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SECTION 02100 - SITE PREPARATION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Demolition of existing site elements per Demolition Plan and/or as required for installation of new work.
B. Clearing of site.

1.02 RELATED SECTIONS:

A. Temporary erosion and sediment control during construction - Section 02150.
B. Earthwork - Section 02200 or Section 02202 and/or Section 02222

1.03 NOTIFICATION TO OWNERS OF UTILITY LINES AND EQUIPMENT:

A. Notify any corporation, company, individual or local authority owning conduits, wires, pipes or equipment on site that is affected by work.
B. Arrange for removal or relocation of indicated items and pay any fees or costs in conjunction with removal or relocation, except as otherwise noted.
C. Cap lines in accordance with instructions of governing authorities or Owners.

1.04 PROTECTIONS:

A. Protect trees, plants and other landscape features designated to remain.

1.05 EXPLOSIVES:

A. Use of explosives is strictly prohibited.

PART 2 - PRODUCTS - NONE IN THIS SECTION

PART 3 - EXECUTION

3.01 PREPARATION:

A. Verify that abandoned utilities have been properly disconnected and capped.
B. Verify that barricades and other protective measures are in place.

3.02 CLEARING:

A. Remove existing scrub trees and shrubs, including root systems.

B. Strip and clear building areas, or areas requiring cutting or filling, free of vegetation. Leave construction areas clean, free of vegetation and debris, and ready for earthwork.
C. Remove debris and trash from site.

END OF SECTION

SECTION 02102 - CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. Cleaning and grubbing shall consist of the removal of trees, stumps, brush, roots, vegetation, logs, rubbish, and other objectionable matter within the project site limits described in the specifications or as shown on plans.

B. Cleaning and grubbing shall be done in advance of grading operation. Grubbing may be done simultaneously with excavation, if the cuts are over 3 feet in depth and objectionable matter is removed as specified.

C. Clearing and Grubbing shall consist of the disposal of all debris resulting from the work specified herein.

1.02 PROTECTION OF ADJACENT WORK:

A. Provide protection necessary to prevent injury or damage to existing improvements, adjacent property, utilities and other facilities, and trees and plants, indicated to remain in place.

B. Protect improvements on adjoining properties and all areas outside indicated construction areas from injury or damage.

C. Restore damaged improvements to their original condition, as acceptable to the Engineer and property owners.

D. Conduct site clearing and grubbing operations to ensure minimum interference with road, streets, walks, and other adjacent, occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Provide all required personnel, equipment, and materials required to perform the work as specified.

PART 3 - EXECUTION

3.01 CLEARING:

A. Clear all areas covered by dikes, roads, structures and embankments within project limits unless otherwise shown in plans.

B. Remove all saplings, brush, down-timber and debris unless shown or directed otherwise.

C. Use tree wound paint to treat scars, gashes or limbs stubs on trees not removed.

3.02 GRUBBING:

A. Trees, stumps, root systems, rocks and other obstructions shall be removed to the depths shown when they fall within the construction templates for the following items:

1.	Footings	18-inches below bottom of footing.
2.	Sidewalks (or other types of walks)	12-inches below bottom of walk.
3.	Roadways or Streets	24-inches below bottom of base material.
4.	Parking Areas	24-inches below bottom of base material.
5.	Grassed Areas	18-inches below top soil.
6.	Fills	24-inches below bottom of fill.

B. Blasting not permitted.

3.03 REMOVAL OF DEBRIS AND CLEANUP

A. Burn as permitted by regulating agencies or the Engineer as work progresses.

B. Unguarded fires will not be permitted.

C. Permits will be obtained, where required, for necessary burning or disposal sites.

D. Dispose of all waste materials not burned by removal from site.

E. Materials cleared and grubbed shall be the property of the Contractor and shall be his responsibility for disposal.

PART 4 - MEASUREMENT AND PAYMENT

4.01 CLEARING AND GRUBBING:

A. Clearing and Grubbing shall be measured for payment either in acres or by lump sum only for areas indicated on the plans, or as provided in the proposal and contract.

B. When not listed as separate contract pay item, Clearing and Grubbing shall be considered as incidental work, and the cost thereof shall be included in such contract pay items as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor equipment, tools and in incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 02110 - SITE CLEARING AND GRUBBING

GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Section, apply to this section.

SUMMARY

This Section includes the following:
Clearing and grubbing.

PROJECT CONDITIONS

Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

Protect improvements on adjoining properties and on Owner's property.

Restore damaged improvements to their original condition.

PRODUCTS

Not applicable to this section

EXECUTION

SITE CLEARING

General: Remove grass and other vegetation, improvements, or obstructions as required to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. "Removal" includes digging out an off-site disposing of stumps and roots.

Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated. Refer to other sections in his division relating to fill requirements.

DISPOSAL OF WASTE MATERIALS

Removal from Owner's Property: Remove waste materials and unsuitable or excess topsoil from owner's properties.

END OF SECTION 02110

SECTION 02150 - TEMPORARY EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Temporary measures required to control erosion and sediment during construction. This includes measures to meet the requirements of the National Pollution Discharge Elimination System (NPDES) administered by the Environmental Protection Agency (EPA).

B. Temporary hay bale dike.

C. Stabilized construction entrance.

D. Silt fence.

E. Rock check dam.

F. Sediment basin with stone and pipe outlet

G. Diversion dike.

H. Storm Water Pollution Prevention Plan (SWP3).

1.02 RELATED SECTIONS:

A. Grass seeding for slope protection and erosion control - Section 02270.

B. Site Preparation - Section 02100.

C. Earthwork - Section 02200 or Section 02202 and/or 02222

1.03 REFERENCES:

A. ASTM D3786 - Hydraulic Bursting Strength of Knitted Goods and Non-woven Fabrics. (Mullen Burst)

B. ASTM D3787 - Bursting Strength of Knitted Goods; Constant Rate of Traverse (CRT) Ball Burst Test

C. ASTM D4355 - Deterioration of Geotextiles From Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).

D. ASTM D4491 - Water Permeability of Geotextiles by Perrnittivity.

E. ASTM D4533 - Index Trapezoidal Tearing Strength of Geotextiles.F. ASTM D4632 Grab Breaking Load and Elongation of Geotextiles. (Tensile Strength).

F. ASTM D4751 - Determining the Apparent Opening Size of a Geotextile.

H. ASTM Al 16, - Zinc Coated (Galvanized) Steel Woven Wire Fence Fabric.

I. ASTM D698 - Test for Moisture Density Relations for Soils (Standard).

J. Texas Department of Transportation (TXDOT) 1993 Standard Specifications for Construction of Highways, Streets, and Bridges. Measurement and payment sections do not apply. Item 432 - Rip Rap.

1.04 SUBMITTALS:

A. Procedures for Submittals: Section 01300.

B. Product Data:
1. Sift fencing.
2. Non-woven filter fabric.
3. Erosion control and revegetation mat

C. Prepare and submit a Storm Water Pollution Prevention Plan (SWP3).

D. Inspection Reports and Certificates:
1. Submit period inspection reports and certificates required for SWP3.
2. Submit Contractor/Subcontractor certifications required for SWP3.

E. Submit revisions or modifications to the erosion and sediment control plan and SWP3.

1.05 MAINTENANCE:

A. Maintain erosion control devices as necessary to comply with NPDES. This includes any revisions or modifications to the plan. Any work required for modifications, revisions and maintenance shall be the responsibility of the Contractor and shall -not be a basis for additional compensation.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Hay bales, if used, shall weigh a minimum of (50) pounds and shall be at least thirty (30) inches in length. Bales shall be composed entirely of vegetable matter and be free of seeds. Binding shall be either wire or nylon string, jute or cotton binding is unacceptable. Bales shall be used for not more than two months before being replaced. However, if weather conditions cause biological degradation of the hay bales, they shall be replaced sooner than the two month time period to prevent a loss of structural integrity of the hay bale dike.

B. Stone material at all drainage structures shall consist of stone rip-rap conforming to TXDOT Standard Specification Item 432 and shall have gradation and be placed as shown on the plans and in a layer of at least 24 inches thick. Stone material for rock check dams shall consist of only well graded crushed rock, 4-8 inches in diameter, and shall be placed as detailed on plans. Stone material for stabilized construction exit shall consist of 3" to 5" crushed rock mixed with Type "A"" Flexbase to create a drivable surface and shall be placed as shown on the plans.

C. Geotextile Fabrics shall be a non-woven polypropylene fabric designed specifically. for use as a soil filtration media. Fabric shall have an approximate weight of 8 oztyd,2.

D. Geotextile Silt Fence Fabric shall be a nylon reinforced polypropylene woven fabric having a reinforcing cord running the entire length to the top edge of the fabric.

Representative Manufacturer Mirafi, Inc. sift fence, Amoco (2130) or owner approved equal.

E. Fence Posts for Sift Fence of sufficient length and strength to support the silt fence system.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION:

A. Submit SWP3 and the erosion and sediment control plan and modify as required for the Contractor's construction sequence. Modifications shall maintain conformance with the Contractor's storm water pollution prevention plan and the requirements of NPDES. Work and materials required for installation, modification and maintenance of the Erosion Control System shall be incidental to the contract.

B. Locate and protect survey horizontal and vertical control.

3.02 TEMPORARY HAY BALE DIKE:

A. Install where shown on the plans or as needed for erosion control.

B. Hay bales shall be embedded a minimum of four (4) inches and securely anchored using 3/8. inch diameter steel stakes or 2" x 2" wood stakes driven through the bales into the ground a minimum of six (6) inches. Hay bales are to be placed end to end directly adjacent to one another leaving no gap between them.

C. Hay bale dikes are to be used in locations receiving overland sheet flow only.

3.03 STABILIZED CONSTRUCTION EXIT

A. A temporary construction exit shall be installed at any point where traffic will be leaving the construction site to a public right-of-way, street, alley, sidewalk or parking area. The purpose of a stabilized construction exit is to reduce or eliminate the tracking or flowing of sediment onto public rights-of-way. The exit must be properly graded or incorporate a drainage swale to prevent runoff from leaving the construction site. The length of the exit shall be as required, but not less than 100 feet and the width shall be at least 20 feet. The stabilized exit shall be constructed of rock as described in 2.1.B. and shall be completely underlined with geotextile filter fabric described in 2.1.C, Value 1.

B. The temporary construction exit shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or clean out of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public rights-of-way must be removed immediately by the Contractor.

C. When necessary, wheels must be washed or brushed to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch or watercourse using approved methods.

3.04 SILT FENCE:

A. Silt Fence: Shall consist of nylon reinforced polypropylene woven fabric supported by posts set a minimum depth of 18 inches and spaced not more than 6 feet on center. A 6-inch wide trench is to be cut 6 inches deep at the toe of the fence on the uphill side to allow the fabric to be laid below the surface and back filled with gravel. Fabric shall have a 6-inch, double overlap securely fastened at a post at abutting ends, and shall be joined such that no leakage or bypass occurs. Remove accumulated sediment when the depth of sediment reaches 6 inches.

3.05 ROCK CHECK DAM:

A. Rock Check Dams shall be constructed at locations shown on the plans and in swales as needed to reduce velocity in swales. Geotextile fabric as described in 2.1.C., Value I shall be placed beneath the rock and shall conform to these specifications. Rock shall conform to these specifications.

3.06 DIVERSION DIKE:

A. Diversion dikes, if used by the Contractor, shall be installed prior to and maintained for the duration of construction and shall intercept no more than five (5) acres of runoff. Dikes shall have a minimum top width of 2'-0" and a minimum height Of Compacted fill of 18" measured from the top of the existing ground at the upslope toe to top of the dike and having side slopes of 3:1 or flatter. The channel which is formed by the dike must have a minimum slope of one (1) percent for the entire length to an outlet. When the slope exceeds three (3) percent, or velocities exceed one foot per second (regardless of slope), stone stabilization (Type "Am rip-rap) is required. Plant grass on dikes not requiring stone stabilization.

3.07 STORM WATER POLLUTION PREVENTION PLAN (SWP3):

A. The Contractor is required to prepare the SWP3 required for this project.

3.08 NOTICE OF INTENT (NOI), NOTICE OF TERMINATION (NOT):

A. Contractor shall submit a Notice of Intent (NOI) at least 48 hours prior to the start of construction.

B. Contractor shall submit a Notice of Termination (NOT) as required by the NPDES regulations.

3.09 At the close of this contract the Contractor shall remove the temporary erosion control devices when permanent facilities are in place.

END OF SECTION

SECTION 02200 - EARTHWORK

GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

SUMMARY

This Section includes the following:

Preparing of subgrade for building slabs.

Excavating and backfilling of trenches within building lines.

Excavating and backfilling for underground mechanical and electrical utilities and buried mechanical and electrical appurtenances.

SUBMITTALS

Test Reports: Submit the following reports directly to Architect from the testing services, with copy to Contractor:

Test reports on borrow material.

Field Reports; in-place soil density test.

One optimum moisture-maximum density curve for each type of soil encountered.

Report of percent compaction and moisture content of each strata tested.

QUALITY ASSURANCE

Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

Testing and Inspection Service: Contractor will employ and pay for a qualified independent Geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations.

Testing Laboratory Qualifications: To qualify for acceptance, the Geotechnical testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct required field and laboratory Geotechnical testing without delaying the progress of the work.

PROJECT CONDITIONS

Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

Use of Explosives: Use of explosives is not permitted.

Protection of Person and Property: Barricade open excavations occurring as part of this work and post with warning lights.

Operate warning lights as recommended by authorities having jurisdiction.

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

Perform excavation by hand within drip line of large trees to remain. Protect root systems form damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PRODUCTS

SOIL MATERIALS

Select fill: Fill under all floor slabs when properly slaked and tested by a qualified testing laboratory shall meet the following requirements:

1. Liquid limit per plans.
2. Plasticity Index per plans.
3. Shall contain no organic material.
4. Shall contain no stones larger than 2 inches.

Samples of proposed select fill shall be furnished to the testing laboratory a minimum of 7 days prior to installation to permit time for specification compliance, inspection, and approval.

Backfill and Fill Materials: Satisfactory soil materials free of clay, rock, or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

EXECUTION

EXCAVATION

Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

STABILITY OF EXCAVATIONS

General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

DEWATERING

Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

See plans for additional information.

STORAGE OF EXCAVATED MATERIALS

Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.

Located and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

EXCAVATION FOR STRUCTURES

Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete form work, installation of services, and other construction and for inspection.

Excavations for footing and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

Excavation for Grade Beams: Cut grade beams to the cross sections and grades as shown on the drawings. Deposit excavated materials away from the proposed building areas.

Excavation for Underground Tanks, Basins, and Mechanical or Electrical
Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete form work, installation of services, and other construction and for inspection. Do not disturb bottom of excavations, intended for bearing surface.

BACKFILL AND FILL

General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.

Under grassed areas, use satisfactory excavated or borrow material.

Under steps, use select fill material.

Under building slabs, use select fill material.

PLACEMENT AND COMPACTION

Remove at least 6 inches of top soil, vegetation, debris, etc., from the proposed building and paved areas to a distance of 5'-0" outside the construction line.

Rework and compact the top 6 inches of the exposed subgrade under all floors, walks, and pavements to 95 % (+ 2%) of maximum density at -2% to +3% of the optimum moisture content, in accordance with test method ASTM D-698, prior to placement of final lift or lifts to achieve required grades.

Select fill under all floors, walks, and pavements shall be compacted in the field in lifts not to exceed 8" maximum density, to +3% of the optimum moisture content, as determined by Texas Highway Department as indicated on plans.

Laboratory moisture-density curve or curves as required, and results of field density checks shall be submitted to the Architect or Engineer. A minimum of one (1) in place density test per 2000 square feet of slab are shall be taken on alternating lifts during placement of select fill.

No backfilling will be permitted where excavations for bearing under footings has been carried too deep. Such excavations shall be filled with concrete of the same class as the member it is to support.

GRADING

General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:
Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.

FIELD QUALITY CONTROL

Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade, base, and fill layer before further backfill or construction work is performed.

If in opinion of Architect, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained. Contractor shall pay for such retesting.

EROSION CONTROL:

Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

MAINTENANCE

Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further constructions.

Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

DISPOSAL OF EXCESS AND WASTE MATERIALS

Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

END OF SECTION 02200

SECTION 02202 - EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Clearing and Grubbing as required in order to perform earthwork as shown within contract drawings.

B. Stripping 6" of existing topsoil, stockpiling on-site and re-spreading topsoil as directed by Owner's Representative

D. Excavation and Fills to grades represented within drawings.

E. Compaction of Embankments and Fills to specified densities.

F. Definitions:
"Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

"Density" is referred to as a percentage of the ASTM D698. Standard Proctor Density

1.03 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: At Contractor's expense, testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations. Testing laboratory to be selected by Owner.

1.04 SUBMITTALS

A. Test Reports: Submit following reports directly to Owner's Representative from the testing laboratory with a copy to the Owner.

1. Test reports on borrow material (as applicable)

2. Field density test reports.

3. One optimum moisture-maximum density curve for each type of soil encountered.

4. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

B. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil bearings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data is made available for convenience of Contractor.

1. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.

C. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult Utility Owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Utility Owner.

2. Do not interrupt existing utilities serving facilities occupied and used by Owner or others during occupied hours except when permitted in writing by Owner or Owner's Representative and then only after acceptable temporary utility services have been provided.

   Provide a minimum of forty eight (48) hour notice to Owner and receive written notice to proceed before interrupting any utility.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

D. Use of Explosives: The use of explosives is not permitted.

E. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction.

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

3. Perform excavations within drip line of large trees to remain by hand and protect root system from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Definitions:

1. Satisfactory soil materials: are those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.

2. Select Backfill : Satisfactory soil materials free of clay, rock, or gravel larger than 2" in any dimension, debris, waste, frozen materials, and other deleterious matter and having a PI < 25.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Excavation is Unclassified and includes excavation to subgrade elevations indicated regardless of character of materials and obstruction encountered.

B. Unauthorized Excavation:

1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner's Representative. Unauthorized excavation, as well as remedial work directed by the Owner's Representative, shall be at Contractor's expense.

2. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to Owner's Representative.

3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavation of same classification, unless otherwise directed by Owner's Representative.

D. Additional Excavation:

1. When excavation has reached required subgrade elevations, notify the Owner's Representative who will make an inspection of conditions.

2. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Owner's Representative.

3. Removal of unsuitable material and its replacement as directed will be paid per contract cost.

4. Stability of Excavations:

   A. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

   B. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

E. Trench Safety Systems:

A trench shoring safety plan shall be required complying with latest OSHA standards for all trench excavations exceeding 5' in depth.

F. Temporary Drainage / Dewatering:

1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding property.

2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well pints, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavation.

3. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavation to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

G. Material Storage:

1. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

2. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

3. Dispose of excess soil material at locations on site as directed by Owner's Representative.

H. Cold Weather Protection: Protect excavation bottoms against freezing when atmosphere temperature is less than 35° F. (1° C.).

3.02 COMPACTION

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

B. Percentage of Density Requirements:

1. Structures, Building Slabs and Steps: in accordance with Structural Drawings. (as applicable)

2. Roadways, parking areas, sidewalks or tracks: Compact subgrade and each layer of backfill or fill material at 95% standard Proctor ASTM D-698-91 at a moisture content of no more than 3% above optimum moisture for cohesive material or 95% maximum density for cohesionless material.

3. Open areas, landscapes, sport fields: Compact subgrade and each layer of backfill or fill material at 90% standard Proctor ASTM D-698-91 at a moisture content of no more than 3% above optimum moisture for cohesive material or 90% maximum density for cohesionless material.

C. Moisture Control:

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during or subsequent to compaction operations.

2. Remove and replace or scarify and air dry soil material that is too wet to permit compaction to specified density.

3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture contact is reduced to a satisfactory value.

3.03 BACKFILL AND FILL

A. Under grassed or open areas: Onsite excavated or borrow material free of: clay, rock or gravel larger than 2" in any dimension, site debris, frozen material and deleterious matter and vegetation.

B. Under roadway, parking and sidewalk: Select backfill. In the event the excavated material or "cuts" do not meet the requirements of select backfill, Engineer shall determine suitability of onsite excavated material. Additional borrow material as required shall be paid for by owner.

C. Under Buildings: (See Structural Drawings as applicable)

D. Ground Surface Preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

2. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density.

E. Placement and Compaction:

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

2. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture contact. Compact each layer to required percentage of maximum density. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

3. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

3.04 GRADING

A. General:

1. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within 0.10' above or below required subgrade elevation.

2. Grade areas to prevent ponding

3.05 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow and coordinate with testing service to inspect and approve subgrades and fill layers before further construction work is performed.

1. Roadways, Parking Areas and Building Slab Subgrade: In each compacted fill layer, make at least one (1) field density test of subgrade for every 50,000 sq. ft. of paved area or building slab, but in no case less than three (3) tests.

2. All other areas: In each compacted fill layer, make at least one (1) field density test for every 75,000 sq. ft. of fill area, but in no case less than two (2) tests.

3. In the event any field density test fail, subsequent density test within this area on this compacted fill layer shall be at the expense of the Contractor.

If in the opinion of the Owner's Representative based on testing labratory reports or inspection, subgrade or fills which have been placed that do not meet the requirements of this specification, Contractor shall provide additional compaction and testing at his expense.

3.06 MAINTENANCE

A. Protection of Graded Areas:

1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.07 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property.

END OF SECTION

SECTION 02230 - EXCAVATION

PART I - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. This work shall consist of excavating and properly utilizing, or otherwise satisfactorily disposing of, all excavated materials, of whatever character, within the limits of work.

B. Excavation shall also consist of constructing, compacting, shaping and finishing of all earthwork in designated areas on the plans, as specified herein, and in conformity with the required line grades and typical cross sections or as directed by the Engineer.

C. When not otherwise included, this items shall include the work described in Section 2101 - Preparation of Right of Way, Section 2102 - Clearing and Grubbing, Section 2236 - Embankment, Section 2238 - Removal of Concrete, and Section 2210 - Subgrade Preparation.

PART II - PRODUCTS

2.01 CLASSIFICATION

A. All excavations shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed.

PART III - EXECUTION

3.01 CONSTRUCTION METHODS

A. Prior to commencing this work, all erosion control and tree protection measures required shall be in place and all utilities located and protected.

B. Construction equipment shall not be operated within the drip line of trees, unless otherwise indicted.

C. Construction materials shall not be stockpiles under the canopies of trees. No excavation or embankment shall be placed within the drip line of trees until tree wells are constructed.

D. All excavation shall be performed as specified herein and shall conform to the established alignment, grades and cross sections.

E. Suitable excavated materials shall be utilized, insofar as practical, in constructing required embankments.

F. The construction of all embankments shall conform to Section 2236 - Embankment. No material shall be stockpiled within the banks of a waterway.

G. Unsuitable excavated materials or excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor. It shall become his sole responsibility to dispose of this material off the limits of the right of way in an environmentally sound manner at a permitted disposal site.

H. Adequate dewatering and drainage of excavation shall be maintained throughout the time required to complete the work.

PART IV - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Measurement of the volume of excavation in cubic yards by the average end areas. Cross sectional areas shall be computed from existing ground section to the established line of the subgrade, as shown on typical sections for the limits of the right-of-way or other work limits, including parkway slopes and sidewalk areas.

B. Measurement of the area in square yards of surface area excavated as shown on the typical sections included in the plans.

C. Measurement of the volume of excavation is in cubic yards, based upon the average end areas taken from pre-construction cross sections and planned grades. The planned quantities for excavation will be used as the measurement for payment for this item.

4.02 PAYMENT:

A. This item will be paid for at the contract unit price bid for "Excavation," as provided under the measurement method as included in the bid, which price shall be full compensation for all work herein specified: including dewatering, drainage, subgrade preparation, unless otherwise indicated and the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work.

B. When not listed as a separate contract pay item, excavation shall be considered as incidental work, and the cost thereof shall be included in such contract pay item(s) as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 02251 - HOT MIX ASPHALTIC CONCRETE (HMAC)

PART 1- GENERAL

1.01 DESCRIPTION OF WORK

A. This work includes the furnishing of plant, labor, equipment, and materials and the performance of all operations required for the laying of an overlay of asphaltic concrete.

B. New HMAC cannot be placed without the owner's representative present.

C. New HMAC cannot be placed until crushed limestone base material conforms to project specifications.

PART 2-PRODUCTS

2.01 TYPE OF PAVING

A. This paving shall consist of hot-mixed, hot-laid, Type "D" Asphaltic concrete paving and shall be subject to the specifications as set forth in Item 340 of the latest Texas Highway Department's Standard Specifications for Construction of Highways, Streets and Bridges, except as modified herein.

2.02 TACK COAT:

A. The tack coat shall be a RC-2 cut-back asphalt spread uniformly at a rate of 0.05 gallon per square yard and shall be allowed to cure properly before any further operations are permitted on the area to which they are applied.

PART 3-EXECUTION

3.01 SURFACE TESTS

A. The surface of the pavement, after compression, shall be smooth and true to the established line, grade and cross-section, and when tested with a 16- foot straight edge placed parallel to the centerline of the roadway, it shall have no deviation in excess of 1/16 inch per foot from the nearest point on contact. The maximum ordinate measured from the face of the straight edge shall not exceed 1/4 inch at any point in the surface not meeting these requirements shall be immediately corrected.

END OF SECTION

SECTION 02270 - GRASS SEEDING FOR EROSION CONTROL

PART I - GENERAL

1.01 SECTION INCLUDES:

A. Items required for preparing ground, providing for sowing of seeds and fertilizing, mulching with straw, watering, weed control, and other management practices required for erosion control and to obtain a grass cover. Areas requiring seeding for erosion control will include the drainage ditch embankment and all areas disturbed by construction, including the working easement.

1.02 RELATED SECTIONS:

A. Temporary erosion and sediment control during construction - Section 02150.

B. Site Preparation - Section 02100.

C. Earthwork - Section 02200.

1.03 REFERENCES:

A. TXDOT - Texas Department of Transportation 1993 Standard Specifications for Construction of Highways and Streets and Bridges.

