SECTION 32 13 13 – CONCRETE PAVING

PART 1 – GENERAL

1.01: Related Documents

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

1.02: Summary

A. Section Includes Concrete Paving, including the following:

1. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Walks.

1.03: Definitions

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

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.04: Submittals

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

B. Samples: For each exposed product and for each color and texture specified.

C. Other Action Submittals:

1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.05: Quality Assurance

A. 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").

B. 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.

PART 2 – PRODUCTS

2.01: Concrete, General

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

2.02: Forms

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

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.

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

2.03: Steel Reinforcement

A. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

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

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

E. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

F. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

G. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars; assembled with clips.

H. Plain-Steel Wire: ASTM A 1064/A 1064M, [as drawn] [galvanized].

I. Deformed-Steel Wire: ASTM A 1064/A 1064M.

J. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated, [plain] [deformed].

K. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars[; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating]. Cut bars true to length with ends square and free of burrs.

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

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

N. Hook Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

O. 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 specified, and as follows:

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

2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

P. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

Q. Zinc Repair Material: ASTM A 780/A 780M.

2.04: Concrete Materials

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

1. Portland Cement: ASTM C 150/C 150M, white portland cement Type I.

2. Fly Ash: ASTM C 618, Class C or Class F.

2.05: Fiber Reinforcement

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, [1/2 to 1-1/2 inches (13 to 38 mm)].

2.06: Curing Materials

A. Absorptive Cover: AASHTO M 182, [Class 3, 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: 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, dissipating.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.07: Related Materials

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

2.08: Concrete Mixtures

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Use admixtures according to manufacturer’s written instructions

C. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than [1.0 lb/cu. yd. (0.60 kg/cu. m)] [1.5 lb/cu. yd. (0.90 kg/cu. m)]

D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

E. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).

2. Maximum W/C Ratio at Point of Placement: 0.45

3. Slump Limit: 4 inches (100 mm) plus or minus 1 inch (25 mm).

4. Air content 6% or +/- 15%

2.09: 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.

PART 3 – EXECUTION

3.01: 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 concrete paving to identify soft pockets and areas of excess yielding.

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

3.02: Preparation

A. Remove loose material from compacted subbase surface immediately before placing concrete.

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

3.04: Steel Reinforcement Installation

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.

3.05: Joints

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

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

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

D. Contraction Joints: 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, to match jointing of existing adjacent concrete paving:

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.06: Concrete Placement

A. 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.

B. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.

C. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

D. 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.

E. Screed paving surface with a straightedge and strike off.

F. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.07: Float Finishing

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: 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-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.

3.08: Special Finishes

A. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:

1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
2. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

3.09: 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. 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 (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.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing.

3.10: Paving Tolerances

A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:

1. Elevation: 3/4 inch (19 mm).

2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).

3. Surface: Gap below 10-feet- (3-m-) long; unleveled straightedge not to exceed 1/2 inch (13 mm).

4. Joint Spacing: 3 inches (75 mm).

5. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.

6. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.11: Repair and Protection

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.

B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

*****End of Section 32 13 13*****

SECTION 32 13 73 – CONCRETE PAVING JOINT SEALANTS

PART 1 – GENERAL

1.01: Related Documents

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

1.02: Summary

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Cold-applied, fuel-resistant joint sealants.
4. Hot-applied, fuel-resistant joint sealants.

1.03: Action Submittals

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.04: Quality Assurance

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.05: Field Conditions

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer [or are below 40 deg F (5 deg C)].
2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01: 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.

2.02: Cold-Applied Joint Sealants

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.

C. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.

2.03: Hot-Applied Joint Sealants

A. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690

B. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I, II, or III.

2.04: Joint-Sealant Backer Materials

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.05: Primers

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.01: Examination

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.02: Preparation

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

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.

3.03: Installation of Joint Sealants

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint 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 joint-sealant backings.

2. Do not stretch, twist, puncture, or tear joint-sealant backings.

3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.

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.

3.04: Cleaning and Protection

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. 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 in repaired areas are indistinguishable from the original work.

*****End of Section 31 25 13*****

SECTION 32 16 00 – SIDEWALKS, CURBS AND GUTTERS

PART 1 GENERAL

1.01: Section Includes

A. Concrete WORK shall consist of air entrained Portland cement constructed on a prepared subgrade in accordance with these SPECIFICATIONS. The completed WORK shall conform to the thicknesses and typical cross-sections shown on the DRAWINGS. The completed WORK shall conform to the lines and grades shown on the DRAWINGS or to those established by ENGINEER at the job site.

1.02: Related Sections

A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 31 23 00, Excavation and Fill.

2. Section 31 23 19, Dewatering.

3. Section 31 23 33, Trenching and Backfilling.

1.03: References

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO):

a. M6, Standard Specification for Fine Aggregate for Hydraulics Cement Concrete.

b. M80, Standard Specification for Coarse Aggregate for Hydraulics Cement Concrete.

c. M148, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

d. M154, Standard Specification for Air-Entraining Admixtures for Concrete M171, Standard Specification for Sheet Materials for Curing Concrete.

f. M182, Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats.

g. M194M/M194, Standard Specification for Chemical Admixtures for Concrete.

h. T22, Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens.

i. T23, Standard Method of Test for Making and Curing Concrete Test Specimens in the Field.

j. T26, Standard Method of Test for Quality of Water to Be Used in Concrete.

T27, Sieve Analysis of Fine and Coarse Aggregates

l. T96, Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

m. T11, Standard Method of Test for Clay Lumps and Friable Particles in Aggregate.

n. T119M/T119, Standard Method of Test for Slump of Hydraulic Cement Concrete.

o. T121M/T121, Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.

p. T141, Standard Method of Test for Sampling Freshly Mixed Concrete.

q. T152, Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method.

r. T176, Standard Method of Test for Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.

s. T199, Standard Method of Test for Air Content of Freshly Mixed Concrete by the Chace Indicator.

2. ASTM International (ASTM):

a. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

b. C920, Standard Specification for Elastomeric Joint Sealants.

3. Louisiana Department of Transportation (CDOT):

a. Section 703.01, Fine Aggregate for Concrete.

b. CP30, Sampling of Aggregates.

c. CP31A, Sieve Analysis of Fine and Coarse Aggregates.

d. CP60, Determining Surface Moisture in Fine and Coarse Aggregates.

1.04: Submittals

A. CONTRACTOR shall cooperate with ENGINEER in obtaining and providing samples of all specified materials.

B. CONTRACTOR shall submit certified laboratory test certificates for all items required in this section.

C. Contractor shall submit mix design for concrete in writing to ENGINEER for approval prior to placement of concrete.

D. CONTRACTOR shall submit batch tickets for each load of concrete. Tickets shall show weight of all materials and additives used in each batch.

PART 2 PRODUCTS

2.01: Materials

A. Concrete Conformance:

1. Concrete shall conform to the following requirements:

Concrete Requirements	
28-Day Field Compressive Strength	3,500 psi
Cement/Fly Ash	600 lbs./cu. yd.
Max. Water/Cement Ratio	0.53
Air Content % Range	5-8
Maximum Slump	4"
Fine Aggregate (max. % of total Aggregate)	50%

2. This material shall consist of a mixture of coarse and fine aggregates, Portland cement, water and other materials or admixtures as required. The type of cement shall be Type I, II, or I/II unless sulfate conditions dictate otherwise. If sulfate conditions exist, Type V cement shall be used.

B. Concrete Aggregates: The grading and composition requirements for coarse and fine aggregates for concrete shall conform to the following tables.

Coarse Aggregates for Portland Cement Concrete	
Sieve Size or Test Procedure	**% Passing or Test Requirement**
1 inch	100
¾ inch	90-100
⅜ inch	20-55
No. 4	0-10
No. 8	0-5
% Wear	45, Max
Clay Lumps * Friable Particles, %	2.0, Max
Coal & Lignites, %	0.5, Max
Sodium Sulfate Soundness %	12, Max

Fine Aggregates for Portland Cement Concrete	
Sieve Size or Test Procedure	**% Passing or Test Requirement**
⅜ inch	100
No. 4	95 - 100
No. 16	45 - 80
No. 50	10 - 30
No. 100	2 - 10
No. 200	3, Max
Friable Particles, %	1.0, Max
Coal & Lignite, %	1.0, Max
Deleterious Material (AASHTO T112),%	3, Max
Sand Equivalent (AASHTO T176),%	80, Min
Fineness Modules	2.50 - 3.50
Sodium Sulfate Soundness, %	20.0, Max
Fine Aggregates for Portland Cement Concrete	
Sieve Size or Test Procedure	**% Passing or Test Requirement**
⅜ inch	100
No. 4	95 - 100
No. 16	45 - 80
No. 50	10 - 30
No. 100	2 - 10
No. 200	3, Max
Friable Particles, %	1.0, Max
Coal & Lignite, %	1.0, Max
Deleterious Material (AASHTO T112),%	3, Max
Sand Equivalent (AASHTO T176),%	80, Min
Fineness Modules	2.50 - 3.50
Sodium Sulfate Soundness, %	20.0, Max

C. Coarse Aggregate for Concrete: Coarse aggregates shall conform to the requirements of AASHTO M80, except that the percentage of wear shall not exceed forty-five (45) when tested in accordance with AASHTO T96. Coarse aggregate shall conform to the grading in above table.

