

**Contract Documents and Specifications**

**For**

**Carolina Tennis Center Restroom Building Erosion Repairs**

**For**

**University of South Carolina**

**Project # CP00423791**

**October 24, 2015**

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Project Number: CP00423791

Project Name: Carolina Tennis Center Restroom Building Erosion Repairs

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# SE-311 INVITATION FOR MINOR CONSTRUCTION QUOTES

**PROJECT NAME:** Carolina Tennis Center Restroom Building Erosion Repair

**PROJECT NUMBER:** CP00423791

**PROJECT LOCATION:** 1300 Block of Heyward Street, Columbia, SC

**BID SECURITY REQUIRED?** Yes  No

**PERFORMANCE BOND REQUIRED?** Yes  No

**PAYMENT BOND REQUIRED?** Yes  No

**CONSTRUCTION COST RANGE:** \$ < \$30,000

**DESCRIPTION OF PROJECT:** Add concrete flume and retaining wall and rework area to alleviate erosion issues by Carolina Tennis Center Restroom Building. Small and minority business participation is encouraged. It is the bidders responsibility to download all bidding documents from the purchasing website <http://purchasing.sc.edu>

**BIDDING DOCUMENTS/PLANS MAY BE OBTAINED FROM:** <http://purchasing.sc.edu> (See Facilities Construction Solicitations & Awards)

**PLAN DEPOSIT AMOUNT:** \$ \$0.00 **IS DEPOSIT REFUNDABLE** Yes  No  N/A

Bidders must obtain Bidding Documents/Plans from the above listed source(s) to be listed as an official plan holder. Only those Bidding Documents/Plans obtained from the above listed source(s) are official. Bidders rely on copies of Bidding Documents/Plans obtained from any other source at their own risk.

**IN ADDITION TO THE ABOVE OFFICIAL SOURCE(S), BIDDING DOCUMENTS/PLANS ARE ALSO AVAILABLE AT:**

N/A

*All questions & correspondence concerning this Invitation shall be addressed to the A-E.*

**A-E NAME:** AECOM

**A-E CONTACT:** Bryan Thomas

**A-E ADDRESS:** Street/PO Box: 101 Research Drive

City: Columbia

State: SC

ZIP: 29203-

**EMAIL:** bryan.thomas@aecom.com

**TELEPHONE:** (803) 254-4400

**FAX:** (803) 771-6676

**AGENCY:** University of South Carolina

**AGENCY PROJECT COORDINATOR:** Aimee B. Rish

**ADDRESS:** Street/PO Box: 743 Greene Street

City: Columbia

State: SC

ZIP: 29208-

**EMAIL:** arish@fmc.sc.edu

**TELEPHONE:** (803) 777-2261

**FAX:** (803) 777-7334

**PRE-QUOTE CONFERENCE:** Yes  No

**MANDATORY ATTENDANCE:** Yes  No

**PRE-QUOTE DATE:** 11/11/2015

**TIME:** 10AM

**PLACE:** 743 Greene Street; Cola SC Conf Room 053

**QUOTE CLOSING DATE:** 11/18/2015

**TIME:** 3PM

**PLACE:** 743 Greene Street; Cola SC Conf Room 053

**QUOTE DELIVERY ADDRESSES:**

**HAND-DELIVERY:**

Attn: Aimee B. Rish "Bid Enclosed"

743 Greene Street

Columbia, SC 29208

**MAIL SERVICE:**

Attn: Aimee B. Rish "Bid Enclosed"

743 Greene Street

Columbia, SC 29208

**APPROVED BY:** \_\_\_\_\_

*(Agency Project Coordinator)*

**DATE:** \_\_\_\_\_

SE-331  
QUOTE FORM

Quotes shall be submitted only on SE-331.

QUOTE SUBMITTED BY: \_\_\_\_\_  
(Offeror's Name)

QUOTE SUBMITTED TO: University of South Carolina  
(Owner's Name)

FOR: PROJECT NAME: Carolina Tennis Center Restroom Building Erosion Repairs  
PROJECT NUMBER: CP00423791

**OFFER**

- 1. In response to the Invitation for Minor Construction Quotes, and in compliance with the Instructions to Bidders for the above-named Project, the undersigned **OFFEROR** proposes and agrees, if this Quote is accepted, to enter into a Contract with the Owner in the form included in the Solicitation Documents, and to perform all Work as specified or indicated in the Solicitation Documents, for the prices and within the time frames indicated in the Solicitation and in accordance with the other terms and conditions stated.
- 2. Pursuant to Section 11-32-3030(1) of the SC Code of Laws, as amended, **OFFEROR** has submitted Bid Security as follows in the amount and form required by the Solicitation Documents:

Bid Bond with Power of Attorney     
  Electronic Bid Bond     
  Cashier's Check  
 (Bidder check one)

- 3. **OFFEROR** acknowledges the receipt of the following Addenda to the Solicitation documents and has incorporated the effects of said Addenda into its Quote (Bidder, check only boxes that apply.):

ADDENDA:       #1       #2       #3       #4       #5

- 4. **OFFEROR** agrees that this Quote, including all bid alternates, if any, may not be revoked or withdrawn after the opening of quotes, and shall remain open for acceptance for a period of **60** Days following the Quote Date, or for such longer period of time that **OFFEROR** may agree to in writing upon request of the Owner.
- 5. **OFFEROR** agrees that from the compensation to be paid, the Owner shall retain as Liquidated Damages the amount of \$ \_\_\_\_\_ for each calendar day the actual construction time required to achieve Substantial Completion exceeds the specified or adjusted Contract Time for Substantial Completion, as provided in the Contract Documents.
- 6. **OFFEROR** herewith submits its offer to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fee, permits, licenses and applicable taxes necessary to complete the following items of construction work:

6.1 BASE QUOTE \$ \_\_\_\_\_  
(enter BASE QUOTE in figures only)

6.1.1 ALTERNATE NO. 1 \$ \_\_\_\_\_ to be ADDED / DEDUCTED from BASE QUOTE.  
(circle one)

6.1.2 ALTERNATE NO. 2 \$ \_\_\_\_\_ to be ADDED / DEDUCTED from BASE QUOTE.  
(circle one)

SC Contractor's License Number: \_\_\_\_\_  
 Classification(s) & Limits: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 \_\_\_\_\_  
 Telephone/Fax \_\_\_\_\_  
 E-mail \_\_\_\_\_

This Quote is hereby submitted on behalf of the Offeror named above.  
 BY: \_\_\_\_\_  
 (Signature of Offeror's Representative)  
 \_\_\_\_\_  
 (Print or Type Name of Offeror's Representative)  
 TITLE: \_\_\_\_\_

USC SUPPLEMENTAL GENERAL CONDITIONS  
FOR CONSTRUCTION PROJECTS

WORK AREAS

1. The Contractor shall maintain the job site in a safe manner at all times. This includes (but is not limited to) the provision and/or maintenance of lighting, fencing, barricades around obstructions, and safety and directional signage.
2. Contractor's employees shall take all reasonable means not to interrupt the flow of student traffic in building corridors, lobbies, stairs and exterior walks. All necessary and reasonable safety precautions shall be taken to prevent injury to building occupants while transporting materials and equipment through the work area. Providing safe, accessible, plywood-shielded pedestrian ways around construction may be required if a suitable alternative route is not available.
3. At the beginning of the project, the USC Project Manager will establish the Contractor's lay-down area. This area will also be used for the Contractor's work vehicles. The lay-down area will be clearly identified to the contractor by the Project Manager, with a sketch or drawing provided to USC Parking Services. In turn, Parking Services will mark off this area with a sign containing the project name, Project Manager's name, Contractor name and contact number, and end date. Where this area is subject to foot traffic, protective barriers will be provided as specified by the Project Manager. The area will be maintained in a neat and orderly fashion.
4. Work vehicles parked in the lay down area (or designated parking areas) will be clearly marked and display a USC-furnished placard for identification. No personal vehicles will be allowed in this area, or in any areas surrounding the construction site. Personal vehicles must be parked in the perimeter parking lots or garages. Temporary parking permits can be obtained at the Contractor's expense at the USC Parking Office located in the Pendleton Street parking garage. Refer to the CAMPUS VEHICLE EXPECTATIONS (below) for additional information.
5. Contractor is responsible for removal of all debris from the site, and is required to provide the necessary dumpsters which will be emptied on a regular basis. Construction waste must not be placed in University dumpsters. The construction site must be thoroughly cleaned with all trash picked up and properly disposed of on a daily basis and the site must be left in a safe and sanitary condition each day. The University will inspect job sites regularly and will fine any contractor found to be in violation of this requirement an amount of up to \$1,000 per violation.
6. Where it is necessary to jump curbs, dimensional lumber and plywood must be built up to appropriate curb elevation to protect curbs from damage. Contractor will be responsible for any project related damage.
7. The Contractor shall be responsible for erosion and sediment control measures where ground disturbances are made.

PROJECT FENCING

8. All construction projects with exterior impacts shall have construction fencing at the perimeter. Fencing shall be 6' chain link with black or green privacy fabric (80-90% blockage). For fence panels with footed stands, sandbag weights shall be placed on the inside of the fence. Ripped sandbags shall be replaced immediately.
9. For projects with long fencing runs and/or high profile locations, decorative USC banners shall be used on top of privacy fabric; banners should be used at a ratio of one banner for every five fence

pancls. USC Project Manager will make arrangements for banner delivery for Contractor to hang.

10. The use of plastic safety fencing is discouraged and shall only be used on a temporary basis (less than four weeks) where absolutely necessary. Safety fencing shall be a neon yellow-green, high-visibility fencing equal to 'Kryptonight' by Tenax. Safety fencing shall be erected and maintained in a neat and orderly fashion throughout the project.
11. Vehicles and all other equipment shall be contained within a fenced area if they are on site for more than 3 consecutive calendar days.

#### BEHAVIOR

12. Fraternalization between Contractor's employees and USC students, faculty or staff is strictly prohibited.
13. USC will not tolerate rude, abusive or degrading behavior on the job site. Heckling and cat-calling directed toward students, faculty or staff or any other person on USC property is strictly prohibited. Any contractor whose employees violate this requirement will be assessed a fine of up to \$500 per violation.
14. Contractor's employees must adhere to the University's policy of maintaining a drug-free and tobacco-free campus. Tobacco product trash that is found on the jobsite may result in a \$25/piece fee.

#### HAZARDOUS MATERIALS & SAFETY COMPLIANCE

15. A USC Permit to Work must be signed prior to any work being performed by the general contractor or sub-contractor(s).
16. The contractor will comply with all regulations set forth by OSHA, EPA and SCDHEC. Contractor must also adhere to USC's internal policies and procedures (available by request). Upon request, the contractor will submit all Safety Programs and Certificates of Insurance to the University for review.
17. Contractor must notify the University immediately upon the discovery of suspect material which may contain asbestos or other such hazardous materials. These materials must not be disturbed until approved by the USC Project Manager.
18. In the event of an OSHA inspection, the Contractor shall immediately call the Facilities Call Center, 803-777-4217, and report that an OSHA inspector is on site. An employee from USC's Safety Unit will arrive to assist in the inspection.

#### LANDSCAPE & TREE PROTECTION

19. In conjunction with the construction documents, the USC Arborist shall direct methods to minimize damage to campus trees. Tree protection fencing is required to protect existing trees and other landscape features to be affected by a construction project. The location of this fence will be evaluated for each situation with the USC Arborist, Landscape Architect and Project Manager. Tree protection fencing may be required along access routes as well as within the project area itself. Fence locations may have to be reset throughout the course of the project.
20. The tree protection fence shall be 6' high chain link fence with 80-90% privacy screening unless otherwise approved by USC Arborist and/or Landscape Architect. If the tree protection fence is completely within a screened jobsite fence perimeter, privacy fabric is not required. In-ground

fence posts are preferred in most situations for greater protection. If utility or pavement conflicts are present, fence panels in footed stands are acceptable. See attached detail for typical tree protection fencing.

21. No entry, vehicle parking, or materials storage will be allowed inside the tree protection zone. A 4" layer of mulch shall be placed over the tree protection area to maintain moisture in the root zone.
22. Where it is necessary to cross walks, tree root zones (i.e., under canopy) or lawns the following protective measures shall be taken:
  - a. For single loads up to 9,000 lbs., a 3/4" minimum plywood base shall be placed over 4" of mulch.
  - b. For single loads over 9,000 lbs., two layers of 3/4" plywood shall be placed over 4" of mulch.
  - c. Plywood sheets shall be replaced as they deteriorate or delaminate with exposure.
  - d. For projects requiring heavier loads, a construction entry road consisting of 10' X 16' oak logging mats on 12" coarse, chipped, hardwood base. Mulch and logging mats shall be supplemented throughout the project to keep matting structurally functional.
23. Damage to any trees during construction shall be assessed by the USC Arborist, who will stipulate what action will be taken for remediation of damage. The cost of any and all remediation will be assumed by the contractor at no additional cost to the project. Compensation for damages may be assessed up to \$500 per caliper inch of tree (up to 8") and \$500 per inch of diameter at breast height (for trees over 8").
24. Damage to trunks and limbs, as well as disturbance of the root zone under the dripline of tree, including compaction of soil, cutting or filling, or storage of materials, shall qualify as damage and subject to remediation.
25. Any damage to existing pavements or landscaping (including lawn areas and irrigation) will be remediated before final payment is made.

#### TEMPORARY FACILITIES

26. Contractor will be responsible for providing its own temporary toilet facilities, unless prior arrangements are made with the USC Project Manager.
27. Contractor must provide its own electrical power supply. Water may be available to the extent of existing sources. Any needed or desired taps, connections, or metering devices, shall be at the sole expense of the contractor.
28. Use of USC communications facilities (telephones, computers, etc.) by the Contractor is prohibited, unless prior arrangements are made with the USC Project Manager.

#### CAMPUS KEYS

29. Contractor must sign a Contractor Key Receipt/Return form before any keys are issued. Keys must be returned immediately upon the completion of the work. The Contractor will bear the cost of any re-keying necessary due to the loss of or failure to return keys.

