

SECTION 321216 - ASPHALT 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 REFERENCE SPECIFICATIONS

- A. Standard Specifications of the Kansas City Metro Chapter of the American Public Works Association, latest edition, form a part of this Section to the extent referred to.

1.3 SUMMARY

- A. Section Includes:

- 1. Hot-mix asphalt paving.
- 2. Pavement-marking paint.

- B. Related Sections:

- 1. Division 31 Section "Site Clearing" for demolition, removal, and disposal of existing asphalt pavements.
- 2. Division 31 Section "Earth Moving" for prepared subgrade.

1.4 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.5 SUBMITTALS

- A. General: Submit according to the following:

- 1. Each sheet or page of each submittal shall bear the review stamp of the Contractor indicating the submittal has been reviewed and is approved. Submittals not bearing the Contractor's review stamp will be returned without review.
- 2. Contract drawings may not be reproduced in whole or in part to be utilized as a submittal. Contract drawings reproduced in whole or in part and modified into submittals will not be accepted and will be returned without review.
- 3. Submittals shall be complete and clearly indicate compliance with specified requirements. Submission of a typical nature for separate components or items but not indicating the specifics of each will not be accepted and will be returned without review.

- B. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

- C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

- D. Asphalt-aggregate mixture design for each type of asphalt-aggregate mixture.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 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:
 - 1. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.
- B. Grade Control: Establish and maintain required lines and elevations.
- C. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone or crushed gravel.
- C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone or gravel, or combinations thereof.
- D. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Cement: ASTM D 946 for penetration-graded material, PG 64-22.
- B. Tack Coat: ASTM D 977 emulsified asphalt, Grade SS-1H.
- C. Water: Potable.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.

1. Color: As indicated.

C. Wheel Stops: Precast, air-entrained concrete, 30000-psi minimum compressive strength, 4-1/2 inches high (minimum) by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes complying with Section 2205 of the reference specifications

1. Base Course: APWA Type 1-01.
2. Surface Course: APWA Type 3-01.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Moisture content and density of the top 9 inches of prepared subgrades shall be evaluated by Owner's Testing and Inspection Agency within 2 days prior to constructing pavements on prepared subgrades. The Contractor shall be responsible for scheduling this subgrade evaluation.
- C. Scarify, moisture condition, and re-compact subgrades that do not comply with requirements specified in Division 31 Section – "Earth Moving" at no additional cost to Owner.
- D. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade base before applying paving materials.
- C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.3 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. 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 base course in number of lifts and thicknesses indicated.
 2. Place hot-mix asphalt surface course in single lift.
 3. Spread mix at minimum temperature of 250 deg F.

4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 5. 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.
1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
 3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct transverse joints by bulkhead method or sawed vertical face method as described in AI's "The Asphalt Handbook."
 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 2 percent 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: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent nor greater than 100 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. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus 1/2 inch, no minus.
 - 2. 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 straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.7 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 60 days 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 of 15 mils.

3.8 WHEEL STOPS

- A. Install wheel stops in bed of adhesive as recommended by manufacturer.
- B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.9 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. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores 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 or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 321216

SECTION 321313 – CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways and roadways.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Sidewalks.
 - 5. Ramps
 - 6. Stairs

- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete".
 - 2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and base course.
 - 3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.2 SUBMITTALS

- A. General: Submit according to the following:
 - 1. Each sheet or page of each submittal shall bear the review stamp of the Contractor indicating the submittal has been reviewed and is approved. Submittals not bearing the Contractor's review stamp will be returned without review.
 - 2. Contract drawings may not be reproduced in whole or in part to be utilized as a submittal. Contract drawings reproduced in whole or in part and modified into submittals will not be accepted and will be returned without review.
 - 3. Submittals shall be complete and clearly indicate compliance with specified requirements. Submission of a typical nature for separate components or items but not indicating the specifics of each will not be accepted and will be returned without review.

- B. Concrete mix designs for each class of concrete. Submittal shall establish weights and volumes of all materials used for each class of concrete in accordance with ACI 318, and shall include the following:
 - 1. Concrete mix proportions.
 - 2. Documentation of test records and standard deviations for field experience method or,
 - 3. Laboratory test results for trial batch method.
 - 4. Materials certificates for cements, fly ash, and aggregates. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material items complies with or exceeds the specified requirements.
 - 5. Product data sheets for admixtures. Provide certifications from admixture manufacturers that chloride content complies with specified requirements.