D. Fine Aggregate for Concrete: Fine aggregates shall meet Louisiana Department of Transportation requirements and gradation as shown above. Fine aggregate for concrete shall conform to the requirements of AASHTO M6. The amount of deleterious substances removable by elutriation shall not exceed three percent (3%) by dry weight of fine aggregate when tested in accordance with AASHTO T11, unless otherwise specified. The minimum Sand Equivalent, as tested in accordance with AASHTO T176 shall be eighty (80), unless otherwise specified. The Fineness Modules shall not be less than two and five-tenths (2.50) nor greater than three and five-tenths (3.50), unless otherwise approved.

E. Fly Ash and Water: Upon approval based on a satisfactory trial mix, CONTRACTOR shall have the option of substituting approved fly ash for Portland cement, up to a maximum of twenty percent (20%) by weight. The total weight of cement and fly ash shall not be less than the specified mix design.

1. Fly ash for concrete shall conform to the requirements of ASTM C618, Class C or Class F. All chemical requirements of ASTM C618 Table 1-A shall apply with the exception of footnote A.

    a. Class C fly ash will not be permitted where sulfate resistant cement is required.

    b. CONTRACTOR shall submit certified laboratory test results for the fly ash. Test results that do not meet the physical and chemical requirements may have been taken to ensure that the material meets the SPECIFICATIONS.

2. Water used in mixing or curing shall be clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substance injurious to the finished product. Water shall be tested in accordance with, and shall meet the suggested requirements of AASHTO T26. Water known to be of potable quality may be used without test. Where the source of water is relatively shallow, the intake shall be enclosed so as to exclude silt, mud, grass, or other foreign materials.

F. Concrete Curing Materials and Admixtures:

1. Curing Materials: Curing materials shall conform to the following requirements as specified:
    a. Burlap Cloth made from Jute or Kenaf: AASHTO M182.

    b. Liquid Membrane-Forming Compounds Curing Concrete: AASHTO M148.

    c. Sheet Materials for Curing Concrete: AASHTO M171.

    d. Straw shall not be used for curing unless approved by ENGINEER.

2. Air-Entraining Admixture: Air-entraining admixtures shall conform to the

requirements of AASHTO M154. Admixtures which have been frozen will be rejected. No chloride containing additives shall be permitted.

3. Chemical Admixtures: Chemical admixtures for concrete shall conform to the requirements of AASHTO M194M/M194. Admixtures which have been frozen will be rejected.

4. Joint Fillers: The joint fillers shall meet the requirements of ASTM C920.

PART 3 EXECUTION

3.01: Subgrade Preparation

A. The subgrade shall be excavated or filled to the required grades and lines. All soft, yielding, or otherwise unsuitable material shall be removed and replaced with suitable material with ENGINEER's approval. Filled sections shall be compacted and compaction shall extend a minimum of six (6) inches outside the form lines.

B. The moisture content of the subgrade shall be brought within +/- two percent (2%) of optimum moisture content and compacted to ninety-five percent (95%) of the maximum standard Proctor density (ASTM D698) for subgrade materials classified as A-4 through A-7 or ninety five percent (95%) of modified proctor density for materials classified as A-1 through A-3.

3.02: Concrete Placement

A. General:

1. Concrete transported in truck mixers or truck agitators shall be delivered to the site of the WORK and completely discharged within a period of ninety (90) minutes after the cement comes in contact with the mixing water or with the combined aggregates containing free moisture in excess of two percent (2%) by weight.

2. The concrete shall be placed either by an approved slip form/extrusion machine, by the formed method, or by a combination of these methods.

3. The subgrade shall be conditioned to provide a uniformly moist surface when concrete is placed.

B. Machine Placement: The slip form/extrusion machine shall be so designed to place, spread, consolidate, screed, and finish the concrete in one (1) complete pass in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogenous concrete section. The machine shall shape, vibrate, and/or extrude the concrete for the full width and depth of the concrete section being placed. It shall be operated with as nearly a continuous forward movement as possible. All operations of mixing, delivery, and spreading concrete shall be so coordinated as to provide uniform progress, with stopping and starting of the machine held to a minimum.

C. Formed Method:

1. The vertical face of previously sawed and adjacent asphalt pavement may NOT be used as a forming surface. CONTRACTOR shall use forms on front and back of all curb and gutter, sidewalks and crosspans.

2. The forms shall be of metal or other suitable material that is straight and free from warp, having sufficient strength to resist the pressure of the concrete without displacement and sufficient tightness to prevent the leakage of mortar. Flexible or rigid forms of proper curvature may be used for curves having a radius of one hundred (100) feet or less. Division plates shall be metal. Where directed by ENGINEER, CONTRACTOR shall use a thin metal back form to preserve landscaping, sprinklers, etc. Form shall be straight and rigid and shall be approved by ENGINEER prior to use on PROJECT.

3. The front and back forms shall extend for the full depth of the concrete. All of the forms shall be braced and staked so that they remain in both horizontal and vertical alignment until their removal. No wooden stakes will be allowed. They shall be cleaned and coated with an approved form-release agent before concrete is placed against them. The concrete shall be deposited into the forms without segregation and then it shall be tamped and spaded or mechanically vibrated for thorough consolidation. Low roll or mountable curbs may be formed without the use of a face form by using a straight edge and template to form the curb face. When used, face forms shall be removed as soon as possible to permit finishing. Front and back forms shall be removed without damage to the concrete after it has set.in the asphalt patch detail to properly correct failed concrete sections, CONTRACTOR shall remove and replace said asphalt pavement to such an extent as to provide a smooth repair. ENGINEER shall be notified prior to commencing any additional asphalt removal.

3.03: Finishing

A. The plastic concrete shall be finished smooth by means of a wood float and then it shall be given final surface texture using a light broom or burlap drag. Concrete that is adjacent to forms and formed joints shall be edged with a suitable edging tool to the dimensions shown on the DRAWINGS.

3.04: Jointing

A. Contraction Joints:

1. Contraction and construction joints shall be placed at the standard spacing of ten (10) feet in curb, gutter, sidewalks, crosspans, trickle channel, etc. A minimum spacing of five (5) feet shall be allowed for repairs.

2. Transverse weakened-plane contraction joints shall be constructed at right angles to the curb line at intervals not exceeding ten (10) feet for curb and gutter or five (5) feet for sidewalk. Joint depth shall average at least one-fourth (1/4) of the cross-section of the concrete.

3. Contraction joints may be sawed, hand-formed, or made by one-eighth inch (1/8") thick division plates in the formwork. Sawing shall be done early after the concrete has set to prevent the formation of uncontrolled cracking. The joints may be hand-formed either by (1) using a narrow or triangular jointing tool or a thin metal blade to impress a plane of weakness into the plastic concrete, or (2) inserting one-eighth inch (1/8") thick steel strips into the plastic concrete temporarily. Steel strips shall be withdrawn before final finishing of the concrete. Where division plates are used to make contraction joints, the plates shall be removed after the concrete has set and while the forms are still in place.

B. Expansion Joints:

1. Expansion joints shall be constructed at right angles to the curb line at immovable structures and at points of curvature for short radius curves. Filler material for expansion joints shall conform to requirements of the requirements of ASTM C920 and shall be furnished in a single one-half inch (1/2") thick piece for the full depth and width of the joint.

2. Expansion joints in a slip-formed curb or curb-and-gutter shall be constructed with an appropriate hand tool by raking or sawing through partially set concrete for the full depth and width of the section. The cut shall be only wide enough to permit a snug fit for the joint filler. After the filler is placed, open areas adjacent to the filler shall be filled with concrete and then troweled and edged. CONTRACTOR may choose to place the filler and pour the concrete around it.

