SECTION

SECTION 311000

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Illinois DOT Standard Specifications for Road and Bridge Construction, latest edition.

C. Illinois DOT Supplemental Specifications and Recurring Special Provisions, latest edition.

D. Illinois Urban Manual, latest edition.

E. Standard Specifications for Water & Sewer Main Construction in Illinois, latest edition.

1.2 SUMMARY

A. Section Includes:
1. Removing existing vegetation.
2. Clearing and grubbing.
3. Removing waste and debris
4. Removing above- and below-grade site improvements.
5. Disconnecting, capping or sealing, and removing site utilities.
6. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Section 015639 “Temporary Tree and Plant Protection”

2. Section 329300 “Exterior Plantings”

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.6 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Traffic: Comply with Site Access requirements as indicated in plans. Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
3. Provide traffic control as required by Owner.

B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

D. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

E. Do not direct vehicle or equipment exhaust towards protection zones.

F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

A. Topsoil: See specification 329300.

B. Erosion Control Blanket: North American Green, EroNet S150 Short term photodegradable double-net straw erosion control blanket, or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches (1372 mm) above the ground. Similarly flag or surround in marking tape on stakes a minimum of 4’ above grade shrubs, or herbaceous vegetation to remain.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations per Section 015639.

3.4 EXISTING UTILITIES

A. Locate, identify, and disconnect utilities indicated to be abandoned in place.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner’s written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.5 VEGETATION REMOVAL (HERBACEOUS VEGETATION INCLUDING TURFGRASS)

A. Remove herbaceous vegetation to permit installation of new construction.
1. During the growing season (May 1-Sept 30) apply non-selective herbicide such as Roundup to leaf surfaces and wait at least 10 days to allow the chemical to kill the plants before physically removing the above ground portions of the plant.
2. Outside of the growing season (Oct 1-April 30) herbaceous plants should be pulled so that as much of the root mass is removed as possible.
3. Do not remove trees, shrubs, and other vegetation indicated to remain.

3.6 CLEARING AND GRUBBING (WOODY VEGETATION)

A. Remove woody trees, shrubs, and stumps to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut out or grind stumps and remove roots, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
3. Remove chipped roots and dispose of off site – do not backfill hole left by ground stump with chipped wood.
4. Use only hand methods for grubbing within protection zones or protect soil from unnecessary compaction through the use of plywood supports
5. Chip removed tree branches and dispose of off-site.
6. Import and place fresh topsoil into holes left by ground stumps.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000

EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preparing subgrades for bioretention areas, walks, pavements (including unit paving), turf, and grasses and plants.
2. Base course for concrete walks and pavements.
3. Excavating and backfilling trenches for utilities and pits for buried utility structures.
4. Excavating and backfilling for structures.

B. Related Sections:

1. Section 015639 “Temporary Tree and Plant Protection”
2. Section 033100 “Cast in Place Concrete for Landscape”
3. Section 311000 “Site Clearing”
4. Section 321216 “Hot Mix Asphalt Paving”
5. Section 321313 “Concrete Paving”
6. Section 321400 “Unit Paving”
7. Section 329300 "Exterior Plantings" for topsoil in non-bioretention planting areas, and for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

A. Amended Bioretention Soil (Bioretention Soil): Engineered topsoil, composed of commercial compost and sand, that has been placed and mixed to meet the requirements of this section and designed to readily infiltrate stormwater runoff.

B. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

C. Base Course: Aggregate layer placed between the subgrade and paving.

D. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

E. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work. Refer to Unit Prices specification in bid forms.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below base, drainage fill, drainage course, or topsoil materials.

J. Utilities: On-site underground pipes, manholes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
1. Aggregates: provide gradation and source.
2. Amended Bioretention Soil: product data for component materials.

B. Samples for Verification: For the following products, in sizes indicated below:
1. Aggregates: 1 small bag.
2. Amended Bioretention Soil: 1 gallon.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: From a qualified testing agency indicating an interpreting test results for compliance with the following:

1. For each on-site and borrow soil material proposed for fill and backfill as follows:
   a. Classification according to ASTM D 2487.
   b. Laboratory compaction curve according to ASTM D 1557.
2. Amended Bioretention Soil:
   a. Organic content and pH measurement of compost component of Amended Bioretention mix per AASHTO T194 and ASTM D4972, respectively.
   b. Particle size analysis of sand component of Amended Bioretention mix per ASTM D422-63.

1.6 QUALITY ASSURANCE

A. Soil Testing and Inspection Service:
   1. The Owner will engage a soil testing and inspection service, to include testing soil materials proposed for use in the Work and initial quality control testing during earthwork operations.

B. Preexcavation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Site Information
   1. The Contractor acknowledges that they have inspected the existing conditions and the information provided in the contract plans and specifications.
   2. No additional subsurface information is available.

B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

C. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion and sedimentation-control measures are in place.

E. Do not commence earth moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GC, GP, GM, SW, SP, SM, SC, ML, and CL according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: 40.
2. Plasticity Index: 15.

C. Unsatisfactory Soils: Soil Classification Groups OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Base Course:

1. For concrete paving, asphalt paving, and unit paving: Sound crushed stone or crushed gravel complying with IDOT CA-6.

E. Open Graded Aggregate: Washed, Sound crushed stone or crushed gravel complying with IDOT CA-7.

F. Bedding Course: IDOT CA6, CA9, CA10, CA18, FA1, FA2, FA5, FA6, FA10, or FA21.

G. Sand: ASTM C33 Fine Aggregate.

H. Amended Bioretention Soil (Bioretention Soil): Amended bioretention Soil shall be a blend of 80-90% sand and 10-20% compost by volume meeting the properties in paragraph 3 below. Loamy Sand or Sandy Loam topsoil may be used as a mixture component with prior approval of the Engineer. Compost and topsoil materials shall be dry and friable while mixing. The material shall be pre-mixed prior to placement. In-place mixing may be accepted with prior approval by the engineer.

1. Compost:
   a. Particle Size: 98% of the compost shall pass through a 0.75-inch screen.
   b. Physical Contaminants: Less than 1% combined glass, metal, and plastic.
   c. Organic Matter / Ash Content: At least 40% organic matter; less than 60% ash content.
   d. Carbon to Nitrogen Ratio: 10-20:1 C:N.
   e. pH: 6-8.
   f. Soluble Salts: Electrical conductivity below 10dS/m.
   g. Moisture Content: 35-50% by weight.
   h. Maturity: The compost shall be resistant to further decomposition and free of compounds, such as ammonia and organic acids, in concentrations toxic to plant growth.
   i. Residual Seeds & Pathogens: Pathogens and noxious seeds shall be minimized.
   j. Compost shall meet Illinois Administrative Code specifications for General Use Compost [35.G.I.i.830].

2. Properties: Amended Bioretention Soil shall be thoroughly mixed prior to placement and meet the following properties in accordance with ASTM D422-63, AASHTO T194 and ASTM D4972. Tests shall be submitted and approved by the Engineer prior to planting for two discrete samples per mixing batch. The mix shall meet the following properties by weight per ASTM:

a. Proportion of Sand: 80%-90%
b. Proportion of Clay (hydrometer analysis): 2% to 5%
c. Organic Content: 3%-5%
d. Ph: 6.8 ≤ pH < 8.0

I. Topsoil: Per Section 329300.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 6 inches beneath bottom of concrete slabs-on-grade.
b. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing

and removing concrete formwork, for installing services and other construction, and for inspections

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree-and Plant-Protection Zone:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 “Temporary Tree and Plant Protection”.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: Per Plan

C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.7 SUBGRADE INSPECTION

A. Notify Engineer / testing agency when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below walks and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Place and compact initial backfill as indicated on Drawings.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill:

1. Sanitary Sewer, Solid Storm Sewer, and Watermain: Final backfill of clay soil meeting USC CL classification to final subgrade elevation

2. Perforated and solid PE Storm Sewer Pipe: Washed, Sound crushed stone or crushed gravel complying with IDOT CA-7.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under bioretention do not compact subgrade.
3. Under walkways, compact each layer of backfill or fill soil material at 92 percent.
4. Under turf or unpaved areas, compact each layer of backfill or fill soil material at 85 percent.
5. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

3.16 BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:

1. Where indicated, install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Where indicated, install Curtain Liner where indicated.
3. Place base course material over subgrade under pavements.
4. Shape base course to required crown elevations and cross-slope grades.
5. Place base course 6 inches or less in compacted thickness in a single layer.
6. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
7. Compact base course for concrete and asphalt paving at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
8. Compact base course for bioretention areas according to AASHTO guidelines for installing open graded aggregates. Base course shall not be over-compacted, which may cause particle abrasion and introduction of fine material into base course.

3.17 BIORETENTION AREAS

A. Inspect subgrade and remove accumulated sediment or debris from native subgrade.

B. Verify that subgrades are constructed to the lines and grades indicated on plans.

C. Scarify subgrade to a depth of 8 inches using a disc attachment or cultivator as shown on plans.

D. Verify rough grades prior to placement of Amended Bioretention Soil layers.

E. Place Amended Bioretention Soil layers as indicated on plans.

F. Place pre-mixed, dry Amended Bioretention Soil. Wet placed Amended Bioretention Soil will not be accepted.
   1. Place in 8 inch lifts and lightly compact will dry with hand roller weighing no more than 100 lbs per foot of width.
   2. For final lift, all depressions caused by settlement of rolling shall be filled with additional Amended Bioretention Soil and the surface shall be re-graded and rolled until a smooth and even finish to the indicated elevations and sections.