#### WELDING

30. A welding (hot work) permit must be issued by the University Fire Marshall before any welding can begin inside a building. The USC Project Manager will coordinate.

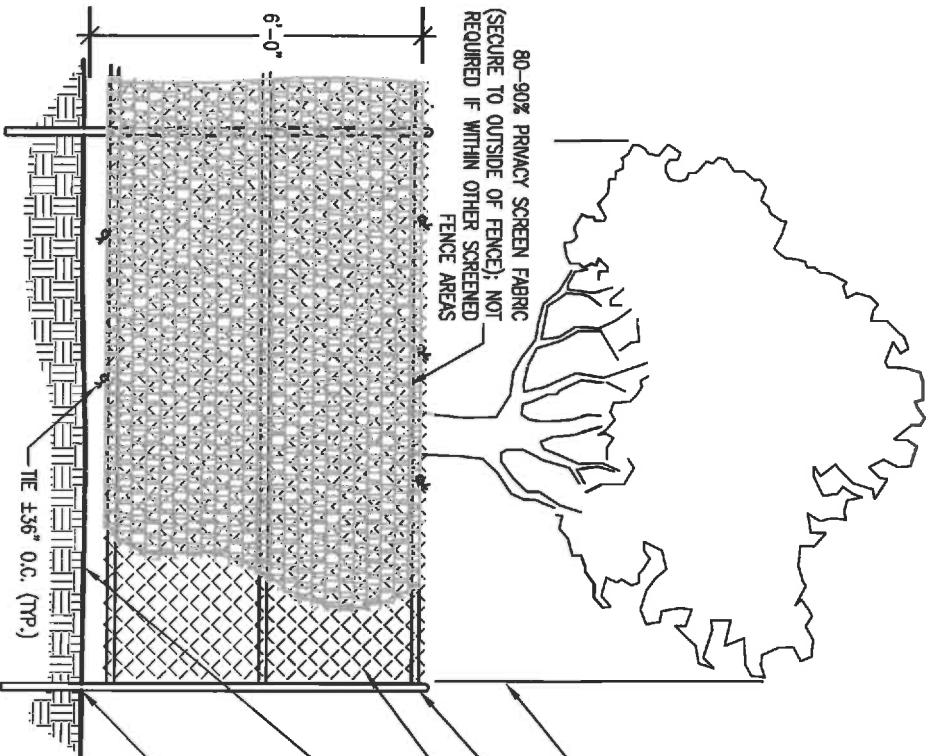
#### PROJECT EVALUATION & CLOSE-OUT

31. For all projects over \$100,000, including IDCs, a Contractor Performance Evaluation (SE 397) will be reviewed with the GC at the beginning of the project and a copy given to the GC. At the end of the project the form will be completed by the USC Project Manager and a Construction Performance rating will be established.
32. Contractor must provide all O&M manuals, as-built drawings, and training of USC personnel on new equipment, controls, etc. prior to Substantial Completion. Final payment will not be made until this is completed.

#### CAMPUS VEHICLE EXPECTATIONS

33. Personal vehicles must be parked in the perimeter parking lots or garages. Temporary parking permits can be obtained at the Contractor's expense at the USC Parking Office located in the Pendleton Street parking garage.
34. All motorized vehicle traffic on USC walkways and landscape areas must be approved by the USC Project Manager and Parking Division, have a USC parking placard, and be parked within the approved laydown area. Violators may be subject to ticketing, towing and fines.
35. All motorized vehicles that leak or drip liquids are prohibited from traveling or parking on walks or landscaped areas.
36. Drivers of equipment or motor vehicles that damage university hardscape or landscape will be held responsible for damages and restoration expense.
37. All vehicles parked on landscape, hardscape, or in the process of service delivery, must display adequate safety devices, i.e. flashing lights, cones, signage, etc.
38. All drivers of equipment and vehicles shall be respectful of University landscape, equipment, structures, fixtures and signage.
39. All incidents of property damage shall be reported to Parking Services or the Work Management Center.





80-90% PRIVACY SCREEN FABRIC  
(SECURE TO OUTSIDE OF FENCE); NOT  
REQUIRED IF WITHIN OTHER SCREENED  
FENCE AREAS

6'-0"

TIE 136" O.C. (TYP.)

TREE CANOPY DRIFLINE;  
SEE NOTE #2.

2 1/2" O.D. GALV. FENCEPOST

CHAIN LINK FENCE PANEL

PROVIDE 4" HARDWOOD MULCH  
AT TREE PROTECTION AREA  
UPON RECOMMENDATION OF  
USC ARBORIST

FENCE POSTS TO BE SET INTO  
GROUND; MARK POST  
LOCATIONS FOR REVIEW AND  
APPROVAL BY USC ARBORIST  
PRIOR TO INSTALLATION. SEE  
NOTE #4.

NOTES:

1. PROVIDE PROTECTION FENCING FOR ALL TREES WITHIN AREA OF DISTURBANCE AND CONSTRUCTION ACCESS.
2. PROTECTION FENCING SHALL BE IN PLACE PRIOR TO BEGINNING CONSTRUCTION.
3. PROTECTION FENCING TO BE PLACED AT THE OUTSIDE OF THE CANOPY DRIFLINE, OR AT A DISTANCE OF ONE FOOT PER ONE INCH OF TREE DIAMETER, MEASURED AT BREAST HEIGHT, WHICHEVER IS LARGER, UNLESS OTHERWISE INDICATED ON LANDSCAPE PLAN OR APPROVED BY UNIVERSITY ARBORIST.
4. IN-GROUND POSTS ARE STANDARD. IF EXISTING ROOTS, UTILITIES OR PAVEMENT PRECLUDE USE OF IN-GROUND POSTS, FOOTED STANDS ARE ACCEPTABLE. SAND BAGS SHALL BE PLACED ON THE INSIDE OF FENCE.
5. DAMAGE TO ANY TREES DURING CONSTRUCTION SHALL BE ASSESSED BY UNIVERSITY ARBORIST AND THE UNIVERSITY ARBORIST SHALL STIPULATE WHAT ACTION WILL BE TAKEN FOR REMEDIATION OF DAMAGE. THE COST OF ANY AND ALL REMEDIATION WILL BE ASSUMED BY CONTRACTOR AT NO ADDITIONAL COST TO THE PROJECT.
6. DISTURBANCE OF ROOT ZONE UNDER DRIFLINE OF TREE, INCLUDING COMPACTION OF SOIL, CUTTING OR FILLING OR STORAGE OF MATERIALS SHALL QUALIFY AS DAMAGE AND SUBJECT TO REMEDIATION.

TREE PROTECTION FENCING (IN-GROUND) WITH SCREENING

NO SCALE REVISED 8.28.14

Project Name: Carolina Tennis Center Restroom Building Erosion Repairs

Project Number: CP00423791

University of South Carolina

**CONTRACTOR'S ONE YEAR GUARANTEE**

STATE OF \_\_\_\_\_

COUNTY OF \_\_\_\_\_

WE \_\_\_\_\_  
as General Contractor on the above-named project, do hereby guarantee that all work executed under the requirements of the Contract Documents shall be free from defects due to faulty materials and /or workmanship for a period of one (1) year from date of acceptance of the work by the Owner and/or Architect/Engineer; and hereby agree to remedy defects due to faulty materials and/or workmanship, and pay for any damage resulting wherefrom, at no cost to the Owner, provided; however, that the following are excluded from this guarantee;

Defects or failures resulting from abuse by Owner.

Damage caused by fire, tornado, hail, hurricane, acts of God, wars, riots, or civil commotion.

\_\_\_\_\_  
[Name of Contracting Firm]

\*By \_\_\_\_\_

Title \_\_\_\_\_

\*Must be executed by an office of the Contracting Firm.

SWORN TO before me this \_\_\_\_\_ day of \_\_\_\_\_, 2\_\_\_\_ (seal)

\_\_\_\_\_ State

My commission expires \_\_\_\_\_

## SECTION 02060

### DEMOLITION

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Work included: Demolish and remove from the site those items so indicated on the Drawings, including parking and roadway areas, miscellaneous structures, poles, walls, utilities, signs, etc.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
  - 2. Section 02110 - Clearing and Grubbing.
  - 3. Section 02616 - Milling, Cutting, and Replacing Pavements.

##### 1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Comply with the International Building Code with due regard to the protection of the public and the provision of safeguards during the performance of the work.
- C. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.
- D. Comply with requirements of governmental agencies having jurisdiction.
- E. Contractor is responsible for being aware of and complying with Asbestos NESHAP regulations, as well as other applicable codes, laws and regulations.
  - 1. The Owner is to be notified immediately upon discovery of asbestos materials.

#### PART 2 - PRODUCTS

- A. No products are required in this Section.

#### PART 3 - EXECUTION

##### 3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the safe, timely, and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

### 3.2 DEMOLITION

- A. General:
  - 1. Prior to start of demolition, carefully study the Drawings and these Specifications.
  - 2. In company with the Owner's representative, visit the site and verify the extent of demolition to be performed under this Contract.
- B. Using only the means and equipment approved for this purpose by the governmental agencies having jurisdiction, demolish and completely remove from the job site the existing construction designated to be removed.
  - 1. Shut off, cap, reroute, and otherwise protect existing public utility lines in accordance with the requirements of the public agency or utility having jurisdiction.
  - 2. Remove rocks larger than 3" diameter, roots, wood, and debris.
- C. Demolished material shall be considered to be property of the Contractor and shall be completely removed from the job site.
- D. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
- E. Use any means necessary to protect the public safety during the demolition process.
- F. Use whatever means necessary to protect the adjacent structures from damage during demolition.
- G. Protection of trees: It may become desirable to save certain trees in areas where cut or fill is eighteen inches or less and in parking areas. Consequently, the Contractor shall obtain approval from Engineer prior to removal of significant trees from such areas. The Contractor shall protect existing trees to remain during construction by constructing barricades around such trees as directed.
- H. Erosion control: Construct and maintain erosion control as shown on the Drawings and in accordance with the local County's requirements.

### 3.3 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the lump sum price bid for the project.

END OF SECTION

## SECTION 02210

### SITE GRADING

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Work included: Cut, fill, excavate, backfill, compact and grade the site as necessary to bring the roads, drives, building sites, paved areas and open areas to the lines and grades shown on the drawings.
1. The work includes, but is not necessarily limited to:
    - a. Roadway, parking area, drive and walk subgrade preparation.
    - b. Excavations and formations of embankments.
    - c. Dressing of graded areas, shoulders and ditches.
  2. Classification: All excavation is unclassified and excavation of every description, regardless of material encountered within the grading limits of the project, shall be performed to the lines and grades indicated.
- B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
  3. Section 02221 - Trenching, Backfilling for Utilities.
  4. Section 02510 - Stone Base Course.
  5. Section 02513 - Asphaltic Concrete Paving.
- C. Definitions:
1. Open areas: Open areas shall be those areas that do not include building sites, paved areas, street right-of-way and parking areas.
  2. Maximum density: Maximum weight in pounds per cubic foot of a specific material.
  3. Optimum moisture: Percentage of water in a specific material at maximum density.
  4. Rock excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery. To be considered as rock excavation, the material shall be continuous; individual boulders or rocks in soil will not be considered rock excavation.
  5. Muck: Materials unsuitable for foundation because of organic content, saturation to the extent that it is somewhat fluid and must be removed by dragline, dredge or other special equipment, are designated as muck. No extra payment will be made for muck removal.
  6. Unsuitable material: Unsuitable material is defined as earth material unsatisfactory for its intended use and as classified by the soils technician. In addition to organic matter, sod, muck, roots and rubbish, highly plastic clay soils of the CH and MH descriptions, and organic soils of the OL and OH descriptions, as defined in the Unified Soil Classification System shall be considered as unsuitable material.

7. Suitable material: Where the term suitable material is used in specification sections pertaining to earthwork, it means earth or materials designated as being suitable for their intended use by soils technicians or the Engineer. Suitable material shall be designated as meeting the requirements of the Unified Soil Classification System types SW, GW, GC, SC, SM, ML, CL or as designated in these specifications.
  8. Select material: Select material is defined as granular material to be used where indicated on the drawings or where specified herein consisting of soils conforming to the Unified Soil Classification types SW, SM, GW or GM or as otherwise approved by the Engineer as select fill. Select material shall contain no stones or rubble larger than 1-1/2" in diameter.
  9. Crushed stone (gravel): Crushed stone shall be No. 57 aggregate or equal conforming to ASTM C-33.
  10. Excavation: Excavation is defined as unclassified excavation of every description regardless of materials encountered.
- D. The Contractor must determine for himself the volume of material required by the site.

## 1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Comply with requirements of governmental agencies having jurisdiction.
- C. A testing laboratory retained by the Owner will make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts of fill material and shall keep the laboratory informed of his progress. The cost of the initial tests shall be paid for by the Owner. Subsequent tests required as a result of improper compaction shall be paid for by the Contractor.

## 1.3 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

## 1.4 JOB CONDITIONS

- A. Notification of intent to excavate:
  1. South Carolina Underground Utility Damage Prevention Act (S.C. Code Ann, 58-35-10, CT-SEQ, Supp. 1978) requires persons to ascertain the location of underground public utility property prior to excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish prior to commencing such operations. Failure to comply could subject the violator to a civil penalty of up to one thousand dollars (\$1,000) for each violation of the Act.
  2. Notification of intent to excavate may be given by calling this toll free number: 1-800-922-0983.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. Soil material used as fill, backfill, subgrade for structures or pavements, embankments, or site grading shall consist of suitable material as found available on site until such supply of on-site material is depleted.
  - 1. Provide suitable material free from organic matter and deleterious substances, containing no rocks or lumps over 6" in greatest dimension, and with not more than 15% of the rocks or lumps larger than 2-1/2" in their greatest dimension.
  - 2. Do not permit rocks having a dimension greater than 1" in the upper 6" of fill or embankment.
- B. Should the quantity of suitable on-site material be insufficient to complete the work, suitable borrow material as approved by the Engineer shall be provided by the Contractor at no additional expense to the Owner.
- C. Select materials may be provided from on-site if acceptable material as approved by the Engineer is available on site. Otherwise approved select material shall be provided by the Contractor from an off-site source.