3. Alternately, an expansion joint may be installed by removing a short section of freshly extruded curb-and-gutter immediately, installing temporary holding forms, placing the expansion joint filler, and replacing and reconsolidating the concrete that was removed. Contaminated concrete shall be discarded.

4. Construction joints may be either butt or expansion-type joints. Curbs or combined curbs-and-gutters constructed adjacent to existing concrete shall have the same type of joints as in the existing concrete, with similar spacing; however, contraction joint spacing shall not exceed ten (10) feet.

3.05: Protection

A. CONTRACTOR shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting. For slip-form construction, materials such as wood planks or forms to protect the edges shall also be required. Concrete damaged by rain shall be required to be removed and replaced at CONTRACTOR's expense.

B. Concrete being placed in cold weather during which the temperature may be expected to drop below thirty-five degrees Fahrenheit (35°F), shall be suitably protected to keep the concrete from freezing until it is at least ten (10) days old. Concrete injured by frost action shall be required to be removed and replaced at CONTRACTOR's expense.

C. CONTRACTOR shall be responsible for correcting any vandalism or defacement (graffiti) that occurs on the concrete prior to final acceptance.

3.06: Curing

A. Concrete shall be cured for at least seven (7) days after placement to protect against loss of moisture, rapid temperature change, and mechanical injury prior to any overlay or reconstruction work. Moist burlap, waterproof paper, white polyethylene sheeting, white liquid membrane compound, or a combination thereof may be used as the curing material. Membrane curing shall not be permitted in frost-affected areas when the concrete will be exposed to deicing chemicals within thirty (30) days after completion of the curing period.

3.07: Backfilling

A. The spaces in front and back of curbs shall be refilled with suitable material to the required elevations after the concrete has set sufficiently. The fill material shall be thoroughly tamped in layers.

3.08: Sealing

A. Where required, concrete shall be sealed with a mixture of one-half (1/2) linseed oil and one-half (1/2) diesel fuel, unless otherwise specified by ENGINEER.

3.09: Tolerance

A. Forms shall not deviate from true line by more than one-quarter (1/4) inch at any point.

B. Mixed concrete shall be not less than fifty degrees Fahrenheit (50°F), nor more than eighty degrees Fahrenheit (80°F) at the time of placement in forms, unless otherwise directed.

C. If air temperature is thirty-five degrees Fahrenheit (35°F) or less at the time of placing, ENGINEER shall require water and/or aggregate heated to not less than seventy degrees Fahrenheit (70°F), or more than one-hundred fifty degrees Fahrenheit (150°F).

D. Finished joints shall not deviate more than one-quarter (1/4) inch in the horizontal alignment from a straight line.

E. Any localized humps and or depressions greater than one-quarter (1/4) inch shall require removal and replacement of the WORK in question at CONTRACTORS expense

F. No ponding of water greater than three-eighths (3/8) inch shall be allowed.

G. Combination curb, gutter and walk and/or vertical curb and gutter flowline depth shall not vary from adopted standards by more than +/- one-half (1/2) inch, measured vertically from the top of curb to the gutter invert.

H. Pedestrian walks shall have a minimum of two percent (2.0%) and a maximum of two and one half percent (2.5%) slope toward the roadway.

I. Heave or settlement of sidewalk, relative to separate curb pour, greater than one-half (1/2) inch shall be cause for corrective action. This provision shall not apply to transverse sidewalk joints.

3.10: Quality Control

A. Testing: Concrete testing and testing laboratory services required shall conform to the following unless otherwise determined by ENGINEER.

Section Type of Test	Project Acceptance Frequency	Point of Sampling Acceptance	Procedures	
			Test Sampling	Project Testing
Sidewalks (Concrete Aggregate Gradation)	1/1000 square yards or fraction thereof for each size aggregate of concrete placed	Stockpile, Belt or Bin	LDOTD	LDOTD
Curbing (Concrete Aggregate Gradation)	1/2000 lineal feet or fraction thereof for each size aggregate of concrete placed		LDOTD	LDOTD
Moisture Content (Fine Aggregate)	1 per day and as often as needed for quality control		LDOTD	LDOTD

Section Type of Test	Project Acceptance Frequency	Point of Sampling Acceptanc	Procedures	
			Test Sampling	Project Testing
Moisture Content (Coarse Aggregate	1 per day min. where moisture content is greater than +0.5% from SSD condition	Stockpile, Belt or Bin	LDOTD	LDOTD
Slump	1 set of tests for every 1000 square yards or fraction thereof of concrete placed per day	The slump, air content, unit weight and compressive strength tests shall be carried out on the first truck of concrete for the daily placement and thereafter in conformance with this table by sampling from the mixer discharge or pumper truck discharge hose	AASHTO T141	AASHTO T119M/ T119
Air Content	1 set of tests for every 1000 square yards or fraction thereof of concrete placed per day		AASHTO T141 T199	AASHTO T152
Yield and Cement	4 tests for every 2000 lineal feet or fraction thereof of concrete placed per a day		AASHTO T141	AASHTO T121M/ T121
Compressive (Sidewalks)	1 set (4) of cylinders per 1000 square yards or fraction thereof of concrete placed per day		AASHTO T141 T23	AASHTO T22
Compressive (Curbing)	1 set (4) of cylinders per 2000 lineal feet or fraction thereof of concrete placed per day		AASHTO T141 T23	AASHTO T22

B. Repair:

1. Prior to backfilling and after forms are removed, honeycombed, defective or damaged areas of concrete shall be repaired. Repairs shall be made within seven (7) days after the forms are removed.

2. At the time of final acceptance inspection, the repair of all cracks shall be completed.

   a. Cracks that are less than one-quarter (1/4) inch wide, exhibit no horizontal or vertical shifting, and do not meet the conditions in 2, 3, and 4, below may, at the discretion of the OWNER, be sealed by routing approximately three-quarter (3/4) inch to one (1) inch deep by one-quarter (1/4) inch wide and filling with Sikaflex 1-A or equivalent.

   b. Any crack that extends through a joint shall require removal and replacement of the entire cracked area.

   c. Any longitudinal cracked section of concrete shall require complete removal and replacement of that section between joints.

   d. Repair action for hairline cracks as determined in 1, above, may be waived at the discretion of OWNER. For the purpose of this section, a hairline crack is one that is reasonably immeasurable and without separation as determined by ENGINEER.

3.11: Clean-Up

A. The surface of the concrete shall be thoroughly cleaned upon completion of the WORK and prior to the substantial completion walk through, and the site left in a neat and orderly condition.

*****End of Section 32 16 00*****

SECTION 32 90 00 - IRRIGATION

PART 1 – GENERAL

1.01 PURPOSE

A. The purpose of this project is to provide the owner with a complete landscape irrigation system.
B. Water for the landscape irrigation system will be supplied by a potable water source.

1.02 GENERAL CONDITIONS

A. The Landscape Irrigation Contractor shall design, furnish and install the landscape irrigation system including all products, equipment and labor required to complete the system as specified in the Contract Documents. Contract Documents are the plans and written specifications.
B. Bids shall include a projected time frame of installing the system. It should reflect, in calendar days, the anticipated time required from the day of the award to completion of the system in a fully operational mode. This schedule should reflect anticipated time for ordering and receiving all components, starting and ending times for installation, starting and ending times for training, system start-up, etc.
C. The Landscape Irrigation Contractor and his project superintendent shall be licensed as per the State of Louisiana Horticulture Law and supply proof thereof. The job supervisor shall be on the job site and at all times during the installation.
D. The Landscape Irrigation Contractor shall be responsible for obtaining and paying for permits, fees, inspections and tests required for the installation.
E. Before bidding this project, the Landscape Irrigation Contractor shall make a site examination of the proposed work and completely familiarize himself with the nature and extent of the work to be accomplished. No extra compensation will be allowed for any work made necessary by unusual conditions or obstacles encountered during the progress of the work, when conditions or obstacles are readily apparent upon a visit to the site.
F. Before bidding this project, the Landscape Irrigation Contractor shall verify existing surface and subsurface conditions, and final (proposed) finished grades of the areas to be irrigated.
G. Upon completion of irrigation system installation, the Landscape Irrigation Contractor shall return the area to a condition equal to or better than its condition prior to installation.
H. Landscape Irrigation Contractor shall be responsible to make all electrical connections as needed to the irrigation equipment.
I. Before beginning on site work, the Landscape Irrigation Contractor will be responsible to locate all underground utilities, lines, pipes, retaining walls and retaining wall reinforcing. The Landscape Irrigation Contractor will be responsible to pay for repairs for damages to any of these located underground utilities, lines and pipes caused by him. If underground utilities, lines and pipes not located are damaged by the Landscape Irrigation Contractor, he is not responsible to pay for those damages.