G. Amended Bioretention Soil contaminated by construction site runoff, sediment, or other foreign materials shall be removed and replaced at no additional expense to the Owner.

3.18 TOPSOIL

A. Per Section 329300.

B. Minimum topsoil respreading depth shall be 6 inches.

3.19 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material and maximum lift thickness comply with requirements.
   3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Pavement Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
   2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

D. During and after excavation to subgrade for bioretention areas, the subgrade shall be protected from construction traffic and construction site runoff. Any rutting, over-compaction, clogging, or other damage to the subgrade of the porous unit paving or bioretention areas shall be repaired to re-establish permeability, lines, and grades at no additional expense to the Owner.

E. Protecting Bioretention Areas: After placement of Amended Bioretention Soil, bioretention areas shall be protected from construction traffic and trampling by temporary silt fence.

1. Amended Bioretention Soil contaminated with construction site runoff shall be removed to a depth of 6 inches and replaced with fresh Amended Bioretention Soil meeting these specifications.
2. Amended Bioretention Soil compacted by construction traffic or trampling shall be removed and replaced with fresh Amended Bioretention Soil meeting these specifications.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 313600

GABION BASKETS

PART 1 GENERAL

1.1 SUMMARY

A. This section contains requirements for supplying and constructing stainless steel, welded wire gabion baskets filled with aggregate.

1.2 RELATED SECTIONS

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section, as well as:

.1 Section 033100 “Cast in Place Concrete for Landscape”

.2 Section 061064 “Exterior Carpentry”

.3 Section 312000 “Earth Moving”

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A974-97

1.4 SUBMITTALS

A. Product Data: For each type of the following products required:

1. Gabion Baskets.
2. Aggregates: provide type and source.

B. Product Samples: For each type of the following products required:

1. Gabion Baskets: Provide one panel sample with specified coating for approval
2. Aggregates: Submit not less than 4 options for aggregate fill to the landscape architect for selection. Provide 1 lbs sample of each type

PART 2 PRODUCTS

2.1 MATERIALS

.1 Gabion baskets:

.1 Factory fabricated so that sides, ends, lid and internal diaphragms readily assemble at site into rectangular baskets of sizes as indicated.

.2 Single unit construction or with joints having strength and flexibility equal to that of mesh.

.3 When length exceeds horizontal width, provide diaphragms of same mesh as gabion walls to divide basket into equal cells of length not in excess of horizontal width.

.4 Wire mesh gabions:

.1 Dimensions

.1 24”x24”x24”

.2 Material

.1 Type 316L Marine Grade Stainless Steel

.3 Welded Wire mesh to be uniform square pattern.

.4 Wire to have following properties:

.1 Mesh: 3”x3” square

.2 Gauge: 6 GA

.5 Stainless Steel Wire Fasteners to have the following properties:

.1 Gauge: 9 GA tie wire

.5 Product/Supplier:

.1 “Dura-weld” by Gabion Supply, phone: 1-866-391-6295, www.gabionsupply.com, or approved equal.

.2 Stone fill:

.1 Hard, durable, abrasion resistant such that it will not disintegrate from action of wetting and drying, wave action, freezing and thawing cycles.

.2 Use tumbled stone meeting the following dimensions:

.1 100% Passing an 8-inch sieve

.2 0-5% passing a 4-inch sieve

.3 Color of stone fill to match aggregate used in existing gabion basket planters south of building.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install gabions to lines and grades as indicated. Follow manufacturer's instructions in assembling baskets.

3.2 PLACING GABIONS

.1 Wherever possible, place baskets in position prior to filling with stones.

.2 Join adjacent baskets together at corners as recommended by manufacturer, so that joints are as strong as mesh.

3.3 FILLING BASKETS AND MATS

.1 Tension geogrid gabions according to manufacturer's instructions before filling with stone. Do not release wall tension until sufficient stone fill has been placed to prevent wall slackening.

.2 On exposed faces of gabions, place stones by hand with flattest surfaces bearing against face mesh to produce satisfactory alignment and appearance.

.3 For wire mesh gabions, fill gabion cells in lifts not exceeding 300 mm and connect opposite walls with 2 tie wires after each lift.

END OF SECTION

SECTION 32 12 16

HOT MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hot mix asphalt paving as shown on the Drawings and as specified herein.

B. Related Sections include:

1. 31 20 00 “Earth Moving”
2. 32 17 23 “Pavement Markings”

1.2 SUBMITTALS

A. Product Data: For each type of product specified. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: For each job mix proposed for the Work.

1. Job-mix design documentation shall include the amount of reclaimed asphalt paving (RAP) material, by percentage of total mix, to be utilized.
2. Job-mix design documentation shall clearly indicate source/origin of RAP material.

C. Qualification Data: For IDOT qualified manufacturer and Installer.

D. Material Certificates: For each paving material, from manufacturer.

E. Material Test Reports: For each paving material and mix.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Illinois Department of Transportation (IDOT) construction guides and manuals as described, specified, and illustrated in the current edition of the "Standard Specifications for Road and Bridge Construction," including Supplemental Specifications and Recurring Special Provisions, latest editions and updates for asphalt paving work. Hereafter these documents are referenced as the "IDOT Standard Specifications."

1. Measurement and payment provisions and safety program submittals included in IDOT Standard Specifications do not apply to this Section.

B. Manufacturer Qualifications: Hot mix asphalt manufacturer shall have valid and current IDOT approvals for materials and work specified.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review condition of subgrade and preparatory work.
c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met. Temperatures are to be taken in the shade, away from exposed pavement and stone aggregate fill and other artificial heat sources.

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Slurry Coat: Comply with weather limitations in ASTM D 3910.
3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
4. Asphalt Binder Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 PAVING MATERIALS

A. Granular Base Course: Complying with requirements of IDOT Standard Specifications, Section 311, for type B base course with gradation CA-6 crushed stone.

B. Hot Mix Asphalt Binders, Surface Courses and Materials: Complying with IDOT Standard Specifications, Section 1030, Class I.

1. Hot-mix Asphalt Surface Course: Complying with IL-9.5L, N_{des} = 30 of the IDOT Standard Specifications.
2. Hot-Mix Asphalt Binder Course: Complying with IL-19L, N_{des} = 30 of the IDOT Standard Specifications.
3. Reclaimed Asphalt Pavement (RAP): RAP, complying with IDOT Standard Specifications, may be used only when approved in writing by the Engineer of Record prior to starting the Work.

a. No more than 25% of the proposed asphalt mix is allowed to be RAP material.
b. RAP material shall be free of contamination, including, but not limited to, dirt, sand, brick, debris, concrete, sheet asphalt, sealant materials, and clean stone.

2.2 AUXILIARY MATERIALS

A. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

B. Joint Sealant: ASTM D 6690, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

C. Commencement of asphalt paving work will be an indication of the acceptance of sub-grade and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.2 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Verify that prepared subgrade is ready to receive paving.

B. Subgrade: Shall have a minimum Illinois Bearing Ratio (IBR) of 2.5 and comply with requirements of IDOT Standard Specifications, Section 301. Subgrade shall be proof-rolled in accordance with Section 31 20 00 "Earth Moving."

C. Tack Coat: Apply uniformly to existing pavement surfaces at a rate of 0.05 - 0.10 gal./sq. yd.

1. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
2. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
3. Prohibit traffic across tack coat for period not less than that required by manufacturer.

D. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.25 - 0.50 gal. / sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure fully.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

3.3 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt paving on prepared surfaces, spread uniformly, and strike off, in accordance with IDOT Standard Specifications, Sections 406 and 407. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt surface coat in single lift.
2. Spread mix at minimum temperature of 250 deg F.
3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.4 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course. Joints between successive days' work shall be constructed to ensure thorough and continuous bond between the newly and previously placed paving.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to the Asphalt Institute MS-22, "Construction of Hot-Mix Asphalt Pavements," for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within two percent (2%) of specified course density.

3.5 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Frames of subsurface structures:

1. Coat surfaces of new and existing frames with oil to prevent bond with asphalt paving.
2. Set cover rings to be flush with finish surface and surround with a ring of compacted asphaltic concrete to one inch below top of frame. Adjust as required to meet paving.
3. Provide temporary covers over openings until completion of rolling operations

H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and sufficiently hardened, as determined by the Project Engineer.

I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2-inch.
2. Binder Course: Plus or minus 1/4-inch.
3. Surface Course: Plus 1/4- inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot long straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/2-inch.
2. Binder Course: Plus or minus 1/4-inch.
3. Surface Course: 1/8-inch.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

    a. Take one core sample for every 1,000 square yards or less of installed pavement, with no fewer than three (3) core samples taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace and/or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.8 DISPOSAL

A. Except for material indicated to be recycled, all rubbish and debris resulting from the Work of this Section must be collected, removed from the site, and disposed of legally in an approved landfill.

END OF SECTION

SECTION 321313

CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Illinois DOT Standard Specifications for Road and Bridge Construction, latest edition.