### 2.2 TOPSOIL

- A. Use topsoil consisting of material removed from the top 3" to 6" of existing on-site soils.
- B. Use topsoil containing no stones, roots or large clods of soil.
- C. Stockpile topsoil separate from other excavated material.

### 2.3 WEED KILLER

- A. Provide a dry, free-flowing, dust free chemical compound, soluble in water, capable of inhibiting growth of vegetation and approved for use on this work by governmental agencies having jurisdiction.

### 2.4 EQUIPMENT

- A. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner without undue waste or damage of material.

## PART 3 - EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

### 3.2 PREPARATION

- A. Clearing and grubbing: Clear and grub areas to be graded prior to commencement of the grading operations.
- B. Where so directed by the Owner, protect and leave standing designated desirable trees.

- C. Complete any demolition and/or removal work as may be required prior to grading operations.
- D. Dispose of all clearing, grubbing and demolition debris and other deleterious material off the project site. Vegetation, roots, brush, rubbish, stumps, etc. may be burned on-site where permitted by local authorities and regulations and approved by the Engineer.
- E. Topsoil: Strip topsoil to a depth of 3" to 6" without contamination from the subsoil and stockpile topsoil separate from other excavated materials.
  - 1. Transport and deposit topsoil in storage piles convenient to areas that are to receive topsoil or in other locations as indicated or approved by the Engineer.
  - 2. Deposit topsoil in areas that are already graded and will not be disturbed by on-going construction.
  - 3. Dispose of unsuitable or unusable stripped material off-site or as otherwise directed by the Engineer.
- F. Sampling and preliminary testing:
  - 1. Prior to beginning the grading operations, the Contractor shall submit to the Engineer his proposed sequence of excavation operations.
  - 2. Based upon the sequence of excavation, samples of the fill materials will be obtained as excavation proceeds and tested for grain size permeability and moisture density relationship using the Standard Proctor Method (ASTM D698, Method A).
  - 3. Allow sufficient time for completion of laboratory tests before any fill operations begin, using the soils being tested.

### 3.3 FINISH ELEVATIONS AND LINES

- A. Construct areas outside of building or structure lines true to grades shown.
  - 1. Where no grade is indicated, shape finish surface to drain away from buildings or structures, as approved by the Engineer.
- B. Degree of finish shall be that ordinarily obtainable from bladegrader, supplemented with hand raking and finishing.
- C. Finish surfaces to within 0.10' above or below the established grade or approved cross section.

### 3.4 GENERAL PROCEDURES

- A. Existing utilities:
  - 1. Unless shown to be removed, locate and protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.
  - 2. If active utility lines are encountered and are not shown on the drawings or otherwise made known to the Contractor, promptly notify the Engineer and take necessary steps to assure that service is not interrupted.
  - 3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
  - 4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.



5. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.
- B. Protection of persons and property:
    1. Barricade open holes and depressions occurring as part of this Work, and post warning lights on property adjacent to or with public access.
    2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
    3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.
  - C. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
  - D. Maintain access to adjacent areas at all times.
  - E. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.
- 3.5 EXCAVATING (CUTS)
- A. Perform excavating of every type of material encountered within the limits of the Work to the lines, grades and elevations indicated and specified herein.
  - B. Provide sloping, sheeting, shoring, and bracing for excavations conforming with 29CFR1926 Subpart P-Excavations and the Contract Documents.
  - C. Suitable excavated materials:
    1. Use all suitable materials removed from the excavation as far as practicable in the formation of the embankments, subgrades, shoulders, building sites and other places as directed.
    2. Surplus suitable materials from excavations shall be wasted on the site as indicated, spreading and leveling as directed.
  - D. Unsuitable excavated material: Remove from the site and dispose of all unsuitable material unless otherwise approved by the Engineer.
  - E. Rock excavation:
    1. Notify the Engineer upon encountering rock or similar material which cannot be removed or excavated by conventional earth moving or ripping equipment.
    2. Do not use explosives without written permission from the Engineer.
    3. When explosives are permitted, use only experienced powdermen or persons who are licensed or otherwise authorized to use explosives. Store, handle and use explosives in strict accordance with all regulatory bodies and the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc.
    4. The Contractor shall be solely responsible for any damage resulting from the use of explosives.
    5. The Contractor is responsible for securing all permits required in performing this work.

- F. Unauthorized excavation:
  - 1. Excavation of material to depths below the grades indicated unless so directed by the Engineer will be deemed unauthorized excavation.
  - 2. Unauthorized overexcavation shall be backfilled and compacted without any additional expense to the Owner.
- G. Authorized overexcavation:
  - 1. In the event that it is necessary to remove unsuitable material to a depth greater than that shown on the drawings or otherwise specified, the Contractor shall remove, replace and compact such material with suitable material as directed by the Engineer at no additional expense by the Owner.

### 3.6 FILLING AND BACKFILLING

- A. Use fills formed of suitable material placed in layers of not more than 8" in depth measured loose and rolled and/or vibrated with suitable equipment until compacted.
- B. Do not place rock that will not pass through a 6" diameter ring within the top 12" of the surface of the completed fill or rock that will not pass through a 3" diameter ring within the top 6" of the completed fill.
- C. Do not use broken concrete or asphaltic pavement in fills.
- D. Selection of borrow material:
  - 1. Material in excess of that available on the site shall be suitable material furnished by the Contractor from private sources selected by the Contractor. The material shall be approved by the Engineer before use. All expenses involved in securing, developing, transporting and placing the material shall be borne by the Contractor.
- E. Placing and compacting:
  - 1. Place backfill and fill materials in layers not more than 8" in loose depth.
  - 2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.
  - 3. Compact each layer to required percentage of maximum density for the area.
  - 4. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
  - 5. Place backfill and fill materials evenly adjacent to structures, to required elevations.
  - 6. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structures to approximately the same elevation in each lift.
- F. Moisture control:
  - 1. Do not use soil material that is either too dry or too wet to achieve proper compaction.
  - 2. Where subgrade or layer of soil material is too dry to achieve proper compaction, uniformly apply water to surface of soil material such that free water does not appear on the surface during or subsequent to compacting operations.
  - 3. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.
  - 4. Soil material that has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by

discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests approved by the Engineer.

G. Compaction requirements:

1. Compact soils to not less than the following percentages of maximum dry density as determined in accordance with ASTM D698, Method A (Standard Proctor).
2. Fill beneath roadway:
 

Top 12" of subgrade	100%
All other fill material	95%
3. Embankments:
 

Top 12" of subgrade	98%
All other fill material	95%
4. Fill beneath walkways:
 

Top 12" of subgrade	95%
All other fill material	90%
5. Lawn and unpaved open areas:
 

All other fill material	90%
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3.7 FINISH GRADING

A. General:

1. Uniformly grade the areas within limits of grading under this Section, including adjacent transition areas.
2. Smooth the finished surfaces within specified tolerance.
3. Grade with uniform levels or slopes between points where elevations are shown on the drawings, or between such points and existing grades.
4. Where a change of slope is indicated on the drawings, construct a rolled transition section having a minimum radius of approximately 8'0", unless adjacent construction will not permit such a transition, or if such a transition defeats positive control of drainage.

B. Grading adjacent to structures: Grade areas adjacent to buildings to achieve drainage away from the structures and to prevent ponding.

C. Ditches and gutters and swales:

1. Cut accurately to the cross sections, grades and elevations shown.
2. Maintain excavations free from detrimental quantities of leaves, sticks, trash and other debris until completion of the work.
3. Dispose of excavated materials as specified herein; do not in any case deposit materials within 3'0" of the edge of a ditch.

3.8 FIELD QUALITY CONTROL

A. Secure the Engineer's construction review and observation and approval of subgrades and fill layers before subsequent construction is permitted thereon.

B. Field density determinations will be made, at no cost to the Contractor, to ensure that the specified densities are being obtained. Field density tests will be performed as determined by the Engineer, considering the following:

1. At areas to receive paving, at least one field density test for every 5,000 sq. ft. of subgrade area, but not less than three tests.
2. In each compacted fill layer, one field density test for every 5,000 sq. ft. of overlaying paved area, but not less than three tests.

3. In fill beneath structures, one field density test for every 2,500 sq. ft. in each layer.
  4. Other tests as deemed necessary by the Engineer.
- C. If, in the Engineer's opinion based on reports of the testing laboratory, subgrade or fills which have been placed are below specified density, provide additional compacting and testing until specified requirements are met.
1. Additional testing will be provided by the Owner's selected testing laboratory and all costs for the additional testing will be borne by the Contractor.
- D. Proofrolling:
1. The Contractor shall proofroll subgrade of areas to receive paving, structures on fill or impervious lining material.
    - a. Make not less than 3 passes of a 25 to 50 ton rubber tired roller over the full area.
    - b. Unstable, soft or otherwise unsuitable materials revealed by the proofrolling shall be removed and replaced with satisfactory materials, compacted as specified herein.

### 3.9 PLACING TOPSOIL

- A. Upon completion of site grading and other related site work, topsoil shall be uniformly spread over the graded or improved areas. Topsoil shall be evenly distributed to conform to final grade elevations shown on the plans.
- B. Place, level and lightly compact topsoil to a depth of not less than 3".
- C. Maintain topsoil free of roots, rocks, debris, clods of soil and any other objectionable material which might hinder subsequent grassing or mowing operations.
- D. Any surplus materials shall be disposed of in approved areas on the site.

### 3.10 MAINTENANCE

- A. Protection of newly graded areas:
  1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.
  2. Repair and re-establish grades in settled, eroded and rutted areas to the specified tolerances.
- B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

### 3.11 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the lump sum price bid for the project.

END OF SECTION

## SECTION 02260

### EROSION AND SEDIMENT CONTROL

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Work included: Provide protection of the environment during the construction of this project to reduce soil erosion and siltation to the lowest reasonably achievable level.

##### 1.2 GENERAL

- A. Exercise every reasonable precaution, throughout the life of the project, to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground or roadway surfaces, or other property. Erosion control practices to be used for this project are shown on the drawings and are to conform to South Carolina Department of Health and Environmental Control (SCDHEC) regulations.

#### PART 2 - PRODUCTS

##### 2.1 CRUSHED STONE

- A. Provide No. 1 aggregate (ASTM C 33) as defined in Section 815 of the SCDOT Standard Specifications for Highway Construction, Latest Edition, for the stabilized construction entrance and exit.
- B. Provide #57 crushed stone for temporary sediment barriers around inlets and for temporary stone check dams.

##### 2.2 GRASSING

- A. Comply with Section 02930 - Grassing.

##### 2.3 SILT FENCE

- A. All posts to be self-fastener angle steel, 5' in length.
  - 1. Wooden posts are not acceptable.
- B. Woven wire shall conform to the requirements of ASTM A 116, Class I zinc coating for wire. Each woven square shall measure 5.33" X 12". The top and bottom wires shall be 10 gauge. All other wires shall be 12-1/2 gauge.
  - 1. Securely attach woven wire to posts with wire ties.
- C. Provide filter fabric meeting the requirements of the South Carolina Department of Health and Environmental Control (SCDHEC), complying with the most current edition of the SCDOT Standard Specifications for Highway Construction and appearing on the SCDOT Approved Materials Sheet #34.
  - 1. Limit splices in filter fabric using continuous rolls whenever possible.
  - 2. Whenever splices are necessary a minimum overlap of 6" is required and all splices must occur at a post so that the integrity of the fence is not compromised.
  - 3. Securely attach filter fabric to top of woven wire and at posts with wire ties.

- D. Silt fences should be continuous and transverse to the flow. The silt fence should follow the contours of the site as closely as possible. Place the fence such that the water cannot runoff around the end of the fence.

## 2.4 EROSION CONTROL BLANKET

- A. Use erosion control blanket S150, from North American Green or approved equal.
  - 1. Use Biostakes where staples are required or indicated on the drawings for stabilization.
    - a. Staple in pattern recommended by blanket manufacturer.
  - 2. Staple locations must be clearly marked on the blanket when stakes are used.

## 2.5 FILTER FABRIC (Temporary Stone Check Dam)

- A. Use Stablenka Filter Fabric (T-140N), Mirafil (140N) or approved equal.

## 2.6 SEDIMENT TUBES

- A. Use sediment tubes as designated on the plans to control erosion along contours, around inlets, and in drainage conveyance swales.
- B. Use sediment tubes manufactured by an experienced manufacturer producing tubes for erosion control.
- C. Tube fill is to be composed of 100% weed free materials consisting of a mix of some or all of the following: curled excelsior wood, natural coconut fibers, hardwood mulch and agricultural straw.
- D. Tubular netting is to be constructed of a flexible outer netting that will contain the fill materials and sediment. Netting is to be constructed from seamless high density polyethylene, polyester, and/or ethyl vinyl acetate, photodegradable materials, treated with ultraviolet stabilizers.
- E. Tubes are to be minimum 20-inches in diameter with minimum weight of 3.2 lbs per foot +/- 10%. Minimum tube length is 10-feet. Netting weight is to be 0.35 oz/foot minimum.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Construct and maintain all erosion control measures until the substantial completion of the project.

### 3.2 TEMPORARY CONSTRUCTION ENTRANCE/EXIT

- A. Construct a gravel area or pad at points where vehicles enter and leave a construction site.
- B. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade and place gravel to the grade and dimensions shown on the plans.

- C. Construct drainage channels to carry water to a sediment trap or other suitable outlet.
- D. Use geotextile fabrics to improve stability of the foundation in locations subject to seepage or high water table.
- E. Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site by periodic top dressing with two inches of stone.
- F. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary.
- G. Immediately remove objectionable materials spilled, washed, or tracked onto public roadways.