1.03 CONTRACTOR'S USE OF PREMISES

A. Coordinate irrigation work with other trades on the job site, particularly those performing the planting.
B. Do not unreasonably encumber site with materials and equipment.
C. Assume full responsibility for protection and safekeeping of materials and equipment stored on-site.

D. Confine operations to areas within contract limits.
E. There should be no interference with regular workplace activities.

1.04 ORDINANCES, REGULATIONS, CODES, PERMITS & INSPECTIONS

A. Follow all regulations, ordinances and codes governing this type of work. Follow all T.C.E.Q. rules and regulations.
B. Any permits that are needed for the installation shall be obtained and paid for by the Landscape Irrigation Contractor following whatever ordinances, regulations and codes requiring the permits. If the authorities of the jurisdiction require inspection at said points of the installation, the Landscape Irrigation Contractor shall arrange for, and be present at, any such inspections.
C. Any additional work or furnishing of materials required due to inspection by the authorities of jurisdiction shall be furnished at no cost to the owner. In the event that the specifications for this project and existing ordinances, regulations or codes are in conflict, the conflict shall be noted in writing by the Landscape Irrigation Contractor to the owner's authorized representative, and any necessary changes in work shall follow the previously established procedure for claims for extra compensation.

1.05 PUBLIC PROTECTION DURING CONSTRUCTION

At all times the Landscape Irrigation Contractor shall protect the public from any accidents caused by his construction. The Landscape Irrigation Contractor shall barricade and cover all holes, ditches, and any other item that poses a threat to public safety. The owner's representative shall determine the type of barricades and types of covers to be used by the Landscape Irrigation Contractor. The Landscape Irrigation Contractor will protect and defend the Owner from any liabilities due to the Landscape Irrigation Contractor's negligence.

1.06 SUPERVISION

A. The Landscape Irrigation Contractor shall provide a competent superintendent and any necessary assistants on the project when work is in progress. The superintendent shall not be changed during the project without the consent of the owner's representative unless the superintendent ceases his status as an employee of the Landscape Irrigation Contractor. The superintendent shall represent the Landscape Irrigation Contractor in the Landscape Irrigation Contractor's absence, and all directions given to him by the owner's representative shall be binding as if they were given to the Landscape Irrigation Contractor.
B. The Landscape Irrigation Contractor's superintendent shall supervise the Landscape Irrigation Contractor's employees on the job site and be responsible for their actions and conduct on the job site.

1.07 WARRANTY

The Landscape Irrigation System shall be warranted to be free of defects and properly installed for one (1) year from the date of final acceptance. All equipment shall have a manufacturer's guarantee against faulty design, improper assembly, defective workmanship or defective materials for a period of one (1) year from final acceptance.

1.08 STANDARDS

A. QUALITY ASSURANCE: Perform all work in compliance with applicable requirements of governing authorities. Electrical work shall conform to State of Louisiana Codes and latest edition of the National Electric Code.
B. APPLICABLE STANDARDS: All Polyvinyl Chloride (PVC) pipe, fittings, and solvent cements for PVC pipe and fittings shall conform to applicable ASTM standards.

1.09 DELIVERY, STORAGE AND HANDLING

A. Protect and maintain work, material, and fixtures from weather damage. Cover or otherwise protect new work likely to be damaged.
B. The Landscape Irrigation Contractor will be responsible for all materials stored on the project site including theft, damage, etc. The Owner will not be responsible to reimburse the Landscape Irrigation Contractor for any theft, damage, etc.

1.10 MAINTENANCE

A. Provide two sets of automatic controller keys per controller and two sets of keys for the controller enclosure. Furnish this equipment to the owner upon final acceptance of work.
B. Provide watering program to owner showing scheduling or sequencing of valves, and desirable timing program for the controller. Schedule controller to start watering at 4 AM. Include suggested operating time for new planting and established growth.
C. Train the Owner's operator in the complete operation of the controller and instructions on the proper method of turning the system off if the controller is inoperable, and instructions on the proper method of cleaning and adjusting nozzles.

PART 2 - PRODUCTS AND MATERIALS

2.01 QUALITY

A. The Landscape Irrigation Contractor shall be a firm specializing in large commercial irrigation work with a minimum of 5 years experience.
B. The Landscape Irrigation Contractor shall provide and pay for all materials, equipment, tools and labor required for the completion of this project. All utilities, transportation, and other facilities necessary for the execution and completion of the contract are also the responsibility of the Landscape Irrigation Contractor.
C. Any material specified by name and/or model number in the specifications or on the irrigation drawings or detail drawings shall be deemed to be used for the purpose of identifying the materials and insuring the specific use of that material in the construction of the system. No substitutions will be permitted without prior written approval by the Owner's Authorized Representative.
D. All materials and equipment shall be installed in a neat and workmanlike manner following the recommendations of the manufacturers of the materials.
E. Materials used shall be new and without flaws or defects of any type, and shall be the best of their class and kind.

2.02 SUBSTITUTIONS

A. If substitutions of material are desired by the Landscape Irrigation Contractor, sufficient descriptive literature and material samples must be furnished to establish the material as an equal substitute and his reasons for desiring substitute materials.
B. Pipe sizes referenced in the construction documents are minimum sizes, and may be increased at the option of the Landscape Irrigation Contractor.

2.03 EQUIPMENT MANUFACTURERS

Shall be as noted herein and on the Drawings.

2.04 SWING PIPE

Shall be Rain Bird SPX series with Rain Bird SB series spiral bard fittings for use on spray type heads.

2.05 SWING JOINT

Shall be Rain Bird SA-12050 swing assembly for use on all rotors and hose bibs.

2.06 POLYVINYL CHLORIDE (PVC) PIPE

Shall be manufactured in accordance with standard noted herein and shall be continuously and permanently marked with the manufacturer's name, pipe size, type of material, SDR number and the NSF (National Sanitation Foundation) seal. All mainline shall be schedule 40 “purple pipe” and lateral pipe shall be class 200.

2.07 PVC PIPE FITTINGS

A. Shall be PVC suitable for solvent weld, slip joint ring, tight seal or threaded connection.
B. All lines shall have schedule 40 PVC Type 1 fittings.

2.08 WIRE

A. Shall be 14 gauge, Type UF with plastic insulation, solid copper and 600 volt rated for direct burial applications.
B. Each controller shall have different color wire for each station and white wire for common.
C. All wire shall be installed in ditches before installing pipe.
D. At each valve location leave 24” of coiled wire and place in valve box.
E. All wire splices shall be located at valves. Buried splices will not be allowed.

2.09 WIRE CONNECTORS

Shall be "King" silicone-filled safety connectors.

2.10 SOLVENT AND CLEANER

A. Use WELD-ON P-68 or P-70 purple primer on all pressurized pipe joints 1 ½” or larger.
B. Use WELD-ON 705 cement on all other pipe joints.

2.11 HEADS AND NOZZLES

A. Heads and nozzles as shown on the drawings.
B. Pop up spray heads shall have swing pipe.
C. Rotary heads and quick couplers shall have swing joints.

2.12 ELECTRIC VALVES, ISOLATION VALVES AND BOXES

A. Electric valves and isolation valves as shown on the drawings.
B. Boxes shall be Armor 10" Round unless noted otherwise on the drawings.

2.13 CONTROLLER WIRE SPLICE BOXES

Shall be Armor 10" Round.

2.14 QUICK COUPLERS AND BOXES: As shown on the Drawings.

2.15 CONTROLLERS (SATELLITES): As shown on the Drawings.

2.16 FILTERS AND BOXES

A. Filters as shown on the drawings.
B. Boxes shall be Armor Standard 12" Box Assembly.

2.17 RAIN AND FREEZE SENSORS: As shown on the Drawings.

2.18 BACKFLOW PREVENTORS AND BOXES: As shown on the Drawings.

2.19 OTHER EQUIPMENT: As shown on the Drawings.

PART 3 - EXECUTION

3.01 SITE INSPECTIONS

A. Verify site conditions and note irregularities affecting work of this section. Report irregularities to the owner's authorized representative prior to beginning work.
B. Beginning work of this section implies acceptance of existing conditions.
C. The Landscape Irrigation Contractor shall verify existing and proposed locations of all site utilities (including gas, water, electric, telephone, sanitary and storm sewers) prior to pipe installation.