- C. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, and curing compounds.

1.3 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: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.
 - 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 and each aggregate from one source.
 - E. Concrete Standards: Comply with provisions of the following Standard's, except where more stringent requirements are indicated.
 - 1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 - 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
 - F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.
- 1.4 COORDINATION
- A. Coordinate with equipment and integral anchors, and other items embedded in concrete.
- 1.5 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 of 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. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain Steel Wire: ASTM A 82, as drawn.
- C. 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.

- D. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels 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. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

- A. General: Materials for use in concrete shall conform to requirements of the Kansas City Metro Materials Board 2004 KCMMB Concrete Material Specification. Use the same brand and type of cementitious material from the same manufacturer throughout the Project unless otherwise acceptable to the Engineer.
- B. Cementitious Materials: Cementitious materials shall meet the current requirements of ASTM C 595 Type IP or IS Blended Hydraulic Cements (including the optional mortar expansion test) as outlined herein. ASTM C 595 includes blending of ASTM C 150 Portland Cement and pozzolanic materials or granulated blast-furnace slag. Cementitious materials may be blended at the ready mix plant.
 - 1. Manufactured ASTM C 595 Blended Hydraulic Cements Type IS and Type IP must comply with all ASTM C 595 standard requirements (including the optional mortar expansion test) with the following limitations:
 - a. Type IS: The slag constituent shall be between 25% and 40% of the mass of the combined Portland Cement and slag.
 - b. Type IP: The pozzolan constituent shall be between 15% and 30% of the mass of the combined Portland cement and pozzolan.
 - 2. Ready mix plant (field mixed) cementitious materials shall comply with the current requirements of ASTM C 595 Type IS or Type IP Blended Hydraulic Cements (including the optional mortar expansion test) with the following limitations:
 - a. Ground granulated blast furnace slag (GGBFS) shall meet the requirement of ASTM C 989 and shall be grade 100 or 120.
 - b. Maximum limit by mass of GGBFS in field mixed Type IS cements shall be between 25% and 40%.
 - c. Maximum combination of GGBFS and pozzolans shall not exceed 40% by mass of cementitious materials.
 - d. Maximum limit by mass of pozzolanic content in field mixed Portland – pozzolan Type IP cements shall be between 15% and 25%.
 - e. All fly ash used shall meet the requirements of ASTM C 618 Class F with the following exceptions:
 - 1) Available alkali is limited to a maximum of 1.5%.
 - 2) Loss on ignition is limited to a maximum of 3.0%
 - 3. The total mass of Portland cement shall be a minimum of 360 pounds per cubic yard of concrete.
 - 4. The total mass of cementitious materials shall be a minimum of 564 pounds per cubic yard of concrete.
 - 5. Mortar expansion for field mixed Type IP cements blended from ASTM C 618 Type F fly ash is accepted if the eight week maximum expansion of 0.060% is met.
- C. Coarse Aggregate: ASTM C 33, Gradation Sizes Number 1 through Number 7, uniformly graded, from a single source, composed entirely of granite, calcite cemented sandstone, quartzite, basalt, diabase, rhyolite, or trap rock. All coarse aggregate shall come from a large, accessible, uniform geological formation and be easily field identified in concrete. All coarse aggregate test results shall not exceed the following percentages by weight.

1. AASHTO T 103, Soundness by Freeze / Thaw 50 cycles: 1.0% for 3/4-inch to 3/8-inch, 2.0% for 3/8-inch to #4.
2. ASTM C 127, Absorption: 0.5%
3. ASTM C123, Lightweight Pieces: 0.5%
4. ASTM C 142 Clay Lumps and Friable Percent Deleterious: 0.3%
5. Coal and Lignite: 0.05%
6. ASTM C 117, Material Finer than #200 by washing: 0.5%
7. Total deleterious material: 1.0%
8. ASTM C 88, Sulfate Soundness (MgSO₄) Weighted Percent Loss: 0.5% for 3/4-inch to 3/8-inch, 4% for 3/8-inch to #4.
9. ASTM C 131 LA Abrasion Percent Loss: 28.0%

D. Fine Aggregate: ASTM C 33, with the percentage by weight of clay lumps and friable particles not exceeding 0.25%, the percentage by weight of material passing the No. 200 sieve not exceeding 2.0%, and the percentage of coal and lignite not exceeding 0.25%.