### 3.3 TEMPORARY GRASSING

- A. Provide a temporary cover for erosion control on disturbed areas that will remain unstabilized for a period of more than 30 days in accordance with Section 02930.
- B. This practice applies to cleared areas, diversions, dams, temporary sediment basins, temporary road banks, and topsoil stockpiles where vegetation is needed for less than 1 year.
- C. Provide grassing on slope 5% or greater within 14 days of disturbance. Comply with Section 02930.

### 3.4 SILT FENCE

- A. Provide silt fence barrier where shown on the plans and on utility construction parallel to the disturbed trench where perpendicular sheet flow runoff occurs on disturbed areas with slopes greater than 4%.
- B. Place at the extreme limits of the area to be disturbed as shown.
- C. Construct temporary sediment barriers of filter fabric, buried at the bottom, stretched and supported by posts and install below small disturbed areas as indicated on the drawings to retain sediment by reducing the flow velocity to allow sediment deposition.
- D. Space posts 10'-0" on center, maximum or as indicated on the drawings.
- E. Remove sediment deposits prior to reaching one-third height of the fence.
- F. Monitor site frequently and place additional silt fencing should evidence indicate that erosion is about to occur at locations other than those shown on plan.

### 3.5 INLET PROTECTION

- A. Construct temporary sediment barriers around storm drain curb inlets using block and gravel as indicated on the drawings.
- B. Construct metal frame barriers around grate and frame of drop inlets as indicated on the drawings.
- C. Inspect structure after each rainfall and repair as required.
- D. Remove sediment when trap reaches one-half capacity.

E. Remove structure when protected areas have been stabilized.

### 3.6 EROSION CONTROL BLANKET

A. Provide on areas as shown on the plans or on all embankments with slopes equal to or steeper than 2-1/2:1.

### 3.7 SEDIMENT TUBES

A. Construct small U-shaped trench that is 20% of depth of tube perpendicular to stormwater flow pattern.

B. Anchor tube in trench according to manufacturers recommendations.

C. Compact the upstream soil surface adjacent to the tube.

D. Backfill sediment tube with coarse filter material on the upstream side.

E. Follow manufactures recommendation on installation.

F. Maintain, repair and/or replace sediment tubes as required to maintain their effectiveness throughout the project

### 3.8 MAINTENANCE

A. Place all erosion control devices or measures prior to any land disturbing activity within the drainage area they are located.

B. Inspect erosion control devices and clean or otherwise remove silt buildup as necessary once a week or 24-hours following a rain event of  $\geq 0.1$ ".

### 3.9 REMOVAL

A. Remove temporary structures after protected areas have been stabilized.

### 3.10 MEASUREMENT AND PAYMENT

A. No separate measurement or direct payment will be made for the items under this Section and all costs for same shall be included in the lump sum price bid for the project.

END OF SECTION



## SECTION 02276

### MODULAR BLOCK RETAINING WALL SYSTEM

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

###### A. Work included:

1. Preparing site and foundation soil.
2. Constructing leveling pad for facing units.
3. Furnishing and installing modular concrete facing units as shown on the construction drawings.
4. Furnishing and installing geosynthetic reinforcement, unit fill, and backfill to the lines and grades designated on the construction drawings.
5. Furnishing and installing all appurtenant materials required for construction of the retaining wall as shown on the construction drawings.

###### B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these specifications.
2. Section 02210 - Site Grading.
3. Section 02220 - Excavation, Backfilling for Structures.

##### 1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

###### B. Applicable standards:

1. ASTM C 90-75 (1981 Rev) - Hollow load-bearing masonry units.
2. ASTM C 140-75 (1981 Rev) - Sampling and testing concrete masonry units.
3. ASTM C 145-75 (1981 Rev) - Solid load-bearing concrete masonry units.
4. Geosynthetic Research Institute GG1-87 Standard Test Method for Geosynthetic Rib Tensile Strength.
5. Geosynthetic Research Institute GG2-87 Standard Test Method for Geosynthetic Junction Strength.
6. Geosynthetic Research Institute GG3-90 Standard Test Method for Tension Creep Testing of Geosynthetics.
7. Geosynthetic Research Institute GG4-90 Standard Practice for Determination of the Long Term Design Strength of Geosynthetics.

###### C. Referenced manufacturers:

1. Referenced manufacturer of concrete facing units is Keystone Retaining Systems, Inc. or, Anchorwall Systems.
2. Referenced manufacturer of geosynthetic soil reinforcing is the Tensar Corporation or, AMOCO Fabrics and Filters Company, Inc., as applicable. Equal products by other manufacturers may be provided upon approval by the Engineer.

### 1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Provide the following product data:
  - 1. Materials list of items proposed to be provided under this Section.
  - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
  - 3. Construction and installation drawings sealed and signed by a Structural Engineer registered in the State of South Carolina.
  - 4. Design calculations in conformance with NCMA *Design Guidelines for Segmental Retaining Walls*, latest Edition, or AASHTO *LRFD Bridge Design Specifications*, latest Edition, whichever is applicable.

### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Geosynthetic soil reinforcement:
  - 1. Check the geosynthetic reinforcement upon delivery to ensure that the proper material has been received.
  - 2. Store geosynthetics above -20°F (-29°C).
  - 3. Prevent excessive mud, wet cement, epoxy and like materials from coming in contact with and affixing to the geosynthetic material.
  - 4. Rolled geosynthetic material may be laid flat or stood on end for storage.
- B. Facing units:
  - 1. Check the units and connecting pins (if used in system) upon delivery to ensure that proper materials have been received.
  - 2. Prevent excessive mud, wet cement, epoxy and like materials from coming in contact with and affixing to the units.
  - 3. Protect the units from damage (i.e., cracks, chips, spalls). Do not incorporate damaged units into the wall.

## PART 2 - PRODUCTS

### 2.1 DEFINITIONS

- A. Geosynthetic reinforcement is high-density polyethylene (HDPE) or polypropylene (PP) grid or, premium polypropylene woven geotextile. Either must be specifically fabricated for use as a soil reinforcement.
- B. Facing units are modular concrete block units.
- C. Unit fill is a free draining aggregate material used within, around and immediately behind the modular concrete block units.
- D. Backfill is compacted soil which is used as fill behind the unit fill and within the reinforced soil mass.
- E. Foundation soil is compacted or in-situ soil beneath the entire wall.

### 2.2 PRODUCTS

- A. Geogrids:

1. Provide Tensar Type UX 1500SB geogrid reinforcement, unless specified otherwise on the drawings, for walls made with Keystone Units.
2. Provide a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil.
3. Provide a dimensionally stable material, able to retain its geometry under construction stresses with a high resistance to deformation under sustained long-term load.
4. Provide geogrid resistant to damage during construction, to ultraviolet degradation and to all forms of chemical and biological degradation normally encountered in the material being reinforced.

**B. Geotextile:**

1. Provide AMOCO 2044 geotextile reinforcement unless specified otherwise on the drawings.
2. Reinforcement material:
  - a. Provide a woven or nonwoven geotextile reinforcement consisting only of long chain polymeric filaments or yarns formed into a stable network such that the filaments or yarns retain their position relative to each other during handling, placement and design service life.
3. Provide a material with at least 95%, by weight, of the long chain polymers or polyolefins, polyesters, or polyamides.
4. Provide material free of defects and tears.
5. Provide geotextile free from any treatment or coatings that might adversely alter its physical properties after installation.
6. Provide geotextile threaded with polypropylene, polyester, or Kevlar thread.
  - a. Do not use Nylon threads.
  - b. Thread must be resistant to ultraviolet radiation if the sewn seam is exposed at the wall face.
7. Provide a material meeting the following minimum requirements for walls made with Anchorwall Units:

Property	Units	Values	Test Method
Grab Strength	lbs	500	ASTM D 4632
Tensile Strength	lbs/ft	4,800	ASTM D 4595
Elongation	%	20	ASTM D 4595
Seam Strength	lbs	2,400	ASTM D 4884
Puncture Strength	lbs	140	ASTM D 4833
Burst Strength	lb/in <sup>2</sup>	1,350	ASTM D 3786
Trapezoid Tear Strength	lbs	300	ASTM D 4533
Ultraviolet Stability	%	80	ASTM D 4355

**C. Modular concrete facing units:**

1. Provide concrete wall units with a minimum 28-day compressive strength of 3000 psi in accordance with ASTM C-90 and adequate freeze/thaw protection with a maximum moisture absorption rate of 6%.
2. Exterior dimensions may vary. Provide units with a minimum of 1/2 sq. ft. of face area each.
3. Provide block with exterior face texture as selected by the Owner.
4. Provide units with positive interlock.
5. Unless otherwise noted on the drawings, supply and install:
  - a. Anchor Vertica Pro (beveled) Series Block (8"h x18"w x22.5"d), or;
  - b. Keystone Standard Unit Block (8"h x18"w x21.5"d).

- D. Base material:** Provide material for footing consisting of compacted sands, gravel and/or concrete as shown on the construction drawings.

- E. Unit fill: Provide clean, free-draining, granular fill. Gradation shall include material to 3/8" minus with fines limited to 10% passing the #200 sieve and less than 50% passing the #40 sieve.
- F. Backfill:
  - 1. Provide native backfill material unless otherwise specified on the drawings. Do not use unsuitable soils for backfill within the reinforced soil mass.
  - 2. Where additional fill is required, submit sample and specifications to the Engineer, who will determine if the material is acceptable.
- G. Drain tile: Provide 4" diameter perforated PVC pipe on all walls unless waived in writing by the Engineer.

## PART 3 - EXECUTION

### 3.1 EXCAVATION

- A. Excavate to the lines and grades shown on the construction drawings.
- B. Do not disturb base beyond the lines shown.

### 3.2 FOUNDATION SOIL PREPARATION

- A. Excavate as required for leveling pad and geosynthetic embedment dimensions shown on the construction drawings, or as directed by the Engineer.
- B. Provide Engineer, or his representative, adequate notification to examine the foundation soil to ensure that the actual foundation soil strength meets or exceeds assumed design strength. Remove and replace soil not meeting required strength with acceptable material.
- C. Fill over-excavated areas with compacted backfill material.
- D. Proofroll soil before construction proceeds.

### 3.3 LEVELING PAD INSTALLATION

- A. Place leveling pad base material on the prepared foundation material to dimensions as shown on the drawings, or to a minimum thickness of 12" and a minimum width of 36".
- B. Compact material to a minimum 98% standard proctor density, to provide a level, firm surface on which to place the first course of units.
- C. Provide for complete contact of retaining wall unit with leveling pad.

### 3.4 UNIT INSTALLATION

- A. Install units in accordance with the manufacturer's approved construction drawings.
- B. Place the first course of modular concrete facing units on top of and in full contact with the leveling pad.
  - 1. Check the units for proper elevation and alignment.
- C. Place units side by side for the full length of the wall.

1. Proper alignment may be achieved with the aid of a string line or offset from baseline.
- D. Install connecting pins, if required, and fill the voids in and/or around the units with unit fill material and tamp.
- E. Install drain tile at the base of the wall behind the starter course. Slope pipe to drain to daylight.
- F. Sweep all excess material from top of units prior to installing next course.
  1. Fill each course completely with unit fill material prior to proceeding to next course.
  2. Extend a minimum of 12" of unit fill behind the facing units to within 1' of final grade. Cap unit fill and backfill with 1' of impervious material.
- G. Turn units into the backfill at the end of each course where the wall changes elevation.
  1. Lay units so as to create the minimum radius possible.
  2. Install a minimum of three (3) units into the grade.
  3. Construct wall so that only the front face of the units is visible from the side of the wall.

### 3.5 GEOSYNTHETIC INSTALLATION

- A. Orient geosynthetic such that the axis of the material capable of sustaining long-term design load is perpendicular to the wall alignment.
- B. Place geosynthetic reinforcement at the elevation(s) and to the extent(s) shown on the construction drawings or as directed by the Engineer.
- C. Lay the geosynthetic soil reinforcement horizontally on compacted backfill, secured between the stacked facing units, and pull taut before backfill is placed on the geosynthetic.
- D. Install geosynthetic reinforcement that is continuous for the full depth of embedment in the reinforced soil mass.
  1. Do not use spliced connections between shorter pieces of geosynthetic unless preapproved by the Engineer, in writing, prior to construction.

### 3.6 BACKFILL PLACEMENT

- A. Place backfill in uniform 8" lifts and compact as specified under Section 02210.
- B. Place, spread, and compact backfill in such a manner that minimizes the development of slack in the geosynthetic reinforcement.
- C. Operate only lightweight hand-operated compaction equipment within 3' of the facing units.
- D. Do not operate tracked construction equipment directly upon the geosynthetic.
  1. Place a minimum fill thickness of 6" over the geosynthetic prior to operation of tracked vehicles on the geosynthetic.
  2. Keep turning of tracked vehicles to a minimum to prevent tracks from displacing the fill and damaging the geosynthetic.

E. Rubber tired equipment may pass over geosynthetic reinforcement at slow speeds, less than 10 MPH.

1. Avoid sudden braking and sharp turning.

### 3.7 MEASUREMENT AND PAYMENT

A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the lump sum price bid for the project.

END OF SECTION

## SECTION 02525

### CONCRETE CURB AND GUTTER, AND SIDEWALK

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Work included: Provide cast-in-place concrete, including formwork, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
  - 2. Section 03300 - Cast-in-Place Concrete.

##### 1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Reference standards: Comply with the following codes, specifications and standards, except as otherwise shown or specified:
  - 1. American Concrete Institute (ACI) Publications:
    - ACI 305 Recommended Practice for Hot Weather Concreting
    - ACI 306 Recommended Practice for Cold Weather Concreting
  - 2. American Society for Testing and Materials (ASTM) Publications:
    - A 185 Welded Steel Wire Fabric for Concrete Reinforcement
    - C 31 Making and Curing Concrete Test Specimens in the Field
    - C 33 Concrete Aggregates
    - C 39-72 Compressive Strength of Cylindrical Concrete Specimens
    - C 94 Ready-Mixed Concrete
    - C 150 Portland Cement
    - C 260 Air-Entraining Admixtures for Concrete
- C. Testing agency: A testing laboratory will be retained by the Owner to perform material evaluation tests required by these specifications.
- D. Qualifications of contractors performing concrete work: Minimum of two (2) years experience on comparable concrete projects.
- E. Plant qualification: Plant equipment and facilities shall meet all requirements of the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C 94.