3.02 LAYOUT REVIEW

A. Stake out the irrigation system. Items staked out are to include: controllers, sensors, hose bibs, valves, heads and electrical power wire routing.
B. Irrigation system layout review will occur after the layout has been completed. Notify the owner's authorized representative 2 days in advance of review. Modifications will be identified by the owner's authorized representative at this review.

3.03 GENERAL

A. Coordinate irrigation work with that of all other site work trades and contractors, as applicable.
B. Piping and sprinkler layout is shown in SCHEMATIC FORM ONLY. All piping to be installed directly behind curb where possible and in all cases to be routed around existing or proposed trees. Refer to the landscape planting and site drawings for approximate tree locations and closely coordinate work and schedules with other contractors.

3.04 TRENCHING, PIPE INSTALLATION AND BACKFILLING

A. GENERAL: Piping shall be generally laid out according to Drawings. In the event of a major piping layout conflict, notify and obtain approval of the Owner's representative prior to trenching. Refer to Drawings for location of water source.

B. OVER-EXCAVATION: Over-excavation shall be backfilled with excavated soil. Do not backfill with excavated soil that contains rock. Remove all unsuitable or excess material from the site.

C. TRENCHES: Trenches shall have sides as nearly vertical as possible and bottoms shall be shaped to provide continuous bedding of each section of pipe along its entire length in undisturbed soil or thoroughly compacted fill. De-water trenches as required for dry work.

D. PIPE INSTALLATION: Pipe installation includes all irrigation piping required for water and electrical wiring to complete the automatic irrigation system. Provide firm, uniform bearing for entire length of each pipeline to prevent uneven settlement. Wedging or blocking of pipe will not be permitted. Remove foreign matter or dirt from inside of pipe before welding and keep piping clean by approved means during and after laying of pipe. Snake pipe in trenches for expansion and contraction.

E. DEPTH OF PIPING: Shall be as shown on the detail sheets.

F. BACKFILL IN LANDSCAPED AREAS: Backfill trenches with material removed during excavation, except where rock is encountered. Do not backfill with excavated soil that contains rock. When rock is encountered, lay pipe in cushion sand bed surrounding the pipe a minimum of 4” deep.

F. COMPACTION: Compact and water-settle all excavation to prevent after-settling. Hand rake excavation and adjoining areas to leave grade at the previous elevation and in as good or better condition than before the installation.

G. CONCRETE THRUST BLOCKS: All main lines shall have concrete thrust blocks as shown on the details.

3.05 PVC PIPE AND FITTING ASSEMBLY

A. SOLVENT: Use only cleaner, primer and solvent specified herein. Thoroughly clean pipe and fittings of dirt, dust and moisture before applying primer and solvent.

B. PVC TO METAL CONNECTIONS: Work metal connections first. Use non-hardening pipe dope (Permatex No. 2) on threaded PVC to metal joints. Use only light wrench pressure.

C. THREADED PVC CONNECTION: Where required, use threaded PVC adapter into which pipe may be welded.

D. SLEEVES: The General Contractor shall locate the exact location of sleeves under paving. Do not use these sleeves for any other utilities.

3.06 SPRINKLERS, LOW VOLUME EQUIPMENT AND ROTARY HEADS:

A. GENERAL: Supply in accordance with the Drawings, with nozzling in accordance with the Drawings. Revise nozzle degree as directed by the Owner's representative for wind conditions.

B. Before installation is started, place a stake or flag where each sprinkler is to be located, in accordance with the Drawings. Anticipate planting areas and adjust head layout accordingly. Owner's representative will approve each sprinkler head location before installing sprinkler heads.

3.07 ELECTRIC VALVES & HOSE BIBS

Supply in accordance with the Drawings and sized as shown on the Drawings. Install in a level position, according to the manufacturer's recommendations and the details on the Drawings. The manufacturer's

specifications and installation instructions for the valve supplied shall become a part of these specifications. Set all valves adjacent to sidewalks or curbs and within landscape areas, or as otherwise indicated.

3.08 VALVE AND METER BOXES

Sized as specified in the drawings. Set over all electric valves, backflow preventers, flow meters, quick couplers, filters and wire connections; box cover to be flush with finish grade or as shown on the detail sheets.

3.09 WIRING

A. Install electric control and flow meter wires in the piping trenches wherever possible. Place wire in trench to one side of pipe. Install wire by "snaking" in trench with as much slack as possible to allow for expansion and contraction of the wire. Where it is necessary to run wire in a separate trench, wire shall have a minimum cover as shown on the detail sheets.
B. Provide sufficient slack at wire connections at remote control valves, in control boxes, and at all wire splices so that the valve bonnet or splice may be brought to the surface without disconnecting the wires when repair is required.
C. Each remote control valve is to be connected to one station of a controller unless otherwise noted.
D. All wires shall be tested prior to backfilling to insure continuity from valve location to controller location. Any wire not indicating continuity shall be repaired or replaced immediately.

3.10 ELECTRICAL WIRE CONNECTIONS

Make wire connection to remote control electric valves and splices of wire in the field, using wire connectors. Provide tight connections, fully bedded in sealant to prevent leakage of water and build up of corrosion in splice. All wire splices in the ground but not at electric valves shall be in a valve box as specified herein.

3.11 BACKFLOW PREVENTER

Install per the Drawings and in conformance with applicable codes. The backflow preventer will be tested and certified by a Louisiana Certified Backflow Tester.

3.12 CONTROLLER

Install the specified controller in the locations shown on the Drawings. Pull valve wires, connect the controller to power source, program the controllers and put controller into operation. If shown on the Drawings, all valve station numbers shall correspond to those shown on the Drawings.

3.13 RAIN SENSOR

Install per the Drawings. Wire into controller through a by-pass switch and calibrate for operation.

3.14 FREEZE SENSOR

Install per the Drawings. Wire into controller through a by-pass switch and calibrate for operation.

3.15 TESTING - GENERAL

Water required for testing and adjustment of the irrigation system will be available on site and paid for by the Owner.

3.17 PIPE PRESSURE TEST

A. The sprinkler main and all piping under paving shall be tested for a period of at least twenty-four (24) hours under normal water pressure and proved tight. Upon completion of system sections, all laterals shall be tested under normal operating pressure.
B. If leaks occur, the joint or joints shall be replaced and the test repeated.
C. All tests shall be completed prior to backfilling. However, sufficient backfill material may be placed in trenches between fittings to insure stability of the line under pressure. In all cases, fittings and couplings must be open to visual inspection for the full period of the test.

3.18 INSPECTIONS

A. Progress inspections will be made at regular intervals during the execution of the work on the project.
B. A final inspection to determine acceptance of the irrigation system shall be made at the request of the Landscape Irrigation Contractor. The irrigation system will be reviewed for acceptance provided all requirements have been complied with and the system is in full working order.

3.19 CLEAN UP

A. Clean the site daily of trash and debris resulting from construction operations. All walks, roads and circulation routes shall be kept clean and free from debris, material and equipment.
B. Upon completion of the work covered by this section, clean up all work areas by removing spoil piles, surplus material and equipment from the site. The ground surface shall be restored to its original condition.

3.20 DISPOSAL OF WASTE MATERIAL

A. Maintain disposal route clear, clean and free of debris.
B. Stockpile, haul from site and legally dispose of waste materials, including unsuitable excavated materials, rock, trash and debris.

3.21 ACCEPTANCE

A. Test and demonstrate to the owner’s authorized representative the satisfactory operation of the system free of leaks.
B. Instruct the owner’s designated personnel in the operation of the system pursuant to the training section already outlined in the specifications.

END OF SECTION 32 90 00

SECTION 32 92 19 - SEEDING

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide seeded lawns as shown and specified. The work includes:
   1. Soil preparation.
   2. Ornamental turf grass seeding.
   3. Maintenance.

B. Related work:
   1. Section 32 92 23: Sodding.
   2. Section 32 31 00: Planting

1.02 SUBMITTALS

A. Submit seed vendor's certification for required seed mixture, indicating percentage by weight, percentage of PLS, germination, and weed seed for each species.

B. Submit material samples in 8-ounce plastic “zip-lock” bags to the Owner’s Representative for approval prior to construction.
   1. Topsoil - “Chocolate” Brown Loam.

C. Submit the following materials certification:
   1. Fertilizer(s) analysis.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver seed and fertilizer materials in original unopened containers, showing weight, analysis, and name of manufacturer. Store in a manner to prevent wetting and deterioration.