1.04 QUALITY ASSURANCE:

A. Regulatory Requirements:

1. Seed shall comply with U.S. Department of Agriculture rules and regulations under the Federal Seed Act.

2. Bags of fertilizer shall be fully labeled complying with applicable State fertilizer laws and shall bear the name, trade name, trademark, warranty of producer, and analysis of contents.

3. Planting material shall conform to Texas Department of Transportation requirements for rural area species in sandy soils as shown in this Section.

B. Contractors Qualifications:

1. The work of this section shall be performed by a Contractor specializing in seeding and/or landscape installations.
2. Guarantee all materials to be of quality and quantity as specified herein.

C. Water For watering plantings, use water free of impurities injurious to plant growth.

1.05 SUBMITTALS:

A. Certificates of Conformance or Compliance:

1. Seed: Type, purity and germination rate analysis.

2. Fertilizer Manufacture's, guaranteed analysis.

3. Hydromulch fiber Manufacturer's guaranteed analysis.

4. Tackifier Manufacture's guaranteed analysis.

1.06 PRODUCT HANDLING:

A. Seed:

1. Furnish seed in sealed standard containers.

2. Seed which has become wet, moldy, or otherwise damaged in transit or in storage shall not be used.

3. Wet moldy, or otherwise damaged seed will be rejected and removed from site.

B. Fertilizer Deliver to site in sealed bags.

PART 2 - PRODUCTS

2.01 MATERIAL:

A. Seed: Refer to Planting Schedule this Section.

B. Fertilizer Complete fertilizer, for use with hydromulch, with minimum 50 percent nitrogen derived from organic sources. The dryweight percentage shall be 18-&12 (N-P-K), also containing zinc and iron.

C. Wood Cellulose Fiber Mulch:

1. Specialty prepared wood cellulose fiber, for use with hydraulic application of grass seed
and fertilizer, processed to contain no growth or germination inhibiting factors, and dyed appropriate color to facilitate visual metering of application of materials. Green is
preferable.

2. Containing not in excess of 10 percent moisture, air dry weight basis.

3. Fibers become uniformly suspended in slurry tank mixture to form homogeneous slurry.

D. Tackifier Provide a binding agent to hold mulch, fiber and seed in place. Tackifier shall

be water-soluble or shall be of remaining in suspension during the application process.

1. Source: Hydro-Tack, N-Tack, or Terra-Tack.

E. Water Free from oil, acid, alkali, salt and other substances harmful to growth of grass.

PART 3 - EXECUTION

3.01 GENERAL:

A. Accomplish seeding and mulching work and seeding and fertilizing work within the planting periods specified in paragraph entitled "Planting Schedule' of this Section.

B. If factors prevail to such an extent that satisfactory results are not likely to be obtained, stop any phase of the work and resume work when desired results are likely to be obtained.

C. Conduct seeding and mulching operations across slope.

D. Accomplish seeding and mulching on all areas disturbed during construction. Including but not limited to excavated areas, fill areas, graded areas, drainage channels, outfall, berms and all borrow and stockpile areas.

3.02 INSPECTION AND TEST:

A. Seed:

1. Each lot of seed may be resampled and retested in compliance with latest rules and regulations under Federal Seed Act at discretion of Owner.

2. Make resampling and retesting by or under supervision of Owner.

3. If these tests reveal seed to be below specified pure live seed content, plant additional seed to compensate for deficiency at no additional cost to Owner.

4. Seed retests: Conducted by approved laboratory.

5. Make allowance for actual pure live seed content of specified grasses in determining actual planting rate.

B. Fertilizers:

1. Retain fertilizer bags and upon completion of project final check of total quantifies of fertilizer used will be made against total area treated.

2. If minimum rates of application have not been met distribute additional quantities of
these materials to make up minimum application specified.

C. Mulch: At least five (5) days prior to commencement of mulching operations, notify

Owner of sources from which mulch materials are available and quantities thereof.

3.03 SEED BED AND PREPARATION:

A. General:

1. Perform seeding after designated areas for seeding and fertilizing have been graded and smoothed to finished lines and grades and typical cross-sections.

2. Equipment necessary for proper preparation of ground surface and for handling and placing required materials shall be on hand and in good condition before work is started.

B. Grading:

1. Maintain grades on areas to be seeded in true and even condition without ruts or tracks.

2. Maintenance shall include any necessary repairs to previously graded area prior to planting of seed.

C. Tillage:

1. Accomplish in such manner as to prepare seed bed.

2. Use tractors with adequate horsepower and heavy duty tillage equipment to accomplish specified tillage operations.

3. Till areas with heavy duty disc, as necessary, followed by discing with disc harrow, and smoothing with weighted spike tooth harrow, railroad irons, or bridge Umber float drag.

4. Cultivate seed bed so that soil particles on surface are small enough and lie close enough together to prevent seed from being covered too deep for optimum germination.

5. Leave areas smooth for ease of mowing.

6. Depth of tillage: 4 inches.

C. Cleanup:

1. Prior to seeding, clear surface of stone, stumps, or other objects larger than 3 inches in thickness or diameter and of roots, brush, wire, grade stakes, and other objects that might be a hindrance to maintenance operations.

2. Mow, rake and remove vegetation that may interfere with operations from site.

3.04 APPLICATION OF FERTILIZER:

A. Apply fertilizer simultaneously with seed and mulch in hydraulic equipment using specified rate of application.

3.05 PLANTING SEED:

A. General:

1. Conduct seeding equipment calibration tests as means of determining coverage per load to plant seed at specified rates.

2. If unplanted skips are noted after germination and growth of grass, seed unplanted areas with grasses that were to have been planted at no additional cost to Owner.

B. Seeding:

1. Rate of application: Refer to Planting Schedule in this section.

2. Uniformly plant one-half of total amount of seed to depth of 1/4 inch to 1/2 inch by use of approved grain drills, native grass seed drills, Brillion Cultipacker seeder or equivalent, or by broadcasting seed and harrowing or raking lightly to cover seed.

3. Spray on other one-half of total amount of seed with hydraulic equipment in combination with fertilizer and mulch.

3.06 APPLICATION OF MULCH:

A. Area to be seeded shall first be cultipacked with Brillion Cultipacker or equivalent

B. Make application of wood cellulose fiber mulch slurry with hydraulic equipment and accomplish immediately upon completion of final tillage.

C. Hydraulically spray slurry on ground to form blotter-like ground cover uniformly impregnated with grass seed which, after application, will allow absorption of moisture and allow rainfall or mechanically applied watering to percolate to underlying soil.

D. Apply wood cellulose fiber mulch at a rate of 50 pounds per 1000 square feet in combination with fertilizer at rate of 10 pounds per 1000 square feet and seed at rate prescribed in paragraph, "Planting Schedule" in this section. Repeat fertilizer (10 pounds per 1000 square feet) in 40 to 65 days.

E. Use hydraulic equipment application of wood fiber mulch having built-in agitation system with operating capacity sufficient to agitate, suspend, and mix homogeneously slurry containing up to 40 pounds of fiber plus combined total of 70 pounds of fertilizer solids for each 100 gallons of water.

F. Slurry Lines: large enough to prevent stoppage.

G. Accomplish application of mulch slurry same day as completion of final tillage.
H. Keep mulch moist by daily application of water, d necessary, for minimum of ten days or until seeds in mulch have germinated and rooted in soil.

3.07 MAINTENANCE OF TURF:

A. General:

1. Contractor is responsible for maintaining areas during planting period and until other work under contract has been completed.

2. Maintenance shall consist of protection replanting, maintaining existing grades, and repair of erosion damage.

B. Protection:

1. Protect seeded and mulched areas against traffic or other use immediately after seeding is completed.

2. Maintain protection of these areas until completion of work under contract

C. Replanting:

1. Prepare, reseed and remulch areas on which less than six live growing grass plants per square foot are present ten days after planting.

3. Replant as specified for original planting.

3. Perform replanting required without cost to Owner.

D. Maintenance of Grades and Repair of Erosion Damage:

1. Contractor is responsible for maintaining grades of slopes after commencement of planting operations and during maintenance period.

2. Promptly repair any damage to finished surface grades.

3. Promptly repair damage in the event erosion occurs from rainfall or other causes.

4. Correct ruts, ridges, tracts, and other surface irregularities and replant areas where required prior to acceptance.

3.08 WATERING AND MAINTENANCE:

A. Apply water after compaction and seeding. Apply water using portable pipe or hose lines with rotating sprinklers within 24 hours after seeding. Sprinkling may be done with water trucks and hoses in certain locations where it is impractical to use portable lines or hoses. Supervise sprinkling to prevent runoff of water. The Contractor shall furnish all pumps, hoses, pipe lines, water trucks and sprinkling equipment required. Water with approved watering equipment in compliance with the schedule of 14,000 gal/acre weekly for 7 weeks, or as required to achieve grass coverage, whichever is greater. Do not water at rates exceeding 5,000 gal/acre/hr., to prevent runoff.

3.09 WEEDING:

A. Keep all seeded areas relatively free from weeds and undesirable grasses, using approved methods, materials and timing.

3.10 DISEASE AND INSECT/PEST CONTROL:

A. Upon discovery of any disease or insect pest infestation identify or have identified the nature or species of infestation and submit the proposed method of control for approval prior to application of control measures.

3.11 MOWING:

A. Mow the grass should the height reach 3-1/2 inches or greater on the average before final acceptance. Mow to a height of 2-1/2 inches. Mow as required until work is accepted.

3.12 SEEDING:

A. Minimum percentage by weight of pure live seed in each lot of seed shall be as follows: seed planted at rate per acre indicated under pure live seed required per acre. Note: Percent Pure Live Seed = Percent Purity times Percent Germination.

B. Seed shall be treated with fungicide.

C. Weed seed shall not exceed 10 percent by weight of total of pure live seed and other material in mixture.

D. Johnson grass, ragweed, nutgrass or other noxious seed in mixture will be cause for rejection of seed.

IF PLANTING IS TO OCCUR
1 FEBRUARY THROUGH 1 SEPTEMBER

Type of Seed	Minimum Percent Pure Live Seed Required	Pounds Pure Live Seed Required Per Acre
a. Green Spangletop	85	0.6
b. Sideoats Grama (Haskell or Premier)	85	1.8
c. Buffalograss	85	5.3
d. Little Bluestem	85	1.1
e. KR Bluestem	85	0.7
f. Switchgrass (Alamao)	85	1.2
	(Total a + b + c + d + e + f)	10.7

If Contractor begins construction outside the above stipulated allowable seeding dates, additional temporary seeding shall be performed. The temporary seeding shall be performed in addition to other seeding as herein specified. The temporary seeding shall be applied to all areas disturbed by construction per rates as specified below. All cost associated with the additional temporary seeding shall be considered subsidiary to Grass Seeding for Erosion Control.

ADDITIONAL TEMPORARY SEEDING

Type of Seed	Minimum Percent Pure Live Seed Required	Pounds Pure Live Seed Required Per Acre
a. Tall Fescue	85	4.0
b. Oats	85	21.0
	(Total a + b):	25.0

END OF SECTION

SECTION 02280 - TERMITE CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to work in this section.

1.2 DESCRIPTION OF WORK:

A. Provide soil treatment for termite control below grade as specified.

1.3 QUALITY ASSURANCE:

A. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for the work, including preparation of substrate and application.
B. Engage a professional pest control operator, licensed by the State of Texas for application of soil treatment solution.

1.4 JOB CONDITIONS:

A. Do not apply soil treatment solution until excavating, filling and grading operations are completed except as otherwise required in construction operations.
B. Ensure penetration; do not apply soil treatment during inclement weather.
C. Comply with other handling and application instructions of the soil toxicant manufacturer.

1.5 SUBMITTALS:

A. Submit four-copies of manufacturer's technical data and application instructions.
B. Include toxicants, composition by percentage, dilution schedule, and intended application rate.

1.6 GUARANTEE:

A. Furnish four-copies of written guarantee certifying that the applied soil poisoning treatment will prevent the infestation of subterranean termites for warranty period.
   1. If subterranean termite activity is discovered during the guarantee period, the Contractor is responsible for re-treat of the soil and repair or replace of damage to the building and its contents caused by termite infestation.
B. Provide guarantee for a period of five years.
C. The Owner reserves the right to renew warranty for an additional 5-year at an additional cost.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for requirements for application in accordance with the EPA.
B. Comply with the general requirements of the Florida Building Code.

1.8 PROJECT CLOSEOUT:

A. Record moisture content of soil before application, date and rate of application, areas of application, diary of toxicity meter readings and corresponding soil coverage.

PART 2 PRODUCTS

2.1 SOIL TREATMENT SOLUTION:

A. EPA approved emulsible concentrate insecticide for dilution with water, specially formulated to prevent infestation by termites.
B. Fuel oil is not permitted as a diluent.
C. Provide a working solution of one of the following chemical elements and concentrations:
   1. Dursban T.C.: 1.0% in water emulsion.
   2. Prevail TC: 0.60% in water emulsion.
   3. Pryfom: 0.75% in water emulsion.
D. Other solutions acceptable to local governing authorities and the EPA may be used.
   1. Use only soil treatment solutions, which are not injurious to planting.

PART 3 EXECUTION

3.1 INSPECTION:

A. Before applying soil treatment for termites, examine areas and conditions; notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.
   1. Do not proceed with the work until conditions are satisfactory.
B. Verify that final grading is complete.

3.2 APPLICATION:

A. Surface Preparation:
   1. Remove foreign matter that could decrease effectiveness of treatment on areas to be treated.
   2. Loosen, rake and level soil-requiring treatment, except previously compacted areas under slabs and foundations.
B. Application Rates: Apply soil treatment solution as specified and in strict accordance with Manufacturer's recommendation for mixing and application.
   1. Allow not less than 12 hours for drying after application, before beginning concrete placement or other construction activities.
   2. Post signs in the areas of application warning workers of soil poisoning.
      a. Remove signs before other construction covers the.
   3. Reapply soil treatment solution to areas disturbed by subsequent excavation or other construction activities following initial application.

END OF SECTION

SECTION 02282 - TERMITE CONTROL

GENERAL

SUMMARY

Provide soil treatment for termite control, under all concrete building slabs on grade.

LEED goals: Not used.

SUBMITTALS

Product data: Submit manufacturer's technical data and application instructions.

QUALITY ASSURANCE

In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including the preparation of substrate and application.

Engage a professional pest control operator, licensed in accordance with regulations of the State of Texas for application of soil treatment solution.

Use only termiticides that are approved by the Texas Department of Food and Agriculture, which bear a Federal registration number of the U.S Environmental Protection Agency, and are on the Texas approved list.

JOB CONDITIONS

Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

To ensure penetration, do not apply soil treatment to excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

SPECIFIC PRODUCT WARRANTY

Furnish written warranty certifying that applied soil termiticide treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation. Provide warranty for period of 2 years from date of treatment, signed by Applicator and Contractor.

PRODUCTS

SOIL TREATMENT SOLUTION

Use an emulsible concentrate termiticide for dilution with water, specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a dilutent. Provide a solution consisting of one of following products (or equal):

Premise 75 - (A/I) Imidacloprid/Chloronicotinyl.

Talstar Termiticide - (A/I) Bifenthrin in dilution 0.06%.

Firstline GT Termite Bait Station - (A/I) N-Ethyl Perfluoroctanesulfonide 0.01%.

Dragnet SFR - (I/A) Permethrin in dilution 0.5%.

Termidor SC - (A/I) Fipronil in dilution 0.125%.

Other solutions may be used as recommended by applicator if also acceptable to architect and approved for intended application by local authorities. Use only soil treatment solutions which are not injurious to planting.

EXECUTION

APPLICATION

Surface Preparation: Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake and level soil to be treated, except previously compacted area under slabs and foundations. Toxicants may be applied before placement of compacted fill under slabs, if recommended by toxicant manufacturer.

Formulation, treatment, storage and disposal of termiticide shall be in accordance with label directions. Water for formulation shall be drawn only from a hose fitted with a backflow perventer meeting local plumbing codes.

Apply treatment solution with a low pressure coarse spray.

Establish a vertical termiticide barrier under slab in critical areas such as inside of foundations walls, both sides of partition walls, and around plumbing and other utility conduits.

Under slab-on-grade structures, treat soil before concrete slabs are placed, using the rates of application recommended by the manufacturer of the termiticide.

At grade beams, treat all surfaces with individual attention to the perimeters and outside edges of the beam.

At expansion joints, control joints, and areas where slabs will be penetrated, apply termiticide at double the rate used in the field of the slab.

Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs when areas are covered by other construction.

Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION 02282

SECTION 02300 - STRUCTURAL EXCAVATION AND BACKFILL

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to complete structural excavation, filling, backfilling, and compacting; to provide protection to equipment and cuts; to include backfill material; the construction or installation of cofferdams, and other similar facilities which may be necessary to perform excavations and/or backfilling; to include the necessary pumping, bailing, or associated drainage; to remove and dispose of surplus materials, cofferdams, and debris; and to provide final grading, as required.

B. The work does not include excavation, filling, and backfilling for utility lines, manholes, vaults, valve boxes, and related structures.

1.02 SUBMITTALS

A. Submittals shall be in accordance with Division 1 submittal requirements and shall include:

1. Submit qualifications of independent testing laboratory for approval.
2. Backfill material classifications. Provide certification by an approved independent testing laboratory.
3. Compaction test results. Provide compaction test results within 24 hours.

1.03 STANDARDS

A. The following publications, referred to hereafter by basic designation only, form a part of this specification as if written herein in their entirety:

ASTM D698	Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D1556	Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D4253	Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4254	Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

B. Any other testing required by these specifications and not specifically referenced to a standard shall be performed under ASTM or other appropriate standards as designated by the Engineer.

C. References herein or on the drawings to soil classifications shall be understood to be according to ASTM D2487, "Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)" unless indicated otherwise.

1.04 DELIVERY AND STORAGE

Deposit material to be used for backfill in storage piles at points convenient for handling of the material during the backfilling operations.

1.05 JOB CONDITIONS

A. Review subsurface investigations. A limited subsurface investigation has been performed by Raba-Kistner Consultants, Inc. A geotechnical report from that investigation is available at the Engineer's office. However, the precise profile of soil and rock strata beneath this site is not known.

B. Review the site and determine the conditions which may affect the structural excavation, prior to the commencement of the excavation.

2.00 PRODUCTS

2.01 MATERIALS

A. STRUCTURAL BACKFILL: Structural backfill shall be TxDOT Item 247 as indicated.

B. TOPSOIL: Topsoil shall consist of soils suitable for topsoil which are relatively free of stones or other objectionable debris, which have sufficient humus content to readily support vegetative growth. The suitability of soils for topsoil shall be subject to the approval of the Engineer.

C. FINE-GRADED GRANULAR MATERIAL: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and 5 to 15 percent passing No. 200 sieve; maximum plasticity index of 7; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.02 COMPACTION EQUIPMENT

Compaction equipment shall conform to the following requirements and shall be utilized as specified herein.

A. PNEUMATIC ROLLERS

Pneumatic rollers shall have a minimum of four (4) wheels equipped with pneumatic tires. The tires shall be such size and ply as can be maintained at tire pressures between 80 and 100 pounds per square inch for a 25,000 pound wheel load during roller operations. The roller wheels shall be located abreast and be designed so that each wheel will carry approximately equal load in transversing uneven ground. The spacing of the wheels shall be such that the distance between the nearest edges of adjacent tires will not be greater than 50% of the tire width of a single tire at the operating pressure of a 25,000 pound wheel load. The roller shall be provided with a body suitable for ballast loading such that the load per wheel may be varied, from 18,000 to 25,000 pounds. The roller shall be towed at speeds not to exceed ten (10) miles per hour. The character and efficiency of this equipment shall be subject to the approval of the Engineer.

B. VIBRATORY ROLLERS

Vibratory rollers shall have a total static weight of not less than 20,000 pounds, with at least 90% of the weight transmitted to the ground through a single smooth drum when the roller is standing in a level position. The diameter of the drum shall be between 5 and 5.5 feet and the width between 6 and 9 feet. The unsprung weight of the drum, shaft, and internal mechanism shall not be less than 12,000 pounds. The frequency of vibration during operation shall be between 1,100 and 1,500 i.e., and dynamic force shall not be less than 40,000 pounds at 1,400 i.e. No backing of the vibratory roller will be allowed on the embankment unless the vibrating mechanism is capable of being reversed. Self-propelled and towed vibratory rollers shall be operated at speeds not exceeding 3 miles per hour and 1.5 miles per hour, respectively.

C. POWER HAND TAMPERS AND VIBRATORY PLATE HAND COMPACTORS

Compaction of material in areas where it is impracticable to use a roller or tractor shall be performed with approved power hand tampers, vibratory plate hand compactors, or other approved equipment. Approval shall be based upon performance in a test section.

3.00 EXECUTION

3.01 PREPARATION

Clear and grub the area to be excavated prior to the start of excavation in accordance with Section 02110, GENERAL CLEARING AND GRUBBING.

3.02 EXCAVATION

A. When footing concrete or masonry is to rest upon rock, remove the rock to a depth sufficient to expose sound rock. Level off or cut the rock to approximate grades, and roughen the area. When footing concrete or masonry is to rest on an excavated surface other than rock, take care not to disturb the bottom of the excavation, and do not make final removal of the foundation material to grade until just before the concrete or masonry is placed.

B. For footings where the soil encountered at established footing grade is an unstable material, use the following procedure unless other methods are specified: Remove unstable soil. Carry the excavation at least 1' beyond the horizontal limits of the structure on all sides. Replace the unstable soil with compacted select fill. Place in uniform layers at a suitable depth for compaction. Wet each layer if necessary and compact by rolling or tamping to provide a stable foundation for the structure.

C. When unfeasible to construct a stable footing as outlined above, construct footing by the use of special materials, such as flexible base, cement stabilized base, cement stabilized backfill, or other material, as directed by the Engineer.

D. Perform excavation to permit surfaces to be brought to final line and grade within + or - 0.1 foot. Restore over-break at the Contractor's expense. In general, perform excavation in open-cut from the surface of the ground and at the line and grade indicated.

E. The sides of the excavation, from the bottom of the excavation to the top of the ground shall be supported in accordance with OSHA requirements. Maintain the supports throughout construction. Remove supports after the completion of the work.

3.03 DEWATERING OF SITE

Pumping or bailing from the interior of any foundation enclosure shall be done in a manner which precludes the possibility of movement of water through or alongside any concrete being placed. No pumping or bailing shall be permitted during the placing of structural concrete, or for a period of at least twenty-four (24) hours thereafter, unless from a suitable sump separated from the concrete work by a water-tight wall. Pumping or bailing during placement of seal concrete shall be only to the extent necessary to maintain a static head of water within a cofferdam. Do not start pumping or bailing to de-water a sealed cofferdam until the seal has aged at least thirty-six (36) hours.

3.04 PLACEMENT OF MATERIAL

A. GENERAL

1. Backfill excavated spaces and areas not occupied by the permanent structure, except that no backfill shall be placed against any structure until the concrete has reached its 28 day compressive strength or seven (7) days whichever is longer. Do not place backfill adjacent to support walls until the top slab has been in place at least four (4) days.
2. Take care to prevent wedging action when placing backfill around structures. If backfill is to be placed on two (2) or more sides of the structure or facility, simultaneously place the backfill on all sides to avoid uneven loading on the structure.
3. Do not permit rollers to operate within 3' of structures.
4. Maximum placement lifts measured in the loose condition are as follows:
   a. 8-inches when heavy compaction equipment is used.

b. 4-inches when hand-directed compaction equipment is used.

5. Subgrade preparation for slab-on-grade

a. Provide a 3-inch layer of compacted FINE-GRADED GRANULAR MATERIAL.

B. MOISTURE CONTROL

1. GENERAL
The materials in each layer of the fill shall uniformly contain the amount of moisture within the limits specified below necessary to obtain the maximum dry density for the soil. Compact Class 1 and Class 2 Earth Fill with a moisture content of at or within five (5) percentage points wet of optimum moisture content. Compact Class 3, Class 4, and Class 5 Earth Fill with a moisture content within two (2) percentage points dry to five (5) percentage points wet of optimum moisture content. The moisture content ranges specified above for the various classes of earth fill represent maximum upper and lower limits of the particular range. Determination of the maximum dry density-optimum moisture shall be by one (1) or more of the following ASTM procedures: D-1556 or D-6938. Completely cohesionless materials which are to be compacted to a specified relative density shall be at a moisture content which will allow use of the specified compaction equipment and consistent achievement of the specified density.

2. MOISTURE CONTROL DURING PLACEMENT
After spreading the soil, adjust the moisture content of the soil if necessary by either aeration or the addition of water to bring the moisture content within the range specified. Uniformly distribute the moisture content throughout the layer of soil to be compacted. In order to accomplish this distribution, thoroughly mix the layer of soil by disking, harrowing, or by the use of a power-driven pulverizer. Should the surface of a previously compacted layer become dry due to exposure to the elements, appropriately wet surface of the compacted layer prior to placing the succeeding layer of soil, and properly disk or harrow the surface. Should a layer of soil be over wet, allow the layer to dry to a proper moisture content prior to compacting. Should the surface of a layer become smooth and hard, roughen the surface by scarifying, and wet the surface if necessary prior to placing the next layer of soil. Reprocess any layer which becomes damaged by weather conditions to meet the specification requirements. There shall be no additional payment made for such reprocessing.

C. COMPACTION

1. Compaction shall be by power hand equipment or rubber tired equipment, provided the rubber tired equipment does no damage. Compaction by power hand equipment or rubber tired equipment shall be completed such that there will be a 24" overlap by roller compaction.