##### 1.3 SUBMITTALS

- A. Comply with the pertinent provisions of Section 01340.

- B. Within 15 calendar days after receiving the Owner's Notice to Proceed, submit proposed mix designs for approval.
  - 1. Proportions shall be determined by means of laboratory tests of concrete made with the cement and aggregate proposed for use.
  - 2. Provide report in detail from an approved testing laboratory showing 7-day and 28-day strengths obtained using materials proposed.
  - 3. Required average strength above specified strength:
    - a. Determinations of required average strength above specified strength (f'c) shall be in accordance with ACI 318 and ACI 301.
  - 4. Cost of this work shall be borne by the Contractor.
- C. Manufacturer's data: Submit manufacturer's specification with application instructions for proprietary materials and items, including curing compound, form release agents, admixtures, patching compounds, and others as required by the Engineer.

#### 1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

### PART 2 - PRODUCTS

#### 2.1 FORMS

- A. Use form materials conforming to ACI 347.
- B. Form coatings: Form release coating shall be neat oil with surface wetting agent or chemical release agent which effectively prevents absorption of moisture, prevents bonding with concrete, is non-staining to concrete and leaves the concrete with a paintable surface.
  - 1. On surfaces to receive an applied coating, use a residual free chemical form release agent that is compatible with the applied coating and will not prevent the applied finish from satisfactorily bonding to the concrete.

#### 2.2 SIDEWALK REINFORCEMENT

- A. Fiber reinforcing:
  - 1. Use fiber reinforcing where indicated on the drawings.
  - 2. Provide polypropylene or co-polymer fibers as manufactured by High Tech Fibers, Inc., Fibermesh Company or an approved equal.
  - 3. Where required, use fiber reinforcing at a rate of 2.0 lbs. per cubic yard unless another rate is indicated on the drawings.
- B. Provide welded wire mesh for sidewalk reinforcement in compliance with ASTM A 185.

#### 2.3 PREMOLDED JOINT FILLERS

- A. In concrete pavements (exterior) and concrete sidewalks, use self-expanding cork joint fillers complying with ASTM 1752, Type III.

#### 2.4 CONCRETE MATERIALS

- A. Cement: Use portland cement: ASTM C 150, Type I, Type I-P or Type II, low alkali.



- B. Aggregates:
  - 1. Fine aggregate: Conform to ASTM C 33.
  - 2. Coarse aggregate: Conform to ASTM C 33, Size #57.
- C. Water: Clean and potable and free from injurious amounts of deleterious materials.
- D. Admixtures:
  - 1. Air entraining admixture: ASTM C 260.
  - 2. Water reducing, set controlling admixture: Conform to ASTM C 494.
    - a. Type A - water reducing.
    - b. Type D - water reducing and retarding.
  - 3. Do not use admixtures containing calcium chloride.
- E. Curing compounds:
  - 1. On all vertical and formed surfaces and construction joints, use a non-residual, non-staining curing compound conforming to ASTM C 309 Type 1 and 1D. Acceptable products are:
    - a. L&M Cure by L&M Construction Chemicals, Inc.
    - b. Horn WB-75 by A.C. Horn Company.
    - c. Sonosil by Sonneborn, Inc.
    - d. Approved equal.

## 2.5 CONCRETE MIXES

- A. Provide concrete with the compressive strength of 4000 psi for a 28-day strength as minimum:
- B. Entrained air: 4000 psi concrete, 5%  $\pm$ 1%.
- C. Slump: 4000 psi concrete, 4"  $\pm$ 1".
- D. Production of concrete:
  - 1. General: Concrete shall be ready mixed and shall be batched, mixed and transported in accordance with ASTM C 94 except as otherwise indicated.
  - 2. Monitor time and mix proportions by plant delivery slips.
  - 3. Air-entraining admixtures: Add air-entraining admixture into the mixture as a solution and measure by means of an approved mechanical dispensing device.
  - 4. Water reducing and retarding admixture: Add water reducing and retarding admixture and measure as recommended by the manufacturer.
  - 5. Addition of water to the mix upon arrival at the job site shall not exceed that necessary to compensate for a 1" loss in slump, nor shall the design maximum water-cement ratio be exceeded. Water shall not be added to the batch at any later time.
  - 6. Weather conditions: Control temperature of mix as required by ACI 306 "Cold Weather Concreting" and by ACI 305 "Hot Weather Concreting".

## PART 3 - EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

- B. Water, mud, organic, and other detrimental material shall be removed from excavations before concrete is deposited.
- C. Notify the Engineer prior to placing concrete and place no concrete until the formwork, reinforcing and embedded items have been inspected by the Engineer.

### 3.2 FORMWORK

- A. General:
  - 1. Construct forms in conformance with ACI 347.
  - 2. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement.
  - 3. Coat form contact surfaces with approved form coating compound prior to placing reinforcing steel.
- B. Formwork reuse: Reuse only forms that are in good condition and which maintain a uniform surface texture on exposed concrete surfaces.
  - 1. Apply a light sanding as necessary to obtain a uniform texture.
- C. Removal of forms:
  - 1. Do not disturb or remove forms until the concrete has hardened sufficiently to permit form removal with complete safety.
  - 2. Exercise care in removing forms from finished concrete surfaces so that surfaces are not marred or gouged and that corners are true, sharp and unbroken.
  - 3. Whenever the formwork is removed during the curing period, continue to cure the exposed concrete by one of the methods specified herein.

### 3.3 PLACING CONCRETE

- A. Preparation:
  - 1. Remove foreign matter accumulated in the forms.
  - 2. Rigidly close openings left in the formwork.
  - 3. Wet wood forms sufficiently to tighten up cracks. Wet other material sufficiently to maintain workability of the concrete.
  - 4. Use only clean tools.
  - 5. Provide and maintain sufficient tools and equipment on hand to facilitate uninterrupted placement of the concrete.
  - 6. Before commencing concrete, inspect and complete installation of formwork and wire mesh.
- B. Conveying:
  - 1. Transport and handle concrete from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete.
  - 2. Provide equipment for lifting, dumping, chuting, pumping or conveying the concrete, of such size and design as to ensure a practically continuous flow of concrete at the delivery and without separation of materials.
  - 3. Do not use concrete that is not placed within 1½ hours after water is first introduced into the mix unless the slump is such that it meets the specified limits without the addition of water to the batch.

- C. Placing:
  - 1. Deposit concrete as nearly as practicable in its final location so as to avoid separation due to rehandling and flowing.
  - 2. Place concrete at such a manner that concrete upon which fresh concrete is deposited is still plastic.
- D. Hot weather placement: Place concrete in hot weather in accordance with ACI 305 "Hot Weather Concreting" and as specified herein.
  - 1. Do not place concrete whose temperature exceeds 100°F.
  - 2. Thoroughly wet forms and reinforcing prior to placement of concrete.
  - 3. Use additional set retarder as necessary to increase set time.
  - 4. Start curing as soon as the concrete is sufficiently hard to permit without damage.
- E. Cold weather placement: Place concrete in cold weather in accordance with ACI 306 and as specified herein.
  - 1. Do not place concrete when the atmospheric temperature is below 40°F.
  - 2. Do not add salts, chemicals, or other materials to the concrete mix to lower the freezing point of the concrete.
- F. Consolidation:
  - 1. Consolidate each layer of concrete immediately after placing, by use of internal concrete vibrators supplemented by hand spading, rodding, or tamping.
    - a. Use vibrators having a 2" head diameter and a minimum frequency of 8000 vibrations per second.
    - b. Provide sufficient number of vibrators to properly consolidate the concrete, keeping up with placement operations.
    - c. Provide at least one spare vibrator on site.
  - 2. Insert and withdraw vibrators at points approximately 18" apart.
  - 3. Do not vibrate forms.
  - 4. Do not use vibrators to transport concrete inside the forms.

### 3.4 PROTECTION

- A. Protect the surface finish of newly placed concrete from damage by rainwater or construction traffic.
- B. Do not apply design loads to structures until the concrete has obtained the specified strength.

### 3.5 CURING

- A. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures and mechanical injury.
- B. Curing compound: Apply curing compound immediately after completion of the finish on unformed surfaces and within two hours after removal of forms on formed surfaces.
  - 1. Spray the entire surface with two coats of liquid curing compound, applying the second coat in the direction of 90° to the first coat.
  - 2. Apply compound in accordance with the manufacturer's instructions to cover the surface with a uniform film that will seal thoroughly.

### 3.6 CONCRETE FINISHING

- A. Finish schedule: Unless otherwise indicated on the drawings, finish all concrete surfaces in accordance with the following schedule:
1. Form finish: Formed surfaces not ordinarily exposed to view, including the underside of slabs not exposed to view.
  2. Broom finish: Exterior, outdoor slabs exposed to view including:
    - a. Outdoor floor slabs and walkways.
    - b. Other floors which may become wet or otherwise require a non-skid surface.
    - c. Sidewalks and concrete pavements.
  3. Edge finish: Exposed edges of slabs not receiving chamfer including:
    - a. Sidewalk edges and joints.
    - b. Pavement edges and joints.
    - c. Other slab edges not chamfered.
- B. Finishing procedures:
1. Form finish:
    - a. Repair defective concrete.
    - b. Fill depressions deeper than 1/4".
    - c. Fill tie holes.
    - d. Remove fins exceeding 1/8" in height.
  2. Broom finish:
    - a. Float finish as specified herein.
    - b. Provide a scored texture by drawing a broom across the surface.
  3. Edge finish: Tool slab edges and joints with a 1/4" radius edging tool.

### 3.7 SURFACE REPAIR

- A. Patching mortar:
1. Make a patching mortar consisting of 1 part portland cement to 2-1/2 parts sand by damp loose volume.
  2. Mix the mortar using one part acrylic bonding admixture to two parts water.
- B. Surface defects:
1. Remove all defective concrete down to sound solid concrete.
  2. Chip edges perpendicular to the concrete surface or slightly undercut, allowing no feathered edges.
  3. Dampen surfaces to be patched.
  4. Patch defects by filling solidly with repair mortar.
- C. Allow the Engineer to inspect the work before placing the patching mortar.
- D. Repair defective areas greater than 1 sq. ft. or deeper than 1-1/2" as directed by the Engineer using materials approved by the Engineer at no additional expense to the Owner.

### 3.8 JOINTS

- A. Construction joints:
1. Unless otherwise approved by the Engineer, provide construction joints every ten (10) feet, or as shown on the drawings.
  2. Continue all reinforcing across construction joints and provide 1-1/2" deep keyways unless indicated otherwise on the drawings.

B. Expansion joints:

1. Provide 1/2" expansion joints with premolded joint filters every thirty (30) feet.

3.9 FIELD QUALITY CONTROL

A. Concrete cylinder tests:

1. During construction, prepare test cylinders for compressive strength testing, using 6" diameter by 12" long single use molds, complying with ASTM C 31.
  - a. Make a set of three test cylinders from each pour.
  - b. Identify each and tag cylinder as to date of pour and location of concrete which it represents.
  - c. Deliver cylinders to testing lab selected by the Owner.
  - d. Cost for preparation and delivery of cylinders shall be borne by the Contractor. Cost for testing cylinders will be borne by the Owner.
2. Should strengths shown by test cylinders fail to meet specified strengths for the concrete represented, then:
  - a. Engineer shall have the right to require changes in the mix proportions as he deems necessary on the remainder of the work.
  - b. Additional curing of those portions of the structure represented by the failed test cylinders shall be accomplished as directed by the Engineer.
  - c. Upon failure of the additional curing to bring the concrete up to specified strength requirements, strengthening or replacement of those portions of the structure shall be as directed by the Engineer.
  - d. The Engineer may require additional testing of concrete in question by either non-destructive methods such as the Swiss Hammer, Windsor Probe or Ultrasonics or by coring and testing the concrete in question in accordance with ASTM C 42. Such testing shall be performed at no additional cost to the Owner.

B. Other field concrete tests:

1. Slump tests: Either the Engineer or a testing laboratory representative will make slump tests of concrete as it is discharged from the mixer.
  - a. Slump test may be made on any concrete batch at the discretion of the Engineer.
  - b. Failure to meet specified slump requirements will be cause for rejection of the concrete.
2. Temperature: The concrete temperature may be checked at the discretion of the Engineer.
3. Entrained air: Air content of the concrete will be checked by a representative of the testing laboratory at the discretion of the Engineer.

C. Coordination of laboratory services: The Contractor shall be responsible for coordination of laboratory services.

1. Maintain a log recording quantities of each type of concrete placed, date and location of pour.
2. Inform the testing laboratory of locations and dates of concrete placement and other information as required to be identified in the laboratory's test reports.

D. Tests required because of extensive honeycombing, poor consolidation of the concrete or any suspected deficiency in the concrete will be paid for by the Contractor.

- E. Dimensional tolerances for allowable variations from dimensions or locations of concrete work, including the locations of embedded items shall be as given in ACI 301.
- F. Concrete which fails to meet strength requirements, dimensional tolerances, watertightness criteria, or is otherwise deficient due to insufficient curing, improper consolidation or physical damage shall be replaced or repaired as instructed by the Engineer at no expense to the Owner.

### 3.10 MEASUREMENT AND PAYMENT

- A. No measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the lump sum price bid for the project.

END OF SECTION

## SECTION 02930

### GRASSING

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Work included: Provide grassing of the areas specified herein, or as indicated, for a complete and proper installation.
  - 1. All cleared areas and areas disturbed by the construction operation.
- B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

##### 1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Seed: Conform to all State laws and to all requirements and regulations of the South Carolina Department of Agriculture.
  - 1. Deliver to site each variety of seed individually packaged and tagged to show name, net weight, origin and lot number.
- C. Fertilizer: Conform to State fertilizer law.