1.04 PROJECT CONDITIONS

A. Work notification: Notify Owner’s Representative at least 72 hours prior to start of seeding operations.

B. Protect existing utilities, paving, and other facilities from damage caused by seeding operations.

C. Perform seeding work only after planting and other work affecting ground surface has been completed.

D. Restrict traffic from lawn areas and seeded areas until grass is established. Erect signs, flagging and barriers as required.

E. Provide hose and lawn watering equipment as required.

F. An irrigation system will be installed prior to seeding. Locate, protect, and maintain the irrigation system during seeding operations. Repair irrigation system components damaged during seeding operations at this contractor's expense. Review extent of irrigation coverage; provide watering for germination and establishment of seeded areas beyond limits of irrigation.

1.05 WARRANTY

A. Provide a uniform stand of grass by watering and maintaining seeded areas until three mowing’s are completed. Reseed areas, with specified materials, which fail to provide a uniform stand until all affected areas are reviewed by the Owner’s Representative.

PART 2 PRODUCTS

2.01 MATERIALS

A. "Sahara" Hybrid Bermuda Grass: Cynodon hybrid, high quality, extra fancy, hulled and treated lawn type seed, at 98% purity and 85% germination.

B. Loam Topsoil: Fertile, friable, natural topsoil of loamy character, 'chocolate' brown in color, without admixture of subsoil material, obtained from a well-drained arable site, reasonably free from clay lumps, coarse sands, stones, plants, roots, sticks, and other foreign materials, with the pH range to match existing soil conditions. Soil containing Nut Sedge, Dalis Grass, Johnson Grass or other aggressive weed seed will be rejected.

C. Cellulose fiber mulch

D. Starter Fertilizer (Type A) containing 10% nitrogen, 20% phosphoric acid and 10% potash, by weight, or similar approved composition.

E. Tackifier: Liquid concentrate diluted with water forming transparent 3-dimensional film-like crust permeable to water and air and containing no agents toxic to seed germination.

F. Erosion Control System for slopes of 3:1 and greater but not bottom of swales and ditches: 'Soil Guard' bonded fiber matrix as manufactured by Weyerhaeuser Company distributed by James Lincoln Corporation, Garland, Texas 1-800/527-2304 or approved equal. Bonded fiber matrix is mixed with specified fertilizer and seed and applied hydraulically to sloped areas.

G. Erosion Control System for bottom and sides of swales and ditches: P300 Flexible channel liners made of 100% recycled nylon or UV stabilized polypropylene fiber matrix sewn between an extra heavy duty, UV stabilized top net and a heavy duty UV stabilized bottom net as manufactured by North American Green distributed by James Lincoln Corporation, Garland, Texas 1-800/527-2304 or approved equal. Provide staples to anchor liner.

H. Topdressing: "Manure Compost" as indicated in the drawings.

I. Water: Free of substance harmful to seed growth. Hoses or other methods of transportation furnished by contractor.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine finish surfaces, grades, topsoil quality, and depth. Do not start seeding work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Limit preparation to areas which will be immediately seeded.

B. Loosen existing topsoil of lawn areas to minimum depth of 4". Remove stones over 1" in any dimension and sticks, roots, rubbish, and extraneous matter.

C. Grade lawn areas to smooth, free-draining and even surface with a loose, uniformly fine texture. Roll and rake; remove ridges and fill depressions as required to drain.

D. Apply Type A fertilizer at the rate indicated in 2.01, C. 1. a. in order to supply 2 lbs. of phosphorus per 1,000 square feet. Apply fertilizer by mechanical rotary or drop type distributor, thoroughly and evenly incorporated with the soil to a depth of 3" by dicing or other approved methods. Fertilize areas inaccessible to power equipment with hand tools and incorporate it into soil.

E. Grade areas to a smooth, free draining even surface with a loose, moderately coarse texture. Roll and rake, remove ridges, and fill depressions as required to drain.

F. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to seeding.

3.03 INSTALLATION

A. Installation of Hybrid Bermuda grass shall be with hydromulch process; 3 pounds PLS, 50 pounds fiber mulch and 10 pounds Type A fertilizer per 1,000 SF of area. On slopes steeper than 3:1 apply grass seed with the specified bonded fiber matrix, mixed at the manufacturer's recommended rates. Add 1½ gallons of Tackifier to 1,000 SF on slopes over 4:1.
   1. Seed immediately after preparation of seedbed. Do not spray outside of lawn areas; protect all surfaces not scheduled to receive hydromulch.
   2. Remove and clean immediately all hydromulch from trees, lights curbs, pavements and structures and other site improvements immediately after hydromulch operations.

B. Install the specified flexible channel liner on the sides and bottoms of swales and ditches after seeding. Anchor liner to ensure contact with ground, following the manufacturer's installation instructions.

3.04 MAINTENANCE

A. Maintain the seeded areas for three complete mowings.

B. Maintain seeded areas, including watering, mowing, spot weeding and re-seeding until a full, uniform stand free of undesirable grass species is achieved and accepted by the Owner's Representative. Re-grade and re-seed washed out or eroded areas as required until a suitable cover is established.
   1. Water daily to maintain adequate surface soil moisture for proper seed germination. Continue daily watering for not less than 30 days. Thereafter, apply water twice weekly as required to promote proper growth until acceptance.
   2. For Bermuda sod mow lawn areas as soon as lawn top growth reaches a 2 1/2" height. Cut back to 1 1/2" height. Repeat mowing as required to maintain specified height. Not more than 40% of grass leaf shall be removed at any single mowing.
   3. Repair, rework, and re-seed all areas that have washed out, are eroded, or do not catch.

3.05 SUBSTANTIAL COMPLETION

A. An inspection of the seeding will be made by the Owner's Representative upon request for Substantial Completion. Provide notification of at least five (5) working days before requested inspection date. Seeded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified grass is established free of undesirable grass species.

3.06 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from seeding operations.

End of Section 32 92 19

SECTION 32 92 23 - SODDING

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide sodded lawns as shown and specified. The work includes:
   1. Soil preparation.
   2. Sodding lawns.
   3. Maintenance.

B. Related work:
   1. Section 32 92 19: Seeding
   2. Section 32 31 00: Planting

1.02 QUALITY ASSURANCE

A. Sod: Comply with American Sod Producers Association (ASPA) classes of sod materials.

B. If requested by the Owner's Representative, provide and pay for soil testing (to be an Additional Cost, not part of the Base Bid for the Project). Testing agency shall be acceptable to the Owner's Representative. Provide the following data:
   1. Topsoil:
      a. pH factor.
      b. Mechanical analysis.
      c. Percentage of organic content.
      d. Recommendations of type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.

1.03 SUBMITTALS

A. Submit sod growers certification of grass species. Identify source location.

B. Submit material samples in 8-ounce plastic "zip-lock" bags to the Owner's Representative for approval prior to construction.
   1. Topsoil - "Chocolate" Brown Loam.

C. Submit the following materials certification:
   1. Fertilizer(s) analysis.

D. Upon sodded lawn acceptance, submit written maintenance instructions recommending procedures for maintenance of sodded lawns.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Cut, deliver, and install sod within a 24-hour period.
   1. Do not harvest or transport sod when moisture content may adversely affect sod survival.
   2. Protect sod from sun, wind, and dehydration prior to installation.
   3. Do not tear, stretch, or drop sod during handling and installation.

1.05 PROJECT CONDITIONS

A. Work notification: Notify Owner's Representative at least 72 hours prior to start of sodding operations.

B. Protect existing utilities, paving, and other facilities from damage caused by sodding operations.

C. Perform sodding work only after planting and other work affecting ground surface has been completed.

D. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as required.
E. Provide hoses and lawn-watering equipment as required.
F. An irrigation system will be installed prior to sodding. Locate, protect, and maintain the irrigation system during sodding operations. Repair irrigation system components damaged during sodding operations at this contractor's expense.

1.06 WARRANTY

A. Provide a uniform stand of grass by watering, mowing, and maintaining lawn areas until three complete mowings are completed. Re-sod areas, with specified materials, which fail to provide a uniform stand of grass until all affected areas are accepted by the Owner's Representative.