E. Water: Potable, ASTM C 94.

2.4 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain no chloride ions.

B. Air-Entraining Admixture: ASTM C 260.

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

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.5 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.

D. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

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

2.6 RELATED MATERIALS

A. Expansion- and Expansion-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

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

2.7 CONCRETE MIXES

- A. Concrete mix designs shall conform to the Kansas City Metro Materials Board 2004 KCMMB Concrete Material Specification designation KCMMB 4K.
- B. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
- C. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
- D. Proportion mixes to provide concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.44.
 - 3. Slump Limit: 3 inches .
- E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to Kansas City Metro Material Board specifications.
- F. Aggregates: Aggregates must be proportioned to have a minimum of 50% coarse aggregate by weight.
- G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content by volume of 6.5% within a tolerance of plus or minus 1.5 percent:

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.
 - 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.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Moisture content and density of the top 9 inches of prepared subgrades shall be evaluated by Owner's Testing and Inspection Agency within 2 days prior to placing base course and constructing pavements on prepared subgrades. The Contractor shall be responsible for scheduling this subgrade evaluation.
- B. Scarify, moisture condition, and re-compact subgrades that do not comply with requirements specified in Division 31 Section – "Earth Moving" at no additional cost to Owner.
- C. Check for unstable areas and verify need for additional compaction. Proceed with concrete placement only after nonconforming conditions have been corrected.
- D. Remove loose material from surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides 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. Check completed formwork and screeds for grade and alignment to following tolerances:
 - 1. Top of Forms: Not more than 1/16 inch in 10 feet.

2. Vertical Face of Longitudinal Axis: Not more than 1/8 inch in 10 feet.

C. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.3 PLACING STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for 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.

3.4 JOINTS

A. General: Construct construction, expansion, and contraction (control) joints 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 concrete, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of concrete and at locations where concrete operations are stopped for more than one-half hour, unless concrete terminates at expansion joints.

1. Continue reinforcement across construction joints, unless otherwise indicated.

2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Expansion Joints: Form expansion joints of preformed joint-filler strips where indicated.

1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated. In curb and gutter, locate expansion joints at points of curvature and at intervals of 50 feet.

2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.

4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length or provide and install expansion cap or tube to prevent concrete bonding to one side of joint.

E. Contraction (Control) Joints: Form weakened-plane contraction (control) joints, sectioning concrete into areas as indicated. In curb and gutter, form contraction joints equidistant between expansion joints at intervals not exceeding 10 feet. Construct contraction (control) joints for a depth indicated, as follows:

1. Sawed Joints: Form contraction (control) joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from base surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- D. Do not add water to concrete during delivery, at Project site, or during placement.
- E. Deposit and spread concrete in a continuous operation between joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
 - 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.
- G. Screed surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form 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 dry-shake surface treatments.
- H. Do not operate equipment on concrete until concrete has attained 85 percent of its 28-day compressive strength.
- I. 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.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- J. 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 at time of placement below 90 deg F (32 deg C). 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 reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, reinforcement steel, and base just before placing concrete. Keep base course moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the 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. Re-float surface immediately to uniform granular texture.
 - 1. Medium -Textured Broom Finish: Draw a broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, medium texture at all locations unless otherwise specified.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. 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. 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. 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 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.