##### 1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
  - 1. Complete materials list of items proposed to be provided under this Section.

##### 1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. At time of delivery, furnish the Engineer invoices of all materials received in order that application rates may be determined.
- C. Immediately remove from the site materials that do not comply with the specified requirements, and promptly replace with materials meeting the specified requirements.

## PART 2 - PRODUCTS

### 2.1 FERTILIZER

- A. Provide commercial balanced 16-4-12 or 12-4-8 fertilizer delivered to the site in bags labeled with the manufacturer's guaranteed analysis.

### 2.2 GRASS SEED

- A. Provide grass seed that is:
  - 1. Free from noxious weed seeds, and recleaned.
  - 2. Grade A recent crop seed.
  - 3. Treated with appropriate fungicide at time of mixing.
  - 4. Delivered to the site in sealed containers with dealer's guaranteed analysis.

### 2.3 LIME

- A. Provide agricultural grade, standard ground limestone conforming to current "Rules, Regulations and Standards of the Fertilizer Board of Control" issued at Clemson University.
- B. Bag tags or delivery slip for bulk loads shall indicate brand or trade name, calcium carbonate equivalent, and other pertinent data to identify the lime.

### 2.4 WOOD CELLULOSE FIBER

- A. Provide wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer.
- B. Material to be heat processed so as to contain no germination or growth inhibiting factors.
- C. It shall be dyed (non-toxic) an appropriate color to facilitate metering.

### 2.5 STRAW MULCH

- A. Provide straw or hay material.
  - 1. Straw to be stalks of wheat, rye, barley or oats.
  - 2. Hay to be timothy, peavine, alfalfa, or coastal bermuda.
- B. Material to be reasonably dry and reasonably free from mature seed bearing stalks, roots, or bulblets or Johnson Grass, Nutgrass, Wild Onion and other noxious weeds.

### 2.6 EXCELSIOR FIBER MULCH

- A. To consist of 4" to 6", average length, wood fibers cut from sound, green timber.
- B. Make cut in such a manner as to provide maximum strength of fiber, but at a slight angle to natural grain of the wood.

### 2.7 EROSION CONTROL BLANKET

- A. Provide on areas as shown on the plans.
- B. Provide Erosion Control Blanket S150, from North American Green, or approved equal.



## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Seed these areas immediately upon completion of grading or construction and clean-up operations.
  - 1. Slopes greater than four horizontal to one vertical.
  - 2. Utility rights-of-way adjacent to stream banks.
- B. Areas ready for planting between August 16 and February 28 shall be planted with a temporary cover of Schedule No. 2. At the acceptable seasons for planting Schedule No. 1, the turf shall be destroyed by reworking the soil, and Schedule No. 1 seeding established as specified herein.
- C. Use Rate A lbs. per 1000 sq. ft. on slopes over 5' horizontal to 1' vertical in height and use Rate B lbs. per 1000 sq. ft. on slopes less than 5' horizontal to 1' vertical.

### 3.2 SEEDING SCHEDULES

- A. Mixtures of different types of seed for the various schedules shall be weighed and mixed in proper proportions in the presence of the Engineer.
- B. Schedule No. 1 - Planting dates March 1 to August 15:

Common Name of Seed	Rate A	Rate B
Rye Grain	1	1
Common Bermuda (hulled)	0	1.5
Sericea Lespedeza (clay soils)	1	0
Weeping Love Grass (sandy soils)	1	0
Centipede	0.5	0.5

- C. Schedule No. 2 - Planting dates August 16 - February 28:

Common Name of Seed	Rate A	Rate B
Rye Grain	0	1
Common Bermuda (hulled)	0	1.5
Brown Top Millet	5	0
Common Bermuda (unhulled)	0	2.0

### 3.3 GROUND PREPARATION

- A. Bring all areas to proper line, grade and cross section indicated on the plans.
- B. Repair erosion damage prior to commencing seeding operations.
- C. Loosen seed bed to minimum depth of 3".
- D. Provide and prepare topsoil in accordance with Section 02210.
- E. Conduct soil test to determine pH factor.
  - 1. If pH is not in the range of 6.0 to 6.5, adjust.

### 3.4 APPLICATION OF FERTILIZER

- A. Spread uniformly over areas to be seeded at:
  - 1. Rate of 18 lbs. per 1000 sq. ft. when using 16-4-12.
  - 2. Rate of 25 lbs. per 1000 sq. ft. when using 12-4-8.
  - 3. Use approved mechanical spreaders.
- B. Mix with soil to depth of approximately 3".

### 3.5 SOWING METHODS

- A. General:
  - 1. Perform seeding during the periods and at the rates specified in the seeding schedules.
  - 2. Do not conduct seeding work when ground is frozen or excessively wet.
  - 3. Produce satisfactory stand of grass regardless of period of the year the Work is performed.
- B. Seeding, slopes less than four horizontal to one vertical:
  - 1. Shall conform to Methods EA, WF or WCF as specified hereinafter.
  - 2. Method EA (Emulsified Asphalt):
    - a. Sow seed not more than 24 hours after application of fertilizer.
    - b. Use mechanical seed drills on accessible areas, rotary hand seeders, power sprayers, etc. may be used on steep slopes or areas not accessible to seed drills.
    - c. Cover seed and lightly compact with cultipacker if seed drill does not.
    - d. Within 24 hours following compaction of seeded areas, uniformly apply 0.2 gallons per square yard of emulsified asphalt over the seeded area.
  - 3. Method WF:
    - a. Sow seed as specified for Method EA.
    - b. Within 24 hours following covering of seeds, uniformly apply excelsior fiber at the rate of 100 lbs. per 1000 sq. ft.
    - c. Apply material hydraulically.
    - d. Seeded areas to be lightly rolled to form a tight mat of the excelsior fibers.
  - 4. Method WCF:
    - a. Apply seed, fertilizer and wood fiber mulch using hydraulic equipment.
    - b. Equipment to have built-in agitation system with capacity to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed and water.
    - c. Minimum capacity of slurry tank: 1000 gallons.
    - d. Apply fiber mulch at rate of 35 lbs. per 1000 sq. ft.
    - e. Regulate slurry mixture so that amounts and rates of application will result in uniform application of all materials at not less than the specified amounts.
    - f. Apply slurry in a sweeping motion, in an arched stream, so as to fall like rain, allowing the wood fibers to build upon each other.
    - g. Use color of wood pulp as guide, spraying the prepared seed bed until a uniform visible coat is obtained.
- C. Seeding, slopes greater than four horizontal to one vertical:
  - 1. Sow seed as specified for Method EA, unmulched.
  - 2. Cover seeded area with erosion control blanket.

3.6 SECOND APPLICATION OF FERTILIZER

- A. When plants are established and showing satisfactory growth, apply nitrogen at the rate of 1.0 lb. per 1000 sq. ft.
- B. Apply in dry form unless otherwise directed by the Engineer.
- C. Do not apply to stands of temporary grasses.

3.7 MAINTENANCE

- A. Maintain all seeded areas in satisfactory condition until final acceptance of the Work.
- B. Areas not showing satisfactory evidence of germination within six weeks of the seeding date shall be immediately reseeded, fertilized and/or mulched.
- C. Repair any eroded areas.
- D. Mow as necessary to maintain healthy growth rate until final acceptance of the Work.

3.8 ACCEPTANCE

- A. Permanently seeded areas (Schedule No. 1) will be accepted when the grass attains a height of 2".
- B. No acceptance will be made of temporary seeded areas (Schedule No. 2). Rework and seed with Schedule No. 1.

3.9 MEASUREMENT AND PAYMENT

- A. No measurement and payment will be made for the work under this Section and all costs for same shall be included in the lump sum price bid for the project.

END OF SECTION

SECTION 03300  
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide cast-in-place concrete, including formwork and reinforcement, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Reference standards: Comply with the following codes, specifications and standards, except as otherwise shown or specified:
  - 1. American Concrete Institute (ACI) Publications:
    - ACI 301 Specification for Structural Concrete for Buildings
    - ACI 305 Recommended Practice for Hot Weather Concreting
    - ACI 306 Recommended Practice for Cold Weather Concreting
    - ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures
    - ACI 318 Building Code Requirements for Reinforced Concrete
    - ACI 347 Recommended Practice for Concrete Framework
  - 2. American Society for Testing and Materials (ASTM) Publications:
    - A185 Welded Steel Wire Fabric for Concrete Reinforcement
    - A615 Deformed and Plain Billet Steel Bars for Concrete Reinforcement
    - C31 Making and Curing Concrete Test Specimens in the Field
    - C33 Concrete Aggregates
    - C39-72 Compressive Strength of Cylindrical Concrete Specimens
    - C94 Ready-Mixed Concrete
    - C150 Portland Cement
    - C260 Air-Entraining Admixtures for Concrete
  - 3. Concrete Reinforcing Steel Institute (CRSI):
    - "Manual of Standard Practice"
  - 4. American Welding Society (AWS) Publication:
    - D12.1-61 Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete
- C. Testing agency: A testing laboratory will be retained by the Owner to perform material evaluation tests required by these specifications.
- D. Qualifications of contractors performing concrete work: Minimum of two (2) years experience on comparable concrete projects.

- E. Plant qualification: Plant equipment and facilities shall meet all requirements of the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C94.

### 1.3 SUBMITTALS

- A. Comply with the pertinent provisions of Section 01340.
- B. Within 15 calendar days after receiving the Owner's Notice to Proceed, submit proposed mix designs for approval.
  - 1. Proportions shall be determined by means of laboratory tests of concrete made with the cement and aggregate proposed for use.
  - 2. Provide report in detail from an approved testing laboratory showing 7-day and 28-day strengths obtained using materials proposed.
  - 3. Required average strength above specified strength:
    - a. Determinations of required average strength above specified strength ( $f_c$ ) shall be in accordance with ACI 318 and ACI 301.
    - b. Establish the required average strength of the design mix using the materials proposed to be employed. Standard deviations shall be determined by thirty tests. Average strength used for selecting proportions shall exceed specified strength ( $f_c$ ) by at least:

400 psi	Standard deviation is less than 300
550 psi	Standard deviation is 300 to 400
700 psi	Standard deviation is 400 to 500
900 psi	Standard deviation is 500 to 600
1200 psi	Standard deviation is above 600 or unknown
    - c. When the ready-mix producer does not have a record of past performance, the combination of materials and the proportions selected shall be selected from trial mixes having proportions and consistencies suitable for the work using at least three (3) different water/cement ratios which will produce a range of strengths encompassing those required. Average strength required shall be 1200 psi above specified strength.
  - 4. Cost of this work shall be borne by the Contractor.
- C. Manufacturer's data: Submit manufacturer's specification with application instructions for proprietary materials and items, including curing compound, form release agents, admixtures, patching compounds, and others as required by the Engineer.
- D. Shop drawings: Submit the following shop drawings to the Engineer for approval before work is started:
  - 1. Reinforcing steel drawings: Prepare in accordance with ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, dimensions and details of bar reinforcing and accessories.
  - 2. Cementitious coating.

### 1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. Store reinforcement in a manner that will avoid excessive rusting or coating by grease, oil, dirt and other objectionable materials.

- C. Keep reinforcement in separate piles or racks so as to avoid loss of identification after bundles are broken.

## PART 2 - PRODUCTS

### 2.1 FORMS

- A. Use form materials conforming to ACI 347.
- B. Form lumber: Use lumber of sufficient quality and grade, size and stiffness to adequately support the work and ensure dimensional accuracy.
- C. Form ties: Use form ties which do not leave an open hole through the concrete and which permit neat and solid patching at every hole.
  - 1. Use ties with cones that allow a 1" break back and facilitate patching.
  - 2. On structures containing water or other liquid or below grade structures, use embedded rod ties with integral waterstops in addition to cones.
  - 3. Through-bolts that utilize a removable tapered sleeve in water containing and below grade applications: Use mechanical EPDM rubber plugs to seal holes made after removal of taper ties. Acceptable product is X-Plug by the Greenstreak Group, Inc. 800-325-9504. Follow manufacturers' instructions for installation. Friction fit plugs are not allowed.
  - 4. Wire ties and wood spreaders will not be permitted.
- D. Form coatings: Form release coating shall be neat oil with surface wetting agent or chemical release agent which effectively prevents absorption of moisture, prevents bonding with concrete, is non-staining to concrete and leaves the concrete with a paintable surface.
  - 1. On surfaces to receive an applied coating, use a residual free chemical form release agent which is compatible with the applied coating and will not prevent the applied finish from satisfactorily bonding to the concrete.
- E. Chamfer strips: Chamfer strips shall be wood or polyvinyl strips or approved equal, designed to be nailed in the forms to provide a 3/4" chamfer (unless indicated otherwise) at all exposed edges and corners of concrete members.

### 2.2 REINFORCEMENT

- A. Comply with the following as minimums:
  - 1. Bars: ASTM A615, Grade 60, unless otherwise shown on the Drawings, using deformed bars for Number 3 and larger.
  - 2. Welded wire fabric: ASTM A185.
    - a. Use sheet (mat) welded wire fabric only.
    - b. Welded wire fabric supplied in rolls will not be accepted.
  - 3. Bending: ACI 315 and ACI 318.
- B. Fabricate reinforcement to the required shapes and dimensions, within fabrication tolerances stated in the CRSI "Manual of Standard Practices".
- C. Do not use reinforcement having any of the following defects:
  - 1. Bar lengths, depths, or bends exceeding the specified fabricating tolerances.
  - 2. Bends or kinks not indicated on the Drawings or required for this Work.
  - 3. Bars with excessive rust, scale, dirt, oil or other defects which will reduce the bond or the effective cross section of the bar.