PART 2 PRODUCTS

2.01 MATERIALS

A. Loam Topsoil: Fertile, friable, natural topsoil of loamy character, 'chocolate' brown in color, without admixture of subsoil material, obtained from a well-drained arable site, reasonably free from clay lumps, coarse sands, stones, plants, roots, sticks, and other foreign materials, with the pH range to match existing soil conditions. Soil containing Nut Sedge, Dalis Grass, Johnson Grass or other aggressive weed seed will be rejected.
B. Manure Compost.
C. Sod (refer to plant list on Drawings for species): Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density, and free of weeds, undesirable grasses, stones, roots, thatch, and extraneous material; viable and capable of growth and development when planted.
    1. Furnish sod machine-stripped in square pads or strips not more than 3'-0" long; uniformly 3/4" to 1 1/4" thick with clean-cut edges. Roll installation method is acceptable. Mow sod before stripping.

C. Fertilizer:
    1. Granular, non-burning product composed of not less than 60% organic slow acting, guaranteed analysis professional fertilizer.
        a. Type A: Starter fertilizer containing 10% nitrogen, 20% phosphoric acid, and 10% potash by weight or similar approved composition.
        b. Type B: Top dressing fertilizer containing 8% nitrogen, 8% phosphoric acid, and 8% potash by weight or similar approved composition.
D. Water: Will be available on site. Owner will pay for all water used. Contractor will provide necessary hoses and other watering equipment required to maintain and complete work. An automatic irrigation system will be installed simultaneously with the landscape planting. Refer to the irrigation contractor's drawings for the extent of the system.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine finish surfaces, grades, topsoil quality, and depth. Do not start sodding work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Limit preparation to areas that will be immediately sodded.
B. Loosen existing topsoil of lawn areas to minimum depth of 4". Remove stones over 1" in any dimension and sticks, roots, rubbish, and extraneous matter.
C. Grade lawn areas to smooth, free-draining and even surface with a loose, uniformly fine texture. Roll and rake; remove ridges and fill depressions as required to drain.
D. Apply Type A fertilizer at the rate indicated in 2.01, C. 1. a. in order to supply 2 lbs. of phosphorus per 1,000 square feet. Apply fertilizer by mechanical rotary or drop type distributor, thoroughly and evenly incorporated with the soil to a depth of 3" by dicing or other approved methods. Fertilize areas inaccessible to power equipment with hand tools and incorporate it into soil.
E. Apply Type B fertilizer at the rate equal to 1.0 lb. of actual nitrogen per 1,000 square feet.
F. Dampen dry soil prior to sodding.
G. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to sodding.

3.03 INSTALLATION

A. Sodding:
    1. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with adjacent curbs, sidewalks, drains, and seeded areas.
    2. Do not lay dormant sod or install sod on saturated or frozen soil.
    3. Install initial row of sod in a straight line, beginning at bottom of slopes, perpendicular to direction of the sloped area. Place subsequent rows parallel to and lightly against previously installed row.
    4. Pin sod on slopes greater than 3-to-1 to prevent slippage at a rate of 2 pins per yard of sod. Pins are to be steel.
    5. Water sod thoroughly with a fine spray immediately after laying.
    6. Roll with light lawn roller to ensure contact with sub-grade.
B. Sod indicated areas within contract limits and areas adjoining contract limits disturbed as a result of construction operations.

3.04 MAINTENANCE

A. Maintain sodded lawns until Substantial Completion of the entire project.

B. Maintain sodded lawn areas, including watering, spot weeding, mowing (Bermuda), application of herbicides, fungicides, insecticides and resodding until a full, uniform stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Owner's Representative.

    1. Water sod thoroughly every 2 to 3 days, as required to establish proper rooting.
    2. Repair, rework, and resod all areas that have washed out or are eroded. Replace undesirable or dead areas with new sod.

3. Mow lawn areas as soon as lawn top growth reaches a 3" height. Cut back to 2-1/2" height. Repeat mowing as required to maintain specified height. Not more than 40% of grass leaf shall be removed at any single mowing.
4. Apply Type B fertilizer to lawns once a month at a rate equal to 1.0 lb. of actual nitrogen per 1,000-sq. ft. Apply with a mechanical rotary or drop type distributor. Thoroughly water fertilizer into soil.
5. Apply herbicides as required to control weed growth or undesirable grass species.
6. Apply fungicides and insecticides as required to control diseases and insects.

3.05 ACCEPTANCE

A. Sodded areas will be inspected at completion of installation and accepted subject to compliance with specified materials and installation requirements.
B. Inspection to determine acceptance of sodded lawns will be made by the Owner's Representative, upon contractor's request. Provide notification at least 5 working days before requested inspection date.
   1. Sodded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, even-colored, viable lawn is established, free of weeds, undesirable grass species, disease, and insects.

3.06 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from sodding operations.

END OF SECTION 32 92 23

SECTION 32 93 00 – TREES, SHRUBS & GROUNDCOVERS

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide trees, shrubs, and ground covers as shown and specified. The work includes:
   1. Soil preparation.
   2. Trees, shrubs, and ground covers.
   3. Planting mix.
   4. Mulch and planting accessories.
   5. Maintenance.

B. Related work:
   1. Section 02392: Seeding
   2. Section 02933: Sodding

1.02 QUALITY ASSURANCE

A. Plant names indicated comply with "Standardized Plant Names" as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Names of varieties not listed conform generally to names accepted by the nursery trade. Provide stock true to botanical name and legibly tagged.

B. Comply with sizing and grading standards of the latest edition of "American Standard for Nursery Stock" by the American Nursery and Landscape Association. A plant shall be dimensioned as it stands in its natural position.

C. All plants shall be nursery grown under climatic conditions and soil conditions similar to those in the locality of the project. Furnish list of suppliers and plants to be obtained from each supplier.

D. Stock furnished shall be at least the minimum size indicated. Larger stock is acceptable, at no additional cost, and providing that the larger plants will not be cut back to size indicated.

E. All trees specified to be balled and burlapped shall be cured for a period of at least six weeks. Contractor shall submit a written statement that the specified trees have been properly cured for at least six weeks. The statement will be submitted to the Owner's Representative before shipment of the trees to the site.

F. All plants shall be inspected and approved before and after they are planted. Trees, shrubs and groundcovers shall be initially inspected and approved through photographic review to assure general conformity to the specifications. Provide good quality color photograph of a representative sample of each species of tree, shrub and groundcover. A person, yardstick or other indication of scale shall be included in each photograph. Such inspection shall not in any way impair the right of rejection for failure to meet other requirements during progress of work. Final inspection for acceptance will be made at the site to confirm that plants meet Specifications and are free of infestations and disease.

G. The Owner's Representative may inspect a representative sample of container plants at the Contractor's local holding yard for suitability and adaptability to selected location, prior to site delivery.

H. Provide and pay for testing of any proposed topsoil to be used for planting areas. Test is to provide the following data:
   1. pH factor.
   2. Percentage of organic content.
   3. Recommendations on type and quantity of additives required to establish satisfactory pH and supply of nutrients to bring nutrients to satisfactory level for planting.

1.03 SUBMITTALS

A. Submit the following material samples in 8-ounce plastic "zip-lock" bags to the Owner's Representative for approval prior to construction.
   1. Topsoil - "Chocolate" Brown Loam.
   2. Compost – Vital Earth Resources, Gladewater, TX, Landscapers Peat Replacer or approved equal
   3.
   4. Fertilizer - factory label must show information shown in Section 2.01,B.3.
   5. Mulch –Shredded Hardwood

B. Submit the following materials certification:
   1. Topsoil source and pH value.
   2. Compost.
   3. Plant fertilizer.

1.04 DELIVERY, STORAGE, AND HANDLING.

A. Deliver fertilizer materials in original, unopened, and undamaged containers showing weight, analysis, and name of manufacturer. Store in manner to prevent wetting and deterioration.

B. Take all precautions customary in good trade practice in preparing plants for moving. Workmanship that fails to meet the highest standards will be rejected. Pack, transport, and handle plants with care to ensure protection against injury. Inspection certificates required by law shall accompany each shipment invoice or order to stock and on arrival, the certificate shall be filed with the Owner's Representative. Protect all plants from drying out. If plants cannot be planted immediately upon delivery, properly protect them with soil, wet peat moss, or in a manner acceptable to the Owner's Representative. Water hilled-in plantings daily. No plant shall be bound with rope or wire in a manner that could damage or break the branches.

C. Cover plants transported on open vehicles with a protective covering to prevent windburn.

D. Pruning is acceptable providing the Contractor has consulted with the Owner's Representative.

1.05 PROJECT CONDITIONS

A. Work notification: Notify Owner's Representative at least 72 hours prior to installation of plant material.

B. Protect existing utilities, paving, and other facilities from damage caused by landscaping operations. Verify locations of all existing utilities with owner before digging.