3.8 TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 - 1. Elevation: 1/8 inch
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch
 - 3. Surface: Gap below 10-foot long, unlevelled straightedge not to exceed 1/8 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 Tie-Bar End Relative to Line Perpendicular to Edge: 1/2 inch
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Edge: Length of dowel 1/4 inch per 12 inches
 - 8. Joint Spacing: 3 inches
 - 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 10. Joint Width: Plus 1/8 inch, no minus.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspection 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. Allow testing agency to inspect and test subgrade preparation and base course installation. Proceed with subsequent work only after test results for previously completed work comply with requirements.
- C. Testing Services: Testing shall be performed according to the following requirements:
 - 1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
 - 2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
 - 3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
 - 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 set of compressive-strength specimens.
 - 5. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
 - 6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd.. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
 - 7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
 - 9. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi . When 7-day test is less than 70 percent of 28-day requirement, concrete may not gain adequate strength. Notify Architect in writing and acknowledge potential non-complying concrete.
- D. Test results shall be reported in writing to Architect, concrete manufacturer (as applicable), and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch, 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 Architect but will not be used as the sole basis for approval or rejection.
- F. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

- A. Remove and replace concrete that is broken, damaged, or defective, or does not meet requirements in this Section.
- B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory areas with portland cement concrete bonded with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from concrete for at least 14 days after placement. When construction traffic is permitted, maintain concrete as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete free of stains, discoloration, dirt, and other foreign material. Sweep concrete not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

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. Expansion and contraction joints within cement concrete pavement.
 - 2. Joints between cement concrete and asphalt pavement.
- B. Related Sections include the following:
 - 1. Division 07 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
 - 2. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
 - 3. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- C. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use ASTM C 1087 or manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

3. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
4. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
 2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).
 3. When joint substrates are wet or covered with frost.
 4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.3 COLD-APPLIED JOINT SEALANTS

- A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

- B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

2.4 HOT-APPLIED JOINT SEALANTS

- A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.
- B. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

2.5 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
- D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.6 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealants from surfaces adjacent to joint.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.
- G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 321373

SECTION 323119 - DECORATIVE METAL 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. Decorative steel fences.
- 2. Swing gates.

- B. Related Sections:

- 1. Division 31 Section "Earth Moving" for site excavation, fill, and backfill where decorative metal fences and gates are located.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For gates. 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 infill materials.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 STEEL AND IRON

- A. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Castings: Either gray or malleable iron unless otherwise indicated.
 - 1. Gray Iron: ASTM A 48/A 48M, Class 30.

2.2 DECORATIVE STEEL FENCES

- A. Decorative Steel Fences: Fences made from steel tubing bars and shapes, hot-dip galvanized.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Ametco; Shadow 100 or comparable product by one of the following:
 - a. A & T Iron Works, Inc. / Orogril.
 - b. Ametco Manufacturing Corporation.
- B. Posts and Rails: Square steel tubing.
 - 1. Line Posts and Rails: 2 by 2 inches (50 by 50 mm) with 3/16-inch (4.76-mm) wall thickness.
 - 2. End and Corner Posts: 4 by 4 inches (102 by 102 mm) with 3/16-inch (4.76-mm) wall thickness.
 - 3. Swing Gate Posts: 4 by 4 inches (102 by 102 mm) with 3/16-inch (4.76-mm) wall thickness.
- C. Post Caps: Formed from steel sheet and hot-dip galvanized after forming.
- D. Infill: As indicated by manufacturer and product reference.
- E. Fasteners: Stainless-steel carriage bolts and tamperproof nuts.
- F. Fabrication: Fabricate bar grating infill into sections of size indicated.
 - 1. Fabricate rails with clips welded to rails for fastening to posts in field.
 - 2. Drill posts, clips, and bar grating for fasteners before finishing to maximum extent possible.
- G. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- H. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
 - 1. Hot-dip galvanize posts and rails.
 - 2. Hot-dip galvanize custom-design rail and infill assemblies after fabrication.
- I. Finish for Fence System: Powder coating.

2.3 SWING GATES

- A. Gate Configuration: Double leaf.
- B. Gate Frame Height: As indicated.
- C. Gate Opening Width: As indicated.
- D. Galvanized-Steel Frames and Bracing: Fabricate members from square tubes 2 by 2 inches (50 by 50 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.
- E. Frame Corner Construction: Welded and 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.