C. Illinois DOT Supplemental Specifications and Recurring Special Provisions, latest edition.

1.2 SUMMARY

A. This Section includes requirements for constructing the following:

1. Pedestrian-rated Poured Concrete Pavement
   a. 5-inch thick, Standard Broom Finish

2. Vehicular-rated Poured Concrete Pavement
   a. 8-inch thick, Standard Broom Finish, with Welded Wire Mesh

3. Sidewalk with Thickened Edge Poured Concrete Pavement
   a. 5-inch thick w/ 9-inch thickened edge, Standard Broom Finish, with rebar

4. Detectable Warning Tiles

B. Related Sections include the following:
1. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product information for:
1. Detectable Warning Tiles

B. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.
   6. Applied finish materials.
   7. Bonding agent or epoxy adhesive.
   8. Joint fillers.

1.5 QUALITY ASSURANCE

A. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

B. Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

C. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

D. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

E. Concrete Testing Service: Contractor to engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
   2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Landscape Architect and not less than 96 inches (2400 mm) by 96 inches (2400 mm).
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Landscape Architect specifically approves such deviations in writing.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Minimizing contraction fractures (air temp, base compaction, base wetting)
c. Air entraining
d. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
a. Contractor's superintendent.
b. Concrete paving subcontractor.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 ; deformed.

D. Plain Steel Wire: ASTM A 82, as drawn.

E. Deformed-Steel Wire: ASTM A 496.

F. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60 . Cut bars true to length with ends square and free of burrs.

G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture

bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type I/II, white. Supplement with the following:

a. Fly Ash: ASTM C 618, Class F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 4M coarse aggregate, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.5 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch .

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals. as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 deg F and 90 deg F , reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F , reduce mixing and delivery time to 60 minutes.

2.7 DETECTABLE WARNING MATERIALS

A. Detectable Warning Tile: Cast (grey) iron tiles by Neenah Foundry, or approved equal.
1. Finish: natural, unpainted

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below areas intended for vehicular uses with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph .
2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons .
3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

C. Contraction Joints for Concrete Paving: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

D. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

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

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed pavement surfaces with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

K. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F , uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

L. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Apply the following to horizontal surfaces: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.8 DETECTABLE WARNINGS

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in plans..

1. Tolerance for Opening Size: Plus 1/4 inch (6 mm), no minus.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches , and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch .
2. Thickness: Plus 3/8 inch , minus 1/4 inch .
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch .
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch .
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch .
6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches .
7. Joint Spacing: 3 inches .
8. Contraction Joint Depth: Plus 1/4 inch , no minus.
9. Joint Width: Plus 1/8 inch , no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 5000 sq. ft. or fraction thereof of each concrete mix placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi .

D. Test results shall be reported in writing to Landscape Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Landscape Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 32 14 00

UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Setting Bed Sand for unit pavements.
   2. Unit paving consisting of concrete pavers set in setting beds.
   3. Plastic edge restraint.

B. Related Sections include the following:

   1. Division 31 Section "Earth Moving" for excavation and compacted subgrade.

   2. Division 31 Section "Earth Moving" for aggregate base.
   3. Division 32 Section “Portland Cement Concrete Paving” for concrete paving that serves as edge restraints for paving.

1.3 SUBMITTALS

A. Product Data: For the following:

   1. Pavers
   2. Setting Bed Sand
   3. Joint Sand
   4. Plastic edge restraint

B. Sieve Analyses: For aggregate materials, according to ASTM C 136.

C. Samples for Verification:

   1. Full-size units of each type of unit paver indicated.
   2. Setting Bed Sand
   3. Joint Sand for paver joint fill.
   4. Plastic edge restraint.

D. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.

1. For solid interlocking paving units, include test data for freezing and thawing according to ASTM C 67.

2. For color selections, provide tests showing Solar Reflectance Index.

1.4 DEFINITIONS

A. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owners authorized representative. Unauthorized excavation, as well as remedial work directed by Owners authorized representative, shall be without additional compensation.

B. Fill: Soil materials used to raise existing grades.

C. Open graded stone: Coarse aggregate used as storage under pavement surfaces, as a drainage layer within rain gardens, and as a component of structural soil.

D. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of paver from one source that has resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

2. Mockup shall consist of a 10’ x 10’ area of completed unit paving.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

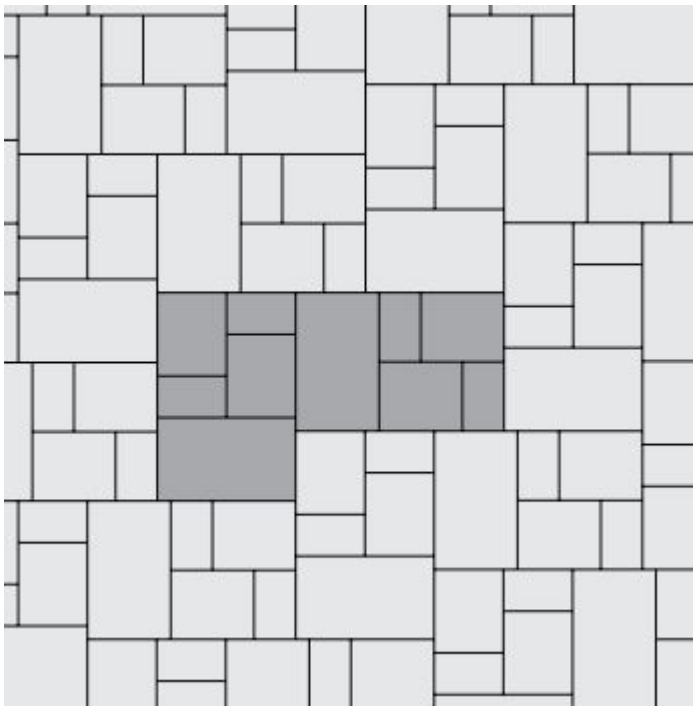
PART 2 - PRODUCTS

2.1 CONCRETE UNIT PAVERS

A. Solid Concrete Unit Pavers: Solid interlocking paving units of shapes that provide openings between units, complying with ASTM C 936, resistant to freezing and thawing when tested according to ASTM C 67, and made from normal-weight aggregates.

1. Products: Subject to compliance with requirements, provide products by the following:

a. Paver Type 1: Unilock Brussels Block
   1) Percent of Mix: 100%
   2) Shall be mixture of half-sized (20%), standard size (40%), and XL-size (40%) pavers
   3) Size: 4 x 6 7/8 x 2 ¾" (half), 6 7/8 x 8 ¼ x 2 ¾" (standard), 8 ¼ x 13 ¾ x 2 ¾"(XL)
   4) Pattern: AF (see below)
   5) Or approved equal.



2.2 SETTING-BED MATERIALS

A. Provide setting bed sand as follows:
   1. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
   2. Do not use limestone screenings, stone dust, or sand material that does not conform to the grading requirements of ASTM C33.
   3. Do not use mason sand or sand conforming to ASTM C144.
   4. Utilize sands that are as hard as practically available where concrete pavers are subject to vehicular traffic.
   5. Conform to the Grading Requirements of ASTM C33 with modifications as shown in the table below:

TABLE 1- SETTING BED SAND GRADATION REQUIREMENTS

ASTM C 33	
Sieve Size	Percent Passing
3/8 in	100
No. 4	95 to 100
No. 8	85 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10
No. 200	0 to 1

2.3 JOINT SAND

A. Use Polymeric Joint Sand
   1. Provide Polymeric Joint Sand as manufactured by:
      a. Alliance Gator G2
         1) Product Type: Dry mix, contains polymeric binding agent, activated with water
         2) Color: Slate Grey
      b. Unicare HP Polymeric Max Sand
         1) Product Type: Dry mix, contains polymeric binding agent, activated with water
         2) Color: Grey
   2. Provide Polymeric Joint sand meeting the minimum material and physical properties as follows:
      a. Compression Strength: proven resistance to compression of 550 PSI after drying for 7 days under controlled conditions (73 deg F at 50% humidity).
         1) Test sand sample shape: cylinder (2” dia. X 4” high)
      b. Gradiation as shown in table below:

TABLE 2- JOINT SAND GRADATION REQUIREMENTS

ASTM C 144		
Sieve Size	Natural Sand Percent Passing	Manufactured Sand Percent Passing
No. 4	100	100
No. 8	95 to 100	95 to 100
No. 16	70 to 100	70 to 100
No. 30	40 to 75	40 to 75
No. 50	10 to 30	20 to 40
No. 100	2 to 15	10 to 25
No. 200	0 to 1	0 to 10

2.4 Base Aggregate: See 312000.

2.5 PLASTIC EDGE RESTRAINT

A. HDPE Invisible edge restraint
   1. Manufacturer/Product
      a. Snap Edge by SEK Surebond, or approved equal.
   2. Size
      a. 2-7/8” wide x 1-7/8” high x 8’0” long
   3. Installation
      a. Anchor with 8” or 10” steel spike
      b. Aggregate base shall extend 6 inches minimum beyond pavement edge in order to anchor spike

PART 3 - EXECUTION

1. EXAMINATION
   a. Examine areas indicated to receive paving for compliance with requirements for installation tolerances and other conditions affecting performance for the following items before placing the Concrete Pavers.
      i. Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
      ii. Verify that Geotextiles, if applicable, have been placed according to drawings and specifications.
      iii. Verify that the Base and Subbase Aggregate materials, thickness, compacted density, surface tolerances and elevations conform to specified requirements.
      iv. Provide written density test results for soil subgrade, Base and Subbase Aggregate materials to the Owner, General Contractor and paver installation subcontractor.

v. Verify location, type, and elevations of edge restraints, concrete curbing, concrete collars around utility structures, and drainage inlets.

b. Proceed with installation only after unsatisfactory conditions have been corrected.

i. Beginning of Bedding Sand and Concrete Paver installation signifies acceptance of Base and edge restraints.