C. A complete list of plants, including a schedule of sizes, and other requirements is shown on the drawings.

D. An irrigation system will be installed simultaneously with planting. Locate, protect, and maintain the irrigation system during planting operations. Repair irrigation system components, damaged during planting operations, at this contractor's expense.

1.06 WARRANTY

A. Warrant plant material to remain alive and be in healthy, vigorous condition for a period of 1 year after Substantial Completion of the entire project.
   A review of plants will be made by the Owner's Representative prior to the end of the Warranty Period.

B. Replace, in accordance with the Drawings and Specifications, all plants that are dead or, as determined by the Owner or Owner's Representative, are in an unhealthy or unsightly condition, and have lost their natural shape due to dead branches, or other causes such as bark abrasions and misuse of chemicals, due to the Contractor's negligence. The cost of such replacement(s) is at Contractor's expense. Warrant all replacement plants for 1 year after installation.

C. Warranty shall not include damage or loss of trees, plants, or ground covers caused by fires, floods, freezing rains, browsing, lightning storms, winds over 75 miles per hour, Owner's neglect, or winter kill caused by extreme cold and severe winter conditions not typical of planting area.

D. Remove and immediately replace all plants, as determined by the Owner's Representative, to be unsatisfactory during the initial planting installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Plant Material: Provide plants typical of their species or variety with normal, densely developed branches and vigorous, fibrous root systems. Provide only sound, healthy, vigorous plants free from defects, disfiguring knots, sunscald injuries, frost cracks, abrasions of the bark, plant diseases, insect eggs, borers, and all forms of infestation. All plants shall have a fully developed form without voids and open spaces.

1. Container-grown stock: Grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm and whole.
   a. No plants shall be loose in the container.
   b. Container stock shall not be pot bound.
2. Dig balled and burlapped plants with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the "American Standard for Nursery Stock". Plants with cracked or mushroomed balls shall be rejected.
3. Provide tree species that mature at heights over 20'-0" with a single main trunk (unless otherwise specified) with an unbroken leader. Trees that have the main trunk forming a "Y" shape or a broken leader are not acceptable.
4. Plants larger than those specified in the plant list may be used when acceptable to the Owner's Representative.
   a. If the use of larger plants is acceptable, increase the spread of roots or root ball in proportion to the size of the plant.
5. The height of the trees, measured from the crown of the roots to the top of the top branch, shall not be less than the minimum size designated in the plant list.
6. Pruning wounds with a diameter of 1" or less must show vigorous bark on all edges. Pruning wounds over 1" diameter are unacceptable.
7. Shrubs shall be branched to the ground.
8. Shrubs and small plants shall meet the requirements for spread and height indicated in the plant list.
   a. The measurements for height shall be taken from the ground level to the average height of the top of the plant and not the longest branch.
   b. Side branches shall be generous, well-twigged, and the plant as a whole well-bushed to the ground.
   c. Plants shall be in a moist, vigorous condition, free from dead wood, bruises, or other root or branch injuries.
   d. Same plants planted together shall be matched in form, height and overall character.

B. Planting Materials:

1. Loam Topsoil: Fertile, friable, natural topsoil of loamy character, 'chocolate' brown in color, without admixture of subsoil material, obtained from a well-drained arable site, reasonably free from clay lumps, coarse sands, stones, plants, roots, sticks, and other foreign materials, with the pH range to match existing soil conditions. Soil containing Nut Grass, Dalis Grass, Johnson Grass or other aggressive weed seed will be rejected.
2. Soil Conditioner – Sterilized Compost as approved by Owner's Representative.
3. Fertilizer: Commercial fertilizer shall be a complete organic fertilizer.
4. Water: The Owner will pay for water used. Contractor will provide necessary hoses and other watering equipment required to maintain and complete work. An automatic irrigation system will be installed simultaneously with the landscape planting.

C. Tree Staking/Guying Materials:

1. Stakes for staking: 1-1/2 x 1-1/2 (angle) painted metal stakes, eight feet long.
2. Anchors for guying: Duckbill Tree Anchors, Model 40 DTS or Model 68 DTS, as appropriate, supplied by Foresight Products Inc., Northglenn CO.
3. Guying/Staking straps: 1-1/2" wide black woven nylon.
4. Strap Fasteners: 2" long #10 self tapping coated wood screws rated for exterior construction, four per strap.

2.02 ACCESSORIES

A. Mulch: Shredded Hardwood Mulch (double shredded, not containing pieces over 4" in length.)
B. Steel Edging: Ryerson 1/8" x 4" x 20' lengths, factory painted dark green as manufactured by Joseph Ryerson Co., Inc., Houston, Tx. or approved equal.
C. Soil Saver/ Jute Mesh: Heavy weight jute mesh as manufactured by Jim Walls Company, 12820 Hillcrest Road, Dallas, Texas 75230, or approved equal.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine proposed planting areas and conditions of installation. Do not start planting work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Planting shall be performed only by experienced workmen familiar with planting procedures under the supervision of a qualified supervisor.
B. Soil Preparation: Excavate bed areas to accommodate 6" prepared Planting Mix and 3" mulch. Place mix into planting areas to 6" total depth.

C. Install steel edging to conform to layout indicated on the Drawings. Curves shall be smooth and continuous without kinks or bends. Top of edging to be 1" above adjacent lawns. Install edging per manufacturer's instructions.
D. Locate plants as indicated on the plans as approved by the Owner's Representative in the field after staking by the Contractor. If obstructions are encountered that are not shown on the Drawings, do not proceed with planting operations until alternate plant locations have been selected by the Owner's Representative. **COORDINATE PLACEMENT OF PLANTS AND IRRIGATION SPRINKLERS TO AVOID INTERFERENCE.**
E. Excavate circular tree pits with vertical sides. Provide tree pits at least 18" larger than diameter of rootball. Depth of pit shall accommodate the root system. Remove excavated materials from the site.
F. Planting mixture as prepared for shrub/groundcover beds shall be used to backfill around rootballs of trees and pit-planted shrubs/groundcovers.

3.03 INSTALLATION

A. Set plant material in the planting pit to proper grade and alignment. Set plants upright, plumb, and faced to give the best appearance or relationship to each other or adjacent structure. Set plant material slightly above the adjacent finish grade. No filling will be permitted around trunks or stems. Backfill

the pit with planting mixture. Do not use frozen or muddy mixtures for backfilling. Form a ring of soil around the edge of each planting pit to retain water.

B. Space shrubs and groundcovers in accordance with spacing indicated on plans. Adjust spacing as necessary to evenly fill planting bed with indicated quantity of plants. Plant to within 12" of the trunks of trees and shrubs within planting bed and to within 6" of edge of bed.

C. On slopes greater than 4:1, a heavy weight jute mesh or soil saver must be installed in the plant bed to prevent erosion. Lay jute mesh out across the grain of the slope. Do not stretch. Staple according to manufacturer's specifications. To plant, pull jute mesh apart enough to plant the shrub or ground cover. Plant in prepared soil mix.

D. Mulching:
   1. Mulch pit planted trees and shrubs and prepared planting beds with mulching material 3" deep immediately after planting. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finished surface.

E. Staking/guying:
   1. Stake/guy all trees immediately after each tree planting.
   2. Stake trees 2" to 5" in caliper.
   3. Guy trees greater than 5" in caliper.
   4. All work to be acceptable to the Owner's Representative.

3.04 MAINTENANCE

A. Maintain the trees, shrubs and groundcovers until Substantial Completion. Following acceptance, the Owner will assume maintenance as recommended by the written maintenance instructions submitted by the Contractor.

B. Maintenance shall include pruning, cultivating, weeding, watering, and application of appropriate insecticides and fungicides necessary to maintain plants free of insects and disease.
   1. Re-set settled plants to proper grade and position. Restore planting saucer and adjacent material and remove dead material.
   2. Tighten and repair guying/staking straps and stakes as required.
   3. Correct defective work as soon as possible after deficiencies become apparent and weather and season permit.
   4. Deep-water trees, plants, and groundcover beds within the first 24 hours of initial planting, and not less than twice per week until final acceptance.

3.05 SUBSTANTIAL COMPLETION

A. An inspection of the trees, shrubs, and groundcovers will be made by the Owner's Representative upon request for Application of Substantial Completion by the Contractor. Provide notification of at least five (5) working days before requested inspection date.

3.06 FINAL COMPLETION

A. An inspection of the trees, shrubs and groundcovers will be made by the Owner's Representative upon request for Final Completion by the Contractor.

3.07 CLEANING

A. Perform cleaning on a daily basis during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment.

End of Section 32 93 00