- F. Infill: Comply with requirements for adjacent fence.
- G. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet (1.52 m) wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
- H. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.
 - 1. Function: 39 - Full surface, triple weight, antifriction bearing.
 - 2. Material: Wrought steel, forged steel, cast steel, or malleable iron.
- I. Mortise Locks: BHMA A156.13, Grade 1, suitable for exterior use.
 - 1. Function: F07 - Storeroom or closet lock.
 - 2. Material: Brass or bronze.
 - 3. Levers: Cast, forged, or extruded brass or bronze.
 - 4. Mounting Box: Configuration necessary to enclose locks. Fabricate from 1/8-inch- (3.2-mm-) thick, steel plate.
- J. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch- (12.7 -mm-) diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.
- K. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- L. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- M. Gate Finish: Powder Coating.

2.4 STEEL FINISHES

- A. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- B. Powder Coating: Immediately after cleaning, apply 2-coat finish consisting of epoxy primer and TGIC polyester topcoat, with a minimum total dry film thickness of not less than 8 mils (0.20 mm). Comply with coating manufacturer's written instructions.
 - 1. Color and Gloss: Match Architect's sample.

2.5 METALLIC-COATED STEEL FINISHES

- A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a zinc-phosphate conversion 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.
- B. Powder Coating: Immediately after cleaning and pretreating, apply TGIC polyester powder-coat finish, with a minimum dry film thickness of 2 mils (0.05 mm).

1. Color and Gloss: Match Architect's sample.

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

3.2 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Post Setting: Set posts in concrete, in grouted masonry cells, or with mechanical anchors as applicable at indicated spacing.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting.
 2. 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.
 3. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch (20 mm) larger than outside diagonal dimension of post.
 - a. Extend posts at least 5 inches (125 mm) into concrete.
 - b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
 4. Space posts as indicated.

3.3 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.4 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. Lubricate hardware and other moving parts.

END OF SECTION 323119

SECTION 329000 - LANDSCAPE, LAWN AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Documents: The Drawings, and general provisions of the Contract, including the General and Supplementary Conditions, and Division-1 Sections of the Specifications, apply to this Section.
- B. Work Included: Provide landscaping work, as indicated on the drawings and as required herein. The Work includes providing topsoil, miscellaneous materials, equipment, and labor to install planting media, trees, shrubs, Grass seeding, Sprigging, Sodding, soil treatment and amendments, fertilizer and mulch, stakes and guys, temporary irrigation, and steel edging, as noted on the drawings, as specified herein, and as necessary for a complete and proper installation.
- C. Related Sections: Protection of existing trees and plants, topsoil stripping, site clearing, excavation, filling and grading required to establish elevations shown on drawings are specified in other applicable Division 2 sections.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
- B. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.
- C. Topsoil Analysis: Furnish to OWNER, OWNER'S REPRESENTATIVE and LANDSCAPE ARCHITECT, a soil analysis of new topsoil made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.
- D. Report suitability to OWNER, OWNER'S REPRESENTATIVE and LANDSCAPE ARCHITECT of topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce satisfactory topsoil.
- E. All plant materials to meet requirements of ANSI-Z60.1-2004 American Standard for Nursery Stock.

1.3 SUBMITTALS

- A. Certification: Submit manufacturers or vendors certified analysis for soil amendments, fertilizer, Turf Type Fescue Sod. Submit other data substantiating that materials comply with specified requirements.
- B. Submit proposed planting schedule indicating dates for each type of landscape work to be installed during normal seasons. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Revise dates only as approved in writing, after documentation of reasons for details.

- C. Submit maintenance instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit prior to expiration of required maintenance period(s).
- D. Obtain and pay for any permits relating to Landscape work, and coordinate planting schedule with authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.
- B. Sod: Harvest, deliver, store, and handle sod according to the requirements of the American Sod Producers Association's (ASPA) "Specifications for Turfgrass Sod Materials and Transplanting/Installing."
- C. Trees and Shrubs: Deliver freshly dug trees and shrubs. Do not prune before delivery, except as approved by Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery.
- D. Handle balled and burlapped stock by the root ball.
- E. Deliver trees, shrubs, and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material. Do not remove container grown stock from containers before time of planting. Water root systems of trees and shrubs stored on site with a fine mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.5 PROJECT CONDITIONS

- A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.
- B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect before planting.