2. PREPARATION

a. Verify that the subgrade soil is free from standing water.

b. Stockpile Setting Bed Sand, Joint Sand, Base and Subbase Aggregate materials such that they are free from standing water, uniformly graded, free of any organic material or sediment, debris, and ready for placement.

c. Remove any excess thickness of soil applied over the excavated soil subgrade to trap sediment from adjacent construction activities before placing the Geotextile and Subbase Aggregate materials.

d. Keep area where pavement is to be constructed free from sediment during entire job. Remove and replace all Geotextile, Joint Sand, Setting Bed Sand, Base and Subbase Aggregate materials contaminated with sediment with clean materials.

e. Complete all subdrainage of underground services within the pavement area in conjunction with subgrade preparation and before the commencement of Base or Subbase Aggregate construction.

f. Prevent to damage underdrain pipes, overflow pipes, observation wells, or inlets and other drainage appurtenances during installation. Report all damage immediately.

g. Compact soil subgrade uniformly to at least 95 percent of Standard Proctor Density per ASTM D 698 for pedestrian areas. Compact soil subgrade uniformly to at least 98 percent Modified Proctor per ASTM D 1557 for vehicular areas. Stabilization of the subgrade and/or base material may be necessary with weak or saturated subgrade soils.

h. Backfill all service trenches within the pavement area to the sub- grade level with approved material placed in uniform lifts not exceeding 4 in. (100 mm) loose thickness. Compact each lift to at least 100 percent Standard Proctor Density as specified in ASTM D 698.

i. Trim the subgrade to within 0 to ½ in. (0 to 13mm) of the specified grades. Do not deviate the surface of the prepared subgrade by more than 3/8 in. (10mm) from the bottom edge of a 39 in. (1m) straight edge laid in any direction.

j. Proof-roll prepared subgrade according to requirements in Division 31 Section "Earth Moving" to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting and replace with compacted backfill or fill as directed.

k. Do not proceed with further pavement construction, under any circumstances, until the subgrade has been inspected by the Architect/Engineer.

Note: Base compaction of the subgrade soil on the recommendations of the Design Engineer. Request the Architect/Engineer to inspect subgrade preparations, elevations and conduct density tests for conformance to specifications.

Note: Mechanical tampers (jumping jacks) are recommended for compaction of soil subgrade and aggregate base around lamp standards, utility structures, building edges, curbs, tree wells and other protrusions. Compact areas, not ac-

cessible to roller compaction equipment, to the specified density with mechanical tampers. **CAUTION** – Proceed with care around the perimeters of excavations, buildings, curbs, etc. These areas are especially prone to consolidation and settlement. Do not place wedges of backfill in these areas. If possible particularly in these areas, proceed with backfilling and compacting in shallow lifts, parallel to the finished surface.

3. INSTALLATION
    a. BASE AND SUBBASE AGGREGATE
        i. Per Specification 312000.
    b. PLASTIC EDGE RESTRAINT
        i. Install per manufacturer's recommendations.
    c. SETTING BED SAND
        i. Provide and spread Setting Bed Sand evenly over the Base Aggregate course and screed to a nominal thickness of 1 in. (25 mm).
            1. Protect screeded Setting Bed Sand from being disturbed by either pedestrian or vehicular traffic.
            2. Screed only the area which can be covered by pavers in one day.
            3. Do not use Setting Bed Sand material to fill depressions greater in the base surface.
        ii. Keep moisture content constant and density loose and constant until Concrete Pavers are set and compacted.
        iii. Screed the Setting Bed Sand using either an approved mechanical spreader (e.g.: an asphalt paver) or by the use of screed rails and boards.
        iv. Carefully maintain spread Setting Bed Sand in a loose condition, and protected against incidental compaction, both prior to and following screeding. Loosen any incidentally compacted sand or screeded sand left overnight before further paving units are placed.
        v. Provide lightly screeded Setting Bed Sand in a loose condition to the predetermined depth, only slightly ahead of the paving units.
        vi. Fully protect screed Setting Bed Sand against incidental compaction, including compaction by rain. Remove any screeded Setting Bed Sand that is incidentally compacted prior to laying of the paving units.
        vii. Inspect the Setting Bed Sand course prior to commencing the placement of the Concrete Pavers. Acceptance of the Setting Bed Sand occurs with the initiation of Concrete Paver placement.
    d. CONCRETE PAVERS
        i. Replace Concrete Pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
        ii. Mix Concrete Pavers from a minimum of three (3) bundles simultaneously drawing the paver vertically rather than horizontally, as they are placed, to produce uniform blend of colors and textures. (Color variation occurs with all concrete products. This phenomenon is influenced by a variety of factors, e.g. moisture content, curing conditions, different aggregates and, most commonly, from different production runs. By installing from a minimum of three (3) bundles simultaneously, variation in color is dispersed and blended throughout the project).
        iii. Exercise care in handling face mix concrete pavers to prevent surfaces from contacting backs or edges of other units.

iv. Provide Concrete Pavers using laying pattern as indicated. Adjust laying pattern at pavement edges such that cutting of edge pavers is minimized. Cut all pavers exposed to vehicular tires no smaller than one-third of a whole paver.
v. Use string lines or chalk lines on Setting Bed Sand to hold all pattern lines true.
vi. Set surface elevation of pavers 1/8 in. (3 mm) above adjacent drainage inlets, concrete collars or channels.
vii. Place units hand tight against spacer bars. Adjust horizontal placement of laid pavers to align straight.
    1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
viii. Provide space between paver units of 1/32 in. (1 mm) wide to achieve straight bond lines.
ix. Prevent joint (bond) lines from shifting more than ±1/2 in. (±13 mm) over 50 ft. (15 m) from string lines.
x. Fill gaps between units or at edges of the paved area that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
xi. Cut Concrete Pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
xii. Prevent all traffic on installed Concrete Pavers until Joint Sand has been vibrated into joints. Keep skid steer and forklift equipment off newly laid Concrete Pavers that have not received initial compaction and Joint Sand material.
xiii. Vibrate Concrete Pavers into leveling course with a low-amplitude plate vibrator capable of a to 5000-lbf (22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions
    1. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
    2. Compact installed Concrete Pavers to within 6 feet (2 meters) of the laying face before ending each day's work. Cover Concrete Pavers that have not been compacted and leveling course on which pavers have not been placed, with nonstaining plastic sheets to prevent Setting Bed Sand from becoming disturbed.
xiv. Protect face mix Concrete Paver surface from scuffing during compaction by utilizing a urethane pad.
xv. Remove any cracked or structurally damaged Concrete Pavers and replace with new units prior to installing Joint Sand material.

e. JOINT SAND
    i. Provide, spread and sweep dry Joint Sand into joints immediately after vibrating pavers into Setting Bed Sand course until full. Vibrate pavers and add Joint Sand material until joints are completely filled, then remove excess material. This will require at least 4 passes with a plate compactor.
    ii. Leave all work to within 3 ft. (1 m) of the laying face fully compacted with sand-filled joints at the completion of each day.

iii. Remove excess Joint Sand broom clean from surface when installation is complete.
iv. Polymeric Joint Sand
1. Install Polymeric Joint Sand per manufacturers recommended instructions.

4. FIELD QUALITY CONTROL
a. Verify final elevations for conformance to the drawings after sweeping the surface clean.
i. Prevent final Concrete Paver finished grade elevations from deviating more than ±3/8 in. (±10 mm) under a 10 ft (3 m) straightedge or indicated slope, for finished surface of paving.
ii. Lippage: No greater than 1/32 in. (0.8 mm) difference in height between Concrete Pavers and adjacent paved surfaces.
5. REPAIRING, CLEANING AND SEALING
a. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
b. Cleaning: Remove excess dirt, debris, stains, grit, etc. from exposed paver surfaces; wash and scrub clean.
i. Clean Concrete Pavers in accordance with the manufacturer’s written recommendations.
6. PROTECTION
a. Protect completed work from damage due to subsequent construction activity on the site.

END OF SECTION 32 14 43

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Illinois DOT Standard Specifications for Road and Bridge Construction, latest edition.

C. Illinois DOT Supplemental Specifications and Recurring Special Provisions, latest edition.

D. Illinois Urban Manual, latest edition.

1.2 SUMMARY

A. Section includes painted markings applied to asphalt pavement.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to marking pavement including, but not limited to, the following:

a. Pavement aging period before application of pavement markings.
b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of IDOT for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4.4 deg C) for alkyd materials, 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products approved by IDOT:

2.2 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Per IDOT

1. Crosswalk Markings:
   a. Color: White
   b. Dimensions: 6 foot wide, 24 inch wide stripes, spaced 24 inches apart in conformance with IDOT’s standard for school and pedestrian crossings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Landscape Architect.

B. Allow paving to age per IDOT before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness per IDOT.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

SECTION 323116

WELDED WIRE FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metallic-coated-steel, welded-wire fences.

B. Related Requirements:
1. Section 312000 "Earth Moving" for site excavation, fill, and backfill where welded-wire fences and gates are located.
2. Section 033100 “Cast in Place Concrete for Landscape” for post footings

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each fence material and for each color specified.

1. Provide Samples 12 inches (300 mm) in length for linear materials.
2. Provide Samples 12 inches (300 mm) square for wire mesh.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For gate operators to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products approved by the manufacturer and having not less than 5 years of experience in fabricating the types of fencing and gates specified.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 METALLIC-COATED-STEEL, WELDED-WIRE FENCES

A. Metallic-Coated-Steel, Welded-wire Fence Systems

1. Manufacturers:
   a. Omega (www.omegafence.com),
   b. Merchant Metals
   c. or approved equal.

B. Fence Fabric: Metallic-coated-steel wire.

1. Spacing of Vertical Wires: As indicated.
2. Vertical Wire Size: 0.192 inch (4.88 mm).
3. Spacing of Horizontal Wires: As indicated.
4. Horizontal Wire Size: 0.192 inch (4.88 mm).

C. Posts:

1. Line Posts: Square tubes 2 by 2 inches (50 by 50 mm) or 3 by 3 inches (76 by 76 mm) formed from steel sheet and hot-dip galvanized after fabrication.
2. End and Corner Posts: Square tubes 3 by 3 inches (76 by 76 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.

D. Post Caps: Formed from aluminum alloy.

E. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips.

F. Finish: Powder coating over zinc coating.

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033100 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum aggregate size.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.4 GROUNDING MATERIALS

A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Grounding Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic-welded type.
2. Grounding Rods: Copper-clad steel.

a. Size: 5/8 by 96 inches (16 by 2440 mm).

2.5 METALLIC-COATED-STEEL FINISHES

A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply aconversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

C. Powder Coating: Immediately after cleaning and pretreating, apply two-coat finish consisting ofepoxy prime coat and TGIC polyester topcoat, with a minimum dry film thickness of 2 mils (0.05 mm) for topcoat. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils (0.10 mm).

1. Color and Gloss: As selected by Landscape Architect from manufacturer's full range.
2. Comply with surface finish testing requirements in ASTM F 2408

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening infill panels to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches (600 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1.2 m).

D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Exposed Concrete: Extend 2 inches (50 mm) above grade. Finish and slope top surface to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
4. Space posts uniformly at 8 feet (2.44 m) o.c.

3.4 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of [1500 feet (450 m)] except as follows:

1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 500 feet (225 m).

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to

lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Contractor to engage a qualified testing agency to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports of grounding resistance at each test location, certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.6 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, and limit switches.

1. Hydraulic Operators: Purge operating system, adjust pressure and fluid levels, and check for leaks.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware, gate operators, and other moving parts.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 323116

SECTION 329300

EXTERIOR PLANTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. References:

1. ASTM D 4972 pH of Soils
2. ASTM D 5268-02. Standard Specification for Topsoil Used for Landscaping Purposes.
3. ASTM D698-00ae1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
4. American Joint Committee on Horticultural Nomenclature, “Standardized Plant Names,” second edition.
5. ANSI Z60.1 Nursery Stock (1990)
6. AASHTO T 194 Organic Content of Soils.
7. Munsell Soil Color Charts, revised edition 1992.

1.2 SUMMARY

A. Provide all labor, materials and equipment required or inferred from the plan documents and this section to complete the indicated work. Section includes:

1. Preparation, materials delivery and installation, and maintenance as indicated on drawings and specified herein. This Section includes:
   a. Deciduous Shade Trees
   b. Shrubs
   c. Turfgrass Sod
   d. Ornamental Perennials, Grasses, and Groundcovers
   e. Top Soil
   f. Soil Amendments
   g. Mulch Placement
   h. Native Seeding

B. Related Sections include the following:

1. Section 015639 “Temporary Tree Protection”

1.3 DEFINITIONS

A. Balled and Burlapped Stock (B&B): Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

B. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than the diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.

C. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

D. Finish Grade: Elevation of finished surface of planting soil.

E. Top Soil: Imported topsoil or imported soil modified to become topsoil; mixed with soil amendments.

F. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification of Seed: From seed vendor for each seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging. Include name and telephone number of each supplier.

1. Within two (2) weeks following notification to proceed, submit for approval to the Construction Manager a written description of the seed mixes indicating the following:

   a. Name and address of seed supplier.

   b. Estimated seed per pound (or seed per ounce) of each species.

2. For delivery, storage, and handling documentation, record and submit the following:

   a. Date of receipt of seed.

b. Date of receipt of seed test results.

c. Vendor’s invoice for each shipment of seed material shall show botanical name, common name, quantities by species and composition of each mixture.

C. Plant Supplier: Within two (2) weeks following notification to proceed, submit for approval to the Landscape Architect a written list indicating the following:

1. Name and address of plant source supplier for each plant species.

2. Quantity of each species to be installed shall be submitted eight (8) weeks prior to delivery to project site.

D. Qualification Data: For Landscape Installer showing compliance with 1.5A.

E. Material Test Reports: For topsoil.

F. Invoices: Vendor or grower’s invoice for each shipment of plants shall show botanical name, common name, size, quantity by species, location where grown, and root treatment of plants.

G. Planting Schedule: Indicating anticipated planting dates for exterior plants (refer to Parts 1.7A & B).

H. Dated timesheets showing fulfillment of required maintenance operations – see 1.9.

I. Samples: for all mulch types used.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A contractor with a minimum of five (5) years experience specializing in planting and seeding, and maintenance procedures for woody plant and native herbaceous species of similar species and maintenance requirements, and of similar size and scope.

1. Installer's Field Supervision: A qualified, experienced, English-speaking full-time supervisor shall be on site during all planting and maintenance operations.

2. Landscape Architect will review and approve all contractor qualifications prior to contract award.

3. The Contractor shall comply with all federal, state and local ordinances, and permits issued for the project.

B. Seed Material:

1. All seed shall comply with and where specified, be tested in accordance with applicable sections of the following:

a. U.S. Department of Agriculture Federal Seed Act, current edition.

2. Source quality control: All seed shall be provided in the supplier's sealed containers labeled in accordance with Wisconsin Compiled Laws Seed Law Implementation.

3. All seed material shall be from stock sources located within 200 miles of project site.

4. Substitutions: Must be approved in writing by the Construction Manager following proof of non-availability and proposal for use of equivalent material. For proof of non-availability, submit a list of sources queried.

C. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

D. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, clay content; cation exchange capacity; deleterious material; and pH of topsoil.

1. Sampling for topsoil analysis shall consist of a composite sample composed of a minimum of ten (10) subsamples.
2. Results of topsoil analysis shall have approval and sign-off by Landscape Architect prior to delivery of off-site topsoil or placement of on-site topsoil.

E. All relevant materials and work shall comply with applicable sections of the following references unless waived in writing:

1. American Association of Nurserymen, Inc. (AAN) Standard: American Standard for Nursery Stock (ANSI Z60.1-1986).
2. Hortus Third, Cornell University, 1976.
3. American Joint Committee on Horticultural Nomenclature "Standard Plant Names", second edition, 1942.
4. ASTM: American Society for Testing Materials.

F. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements six (6) inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

G. Observation: Landscape Architect may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from project site.

H. Plant Material: Provide quality, size, genus, species, and variety of herbaceous plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock".

1. All landscape materials shall be from stock sources located within 200 miles of project site.

2. Substitutions: Must be approved in writing by the Landscape Architect following proof of non-availability and proposal for use of equivalent material. For proof of non-availability, submit a list of sources queried.

3. Plants shall be supplied at the sizes specified. Plants of larger size may be used if acceptable to the Landscape Architect and if sizes of containers or root balls are proportionately increased.

4. Container plants may be substituted for those designated "B & B" only if approved by the Landscape Architect.

I. Pre-installation Conference: Conduct pre-installation conference at Project site.

J. Approval and Selection of Materials and Work: The selection of all materials and the execution of all operations required under the specifications and drawings are subject to the approval of the Landscape Architect. He/she has the right to reject any and all materials and any and all work, which, in his/her opinion, does not meet the requirements of the contract documents at any stage of the operations. The Contractor shall remove rejected work and/or material from job site and replace promptly.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General:

1. Notify Landscape Architect 48 hours in advance of all delivery times.

B. Plant Materials:

1. Do not prune trees and shrubs before delivery, except as approved by Landscape Architect.

2. Transport plant material in closed vehicles or in open vehicles with the entire load properly covered for protection from drying winds, heat, freezing or other exposure that may be harmful. Make arrangements to have plant material watered during shipment as necessary to avoid excessive stress. Plant material may be rejected if not properly shipped. Plant material shall not be shipped when temperatures are below 20 degrees Fahrenheit.

3. Labels: Shipment of plants shall be clearly identified with durable and legible, waterproof labels stating correct botanical plant name (genus and species) and size of plant securely attached to individual plants or to bundles of like variety and size.

C. Seed:

1. Deliver seed in original sealed, labeled, and undamaged containers, in accordance with standard commercial practice.

2. All seed shall be kept dry and protected from temperature extremes to maintain dormancy and viability while in transit, storage, and during installation operations.

D. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's (Turfgrass Producers International's) "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

E. Shipping shall be scheduled to minimize on site storage of seed/plants. Deliver seed material/plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants in shade, protect from weather and mechanical damage, and keep roots moist.

1. Plants shall not be bent, stacked, or bound in a manner that damages bark, breaks branches, deforms root balls, or destroys natural shape.
2. Handle planting stock by root ball.
3. Cover root balls of trees and shrubs with soil and mulch.
4. Water root systems of all plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.
5. Do not remove container-grown stock from containers until planting time.
6. If it is necessary to store seed material after arrival to the project site, it shall be stored in an approved cool, dry, waterproof building in such a manner as to protect the seeds from deterioration and to permit easy access for inspection. Seed shall be stored away from contaminants. Any chemical treatment material shall not be stored with the seed or plant material.

F. Seed and plant material shall be inspected upon arrival at the project site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five (5) months or older shall be rejected.

G. Packaged Materials: Deliver packaged materials in original, unopened containers, showing weight, analysis and name of manufacturer. During shipment and storage on site, protect materials from breakage, moisture, heat or other damage.

1.7 COORDINATION

A. Exterior Planting Schedule: Two (2) weeks following contract award, submit description of work and schedule for woody, seed, and herbaceous planting and maintenance. Planting Schedule shall include dates for each of the following items of work and shall be provided to the Landscape Architect:

1. Exterior Planting Material order verification.
2. Delivery of exterior planting materials to the project site.
3. Tree/Shrub/Sod/Plant Installation.
4. Native Seeding
5. Substantial Completion.
6. Maintenance period.
7. Final acceptance.

B. Installation Seasons and Conditions: Consult the Landscape Architect for a detailed construction schedule that indicates the timeframes during which all planting must be completed. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion. The following outlines the recommended installation timeframe provided the construction schedule is completed on a timely basis.

1. Native seed installation: Seeding shall be preferentially conducted in spring (as soon as the soil is free of frost and in a workable condition, but no later than June 15th) or as a late fall dormant seeding (after November 15).

2. Tree/shrub installation: Sequence tree/shrub installation after completion of construction work including construction access. There shall be no disturbance to areas after woody material installation. Preferred installation timeframe is April 15 to June 15. If installation cannot occur until later, contractor shall be responsible for supplemental watering.

3. Turfgrass sod installation: Sodding shall be preferentially conducted in spring between May 1st and July 1st, as soon as farms are cutting sod or between Sept 1st and Oct 1st. In no event may sod be installed after October 15th.

4. Herbaceous material installation: Sequence installation with completion of seeding and erosion blanket installation where applicable. Herbaceous material installation shall be preferentially installed between May 1st and July 1st or between Sept 1st and Oct 15th.

5. If special conditions exist which warrant installation outside these proposed planting timeframes, submit a written request to the Landscape Architect describing conditions and stating the proposed variance. If approved, the installation contractor may be responsible for the supplemental watering at a frequency and duration for proper vegetation establishment and development.

C. Project Site Conditions:

1. Prior to beginning work, the contractor shall examine and verify the acceptability of the project site and notify the Landscape Architect in writing of unsatisfactory conditions. Do not proceed with any work until unsatisfactory conditions have been corrected or resolved in writing with the Landscape Architect.

2. Where seeding/planting occurs in close proximity to other site improvements, adequate protections shall be given to all features prior to commencement of work.

Any items damaged during planting operations shall be promptly repaired to their original condition at no cost to the owner.

3. Contractor shall have all underground utilities located by servicing agencies prior to beginning work. In the vicinity of utilities, hand excavate to minimize possibility of damage to underground utilities.

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit. Do not plant when weather conditions are unfavorable such as during high winds, or extremely wet or muddy conditions.

1. When conditions detrimental to plant growth are encountered such as adverse drainage conditions or obstructions, notify the Landscape Architect prior to planting.

E. Coordination with Other Work:

1. Proceed with and complete work as rapidly as portions of project site become available, working within the seasonal limitations for each kind of work required.
2. Herbaceous plant material shall be planted following seed and erosion blanket installation within those areas that are to receive erosion blanket as indicated on plan documents, unless otherwise coordinated with and accepted by the Landscape Architect.

1.8 WARRANTY

A. Warranty Period: Warrant all exterior planting material, for the warranty period indicated, against defects including death, disease or infestation, and unsatisfactory growth, except for defects resulting from neglect, or abuse by Owner, or incidents that are beyond Contractor's control.

1. Warranty Period for Trees and Shrubs: 1 year from date of Substantial Completion.

2. Warranty Period for Sodding covered under this Section: 1 year from date of Substantial Completion.

3. Warranty Period for Herbaceous Plants: 2 years from date of Substantial Completion.

4. Warranty Period for native seeding: 2 years from date of Substantial Completion.

B. Replacements within Warranty Period:

1. At end of warranty period replace exterior plants that are more than 25 percent dead or in an unhealthy or unsightly condition, or for woody material that have lost their natural shape due to dead branches.
2. Remove dead plant material immediately. Replace immediately unless required to plant in the succeeding planting season.

3. Replacement plants and planting operations shall be in accordance with the original specifications. Fully restore areas damaged by replacement operations to their original and specified condition.
4. The guarantee of all replacement plants shall extend for an additional period of one (1) year from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of said extended guarantee, the Landscape Architect may elect subsequent replacement or credit for that item.

C. Warranty/Performance Standards:

1. At the end of the Warranty Maintenance Period and at the time of final acceptance the following performance standards shall be met:
   a. 100% of the woody material shall be alive and growing in a healthy condition.
   b. 95% of the seeded species within each corresponding planting zone shall be alive and growing in a healthy condition.
   c. 95% of the planted plugs and container-grown plants shall be alive and growing in a healthy condition.

1.9 MAINTENANCE

A. Begin maintenance immediately after each tree/shrub is installed and area is seeded and planted and continue until final acceptance and approval by the Landscape Architect at the end of the warranty maintenance period.

1. For seeded areas, establish and maintain seeded vegetation by watering, weeding, reseeding, and other Construction Manager approved operations. Do not let weedy volunteer species exceed 10% of total ground cover unless a different rate is agreed to in writing prior to contract award.

2. Trees and Shrubs: Maintain for the maintenance period by pruning, cultivating, watering, weeding, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Coordinate with Landscape Architect for application of insecticide, fungicide, fertilizer, etc. Restore or replace diseased, deformed, or damaged trees and shrubs.

3. For sodded areas, establish and maintain sod vegetation by watering, mowing, weeding, reseeding, and other Landscape Architect approved operations. Do not let weedy volunteer species exceed 10% of total ground cover unless a different rate is agreed to in writing prior to contract award.

4. Planted plugs and container-grown plants: Maintain for the maintenance period by watering, weeding, and other operations as required to establish healthy, viable plantings. Do not let weedy volunteer species exceed 10% of total ground cover unless a different rate is agreed to in writing prior to contract award.

a. Hand weed and/or use appropriate herbicide (by licensed applicator) at a minimum twelve (12) times each growing season during the maintenance period. Submit dated time sheets of required maintenance operations to Landscape Architect.

1) Hand pulling should include the removal of all aboveground and belowground stems, roots, and flower masses prior to the development of seeds. Care should be taken to disturb as little soil as possible during hand pulling to avoid exposure of additional weed seed in the soil layer, and protect adjacent emerging seedlings.

B. Special Maintenance Areas: Additional maintenance activities are required for the following planting zones: Native Prairie Seed Mix.

1. Seeded Zones shall be mowed during the 1st growing season with a flail type mower and/or string trimmers as needed to keep plant material to a height of 4-6 inches (approximately 5 mowings). The 1st mowing should occur after plants in the seeded areas reach a height of 8-12 inches. Permit growth in the seeded prairie areas to remain at a height of 6-12 inches at the end of the 1st growing season. In the spring of the 2nd growing season all prairie growth (plugged areas included) should be mowed close to the ground and the cuttings raked off.
2. Provide temporary irrigation measures to water areas all special maintenance areas (seeded and herbaceous plugs) a minimum of 3 times a week to provide 2" water per week for the first 6 weeks after installation, or at the beginning of the first growing season for fall seeded areas. Thereafter, provide temporary irrigation measures for an additional 6 weeks to all prairie areas (seed and herbaceous plugs) a minimum of 2 times a week to provide 1" water per week. Temporary irrigation measures may supplement rainfall to provide the minimum water requirements if Contractor maintains and monitors rain gauges on site. Temporary irrigation measures include the provision of hoses, valves, automatic timers, sprinklers (reel, or impact rotor), and drip valves. Hand watering may be allowed at the discretion of the owner. Owner will provide exterior hose bibs and will provide water. Contractor to measure output at different areas of installations to determine if watering requirements are met. Contractor shall also be responsible for monitoring temporary equipment to make sure that it is in proper repair and in good working order.
3. Weekly prairie maintenance reports shall be submitted by the contractor during the first growing season (April 15th – November 1st) and shall document weeding, mowing, and irrigation services performed. Reports shall be submitted to the Landscape Architect on a monthly basis for review. Reports shall be submitted no later than the 15th of the month following the prior month's period of service. Reports shall include information on the contractor performing the service, the nature of the service, when the service was performed, and weather conditions at the time of service. Temporary irrigation reports shall also include measured water quantities at no less than five (5) gauge sites in the prairie and herbaceous plug zones. Water quantities should differentiate between natural rainfall and supplemental irrigation provided by contractor.

PART 2 - PRODUCTS

2.1 GENERAL

A. Warrant all plant material to be true to botanical name and specified size. Any repercussions resulting from incorrect supplied materials (i.e. removal/replacement) will be borne by the contractor.

2.2 PLANT MATERIAL

A. Tree and Shrub Material: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required.
2. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.
3. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.
4. Multi-stem Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1.
5. Deciduous Shrubs: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

B. Herbaceous Plant Material: Provide nursery propagated stock in accordance with best horticultural practice. Collected stock or nursery grown wild plants will not be permitted. Plants shall be free of disease, insects, eggs, larvae, and defects such as knots, sunscald, injuries, abrasions, or disfigurement. They shall be sound, healthy and vigorous of uniform growth typical of the species and variety, well formed, free from irregularities with the minimum quality conforming to American Society for Nursery Stock:

1. Plants designated as plugs shall be grown in containers with sidewall grooves, ribs, or slits and a minimum of 2 ¼ inch in diameter by 5 ½ inches depth.
2. Plants furnished in containers shall have roots well established in the soil mass and shall exhibit root growth that holds soil together when pulled from the container. Containers shall be large enough to provide earth-root mass of adequate size to support the plant tops being grown. Plants over-established in the container, as evidenced by pot-bound root ends, will not be accepted.
3. Herbaceous perennial plant material shall be subject to final approval by the Landscape Architect at the project site prior to installation.
4. Refer to plan documents for species, type, quantity and planting locations.

C. Native (or adapted) Seed Mixes: Reference drawings and coordinate with Construction Manager for placement of each distinct native, or adapted seed mix.

1. Seed shall be fresh, clean, dry new-crop seed provided in original sealed packages bearing the producer's guaranteed analysis for purity, germination, hard seed, and weed seed content.

2. Seed mixtures shall be proportioned by weight in PLS (Pure Live Seed). Mixing of the individual varieties of seed to form such mixtures shall be performed under the supervision of the Construction Manager or shall be completed by the seed supplier, who shall provide documentation of the percentage of each species used to form the mix.

3. Seed mixes shall be as follows:

    a. Mix 1 "Wet-Mesic Prairie"
        i. Cover Crop – Fall Applications
            1. Secale Cereale (Winter Rye)
            2. Application rate: 40 lbs/acre
        ii. Cover Crop – Spring Applications
            1. Avena sativa (Seed Oats)
            2. Application rate: 40 lbs/acre
        iii. "WI Basic Prairie 327 – CP2 Wet" as supplied by Taylor Creek Nursery, or approved equal.
            1. Application Rate: 66.80 oz/ac (26.87 seeds psf)
    b. Mix 2 "Mesic-Dry Prairie"
        i. Cover Crop – Fall Applications
            1. Secale Cereale (Winter Rye)
            2. Application rate: 40 lbs/acre
        ii. Cover Crop – Spring Applications
            1. Avena sativa (Seed Oats)
            2. Application rate: 40 lbs/acre
        iii. "WI Basic Prairie 327 – Mix CP2_3 Dry-Mesic" as supplied by Taylor Creek Nursery, or approved equal.
            1. Application Rate: 81.65 oz/ac (23.81 seeds psf)

2.3 TURFGRASS SOD

A. Turfgrass Species: Sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
2. Sun and Partial Shade: Proportioned by weight as follows:

    a. 50 percent Kentucky bluegrass (Poa pratensis).
    b. 30 percent chewings red fescue (Festuca rubra variety).
    c. 10 percent perennial ryegrass (Lolium perenne).
    d. 10 percent redtop (Agrostis alba).

3. Shade: Proportioned by weight as follows:

    a. 50 percent chewings red fescue (Festuca rubra variety).
    b. 35 percent rough bluegrass (Poa trivialis).
    c. 15 percent redtop (Agrostis alba).

2.4 PLANTING SOIL

A. For Turfgrass: 100% Topsoil

B. For Tree/Shrub Backfill and Groundcover and Perennial Planting: Topsoil with amendments

1. Compost: 10 cubic yards per 1,000 square feet of planting area to provide planting soil with approximately 27% compost by volume.

2. Sand: 5 cubic yards per 1,000 square feet of planting area.

C. For Native Seeding: Bioretention Soil. See specification 312000.

D. Topsoil: ASTMD 5268, pH range of 5.5 to 7; consists of 45-50% sand, 35-40% silt, and 10-15% clay as determined by mechanical analysis and based on the U.S.D.A. classification system; uniformly composed from the A-horizon of soil profiles of local soils without admixture of subsoil. Provide topsoil that is free of toxic material, fertile, friable, (i.e. not pulverized), natural loam free from subsoil, clay lumps, brush, litter, stones, weed propagules (seeds, rhizomes, and plants), roots, or similar objects larger than 1-inch in any dimension, or other deleterious materials.

1. Organic content: Between 3% and 10%.
2. Topsoil Source: Import topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes. The top two (2) inches of surface soil shall be removed/scrapped to remove primary weed seed source; clean soil shall be obtained from 2-inch to subsoil interface depth. Topsoil shall not have been stored or stockpiled for more than one year.

3. Material stripped from the following sources shall not be considered suitable for use as topsoil: chemically contaminated soils, areas from which the original surface has been stripped and/or covered over such as borrow pits, open mines, demolition sites, dumps and sanitary landfills.

2.5 MULCHES

A. Top Dress Mulch: Free from deleterious materials and suitable as a top dressing of trees and perennial areas consisting of one of the following:

1. For Woody Tree and Shrub beds: Double shredded hardwood bark that is clean, fresh, free from branches, free of dyes, free of pieces over 2” in length, free of foreign matter and free of insects.

2. For maintenance paths and other bedding areas: Double shredded hardwood bark that is clean, fresh, free from branches, free of dyes, free of pieces over 2” in length, free of foreign matter and free of insects.

3. For Herbaceous Plant Beds: Partially-composted leaf mulch that is clean, free of foreign matter, and free of insects.

B. Straw Mulch:

1. Shall be clean, seed-free hay of threshed straw of wheat, rye, oats, or barley.

2.6 EROSION CONTROL BLANKET

A. Refer to specification 311000 “Site Clearing”

2.7 COMPOST

A. Aged Pine Fines

1. Physical Properties (dry weight basis):

Percent passing	Sieve Size
95-100	6.35 mm (1/4 in.)
80-100	2.38 mm (#8, 8 mesh)
0-30	500 micron (#35, 32 mesh)

2. Organic Content (dry weight basis): 94% minimum as determined by ash analysis.
3. Chemical Properties
   a. Nitrogen Content (dry weight basis): 0.8% minimum
   b. Soluble Salts/Salinity: Maximum Saturation Extract Conductivity 3.0 millimhos/cm at 25 degrees C, by method.
   c. Iron (dry weight basis): 0.08% minimum

d. pH: 6.5-7.5

4. Wettability:

a. When applied to a cup or small beaker of water @ 70 degrees F. in the amount of 1 teaspoon, the air-dry product shall become completely wet in a period not exceeding 2 minutes.

b. All wetting agents to be non-phytotoxic at rate used.

2.8 FERTILIZERS

A. Do not apply fertilizers unless coordinated with and approved by the Landscape Architect.

2.9 PESTICIDES

A. Do not apply pesticides unless expressly directed to in the plans/specs and coordinated with and approved by the Landscape Architect.

2.10 STAKES AND GUYS

A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches by length indicated, pointed at one end.

B. Guy and Tie Wire: ASTMA 641/A641M, Class 1, galv.-steel wire, 2-strand, twisted, 0.106 inch in dia.

C. Guy Cable: 5-strand, 3/16-inch- diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.

D. Hose Chafing Guard: Reinforced rubber or plastic hose at least 1/2 inch in diameter, black, cut to lengths required to protect tree trunks from damage.

E. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

PART 3 - EXECUTION

3.1 PROCUREMENT

A. Immediately following contract award, the installing contractor shall begin exterior planting material procurement. During the procurement period, the contractor shall locate sufficient quantities of specified materials and set up growing contracts, if necessary, to ensure that the quantities and quality of exterior plant material will be available during the specified installation period. Contractor shall provide the Landscape Architect with this information as soon as possible.

3.2 EXAMINATION

A. Examine areas to receive exterior plant material for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 GENERAL PREPARATION

A. General.

1. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.
2. The newly prepared site shall be protected with barricades as required from traffic, compaction, and erosion.
3. The final grading contractor will establish finished grades per all applicable project specifications and documentation. All subgrade elevations shall be approved by the Landscape Architect prior to placement of topsoil.

3.4 LAYOUT

A. Woody Planting:

1. Individual tree/shrub locations shall be staked on the project site by the contractor and approved by the Landscape Architect before any planting pits are dug. The Landscape Architect reserves the right to adjust plant material locations prior to planting to meet field conditions without additional cost to the owner.

B. Herbaceous Planting:

1. Contactor shall layout planting zones by species as per plan documents, establish transect lines for linear layout of prairie plantings per plan; stake or flag locations, outline areas, adjust areas when requested, and obtain Landscape Architect's acceptance of layout prior to any planting. The Landscape Architect reserves the right to make field adjustments without any additional cost to the owner. Review course of action with Landscape Architect prior to proceeding with this part.

C. Seeding:

1. For all seed applications refer to plan documents for planting zone locations. Flag and review areas to be seeded with Construction Manager prior to installation. The contractor shall supply all equipment, materials, and items necessary for clear layout according to the plans.

3.5 NEW PLANTING BED ESTABLISHMENT AND PREPARATION (IN FORMERLY PAVED AREAS)

A. Comply with Part 1.7B of this Section for timeframe of topsoil placement.

B. Refer to plans for location of new planting areas.

C. In areas with new planting soil (formerly paved areas): Loosen subgrade to a minimum depth of 6 inches

   a. Before topsoil installation, Contractor shall ensure area to be covered is free from debris including deleterious materials, such as, but not limited to, building materials, plaster, paints and stains, concrete and stucco, road base type materials, petroleum based chemicals, oils, and other harmful materials as well as remove stones larger than 1 inch in any dimension and sticks, roots, and rubbish. Contractor shall designate an area for these materials to be disposed in and shall follow local ordinances for disposal of said materials.

   b. Contractor shall give Landscape Architect sufficient notice before topsoil installation to allow inspection of the site to ensure that subsoil is free of debris and meets penetrability standards.

D. Placement of Top Soil. Spread planting soil mix to a depth of 12 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

   1. Placement of planting soil must be coordinated with construction access and schedule to minimize traffic over soil lifts and the final grade as to prevent undesirable soil compaction.

   2. Spread top soil mix over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Moderately hand-tamp planting soil not to exceed 85 Proctor density.

E. Finish Grading: Fine grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus/minus ½ inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.6 PREPARING PLANTING SOIL FOR BACKFILL OF WOODY AND HERBACEOUS PLANTINGS

A. After removing soil from the planting hole of woody trees/shrubs or herbaceous perennial plantings, incorporate the specified planting soil amendments as follows:

   1. Separate removed topsoil (dark black, organic soil) from removed clayey subgrade soil. Take care not to intermix materials by using tarps or other measures.

   2. Dispose of clayey subgrade material off site at contractor’s expense.

   3. Mix removed topsoil with amendments (compost and sand) in the proportions specified using hand or mechanical mixers.

3.7 WOODY PLANTING

B. Excavation: Rocks and other underground obstructions shall be removed to a depth necessary to permit proper planting according to plans and specifications. If

underground utilities or other structural obstructions are encountered, alternate planting locations will be determined by the Landscape Architect.

C. Tree/Shrub Planting: Planting, unless otherwise directed, shall be performed as specified in Part 1.7. Do not plant when ground is frozen or too wet.

1. Balled and burlapped plants: Excavate circular pits that are twice the size of the root ball with sides sloped inward. Scarify sides of plant pit. If necessary, add compacted planting mixture in the bottom of the pit or to a depth necessary to set the plant flare above grade. Set the plant in the pit to the proper position, faced to give the best appearance or relationship to one another and adjacent structures. Cut away burlap, rope, wire or other wrapping materials from the top of the ball, and remove from pit. Do not remove burlap or ties from sides or bottom of ball. Clearly cut off broken or frayed roots. Place planting mixture around the ball and carefully compact to avoid injury to the roots and to fill the voids. After backfilling planting pit approximately two-thirds full, add water and allow planting mixture to settle. After water has been absorbed, fill the planting pit with planting mixture and tamp light to 2” below grade. Apply 3” top dress mulch to 12 inches beyond the edge of the planting pit or trench, or as indicated throughout a planting bed. Place mulch to within (4) inches of the plant’s trunk. Mulch shall be applied within five (5) days after planting.

2. Container-grown stock shall be planted the same as specified above for balled and burlapped plants, and as modified herein. Remove containers before planting and sever the sides of root ball in several places, loosening the roots on the outside of the ball sufficiently to encourage rapid root extension into the surrounding soil and to prevent girdling of root mass.

C. Smooth planting areas to conform to specified grades after full settlement has occurred.

3.8 SEED INSTALLATION

A. Uniformly seed all areas with their appropriate mixes at their designated rates.

1. Seed Planting Zones. The seed mixes shall be uniformly installed. Prior to seeding, methods shall be coordinated and approved by the Construction Manager for each of the designated planting zones. Based on approved installation method by Construction Manager, the following drill and broadcast seed requirements shall be followed.

   a. Broadcast Seed: Seed shall be uniformly broadcast at the specified rates. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Area shall be raked/rolled to ensure adequate seed-soil contact.

   b. Drill Seed: Seed shall be uniformly drilled at the specified rates using equipment with drills a maximum seven (7) inches apart and equipped with rollers. At a minimum, no seeded rows shall be greater than seven (7) inches apart. Half the

total rate of seed application shall be drilled in one direction, with the remainder of the seed rate drilled at 45 degrees from the first direction. Drilling equipment shall be maintained with half full seed boxes during the seeding operations.

B. For Spring Installations: Crimp 2,000 lbs per acre of straw mulch within 7 days of seeding onto seeded areas.

C. For Late Fall Dormant Seeding Installations in areas not otherwise designated to receive erosion control blanket:
   1. Establish cover crop for over-winter erosion control by seeding cover crop species separately prior to October 15th, or …
   2. Install cover crop species concurrently with late fall dormant seeding and install erosion control blanket over all seeded areas.

D. Do not use wet seed or seed that is moldy or otherwise damaged.

E. If area to be seeded was treated with herbicide, seeding shall occur no less than 14 days after the herbicide application or as recommended by manufacturer.

F. Do not fertilize and do not apply mulch other than specified to seeded areas.

3.9 EROSION BLANKET INSTALLATION

A. Immediately following seed installation, install specified erosion control blanket following manufacturer's specifications and installation procedures for areas as indicated on the plan documents.

3.10 SODDING

A. Lay sod within 24 hours of harvesting unless a suitable preservation method is accepted by Landscape Architect prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

   1. Lay sod across slopes exceeding 1:3.
   2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

3.11 HERBACEOUS PLANTING

A. Install herbaceous plant material within specified timeframe as provided in part 1.7 of this Section.

B. Restore planting beds if eroded or otherwise disturbed after seeding, and remove any accumulated debris, trash, or other extraneous materials within the planting zones before planting.

C. For those areas that are to receive erosion blanket as specified on the plan documents, plant after seeding and placement of erosion control blanket. Contractor will be required to carefully slit installed erosion control blanket for plug installation. Contractor shall ensure minimal disturbance to the erosion control blanket.

D. Herbaceous plant zones and plant spacing shall be as per the plan documents.

E. Remove plugs from containers of cells, loosen roots and install in prepared soil.

F. Dig holes large enough to allow spreading of roots, and backfill with planting soil. Plant to a depth to sufficiently cover all roots.

G. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

H. Plants shall be moist at the time of planting. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

I. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

J. Place a 3 inch deep layer of leaf mulch around all herbaceous plug and ornamental perennial areas.

3.12 TREE AND SHRUB PRUNING

A. Do not prune plants prior to delivery. After planting, minimally prune the branches of deciduous stock to removed damaged or broken branches. Pruning shall be done by workers with two years experience in this type of work. Do not leave stubs or use hedge shears.

1. Prune trees to retain required height and spread. Unless otherwise directed by the Landscape Architect, do not cut tree leaders. Only remove injured or dead branches from flowering trees.

2. Prune shrubs to retain natural character.

3.13 GUYING AND STAKING

A. Guying and Staking: Trees that shift in the weeks following planting or during the maintenance period shall be promptly staked with no fewer than 3 guys attached to stakes 30 inches long, driven to grade.

3.14 ACCEPTANCE

A. Substantial Completion: Notify the Landscape Architect in writing of the completion of exterior planting.

1. Within 10 days after notification of completion of work, the Landscape Architect will inspect the work and prepare a Notice of Substantial Completion, along with a list of items the require completion or correction.

2. Issuance of the “Notice of Substantial Completion” shall constitute the start of the Warranty Maintenance Period for any portion accepted.

B. Periodic inspections will be made from time to time by the Landscape Architect to review the quality and progress of the work. Work found to be unacceptable must be corrected within 15 calendar days.

C. Final Acceptance Inspection: The final inspection of all exterior plantings will be made by the Landscape Architect. Before final acceptance shall be made, the terms of the warranty shall be met.

1. Acceptance of all exterior planting will be granted after warranty conditions and warranty performance standards are met and all materials are viable and vigorous, free of insects and diseases, firmly rooted and reflect industry standards of appearance.

D. If all of the above and the warranty conditions are met, the work will be accepted. If not accepted and the work is deemed by the Landscape Architect to be an installation failure, the contractor shall replant/reseed the appropriate zones at no additional cost to the owner.

3.15 CLEANUP AND PROTECTION

A. All materials, equipment and procedures used on the site shall conform to all federal, state, and local ordinances, regulations, and laws. Excavated materials unsuitable to backfilling, as well as debris and other refuse materials shall be disposed of off site in compliance with local codes and ordinances.

B. During planting operations, keep adjacent areas clean and the work area in an orderly condition.

1. No hauling operations and construction site traffic on planting areas that have been previously seeded.

2. Excess and waste material shall be removed daily during construction.

C. Repair, to original condition, any damage to existing landscape, paving, or other such features as a result of work related to this contract. Work to be completed at no additional cost to owner.

D. Protection: Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after vegetation establishment.

1. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, trespassers, vandalism and herbivory. Maintain protection during installation and maintenance periods. Treat, repair, or reseed/replant as directed by the Landscape Architect.

E. Repair: Any damage to existing landscape or other features as a result of work related to this contract shall be repaired by the responsible contractor to its original condition.

3.16 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off owner's property.

END OF SECTION 329300