- D. Furnish all support bars, tie bars, chairs, bolsters, etc. required for properly supporting and spacing bars in the forms.
1. For slabs on grade, use supports with stand plates or horizontal runners where wetted base materials will not support chair legs. Other supports must be approved by the Engineer.
  2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are hot-dip galvanized, plastic protected or stainless steel.
  3. Supply supports for welded wire fabric as follows:

**Welded Wire Fabric Support Spacing**

<b>Welded Wire Reinforcement (diameter)</b>	<b>Welded Wire Spacing (inches)</b>	<b>Maximum Support Spacing (feet)</b>
W9 or larger	12 and greater	4
W5 to W8	12 and greater	3
W9 and larger	Less than 12	3
W4 to W8	Less than 12	2
Less than W4	Less than 12	1.5

- E. Tie wire: FS QQ-W-461, annealed steel, black, 16 gauge minimum.
- F. Welding electrodes: AWS A5.1, low hydrogen, E70 series.
- G. Splice devices: Shall be sized to develop one hundred twenty-five (125%) percent of yield strength of bar.

**2.3 CONCRETE MATERIALS**

- A. Cement: Use portland cement: ASTM C150, Type I, Type I-P or Type II, low alkali.
1. Where concrete will be exposed to sewage, use Type II or I-P cement.
  2. Fly ash shall conform to ASTM C618, Class C or F.
  3. Fly ash content shall not exceed 20% by weight of the total amount of cementitious materials (portland cement plus fly ash).
- B. Aggregates:
1. Fine aggregate: Conform to ASTM C33.
  2. Coarse aggregate: Conform to ASTM C33, Size #57.
- C. Water: Clean and potable and free from injurious amounts of deleterious materials.
- D. Admixtures:
1. Air entraining admixture: ASTM C260.
  2. Water reducing, set controlling admixture: Conform to ASTM C494.
    - a. Type A - water reducing.
    - b. Type D - water reducing and retarding.
  3. Superplasticizers: Conform to ASTM C494, Types F and G.
    - a. Use superplasticizers in thin section placements and in areas of congested reinforcing and/or embedded items, or where otherwise approved by the Engineer.
    - b. Use where conventional consolidation techniques are impractical.
  4. Do not use admixtures containing calcium chloride.

- E. Fiber reinforcing:
1. Use fiber reinforcing where indicated on the drawings.
  2. Provide polypropylene or co-polymer fibers as manufactured by High Tech Fibers, Inc., Fibermesh Company or an approved equal.
  3. Where required, use fiber reinforcing at a rate of 2.0 lbs. per cubic yard unless another rate is indicated on the drawings.
- F. Curing compounds:
1. On all vertical and formed surfaces, construction joints, basin slabs, surfaces to receive an applied coating or finish, and other surfaces except as otherwise indicated or specified, use a non-residual, non-staining curing compound conforming to ASTM C309 Type 1 and 1D. Acceptable products are:
    - a. L&M Cure by L&M Construction Chemicals, Inc.
    - b. Horn WB-75 by A.C. Horn Company.
    - c. Sonosil by Sonneborn, Inc.
    - d. Approved equal.
  2. On building floor slabs not otherwise receiving an applied coating or finish and on other flatwork as indicated on the Drawings, provide an acrylic copolymer curing and sealing compound conforming to ASTM C309 Type 1 and the following:
    - a. Non-yellowing.
    - b. Minimum 20% solids.
    - c. Maximum unit moisture loss in accordance with ASTM C156 - 0.40 kg./sq.m at 72 hours.
    - d. Acceptable products are Dress & Seal by L&M Construction Chemicals, Inc., Clear Seal Standard by A. C. Horn Company, Kure-N-Seal 0800 by Sonneborn, Inc., or approved equal.

## 2.4 CONCRETE MIXES

- A. Provide concrete with the compressive strengths shown on the Drawings. When such strengths are not shown on the Drawings, provide the following 28-day strengths as minimum:
- |    |  |                                 |
|----|--|---------------------------------|
| 1. | All structural concrete except as indicated in Nos. 2 and 3 below or as noted otherwise on the plans | 4000 psi                        |
| 2. | All sidewalks, curbs and gutters, and unreinforced foundations                                       | 4000 psi with fiber reinforcing |
| 3. | Thrust blocking, backfill or encasement for piping, and concrete fill                                | 2500 psi                        |
| 4. | Prestressed or precast concrete:   | 5000 psi                        |
- B. Maximum water cement ratios:
- |                   |      |
|-------------------|------|
| 4000 psi concrete | 0.5  |
| 3000 psi concrete | 0.53 |
| 2500 psi concrete | 0.67 |
- C. Entrained air:
- |                            |              |
|----------------------------|--------------|
| 3000 and 4000 psi concrete | 5% ± 1%      |
| 2500 psi concrete          | Not Required |
- D. Slump:



3000 and 4000 psi concrete  
2500 psi concrete

4" ± 1"  
5" ± 1"

E. Production of concrete:

1. General: Concrete shall be ready mixed and shall be batched, mixed and transported in accordance with ASTM C94 except as otherwise indicated.
2. Monitor time and mix proportions by plant delivery slips.
3. Air entraining admixtures: Add air entraining admixture into the mixture as a solution and measure by means of an approved mechanical dispensing device.
4. Water reducing and retarding admixture: Add water reducing and retarding admixture and measure as recommended by the manufacturer.
5. Addition of water to the mix upon arrival at the job site shall not exceed that necessary to compensate for a 1" loss in slump, nor shall the design maximum water-cement ratio be exceeded. Water shall not be added to the batch at any later time.
6. Weather conditions: Control temperature of mix as required by ACI 306 "Cold Weather Concreting" and by ACI 305 "Hot Weather Concreting".

## PART 3 - EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Water, mud, organic, and other detrimental material shall be removed from excavations before concrete is deposited.
- C. Notify the Engineer prior to placing concrete and place no concrete until the formwork, reinforcing and embedded items have been observed by the Engineer.

### 3.2 FORMWORK

- A. General:
  1. Construct forms in conformance with ACI 347.
  2. Design, erect, support, brace and maintain formwork so it will safely support vertical and lateral loads which might be applied until such loads can be supported safely by the concrete structure.
  3. Construct forms to the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in the finished structure.
  4. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and prevent fins.
- B. Form construction and erection:
  1. Construct forms in conformance with ACI 347.
  2. Provide for openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts and other embedded items as required.

3. Hold inner and outer forms for vertical concrete together with combination steel ties and spreaders approved by the Engineer.
  4. Unless specifically stated otherwise, provide 3/4" chamfer at all exposed edges of concrete.
  5. Provide temporary openings in the formwork where necessary to facilitate cleaning and inspection of the formwork.
  6. Coat form contact surfaces with approved form coating compound prior to placing reinforcing steel.
  7. Do not allow excess form coating material to accumulate in the forms or to come in contact with reinforcing surfaces which will bond to fresh concrete.
  8. Side forms for footings may be omitted, and concrete may be placed directly against excavation only when requested by the Contractor and approved by the Engineer.
  9. Provide a positive means of adjustment of shores and struts and ensure that all settlement is taken up during concrete placing.
  10. Construct blockouts and formed openings of sufficient size and proper location to permit final alignment of items within it or passing through it.
    - a. Allow sufficient space for grouting, packing or sealing around any items penetrating the opening as may be required to ensure watertightness.
    - b. Provide openings with continuous keyways with waterstops where required, and provide a slight flare to facilitate grouting and the escape of entrapped air during grouting.
    - c. Provide only blockouts or openings that are shown on the drawings or otherwise approved by the Engineer.
- C. Formwork reuse: Reuse only forms that are in good condition and which maintain a uniform surface texture on expose concrete surfaces.
1. Apply a light sanding as necessary to obtain a uniform texture.
  2. Plug unused tie holes and penetrations flush with the form surface.
- D. Removal of forms:
1. Do not disturb or remove forms until the concrete has hardened sufficiently to permit form removal with complete safety. Do not remove shoring until the member has acquired sufficient strength to support its own weight, the load upon it, and the added load of construction.
  2. Do not remove forms before the following minimum times without prior approval from the Engineer:
 

a. Sides of footings or slabs on grade	24 hrs
b. Walls not supporting load	48 hrs
c. Vertical sides of beams	48 hrs
d. Columns not supporting load	48 hrs
e. Suspended slabs or beam bottoms (forms only)	10 days
  3. In determining the minimum stripping times, consider only the cumulative time during which the ambient temperature of the air surrounding the concrete is above 50°.
  4. Do not remove shoring for suspended slabs or beams until the concrete has reached 75% of the specified 28 day strength.
  5. When reshoring or backshoring is permitted or required, plan the operations in advance and submit procedures to the Engineer for approval.
    - a. Design and plan all reshoring operations to support all construction loading and in accordance with ACI 347.
  6. Exercise care in removing forms from finished concrete surfaces so that surfaces are not marred or gouged and that corners are true, sharp and unbroken.
  7. Do not permit steel spreaders, form ties, or other metal to project from or be visible on any concrete surface except where so shown on the drawings.

8. Whenever the formwork is removed during the curing period, continue to cure the exposed concrete by one of the methods specified herein.

### 3.3 EMBEDDED ITEMS

- A. Embedded items: Set anchor bolts and other embedded items accurately and securely in position in the forms until the concrete is placed and set.
  1. Use templates where practical for all anchor bolts.
  2. Check locations of all anchor bolt and special castings prior to placing concrete and verify locations after concreting.
- B. Piping cast in concrete:
  1. Install and secure sleeves, wall pipes and pipe penetrations before placing concrete.
  2. Do not weld or otherwise attach piping to reinforcing steel.
  3. Support piping to be encased in concrete securely and on firm foundation so as to prevent movement or settlement during concreting.
- C. Locate electrical conduit so that it will not impair the strength of the construction.
  1. Do not use conduits running within (not passing through) a slab, wall or beam that are larger in outside diameter than 1/3 overall concrete thickness unless otherwise approved by the Engineer.
  2. Do not space conduits closer than three conduit diameters apart unless otherwise approved by the Engineer.

### 3.4 REINFORCEMENT

- A. General: Comply with the specified codes and standards and Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for details and methods of reinforcement placement and supports and as herein specified.
  1. Clean reinforcement and remove loose dust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
  2. Position and secure reinforcement against displacement by forms, construction, and the concrete placement operations.
  3. Use adequate number of ties to secure reinforcing.
  4. Do not weld or field bend reinforcing without prior approval by the Engineer.
- B. Placing reinforcing:
  1. Provide and install all chairs, runners, bolsters, standees and other accessories in sufficient quantities to satisfactorily position the reinforcing and hold it in place during concrete placement.
  2. Support reinforcing for slabs on ground on chairs or bolsters with stand plates or a properly sized concrete cube.
    - a. Use concrete bricks as supports only as approved by the Engineer.
  3. Secure and tie dowels in place prior to placing concrete. Do not press dowels into wet concrete.
- C. Concrete cover: Unless otherwise indicated on the drawings or specified herein, install reinforcing with clear concrete coverage in conformance with ACI 318.
  1. All reinforcement, regardless of size, exposed to water or sewage shall have 2" cover.
  2. Place reinforcement a minimum of 2" clear of any openings or metal pipe or fittings.

- D. Splicing reinforcement: Splice reinforcement steel in accordance with the latest revisions of ACI 318 "Building Code Requirements for Reinforced Concrete" unless shown otherwise on the drawings.
1. All splices at wall corners or intersections and at wall and foundation intersections shall be Class B tension splices per ACI 3-18, Sections 12.2.2 and 12.15.
  2. All other splices of vertical or horizontal steel in walls shall be Class B tension splices as per ACI 318 per ACI 318, Sections 12.2.2 and 12.15.
  3. Horizontal ring steel in circular, non-prestressed concrete tanks shall be Class B tension splices and the splices shall be staggered so that no more than 50% of the bars are spliced at any one location.
  4. All welded or mechanical splicing devices shall develop 125% of the yield strength of the bar.
  5. Column vertical bars shall lap 30 bar diameters with dowels at the base of the column unless otherwise noted. Dowels shall be the same size and quantity as column vertical bars unless otherwise noted.
  6. All splices not otherwise shown or specified shall be Class B tension lap splices per ACI 318, Sections 12.2.2 and 12.15.
- E. Tolerances: Place bars in the locations indicated within the tolerances conforming to the CRSI "Manual of Standard Practice".
- F. Welded wire mesh: Install welded wire fabric in as long of a length as practicable and lay flat before placing concrete.
1. Use only mat welded wire fabric. Do not use welded wire fabric from rolls.
  2. Support and tie mesh to prevent movement during concrete placement.
  3. Lap adjoining pieces at least one full mesh and lace splices with wire.
  4. Provide, at a minimum, supports for welded wire fabric according to the Table in Section 2.2.D.3. Confirm the adequacy of the support spacings listed therein for the anticipated construction loads. Increase the number of supports, if necessary, to assure that the final position of the welded wire fabric will conform to that shown on the drawings.
  5. Do not place welded wire fabric on the subbase surface and then hook or "pull up" the reinforcement during concrete placement.
  6. Do not lay welded wire fabric on top of the freshly placed concrete and then "walk it" into place.

### 3.5 PLACING CONCRETE

#### A. Preparation:

1. Remove foreign matter accumulated in the forms.
2. Rigidly close openings left in the formwork.
3. Wet wood forms sufficiently to tighten up cracks. Wet other material sufficiently to maintain workability of the concrete.
4. Use only clean tools.
5. Provide and maintain sufficient tools and equipment on hand to facilitate uninterrupted placement of the concrete.
6. Before commencing concrete, inspect and complete installation of formwork, reinforcing steel and all items to be embedded or cast-in.