1.6 COORDINATION AND SCHEDULING

- A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

- B. Special Warranty: Warrant the following living planting materials for a period of one year after date of Substantial Completion, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor's control:
 - 1. Trees.
 - 2. Shrubs.
- C. Remove and replace dead planting materials immediately unless required to plant in the succeeding planting season. Replace planting materials that are more than 25 percent dead or in an unhealthy condition at end of warranty period. A limit of one replacement of each plant material will be required, except for losses or replacements due to failure to comply with requirements.
- D. Sodded area Warranty under Irrigation: Warrant the areas that are Fescue sod for the maintenance period of 60 Days. Turn over responsibility to the Owner, for watering. Replace any sodded areas that are dead, before the Warranty period is up. Stand of Sodded turf areas under irrigation should be 100% when turned over to Owner. SEE SECTION 3.11 FOR TEMPORARY IRRIGATION.

1.8 MAINTENANCE

- A. Tree, Shrub, and Lawn Maintenance:
 - 1. Maintain trees and shrubs by pruning, cultivating, watering, weeding, fertilizing, 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. Spray as required to keep trees and shrubs free of insects and disease. Maintain trees and shrubs for 60 days after date of Substantial Completion.
- B. Ground Cover and Perennial Plant Maintenance:
 - 1. Maintain ground cover and perennial plants by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings for 30 days following Substantial Completion.
- C. Lawn Maintenance:
 - 1. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - a. Sodded Lawns: 60 days after installation and initial watering. If sodding time is not appropriate for success, after consultation with Owner and Architect, Contractor may be asked to extend maintenance period for a negotiated cost. See Section 3.11 for Temporary Irrigation for Sodded Areas.

PART 2 - PRODUCTS

2.1 LANDSCAPING PLANT MATERIALS

- A. Refer to the Drawings for description and sizes (as applicable) of materials required, and as follows:
- B. Tree and Shrub Material:
 - 1. General: Furnish nursery grown trees and shrubs conforming to ANSI Z60.1-2004, 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.
 - 2. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1-2004 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.
 - 3. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.

- C. Shade and Flowering Trees:
 - 1. Shade Trees: Single stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, conforming to ANSI Z60.1-2004 for type of trees required.
 - 2. Branching Height: Half of tree height.
- D. Deciduous Shrubs:
 - 1. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1-2004 for type, shape, and height of shrub. Provide only balled and burlapped deciduous shrubs.
- E. Evergreens:
 - 1. Form and Size: Normal quality, well balanced evergreens, of type, height, spread, and shape required, conforming to ANSI Z60.1-2004. Provide only balled and burlapped evergreens.
- F. Ground Covers and Perennials:
 - 1. Provide perennial plants established and well rooted in removable containers or integral peat pots and with not less than the minimum number and length of runners required by ANSI Z60.1-2004 for the pot size indicated.
- G. Sod:
 - 1. Provide strongly rooted sod, not less than two (2) years old, free of weeds and undesirable native grasses and machine cut to approximate pad thickness of 3/4 inch, excluding top growth and thatch. Provide only sod capable of vigorous growth and development when planted (viable, not dormant). Sod to be commercially grown fescue mix proportioned by weight as follows:
 - a. 90 percent three-part blend of hybrid turf type fescue.
 - b. 10 percent Kentucky Bluegrass.
 - c. PLASTIC HARVEST NETTING MUST BE REMOVED PRIOR TO INSTALLATION.
- H. Topsoil:
 - 1. Topsoil Material: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch or larger in any dimension, and other extraneous materials harmful to plant growth.
 - 2. Topsoil Source: Import topsoil from off-site sources. Obtain topsoil from naturally well drained sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.
 - 3. Soil amendments below as recommended by soil testing only.
- I. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 sieve and a minimum 75 percent passing a No. 60 sieve.
- J. Aluminum Sulfate: Commercial grade, unadulterated.
- K. Sand: Clean, washed, natural or manufactured sand, free of toxic materials.
- L. Perlite: Horticultural Perlite, soil amendment grade.
- M. Peat Humus: Back to Nature Cotton Boll Compost available in 2 cu. ft. bags.
- N. Manure: Well rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.
- O. Water: Potable.
- P. Fertilizer:

1. Commercial Fertilizer (18-24-12): Commercial grade Professional Starter Fertilizer for all Lawn Areas. MUST BE SWEEPED OR BLOWN OFF ANY CONCRETE WALK OR DRIVE TO AVOID DISCOLORATION.
 2. Slow Release Fertilizer (at Trees, Shrubs, And Planting Beds): Granular fertilizer consisting of 50 percent water insoluble nitrogen, phosphorus, in amounts recommended in soil reports from a qualified soil-testing agency. (ONLY IF RECOMMENDED BY SOIL TEST REPORTS).
- Q. Mulches:
1. Organic Mulch: Double Ground Hardwood Mulch ONLY, free from deleterious materials and suitable as a top dressing of trees, shrubs, ground covers, and planting beds.
 2. Decorative Rock Mulch: For Rain garden, use 4-10" Cobblestones known as River Jack for the area adjacent to the concrete Curbing and Sidewalk. Central portion of the area left open for the Canada Ryegrass plantings. River Jack is available from Sturgis Materials; 7th & Kansas Avenue, KC.,KS. 913.371.7757
- R. Weed Control Barriers: Dewitt Pro-5 Landscape Fabric shall be used in ALL planting areas. Use plenty of companion pins to hold it in place.
- S. Erosion control materials if called for on Drawings.
- T. Fiber Mesh: if called for on Drawings. Biodegradable twisted jute or spun coir mesh, 0.92 lb per sq. yd. minimum, with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.
- U. Stakes and Guys:
1. 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, OR, 6' Steel "T" Fence Post.
 2. Guy and Tie Wire: ASTM A 641 (ASTM A 641M), Class 1, galvanized steel wire, 2 strand, twisted, 0.106 inch in diameter.
- V. 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.
- W. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.
- X. Landscape Edgings:
1. Ryerson or Pro Steel 3/16" Steel Edging with appropriate stakes. Install according to manufacturer's recommendations. See Detail on Drawing.
- Y. Miscellaneous Landscape Materials:
1. Pre-Emergent Herbicide: Treflan, Preen, or equal.
 - a. Use in all planting bed areas according to label directions.

PART 3 - EXECUTION

3.1 PREPARATION OF PLANTING SOIL

- A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
- B. For pit and trench type excavations, use backfill soil only to plant all freestanding trees and shrubs in Turf areas.

- C. For planting beds, mix native topsoil with Back to Earth Cotton Boll Compost at rate of one 2 cu ft bag per 25 sq. ft and rototill to a depth of 4 inches.

3.2 PREPARATION FOR PLANTING LAWNS

- A. Apply fertilizer and soil amendments (if specified in Soils Report) at rates specified and thoroughly mix into upper 2 inch of topsoil. Delay application of fertilizer if lawn planting will not follow within a few days. APPLY 18-24-12 STARTER FERTILIZER AT RATE OF 175 LBS PER ACRE AT TIME OF SODDING. MUST BE WASHED OR BLOWN OFF ANY CONCRETE WALK OR DRIVE TO AVOID DISCOLORATION.
- B. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Till soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter. Limit fine grading to areas which can be planted immediately after grading.
- C. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.
- D. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

3.3 EXCAVATION FOR TREES AND SHRUBS

- A. Pits and Trenches: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation.
- B. Balled and Burlapped Trees and Shrubs: Excavate approximately 1-1/2 times as wide as ball diameter and equal to ball depth.
- C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations, such as poor drainage.
- D. Hardpan Layer: Drill 6 inch diameter holes into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free draining material.
- E. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

3.4 PLANTING TREES AND SHRUBS

- A. Set balled and burlapped stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated. Look for Trunk Flare and 1st Major Root. 1st Major Root should be adjacent to surrounding soil, or up to 1.5" above surrounding soil. Place stock on setting layer of compacted planting soil. Remove burlap and wire baskets from tops of balls and partially from sides, but do not remove from under balls. Remove pallets, if any, before setting. Do not use planting stock if ball is cracked or broken before or during planting operation. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

3.5 TREE AND SHRUB PRUNING

- A. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are size after pruning.