2. Compact the Class 1 and Class 2 Earth Fill zones by a minimum of eight (8) passes with a tamping roller. Compact the Class 3, Class 4, and Class 5 Earth Fill zones by a minimum of eight (8) passes with a tamping roller or by a minimum of four (4) passes with a tamping roller, followed by a minimum of four (4) passes with a pneumatic roller. A vibratory roller shall be required if the material is sandy and if requested by the Engineer. A pass shall consist of one (1) trip over the area being compacted. The front and rear axle rollers on self propelled models shall only be considered as one (1) pass per trip. The initial and final area to be rolled shall each have eight (8) passes. Stagger passes between the initial and final area in order to establish overlapping with at least eight (8) passes at all locations. Approve the exact method based upon the test section. Dumping, spreading, sprinkling, and compacting may be performed at the same time at different points along a section where there is sufficient area to permit these operations to proceed simultaneously.

3. Areas of the fill being compacted with power hand tampers or vibratory plate hand compactors shall receive a minimum of eight (8) passes of the equipment with an overlap of 50% of the equipment base plate width.

4. The in-place density of Class 1 through Class 5 Earth Fill shall not be less than 95% of maximum dry density as determined by ASTM D-698, Standard Proctor, except compact the top 12" of fill underneath roadways and parking areas to not less than 100% of maximum dry density as determined by ASTM D-698, Standard Proctor. In areas cut underneath roadways and parking

areas scarify and re-compact the top 8" of the subgrade within the specified moisture content, to not less than 100% of maximum dry density as determined by ASTM D-698, Standard Proctor.

5. Compact cohesionless materials on which are not practical to control the density by proctor methods to a minimum of 75% relative density as determined by ASTM D-4253 and ASTM D-4254. At the discretion of the Engineer, an alternate method of determining relative density may be used which has been correlated with methods ASTM D-4253 and ASTM D-4254.
6. If necessary, to achieve the specified density, increase the number of passes of the compaction equipment, and/or modify the weight of the compaction equipment.
7. Regardless of the density achieved, the number of passes of the compaction equipment shall not be less than eight (8).

3.05 FIELD QUALITY CONTROL

The Owner is responsible for the costs involved in providing an approved testing laboratory to perform quality control testing of backfill operations. The testing laboratory shall make tests of in-place density in accordance with ASTM Standards. The testing laboratory shall monitor backfill operation continuously or at intervals acceptable to the Owner and Engineer at structures. It shall be the responsibility of the Contractor to notify the testing laboratory before backfill operations begin.

1. Unless noted otherwise, in-place density tests shall be conducted at a rate of one test per 3,000 square feet for every lift.

2. If duplication of Owner inspection effort exists between quality control requirements above and those listed in the Statement of Special Inspection, then complete only one inspection in accordance with the Statement of Special Inspection.

END OF SECTION

SECTION 02361 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for termite control:

1. Soil treatment.

1.3 DEFINITIONS

A. EPA: Environmental Protection Agency.

B. PCO: Pest control operator.

1.4 SUBMITTALS

A. Product Data: Treatments and application instructions, including EPA-Registered Label.

B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner

may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1.Chloropyrifos:

a. Dursban TC, Dow Chemical Co.

2. Permathrin:

a. Dragnet FT, FMC Corp.
b. Torpedo, ICI Americas, Inc.

3. Cypermethrine:

a. Prevail FT, FMC Corp.
b. Demon, ICI Americas, Inc.

4. Fenvalerate:

a. Gold Coast Tribute, Du Pont.

5. Isofenphose:

a. Pryfon, Mobay Corp.

C. Dilute with water to concentration level recommended by manufacturer.

D. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.

PART 3 - EXECUTION

3.1 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.2 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

1. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following application rates:

   a. Apply 1 gallon of chemical solution per 10 sq. ft. ((4.1 L of chemical solution per sq. m)) as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallon of chemical solution per 10 sq. ft. ((6.1 L of chemical solution per sq. m)) to areas where fill is washed gravel or other coarse absorbent material.

2. At grade beams, treat voids at rate of 2 gallons per 10 linear feet, poured directly into the hollow spaces.

3. At expansion joints, control joints, and areas where slabs will be penetrated, apply at rate of 4 gallons per 10 linear feet ((5.1 L per linear m)) of penetration.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 02361

SECTION 02444 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 Chain link fence material shall be produced and installed by methods recognized as good commercial practices in accordance with the Chain Link Fence Manufacturers Institute.

1.02 Type of Fence. Chain link fencing shall conform to the requirements stipulated herein. Chain link fencing shall be either buried perimeter fencing or standard fencing as indicated in the contract.

A. Buried Perimeter Fencing shall be a fence with 8-feet-0-inches of chain link fabric and top and bottom rails. The bottom rail and fabric shall be buried 6 inches below grade. Place three strands of barbed wire on extension arms for a total fence height of 8-feet-6-inches above grade.

B. Standard Fencing shall be a fence with 8-feet-0-inches of chain link fabric and top and bottom rails. The bottom rail shall be within two inches above the finish grade. Place three strands of barbed wire on extension arms for a total fence height of 9-feet-0-inches above grade.

C. As a general rule, buried perimeter fencing will be used on perimeter fences placed over soil. Standard fencing will be used on non-perimeter fences and for perimeter fences placed over a concrete or asphalt paved surface. Exceptions to this rule will be indicated in the contract.

1.02 Relocation of Existing Fence. Any existing fence indicated on the drawings to be removed and relocated shall be taken down, have concrete broken off the posts, and be reinstalled in accordance with these specifications. At no additional cost to Owner, the contractor may keep the removed posts and install new posts. Splicing posts by welding is not permitted.

1.03 Fence Removal for Storage. Fence material shall be stored only when specifically noted in the contract. Any existing fence to be removed and stored for future use shall be taken down and have concrete broken off posts. Posts shall be bundled and tied with wire or strapping tape. Rails shall be bundled in like manner. Fabric shall be rolled, tied and tagged showing length. Separate sections of fabric and wire shall be rolled separately and tagged. All hardware (bolts, nuts, hinges, etc.) that is reusable shall be boxed and tagged as "Fence Hardware." Gates shall remain intact. Material shall be delivered to a warehouse as directed by the inspector.

NOTE: Unless specifically directed by the engineer, all barbed wire shall be taken to salvage. (Reusing barbed wire is dangerous due to its tendency to snap when re-pulled.)

A. Fence Removal for Salvage. Any existing fence to be removed and turned into salvage shall be handled in the same manner as noted in the previous paragraph except that concrete may be left on the poles.

PART 2 - PRODUCTS

2.01 Concrete shall be at least 2500 psi.

2.02 Fencing Materials. Posts, gate frames, braces, rails, stretcher bars, truss rods and tension wire shall be of galvanized steel. Gate hinges, post caps, barbed wire extension arms, stretcher bar bands, bolts, hardware, and other parts shall be of steel, malleable iron, ductile iron, except that post tops, rail ends, and clips may be of aluminum. All fencing, pipe, fabric, and accessories shall conform to the specifications described in the "Product Manual" published by the Chain Link Fence Manufacturers Institute unless further restricted by this section.

A. Fabric: Fabric shall be ASTM A392, Class 1, zinc coated (1.2 ounces), steel wire/fabric, woven in a 2 inch mesh size, 11-gage (0.120 inches) coated wire size, galvanized before weaving, with twisted barbed selvages top and bottom.

B. Pipe: All posts, braces, rails, and gate framing members shall be coated with zinc by the hot-dip process after fabrication. The strip steel used in the manufacture of the pipe shall conform to either ASTM A-120 (Schedule 40) or ASTM A-569 (SS 40 by Allied Tube and Conduit Corp. or equal). Pipe conforming to ASTM A-120 shall receive not less than 1.8 ounces per square foot of zinc coating. Pipe conforming to ASTM A-569 shall be triple coated with a minimum of 0.9 ounces per square foot of zinc, 15 micrograms per square inch of chromate, and 0.3 mils of polyurethane finish. Pipe shall be straight or have an installed deflection not greater than 1/2" per span or post.

C. Line Posts: All line posts shall be nominal 2-inch, 2.375 inch O.D. steel pipe for fabric height up to 8 feet, and nominal 2-1/2 inch, 2-7/8 inch O.D. for fabric height over 8 feet to 16 feet or less.

D. Terminal Posts: Angles, corners, ends, and pull posts shall be nominal 2-1/2 inch, 2.875 O.D. steel pipe for fabric height up to 8 feet, and nominal 3-1/2, 4 inch O.D. for fabric height over 8 feet to 16 feet or less.

E. Top Rail: All top rails shall be nominal 1-1/4 inch, 1.660 inch O.D. steel pipe. Top rails shall be provided with expansion couplings and shall be securely fastened to gate and terminal posts by means of suitable hot-dipped galvanized connections.

F. Bottom Rail: All bottom rails shall be nominal 1-1/4 inch, 1.660 inch O.D. pipe.

G. Bracing: Rails shall be nominal 1-1/4 inch, 1.660 inch O.D. galvanized steel pipe with adjustable truss braces 3/8" in dia. and all fittings hot-dipped galvanized.

H. Barbed Wire Support Arms: All posts shall be provided with pressed copper-bearing galvanized steel extension arms. All end posts shall be provided with heavy malleable iron extension arms. All extension arms shall be heavily coated with zinc by the hot-dip process. Each extension arm shall be sized to carry three strands of barbed wire at an angle of 45 degrees, the upper strand 12 inches out from the fence line and 12 inches above the top of the fabric. Arms shall be the type that allow top rail to pass through their bases to form a continuous brace. Barbed wire arms shall be of sufficient strength

to withstand a weight of 250 pounds applied at the outer or the top strand of barbed wire.

I. Barbed Wire: Barbed wire shall be of the four-point pattern, composed of two strands of No. 12-1/2 gauge copper-bearing steel wire, Class III with large hard temper barbs spaced a maximum of 5 inches apart, and shall be heavily galvanized by the hot-dip process.

J. Tension Bars shall be 3/16 x 3/4-inch hot-dipped galvanized steel.

K. Fabric Ties shall be minimum No. 11 gauge copper-bearing hot-dipped galvanized steel wire, or similar galvanized steel wire of a tensile strength and gauge not less than that of the main fence fabric.

L. Gates: Gate frames shall be nominal 1-1/2 inch, 1.900 inch O.D. galvanized high carbon-welded steel tubing with internal bracing of nominal 1-1/4 inch, 1.660 inch O.D., galvanized high carbon-steel tubing welded at all joints to provide rigid water-tight construction. Gate fabric shall match the line fence fabric. Gates shall be 8-feet high with heavy malleable iron extension arms as previously described. Swing gates shall be furnished with pivot-type hinges, center stop, and hold open devices. Gates shall provide clear openings as shown on the drawings. If requested on the submittal list, the contractor shall submit shop and erection drawings on the gates, hardware, type of hangers, spacing, and all other details required for a complete installation. Latches are required only if called for in the contract.

1. Gate Posts. For gates over 4 feet wide, gate posts shall be nominal 3-1/2 inch, 4.00 inch O.D. galvanized steel pipe. The posts shall be provided with heavy malleable iron extension arms as previously described. For gates 4-feet wide and smaller, gate posts may be nominal 2-1/2 inch, 2.875 inch O.D.

M Post Caps: Formed Steel, malleable cast iron, or aluminum, sized to post diameter, with set screw retainer.

PART 3 - EXECUTION

3.01 Site Preparation: Blade off all fence lines to finish grade before construction of fences.

3.02 Erection: The fence erection, including all connections, shall be made in accordance with manufacturer's directions and the "Product Manual" published by the Chain Link Manufacturers Institute.

3.03 Concrete Placement: Posts and gate hold open devices shall be placed in concrete. Concrete shall meet the requirements of Standard Specification 03300 Cast-In-Place Concrete. The contractor shall insure that the fresh concrete has sufficiently cured prior installing and pulling the fabric.

3.04 Fabric shall be stretched taut enough to resist a 6-inch deflection laterally, top or bottom, when force is exerted with the hand. Fabric shall be attached to and supported by terminal and gate posts by means of 3/16 x 3/4 inch hot-dipped galvanized tension bars.

Fabric shall be fastened to line posts and to the top and bottom rails by means of tie wire (Fabric Ties) spaced approximately two feet apart. There shall be two complete wraps made with the tie wire around the fabric on all perimeter security fences.

Posts bracing, and other structural members shall be located on the inside of the security fence.

The fence and gate fabric for fences 16 feet in height shall be 2 pieces of 8 foot high 11 GA. Material overlapped 4 inches and hog-tied every 12 inches using 11 GA. Galvanized Steel Wire per SNL Standard Drawing CJ1005STD.

3.05 Top Rail shall pass through the extension arms to form a continuous brace from end to end of each stretch of fence.

3.06 Bottom Rail shall be installed in accordance with manufacturer's directions using couplings.

3.07 Bracing: All end and corner posts, unless otherwise shown, shall be suitably braced with pipe set in horizontal position, with adjustable truss braces between terminal and first line posts, complete with all fittings. Terminal posts shall be braced laterally in an approved manner.

3.08 Barbed Wire: Each extension arm shall carry three strands of barbed wire at an angle of 45 degrees, the upper strand 12 inches out from the fence line and 12 inches above the top of the fabric. The extension arms shall be installed so that they are pointing to the exterior of the perimeter created by the fence.

3.09 Post Spacing and Setting: All posts shall be spaced in the line of the fence not to exceed 10-foot centers for a fence height not exceeding 8 feet and 8-foot centers for a fence height greater than 8 feet not exceeding 16 feet. All posts shall be set in concrete foundations to a depth of not less than 36 inches for a fence height not exceeding 8 feet, and a minimum of 60 inches for a fence height greater than 8 feet not exceeding 16 feet.

Top of concrete for buried fabric shall be 6-inches below finish grade. Concrete foundations shall be circular in horizontal section, not less than 10-inches in diameter for line posts, and with a diameter not less than the outside diameter of the post plus 9 inches for each gate and terminal post for a fence height not exceeding 8 feet. Concrete foundations shall be 12-inches in diameter for line posts, and 14-inches in diameter for each gate and terminal post for a fence height greater than 8 feet but not exceeding 16 feet.

Set terminal posts (end, corner, and gate) at beginning and end of each continuous length of fence and at abrupt changes in vertical and horizontal alignments.

3.10 Bolts and Hardware:

A. All screws, nuts, bolts, bars, wire mesh, hinges and hinge pins shall be securely fastened to preclude surreptitious removal and assure visual evidence of tampering.

B. Hardware accessible from outside the area shall be restrained by peening, brazing, or spot welding to preclude removal.

1. Exceptions: Carriage bolts with round head need not be restrained when used to connect top or bottom rail, latches or center stop. Carriage bolts need not be restrained when used on hardware when the nut is not accessible from the outside.

2. Exceptions: Bolts and hardware on fence other than perimeter security fence shall not be restrained unless directed otherwise.

3.11 Painting: Surfaces that have been cut, filed, or where the galvanized coating has been damaged shall be coated with a zinc-enriched paint to prevent corrosion per ASTM A 780.

3.12 Clearance:

A. The bottom rail shall be installed so that it is not over 2 inches above grade at any point. (Standard fence only)

B. Provide suitable closure at irregularities in grade, such as curbs or ditches. This can be accomplished with suitable extensions from the bottom rail made from an equivalent material. Vertical posts shall not exceed 6 inches open space to the adjacent post or solid structure. If fabric is utilized in the closure it shall be sufficiently secured to the bottom rail and extensions with fabric ties. Overlap the fabric for the enclosure a minimum of 6 inches above the bottom rail.

C. Vertical posts shall not exceed 6 inches open space to the adjacent post or solid structure.

D. Gates in the closed position shall have vertical and horizontal clearances not greater than 6 inches.

- END OF SECTION -

SECTION 02514 - CONCRETE FLATWORK, CURBS, & APPROACHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of portland cement concrete paving is shown on drawings including walks, curbs, and approaches.

1.03 QUALITY ASSURANCE

A. Codes and Standards: Comply with local governing regulations.

1.04 JOB CONDITIONS

A. Traffic Control:

1. Maintain access for vehicular and pedestrian traffic as required for other construction activities.

2. Utilize barricades and warning signs as required.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

1. Use flexible spring steel forms or laminated boards to form radius bends as required.

2. Coat forms with a nonstaining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Architect.

C. Reinforcing Bars: Deformed steel bars ASTM A615, Grade 40.

D. Fabricated Bar Mats: Welded or clip assembled steel bar or rod mats, ASTM A184. Use ASTM A615, Grade 40 steel bars, unless otherwise indicated.

E. Joint Dowel Bars: Plain steel bars, ASTM A615, Grade 40. Cut bars true to length with ends square and free of burrs.

F. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I

a. Use one brand cement throughout project, unless otherwise acceptable to Architect.

2. Normal Weight Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source for exposed concrete.

a. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling causing deleterious substances.

b. Local aggregates not complying with ASTM C33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.

G. Expansion Joint Materials: Contractor shall use pre-formed expansion joint fillers and sealers.

H. Liquid Membrane Forming Curing Compound: Complying with ASTM C309, Type I, Class A unless other type acceptable to Architect. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. "Masterseal", Master Builders
b. "Clear Seal", A.C. Horn
c. "Sure Cure", Kaufman Products, Inc.
d. "Sealkure", Toch Div. - Carboline
e. "Kure-N-Seal", Sonneborn-Contech
f. "Sonocrete", Sonneborn-Contech
h. "L&M Cure", L&M Construction Chemicals

I. Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:
a. "Weldcrete", Larsen Products
b. "Everbond", L&M Construction Chemicals
c. "Hornweld", A.C. Horn
d. "Sonocrete", Sonneborn-Contech
e. "Acrylic Bondcrete", The Burke Co.

2.02 CONCRETE MIX, DESIGN, AND TESTING

A. Design mix to product normal weight concrete consisting of portland cement, aggregate, and water to produce the following properties.

1. Compressive Strength: 3000 psi, minimum at 28 days, unless otherwise indicated.

2. Slump Range: 5" for concrete containing HRWR admixture (super-plasticizer); 3" for other concrete.

3. Air Content: 5% to 8%.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

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

B. Proof roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3.02 FORM CONSTRUCTION

A. Set forms to required grades and lines rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least twenty four (24) hours after concrete placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8" in 10'.

2. Vertical face on longitudinal axis, not more than 1/4" in 10'.

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

3.03 REINFORCEMENT

A. Locate, place, and support reinforcement as specified in this section unless otherwise indicated on plans.

B. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.

C. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

D. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

E. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Engineer.

F. Place reinforcement to obtain at least minimum coverage's for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

G. Install welded wire fabric in as long lengths 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.

3.04 CONCRETE PLACEMENT

A. General: Comply with requirements of Division 3 sections for mixing and placing concrete and as herein specified.

1. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required 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.

2. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

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

4. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

B. Fabricated Bar Mats:

1. Keep mats clean and free from excessive rust and handle units to keep them flat and free of distortions. Straighten bends, kinks, or other irregularities or replace units as required before placement. Set mats for a minimum 2" overlap to adjacent mats.

2. Place concrete in 2 operations; strike-off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike-off and screed.

a. Remove and replace portions of bottom layer of concrete which has been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

C. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

3.05 JOINTS

A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the center line unless otherwise indicated.

1. When joining existing structures, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness as follows:

1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

2. Sawed Joints: (Contractor's Option) Form weakened-plane joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.

C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such placements terminate at expansion joints.

1. Construct joints as shown or, if not shown, use standard metal keyway-section forms.

2. Where load transfer slip dowel devices are used, install so that one end of each dowel bar is free to move.

D. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.

1. Locate expansion joints at 50' o.c. for each pavement lane, unless otherwise indicated.

2. Extend joint fillers full width and depth of joint and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

3. Furnish joint fillers in one piece lengths for full width being placed wherever possible where more than one length is required, lace or clip joint filler sections together.

4. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

E. Fillers and Sealants: Comply with requirements of applicable Division 7 sections for preparation of joints, materials, installation, and performance.

3.06 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool and round to 1/2" radius unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing as follows:

1. Broom finish by drawing a fine hair broom across concrete surface perpendicular to the line of traffic. Repeat operation, if required, to provide a fine line texture acceptable to Architect.

2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff bristled broom perpendicular to the line of traffic.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects as directed by Architect.

3.07 CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

1. Provide moisture curing by one of the following methods.

2. Keep concrete surface continuously wet by covering with water.

3. Use continuous water-fog spray.

4. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet.

5. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

6. Provide moisture-cover curing as follows:

    a. Cover concrete surfaces with moisture-retarding cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by water proof tape or adhesive.

    b. Immediately repair any holes or tears during curing period using cover material and water proof tape.

    c. Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:

        i. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen as disappeared).

        ii. Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions.

        iii. Recoat areas subjected to heavy rainfall within 3 hours after initial application.

        iv. Maintain continuity of coating and repair damage during curing period.

        v. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied to concrete.

3.08 REPAIRS AND PROTECTIONS

A. Repair or replace broken or defective concrete as directed by Architect.

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

C. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

END OF SECTION

SECTION 02521- CONCRETE CURB AND GUTTER AND VALLEY GUTTER

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This work shall consist of the construction of concrete curb, concrete curb and gutter, concrete gutter or valley gutter, or combination thereof in compliance with the specifications, lines, grades, and details shown on the plans, or as directed by the ENGINEER.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Concrete and manufactured curb and gutter materials shall be subject to inspection and tests at plants and construction sites for compliance with quality requirements.

B. Concrete curb and gutter or concrete valley gutter shall be constructed with concrete conforming to the provisions of Section 02614 - Portland Cement Concrete Paving, or Class "B" concrete conforming to the requirements of Section 03300 - Cast-In-Place Concrete.

C. Preformed expansion Joint Filler shall conform to the requirements of AASHTO M-33 or M-153.

D. Linseed Oil shall conform to the requirements of AASHTO D-260.

E. Mineral Spirits shall conform to the requirements of AASHTO D-235.

2.02 FOUNDATION:

A. Concrete curb and gutter or concrete valley gutter shall be placed on an approved foundation conforming to the requirements of the following City of Los Fresnos Specifications:

1. Section 02210 - Subgrade Preparation,
2. Section 02260 - Flexible Base,
3. Section 0223 - Roadway Excavation, Borrow, and Embankment.

PART 3 - EXECUTION

3.01 EXCAVATION:

A. When required, excavation shall be made to the specified depth, and the base upon which the curb and gutter or valley gutter is to be placed shall be compacted to a firm, even surface conforming to the requirements of Subsection 2.02 above.

B. All soft and unacceptable material shall be removed and replaced with material approved by the ENGINEER in conformance with the requirements of Subsection 2.02 above.

3.02 FORMS:

A. Forms shall be of wood or metal, straight, free from warp, and of such construction that facilitates the inspection of the grade and alignment for compliance with the approved plans and specifications.

B. All forms shall extend for the entire depth of the curb and gutter and shall be braced and secured sufficiently so that no deflection from alignment or grade will occur during the placement of the concrete. Flexible forms shall be used in curved sections so that the top surface of the forms will form a smooth, continuous arc.

3.03 MIXING AND PLACING:

A. Concrete shall be proportioned, mixed, and placed in accordance with the requirements of Section 02614 and Section 03300.

B. Compaction of the concrete placed in forms shall be by vibration or other acceptable methods.

C. Unless otherwise provided, the exposed surfaces of curbs and gutters shall be finished by belting or with wooden floats. Forms shall be left in place until the concrete has set sufficiently so that they can be removed without injury to the curb and gutter.

3.04 SECTIONS:

A. Curb and gutter shall be constructed in sections having a uniform length of 20 feet, unless otherwise directed by the ENGINEER. Except at expansion joints, sections shall be separated by open joints 1/8 inch wide.

3.05 EXPANSION JOINTS:

A. Expansion joints shall be formed at the intervals shown on the plans using a preformed expansion joints filler having a thickness of 3/4 inch.
B. When the curb and gutter or concrete valley gutter is constructed adjacent to an existing concrete pavement, an expansion joint shall be located between the curb and gutter section and the existing concrete pavement.

3.06 CURING

A. Immediately upon completion of the finishing, the curb and gutter shall be moistened and kept moist for 3 days, or the curb and gutter shall be cured by the use of a membrane-forming material. The method and details of curing shall be subject to the approval of the ENGINEER.

3.07 SURFACE TREATMENT:

A. The surface of concrete curb and gutter or concrete valley gutter shall be treated with a solution of Linseed Oil and Mineral Spirits in accordance with the applicable requirements of Section 03300 - Cast-In-Place Concrete.

3.08 BACKFILLING:

A. After the concrete has set sufficiently, the spaces in front and behind the curb and gutter section shall be refilled to the required elevation with material approved by the ENGINEER, and shall be thoroughly tamped in layers of not more than 6 inches.

3.09 SLIP-FORM CONCRETE CURB, CONCRETE CURB AND GUTTER OR CONCRETE VALLEY GUTTER:

A. Any concrete curb or concrete curb and gutter, except on structures, may be placed using a slip form machine provided that the finished concrete curb or concrete curb and gutter is true to line and grade, the concrete is dense, and of the required surface texture.

B. The concrete shall be of a consistency that it will maintain the shape of the concrete curb or concrete curb and gutter section without support after slip forming.

C. The top and face of the finished concrete curb or concrete curb and gutter shall be true an straight and the top surface of the concrete curb or concrete curb and gutter shall be of uniform width and free from humps, sags, or other irregularities.

D. The forming portion of the slip form machine shall be readily adjustable vertically during the forward motion of the slip form machine to provide a variable height of concrete curb or concrete curb and gutter grade when necessary. A grade line gauge or pointer shall be attached to the slip form machine in such a manner that a continual comparison can be made between the concrete curb or concrete curb and gutter grade as indicated by the offset guidelines.

E. Concrete shall be fed to the slip form machine at a uniform rate. The slip form machine shall be operated under sufficient uniform restraint to forward motion to produce a well compacted mass of concrete free from surface pits larger than 3/16 inch in diameter and requiring no further finishing, other than light brushing with a wet brush. Finishing with a brush application of grout will not be permitted.

F. Transverse weakened planes and expansion joints shall be constructed at right angles to the line of the concrete curb, concrete curb and gutter, or concrete valley gutter.

G. Expansion joints may be constructed by sawing through the concrete curb or concrete curb and gutter section to its full depth. The width of the cut shall be such as to admit the joint filler with a snug fit.

H. The operations of sawing and inserting the joint filler shall be completed before curing the concrete. At the conclusion of the curing period the filler in each joint shall be checked for tightness of fit. Loose filler in any joint shall be mortared in place and cured.

I. Excavation shall be as per Subsection 3.02 above.

J. All remaining provisions of Subsection 2.02 above also apply, unless otherwise specified.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Curb and gutter, curb, and valley gutter shall be measured by the linear foot.

1. Curb shall be measured along the front face of the section at the finished grade elevation.

2. Combination curb and gutter will be measured along the face of the curb at the flowline of the gutter.

3. Valley gutter will be measured along the flowline of the gutter.

B. A deduction in length shall be made for drainage structures, such as catch basins or inlets, in the curb, gutter, or combination thereof.

C. There will be no direct measurement or payment of materials used to construct curb and gutter, curb, or valley gutter.

D. Excavation or construction of embankment for foundation of curb, valley gutter, or combination curb and gutter will not be measured for payment.

4.02 PAYMENT:

A. The accepted quantities of curb, valley gutter, and curb and gutter will be paid for at the contract unit bid price per linear foot for each kind and type specified, complete and in place.

B. Foundation preparation by excavating or constructing embankment to the required subgrade elevation is considered incidental to the completion of the work and no direct payment will be made thereof.

C. Compensation will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

*** * * END OF SECTION * * ***

SECTION 02660 - WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall furnish all labor, equipment, and materials and perform all operations necessary to construct a complete, functioning water distribution system.
B. All materials and work performed shall be in accordance with plans, specifications, applicable codes and standards, and of first-class workmanship.

1.2 SAFETY PROVISIONS

A. It shall be the responsibility of the Contractor to protect persons from injury and to avoid property damage.
B. Contractor shall provide and maintain adequate barricades, construction signs, torches, red lanterns and guards during the progress of the construction work and until it is safe for traffic to drive over the trenches in the roadway.
C. Contractor shall perform all construction in a safe manner, specifically, the rules and regulations of the Occupational Safety and Health Administration (OSHA) and the Manual of Uniform Traffic Control Devices (MUTCD).

1.3 REFERENCES

A. City's Minimum Engineering and Construction Standards.
B. Texas Building Codes.
C. Texas Fire Prevention Code.
D. Manual of Uniform Traffic Control Devices (MUTCD)
E. NFPA 24
F. ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings
G. ASTM B88, Standard Specification for Seamless Copper Water Tube
H. ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable
I. ASTM D1599, Standard Test Method for Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
J. ASTM D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
K. ASTM D2241, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
L. ASTM D2737, Standard Specification for Polyethylene (PE) Plastic Tubing
M. ANSI/AWWA C110, American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids - International Restrictions
N. ANSI/AWWA C500, AWWA Standard for Metal-Seated Gate Valves for Water Supply Service - International Restrictions
O. ANSI/AWWA C600, Standard for Installation of Ductile-Iron Water Mains and their Appurtances - International Restrictions
P. ANSI/AWWA C651, Disinfecting Water Mains - International Restrictions
Q. ANSI/AWWA C800, Underground Service Line Valves and Fittings - International Restrictions
R. ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution - International Restrictions

1.4 EXISTING UTILITIES

A. Contractor shall provide necessary temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work at his own expense.
B. Where existing utility structures such as conduits, ducts, pipe branch connections to main sewers, or main drains obstruct the grade or alignment of the pipe, the Contractor shall permanently support, relocate, remove, or reconstruct, the existing structure with the cooperation of the their owners.
   1. Do not deviate from the required line or grade except, as directed, in writing by the Architect.
C. The Contractor shall obtain a Certification number and an existing utility field location at least 48 hours prior to beginning any excavation.
D. Prior to beginning construction, the Contractor shall verify the size, location, elevation, and material of all existing utilities within the area of construction by use of record drawings, electronic locating devices, ground penetrating radar, potholing, or other suitable techniques.
E. Existing utility locations shown on these plans are approximate and identified as either "to remain" or "to be removed".
   1. The Architect assumes no responsibility for the accuracy of existing utilities shown or for any existing utilities not shown.
F. The Contractor is responsible for repairing any damage done during construction to any and all existing utilities.
G. If upon excavation, an existing utility is found to be in conflict with the proposed construction or to be of a size or material different from that shown on the plans; the Contractor shall immediately notify the Architect.
H. Provide water services to each building from the underground water main system, and not from adjacent buildings.

1.5 SHOP DRAWINGS AND SUBMITTALS

A. The Contractor shall provide the Architect a copy of all manufacturers' literature and data for materials installed under this section.
   1. The Architect shall review and stamp the submittals, "Approved" prior to installation by the Contractor.
B. Prior to final approval and acceptance of work, the Architect and other Regulatory Agencies shall review and accept the Contractors "As-Built" documentation.
   1. The Contractor shall provide complete and accurate "As-Built" information relative to manholes, valves, services, fittings, length of pipe, and the like, with the horizontal and vertical information verified by an independent Registered Surveyor to the Architect and other regulatory Agencies.

1.6 APPLICABLE CODES

A. General: All construction and materials shall conform to the Florida Building Code and all local and national codes where applicable.
B. Survey Data: All elevations on the plans or referenced in the specifications are based on National Geodetic Vertical Datum of 1929 (NGVD).
C. Portable water shall comply with the "City's Minimum Engineering and Construction Standards, Water and Sewer Systems," and/or the construction standards of any municipality having, jurisdiction.

1.7 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under, Division 1, General Requirements, are included as part of this section.
B. Section 02200 - Earthwork.

PART 2 PRODUCTS

2.1 PIPE

A. OFF-SITE
   1. For water main construction within the public right-of-way and utility easements refer to city, county, or state utility standards and specifications for water main construction within their right-of-way.
B. ON-SITE
   1. The water main shall be either polyvinyl chloride (PVC) pipe or ductile iron pipe (DIP) and shall have push on rubber gasket joints.
   2. Pressure pipe (4" and larger) PVC pipe shall be pressure pipe with iron o.d. class 150 (SDR 18) for domestic water and class 200 (SDR 14) for fire mains, conforming to AWWA C900.
   3. Ductile iron pipe (4" and larger) shall be cement-mortar lined and seal coated, class 150 for domestic water and class 200 for fire mains, mechanical, or push-on joints.
   4. Pressure pipe (under 4") Polyvinyl chloride (PVC) pressure pipe, schedule 40 conforming to ASTM D-1785 or SDR 21 conforming to ASTM D2241 with cement-solvent welded joints.
   5. Miscellaneous: ¾" threaded tie-rods shall be cadmium plated and painted with a coal tar base paint following installation.

2.2 FITTINGS

A. Fittings for ductile iron and PVC pipes (4" and larger) shall have a pressure rating of 250 psi; use mechanical joints and conform to the latest revision of ANSI/AWWA C110.
B. Mechanical joint fittings shall conform to the latest revision of ANSI/AWWA C110.
C. Flanged fittings shall conform to ANSI Specifications for Class 125.
D. Brass fittings shall conform to ANSI/AWWA C800, with all exposed threads covered with a protective plastic coating.
E. Fittings for PVC pipe shall be cast iron mechanical joint type having a pressure rating of 250 psi and conforming to ANSI/AWWA C110.

2.3 VALVES

A. Gate valves 2½" or less in size shall be standard 125 pound, non-rising stem, bronze, double-disc, screwed type, equipped with hand wheel.
B. Gate valves over 2½" shall be resilient seat gate valves with iron body, non-rising stem, fully coated disc with rubber seat ring manufactured in accordance with ANSI/AWWA C500.

2.4 VALVE BOXES

A. Valve boxes shall be of standard extension design manufactured with top cover marked "water."
B. The top section shall be adjustable for elevation and shall be set to allow equal movement above and below grade.
C. Provide valve box appropriate in size for the required valve.
D. Center the base of valve box over the valve and rest firmly on compacted backfill and the entire assembly shall be plumb.
E. Valve boxes shall be like Figure H-10364, as manufactured by Mueller Company, or an approved equal.

2.5 HYDRANTS

A. Hydrants shall have a minimum 6" mechanical joint base pipe connection, 5¼" main valve opening, two 2½" hose nozzles, and one 4½" pumper nozzle.
   1. Threads shall be National Standard.
   2. Hydrants shall be cast iron body, fully bronze mounted, suitable for a working pressure of 150 pounds, and shall be in accordance with the latest specification of the ANSI/AWWA.
   3. They shall be of the O-ring seal type.
   4. Operation nut shall open counter-clockwise and be of the pentagonal shape, measuring 1½" from point to opposite flat.

B. Provide hydrants with a breakaway feature that breaks cleanly upon impact.
   1. This shall consist of a two-part breakable safety flange with a breakable stem coupling.
   2. The upper and lower barrels shall be fluted and ribbed above and below the safety flange or have an extra strength lower barrel.

C. Paint hydrants with one coat of zinc chromate primer and two finish coats of an approved paint of Architect approved color.
   1. Hydrants shall be Number A-423, Traffic type, as manufactured by Mueller Company, or an approved equal.

2.6 SERVICE CONNECTION AND METER

A. The Contractor shall install or have the City install water meters complete with dual backflow preventer, valves and meter vault, at the locations shown on the drawings, and in accordance with the specifications as shown on the drawings.

B. Contractor shall submit shop drawings for meter, valves, and backflow preventer.

C. Contractor is responsible for all costs associated with providing and installing water meters, vaults, backflow preventers, valves, and connections in accordance with the applicable local utility or Palm Beach County Standards.

2.7 SERVICE METERS (3" Maximum)

A. Service water meters shall be of the rotating disc, bronze split case housing type.

B. The meter shall be of the straight reading type, recording flow in gallons, and shall be of the sealed register type.

C. Meters shall conform to applicable specifications of ANSI/AWWA and shall be as manufactured by Neptune Meter Company, or an approved equal.

2.8 METER BOXES

A. Meter boxes shall be precast concrete with a two-piece reinforced concrete cover including a round concrete reading lid. All meter boxes must also meet local utility company requirements.
   1. Meter boxes for ⅝" or ¾" meters shall be Model 36R, as manufactured by Brooks Products, Inc.
   2. Meter boxes for larger meters shall be of suitable size for the enclosed meter.

B. Contractor shall submit shop drawings for meter boxes larger than ¾".

2.9 BACKFLOW PREVENTERS

A. Backflow preventers shall conform to AWWA Standard C506 and shall be of the "reduced pressure principle type".

1. The backflow preventer shall be provided as an assembly from one manufacturer. The assembly shall include two isolation valves, two check valves, and all other fittings or accessories needed to satisfy referenced design standards.

B. Paint backflow preventers with one coat of zinc chromate primer and two finish coats of an approved paint of Architect approved color.

C. Provide chain and padlock then chain and lock valves on all backflow preventers together.

2.10 PRESSURE GAGES

A. Pressure Gages: Pressure gages for line pressure measurement shall conform to Federal Specifications GG-G-76, Class 1, Style A, Type 1, 3½" diameter with phenolic case, or as indicated on the drawings.

2.11 CHECK VALVES

A. Check valves shall be AWWA standard for 175-psi working pressure, swing type, iron body, or bronze mounted, leather faced disc, suitable for vertical or horizontal position.

B. Valves shall be Mueller Figure A-2600 or approved equal.

C. Where designated on the plans, check valves shall be spring loaded, double half disc wafer check valve, manufactured by TRW Mission, or approved equal.

D. Spring shall be of sufficient tension so valve will close without appreciable slam.

2.12 WATER SERVICES

A. Polyethylene Tubing - Material shall comply with ASTM D1248 and the following:
   1. Polyethylene extrusion compound for extruding the polyethylene tubing shall comply with applicable requirements for PE-3406 or 3408 ultra high molecular weight polyethylene plastic material
   2. Tubing shall have a working pressure rating of 160 psi at 73.4°F.
   3. Tubing must be capable of maintaining pressure of 340 psi at 73.4°F for 1,000 hours when tested in accordance with ASTM D1599.
   4. Tubing surfaces shall be free from bumps and irregularities. Materials must be completely homogeneous and uniform in appearance.
   5. Tubing dimensions and tolerances shall correspond with the valves listed in ASTM D2737 with a standard dimension ratio (SDR) of 9.
   6. Provide label on tubing with brand name and manufacturer, NSF Seal, size, type of plastic material, and ASTM applicable designation with which the tubing complies.

B. Copper tubing shall be type "K" and conform to AWWA Specification 75-CR and ASTM B88 with a working pressure rating of 160 psi at 73.4°F.

C. Other service materials may be considered for specific installations, upon submissions of specification and approval by the Architect.

D. Joints:
   1. Joints for polyethylene or copper tubing shall be of the compression type utilizing a totally confined grip seal and coupling nut.
      a. Provide stainless steel tube stiffener insert for P.E. tubing service.
   2. Other type joints may be considered for specific installations, upon submissions of specifications and approval by the Architect.

2.13 METER VALVES

A. Meter valves shall be of bronze construction in accordance with ASTM B62.

B. Meter valves shall be closed bottom design and resilient "o" ring sealed against external leakage at the top.

C. Provide a shut-off with a resilient pressure actuated seal so positioned in the plug as to completely enclose the flow way in the closed position.
D. The inlet side of all meter valves shall have a compression type fitting as detailed in Section C Part 1.
E. Meter valves for meter size 1" and under shall be equipped with a meter-coupling nut on the outlet sides.
F. Meter valves for 1½" and 2" meters shall have flanged connections on the outlet sides.
G. Provide meter valves over 2" on individual basis for the particular installation.

2.14 CURB STOPS

A. Curb stops shall be of the inverted key type with tee-head shut off.
B. Curb stops shall be made of brass alloy in accordance with ASTM B62.

2.15 CORPORATION STOPS

A. Provide corporation stops manufactured of brass alloy in accordance with ASTM B62.
B. Inlet thread shall be taper thread in all sizes in accordance with ANSI/AWWA C800.
C. Outlet connections shall have a compression type fitting as detailed in Section C Part 1.

2.16 TAPPING SLEEVES

A. Ductile iron tapping sleeves shall be of the mechanical joint type having a flat-faced ductile iron flange, recessed for a tapping valve with all end and side gaskets totally confined.
B. The contractor shall determine the outside diameter of the existing main before ordering the sleeve.

PART 3 EXECUTION

3.1 UNLOADING MATERIAL

A. The Contractor shall exercise care in unloading and handling pipe, valves, fittings, and all other material.
B. Do not drop pipe from trucks or allow pipe to roll against other pipe.

3.2 EXCAVATION

A. All excavation to conform to Section 02200.

3.3 SEPARATION OF WATER AND SEWER MAINS

A. See design plans for water and sewer separation statement and requirements.

3.4 WATER METER

A. Domestic water service; provide a water meter (max. 3") and dual backflow preventer assembly. (Meter bypass with gate valve), (gate valve, meter, gate valve), (bypass reconnection), and (gate valve, backflow preventer, gate valve).
   1. All service pipes for 3" water meter shall be 4" ductile iron pipe with 4" gate valves with flanged fittings for above ground use, and mechanical fittings with retainer glands for underground use.
B. Fire line system; provide a double detector check valve assembly and a fire department connection.

1. Provide gate valve, (¾" meter bypass with a gate valve and check valve).

C. Locate both assemblies adjacent to property line, and provide either 6' high chain link fence around the assembly or chain lock the valves as indicated on the plans.

3.5 INSTALLATION OF PIPE

A. Obtain permission of the Health Department, Water Department, and the Fire Department having jurisdiction, before installing water mains.

B. All installation of pipe shall conform to AWWA C600.
   1. Do not roll or push pipe into the trench from the bank.
   2. Contractor shall thoroughly inspect all pipes before lowering into the trench, to insure its sound condition and eliminate the possibility of leakage or bursting under test pressure.
   3. Do not use pipes, valves, fittings or any other materials showing defects.
   4. Remove all such defective materials from the construction site immediately.
   5. Before lowering pipe into the trench, swab or brush it to insure that no dirt or foreign matter is in the finished line.

C. Lay pipe on a flat bottom trench and backfill tamped to 6" above the top of the pipe.
   1. Pipe installation shall conform to "Type B Method" as adopted by Committee A21 of the American Standards Association.
   2. Provide a firm even bearing throughout the length of each section of pipe.
   3. Pipe shall not bear on any un-yielding structures, nor shall it support any other structures.
   4. Plug or cap all dead ends, anchor and hold in place with concrete backing as required.
   5. Except while work is in progress, plug all pipe openings to prevent entrance of water or any foreign matter.
   6. Remove material deemed unstable for providing adequate support for pipe and replace with a suitable material.
   7. Provide an adequate backfill material on the pipe to prevent floating, remove and relay any pipe that floats as directed by the Architect.

D. Use one of the three following methods to connect new systems to existing mains:
   1. Method A that involves a reduced size temporary connection between the existing main and the new main.
   2. Method B that involves a direct connection between the new and existing mains using two gate valves separated by a sleeve with a vent pipe.
   3. Method C that involves a tap with one gate valve requiring disinfection of the new system prior to conducting the pressure test.

E. The water utility company shall approve and witness the connection method.

3.6 JOINTS

A. All joints shall be suitable for the type of pipe being jointed and shall be made in accordance with manufacturer's recommendations.

B. Mechanical Joints:
   1. Mechanical joints shall be of the stuffing box type.
   2. Place the gland, followed by the rubber gasket over the plain end of the pipe inserted into the socket.
   3. Then push the gasket into position to evenly seat in the socket.
   4. Move the gland into position against the face of the socket, insert bolts and make finger tight.
   5. Using a ratchet wrench suitable to the pipe size, tighten bolts alternately bottom then top, etc., until the joint is complete.

C. Compression Joints:

1. Compression joints shall be a rubber seal joint, made pressure tight by a molded rubber gasket and lubricant to facilitate assembly.
2. Make the joint tight by inserting the plain end into the bell after lubrication.
3. The compression joint shall be similar and equal to "Altite" b as manufactured by Alabama Pipe Company.
4. Follow the manufacturer recommendations in making up the joints.

D. Flanged Joints:
1. Use rubber gaskets to make flanged joints, with bolts having rough square hands and hexagonal nuts made to American Standard rough dimensions that are chamfered and trimmed.
2. Bolts shall be the recommended size for the diameter of pipe being joined and be tightened to evenly distribute the stress in the bolts and bring the pipe in alignment.

3.7 INSTALLATION OF FITTINGS

A. Applicable portions of these specifications shall apply to installation of fittings.
B. Provide reaction or thrust blocking at bends and tees, and where changes in pipe diameter occur at reducers or in fittings.
C. Refer to details for concrete strength and dimensions.
D. Provide restrained joints for all fittings in the public right-of-way.

3.8 INSTALLATION OF FIRE HYDRANTS

A. Applicable portions of these specifications shall apply to installation of fire hydrants.
B. All hydrants shall stand plumb and burial line shall be set at finished grade.
C. Place sufficient concrete thrust blocking as shown on the plans or as directed by the Architect.

3.9 INSTALLATION OF VALVES

A. Applicable portions of these specifications shall apply to installation of valves.
1. All valves shall stand plumb unless otherwise shown on the plans or directed by the Architect.
2. The operation of installing tapping sleeves and an experienced contractor who has been engaged in this type of work not less than one-year with a representative list of successful installations shall install the valves.

B. Provide appropriate shut-off in a valve box approximately 5' from the building on domestic water line to each building.

3.10 PRESSURE TESTS

A. After adequately backfilling the pipe and at least seven days after placing the last concrete thrust blocking, pressure test all laid pipe for two hours at 150 psi minimum, in accordance with ANSI/AWWA C600-93.
B. The pressure test shall not vary more than ±5 psi during the test.
C. Remove all air is from the pipe prior to pressure tests.
D. The Contractor shall provide such means of venting the pipe as are required.
E. The Contractor shall replace any material or installation proving defective.
F. A representative of the City/County and the Architect shall witness the pressure test.

3.11 LEAKAGE TESTS

A. Bring the main up to test pressure, and hold at this pressure.

1. Carefully measure make-up water by use of a displacement meter or by pumping the water from a vessel of known volume.
2. Walk the length of the pipeline and inspect all joints for leakage and movement of pipe.
3. Repair all visible leaks.
4. Should any section of pipeline disclose joint leakage greater than that permitted, the Contractor shall, at his own expense, locate and repair the defective joints until leakage is within the permitted allowance.

B. All pipe, etc. shall be tested under a constant pressure of 150 psi (fire main at 200 psi) for a minimum test of two hours and shall not exceed the leakage requirements as per ANSI/AWWA specifications of C600-93 leakage formula:
1. $Q = \frac{SD\,p5}{133{,}200}$

Q = allowable leakage in gallons per hour
S = total length of pipe tested in feet
D = diameter of the pipe tested in inches
P = average test pressure in pounds per square inch

3.12 BACKFILL

A. Backfill shall be in compliance with Section 02200 Earthwork.
B. On completion of pressure and leakage tests, the exposed joints shall be backfilled to a depth of 12" above the top of the pipe.
1. Backfill shall be carefully compacted until 12" of cover exists over the pipe.
2. Place the remainder of the backfill and compacted thoroughly by puddling and tamping.
3. When directed, the contractor may backfill the trench neatly rounded to a sufficient height allowing for settlement to grade after consolidation.

3.13 STERILIZATION OF COMPLETED PIPELINE

A. Before final acceptance of completed pipeline, all requirements of the County and State Board of Health shall be satisfied.
1. Forward satisfactory bacteriological test results from these agencies to the Architect.
B. Prior to chlorination of mains, remove all dirt and foreign matter by high velocity flushing through fire hydrants or other approved blow-offs.
1. Disinfect the main in accordance with the application sections of AWWA C651 and with local health department requirements.

3.14 RESTORATION OF SURFACES AND/OR STRUCTURES

A. The Contractor shall restore and/or replace paving, curbing, sidewalks, fences, sod, survey points, or other disturbed surfaces or structures to a condition equal to that before the work was begun and to satisfaction of the Architect, and shall furnish all labor and materials incidental thereto.
B. Restoration of surfaces and/or structures shall comply with all requirements of the applicable governing agencies including City, Town, County, and State.

3.15 CLEANING UP

A. The Contractor shall remove surplus pipeline material, tools, temporary structures, etc., and as directed by the Architect, shall dispose of all dirt, rubbish, and excess earth.
B. The construction site shall be left clean, to the satisfaction of the Architect

3.16 INSPECTIONS

A. The Contractor shall notify the City, Architect, and the Owner 24 hours prior to beginning construction to arrange the required inspection of the water system.

3.17 PROJECT RECORD DOCUMENTS

A. The Contractor shall maintain accurate and complete records of work items completed.
B. Prior to the placement of any asphalt or concrete pavement, the Contractor shall submit to the Architect, "as-built" plans showing water improvements.
   1. Paving operations shall not commence until the Architect has reviewed the "as-built."
C. All "as-built" information submitted to the Architect shall be sufficiently accurate, clear and legible to satisfy the Architect that the information provides a true representation of the improvements constructed.
D. Upon completion of construction, the Contractor shall submit to the Architect five complete sets of "as-built" construction drawings and one set of mylars.
   1. Clearly mark these drawings "as-built" show all construction changes and dimensioned locations and elevations of all improvements and signed by the Contractor.
   2. A Professional Land Surveyor registered in the State of Texas shall sign and seal the "As-Built drawings.
E. "As-built" information on the water system shall include vertical and horizontal locations of all valves, fittings, fire hydrants, water services, and connection points.
   1. They shall show the associated pipe size and material type, and must also show the sample points and the sample point numbers must conform to the numbers used on the bacteriological test results.

3.18 FIRE PROTECTION SYSTEM.

A. The domestic water system is separate loop from the fire protection system.
B. Buildings with fire pumps; install the Fire Department connection pipe on the discharge side of the pump.
C. Fire line extension from the main to the building, will be installed by a licensed fire sprinkler contractor. Test fire sprinkler pipe to 200 psi.
D. All fire fighting equipment (fire department connection, hydrants, double detector check valve, and gate valves) to be more than 40' away from the building.
   1. Maintain 7' clearance around each fire hydrant.
E. Provide flow and pressure test reports according to NFPA 24.
F. All points on each building will be within 200' of an existing or proposed fire hydrant.
G. Verify the fire protection water systems and hydrant locations are approved by the fire fighting authority having, jurisdiction.
H. Multi-building campus; provide to each building or group of buildings a fire service pipe that contains a post indicator valve, backflow device, and a fire department connection, and a fire hydrant within 150'.
I. Use ductile iron pipe for fire hydrant branches, fire main service (from the loop to the building), and fire department connections.

END OF SECTION

SECTION 02700 - STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

A. The City shall approve drainage system and finish floor elevation.
   1. Do not set finish floor elevation of a new building lower than the existing buildings on the campus without written permission of the Building Official.
   2. Keep buildings and sports-fields a minimum of 12" above adjacent roads and perimeter roads.
B. Design the storm water system like a sanitary sewer system with wye fittings and not with tees and elbows.
C. All drainage systems shall have an outfall to a retention pond, canal, city storm sewer, etc.
   1. Provide storm water branches to roof leaders (8" dia, 1% min. slope).
   2. Storm catch basins shall not be located within ten feet of a sidewalk.
   3. Provide traffic covers as required. Place the word "STORM" on the manhole cover.
D. Interconnect all drainage retention/detention ponds.
E. Connect condensate pipes with backflow valves to the storm drainage system.
F. Contractor shall utilize construction methods and devices such as turbidity curtains and floating silt barricade when necessary to comply with state and local water quality standards.
G. No exfiltration trenches permitted in a municipal or county wellfield.
H. Provide perimeter berms as shown on plan to prevent storm water draining on to adjacent property.

1.2 REFERENCES

A. ASTM C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
B. ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C. ASTM C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
D. ASTM C478, Standard Specification for Precast Reinforced Concrete Manhole Sections
E. ASTM C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
F. ASTM C1450, Standard Specification for Non-Asbestos Fiber-Cement Storm Drain Pipe
G. ASTM D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
H. ASTM D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
I. ASTM D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
J. ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.
B. Submit shop drawings with manufacturer's catalog cuts, technical data, certificate(s) of compliance or certified analysis in accordance with applicable standards on the following:
   1. Pre-cast concrete structures and catch basins
   2. Frames and grates
   3. Pipe

4. Test reports
5. Plastic filter fabric

C. Submit complete "as-built" information in the form of Project Record Documents.
1. Maintain accurate, clear, legible and complete records forming a true representation of the Work completed and in progress.
2. Provide drawing and specification documentation relative to:
   a. Catch basins, manholes, valves, services, and fittings.
   b. Vertical and horizontal locations of all storm drainage structures, drainage lines, and connection points.
   c. Pipe length, size, and material type.
3. Registered Surveyor shall be measure and record all horizontal and vertical information and include the information in the project Record Documents.
4. Project Record Documents: Signed and sealed by the preparing professional Land Surveyor registered in the State of Texas.

1.4 QUALITY ASSURANCE

A. Applicable Codes and Jurisdictional Authorities:
1. Texas Building Code
2. Occupational Safety and Health Administration (OSHA)
3. Manual of Uniform Traffic Control Devices (MUTCD)

B. Inspections: The Builder shall notify the municipal or county, Architect, and Owner at least 48 hours prior to arrange the required inspection of the system.

C. Survey Data: All elevations on the plans or referenced in the specifications are based on National Geodetic Vertical Datum.

D. Provide a copy of the SFWMD application for the "Surface Water Management Permit."

E. Set parking lot and roadway minimum elevations at the ten-year, one-day storm event.

F. Set playing fields minimum elevations for elementary, middle, and high schools at the ten-year, one-day storm event.

G. If wetland mitigation and/or dredge and fill are required, submit a joint permit application as required by the Texas Department of Environmental Protection and the U.S. Army Corps of Engineers, along with a preliminary mitigation plan.

1.5 RELATED WORK

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work in this section.

B. Section 02200 - Earthwork.

PART 2 PRODUCTS AND MATERIALS

2.1 POLYETHYLENE PIPE AND FITTINGS:

A. Provide high-density corrugated polyethylene smooth interior pipe with annular exterior corrugations.
1. Provide pipe fittings and accessories of same material and weight/class as pipes, with adjoining method as indicated.
2. Connect all roof drain with a pre-manufactured welded tee fitting.

B. All materials shall comply with AASHTO M294 Type S, AASHTO M252, ASTM D3350 and ASTM D2321. Joints shall be water-tight in compliance with ASTM D-3212.

C. All pipe and fittings shall be "HI-Q SURE-LOK" as manufactured by Hancor, Inc. or as approved by the Architect.

2.2 STORM SEWER PIPE: POLYVINYL CHLORIDE PIPE:

A. 6" to 8" diameter PVC: SDR 35 conforming to ASTM D3034, with push-on rubber gasket joints.
B. 10" to 12" diameter and larger PVC: PS 10 Perma-Lock with push-on rubber gasket joints similar to those as manufactured by J-M Manufacturing Company, Inc.
C. Polyvinyl-chloride pipe for use in storm sewers connections to building drains shall conform to the requirements of ASTM D1785, for Type II grade 1, Schedule 40.

2.3 REINFORCED CONCRETE PIPE:

A. Conform to ASTM C76, Table III, Wall B, or latest revision.
B. Provide all pipes with modified tongue and groove joints, and have rubber gaskets.

2.4 FIBER REINFORCED CONCRETE PIPE

A. Pipe shall be as manufactured by Hardie Pipe or pre-approved equal.
   1. Hardie pipe shall set the specific performance standard by which we evaluate all proposed substitute products.
B. Pipe shall be 16 foot finished lengths and assembled using rubber gasketed male-female ends.
   1. Form the female joint in pipes with nominal diameters less than 24" by attaching an external bell to the pipe barrel.
   2. Machine both male and female ends of the joint. The pipe joint shall be capable of deflecting up to 1.5° with a non-bell joint and 3° with a bell joint.
   3. The gasket shall conform to the requirements of ASTM C443 and FDOT Standard Specifications for Road and Bridge Construction, Section 449-6, 2004 Edition.
C. Manufacture the pipe in accordance with ASTM C1450 and shall offer a saturated ultimate D-load stress at failure of 2,000 lb/ft/ft.
D. The pipe shall comply with requirements presented in FDOT Standard Specifications for Road and Bridge Construction, Section 449-5, 2004 Edition.
E. The minimum thickness class for Hardie pipe shall be Class III up to and including 18" nominal diameter and Class II for larger sizes. School District Building Department shall pre-approve any lower thickness.

2.5 PLASTIC FILTER FABRIC:

A. Conform to Section 985 of the FDOT Standard Specifications.
B. Provide filter fabric similar to Carthage Mills Filter X or Mirafi.

2.6 CEMENT MORTAR:

A. Provide mortar for manhole construction with one part cement and two parts clean sharp sand, may add lime in the amount not over twenty-five percent (25%) volume of cement.
B. Dry mix and then wet mortar to proper consistency for use.
C. Do not use mortars that have stood for more than one hour after mixing.

2.7 CASTINGS:

A. Castings for inlets and other items: Conform to the ASTM A48, Class 25.
B. Provide castings true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength or otherwise make them unfit for the service intended.
C. Plugging or filling: Not allowed.

2.8 BALLAST ROCK AND PEA ROCK:

A. Rock shall be clean and free of salinity or any other residue.
B. When subjected to ASTM C131 tests, loss shall not exceed 40%.
C. ½" ballast rock: fall within the ½" to ¾" range.
D. ¾" ballast rock: fall within the ¾" to 2½" range.

2.9 STORM SEWER MANHOLES:

A. General: Provide pre-cast reinforced concrete storm sewer manholes as indicated, complying with ASTM C478.
B. Top: Pre-cast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated.
C. Base: Pre-cast concrete, with base riser section and integral floor, as indicated.
D. Frame and Cover: Ductile-iron, 26"- diameter cover, heavy-duty, indented top design, with lettering cast into top reading "STORM SEWER."

2.10 CATCH BASINS:

A. General: Provide pre-cast reinforced concrete catch basins as indicated.
B. Basin: Pre-cast reinforced concrete, in accordance with FDOT Standard Specification Section 425, standard index drawings and ASTMC 478.
   1. If above water table, provide sump and drain holes in bottom of catch basin.
C. Frame and Grate: As indicated on drawings, meeting FDOT Standard Specification Section 425
D. Pipe Connectors: Resilient, complying with ASTM C923.

2.11 OUTFALLS:

A. Construct of cast-in-place or pre-cast concrete as indicated, with reinforced headwall, apron, and tapered sides.
   1. Provide riprap as indicated to prevent washout of outfall discharge.
B. Backfilling: Provide backfilling under provisions of Section 02200 - Earthwork
C. Fill Material:
   1. Satisfactory fill material: local sand and rock mixture free of organic material placed in 12" thick loose lifts and thoroughly compacted to a density of not less than 98% of maximum density as determined by the AASHO Method T 180.
   2. The maximum size rocks used in the roadway fill: Classified as A-1, A-2-4, or A-3 conforming to AASHTO M-145 and not containing material which will pass sieve No. 200 by 10% of its total weight.

PART 3 EXECUTION

3.1 PREPARATION

A. Existing Utilities:
   1. Provide temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work.
   2. Permanently support, relocate, remove, or reconstruct existing utility structures (such as conduits, ducts, pipe branch connections to main sewers, main drains or other structures).
      a. Deviations from the required line or grade: Not permitted.

3. Contact the Sunshine State One Call Center and verify existing utility field locations at least 48 hours prior to beginning any excavation.
4. Verify the size, locations, elevation, and materials of all existing utilities within the area of construction.

3.2 UNLOADING MATERIALS:

A. Exercise care in unloading and handling pipe, valves, fittings, and all other material.
B. Follow manufacturers requirements.

3.3 EXCAVATION:

A. Excavate pipe trenches to required depths.
B. In general pipes shall have a minimum of 36" cover.
C. If rock is encountered, excavate to a minimum of 6" below bottom of pipe, and backfill trench.
D. Sufficient to allow workmen to perform all operations incidental to constructing the pipeline.
E. Provide hand dug bell holes to permit proper joint making.
F. Pipe bearing on rock: Not permitted.
G. Provide trenching under provisions of Section Earthwork.
H. Pipe Trench Width.
1. Provide maximum clear width of trench measured at the spring line, without under-cutting the banks, in accordance with the following table.

Size of Pipe (Inches)	Width of Trench (Inches)
6	24
8	36
10	36
12	36
15	36
18	40
21	42
24	48
27	54
30	60
36	66
42	76
48	84
54	91
60	98
66	109
72	112
78	120

2. Minimum width of trench: Leave at least 6" clear space between the bell of pipe and the sheeting or the sides of the trench where no sheeting is used on each side of the bottom without under-cutting the banks.

3.4 PREPARATION OF TRENCH BOTTOM:

A. While preparing the trench bottom or installing pipe, keep water out of trenches.
B. Shape continuous trough to receive the bottom quadrant of the pipe barrel.
C. Carefully prepare trench bottom and place pipe so that pipe is true line and grade.
D. Sand, crushed rock, gravel or pea rock used to support the pipe:

1. Place materials in the trench bottom 4" minimum below the bottom of the pipe.
2. Form trough to uniformly support the bottom quadrant of the pipe barrel.

3.5 INSTALLATION

A. PVC Pipe Installation:
   1. In accordance with the Uni-Bell Plastic Pipe Association's "Recommended Practice for Installation of PVC Sewer Pipe."
   2. Grout PVC drainage pipe in place at catch basin walls.

B. Drain and Culvert Pipe:
   1. Comply with TXDOT Standard Specifications for Road and Bridge Construction, Section 125 and 430, 2004 Edition.
   2. Protect pipe during handling against impact shocks and free falls.
      a. Keep pipe clean at all times, and do not use pipe that does not conform to the specifications.
   3. Lay pipe with ends abutting and true to line and grade. Carefully center pipes and lay with a uniform invert.
   4. Accurately lay pipe to the line and grade required for fully functional system.
      a. Prior to making pipe joints, clean and dry all pipe surfaces being joined.
      b. Use lubricant, primers, adhesives, etc., as recommended by the pipe or joint manufacturer's specifications.
   5. Place, fit, joint, and adjust jointing materials or factory fabricated joints in such a manner as to obtain a watertight line.
      a. Provide sufficient backfill material along each side of the pipe to prevent movement of pipe off line and grade.
      b. Compact backfill in accordance with the manufacturer's guidelines to ensure adequate structural support for the pipe.
   6. Install all gravity flow pipes manufactured with bell and spigot joints so the spigot ends point in the direction of flow.

C. Exfiltration Trench: (Not allowed in well fields)
   1. Excavate trench to depths required for drainage capacity.
   2. Place filter fabric and ballast rock to the level of the proposed pipe.
   3. After pipe is laid and accepted, place ballast rock carefully to avoid displacement of pipe and tamp carefully.
   4. Fill trench to level indicated on drawings with ballast rock of size or sizes indicated.
   5. Install filter fabric at top, bottom, and sides, overlapping two feet on top.
   6. Backfill and compact in accordance with requirements of Section 02200 Earthwork.

D. Catch basins: Install per manufacturer's recommendations.

E. Fill and Embankment:
   1. Place roadway fill to within 1/10 (.1) foot of the required elevation.
   2. If improperly fill or settlement, remove fill, refill with new material, compact, smooth, and make to conform to grade.

F. Drainage and Culvert Pipe:
   1. Install at elevation and line to provide working system.

3.6 FIELD QUALITY CONTROL

A. Temporary Drainage During Construction
   1. Construct and maintain temporary drainage facilities that may be required to provide drainage relief for the new construction without causing abnormal or adverse flooding impacts to the existing or new facilities.
   2. Temporary facilities may include swales, pipe, etc. as necessary.

B. Restoration of Surfaces and/or Structures:

1. Restore and/or replace paving, curbing, sidewalks, fences, sod, survey points, or other disturbed surfaces or structures to a condition equal to that before start of work.
2. Restoration of surfaces and/or structures outside the Owner's property line: comply with requirements of the applicable governing agencies.

C. Cleaning Up:
1. Remove surplus pipeline material, tools, temporary structures, etc.
2. Dispose of all dirt, rubbish, and excess earth shall be disposed of off site.

D. Quality Assurance
1. Provide a visual inspection of the installed system via "lamping" or other method.
2. Provide mandrel test of all flexible piping systems using a mandrel with an effective outside diameter of at least 95% of the actual pipe inside diameter.
   a. Test will occur 30 days or more after the pipe trench is backfilled.
3. Repair all visible infiltration regardless of flow rate.
4. Dig-up all pipe that fails the mandrel test, and relay the pipe and re-backfill, then retest the pipe.
5. Provide a written summary of test results to the Architect and Owner.

END OF SECTION

SECTION 02720 - STORM SEWER

PART I - GENERAL

1.01 SECTION INCLUDES:

A. Material and installation of storm sewer pipe and appurtenances, including headwalls.

1.02 RELATED SECTIONS:

A. Section 02222 - EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

1.03 REFERENCES:

A. ASTM C76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

B. Texas Department of Transportation (TXDOT) 1993 Standard Specifications for Construction of Highways, Streets and Bridges.

1.04 SUBMITTALS:

A. Procedures for Submittals: Section 01300.

B. Pipe Certification: Manufacture's certification that pipe meets the requirements of these specifications.

PART 2 - PRODUCTS

2.01 STORM SEWER PIPE:

A. Reinforced Concrete Pipe: Provide reinforced concrete pipe which conforms with ASTM C76, Class III

2.02 CONCRETE PIPE JOINT MATERIAL:.

A. Cold Compound Joints: For concrete pipe sections carrying rainfall runoff, furnish pipe joint material (Talcote No. 0.52, Gulf States No. GS 702, or Ram-Nek flexible) plastic gasket manufactured by the K. T. Snyder Company, Inc.) meeting the requirements of the SDHPT Standard Specification for Construction of Highways, Streets and Bridges, Item 464.2 paragraph 13b and 13d. Apply a primer of the type recommended by the manufacturer of the compound used.

PART 3 - EXECUTION

3.01 EXCAVATION, BACKFILLING AND COMPACTION:

A. Trenching and backfilling shall be in accordance with Section 02222 and details.

3.02 PIPE INSTALLATION:

A. Pipe Sewers and Culverts: Do not place pipe until the excavation has been completed, the bottom of the trench shaped, proper bedding material placed, and the line and grade have been obtained. Lay pipe accurately to line and grade in a straight line with spigot or tongue end of the pipe pointing in the direction of flow. Layout pipes together and match them so that when laid, the pipe will form a sewer or culvert with a smooth and uniform invert except where there is a pipe size change, in which case, the crowns of the larger and smaller pipes shall be at the same elevation and a concrete collar used to make the connection, unless otherwise shown.

3.03 CONCRETE PIPE CULVERT JOINT INSTALLATION:

A. Cold Compound Joints.

1. Tongue and Groove Pipe. Completely coat both ends of the pipe with primer. Coat pipe only when the pipe is clean and dry. Allow the primer to dry before the pipe is laid. Pipe 24 inches and larger must be primed at the factory. After pipe has been set to proper line and grade in the trench, trowel or otherwise apply to the groove end of the pipe a 1/2-inch-thick layer of compound. Cover two-thirds of the joint face around the entire circumference. next shove home the tongue end of the next pipe with sufficient pressure to make a tight joint. Take care to avoid leaving ridges of compound projecting into the pipe. Make necessary adjustments in the quality, and consistency of the compound, as directed by the Owner.

2. Positioning. Joints made with cold compound may be pulled home by means of a suitable winch or other suitable power equipment or a come-along. Do not use a bar stuck into the ground for positioning joints on pipe larger than 10 inches. A bar may be used to push home the joints in pipe 10 inches and smaller, provided the joints are pushed all the way home. Positioning joints multiplied by the laying length per joint must equal the actual length of sewer in any given section. Pull pipe home in a straight line with all parts of the pipe on line and grade. Do not permit horizontal or vertical movement of the pipe during or after the pulling operation. Pull or push home rubber gasket joints by any suitable means that will provide adequate pressure to ensure proper assembly of the joint Use special care to ensure that the joints are positioned in accordance with the published instructions of the manufacturer. Do not mortar the outside of joints. Do not use backhoe to drive pipe to make-up pipe joints.

3.04 HEADWALL, MANHOLE AND INLET INSTALLATION:

A. Construct all headwalls to line and grade and at locations shown. Construct in accordance with TXDOT 1993 Standard Specifications for Construction of Highways, Streets, and Bridges. Neatly cut off all pipe leads at the appropriate face of the headwall, manhole or inlet wall and finish with mortar.

END OF SECTION

SECTION 02730 -SANITARY SEWERAGE UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Sanitary sewer pipes & fittings.
B. Excavation for pipe trenches.
C. Manholes, covers, and grease traps.
D. Requirements for documentation.

1.2 REFERENCES

A. ANSI/AWWA C110, American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids
B. ANSI/AWWA C151/A21.51, American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
C. ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution
D. ANSI/AWWA C905, Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. through 36 In
E. ASTM A48, Standard Specification for Gray Iron Castings
F. ASTM C62, Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale
G. ASTM D1782. Standard Test Method for Operating Performance of Particulate Cation-Exchane Materials
H. ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
I. ASTM D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
J. ASTM D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

1.3 EXISTING UTILITIES

A. The contractor shall obtain a Certification number at least 48 hours prior to beginning any excavation.
B. Prior to beginning construction, the Contractor shall verify the size, location, elevation, and material of all existing utilities within the area of construction by use of record drawings and/or electronic locating devices.
C. Existing utility locations shown on the plans are approximate and based on available records.
    1. The Contractor is responsible for verifying all utilities, and notifying the Architect of conflicts and variations.
D. The Contractor is responsible for damage to any existing utilities for which he fails to request locations from the utility owner, and for damage to existing utilities that are properly located.
E. The Contractor shall immediately notify the Architect, if upon excavation finds the existing utility in conflict with the proposed construction or of a different size or material from that shown on the plans.

1.4 SHOP DRAWINGS AND SUBMITTALS

A. Submit under provisions of Section 01300.

B. Prior to installation, the Contractor shall furnish to the Architect the manufacturers' literature and data for all materials installed under this section for his approval.
C. Complete As-Built information and plans required before final acceptance of the system.
   1. Contractor shall provide accurate record of complete system relative to manholes, cleanouts, services, fittings, pipe size, pipe material, pipe lengths, and the like.
   2. Registered Surveyor shall provide all horizontal and vertical information in the Contractor's As-Built information.
   3. Final approval of the project "As-Built" information from the regulatory agencies having jurisdiction.
   4. Contractor shall camera the sewer lines and provide the District with a copy of the videotape.

1.5 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work in this section.
B. Section 02200 - Earthwork

1.6 APPLICABLE CODES

A. General: All construction and materials shall conform to the Florida Building Code-Plumbing, all local and national codes where applicable.
B. City's Water Utilities Department Minimum Engineering and Construction Standards.
C. Construction Safety: Perform all construction in a safe manner; follow Occupational Safety and Health Administration (OSHA) and the Manual of Uniform Traffic Control Devices (MUTCD) regulations.
D. Survey Data: All elevations on the plans or referenced in the specifications are based on National Geodetic Vertical Datum of 1929 (NGVD).

1.7 SANITARY SEWER SYSTEM

A. Gravity sewer, lift station and force main shall comply with the Palm Beach County Water Utilities Department Minimum Engineering and Construction, Water and Sewer Systems, or the construction standards of the municipality having jurisdiction.
   1. Submit a copy of the Texas Department of Environmental Protection Permits.

PART 2 PRODUCTS

2.1 SEWER PIPE AND FITTINGS

A. All sewer pipe and fittings shall be non-pressure polyvinyl chloride (PVC) pipe conforming to ASTM D3034, SDR 35, with push-on rubber gasket joints or ductile iron pipe with a ceramic epoxy lining and bituminous exterior coating.
B. Gravity sewer pipes and force mains in wellfield zones #1 and #2.
   1. Contractor shall have permission from before working in a zone 1 wellfield.
   2. Ductile iron pipe ANSI/AWWA C151/A21.51; ceramic epoxy lined and bituminous exterior coatings.
   3. Polyvinyl chloride pipe, 4" and larger, ANSI/AWWA C900 and ANSI/AWWA C905, dimension ratio DR18.
C. Fittings: PVC and DI pipe, over 4", use ductile iron mechanical joint fittings complying with AWWA/ANSI-C110and having coating/lining per B. Above.
   1. All fittings and accessories shall be as manufactured or supplied by the pipe manufacturer or approved equal.

D. In addition to the above-cited specifications, all PVC sewers shall conform to the following additional requirements:
   1. The PVC sewer piping shall be of a product having a dimension ratio (DR) of 35 and minimum pipe stiffness (PS) of 46 psi.
   2. Joints: Use an integral bell gasket joint, designed so that when assembled, the elastomeric gasket inside the bell is compressed radically on the pipe spigot to form a positive seal.
      a. The joint shall avoid displacement of the gasket when installed in accordance with the manufacturer's recommendation.
   3. Use manufacturer's recommended lubricants for joining of the pipes.
      a. No solvent cement joints accepted.
      b. Follow the pipe manufacturer's instructions for the joining of the pipe on the job, complete in the trench unless otherwise directed by the Architect.
   4. Gaskets: Mold all gaskets in a circular form or extruded to the proper section and then splice into circular form, and have a properly vulcanized high-grade elastomeric compound.
      a. The basic polymer being natural rubber, synthetic elastomer or a blend of both.
      b. The gaskets shall be of materials resistant to domestic sewage and as recommended by the manufacturer, with an adequate compressive force so as to affect a positive seal under all combinations of joint tolerance, as the gasket shall be the only element depended upon to make the joint flexible and watertight.
   5. Pipe and Fittings: The pipe shall be made of PVC plastic having a cell classification of 12454-B or 12454-C or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in ASTM D1784.
      a. The fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C or 13343-C as defined in ASTM D1782.
      b. Compounds that have different cell classifications because one or more properties are superior to those of the specified compounds are also acceptable.
      c. Clean rework material generated by the manufacturer's own production may be used so long as the pipe or fittings produced meet all the requirements of the specification.
   6. The pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects.
      a. The pipe shall be as uniform as commercially practical in color, capacity, density and other physical properties.
      b. PVC pipe and fittings showing signs of ultra-violet degradation are not allowed.
   7. Pipe Marking: Clearly mark each standard and random length of pipe in accordance with the following example at intervals of 1.5 M (5') or less:
      a. Manufacturer's Name or Trademark
      b. Nominal Pipe Size
      c. The PVC Cell Classification
      d. The Legend Type e.g.- DR 35 PVC Sewer Pipe
      e. Color: Green.
   8. Fittings Marking: The fittings in compliance with this standard shall be clearly marked per the following example:
      a. Manufacturer's Name or Trademark
      b. Nominal Pipe Size
      c. The Material Designation PVC PSM
   9. Adapters: If field conditions require adapters, install per Architect's direction.
   10. Plugs: Service plugs shall be flexible virgin polyvinyl chloride as supplied by Fernco Joint Sealer Company.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

A. The contractor shall provide for the furnishing of all labor, equipment, and materials to perform all operations necessary to construct and test the wastewater collection system in accordance with the plans and specifications.
B. Obtain permission from the Health Department and utility company having jurisdiction before install the sewerage systems.
C. Construct on site utilities in accordance with the City's Water Utilities Department Minimum Engineering and Construction Standards.
   1. Materials, installation, cleaning, testing, and disinfection.
D. Waterproof interior of manholes, do not provide ladder rungs, and label covers.

3.2 EXCAVATIONS

A. Keep trenches as nearly vertical as possible and if required, provide sheeting and bracing.
   1. Keep sheeting in place if in the opinion of the Architect or Contractor, damage could result from its removal.
B. Except in rock, water-bearing earth, or where a granular or concrete base is used, stop mechanical excavation of trenches above the final grade elevation laying of pipe on a firm, undisturbed native earth bed.
   1. If over digging occurs, remove all loosened earth and bring the trench bottom back to grade with granular material.
C. Carry excavations and trenches in rock to a depth of not less than 4" below the pipe bottom, and then fill with granular material or washed rock.
D. Width of trenches shall be such as to provide adequate space for placing and jointing pipe properly, keep trench to a minimum width.
E. Remove any unstable soil encountered and replace with gravel, crushed rock, or rock and sand suitably compacted.
F. All excavations shall be in conformance with Section 02200, Earthwork.

3.3 DEWATERING

A. The Contractor shall provide adequate equipment for the removal of storm or surface water that may accumulate in the excavation areas.
B. If the contractor encounters subsurface water, he shall use an approved method to adequately dewater the excavation site so that it is suitably dry for working, form setting, concrete pouring, and pipe installation.
C. This method shall be in place as necessary to maintain the excavation in a dry condition for such operations.
D. All cost for this equipment and work shall be at the Contractor's expense.

3.4 PREPARATION OF TRENCH BOTTOM

A. Do not allow water in the trenches during preparation of the trench bottom or during installation of pipe, unless authorized by the Architect.
B. Shape a continuous trough to receive the bottom quadrant of the pipe barrel.
   1. Excavate bell holes so that after placement, only the barrel of the pipe receives bearing pressure from the trench bottom.
C. Carefully prepare the trench bottom and place the pipe so that when in final position, the pipe is true to line and grade.
D. When sand, crushed rock, gravel or pea rock are used to support the pipe, place such material in the trench bottom a minimum of 4" below the bottom of the pipe, and form the trough as described above to uniformly support the bottom quadrant of the pipe barrel.

3.5 INSTALLATION OF SEWER PIPE

A. Install sewer pipe in accordance with ASTM D2321 and the Uni-Bell Plastic Pipe Association's Recommended Practice for the Installation of PVC Sewer Pipe.
B. Protect pipe during handling against impact shocks and free falls.
   1. Keep pipe clean at all times and do not use pipe that does not conform to the specifications.
C. Start laying the pipe at the lowest point, with spigot ends pointing in the direction of flow.
   1. Lay all pipes with ends abutting and true to line and grade.
   2. Carefully center pipe so that when laid, they will form a sewer with a uniform invert.
   3. Lay pipe in accordance with manufacturer's requirements as reviewed by the Architect.
D. Lay pipe accurately to the line and grade as shown on the plans.
   1. Preparatory to making pipe joints, all surfaces of the portions of the pipe to be jointed or of the factory-made jointing material shall be clean and dry.
   2. Use lubricant, primers, adhesives, etc., as recommended by the pipe or joint manufacturer's specifications.
   3. The jointing materials or factory-fabricated joints shall be placed, fitted, joined and adjusted in such a manner as to obtain a watertight line.
   4. As soon as possible after making the joint, place sufficient backfill material along each side of the pipe to prevent movement of pipe off line and grade.
E. Properly plug the exposed ends of pipe to prevent earth, water or other substances from entering the pipe when construction is not in progress.
F. Properly grout the Harco or approved equal manhole couplings in place at each pipe connection into a manhole wall.

3.6 BACKFILLING TRENCHES

A. Backfill all trenches and excavations immediately after laying pipe unless directed otherwise.
   1. Do not permit water to rise in open trenches after placement of pipe.
   2. Backfilling shall be in compliance with Section 02200.
B. Backfill trenches with approved material free from large clods, stones or rocks larger than 1" in diameter, and carefully deposited in layers, not exceeding 6", until enough fill is placed to provide a cover of not less than 12" above the pipe.
   1. Place each layer, and then carefully and uniformly tamp, so as to eliminate the possibility of pipe displacement.
   2. Place the remainder of backfill material, moisten, and compacted, to 95% of AASHTO Specifications T-180 in landscaped areas and 98% of maximum density in paved areas.
C. Refill, compact, smooth, and make to conform to surrounding grade any trenches improperly filled or settled.
D. Unless otherwise directed, or shown on the plans, backfill in trenches in or through roadways shall be made as specified above, except that the entire fill above 1" over the pipe shall be deposited in layers not to exceed 12" thickness, moistened, and compacted to density equal to greater than that of adjacent material so that pavement can be placed immediately.

3.7 CONCRETE ENCASEMENT OF SEWER PIPE

A. May use mechanical equipment to completely excavate trenches for pipe encasements.
B. Prior to formation of the encasement, in at least two places provide temporary supports consisting of timber, wedges or masonry to support the pipe, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket, and the other near the spigot end.
C. After the completion of jointing the pipe, uniformly pour concrete beneath and on both sides of the pipe.
   1. Use sufficient concrete so that encasement is at least 4" thick at all points.

3.8 MANHOLES

A. Provide pre-cast concrete manholes with 4000-psi min compressive strength and grade-60 steel.
B. May use other materials with prior approval of the Architect.
C. Construct the manholes to ASTM C-478 requirements and the following:
    1. Minimum wall thickness shall be 8", and the inside diameter of base sections 48".
    2. Provide minimum 8" thick pre-cast reinforced base monolithically casted with the bottom section of manhole walls.
        a. Extend the base slab a minimum of 4" from the outside of the manhole.
    3. Lifting holes through the structures are not permitted.
        a. All holes shall be grout filled to a smooth surface.
    4. Minimum height of base sections shall be 3' from the bottom of base slab.
    5. Join manhole sections with a mastic compound or a round compression ring of neoprene material set in annular spaces cast into the spigot end of a bell spigot-type joint.
        a. Uniformly compress the mastic compound or ring between the sections to form a watertight joint.
        b. After the assembling the sections, point and fill the remaining space in the joint with a dense cement mortar and finish to a smooth, continuous surface inside and outside the wall sections.
    6. Pre-cast manhole cones, when used, shall terminate at such elevations as will permit laying up a minimum of two and maximum of four courses of clay brick under the manhole frame to make allowance for future street grade adjustment.
        a. Approved HDPE adjusting rings may be used in-lieu of brick.
        b. Mechanically attach HDPE rings to the marble frame and the cone.
        c. Submit detail for approval prior to construction.
    7. Use dense, hard burned, common clay brick conforming to ASTM C62 latest revision for manhole construction, brick absorption shall be between 5 and 25 grams of water in one minute by dried brick, set flat face down, in ⅛" of water.
        a. Thoroughly slush all brick with mortar at every corner.
    8. Construction of invert channels shall be:
        a. Smooth and semicircular in shape conforming to inside of adjacent sewer section.
        b. Changes in direction of flow shall be smooth curve of as large a radius as the size of the manhole will permit.
        c. Changes in size and grade of channels shall be gradual and even.
        d. Form invert channels by one of the following methods:
            i) Directly into concrete manhole base, build up with block and mortar, lay half tile in concrete, or
            ii) Lay full section of sewer pipe through manhole and cut out top half after the surrounding concrete has cured; cut shall be smooth and even.
        e. Make the manhole floor outside of channels smooth, and slope toward channels at a slope of 1" per foot.
    9. Where shown on the drawings, the contractor shall place stub outs for future extensions, with a plug marked with a metallic locating device.
    10. Service laterals not permitted through manhole walls.
    11. Outside drop connections are required when the vertical distance between pipe inverts exceeds 2'.
        a. Cast required drop connections monolithically with the manhole elements.
    12. Cover the entire inside of the manhole with two coats (8 mil each) of Koppers 300M Bitumastic Paint.
        a. Remove all dirt, dust, oils, compounds and other foreign matter, and etch the surfaces with 18% to 20% muriatic acid solution.
        b. Then thoroughly rinsed all surfaces with clean, clear water prior to paint application. Completely dilute the acid solution prior to removal from the system.
    13. Jointing and Plastering: Mortar for jointing and plastering shall consist of one part Portland cement and two parts of find sand.

14. Grout the influent and effluent sewers in place using a waterproof, expanding grout, acceptable to the Architect.
    a. Seal all openings and joints watertight.
15. Make all castings for manhole frames and covers of clean even grain, tough gray cast iron.
    a. The castings shall be smooth, true to pattern, and free from projects, sand holes, warp and other defects.
    b. The horizontal surfaces of the frame cover seat and the under surface of the cover which rests upon the cover seat shall be machined.
    c. The cover shall not rock after seating in any position of its associated frame.
    d. Machining is required only on those frames and covers intended for vehicular traffic.
16. Coat castings with coal tar pitch varnish that shall make a smooth coating, tough and tenacious when cold, not tacky and not brittle.
    a. Iron used for castings shall conform to ASTM A48 for Class 30, gray iron.
17. Cast the words "Sanitary Sewer", and the name of the Owner in the cover.
    a. Set the manhole frames and covers so that the top cover is flush with the finished grade or as indicated on the drawings.
    b. The manhole frame and cover type shall be as indicated on the drawings.
    c. Frames will be suitable for the future addition of cast iron rings for upward adjustment of top elevation.
    d. Machine the seating surfaces between frames and covers to fit true.
    e. No plugging or filling is allowed.
    f. Cast pick type lifting holes into lids, but do not go clear through the lid.
18. When a manhole is in low-lying areas or when in the opinion of the Architect an unusual condition exists, a sealed locking type lid may be required.
    a. Installation of this type as directed by the Architect.

3.9 GREASE TRAPS/OIL SEPARATORS

A. Provide concrete grease trap tanks, 1250-gallon max per tank, with 2½" drop between tanks.
    1. Capacity = seats in dining room x part of day x loading factor.
    2. Internal concrete baffle is not required for multiple tanks.
B. Grease traps shall resist floatation at all times, even when empty.
C. In paved vehicle traffic areas, grease trap shall meet H-20 truck loading requirements.
    1. Place top slab reinforcing in the bottom of the slab, not the top.
D. Connect dumpster pad drain to the grease trap.
E. Place two-way cleanouts before, after, and between tanks.
F. Provide traffic covers and drop pipes as required.
G. Provide a neutralizing tank for acid waste pipes before draining into the sanitary system.
H. The effluent from the oil/water separator for vehicle wash down and garage areas shall drain into the sanitary sewer system.
    1. The tank shall be as manufactured by Highland Tank Co., Storytown, Pa. or approved equal.
    2. The tank shall be doubled wall with a 30-mil thick exterior coating.
    3. Have metallic risers with a corrosion-resistant coating, watertight manhole cover (fiber-lite if over 36" dia.), and an electronic alarm panel installed inside the building.
    4. Contractor to provide the required dead-man anchors

3.10 CROSSING OF WATER LINES WITH SEWERS

A. Use ductile iron pipe in lieu of PVC pipes in the following conditions.
    1. When sewer line is less than 18" under a water line.
    2. When a sewer line is above a water line.
    3. The pipe is less than 4' from the top grade to the invert of the pipe.

4. When there is less than 10' of horizontal separation between the water and sewer pipes.

3.11 SEWER TEST

A. On completion of each block or section of sewer, or such other times as the Architect may direct, the block or section of sewer is to be cleaned, tested and lamped.
   1. Each section of the sewer is to show on examination from either end, a full circle of light between manholes.
   2. Each manhole, or other appurtenance to the system, shall be of the specified size and form, to be watertight, neatly and substantially constructed, with the top set permanently to exact position and grade.
   3. All repairs shown necessary by the inspection are to be made; broken or cracked pipe replaced, all deposits removed, and the sewers left true to line and grade, entirely clean and ready for use.
   4. The Architect of Record and the City/County shall witness the sewer lamping.
B. The allowable limits of infiltration or exfiltration for the system, or any portion thereof, shall not exceed a rate of 100 gallons per inch of inside pipe diameter per mile of pipe per 24 hours.
   1. No additional allowance allowed for house service lines.
   2. The allowable limits of infiltration or exfiltration of manholes shall not exceed a rate of four gallons per manhole per 24 hours.
   3. The Architect may direct testing of part or the entire system for infiltration or exfiltration.
   4. Prior to testing for infiltration, pump out the system so that normal infiltration conditions exist at the time of testing.
   5. The amounts of infiltration or exfiltration shall be determined by pumping into or out of calibrated drums, or other Architect approved methods.
C. Conduct the exfiltration test by filling the portion of the system being tested with water to a level equal to the lowest part of the manhole frame.
   1. May substitute an air test for the water exfiltration test upon the Architect, District's Building Department, and the City's approval.
D. Conduct tests on portions of the system not exceeding three manhole sections or 1000'; whichever is greater, unless directed by the Architect.
   1. Run tests continuously for 2 hours.
E. Where infiltration or exfiltration exceeds the allowable limits specified herein, the Contractor shall locate and repair the defective pipe, joints, or other faulty construction.
   1. If the defective portions cannot be located, the Contractor shall remove and reconstruct as much of the work as is necessary in order to conform to the specified allowable limits.
   2. Repair all visible infiltration regardless of test results.
F. The Contractor shall provide all labor, equipment and materials and shall conduct all testing required under the direction of the Architect.
   1. The Contractor shall include the cost of this work in the base bid.

3.12 INSPECTIONS

A. The Contractor shall notify the City and the Architect of Record at least 24 hours prior to beginning construction in order to arrange inspection of the sanitary sewer.

3.13 RESTORATION OF SURFACES AND/OR STRUCTURES

A. The Contractor shall restore and/or replace paving, curbing, sidewalks, fences, sod, survey points, or any other disturbed surfaces or structures to a condition equal to that before the work began and to the satisfaction of the Architect and shall furnish all labor and materials incidental thereto.

B. Restoration of surfaces and/or structures shall comply with all requirements of the applicable governing agencies.

3.14 PROJECT RECORD DOCUMENTS

A. The Contractor shall maintain accurate and complete records of work items completed.
B. All as-built information submitted to the Architect shall be sufficiently accurate, clear and legible to satisfy the Architect that the information provides a true representation of the improvements constructed.
C. Upon completion of construction, the Contractor shall submit to the Architect one complete set of as-built construction drawings.
    1. These drawings shall be marked to show as-built construction changes and dimensional locations and elevations of all improvements and signed by the Contractor.
D. A registered land surveyor shall certify all as-built information for water and sewer lines and submit in a format acceptable to all local reviewing agencies.
E. Contractors shall camera the sewer lines and provide the District with a copy of the videotape.

END OF SECTION

SECTION 02751 - CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Walkways.
2. Curbs and Gutters.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for subgrade preparation, grading, and subbase course.
2. Division 2 Section "Pavement Joint Sealants" for joint sealants within concrete pavement and at isolation joints of concrete pavement with adjacent construction.
3. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Cementitious materials and aggregates.
2. Admixtures.
3. Curing compounds.
4. Bonding agent or adhesive.

1.5 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

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

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

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

PART 2 - PRODUCTS

2.1 FORMS

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

1. Use flexible or curved forms for curves of a radius 100 feet (30.5 m) or less.

2.2 STEEL REINFORCEMENT

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

B. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed.

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

D. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

2.3 CONCRETE MATERIALS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

B. Portland Cement: ASTM C 150, Type I.

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

C. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:

1. Class: 1N.
2. Maximum Aggregate Size: 1-1/2 inches nominal.
3. Do not use fine or coarse aggregates containing substances that cause spalling.

D. Water: ASTM C 94.

2.4 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.

B. Air-Entraining Admixture: ASTM C 260.

2.5 CURING MATERIALS

A. Water: Potable.

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

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

D. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Evaporation Retarder:

   a. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
   b. Sure Film; Dayton Superior Corporation.
   c. Or approved equal.

2. Clear Waterborne Membrane-Forming Curing Compound:

   a. Aqua Resin Cure; Burke Group, LLC (The).
   b. Day Chem Rez Cure (J-11-W); Dayton Superior Corporation.
   c. Or approved equal

2.6 RELATED MATERIALS

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

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

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:

1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.

2.7 CONCRETE MIXES

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

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

C. Proportion mixes to provide concrete with the following properties:

1. Compressive Strength (28 Days): 3000 psi 20.7 MPa.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 inches (100 mm).

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2.5 to 4.5 percent.

2.8 CONCRETE MIXING

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

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

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

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

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

3.3 STEEL REINFORCEMENT

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

1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated 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 fabric 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.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap to adjacent mats.

3.4 JOINTS

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

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

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

1. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Provide tie bars at sides of pavement strips where indicated.
3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

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

1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. 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:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

1. Radius: 3/8 inch.

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

C. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

D. Do not add water to concrete during delivery, at Project site, or during placement.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

F. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping.

Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

G. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.

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

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

3.6 CONCRETE FINISHING

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.7 CONCRETE PROTECTION AND CURING

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

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

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

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

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

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

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.9 FIELD QUALITY CONTROL

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

B. Testing Services: Testing shall be performed according to the following requirements:

1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.
5. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. (38 cu. m). One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.

C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

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

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

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

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

END OF SECTION 02751

SECTION 02810 - IRRIGATION

PART 1 – GENERAL

1.01 SCOPE

A. An automatic underground irrigation system for exterior landscaped areas including, but not limited to, supply an installation of water meter, backflow device, booster pump and controller, boring and sleeving, rotary heads and spray heads in lawn areas and spray heads and drip lines in shrub, ground cover, and flower bed areas.

1.02 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Provide connection to water source (existing mainline) and new water meters as specified and in accordance with local code requirements.
   2. Provide for an electro-mechanical controller.

B. Performance Requirements: Provide for irrigation at a rate of 1 in. per week applied at 2 or 3 day intervals.

1.03 QUALIFICATIONS

A. Irrigation work to be performed by a Texas licensed irrigation company specializing in commercial irrigation installation with a minimum of five (5) years experience on similar projects. Owner/SSP Design to review qualifications and approve subcontractor prior to commencing work.

1.04 SUBMITTALS

A. Submittals shall be formatted electronically in a PDF file with a table of contents and tabs identifying each section. The following submittals are required for this section:
   1. Product Data: Manufacturers' technical data (Cut Sheets) and installation information for all components including: Backflow Assembly (Pressure Vacuum Breaker PVB or Reduced Pressure, Backflow Preventer RPZ (as specified), Y strainer (if required), Ball valves, PVC pipe, PVC fittings, PVC primers, solvents, cement, glue, etc., Control wire / tracking wire, Wire connectors, Pump stations, booster pumps (if specified), Pump enclosures (if specified), Controller (incl. communications modules, etc.), Rain/freeze sensors, Valves, Valve boxes, Decoders (if specified), Rotors, Sprays, Nozzles, Bubblers, Drip line, Drip filters, Drip indicators (operind), Air relief valves

1.05 QUALITY CONTROL

A. Submit verification of water pressure at meter or point of connection.

1.06 MAINTENANCE/WARRANTY

A. Provide the following extra materials to the Owner:
   1. Two (2) quick coupler hose bib keys.

2. Four (4) keys for the controller door lock.

B. Maintenance Requirements: Maintain the work of this Section for ninety days after 'substantial completion' and until final acceptance by Owner. Notify the owner in writing of 'substantial completion'. Maintenance period begins after owner's acceptance of 'substantial completion'.

C. Maintenance Service: Perform the following maintenance operations at least once a week:
   a. Test entire system and adjust timer as necessary and as directed by landscape contractor, landscape designer or owner.
   b. Replace or repair any broken parts or equipment.
   c. Report any significant problems in writing to landscape contractor, owner and landscape designer.

D. Warranty: Warranty shall cover all parts and equipment for a period of one year from the date of final acceptance. Repairs and replacements shall be completed within two weeks of notification from owner.

PART 2- PRODUCTS

2.1 MATERIALS

A. PVC Plastic Pipe: ASTM D 2241-83, SDR21, class 160 lateral piping; ASTM D1785, class 200 mainline piping.

B. Pipe Fittings:
   1. Pipe under 3 in., id: Socket type, ASTM D 2466-78, with solvent Cement, ASTM D 2564-80.
   2. Pipe 3 in. id and Larger: Gasketed fittings of epoxy coated steel with non-hardening pipe dope or Teflon tape for threads.

C. Concrete: 2500 psi min. compressive strength.

2.2 MANUFACTURED UNITS

A. Controller: Electro-mechanical, 24 hr./14-day clock with manual operation capacity, with adequate number of stations for system operating requirements (two wire) (see irrigation equipment table). Provide both freeze-protection and rain-sensor devices with controller. Provide ground-fault interrupt and lightning protection.

B. Water Meters: Water meters in locations shown on plans. Contractor to coordinate application, permit and installation with local utility company. Contractor responsible for water meters and all associated installation costs.

C. Booster Pump: If shown on plans/schedules, contractor shall furnish and install booster pump with enclosure as specified. Contractor shall also provide a concrete pad and any and all fittings, adaptors, connections, enclosure, etc. for the complete installation and proper operation of booster pump.

D. Backflow Preventers: Provide and install backflow devices per local codes, specifications and requirements. Provide steel mesh enclosure per plans/schedule.

E. Electric Valves: Normally closed, 24v AC, 60 cycle, solenoid actuated, globe pattern, diaphragm type. Cast brass or plastic body and nylon reinforced nitrile rubber diaphragm.

F. Quick coupling Valves: Cast brass body with self-closing cover. Provide (2) brass keys with 1 in. female threaded outlet.

G. Sprinkler Heads: Heavy-duty plastic sprinkler case, high density plastic sprinkler body, corrosion-resistant internal parts, plastic spray nozzles with adjustable flow and direction features.

H. Control Wire: 24v UL/UF., approved for direct burial. Provide color-coded wire with white used for common (14-gauge, single-strand copper) and red for control (14-gauge single-strand copper).

I. Tracking Wire: 18 gauge copper (only where mainline and wiring bundle are separated)

J. Valve Boxes: Heavy-duty commercial grade, fiberglass reinforced, plastic with locking covers. Rainbird VB series, 10" Round or Standard Rectangular Min. or apprvd equal.

K. Swing Joints: 3 high density polyethylene street ells with 8 in. Schedule 80 PVC nipple; sized the same as inlet to sprinkler head.

L. Sleeves: Schedule 40 PVC. Boring as required under all existing pavement, walls or curbs.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine the site and conditions under which irrigation work is to be performed. Irrigation contractor shall notify the landscape contractor in writing, with a copy to Construction Manager, if the site is unsatisfactory. Do not begin the work until unsatisfactory conditions have been corrected in a manner acceptable to irrigation contractor. Beginning of work indicates acceptance of the site as satisfactory by the irrigation contractor.

3.02 INSTALLATION

A. General: Install tracking wire along mainline pipe if separate from valve wiring bundle.

B. Excavating and Filling:
   1. Cover for Piping:
      a) Mains: 18 in. min.

b) Laterals: 12 in. min.

2. Use clean backfill material without stones larger than 1/2 in., debris or extraneous material that may damage pipe assembly.
3. Compact all trenches to a minimum 95% Standard Proctor Density.

C. Pipe:
1. Install in existing sleeves under pavement or provide boring and sleeves under pavement as required.
2. Clean pipe and joints before making connections. Purple primer to be used on all joints before applying solvent. Per TCEQ Regulations.
3. Attach joints according to manufacturer's instructions. Threaded joints to be coated with "Teflon" tape. Allow joints to set for at least 24 hrs. before applying water pressure to the system.
4. Thoroughly flush piping before sprinkler heads are installed and test under pressure for leaks in each line separated by valves.

D. Water Meters: Provide and install water meters per local codes, specifications and requirements. Coordinate permit and application with owner and local utility company. Adjust locations as necessary to coordinate with existing water line locations.

E. Back Flow Protection: Provide and install backflow devices per local codes, specifications and requirements including enclosure.

F. Valves:
1. Provide isolation valve on inlet side of every electric control valve (if specified).

Install electric and gate valves with at lest 10 in. of cover over the valve and at least 6 in. of cover over the stem.

2. Install valve box centered over the flow control handle. Provide 1 cu. ft. of clean pea gravel in the bottom of each valve box with filter fabric below.
3. In lawn areas, valve boxes to be set flush with existing grade; in planting bed areas valve boxes shall be set 2" above grade.

G. Controllers: Hard wire to nearest power source and CAT6 data line. Coordinate with general contractor. Install on exterior wall in location as shown on plans or as directed/approved by Owner / SSP.

H. Sprinkler Heads: Install all heads on swing joint assemblies and flush with finish grade.

I. Wiring:
1. Bundle and tape wires at 10 ft. o.c., max.
2. Snake wire in trenches to allow for expansion. Provide expansion coils at 100 ft. o.c. max., and at the entry to each valve box.
3. Splice wires using mechanical sealant connector for a waterproof connection. Make all wire splices within valve boxes. Use RB WPCONN N90300 or approved equal.

3.03 FIELD QUALITY WORK

A. General: Notify the Construction Manager at least 48 hours before testing is begun.
B. Hydrostatic Test: Test mainline piping to a hydrostatic pressure of not less than 100 psi for a minimum of 24 hours. Piping may be tested in sections to expedite work. Remove and repair piping and connections which do not pass hydrostatic testing.
C. Operational Testing: Perform operational testing after hydrostatic testing is completed, backfill is in place, and sprinkler heads adjusted to final position.

3.04 ADJUSTING

A. Check sprinkler heads for arc of spray. Adjust as necessary to provide 100% coverage of all landscaped areas.
B. Adjust layout to conform to actual layout of landscape plantings.

3.05 DEMONSTRATION

A. Demonstrate operation of the system to Owner's personnel and staff.

3.06 CLOSE-OUT DOCUMENTS

A. As-Built Drawings: Submit 'As-Built' drawings before project close-out showing the irrigation system layout, including line locations and sizes, spray heads and types, points of connection, booster pump, location of backflow device(s), controller, and other installation information.
B. Warranty Letters: Submit warranty letters for all irrigation items including labor for the specified warranty period.
C. Operation and Maintenance Data: Submit Manufacturers' operation and maintenance instructions and laminated colored (11x17) valve Zoning Diagram.

END OF SECTION

SECTION 02853 - PARKING BUMPERS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Precast concrete, recycled plastic, or recycled composite parking bumpers and anchorage.

1.2 REFERENCES

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
B. ASTM C33 - Standard Specification for Concrete Aggregates.
C. ASTM C150 - Standard Specification for Portland Cement.
D. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
E. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.

1.3 SUBMITTALS FOR REVIEW

A. Section 01300 Submittals: Procedures for submittals.
B. Product Data: Provide unit configuration, dimensions.

PART 2 PRODUCTS

2.1 CONCRETE BUMPERS

A. Cement: ASTM C150, Portland Type I - Normal gray color.
B. Concrete materials: ASTM C33; water and sand.
C. Reinforcing Steel: ASTM A615, deformed steel bars; galvanized finish, strength and size commensurate with precast unit design.
D. Air Entrainment Admixture: ASTM C260.
E. Concrete Mix: Minimum 3500 psi, 28-day strength, air entrained 5% to 7%.
F. Use rigid molds, constructed to maintain precast units uniform in shape, size, and finish.
   1. Maintain consistent quality during manufacture.
G. Embed reinforcing steel, and drill or sleeve for two dowels.
H. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
I. Minor patching in plant is acceptable, providing appearance of units is not impaired.

2.2 RECYCLED PLASTIC/COMPOSITE

A. Color to be gray.
B. Recycled Plastic: Recycled plastic, solid wheel stops.
C. Recycled Composite: As manufactured by Xpotential Products, or equal.
D. Provide minimum five-year product warranty.
E. Products shall be chemical and weather resistant.

2.3 CONFIGURATION

A. Concrete Profile: Triangular cross section with sloped vertical faces, square ends, nominal size

of 4" H x 6" W x 6' L.

B. Recycled Profile: Pentagonal section, non-equilateral, nominal size of 4" H x 6" W x 6' L.

2.4 ACCESSORIES

A. Concrete Stops: Dowels 2-Steel, galvanized ½" diameter, 18" long pins per stop.

B. Recycled Plastic or Composite: Use manufacturers required fasteners, at minimum provide 2-galvanized steel dowels ½" diameter x 18" long per stop.

PART 3 EXECUTION

3.1 INSTALLATION

A. Set wheel stop with anchors at each parking space as shown on the plans.
   1. Grout bottom as required for firm bearing.
   2. Install units without damage to shape or finish, replace or repair damaged units.
   3. Install units in alignment with adjacent work.
   4. Fasten units in place with two anchors per unit bumper.
   5. Drive anchors to within 1" of top surface of wheel stop, then using a setting tool drive anchor below top of stop ½" to 1", grout or caulk opening.

END OF SECTION

SECTION 02900 - PLANTING

PART 1 - GENERAL

1.1 SCOPE

A. Supply and installation of all approved materials, labor, equipment, transportation and services required and incidental thereto, in conformity with the plans and specifications, including but not limited to; vegetation protection/pruning, fine grading, earth mounding, bed excavation and preparation, bed edging, planting soil/compost mixes, fertilizer, mulch, trees, palms, shrubs, ground covers, staking, paving, site furniture, clean-up, maintenance, and warranty.

B. Related Sections:
   1. Irrigation – 02810
   2. Lawns – 02930

1.2 REFERENCE STANDARDS

A. General: "Hortus Third," 1976.

B. Texas Association of Nurserymen, Grades and Standards for Nursery Stock.

C. Plant Material: "American Standard for Nursery Stock," ANSI Z60.1-1990.

D. National Arborist Association Standards

1.03 DEFINITIONS

A. Specimen Plants: Plants having exceptional character, superiority in form and branching, and the best attributes of the species; all as determined by the Architect, Landscape Designer or Owner.

1.04 QUALIFICATIONS

A. Landscape work to be performed by a single firm specializing in commercial landscape work with a minimum of five (5) years experience on similar type projects. Owner/SSP Design to review qualifications and approve subcontractor prior to commencing work.

1.4 SUBMITTALS

A. Submittals shall be formatted electronically in a pdf file with a table of contents and tabs identifying each section. The following submittals are required for this section:
   1. Landscape Construction Sequence
   2. Edging Materials
   3. Post emergent Herbicides
   4. Pre emergent Herbicides
   5. Soils, Compost and Mulch
   6. Sources of all Plant Materials (including address and telephone numbers)

7. Product Data Material Safety Data Sheets
8. Paving Materials
9. Staking Materials
10. Samples: One foot sections of edging (as specified on plans), one pound bag sample of each; topsoil, premium compost, mulch, decomposed granite, river rock, washed gravel and example boulder/rocks.
11. Photographs of all plant material prior to ordering/installation
12. Name and License Number of Subcontractor for pruning trees (Certified I.S.A. Arborist required)

1.5 PROTECTION

A. Before commencing work, contractor shall place orange construction fencing around all vegetation labeled “to remain” on landscape plans. Fencing shall be placed squarely around each tree 6’ x 6’ and at least 60” in height or continuously around groups of vegetation as shown on plans. No work may begin until this requirement is fulfilled. All other vegetation not labeled “to remain” shall be cleared and grubbed including root systems.

B. In order to avoid damage to roots, bark or lower branches, no truck or other equipment shall be driven or parked within the drip line of any tree, unless the tree overspreads a paved way.

C. The contractor shall use any and all precautionary measure when performing work around trees, walks, pavements, utilities, and any other features either existing or previously installed under this Contract.

D. The Contractor shall adjust depth of earthwork and loaming when working immediately adjacent to any of the aforementioned features in order to prevent disturbing tree roots, undermining walks and pavements, and damage in general to any existing or newly incorporated item.

E. Where excavating, fill or grading is required within the branch spread of trees that are to remain, the work shall be performed as follows:

   a. TRENCHING: When trenching occurs around trees to remain, the tree roots shall not be cut but the trench shall be tunneled under or around the roots by careful hand digging and without injury to the roots.

   b. RAISING GRADES: When the existing grade at tree is below the now finished grade, and fill not exceeding 16 inches (16") is required, clean, washed gravel graded from one to two inches (1" - 2") in size shall be placed directly around the tree trunk. The gravel shall extend out from trunk on all sides a minimum of 18 inches (18") and finish approximately two inches (2") above the finished grade at tree. Install gravel before any earth fill is placed. New earth fill shall not be left in contact with the trunks of any trees requiring fill. Where fill exceeding 16 inches (16") is required, a dry laid tree well shall be constructed around the trunk of the tree. The tree well shall extend out from the trunk on all sides a minimum of three feet (3') and to three inches (3") above finish grade. Coarse grade rock shall be placed directly around the tree well

extending out the drip line of the tree. Clean, washed gravel graded from one to two inches (1" - 2") in size shall be placed directly over the coarse rock to a depth of three inches (3"). Approved backfill material shall be placed directly over the washed gravel to desired finished grade.

c. LOWERING GRADES: Existing trees in areas where the now finished grade is to be lowered shall have regarding work done by hand to elevation as indicated. Roots as required shall be cut cleanly three inches (3") below finished grade and scars covered with tree paint.

d. Trees marked for preservation that are located more than six inches (6") above proposed grades shall stand on broad rounded mounds and be graded smoothly into the lower level. Trees located more than 16 inches (16") above proposed grades shall have a dry laid stonewall, or other retaining structure as detailed on the plans, constructed a minimum of five feet (5') from the trunk. Exposed or broken roots shall be cut clean and covered with topsoil.

F. Contractor is responsible for all protection measures listed above. If these procedures are not followed, contractor is responsible for replacement of existing trees with approved trees of equal caliper and height.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Transport plant materials covered or in closed vehicles to protect from exposure to heat and wind. Spray trees and in full leaf with anti-desiccant - as recommended by the manufacturer - before shipping. Take precautions to protect plant materials from desiccation and from damage to bark, branches and roots. Do not allow root balls to crack. Schedule shipments to coincide with planting work schedule.

B. Storage and Protection: If planting is delayed after delivery, keep plants in a shaded area, cover roots with mulch or topsoil, and keep plants constantly watered until planted.

1.7 MAINTENANCE/WARRANTY

A. Maintenance Requirements: Maintain the work of this Section throughout construction and for ninety days after 'substantial completion' and until final written acceptance by Owner. Notify the owner in writing of 'substantial completion'. Maintenance period begins after owner's written acceptance of 'substantial completion'.

B. Maintenance Service: Perform the following maintenance operations at least once a week:
   1. Remove and replace dead plant material. Prune plants to remove dead wood and to maintain health of plants.
   2. Maintain all mulched areas at a 2 in. depth. Remove weeds and grass from shrub and ground cover areas and from watering basins.
   3. Provide insect and disease control to maintain health of plants.
   4. Irrigation:
      a) If the irrigation system is operating, program and monitor the system to provide adequate water for plants.

b) If the irrigation system is not operating, hand water plants. Deep water trees each week.

5. Dispose of all maintenance debris/clippings off-site. Owner's dumpsters shall not be used.
6. Keep all site areas tidy and free of grass clippings, mulch or other foreign materials.
7. Submit dates, descriptions and receipts of all maintenance operations to SSP Design for approval.

C. Warranty: Warranty shall cover all shrubs/groundcovers for a period of three months and trees/palms for a period of one year from the date of final acceptance. Any plant material deemed dead or unrecoverable by the owner shall be replaced with similar species and size within two weeks of notification from owner.

1.8 RIGHT OF REJECTION

A. The Owner/SSP Design reserve the right to inspect and reject plants at any time and at any place.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fertilizer: 13-13-13 Osmocote slow release fertilizer granules or approved equal.

B. Planting tablets: Agraform 21 gram slow release fertilizer tablets or approved equal.

C. Compost: Premium grade compost ('9 Kids Compost' or approved equal).

D. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0; organic matter to exceed 1.5%, magnesium to exceed 100 units; phosphorus to exceed 150 units; potassium to exceed 120 units; soluble salts/conductivity not to exceed 900 ppm/0.9 mmhos/GC in soil.

A. Mulch:
   1. Shrub and Ground Cover Planting Areas: Grade Grade A Shredded Hardwood; long, fibrous bark strands free from wood chips. Texas Natives or Approved Equal.
   2. Watering basins: Grade A Shredded Hardwood; long, fibrous bark strands free from wood chips. Texas Natives or Approved Equal.

B. Plants:
   1. General: Provide plant materials that are healthy and free from disease, insects, and larvae and without damage to bark, branches, and roots.
   2. Approval: All plants must be approved by Owner/SSP Design prior to installation. Any plants not approved by Owner/SSP Design shall be subject to rejection. All trees/palms must be inspected, approved and tagged by Owner/SSP Design at their place of origin or as directed in writing by Owner/SSP Design. Container grown trees shall be obtained by Glen Flora Farms, Inc. or approved equal.
   3. Sizes: Measured after pruning and in accordance with the plant schedule.

4. Root Treatment: As follows in accordance with the Reference Standards:
    i. Palms: Balled and burlapped or containerized if they have been in the container for at least one growing season.
    ii. Trees, Shrubs, Ground Cover Plants: Container grown with a well-established fibrous root system.
5. Palms: All new palms shall be field dug or containerized material in specified sizes shown in plant schedule. All palms shall have good form (straight trunks) consistent of its species, free of scares/abrasions/burn marks and disease and insects, with large healthy root systems. Rootballs sizes for B/B material must meet the following minimum specifications:
    a) Sabal Palms - 44" diameter, 36" height
    b) Washingtonia Palms - 44" diameter, 36" height
    c) Cuban Royal Palms, Mediterranean Fan Palms, Cocos Palms - 30" diameter, 30" height

C. Staking material:
1. Stakes shall be commercial grade T-Posts, 1.25 Gauge, 8' Ht., Green with orange safety caps on tops. Note: Do not drive through stakes through root balls.
2. Tree ties shall be Poly Chain Lock – 1" width, black, ProLock or approved equal
1. Stakes shall be commercial grade steel T-Posts per details (do not drive through rootball).

D. Edging:
1. Concrete Edging: Extruded, colored, fibermesh reinforced concrete edging (per details)
Curb Appeal (or approved equal)
2. Tree Rings: 4" Ht., 30" Dia., Black Anodized Aluminum tree rings. *Dreamscapes (or approved equal)*

3. Aluminum edging: 4" Ht., Black Anodized Aluminum Edging. *Dreamscapes (or approved equal)*

2.2 PLANTING SOILS

A. Planting Mix: 75 percent sandy-loam topsoil; 25 percent premium compost; (3:1 ratio by volume); and specified fertilizer or planting tablets.

B. Shrub and Ground Cover Areas:
1. Where topsoil has been installed: Apply one inch layer in planting bed; till into the top six inches of soil.
2. Where no topsoil has been installed: Remove twelve inches of existing soil and replace with ten inches of 'Planting Mix' as described in Item A above.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine the site and conditions under which landscape work is to be performed. Have the installer notify the Contractor in writing, with a

copy to SSP Design if the site is unsatisfactory. Do not begin the work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Beginning of work indicates acceptance of the site as satisfactory by the installer.

3.2 EXECUTION

A. Site Preparation: Contractors must visit and review site prior to bidding. Compacted soils and sub-soils from construction activities must be ripped and tilled until a loose, friable and free-draining condition is met. All existing weeds, grass, stabilized sub-base material, rubble, excavated soil and other material shall be removed from the site and disposed of by the contractor prior to starting any new landscape work. Soil conditions around entire site must be approved by Owner/SSP Design prior to rough and finished grading operations. Contractor shall not install any fill or topsoil in landscape areas prior to site condition approval by Owner/SSP Design.

B. Drainage: Landscape contractor shall follow grading as shown and specified on Civil Engineer's grading plans. Landscape contractor shall coordinate grading operations with site contractor. Landscape contractor shall ensure final grades conform to the Civil Engineer's grading plan including grades around building, swales, sidewalk under-drains/swales, roof drains, splash blocks and rock swales through planting beds.

C. Vegetation Protection: Contractors are responsible for protection of existing vegetation labeled on plans "to remain". Protection of existing vegetation includes supply and installation of protective fencing around all existing planting areas.

D. Bed Preparation and herbicide: All planting areas shall be free of weeds, grass, insects, or any other deleterious material prior to bed preparation. Contractor shall herbicide all planting areas with 'RoundUp' or approved equal at least two times prior to installation of any new plants. Pre-emergent herbicide shall be applied after planting and before placement of mulch.

E. Planting Beds: Excavate 12" of existing soil within planting beds and replace with 8" of imported topsoil and 2" of premium compost. Mechanically till into top six inches of bed until a loose, friable soil condition is met. Final grades within all planting beds shall be 2-3" below adjacent curbs to allow for mulch. Contractor to ensure positive drainage throughout all landscape areas. Adjust grades as necessary to direct water away from planting beds. Report any discrepancies on all drainage issues in writing to Construction Manager or the Civil Engineer. Owner or SSP Design to approve planting beds prior to planting operations.

F. Edging: Edging shall be installed as shown on plans. Edging shall allow for tapered drainage points to ensure free drainage away from all structures and walkways. Edging shall be set flush with adjacent paving, sidewalks or driveways.

G. Grass Areas: Scarify, float and fine grade all areas to receive sod or hydromulch for approval by SSP prior to placement of sod or application of hydromulch. Supply additional topsoil as necessary to fill any/all low areas and ensure positive drainage away building / planting beds. (see specification on lawns for further requirements).

H. Berms and Mounding: Supply topsoil and construct berms as indicated on plans. Berms shall have a maximum slope of 1:4. Owner or Construction manager to approve berming and mounding prior to planting operations.

I. Planting:

1. Installation:
    a) Excavate planting pit to depth and width indicated on Drawings.
    b) Set root ball on undisturbed or compacted soil in planting pit. Remove burlap, rope, wire, and all other wrapping material from top of ball. Remove any binding rope which is not biodegradable completely.
    c) Fill planting pit 2/3 full with planting mix, soak with water and allow settling, and adding fertilizer tablets as detailed. Finish filling pit with planting mix and tamp lightly.
    d) Construct a watering basin as detailed and install 2 in. of mulch. Water-in to completely saturate the root ball and planting mix. Add planting mix where any settling or air pockets occur.
    e) Stake all trees/palms immediately after planting as detailed.

2. Palms: New Washingtonia palms shall be cleaned (skinned) completely of their leafstem bases and fibers to a height 4 feet below the crown. Sabal palms shall be planted with their leafstem bases remaining but cleaned and trimmed evenly. All palms shall be planted with several petioles or fronds tied up straight with natural twine. Remaining fronds shall be trimmed or 'hurricane cut' to lighten wind load on terminal bud. Contractor is responsible for removing or cutting the twine supporting the fronds at the appropriate time. All palms must be inspected and approved on site by SSP Design prior to installation.

3. Shrubs: All plants shall be of species denoted on plans and shall be container-grown material at specified sizes. All plants shall be of size equal or greater than T.A.N. standards for their respective container size. All material shall be vigorous, well established, of good form consistent of species, free of disease and insects, with large healthy root systems and with no evidence of being restricted or damaged. All plants shall be inspected and approved on site by SSP Design prior to installation.

4. Planting Holes: All tree/palm holes shall be excavated with a diameter at least two times the rootball size and to a depth equal to the height of the rootball. The bottoms and sides of each hole shall be scarified with a pick to allow for free drainage and maximum root penetration. After tree/palm placement, the hole shall be backfilled with a mixture of excavated soil and premium compost mixture (Earthwise Organics 'RGV' Mix or approved equal). All holes shall be tested/inspected by SSP Design for free drainage prior to installation of trees.

5. Watering Basins: Watering basins for all trees/palms shall be constructed in a ring shape around each tree or palm trunk. This earthen berm shall be constructed 6" in height and 36" in diameter so as to hold water and allow infiltration around root ball. A minimum of 2 inches of cypress mulch shall be placed within the watering basin. Watering basins must be maintained and kept free of weeds during the entire maintenance period.

J. Insect and Disease Control: Apply treatment as frequently as required during construction and 90-day maintenance period to prevent damage to plant material. Use only chemicals specifically approved by TNRCC.

K. Pruning: All existing and new vegetation shall be pruned/trimmed by a Certified I.S.A. Arborist as directed on site by SSP Design.

3.3 CLEANUP AND PROTECTION

A. Remove debris from landscaped areas daily and sweep clean adjacent pavements, if soiled by landscape activities.
B. Provide temporary barriers or fences as required to protect landscaping from damage or theft until final acceptance.

3.4 CLOSE-OUT DOCUMENTS

A. As-Built Drawings: Submit 'As-Built' drawings before project close-out showing the landscape layout, including revised plant material, and other installation information.

B. Warranty Letters: Submit warranty letters for trees / palms / lawns / shrubs / pavers / / furniture / masonry / stone / amenities.

END OF SECTION

SECTION 02930 - LAWNS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The establishment of a complete and uniform lawn by sodding and/or hydromulching.

B. Related Sections:
   1. Section 02810-Irrigation
   2. Section 02900-Planting

1.2 QUALIFICATIONS

A. Lawn work to be performed by a single firm specializing in commercial landscape work with a minimum of five (5) years experience on similar type projects. Owner/SSP Design to review qualifications and approve subcontractor prior to commencing work.

1.3 SUBMITTALS

A. Submittals shall be formatted electronically in a pdf file with a table of contents and tabs identifying each section. The following submittals are required for this section:

   1. Product Data: Manufacturer's specifications and application instructions for fertilizer.

   2. Certificates: Inspection certificate from Texas Department of Agriculture indicating sod has been found free of diseases, insects and larvae.

   3. Certificates: Breakdown of seed types, percentages, and mixture composition.

   4. Sod Delivery Tickets: One per truckload indicating sod species, nursery certification, date and time of cutting.

1.4 DELIVERY, STORAGE AND HANDLING

A. Sod Delivery: Have sod delivered within forty-eight hours of cutting. Stack sod with roots to roots, protected from exposure to elements during shipment.

B. Storage: Lay sod as soon a practicable after delivery. If installation is delayed more than four hours, store sod under shade and keep constantly moist. Sod must be laid within forty-eight hours of cutting. Do not pile more than two foot depth of sod. Do not tear, stretch or drop sod. Do not allow soil to break free of turf roots.

1.5 PROJECT CONDITIONS

A. Utility Construction: Do not lay sod or begin hydro-mulching until all underlying utility work is complete, trenches backfilled, compacted and graded, and topsoil placed and fine graded.

1.6 MAINTENANCE/WARRANTY

A. Maintenance Service: Maintain the work of this Section throughout construction and until the Date of Substantial Completion and ninety (90) days thereafter or until a complete and uniform lawn has been established.

1. Establish hydro-mulched or sodded lawns per planting plans. Reapply hydro-mulch or re-sod as necessary until full and uniform coverage is obtained.
2. Mow lawns to maintain height of grass at 2 inches or as directed by SSP Design.
3. Trim/edge all lawn areas adjacent to watering basins, pavements, driveways, walls, structures, curbs, planting beds, edges and islands.
4. Provide insect and disease control to maintain health of grass.
5. Fertilize with commercial grade lawn fertilizer until complete and uniform coverage is obtained.
6. Irrigation:
   a) If the irrigation system is operating, program and monitor the system to provide adequate water for grass.
   b) If the irrigation system is not operating, hand water grass.

B. Warranty: Warranty shall cover all lawn grasses for a period of three months from the date of final acceptance. Final acceptance will not be approved until full and uniform lawns are completely established.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: See Section 02900, Planting.

B. Sod: (See schedule for type). Provide premium #1 certified sod grown in a sod nursery on sandy soil, at least 1 yr. old with a heavy top and a strong, well-knit root system, and not more than five percent weeds or foreign grasses.

C. Hydro-mulch mixture: (See schedule for type). Lawn seed mixture shall be shall be fresh, clean new, crop seed. Hydromulch mixture shall be composed of both hulled and unhulled seed with an appropriate percentage of Rye according to season of planting. The Contractor shall furnish to the Landscape Designer or Owner the dealer's guaranteed statement of the composition of the mixture and the percentage of purity and germination of each variety.

D. Fertilizer: 12-4-8 (N-P-K), formulated for slow-release Nitrogen.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine the site and conditions under which this work is to be performed. Have the installer notify the Contractor in writing, with a copy to SSP Design, if the site is unsatisfactory. Do not begin the work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Beginning of work indicates acceptance of the site as satisfactory by the installer.

3.2 PREPARATION

A. Topsoil: Refer to Section 02900 'Landscaping' for topsoil amendment.

B. Site Preparation: Contractors must visit and review site prior to bidding. Compacted soils and sub-soils from construction activities must be ripped and tilled until a loose, friable and free-draining condition is met. All existing weeds, grass, stabilized sub-base material, rubble, excavated soil and other material shall be removed from the site and disposed of by the contractor prior to starting any new landscape work. Soil conditions around entire site must be approved by SSP Design prior to rough and finished grading operations. Contractor shall not install any fill or topsoil in landscape areas prior to site condition approval by SSP Design.

3.3 INSTALLATION – HYDROMULCH/SEED

A. All exterior ground within the limit of contract or any damaged adjacent areas, except surfaces occupied by structures and paving, except areas indicated to be undisturbed, shall be seeded, hydromulched or planted as shown on drawings. Furnish topsoil, finish grading, prepare seed bed, seed, hydromulch and maintain areas as indicated on the drawings.

B. Lawn Area Preparations - Grade areas to finish grades, filling as needed or removing surplus material. Float all lawn areas to a smooth, uniform grade as indicated on engineers grading plans. All lawn areas shall slope to drain away from structures and planting beds. Where no grades are shown, areas shall have a smooth and continual grade between existing or fixed controls (such as walks, curbs, catch basin, elevational steps or structures) and elevations shown on plans. Contractor to ensure proper drainage around all structures. Adjust grades as necessary to direct water away from structures and planting beds. Report any discrepancies on all drainage issues in writing to SSP Design or the project engineer.

C. Roll, scarify, rake and level as necessary to obtain true, even lawn surfaces. All finish grades shall meet approval of the SSP, before seeding/hydromulching operations. Loosen soil to a depth of six inches (3") in lawn areas by approved method of scarification and grade to remove edges and depressions. Remove stones or foreign matter over one half inch (1/2") in diameter from the top two inches (2") of soil. Float lawn areas to finish grades as shown on civil plans. Install topsoil over prepared subbase if included in materials schedules or as required to allow for a proper seed bed for germination and strong healthy growth.

D. Lawn areas should be permitted to settle or should be firmed by rolling before seeding/hydromulching.

E. Seeding/hydromulching shall not be performed in windy weather.

F. Lawn areas shall be seeded by hydro-mulching evenly with an approved mechanical hydro-mulcher at the rate of a minimum of three (3) pounds per 1,000 square feet. In areas inaccessible to hydro-mulching equipment, the seeded ground shall be lightly raked with flexible rakes and rolled with a water ballast roller. After rolling, seeded areas are to be lightly mulched with wheat straw or approved material.

G. Lawns shall be maintained by the Contractor for at least 90 days after substantial completion or as long as necessary to establish a uniform stand of the specified grasses, or until final acceptance of lawns, whichever is later.

H. Water seeded/hydromulched areas twice the first week to a minimum depth of six inches (6") with a fine spray and once per week thereafter as necessary to supplement natural rain to the equivalent of one inch (1") or to a six-inch (6") depth.

I. The surface layer of soil for seeded/hydromulched areas must be kept moist during the germination period. After first cutting, water as specified above.

J. Make weekly inspections to determine the moisture content of the soil and adjust the watering schedule established by the irrigation system installer to fit conditions

K. After grass growth has started, all areas or parts of areas, which fail to show a uniform stand of grass for any reason whatsoever shall be reseeded/hydromulched in accordance with the plans and as specified herein. Such areas and parts of areas shall reseeded, hydromulched or sodded repeatedly until all area are covered with a satisfactory growth of grass at no additional cost to the Owner.

L. Watering shall be done in such a manner and as frequently as is deemed necessary by SSP to assure continued growth of healthy grass. All areas of the site shall be watered in such a way as to prevent erosion due to excessive quantities applied over small areas and to avoid damage to the finished surface due to the watering equipment.

M. Water for the execution and maintenance of this work shall be provided by the Owner at no expense to the Contractor. The Contractor shall, however, furnish his own portable tanks, pumps, hose, pipe, connections, nozzles, and any other equipment required to transport the water from the available outlets and apply it to the seeded area in an approved manner.

N. Mowing of the seeded, hydromulched or sodded areas shall be initiated when the grass has attained a height of one and one-half to two inches (1-1/2" to 2"). Grass height shall be maintained between one and one and one-half inches (1' to

1½") at subsequent cutting depending on the time of year. Not more than one third (1/3) of the grass leaf shall be removed at any cutting and cutting shall not occur more than seven (7) days apart.

O. When the amount of grass is heavy, it shall be removed to prevent destruction of the underlying turf. If weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be mowed or, in the case of rank growths, shall be uprooted, raked and removed from the area by methods approved by the SSP.

P. Protect seeded/hydromulched areas against trespassing while the grass is germinating. Furnish and install fences, signs, barriers or any other necessary temporary protective devices. Damage resulting from trespass, erosion, washout, settlement or other causes shall be repaired by the Contractor at his expense.

Q. Remove all fences, signs, barriers or other temporary protective devices after final acceptable.

3.4 INSTALLATION – SOD

A. Sod shall be installed to all areas as indicated on plans.

B. Sod Bed Preparation - Grade areas to finish grade, filling as needed or removing surplus dirt, stone, debris, etc. and floating areas to a smooth, uniform grade as indicated on grading plans. All lawn areas are to slope to drain.

C. Sod shall be laid within 48hrs of being cut. Only healthy vigorous growing sod is to be laid.

D. Always lay sod across slope and tightly together so as to make a solid area.

E. Roll or firmly but lightly tamp with suitable wooded or metal tamper all new sod sufficiently to set or press sod into underlying soil.

F. After sodding has been completed, clean up and thoroughly moisten by sprinkler newly sodded areas.

3.5 FERTILIZING – GRASS

Fertilizer shall be included in the hydromulch mixture. After full germination and or sodding, all lawn areas shall have fertilizer applied in two (2) applications with a thorough watering immediately following application. The first application shall be one (1) week after sodding or full germination at the rate of 5 pounds per 1,000 square feet. The second application shall be done after 60 days at the rate of 3 pounds per 1,000 square feet. Soil analysis and time of year shall be considered with SSP to determine fertilizer type, composition and final application rates . Submit fertilizer type and analysis to SSP for approval before any application. Document fertilizer application with photos and receipts of

fertilizer purchases.

3.6 CLEANUP AND PROTECTION

A. Remove debris from landscaped areas daily and sweep clean adjacent pavements, if soiled by landscape activities.

B. Protect lawns from damage, theft or vandalism until final acceptance. Install stakes and flagging or temporary fencing if required to keep traffic off newly established lawn areas

END OF SECTION

INDEX

SECTION 03300 - CONCRETE WORK

GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

SUMMARY

Extent of concrete work is shown on drawings.

SUBMITTALS

Product Data: Submit data for non-proprietary materials and items, including admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Architect.

Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACT 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

QUALITY ASSURANCE

Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

ACT 301 "Specifications for Structural Concrete for Buildings".

ACT 318 "Building Code Requirements for Reinforced Concrete".

Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

Materials and installed work may require testing and retesting at anytime during progress of work. Retesting of rejected materials for installed work, shall be done at Contractor's expense.

PROJECT CONDITIONS

Protect adjacent finish materials against spatter during concrete placement.

PRODUCTS

FORM MATERIALS

Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.

REINFORCING MATERIALS

Reinforcing Bars: ASTM A 615, Grade 60 deformed.

Steel Wire: ASTM A 82, plain, cold-drawn steel.

Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.

For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Brick scrap is acceptable.

CONCRETE MATERIALS

Portland Cement: ASTM C 150, Type I, "Alamo Cement" or equal. Use one brand of cement throughout project, unless otherwise acceptable to Architect.

Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.

Water: Drinkable.

Water-reducing Admixture: ASTM C 194, Type A, and containing not more than 0.1 percent chloride ions.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"WRDA Hycol"; W.R. Grace.

"PSI N"; Gifford-Hill/American Admixtures
"Eucon WR-75"; Euclid Chemical Co.
"Pozzolith Normal"; Master Builders.
"Plastocrete 160"; Sika Chemical Corp.
"Chemtard"; Chem-Masters Corp.
"Pro-Kete-N"; Protex Industries, Inc.

Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C 494, Type E, and containing not more than 0.1 percent chloride ions.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Accelguard 80"; Euclid Chemical Co.
"Pozzolith High Early"; Master Builders.
"Gilco Accelerator"; Gifford-Hill/America Admixtures

Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 0.1 percent chloride ions.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Edoco 20006"; Edoco Technical Products.
"Pozzolith Retarder"; Master Builders.
"Eucon Retarder 75"; Euclid Chemical Co.
"Daratard"; W.R. Grace.
"PSI R"; Gifford-Hill/American Admixtures.
"Plastiment"; Sika Chemical Co.
"Protard"; Protex Industries, Inc.

Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 percent chlorine ions are not permitted.

RELATED MATERIALS

Vapor Retarder: Provide vapor retarder cover over prepared base material where indicated below slabs on grade. Use only materials which are resistant to decay when tested in accordance with ASTM E 154, as follows:

Polyethylene sheet not less than 10 mils thick.

Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C 309. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq ft./gal.

Products: Provide the following:

"Sonosil': Sonneborn.

Bonding Compound: Polyvinyl acetate or acrylic base.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

Polyvinyl Acetate (Interior Only):

"Euco Weld"; Euclid Chemical Co.
"Weldcrete"; Larsen Products Corp.

Acrylic or Styrene Butadiene:

"J-40 Bonding Agent"; Dayton Superior Corp.
"Everbond"; L & M Construction Chemicals.
"Hornweld': A.C. Horn, Inc.
"Sonocrete"; Sonneborn-Rexnord.
"Acrylic Bondcrete"; The Burke Co.
"SBR Latex"; Euclid Chemical Co.
"Daraweld C"; W.R. Grace

PROPORTIONING AND DESIGN OF MIXES:

Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACT 301. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

Submit written reports to Architect and Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:

3000 psi 28-day compressive strength; W/C ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained). For structural slabs.

Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

Admixtures:

Use water-reducing admixture in concrete as required for placement and workability.

Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

Ramps, slabs, and sloping surfaces: Not more than 5".

Reinforced foundation systems: Not less than 3" and not more than 5".

Other concrete: Not less than 3" nor more than 5".

CONCRETE MIXING

Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

EXECUTION

GENERAL:

Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

FORMS:

Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACT 347.

Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorage insets, and other features required in work. Use selected materials to obtain required finishes. Solidly but joints and provide back-up at joints to prevent leakage of cement paste.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Provisions for Other Trades: Provide openings is concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

VAPOR RETARDER INSTALLATION

Following leveling, tamping, and termite treatment of granular base for slabs on grade, place vapor retarder sheeting with longest dimension parallel with direction of pour.

Lap joints 6" and seal with appropriate tape.

PLACING REINFORCEMENT

Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

> Avoid cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

JOINTS:

Construction Joints: Locate and install construction joints as indicated or, if not indicated, located so as not to impair strength and appearance of the structure, as acceptable to Architect.

Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.

INSTALLATION OF EMBEDDED ITEMS

General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

PREPARATION OF FORM SURFACES

Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

Coat steel forms with, if used, a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

CONCRETE PLACEMENT

Replacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or casting. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

General: Comply with ACT 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACT 309.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly space locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

Bring slab surfaces to correct level within straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

Maintain reinforcing in proper position during concrete placement operations.

Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACT 306 and as herein specified.

When air temperature has fallen to or is expected to fall below 40 deg F (4deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (27 deg C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix design.

Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACT 305 and as herein specified.

Cool ingredients before mixing to maintain concrete temperature at time of placement below 95° deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.

Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

FINISH OF FORMED SURFACES

Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

MONOLITHIC SLAB FINISHES:

Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

After placing slabs, plane surface to tolerances for floor flatness (F) of 25 and floor levelness (F1) of 20. Slope surfaces uniformly to drains where requires. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of F 18 - F 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin firm finish coating system.

After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface procedures a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F 20 - F 25. Grind smooth surface defects which would telegraph through applied floor covering system.

Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristly broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

CONCRETE CURING AND PROTECTION

General: Protect freshly placed concrete from premature drying and excessive cold or hot temperature.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.

Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs, as follows:

Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in

accordance with manufacturer's directions. Recoat areas subjected to heave rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.

Sealer and Dustproofer: Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

REMOVAL OF FORMS

Formwork not supporting weight of concrete, such as sides of beams and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

RE-USE OF FORMS

Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

MISCELLANEOUS CONCRETE ITEMS

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

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

CONCRETE SURFACE REPAIRS:

Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

For exposed-to-view surfaces blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

Repair of Formed Surfaces: Removed and replaced concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

Correct high area in unformed surfaces by grinding, after concrete has cured at least 4 days.

Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 2-1/2" parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

Perform structural repairs with prior approval of Architect or Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.

Repair methods not specified above may be used, subject to acceptance of Architect.

QUALITY CONTROL TESTING DURING CONSTRUCTION

The Contractor will employ a testing laboratory to perform test and to submit test reports.

Sampling and testing for quality control during placement of concrete shall include the following, as directed by Architect.

Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, and when 80 deg F (27 deg C) and above; and each time a set of compression test specimens are required.

Compression Test Specimen: ASTM C 31, one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu yds. plus additional sets for each 50 cu yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required. When frequency of testing will provide less than 5 strength test for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

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

Test results will be reported in writing to Architect, Structural Engineer, and Contractor within 24 hours after tests. Reports of compressive strength test shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

See Structural Plans for additional requirements.

END OF SECTION 03300

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:

1. Foundations and footings.
2. Slabs-on-grade.
3. Equipment pads and bases.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 2 Section "Portland Cement Concrete Paving" for concrete paving and walks.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Engineer.

C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI SP-66 (88), ▫ACI Detailing manual," showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

D. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.

1. Architect's review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.

E. Samples of materials as requested by Engineer, including names, sources, and descriptions, as follows:

1. Color finishes.
2. Normal weight aggregates.
3. Reglets.
4. Waterstops.
5. Vapor retarder/barrier.

F. Laboratory test reports for concrete materials and mix design test.

G. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

H. Minutes of preinstallation conference.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Concrete Testing Service: Owner to engage an independent testing laboratoryacceptable to Engineer to perform material evaluation tests and to design concrete mixes.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

D. Mockup: Cast mockup of size indicated or as required to demonstrate typical joints, form tie spacing, and proposed surface finish, texture, and color. Maintain sample panel exposed to view for duration of Project, after Architect's acceptance of visual qualities.

1. Demolish mockup and remove from site when directed by Architect.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings" and the following:

1. At least 35 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress

schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:

a. Contractor's superintendent.
b. Agency responsible for concrete design mixes.
c. Agency responsible for field quality control.
d. Ready-mix concrete producer.
e. Concrete subcontractor.
f. Primary admixture manufacturers.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.
2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 mg/l volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

1. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 40 for No. 3 bars, Grade 60 for No. 4 bars and larger, deformed.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.

C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

D. Deformed-Steel Welded Wire Fabric: ASTM A 497.

E. Supports for Reinforcement: Bolsters, chairs, ACI approved precast concrete block supports,spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.

1. Use one brand of cement throughout Project unless otherwise acceptable to Engineer of Record.

B. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Engineer.

C. Lightweight Aggregates: ASTM C 330.
1. Nominal maximum aggregate size: ▫ inch.

D. Water: Potable.

E. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Air-Tite, Cormix Construction Chemicals.
b. Air-Mix or Perma-Air, Euclid Chemical Co.

c. Darex AEA or Daravair, W.R. Grace & Co.
d. MB-VR or Micro-Air, Master Builders, Inc.
e. Sealtight AEA, W.R. Meadows, Inc.
f. Sika AER, Sika Corp.

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

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Chemtard, ChemMasters Corp.
b. PSI N, Cormix Construction Chemicals.
c. Eucon WR-75, Euclid Chemical Co.
d. WRDA, W.R. Grace & Co.
e. Pozzolith Normal or Polyheed, Master Builders, Inc.
f. Metco W.R., Metalcrete Industries.
g. Prokrete-N, Prokrete Industries.
h. Plastocrete 161, Sika Corp.

H. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Super P, Anti-Hydro Co., Inc.
b. Cormix 200, Cormix Construction Chemicals.
c. Eucon 37, Euclid Chemical Co.
d. WRDA 19 or Daracem, W.R. Grace & Co.
e. Rheobuild or Polyheed, Master Builders, Inc.
f. Superslump, Metalcrete Industries.
g. PSPL, Prokrete Industries.
h. Sikament 300, Sika Corp.

I. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Q-Set, Conspec Marketing & Manufacturing Co.
b. Lubricon NCA, Cormix Construction Chemicals.
c. Accelguard 80, Euclid Chemical Co.
d. Daraset, W.R. Grace & Co.
e. Pozzutec 20, Master Builders, Inc.
f. Accel-Set, Metalcrete Industries.

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

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. PSI-R Plus, Cormix Construction Chemicals.
    b. Eucon Retarder 75, Euclid Chemical Co.
    c. Daratard-17, W.R. Grace & Co.
    d. Pozzolith R, Master Builders, Inc.
    e. Protard, Prokrete Industries.
    f. Plastiment, Sika Corporation.

2.4 RELATED MATERIALS

A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217-inch-thick (26-gage) galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336 inch thick (22 gage) with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.

C. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.

D. Rubber Waterstops: Corps of Engineers CRD-C 513.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

    a. The Burke Co.
    b. Progress Unlimited.
    c. Williams Products, Inc.

E. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

    a. The Burke Co.
    b. Greenstreak Plastic Products Co.
    c. W.R. Meadows, Inc.
    d. Progress Unlimited.

e. Schlegel Corp.
f. Vinylex Corp.

F. Sand Cushion: Clean, manufactured or natural sand.

G. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:

1. Polyethylene sheet not less than 6 mils thick.

H. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as the abrasive aggregate for a nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, nonglazing, and unaffected by freezing, moisture, and cleaning materials.

I. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

J. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

K. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 mg per liter.
2. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
3. Products: Subject to compliance with requirements, provide one of the following:

a. A-H 3 Way Sealer, Anti-Hydro Co., Inc.
b. Spartan-Cote, The Burke Co.
c. Conspec #1, Conspec Marketing & Mfg. Co.
d. Sealco 309, Cormix Construction Chemicals.
e. Day-Chem Cure and Seal, Dayton Superior Corp.
f. Eucocure, Euclid Chemical Co.
g. Horn Clear Seal, A.C. Horn, Inc.
h. L&M Cure R, L&M Construction Chemicals, Inc.
i. Masterkure, Master Builders, Inc.
j. CS-309, W.R. Meadows, Inc.
k. Seal N Kure, Metalcrete Industries.
l. Kure-N-Seal, Sonneborn-Chemrex.
m. Stontop CS2, Stonhard, Inc.

L. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Highseal, Conspec Marketing and Mfg. Co.
    b. Sealco - VOC, Cormix Construction Chemicals.
    c. Safe Cure and Seal, Dayton Superior Corp.
    d. Aqua-Cure, Euclid Chemical Co.
    e. Dress & Seal WB, L&M Construction Chemicals, Inc.
    f. Masterkure 100W, Master Builders, Inc.
    g. Vocomp-20, W.R. Meadows, Inc.
    h. Metcure, Metalcrete Industries.
    i. Stontop CS1, Stonhard, Inc.

M. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

3 Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
4 Products: Subject to compliance with requirements, provide one of the following:

    a. Aquafilm, Conspec Marketing and Mfg. Co.
    b. Eucobar, Euclid Chemical Co.
    c. E-Con, L&M Construction Chemicals, Inc.
    d. Confilm, Master Builders, Inc.
    e. Waterhold, Metalcrete Industries.

N. Bonding Agent: Polyvinyl acetate or acrylic base.

5 Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
6 Products: Subject to compliance with requirements, provide one of the following:

    a. Polyvinyl Acetate (Interior Only):

        1 Superior Concrete Bonder, Dayton Superior Corp.
        2 Euco Weld, Euclid Chemical Co.
        3 Weld-Crete, Larsen Products Corp.
        4 Everweld, L&M Construction Chemicals, Inc.
        5 Herculox, Metalcrete Industries.
        6 Ready Bond, Symons Corp.

    b. Acrylic or Styrene Butadiene:

        7 Acrylic Bondcrete, The Burke Co.
        8 Strongbond, Conspec Marketing and Mfg. Co.

9 Day-Chem Ad Bond, Dayton Superior Corp.
10 SBR Latex, Euclid Chemical Co.
11 Daraweld C, W.R. Grace & Co.
12 Hornweld, A.C. Horn, Inc.
13 Everbond, L&M Construction Chemicals, Inc.
14 Acryl-Set, Master Builders Inc.
15 Intralok, W.R. Meadows, Inc.
16 Acrylpave, Metalcrete Industries.
17 Sonocrete, Sonneborn-Chemrex.
18 Stonlock LB2, Stonhard, Inc.
19 Strong Bond, Symons Corp.

O. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

7 Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
8 Products: Subject to compliance with requirements, provide one of the following:

a. Burke Epoxy M.V., The Burke Co.
b. Spec-Bond 100, Conspec Marketing and Mfg. Co.
c. Resi-Bond (J-58), Dayton Superior.
d. Euco Epoxy System #452 or #620, Euclid Chemical Co.
e. Epoxtite Binder 2390, A.C. Horn, Inc.
f. Epabond, L&M Construction Chemicals, Inc.
g. Concresive Standard Liquid, Master Builders, Inc.
h. Rezi-Weld 1000, W.R. Meadows, Inc.
i. Metco Hi-Mod Epoxy, Metalcrete Industries.
j. Sikadur 32 Hi-Mod, Sika Corp.
k. Stonset LV5, Stonhard, Inc.
l. R-600 Series, Symons Corp.

2.5 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.

9 **Do not use the same testing agency for field quality control testing.**
10 Use of fly ash or calcium chloride will not be permitted in concrete, unless noted otherwise.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Engineer.

C. Design mixes to provide normal weight concrete with the following properties as indicated on

drawings and schedules:

11 3000-psi, 28-day compressive strength; water-cement ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained). For slabs on grade, grade beam, loading docks & ramps.
12 2500-psi, 28-day compressive strength; water-cement ratio, 0.67 maximum (non-air-entrained), 0.54 maximum (air-entrained). For miscellaneous sidewalks and curbs not otherwise called out to have a higher strength.

D. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

13 Subjected to freezing and thawing: W/C 0.45.

E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

14 Ramps, slabs, and sloping surfaces: Not more than 3 inches.
15 Reinforced foundation systems: Not less than 1 inch and not more than 5 inches.
16 Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.
17 Other concrete: Not more than 4 inches.

F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

2.6 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

D. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING

A. Job-Site Mixing: Mix concrete materials in appropriate drum-type batch machine mixer. For

mixers of 1 cu. yd. or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than 1 cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd.

18 Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

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

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

20 Provide Class A tolerances for concrete surfaces exposed to view.
21 Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER/BARRIER INSTALLATION

A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.

B. Lap joints 6 inches and seal with manufacturer's recommended mastic or pressure-sensitive tape.

3.4 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

22 Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Engineer.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one

full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.

B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

23 Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch wide by one-fourth of slab depth or inserts 1/4 inch wide by one-fourth of slab depth, unless otherwise indicated.

24 Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

25 Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

26 If joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

27 Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

3.6 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. Install dovetail anchor slots in concrete structures as indicated on drawings.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.7 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

28 Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

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

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

29 Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

30 Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into

preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

31 Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
32 Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
33 Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

34 Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
35 Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

36 Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
37 Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
38 Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
39 Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas

repaired and patched, and fins and other projections exceeding 3/4 inch in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.

40 Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.

41 Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.

42 Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

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

3.10 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

43 After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing,

membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

44 After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

45 After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155. Grind smooth any surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

46 Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and where indicated.

47 After completing float finishing and before starting trowel finish, uniformly spread 25 lb of dampened nonslip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as specified.

48 After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous

concrete filling shown or required to complete Work.

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

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

3.12 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:

49 Keep concrete surface continuously wet by covering with water.
50 Use continuous water-fog spray.
51 Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing as follows:

52 Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:

53 Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

54 Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

55 Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.13 REMOVING FORMS

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

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.14 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.15 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

56 Cut out honeycombs, rock pockets, voids over 3/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

57 For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

58 Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

59 Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

60. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

61. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.

62. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior approval of Engineer for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Engineer.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Owner will employ a testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

    a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
    b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
    c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
    d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
    e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
    f. For drilled piers, u.n.o., there shall be (1) set of compressive strength test for each 10 cu. Yds.
2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
3. When total quantity of a given class of concrete is less than 50 cu. yd., Engineer may waive strength testing if adequate evidence of satisfactory strength is provided.
4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective

procedures for protecting and curing the in-place concrete.

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

C. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION 03300

SECTION 03310 - CONCRETE WORK

GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

SUMMARY

Extent of concrete work is shown on drawings.

SUBMITTALS

Product Data: Submit data for non-proprietary materials and items, including admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Architect.

Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACT 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

QUALITY ASSURANCE

Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

ACT 301 "Specifications for Structural Concrete for Buildings".

ACT 318 "Building Code Requirements for Reinforced Concrete".

Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

Materials and installed work may require testing and retesting at anytime during progress of work. Retesting of rejected materials for installed work, shall be done at Contractor's expense.

PROJECT CONDITIONS

Protect adjacent finish materials against spatter during concrete placement.

PRODUCTS

FORM MATERIALS

Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.

REINFORCING MATERIALS

Reinforcing Bars: ASTM A 615, Grade 60 deformed.

Steel Wire: ASTM A 82, plain, cold-drawn steel.

Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.

For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Brick scrap is acceptable.

CONCRETE MATERIALS

Portland Cement: ASTM C 150, Type I, "Alamo Cement" or equal. Use one brand of cement throughout project, unless otherwise acceptable to Architect.

Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.

Water: Drinkable.

Water-reducing Admixture: ASTM C 194, Type A, and containing not more than 0.1 percent chloride ions.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"WRDA Hycol"; W.R. Grace.
"PSI N"; Gifford-Hill/American Admixtures
"Eucon WR-75"; Euclid Chemical Co.
"Pozzolith Normal"; Master Builders.
"Plastocrete 160"; Sika Chemical Corp.
"Chemtard"; Chem-Masters Corp.
"Pro-Kete-N"; Protex Industries, Inc.

Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C 494, Type E, and containing not more than 0.1 percent chloride ions.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Accelguard 80"; Euclid Chemical Co.
"Pozzolith High Early"; Master Builders.
"Gilco Accelerator"; Gifford-Hill/America Admixtures

Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 0.1 percent chloride ions.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Edoco 20006"; Edoco Technical Products.
"Pozzolith Retarder"; Master Builders.
"Eucon Retarder 75"; Euclid Chemical Co.
"Daratard"; W.R. Grace.
"PSI R"; Gifford-Hill/American Admixtures.
"Plastiment"; Sika Chemical Co.
"Protard"; Protex Industries, Inc.

Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 percent chlorine ions are not permitted.

RELATED MATERIALS

Vapor Retarder: Provide vapor retarder cover over prepared base material where indicated below slabs on grade. Use only materials which are resistant to decay when tested in accordance with ASTM E 154, as follows:

Polyethylene sheet not less than 10 mils thick.

Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C 309. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq ft./gal.

Products: Provide the following:

"Sonosil': Sonneborn.

Bonding Compound: Polyvinyl acetate or acrylic base.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

Polyvinyl Acetate (Interior Only):

"Euco Weld"; Euclid Chemical Co.
"Weldcrete"; Larsen Products Corp.

Acrylic or Styrene Butadiene:

"J-40 Bonding Agent"; Dayton Superior Corp.
"Everbond"; L & M Construction Chemicals.
"Hornweld': A.C. Horn, Inc.
"Sonocrete"; Sonneborn-Rexnord.
"Acrylic Bondcrete"; The Burke Co.
"SBR Latex"; Euclid Chemical Co.
"Daraweld C"; W.R. Grace

PROPORTIONING AND DESIGN OF MIXES:

Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACT 301. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

Submit written reports to Architect and Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:

3000 psi 28-day compressive strength; W/C ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained). For structural slabs.

Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

Admixtures:

Use water-reducing admixture in concrete as required for placement and workability.

Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

Ramps, slabs, and sloping surfaces: Not more than 5".

Reinforced foundation systems: Not less than 3" and not more than 5".

Other concrete: Not less than 3" nor more than 5".

CONCRETE MIXING

Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

EXECUTION

GENERAL:

Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

FORMS:

Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACT 347.

Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorage insets, and other features required in work. Use selected materials to obtain required finishes. Solidly but joints and provide back-up at joints to prevent leakage of cement paste.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Provisions for Other Trades: Provide openings is concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

VAPOR RETARDER INSTALLATION

Following leveling, tamping, and termite treatment of granular base for slabs on grade, place vapor retarder sheeting with longest dimension parallel with direction of pour.

Lap joints 6" and seal with appropriate tape.

PLACING REINFORCEMENT

Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

> Avoid cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

JOINTS:

Construction Joints: Locate and install construction joints as indicated or, if not indicated, located so as not to impair strength and appearance of the structure, as acceptable to Architect.

Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.

INSTALLATION OF EMBEDDED ITEMS

General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

PREPARATION OF FORM SURFACES

Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

Coat steel forms with, if used, a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

CONCRETE PLACEMENT

Replacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or casting. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

General: Comply with ACT 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACT 309.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly space locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

Bring slab surfaces to correct level within straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

Maintain reinforcing in proper position during concrete placement operations.

Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACT 306 and as herein specified.

When air temperature has fallen to or is expected to fall below 40 deg F (4deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (27 deg C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix design.

Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACT 305 and as herein specified.

Cool ingredients before mixing to maintain concrete temperature at time of placement below 95° deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.

Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

FINISH OF FORMED SURFACES

Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

MONOLITHIC SLAB FINISHES:

Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

After placing slabs, plane surface to tolerances for floor flatness (F) of 25 and floor levelness (F1) of 20. Slope surfaces uniformly to drains where requires. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of F 18 - F 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin firm finish coating system.

After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface procedures a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F 20 - F 25. Grind smooth surface defects which would telegraph through applied floor covering system.

Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristly broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

CONCRETE CURING AND PROTECTION

General: Protect freshly placed concrete from premature drying and excessive cold or hot temperature.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.

Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs, as follows:

Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heave rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.

Sealer and Dustproofer: Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

REMOVAL OF FORMS

Formwork not supporting weight of concrete, such as sides of beams and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

RE-USE OF FORMS

Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

MISCELLANEOUS CONCRETE ITEMS

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

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

CONCRETE SURFACE REPAIRS:

Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

For exposed-to-view surfaces blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

Repair of Formed Surfaces: Removed and replaced concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

Correct high area in unformed surfaces by grinding, after concrete has cured at least 4 days.

Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 2-1/2" parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

Perform structural repairs with prior approval of Architect or Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.

Repair methods not specified above may be used, subject to acceptance of Architect.

QUALITY CONTROL TESTING DURING CONSTRUCTION

The Contractor will employ a testing laboratory to perform test and to submit test reports.

Sampling and testing for quality control during placement of concrete shall include the following, as directed by Architect.

Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, and when 80 deg F (27 deg C) and above; and each time a set of compression test specimens are required.

Compression Test Specimen: ASTM C 31, one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

Compressive Strength Tests: ASTM C 39; one set for each day's pour
exceeding 5 cu yds. plus additional sets for each 50 cu yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required. When frequency of testing will provide less than 5 strength test for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

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

Test results will be reported in writing to Architect, Structural Engineer, and Contractor within 24 hours after tests. Reports of compressive strength test shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

See Structural Plans for additional requirements.

END OF SECTION 03310

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