#### B. Conveying:

1. Transport and handle concrete from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete.

2. Provide equipment for lifting, dumping, chuting, pumping or conveying the concrete, of such size and design as to ensure a practically continuous flow of concrete at the delivery and without separation of materials.
  3. Use hoppers and elephant trunks where necessary to prevent the free fall of concrete for more than 4'.
  4. Do not use concrete that is not placed within 1-1/2 hours after water is first introduced into the mix unless the slump is such that it meets the specified limits without the addition of water to the batch.
- C. Placing:
1. Deposit concrete as nearly as practicable in its final location so as to avoid separation due to rehandling and flowing.
  2. Deposit concrete in horizontal layers not deeper than 2', avoiding inclined layers.
  3. Place concrete at such a manner that concrete upon which fresh concrete is deposited is still plastic.
  4. Bring slab surfaces to the correct level with screeds set to the proper elevation.
- D. Hot weather placement: Place concrete in hot weather in accordance with ACI 305 "Hot Weather Concreting" and as specified herein.
1. Do not place concrete whose temperature exceeds 100°F.
  2. Thoroughly wet forms and reinforcing prior to placement of concrete.
  3. Use additional set retarder as necessary to increase set time.
  4. Limit the size of the pour where it may reduce the likelihood of cold joints due to reduced set time.
  5. Shade the fresh concrete as soon as possible after placing.
  6. Start curing as soon as the concrete is sufficiently hard to permit without damage.
- E. Cold weather placement: Place concrete in cold weather in accordance with ACI 306 and as specified herein.
1. Except when authorized specifically by the Engineer, do not place concrete when the atmospheric temperature is below 40°F.
  2. When cold weather placement is approved by the Engineer, heat either the mixing water or aggregate or both so that the concrete temperature is between 65°F and 85°F.
  3. Protect the freshly placed concrete by adequate housing or covering and provide heat to maintain a temperature of not less than 50°F for not less than four days.
  4. Do not add salts, chemicals, or other materials to the concrete mix to lower the freezing point of the concrete.
- F. Consolidation:
1. Consolidate each layer of concrete immediately after placing, by use of internal concrete vibrators supplemented by hand spading, rodding, or tamping.
    - a. Use vibrators having a 2" head diameter and a minimum frequency of 8000 vibrations per second.
    - b. Provide sufficient number of vibrators to properly consolidate the concrete, keeping up with placement operations.
    - c. Provide at least one spare vibrator on site.
  2. Insert and withdraw vibrators at points approximately 18" apart.
  3. Do not vibrate forms or reinforcement.
  4. Do not use vibrators to transport concrete inside the forms.

### 3.6 PROTECTION

- A. Protect the surface finish of newly placed concrete from damage by rainwater or construction traffic.
- B. Do not apply design loads to structures until the concrete has obtained the specified strength.
  - 1. Do not backfill against walls until they have reached the specified strength and all supporting or bracing walls, slabs, etc. have also reached the specified strength, unless otherwise permitted by the Engineer.
  - 2. Protect structures from construction overloads.

### 3.7 CURING

- A. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures and mechanical injury.
- B. Continuously cure concrete for a period of not less than 7 days after placement.
  - 1. When seven-day cylinder breaks indicate, in the opinion of the Engineer, the possibility of low strength concrete, provide additional curing as per the request of the Engineer.
  - 2. When temperatures during the curing period fall below 40°F, provide additional curing time as directed by the Engineer.
- C. Unless otherwise directed by the Engineer, cure concrete not in contact with forms in accordance with one of the following procedures:
  - 1. Ponding or sprinkling: Keep entire concrete surface wet by continuously sprinkling or by allowing water to pond, covering all surfaces.
  - 2. Wet burlap: Thoroughly wet and cover all concrete surfaces with wet burlap mats as soon as the concrete has set sufficiently to avoid marring the surface.
    - a. Keep the burlap continuously wet during the curing period.
  - 3. Curing blankets: Thoroughly wet concrete surfaces to be cured and cover with curing blankets as soon as the concrete has set sufficiently to avoid marring the surface.
    - a. Weight the blankets down to maintain close contact with the concrete surface.
    - b. Use sheets of waterproof kraft paper with the joints between sheets taped continuously; or
    - c. Use sheets of 4 mil or thicker polyethylene with the joints between sheets continuously taped.
  - 4. Wet sand: Apply a layer of sand over the entire surface and keep it continuously wet.
  - 5. Curing compound: Apply curing compound immediately after completion of the finish on unformed surfaces and within two hours after removal of forms on formed surfaces.
    - a. Spray the entire surface with two coats of liquid curing compound, applying the second coat in the direction of 90° to the first coat.
    - b. Apply compound in accordance with the manufacturer's instructions to cover the surface with a uniform film which will seal thoroughly.
- D. Hot weather: When necessary, provide wind breaks, shading, fog spraying, sprinkling, ponding or wet covering with a light colored material applying as quickly as concrete hardening and finishing operations will allow.

### 3.8 CONCRETE FINISHING

- A. Finish schedule: Unless otherwise indicated on the drawings, finish all concrete surfaces in accordance with the following schedule:
1. Form finish: Formed surfaces not ordinarily exposed to view, including:
    - a. Interior walls of open tanks below a line one foot lower than the lowest normal water level.
    - b. The underside of slabs not exposed to view.
    - c. Walls below grade.
  2. Cementitious coating: All formed surfaces exposed to view including:
    - a. Interior walls of tanks above a line one foot lower than the lowest normal water level.
    - b. The underside of slabs, soffits, etc. exposed to view.
  3. Float finish: Slab surfaces not exposed to view or not receiving an applied thin finish, including:
    - a. Bottom slabs of tanks or structures containing water sewage or other liquid.
    - b. Foundations not exposed to view.
    - c. Roof slabs to be covered with insulation and/or built-up roofing.
  4. Trowel finish: Interior slab surfaces exposed to view or to receive an applied thin film coating or floor finish, including:
    - a. Interior, indoor slabs and floors of buildings.
    - b. Surfaces on which mechanical equipment moves.
    - c. Floors receiving vinyl tile, resilient flooring, carpet, paint, etc.
  5. Broom finish: Exterior, outdoor slabs exposed to view including:
    - a. Outdoor floor slabs and walkways.
    - b. Other floors which may become wet or otherwise require a non-skid surface.
    - c. Sidewalks and concrete pavements.
  6. Scratch finish: Surfaces which are to receive a thick topping or additional concrete cast against them including:
    - a. Surfaces receiving concrete equipment pads.
    - b. Floors receiving concrete topping.
    - c. Construction joints not otherwise keyed.
  7. Edge finish: Exposed edges of slabs not receiving chamfer including:
    - a. Sidewalk edges and joints.
    - b. Pavement edges and joints.
    - c. Other slab edges not chamfered.
- B. Finishing procedures:
1. Form finish:
    - a. Repair defective concrete.
    - b. Fill depressions deeper than 1/4".
    - c. Fill tie holes.
    - d. Remove fins exceeding 1/8" in height.
  2. Cementitious finish:
    - a. Patch all tie holes and defects and remove all fins.
    - b. Within one day of form removal, fill all bug holes, wet the surfaces and rub with carborundum brick until a uniform color and texture are produced; or
    - c. Dampen surfaces, brush apply a grout slurry consisting of 1 part portland cement to 1-1/2 parts sand, and rub the surface vigorously with a stone. Remove all excess grout.
    - d. Provide a two coat cement base waterproofing, sealing finish of Thoroseal and Thoroseal Plaster Mix as manufactured by Standard Dry Wall Products, Inc. or an approved equal.

- 1) Patch all tie holes and defects and removal all fins, and clean surface of all dirt, laitance, grease, form treatments, curing compounds, etc.
  - 2) Key coat: Apply key coat of Thoroseal at a rate of two (2) lbs. per sq. yd. by fiber brush. Mix material using one part of Acryl 60 to three parts clean water. Should material start to drag during application, dampen surface with water. During hot weather periods, dampen surfaces with water prior to application of key coat material. Key coat shall be allowed to cure for five (5) days before applying finish coat.
  - 3) Apply a finish coat consisting of a four (4) to six (6) lbs. per sq. yd. application of Thoroseal Plaster Mix using steel trowel or spray gun. Color to be selected by the Owner. Mix dry material using one (1) part Acryl 60 to three (3) parts clean water. Firmly press the mix into all voids and level with a steel trowel. When surface is set so that it will not roll or lift, float it uniformly using a sponge float.
3. Float finish:
    - a. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
    - b. Cut down all high spots and fill all low spots and float the slab to a uniform sandy texture.
  4. Trowel finish:
    - a. Float finish as specified herein.
    - b. Power trowel to a smooth surface free of defects.
    - c. After the surface has hardened sufficiently, hand trowel until a ringing sound is produced as the trowel is moved over the concrete surface.
  5. Broom finish:
    - a. Float finish as specified herein.
    - b. Provide a scored texture by drawing a broom across the surface.
  6. Scratch surface:
    - a. Screed the surface to the proper elevations.
    - b. Roughen with rakes or stiff brushes.
  7. Edge finish: Tool slab edges and joints with a 1/4" radius edging tool.

### 3.9 SURFACE REPAIR

- A. Patching mortar:
  1. Make a patching mortar consisting of 1 part portland cement to 2-1/2 parts sand by damp loose volume.
  2. Mix the mortar using one part acrylic bonding admixture to two parts water.
- B. Tie holes: Clean and dampen all tie holes and fill solidly with patching mortar.
- C. Surface defects:
  1. Remove all defective concrete down to sound solid concrete.
  2. Chip edges perpendicular to the concrete surface or slightly undercut, allowing no feather edges.
  3. Dampen surfaces to be patched.
  4. Patch defects by filling solidly with repair mortar.
- D. Allow the Engineer to observe the work before placing the patching mortar.
- E. Repair defective areas greater than 1 sq. ft. or deeper than 1-1/2" as directed by the Engineer using materials approved by the Engineer at no additional expense to the Owner.



### 3.10 JOINTS

#### A. Construction joints:

1. Unless otherwise approved by the Engineer, provide construction joints as shown on the drawings.
2. If additional construction joints are found to be required, secure the Engineer's approval of joint design and location prior to start of concrete placement.
3. Continue all reinforcing across construction joints and provide 1-1/2" deep keyways unless indicated otherwise on the drawings.
  - a. Form keyways in place.
4. Provide waterstops in all construction joints of liquid containing structures, structures below grade or other structures as shown on the drawings.

#### B. Expansion joints:

1. Provide expansion joints of size, type and locations as shown on the drawings.
2. Do not permit reinforcement or other embedded metal items that are being bonded with concrete (except smooth dowels bonded on only one side of the joints, where indicated on the drawings) to extend continuously through any expansion joint.
3. Provide waterstops where required.

#### C. Control or contraction joints:

1. Locate and construct control and contraction joints in accordance with the Drawings.
2. Where no specific joint pattern is indicated in slabs on grade or concrete pavements, submit a proposed joint layout to the Engineer for approval.
3. Where no specific joint details are shown on the drawings, joints may be tooled, preformed or saw-cut.
4. Saw-cut joints as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw.

### 3.11 FIELD QUALITY CONTROL

#### A. Concrete cylinder tests:

1. During construction, prepare test cylinders for compressive strength testing, using 6" diameter by 12" long single use molds, complying with ASTM C31.
  - a. Make a set of three test cylinders from each pour of 50 cubic yards or less, plus one additional set of cylinders for each additional 50 cubic yards or fraction thereof.
  - b. Identify each and tag cylinder as to date of pour and location of concrete which it represents.
  - c. Deliver cylinders to testing lab selected by the Owner.
  - d. Cost for preparation and delivery of cylinders shall be borne by the Contractor. Cost for testing cylinders will be borne by the Owner.
2. Should strengths shown by test cylinders fail to meet specified strengths for the concrete represented, then:
  - a. Engineer shall have the right to require changes in the mix proportions as he deems necessary on the remainder of the work.
  - b. Additional curing of those portions of the structure represented by the failed test cylinders shall be accomplished as directed by the Engineer.

- c. Upon failure of the additional curing to bring the concrete up to specified strength requirements, strengthening or replacement of those portions of the structure shall be as directed by the Engineer.
  - d. The Engineer may require additional testing of concrete in question by either non-destructive methods such as the Swiss Hammer, Windsor Probe or Ultrasonics or by coring and testing the concrete in question in accordance with ASTM C42. Such testing shall be performed at no additional cost to the Owner.
- B. Other field concrete tests:
  - 1. Slump tests: Either the Engineer or a testing laboratory representative will make slump tests of concrete as it is discharged from the mixer.
    - a. Slump test may be made on any concrete batch at the discretion of the Engineer.
    - b. Failure to meet specified slump requirements (prior to addition of any superplasticizers) will be cause for rejection of the concrete.
  - 2. Temperature: The concrete temperature may be checked at the discretion of the Engineer.
  - 3. Entrained air: Air content of the concrete will be checked by a representative of the testing laboratory at the discretion of the Engineer.
- C. Coordination of laboratory services: The Contractor shall be responsible for coordination of laboratory services.
  - 1. Maintain a log recording quantities of each type of concrete placed, date and location of pour.
  - 2. Inform the testing laboratory of locations and dates of concrete placement and other information as required to be identified in the laboratory's test reports.
- D. Tests required because of extensive honeycombing, poor consolidation of the concrete or any suspected deficiency in the concrete will be paid for by the Contractor.
- E. Dimensional tolerances:
  - 1. Dimensional tolerances for allowable variations from dimensions or locations of concrete work, including the locations of embedded items shall be as given in ACI 301.
  - 2. Where anchor bolts or other embedded items are required for equipment installation, comply with the manufacturer's tolerances if more stringent than those stated in ACI 301.
- F. Watertight concrete:
  - 1. All liquid containing structures, basements or pits below grade shall be watertight.
  - 2. Any visible leakage or seepage shall be repaired as instructed by the Engineer at no expense to the Owner.
  - 3. Where physical evidence of honeycombing, cold joints or other deficiencies which may impair the watertightness of a structure exists, the Engineer may at his discretion call for leak testing of the structure.
    - a. Fill the structure with water and allow to stand for not less than 48 hours.
    - b. Make repairs on the structure until all visible leaks are sealed and the leakage rate of the water in the structure is less than 0.1% of the volume held in the structure per day.

- c. The cost of testing and repairs shall be performed at no expense to the Owner.
- G. Concrete which fails to meet strength requirements, dimensional tolerances, watertightness criteria, or is otherwise deficient due to insufficient curing, improper consolidation or physical damage shall be replaced or repaired as instructed by the Engineer at no expense to the Owner.

### 3.12 MEASUREMENT AND PAYMENT

- A. No measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the lump sum price bid for the project.

END OF SECTION