3.6 TREE AND SHRUB GUYING AND STAKING

- A. Upright Staking and Tying: Stake trees of 2 through 5 inch caliper. Stake trees of less than 2 inch caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with two (2) strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.7 PLANTING PERENNIALS

- A. Space Perennial plants as indicated. Dig holes large enough to allow spreading of roots, and backfill with planting soil. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

3.8 MULCHING

- A. Mulch trees, shrubs, planted areas, and other areas indicated in a 2-2.5 inch layer. Do not place mulch against trunks or stems of plants.

3.9 SODDING NEW LAWNS

- A. Lay sod within 24 hours of stripping. Do not lay sod if dormant or if ground is frozen. 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 subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, 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. Lay sod across angle of slopes exceeding 3:1. Anchor sod on slopes exceeding 6:1 with wood pegs spaced as recommended by sod manufacturer but not less than two (2) anchors per sod strip to prevent slippage.
- B. PLASTIC HARVEST NETTING MUST BE REMOVED PRIOR TO INSTALLATION.
- C. Saturate sod with fine water spray within 2 hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1/2 inch (12 mm) below the sod.
 - 1. Apply 18-24-12 starter fertilizer just before or just after sodding.
MUST BE SWEEPED OR BLOWN OFF ANY CONCRETE WALK OR DRIVE TO AVOID DISCOLORATION.

3.10 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. PLASTIC HARVEST NETTING MUST BE REMOVED PRIOR TO INSTALLATION.

- C. Remove by grading, any existing grass, vegetation, or turf. Do not mix into soil surface.
- D. 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 subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, 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.
- E. Lay sod vertically on slopes exceeding 3:1.
- F. Anchor sod on slopes exceeding 6:1 with wood pegs spaced as recommended by sod manufacturer but not less than two (2) anchors per sod strip to prevent slippage.
 - 1. Apply 18-24-12 starter fertilizer just before, or just after sodding. **MUST BE SWEEPED OR BLOWN OFF ANY CONCRETE WALK OR DRIVE TO AVOID DISCOLORATION.**
- G. 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 inch (25 mm) below sod.

3.11 LAWN MAINTENANCE/TEMPORARY IRRIGATION FOR FESCUE SOD AREAS.

- A. Watering: Provide and maintain temporary hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 1 inch (25 mm) for the areas shown on plans as FESCUE SOD, AND HYDROSEEDING.
- B. **YOU MAY USE AT YOUR OPTION, A WATERING TRUCK,** and lawn watering equipment. If used, lawn must remain uniformly moist, (as would be the case with sprinklers and hoses), to a depth of 1 inch (25 mm)
- C. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
- D. Water lawn with fine spray at a minimum rate of 1 inch (25 mm) in spring and fall, and 1.5 inches June through August, per week unless rainfall precipitation is adequate.
- E. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - 1. Mow grass to a height of 2 to 3 inches (50 to 75 mm).
- F. Lawn Post fertilization: Owner will apply fertilizer four (4) weeks after installation.

3.12 ERADICATION OF EXISTING PLANTINGS IN RAINGARDEN

- A. Where Rain garden exists, you will need to spray 3x applications of Round up 2 weeks apart to eradicate the existing grasses in place. Once dead, excavate the proposed area to 12" deep and remove the soil to be replaced with new topsoil.

- C. Add 2 bags Cotton Burr Compost and hand spade well.
- D. Area is now ready to accept Planting and Cobblestone Rock according to plan.

3.13 INSTALLATION OF DECORATIVE ROCK IN RAINGARDEN.

A. Install the Specified COBBLESTONE Rock around the edge of the rain garden in a continuous band approximately 8”in width, AND at the concrete flume leading to the mowable swale. Install carefully by hand. They should be placed to “intercept” runoff from the surrounding area and are meant to help hold the looser Rain garden Soil in place. Cobblestones should be placed “tight” together and up to, but not placed against the Grass plants. The combination of Cobblestones and Grasses will act as a filter and allow filtration of rain water without erosion. COBBLESTONES ARE TO BE PLACED AROUND RAINGARDEN EDGE, AND AT BASE OF THE FLUME ONLY, **NOT** THE ENTIRE SURFACE OF THE RAIN GARDEN.

3.14
CLEANUP AND PROTECTION

- A. During landscaping, keep pavements clean and work area in an orderly condition. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.
- B. Disposal: Remove surplus soil and waste material, including unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION

