TABLE OF CONTENTS

DIVISION 14 - CONVEYING EQUIPMENT
NOT APPLICABLE

DIVISION 21 - FIRE SUPPRESSION
NOT APPLICABLE

DIVISION 22 - PLUMBING
NOT APPLICABLE

DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING
NOT APPLICABLE

DIVISION 25 – INTEGRATED AUTOMATION
NOT APPLICABLE

DIVISION 26 - ELECTRICAL

DIVISION 27 - COMMUNICATIONS
NOT APPLICABLE

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY
NOT APPLICABLE

DIVISION 31 - EARTHWORK
NOT APPLICABLE

DIVISION 32 - EXTERIOR IMPROVEMENTS
321000 BASES, BALLASTS, AND PAVING
329223 SODDING

DIVISION 33 - UTILITIES
NOT APPLICABLE

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION
NOT APPLICABLE

DIVISION 40 - PROCESS INTERCONNECTIONS
NOT APPLICABLE

DIVISION 41 - MATERIAL PROCESSING AND HANDLING EQUIPMENT
NOT APPLICABLE

DIVISION 43 - PROCESS GAS AND LIQUID HANDLING PURIFICATION, AND STORAGE EQUIPMENT
NOT APPLICABLE

DIVISION 44 - POLLUTION AND WASTE CONTROL EQUIPMENT
NOT APPLICABLE

DIVISION 46 - WATER AND WASTEWATER EQUIPMENT
NOT APPLICABLE

SECTION 010000 – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work: The Work to be done consists of the furnishing of all labor, materials and equipment, and the performance of all Work included in this Contract.

B. Work Included:

1. The Contractor shall furnish all labor, superintendence, materials, plant power, light, heat, fuel, water, tools, appliances, equipment, supplies, and means of construction necessary for proper performance and completion of the Work. The Contractor shall obtain and pay for all necessary local building permits. The Contractor shall perform and complete the work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer, and in strict accordance with the Contract Documents. The Contractor shall clean up the Work and maintain it during and after construction, until accepted, and shall do all Work and pay all costs incidental thereto. The Contractor shall repair or restore all structures and property that may be damaged or disturbed during performance of the Work.

2. The cost of incidental work described in these project requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the Work and shall be included in the prices for the various Contract Items. No additional payment will be made therefore.

3. The Contractor shall provide and maintain such modern plant, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the Work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of their workmanship, materials, and equipment, prior approval of the Engineer notwithstanding.

C. Public Utility Installations and Structures

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, vaults, manholes, and all other appurtenances and facilities pertaining thereto whether owned or controlled by the Owner, other governmental bodies, or privately owned by individuals, firms, or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage, water, or other public or private property which may be affected by the Work shall be deemed included hereunder.

2. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy, and it is the responsibility of the Contractor to make their own investigations to inform themselves fully of the character, condition, and extent of all such

installations and structures as may be encountered and as may affect the construction operations.

3. The Contractor shall protect all public utility installations and structures from damage during the Work. Access across any buried public utility installation or structure shall be made to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at their expense. All existing public utilities damaged by the Contractor shall be repaired by the Contractor, at their expense. No separate payment shall be made for such protection or repairs to public utility installations or structures.

4. Public utility installations or structures owned or controlled by the Owner or other governmental body which are shown on the Drawings to be removed, relocated, replaced, or rebuilt by the Contractor shall be considered as a part of the general cost of doing the Work and shall be included in the prices bid for the various Contract Items; therefore, no separate payment shall be made.

5. Where public utility installations of structures owned or controlled by the Owner or other governmental body are encountered during the course of the Work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the Engineer, removal, relocation, replacement, or rebuilding is necessary to complete the Work under this Contract, such Work shall be accomplished by the utility having jurisdiction, or such Work may be ordered, in writing by the Engineer, for the Contractor to accomplish. If such work is accomplished by the utility having jurisdiction it will be carried out expeditiously, and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement, or rebuilding as required. If such work is accomplished by the Contractor, it will be paid for as extra work as provided in the Agreement.

6. The Contractor shall, at all times in performance of the Work, employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage, or destruction of public utility installations and structures; and shall, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, public utility services, and shall cooperate fully with the utility owners.

7. The Contractor shall give written notice to the Owner and other governmental utility departments and other owners of public utilities of the location of their proposed construction operations, at least forty-eight (48) hours in advance of breaking ground in any area or on any unit of the Work.

8. The maintenance, repair, removal, relocation, or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the owners of such utilities.

1.2 DRAWINGS AND PROJECT MANUAL

A. Drawings: When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions, and large-scale drawings in preference to small-scale drawings.

B. Supplementary Drawings:

1. When, in the opinion of the Engineer, it becomes necessary to explain more fully the Work to be done or to illustrate the Work further or to show any changes which may be required, drawings known as Supplementary Drawings, with Specifications pertaining thereto, will be prepared by the Engineer, and the Contractor will be furnished an electronic copy of the plans and project manual.

2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Contract Drawings. Where such Supplementary Drawings require either less or more than the estimated quantities of Work, credit to the Owner or compensation therefore to the Contractor shall be subject to the terms of the Agreement.

C. Contractor to Check Drawings and Data:

1. The Contractor shall verify all dimensions, quantities, and details shown on the Drawings, Supplementary Drawings, schedules, Specifications, or other data received from the Engineer, and shall notify them of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, omissions, conflicts, or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction, or improper operation resulting there from, nor from rectifying such conditions at their own expense. The Contractor will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Engineer, should such errors or omissions be discovered.

2. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

D. Specifications: The Technical Specifications consist of three (3) parts: General, Products, and Execution. The General part of a Specification contains General Requirements which govern the Work. The Products and Execution parts modify and supplement the General Requirements by detailed requirements for the Work and shall always govern whenever there appears to be a conflict.

E. Intent:

1. All Work called for in the Specifications applicable to this Contract but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications but involved in carrying out their intent or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

2. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, the interpretation of these Specifications shall be made upon that basis.

1.3 MATERIALS AND EQUIPMENT

A. Manufacturer:

1. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request and at the Engineer's option, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from their full responsibility under this Contract.

2. Any two (2) or more pieces of material or equipment of the same kind, type, or classification, and being used for identical types of service, shall be made by the same manufacturer.

B. Delivery:

1. The Contractor shall deliver materials in ample quantities to ensure the most speedy and uninterrupted progress of the Work so as to complete the Work within the allotted time.

2. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

C. Tools and Accessories:

1. The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind, or size of equipment, one (1) complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

2. Spare parts shall be furnished as specified herein and as recommended by the manufacturer necessary for the operation of the equipment, not including materials required for routine maintenance.

3. Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight, and principal rate data.

D. Service of Manufacturer's Engineer:

1. The Contract Prices for equipment shall include the cost of furnishing a competent and experienced Engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test, and place in operation, the equipment in conformity with the Contract Documents.

2. After the equipment is placed in permanent operation by the Owner, such Engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is in proper and satisfactory operating condition and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.4 INSPECTION AND TESTING

A. General:

1. For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests, and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. One (1) original and one (1) electronic copy of the reports shall be submitted, and authoritative certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

2. If, in the making of any test of any material or equipment, it is ascertained by the Engineer that the material or equipment does not comply with the Contract Documents, the Contractor will be notified thereof, and they will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the Work and replace it with acceptable material, without cost to the Owner.

3. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with the recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

4. The Contractor shall be fully responsible for the proper operation of equipment during testing and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

B. Costs:

1. All inspection and testing of materials furnished under this Contract will be provided by the Contractor, unless otherwise expressly specified.

2. The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor, and such costs shall be deemed to be included in the Contract Price.

3. Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the Owner for compliance. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests of materials and equipment which are rejected for non-compliance.

C. Certificate of Manufacture:

1. Contractor shall furnish to Engineer authoritative evidence in the form of a certificate of manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents.

2. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

D. Shop Tests:

1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function, or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents.

2. Five (5) copies of the manufacturer's actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company and/or independent laboratory, shall be submitted to the Engineer for approval.

3. The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

E. Start-up Tests:

1. As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make start-up tests of equipment.

2. If the start-up tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, prior to demonstration tests, make all changes, adjustments, and replacements required. The furnishing Contractor shall assist in the start-up tests as applicable.

F. Demonstration Tests:

1. Prior to Contractor's request for a Substantial Completion inspection, all equipment and piping installed under this Contract shall be subjected to demonstration tests as specified or required to prove compliance with the Contract Documents.

2. The Contractor shall furnish labor, fuel, energy, water, and all other materials, equipment, and instruments necessary for all demonstration tests, at no additional cost to the Owner. Contractor shall assist in the demonstration tests as applicable.

1.5 LINES AND GRADES

A. Grade:

1. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

B. Surveys:

1. The Contractor shall furnish and maintain, at their own expense, stakes and other such materials.

2. The Contractor shall check such reference marks by such means as they may deem necessary and, before using them, shall call the Engineer's attention to any inaccuracies.

3. The Contractor shall, at their own expense, establish all working or construction lines and grades as required from the reference marks set by the Engineer, and shall be solely responsible for the accuracy thereof. They shall, however, be subject to the check and review by the Engineer.

C. Safeguarding Marks:

1. The Contractor shall safeguard all points, stakes, grade marks, monuments, and benchmarks made or established on the Work, bear the cost of re-establishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes, and marks.

2. The Contractor shall safeguard all existing and known property corners, monuments, and marks adjacent to but not related to the Work and shall bear the cost of re-establishing them if disturbed or destroyed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 010000

SECTION 011100 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. This Contract is for the construction of the **US1 Undergrounding Phase 2 – Decorative Streetlights.** The work consists of furnishing all labor, equipment, and materials for the construction of the facilities consisting of, but not limited to, the following:

B. *The work includes the construction of 14 decorative streetlights, including poles, arms and fixtures, along with associated work including, pull boxes, conduit, concrete sidewalk modifications, coordination with FPL, maintenance of traffic and restoration. The work is part of an overall project to underground the existing overhead utilities along US1 between McDonald Street and Ridge Boulevard.*

C. The Contractor shall furnish all labor, equipment, tools, services and incidentals to complete all Work required by these Specifications and as shown on the Drawings.

D. The Contractor shall perform the Work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, cleanup, replacements and restoration required as a result of damages caused during this construction.

E. All materials, equipment, skills, tools and labor which is reasonably and properly inferable and necessary for the proper completion of the Work in a substantial manner and in compliance with the requirements stated or implied by these Specification or Drawings shall be furnished and installed by the Contractor without additional compensation, whether specifically indicated in the Contract Documents or not.

F. The Contractor shall comply with all City, County, State, Federal, and other codes which are applicable to this Project.

1.2 CONTRACTOR'S USE OF PREMISES

A. The Contractor shall assume full responsibility for the protection and safekeeping of products and materials at the job site. If additional storage or work areas are required, they shall be obtained by the Contractor at no additional cost to the Owner.

1.3 PROJECT SEQUENCE

A. The Contractor shall establish their work sequence based on the use of crews to facilitate completion of construction and testing within the specified Contract Time.

B. Work sequence shall allow one (1) side of US1 to have active streetlights while work occurs on opposite side so not to have any time that no streetlighting is provided.

PART 2 - PRODUCTS (NOT USED

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011100

SECTION 012000 – PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SCOPE

A. Separate payment will be made only for the items of work described herein and listed on the Bid Form. Any related work not specifically listed, but required for satisfactory completion of the work, shall be considered to be included in the scope of the appropriate listed work items.

B. The Contractor's attention is called to the fact that cleanup is considered a part of the work of construction. No payment will be made until cleanup is essentially complete.

C. No separate payment will be made for the following items, and the cost of such work shall be included in the applicable pay items of work if not shown as a separate pay item.

1. Clearing and grubbing
2. Excavation, including necessary pavement base removal.
3. Shoring and sheeting.
4. Dewatering and disposal of surplus water.
5. Structural fill.
6. Backfill.
7. Grading.
8. Replacement of unpaved roadways, grass, and shrubbery plots.
9. Cleanup.
10. Testing and placing system in operation.
11. Any material and equipment required to be installed and utilized for the test.
12. Pipe, structures, pavement replacement and/or appurtenances included within the limits of lump sum work

D. No payment shall be made for work constructed outside the authorized limits of work.

PART 2 - PRODUCTS

2.01 Mobilization/Demobilization, Bid Item 1

Payment shall be made at the contract lump sum price for mobilization and demobilization including bonds, soil and erosion control, layout, storage, construction aids, temporary facilities and other work required. 30% of amount shall be allocated to demobilization and paid upon completion of demolization.

2.02 Maintenance of Traffic, Bid Item 2

Payment shall be made at the contract lump sum price for providing Maintenance of Traffic including vehicular, pedestrian and bicycle traffic pre FDOT standards along FDOT and City roads and upon private property/easement areas.

2.03 Decorative Street Light (Pole, Arm and Fixture), Bid Item #3

Payment shall be made at the contract unit cost for each complete streetlight pole including foundation, pole, wire, arm, fixture, photocell, grounding, testing/adjustment and other required work. Coordination with FPL for pole installation adjacent to existing FPL overhead facilities is included.

2.04 Install FPL-Provided Pull Box/Handhole per FPL Requirements, Bid Item #4

Payment shall be made at the contract unit cost for each linear foot of conduit installed and shall include acquisition of materials from FPL and all work required by FPL and NEC.

2.05 Install FPL-Provided Pull Box/Handhole per FPL Requirements, Bid Item #5

Payment shall be made at the contract unit cost for each pull box/handhole installed and shall include acquisition of materials from FPL and all work required by FPL and NEC.

2.06 Concrete Sidewalk Remove/Replace, Bid Item #6

Payment shall be made at contract unit cost for each square yard of sidewalk replaced. Work shall include saw cutting and removal of existing sidewalk, forming, finishing, expansion joints, control joints, ADA detectable warning mats, and other work required by FDOT. Sidewalk work includes adjustment of sidewalks at light poles and restoration of sidewalk impacted by the conduit installation, if open cut.

2.07 Asphalt Parking Lot Pavement Remove/Replace, Bid Item #7

Payment shall be made at contract unit cost for each square yard of asphalt pavement replaced. Work shall include saw cutting and removal of existing asphalt, subbase, base, striping/pavement markings, and other work required by FDOT. Asphalt pavement work includes restoration of asphalt pavement impacted by the conduit installation, if open cut.

2.08 Coordination with FPL, Bid Item #8

Payment shall be made at the contract lump sum price for coordination of the Contract work with FPL who is underway with their undergrounding work. Coordination shall include installing and activating light poles on one side of US1 at a time, allowing existing streetlights to remain in service on opposite side to provide some level of lighting throughout construction.

2.09 Restoration, Bid Item #9

Payment shall be made at the contract lump sum price for the restoration of existing features in the public rights of way and the private property/easement areas impacted by the Contract work including irrigation, sodding, landscaping, mulch, curbing, and other work.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012000

SECTION 012500 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 REQUESTS FOR REVIEW

A. Requests to review substitute items of material and equipment will not be accepted by the Engineer from anyone other than the Contractor. If the Contractor wishes to furnish or use a substitute or equivalent item of material or equipment, the Contractor shall make written application to the Engineer for acceptance, certifying that the proposed substitute will perform adequately the functions called for by the general design, be similar and of equivalent substance to that specified and be suited to the same use and capable of performing the same function as that specified. The application will state whether or not acceptance of the substitute for use in the work will require a change in Drawings or Specifications to adapt the design to the substitute and whether or not incorporation or use of the substitute in connection with the work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified shall be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other Contractors affected by the resulting change, all of which shall be considered by the Engineer in evaluating the proposed substitute. The Engineer may require the Contractor to furnish at the Contractor's expense additional data about the proposed substitute. The Engineer will be the sole judge of acceptability, and no substitute will be ordered or installed without the Engineer's prior written acceptance. The Owner may require the Contractor to furnish at the Contractor's expense, a special performance guarantee or other surety with respect to any substitute.

1.2 SUBSTITUTION AFTER EXECUTION OF AGREEMENT

A. After execution of the Agreement, substitution of materials or equipment supplied by manufacturers or suppliers other than those listed, will be considered only if it is demonstrated by the Contractor that:

1. The material or equipment proposed for substitution is superior in design, construction and/or efficiency to that of the listed manufacturer or supplier;

2. The material proposed for substitution is in every way equal to that of the listed supplier, and that availability and/or delivery of listed materials within the time frame scheduled cannot be met;

3. or the material proposed for substitution is in every way equal to that of the listed supplier and is available at a lower cost. In the event such a substitution is allowed, the Contractor shall accept and execute a Change Order reducing the Contract Price by an amount equal to the cost differential.

1.3 EQUIVALENT MATERIALS AND EQUIPMENT

A. Whenever materials or equipment are specified or described in the Drawings or Specifications by using the name of a proprietary item or the name of a particular manufacturer, fabricator, supplier or distributor, the naming of the item is intended to establish the type, function, and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other manufacturers, fabricators, suppliers or distributors may be accepted by the Engineer if it is determined that the material or equipment proposed is equivalent to that named.

B. It is not the intent of the Contract Documents to function as proprietary specifications. Where a particular manufacturer make and model are cited and specifically required for interchangeability of parts and/or match existing equipment, this has been so stated in the Specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012500

SECTION 012976 – PROGRESS PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work: Submit Application for Payment to the Engineer in accordance with schedule established by conditions of the Contract and Agreement between Owner and Contractor.

1.2 FORMAT REQUIRED

A. Submit applications on the form provided.

B. Provide itemized data on continuation sheets of format, schedules, line items, and values specified on the Application and Certificate for Payment Form. The Contractor shall use the item descriptions and contract values included in the Schedule of Values, approved and accepted by the Engineer as a basis for preparation of the Application for Payment Form.

1.3 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

A. Application Form:

1. Fill in required information, including that for Change Orders executed prior to date of submittal of application.

2. Fill in percent complete for each activity and dollar values to agree with respective percents.

3. Execute certification with signature of a responsible officer of the Contractor.

B. Continuous Sheets:

1. Fill in total of all scheduled component items of the Work, with item number and schedule dollar value for each item.

2. Fill in dollar value in each column for each scheduled line item when Work has been performed or products stored. Round off values to nearest dollar, or as specified for Schedule of Values.

3. List each Change Order executed prior to date of submission, at the end of the continuation sheets. List by Change Order Number, and description, as for an original component item Work.

4. To receive approval for payment on component material stored on site, submit copies of the original invoices with Application and Certificate for Payment.

5. As provided for in the Application and Certificate for Payment Form, the Contractor shall certify, for each current pay request, that all previous progress payments received from the

Owner, under this Contract, have been applied by the Contractor to discharge in full, all obligations of the Contractor in connection with Work covered by prior Applications for Payment, and all materials and equipment incorporated into the Work are free and clear of all liens, claims, security interest, and encumbrances. Contractor shall attach to each Application and Certificate for Payment like affidavits by all subcontractors.

1.4 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. Contractor shall submit suitable information, with a cover letter identifying:

1. Project.

2. Application number and date.

3. Detailed list of enclosures.

4. For stored products:
   a. Item number and identification as shown on application.
   b. Description of specific material.

B. Submit one (1) copy of data and cover letter for each copy of application.

C. The Contractor is to maintain an updated set of drawings to be used as record drawings. As a prerequisite for monthly progress payments, the Contractor is to exhibit the updated record drawings for review by the Owner and the Engineer.

D. Each monthly Application for Payment shall incorporate the corresponding “monthly progress status report” and updated construction schedule, prepared in accordance the applicable Specification section.

E. As a prerequisite for payment, Contractor shall submit a duly executed letter from surety consenting to payment due and progress to date.

F. Provide construction photographs in accordance with applicable Specification sections.

1.5 PREPARATION OF APPLICATION FOR FINAL PAYMENT

A. Fill in application form as specified for progress payments.

B. Furnish evidence of completed operations and insurance in accordance with the General Conditions.

C. Provide Contractor’s final release of lien and other close-out submittals as required by the General Conditions.

1.6 SUBMITTAL PROCEDURE

A. Submit Application for Payment to the Engineer at the time stipulated in the Agreement, or as agreed to at the pre-construction meeting. Review the percentage complete with the Engineer and resolve any conflict or discrepancies.

B. Application for Payment to be submitted electronically in color for processing and payment.

C. When the Engineer finds the Application and Certificate for Payment Form is properly completed and correct, they will execute the Certificate for Payment and transmit the forms to the Owner, with a copy to the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012976

SECTION 013119 – PROJECT MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work:

1. The Contractor shall coordinate with the Engineer to schedule and administer the preconstruction meeting, resident meeting, utility coordination, periodic progress meetings, and specifically called meetings throughout the progress of the Work.

2. The Engineer shall:
   a. Prepare agenda for meetings.
   b. Make physical arrangements for meetings.
   c. Preside at meetings.
   d. Take and distribute meeting minutes.

3. The Contractor shall:
   a. Attend all meetings along with pertinent subcontractors and suppliers.
   b. Appoint attendees who are qualified and authorized to act on behalf of the entity each represents.
   c. Provide requested information at meetings.
   d. Provide revised CPM schedule and a three-week look-ahead schedule.

4. The Owner shall:
   a. Attend meetings to ascertain that the Work is expedited consistent with Contract Documents and construction schedules.

1.2 PRECONSTRUCTION MEETING

A. Purpose: To initiate coordination of contractual requirements prior to start of work.

B. Scheduling: Engineer will schedule a preconstruction meeting after execution of the Contract. Invites shall be sent via electronic mail.

C. Location: A local site, convenient for all parties, designated by the Engineer/Owner.

D. Attendance:

1. Owner's representative.

2. Engineer

3. Resident project representative.

4. Contractor and their superintendent.

5. Major subcontractors.

6. Representatives of major suppliers and manufacturers, as appropriate.

7. Governmental and franchised utility representatives, as appropriate.

8. Permit agency representatives, as appropriate.

9. Funding agency representatives, as appropriate.

10. Others as requested by the Contractor, Owner, and Engineer.

E. Suggested Agenda:

1. Introductions and Roles

2. Contract Execution and Dates
   a. Contracts
   b. Contract Time/Dates
   c. Copies of Conformed Documents

3. Communications
   a. Lines of Communication
   b. Coordination Meetings
   c. Contact List
   d. Requests for Information (RFIs)

4. Preconstruction Matters
   a. Submittals
   b. Material Acquisition
   c. Mobilization
   d. Permitting

5. Construction/Coordination
   a. Working Days/Hours
   b. Change Orders
   c. Locating Existing Facilities
   d. Demolition
   e. Testing
   f. Updated Schedules

6. Pay Requests
   a. Process
   b. Schedule of Values
   c. Stored Materials
   d. Preliminary As-Builts

7. Contract Closeout
   a. Substantial Completion
   b. Punch-list
   c. Final Acceptance

d. Warranty
e. Final Payment

1.3 RESIDENT MEETING(S) – NOT REQUIRED

A. Purpose: To present construction approach to affected residents and to allow residents to ask questions concerning such.

B. Scheduling: Engineer/Owner will schedule resident meeting(s) after preconstruction meeting is held, but before construction begins. Invites shall be distributed via electronic mail and hard copy flyers. Contractor shall assist in the distribution of flyers.

C. Location: A local site, convenient for all parties, designated by the Engineer/Owner.

D. Attendance:

1. Owner's representative.

2. Engineer.

3. Resident project representative.

4. Contractor and their superintendent.

5. Major subcontractors, as appropriate.

6. Residents.

E. Suggested Agenda: To be determined by Engineer/Owner

1.4 UTILITY COORDINATION MEETING(S) – NOT REQUIRED

A. Purpose: To discuss the coordination of the construction with existing and proposed utilities.

B. Scheduling: Engineer will schedule utility coordination meeting(s) as needed. These meetings may be held in conjunction with Progress Meetings. Invites shall be distributed via electronic mail.

C. Location: A local site, convenient for all parties, designated by the Engineer/Owner.

D. Attendance:

1. Owner's representative.

2. Engineer.

3. Resident project representative.

4. Contractor and their superintendent.

5. Major subcontractors, as appropriate.

6. Utility representatives.

E. Suggested Agenda: To be determined by Engineer.

1.5 PROGRESS MEETINGS

A. Purpose: To discuss the progress of the construction and projected work activities.

B. Scheduling: Engineer will schedule progress meetings on a regular basis at a maximum frequency of once per week or less frequently, i.e. once per month, depending on the level of communication required for the project. Invites shall be distributed via electronic mail.

C. Location: A local site, convenient for all parties, designated by the Engineer/Owner.

D. Attendance:

1. Owner's representative.

2. Engineer and sub-consultants, as appropriate.

3. Resident project representative.

4. Contractor and their superintendent.

5. Major subcontractors, as appropriate.

6. Utility representatives, as appropriate.

7. Permit agency representatives, as appropriate.

8. Funding agency representatives, as appropriate.

E. Suggested Agenda:

1. Work progress since last meeting

2. Work scheduled this period

3. Field observations, problems and conflicts.

4. Construction schedule
   a. Status of current schedule
   b. Issues impacting schedule
   c. Fabrication and delivery schedules
   d. Corrective measures to regain projected schedule

5. Submittals

6. RFIs

7. Pending Changes and Substitutions
8. Quality Control
9. Pay Requests
10. Other Business

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 013119

SECTION 013233 – PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Scope of Work: The Contractor shall employ a competent photographer to take construction record photographs and video recording prior to start of the Work, periodically during the course of the Work, and following the completion of the Work.

B. Summary: This section includes administrative and procedural requirements for the following:

1. Preconstruction photographs. – NOT REQUIRED
2. Preconstruction video recordings.
3. Periodic Construction ground and aerial photographs. – NOT REQUIRED
4. Periodic Construction video recordings. – NOT REQUIRED
5. Construction completion photographs. – NOT REQUIRED
6. Web-based construction photographic documentation. NOT REQUIRED

C. Photographs and videos shall be taken in conformance with this Section and shall be furnished to the Engineer with each pay request. Failure to comply will result in rejection of pay request.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of the Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include the same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three (3) days of taking photographs

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:
   a. Name of Project.
   b. Name and contact information for photographer.
   c. Name of Engineer.
   d. Name of Contractor.
   e. Date photograph was taken.

f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Unique sequential identifier keyed to accompanying key plan.

C. Construction Photographs: Submit two (2) prints of each photographic view within seven (7) days of taking photographs.

1. Format: Electronic submittal to Engineer.

2. Identification: With each submittal, provide the following information:
a. Name of Project.
b. Name and contact information for photographer.
c. Name of Engineer and Construction Manager.
d. Name of Contractor.
e. Date photograph was taken if not date stamped by camera.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Unique sequential identifier keyed to accompanying key plan.

D. Video Recordings: Submit video recordings within seven (7) days of recording.

1. Submit video recordings in digital video disc format acceptable to Engineer by posting to Web-based photographic documentation service provider's Web site.

2. Identification: With each submittal, provide the following information:
a. Name of Project.
b. Name and address of photographer.
c. Name of Engineer and Construction Manager.
d. Name of Contractor.
e. Date video recording was recorded.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Weather conditions at time of recording.

E. Web-Based Photographic Documentation: Submit time-lapse sequence video recordings simultaneously with recording within seven (7) days of recording.

1. Submit time-lapse sequence video recordings by posting to Web-based photographic documentation service provider's Web Site, identify the posting location. A digital video disc is required monthly.

2. Identification: For each recording, provide the following information:
a. Name of Project.
b. Name and contact information for photographer.
c. Name of Engineer and Construction Manager.
d. Name of Contractor.
e. Date(s) and time(s) video recording was recorded.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Weather conditions at time of recording.

1.3 COST OF PHOTOGRAPHY

A. The Contractor shall pay costs for specified ground and aerial photography, videography, and web-based documentation.

1.4 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three (3) years.

B. Digital photographs may be taken by the Contractor's personnel but must be of professional quality as herein specified. Photographs which are deemed unsatisfactory will be rejected and retakes will be required.

C. Web-Based Photographic Documentation Service Provider: A firm specializing in providing photographic equipment, Web-based software, and related services for construction projects with record of providing satisfactory services similar to those required for the Project.

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from the Photographer to the Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

B. Digital Video Recordings: Provide high-resolution digital video disc in format acceptable to Engineer.

2.2 WEB-BASED PHOTOGRAPHIC DOCUMENTATION

A. Project Camera: Provide fixed exterior camera installation, mounted to provide unobstructed view of construction site from location approved by Engineer.

1. Provide **(Insert Number)** fixed-location camera(s), with the following characteristics:
   a. Static View, remotely controllable view with mouse click user navigation for horizontal pan, vertical tile and optical zoom of 500 percent minimum.
   b. Capable of producing minimum 3.0-megapixel pictures.
   c. Provide power supply, active high-speed data connection to service provider’s network, and static IP address for each camera.

B. Wireless Hand-Held Cameras: Provide portable camera system capable of producing images complying with requirements in this section, with wireless transmission to service provider's network enabling a live image stream viewable by multiple parties.

1. Provide battery charger, spare battery pack, base station hub, and base station connections in a number and distribution adequate to enable wireless camera operation throughout the Project site.

2. Provide power supply, active high-speed data connection to service provider's network, and static public IP address at base station hub and base station connections.

C. Web-Based Image Access: Password-protected access for project team administered by Contractor, providing current image access and archival image access by date and time, with images downloadable to viewer's device.

1. Provide public viewer open access to most recent project camera image.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.

2. Field Office Images: Maintain one (1) set of images accessible in the field office at the Project site, available always for reference. Identify images in the same manner as those submitted to Engineer and Construction Manager.

D. Preconstruction Photographs: Before starting construction, take photographs of the Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Engineer and Construction Manager.

1. Flag excavation areas and construction limits before taking construction photographs.

2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.

3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

E. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Engineer and Construction Manager Directed Construction Photographs: From time to time, Engineer and Construction Manager will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

G. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.

1. Frequency: Take photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment.

2. Vantage Points: Following suggestions by Engineer and Construction Manager and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time to create a time-lapse sequence as follows:
   a. Commencement of the Work, through completion of subgrade construction.
   b. Above-grade structural framing.
   c. Exterior building enclosure.
   d. Interior Work, through date of Substantial Completion.

H. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Engineer and Construction Manager will inform photographer of desired vantage points.

1. Do not include date stamp.

I. Additional Photographs: Engineer or Construction Manager may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.

1. Three (3) days' notice will be given, where feasible.

2. In emergency situations, take additional photographs within 24 hours of request.

3. Circumstances that could require additional photographs include, but are not limited to, the following:
   a. Special events planned at the Project site.
   b. Immediate follow-up when on-site events result in construction damage or losses.
   c. Photographs to be taken at fabrication locations away from the Project site. These photographs are not subject to unit prices or unit-cost allowances.
   d. Substantial Completion of a major phase or component of the Work.
   e. Extra record photographs at time of final acceptance.

f. Owner's request for special publicity photographs.

J. Periodic Aerial Construction Photographs: Provide at least two (2) aerial photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

3.2 CONSTRUCTION VIDEO RECORDINGS

A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings. Time must be accurate and continuously generated.

B. Recording: Mount camera on tripod before starting recording unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at the Project site.

C. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.

1. Confirm date and time at beginning and end of recording.

2. Begin each video recording with name of the Project, Contractor's name, videographer's name, and Project location.

D. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.

E. Preconstruction Video Recording: Before starting construction, record video recording of the Project site and surrounding properties from different vantage points, as directed by Engineer and Construction Manager.

1. Flag excavation areas and construction limits before recording construction video recordings.

2. Show existing conditions adjacent to the Project site before starting the Work.

3. Show existing buildings either on or adjoining the Project site to accurately record physical conditions at the start of construction.

4. Show protection efforts by Contractor.

F. Periodic Construction Video Recordings: Record video recording monthly, coinciding weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be thirty (30) minutes.

G. Time-Lapse Sequence Construction Video Recordings: Record video recording to show status of construction and progress.

1. Frequency: During each of the following construction phases, set up video recorder to automatically record one frame of video recording every five (5) minutes, from same vantage point each time, to create a time-lapse sequence of thirty (30) minutes in length as follows:
   a. Commencement of the Work, through completion of subgrade construction.
   b. Above-grade structural framing.
   c. Exterior building enclosure.

2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight construction work hours.

3. Vantage points: Following suggestions by Engineer and Construction Manager and Contractor, photographer shall select vantage points.

3.3 WEB-BASED CONSTRUCTION PHOTOGRAPHIC DOCUMENTATION

A. Live Streaming Construction Site Images: Provide Web-accessible image of current site image from fixed, viewer-controlled, location camera(s), updated at 15-minute intervals during daytime operation.

B. Time-Lapse Sequence Construction Site Recordings: Provide video recording from a fixed location camera to show status of construction and progress.

1. Frequency: Record one (1) frame of video recording every 15 minutes, from same vantage point each time, to create a time-lapse sequence of construction activities.

2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight construction work hours.

C. Maintain cameras and Web-based access in good working order according to Web-based construction photographic documentation service provider's written instructions until final completion. Provide for service of cameras and related networking devices and software.

3.4 DELIVERY OF PHOTOGRAPHS AND VIDEOS

A. Photographs and videos will be delivered electronically following Specifications above with a coordinating log, to the Engineer as attachment to Application for Payment.

B. Distribution of construction photographs, as soon as processed, is anticipated to be as follows:

1. Engineer one (1) set.

2. Project record file one (1) set to be stored by Contractor until the end of the project which shall then be delivered with Project Record Documents.

3. Contractor one (1) set.

END OF SECTION 013233

SECTION 013323 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the Engineer for review and approval, such working drawings, shop drawings, test reports and data on materials and equipment, and material samples materials list, certificates and affidavits as are required for the proper control of work, including but not limited to those working drawings, shop drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.

B. Within 20 calendar days after the Effective Date of the Agreement, the Contractor shall submit to the Engineer a complete materials list of preliminary data on items for which Shop Drawings are to be submitted. Included in this materials list shall be the names of all proposed manufacturers furnishing specified items. Review of this list by the Engineer shall in no way be expressed or implied relief to the Contractor from submitting complete Shop Drawings and providing material, equipment, etc., fully in accordance with the Specifications. This procedure is required in order to expedite final review of Shop Drawings.

C. The Contractor shall maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the Owner and the Engineer. This log shall include the following items:

1. Submittal Description and Number assigned.
2. Date submitted to Engineer
3. Date returned to Contractor (from Engineer).
4. Status of Submittal (Approved, Approved as Noted, Not Approved/Resubmit).
5. Date of Resubmittal and Return (as applicable).
6. Date of material release (for fabrication).
7. Projected date of fabrication.
8. Projected date of delivery to site.
9. Status of O&M manuals submitted.
10. Specification Section.
11. Drawings Sheet Number.

1.2 CONTRACTOR'S RESPONSIBILITY

A. It is the duty of the Contractor to check all drawings, data and samples prepared by or for them before submitting them to the Engineer for review. Each and every copy of the drawings and data shall bear Contractor's stamp and signature showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp and signature will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the Contract Documents. If the Contractor takes exception to the Specifications, the Contractor shall note the exception in the letter of transmittal to the Engineer. Shop drawings submittals shall not be used as a vehicle for requesting approval of substitute or alternative equipment and materials. Substitution requests will be considered only when submitted in accordance with the applicable provisions.

B. Determine and Verify:

1. Field measurements.

2. Field construction criteria.

3. Catalog numbers and similar data.

4. Conformance with Specifications.

C. The Contractor shall furnish the Engineer a schedule of Shop Drawings submittals fixing the respective dates for the submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall indicate those that are critical to the progress schedule.

D. The Contractor shall not begin any of the work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned to the Contractor, by the Engineer, with approval.

E. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than 30 calendar days for checking and appropriate action from the time the Engineer receives them.

F. All submittals shall be accompanied by a transmittal letter prepared in duplicate containing the following information:

1. Date.

2. Project Title and Number.

3. Contractor's name and address.

4. Notification of deviations from Contract Documents.

5. Submittal Log Number conforming to Specification Section Numbers.

G. The Contractor shall submit descriptive or product data submittals/drawings electronically to the Engineer. The Engineer will review the submittals/drawings and return marked-up submittals/drawings with appropriate review comments electronically to the Contractor.

H. Once submittals/drawings are approved, they are to be distributed electronically to the Owner, Engineer and Contractor.

I. The Contractor shall be responsible for and bear all costs of damages which may result from the ordering of any material or from proceeding with any part of work prior to the completion of the review by Engineer of the necessary shop drawings.

J. The Contractor shall be fully responsible for observing the need for and making any changes in the arrangement of piping, connections, wiring, manner of installation, etc., which may be required by the materials/equipment they proposed to supply both as pertaining to their own work and any work affected under other parts, headings, or divisions of Drawings and Specifications.

1.3 ENGINEER'S REVIEW OF SHOP DRAWINGS

A. The Engineer's review of drawings, data and samples submitted by the Contractor will cover only general conformity to the Specifications, external connections, and dimensions which affect the installation. The Engineer's review and exceptions, if any, will not constitute an approval of dimensions, quantities, and details of the material, equipment, device, or item shown.

B. The review of drawings and schedules will be general, and shall not be construed:

1. As permitting any departure from the Contract requirements;

2. As relieving the Contractor of responsibility of any errors, including details, dimensions, and materials;

3. As approving departures from details furnished by the Engineer, except as otherwise provided herein.

C. If the drawings or schedules as submitted describe variations and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings, without noting an exception.

D. When reviewed by the Engineer, each of the Shop Drawings will be identified as having received such review, being so stamped and dated. Shop Drawings stamped "NOT APPROVED/RESUBMIT" and with required corrections shown will be returned to the Contractor for correction and re-submittal.

E. Resubmittals will be handled in the same manner as first submittals. On Resubmittals the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by the Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.

F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer.

G. Shop Drawings and submittal data shall be reviewed by the Engineer for each original submittal and first Resubmittal; thereafter review time for subsequent Resubmittals shall be charged to the Contractor in accordance with the terms of the Engineer's Agreement with the Owner.

H. When the Shop Drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

I. No partial submittals will be reviewed. Submittals not complete will be returned to the Contractor for Resubmittal. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items for:

1. Systems

2. Processes

3. As indicated in Specifications, all drawings, schematics, manufacturer's product data, certifications and other shop drawing submittals required by a system specification shall be submitted at one time as a package to facilitate interface checking.

1.4 SHOP DRAWINGS

A. When used in the Contract Documents, the term "Shop Drawings" shall be considered to mean Contractor's plans for materials and equipment which become an integral part of the Project. These drawings shall be completed and detailed. Shop Drawings shall consist of fabrication, erection and setting drawings and schedule drawings, manufacturer's scale drawing, and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature, and performance and test data shall be considered only as supportive to required shop drawings as defined above. As used herein, the term "manufactured" applied to standard units usually mass-produced; and "fabricate" means items specifically assembled or made out of selected materials to meet individual design requirements.

B. Manufacturer's catalog sheets, brochures, diagrams, illustrations and other standard descriptive data shall be clearly marked to identify pertinent materials, product or models. Delete information which is not applicable to the Work by striking or cross-hatching.

C. Drawings and schedules shall be checked and coordinated with the work of all trades involved, before they are submitted for review by the Engineer and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval shall be returned to the Contractor for resubmission.

D. Each Shop Drawing shall have a transmittal sheet. The transmittal sheet shall display the following:

1. Project title and number.

2. Name of project building or structure.

3. Number and title of the shop drawing.

4. Date of shop drawing or revision.

5. Name of Contractor and subcontractor submitting drawing.

6. Supplier/manufacturer.

7. Separate detailer when pertinent.

8. Specification number.

9. Drawing number.

A Letter of Transmittal Excel document shall be provided to the Contractor per request.

E. If drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in their letter of transmittal. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations, they shall not be relieved of the responsibility for executing the work in accordance with the Contract, even though such drawings have been reviewed.

F. Data on materials and equipment include, without limitation, materials and equipment lists, catalog data sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material. Materials and equipment lists shall give, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.

G. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name, address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.

H. All manufacturers or equipment suppliers who are proposed to furnish equipment or products shall submit an installation list to the Engineer along with the required shop drawings. The installation list shall include at least five (5) installations where identical equipment has been installed and has been in operation for a period of at least one (1) year.

I. Only the Engineer will utilize the color "red" in marking shop drawing submittals.

1.5 WORKING DRAWINGS

A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's plan for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, ground water control systems, forming and false work; for underpinning; and for such other work as may be required for construction but does not become an integral part of the project.

B. Copies of working drawings as noted in paragraph 1.5A. above, shall be submitted to the Engineer where required by the Contract Documents or requested by the Engineer, and shall be submitted at least 30 calendar days (unless otherwise specified by the Engineer) in advance of their being required for work.

C. Working drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculations or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Review of working drawings by the Engineer will not relieve the Contractor in any way from their responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the Contractor; the Owner and Engineer shall have no responsibility therefore.

1.6 SAMPLES

A. The Contractor shall furnish, for the approval of the Engineer, samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until approved by the Engineer.

B. Samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.

2. Full range of color, texture and pattern.

3. A minimum of two (2) samples of each item shall be submitted.

C. Each sample shall have a label indicating:

1. Name of project.

2. Name of Contractor and subcontractor.

3. Material or equipment represented.

4. Place of origin.

5. Name of producer and brand (if any).

6. Location in project.

7. Submittal Number.

8. (Samples of finished materials shall have additional marking that will identify them under the finish schedules).

D. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required in paragraph 1.6B above. The Contractor shall enclose a

copy of this letter with the shipment and send a copy of this letter to the Engineer. Approval of a sample shall be only for the characteristics or use names in such approval and shall not be construed to change or modify any Contract requirements.

E. Approved samples not destroyed in testing shall be sent to the Engineer or stored at the site of work. Approved samples of the hardware in good condition will be marked for identification and may be used in the work. Materials and equipment incorporated in work shall match the approved samples. Samples which failed testing or were not approved will be returned to the Contractor at their expense, if so, requested at time of submission.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 013323

SECTION 014529 – TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work:

1. Contractor will employ and pay for services of an independent testing laboratory to perform testing specifically indicated on the Contract Documents or specified in the Specifications herein and may at any other time elect to have materials and equipment tested for conformity with the Contract Documents.

2. Contractor shall cooperate with the laboratory to facilitate the execution of its required services.

3. Contractor shall provide Engineer with all test results as indicated herein within five (5) days of receipt.

B. The following schedule defines the responsibility for various tests.

Test	Notes	Paid for By
Soil Compaction	Pipe Work: every 300 ft. at each lift of compaction minimum. Beneath Structures: each 500 sq. ft. lift of compaction minimum and each lift around structures.	Contractor
Pressure	As specified	Contractor
Bacteriological	As required by local and state agencies.	Contractor
LBR	Each 1500 SF of pavement (minimum).	Contractor
Concrete	Slump test each delivery and compression test five cylinders every 50 C.Y. (minimum).	Contractor

C. Additional Tests: The Contractor shall pay for first tests as specified herein. In the event that first test samples do not meet the applicable material Specification, the Contractor shall take measures to conform the material and equipment to the Specifications. All subsequent tests shall be paid for by the Contractor at no additional cost to the Owner.

1.2 LABORATORY TESTS

A. The materials listed below shall require advance and periodic laboratory tests as indicated, and shall be sampled in accordance with the methods of the A.S.T.M. and as directed by the Engineer. With the exception of concrete test cylinders and mixing water, duplicate advance samples of all materials requiring laboratory tests shall be submitted to the Engineer, one of which will be certified by the Engineer for submission to the testing laboratory and the other retained on the job

site in suitable storage provided by the Contractor. Except as noted below, preliminary samples of materials for advance laboratory tests shall be submitted at least two (2) weeks prior to starting delivery of such materials to the site of the project. The testing laboratory shall furnish both the Engineer and the Contractor with two (2) copies of the reports showing the results of such tests, and the reports shall be considered as sufficient evidence of the acceptance or rejection of the quality of the materials tested. The Specifications for, and the method of testing, will be found under the detailed Specifications for the particular material involved. All samples shall be properly packed and clearly marked as to source and intended use.

MATERIALS	TEST FREQUENCY	SAMPLE SIZE	SHIPPING CONTAINER
Fine Aggregate	Advance, first shipment then each 100 tons	100 lbs.	Canvas Sack
Coarse Aggregate	Advance, first shipment then each 200 tons	Stone or Gravel 200 lbs.	Strong Sack
Concrete	Advance test using approved materials	4 cylinders per mix, 2 broken at 7 days, 2 at 28 days	
Concrete (b) Air Entrainment	Advance test on trial mix air entraining agent is used. Test as specified under Article 405 (e)		

1.3 TESTS

A. The materials listed below shall be tested at the shop or plant of, and by, the producer. Each manufacturer of such materials shall be fully equipped to carry out the tests herein designated. Upon demand of the Engineer, the manufacturer shall perform such additional number of tests as the Engineer may deem necessary to establish the quality of the material offered for use. The Engineer shall be furnished with the certified records of reports of the results of all tests, such reports of records to contain a sworn statement that the tests have been made as specified.

MATERIAL	TEST METHOD
Cement	ASTM C114
Ductile Iron Pipe (Centrifugally Cast)	As required under ANSI A21.51-1176
Brick	ASTM C-32
Reinforcement	ASTM A-15 & A-305

1.4 FIELD TESTS

A. All sewers, water lines, piping and equipment shall be tested in the field in the presence of the Engineer or their authorized representative, in the manner prescribed in the sections of these Specifications pertaining to such installations. The Engineer may also perform or have performed any other field tests necessary to determine compliance with the Contract requirements. The Contractor shall furnish all necessary labor, equipment, and materials for such tests and, with the exception of the Engineer's expenses, shall bear all the cost thereof.

1.5 PAVING TESTS

A. The following tests will be made, unless otherwise stipulated by the Engineer, by a testing laboratory approved by the Engineer:

Material	Test or Test Method	Frequency
Subbase	1) AASHO T-180 (Modified Proctor Minimum 98% Density)	Every 300 LF
	2) Lime rock Bearing Ratio 40	Every 300 LF
Base	(Soil Cement) (1) Mix Design 350 psi @ 28 days. Mix design required 7 days in advance.	Prior to Mixing Base
	(2) Optimum Moisture content and Maximum Density (AASHTO T-134)	Every 300 LF
	(3) LBR 100	Every 1500 sf
	(4) Depth (6-inch minimum)	Every 300 feet
Paving	(1) Job Mix Formula. Required 7 days in advance and submit to Engineer	Each Job
	(2) Bitumen Content of Mix	Every 2500 SY or fraction thereof
	(3) In Place Density	Every 300' (left, right & center)
	(4) Marshall Field Stability Index	Every 1500 SY or fraction thereof
	(5) Thickness Cores	Every 300' (left, right, & center)

1.6 Basis of Payment

A. All shop tests and mill inspection shall be included in the price of the manufactured article, and no separate or extra payment will be made for such tests and inspection.

B. All laboratory and field tests will be paid for by the Contractor. Contractor shall furnish all necessary labor, equipment and materials for such tests and, with the exception of the Engineer's expenses, shall bear all the costs thereof.

1.7 LABORATORY DUTIES: LIMITATIONS OF AUTHORITY

A. Cooperate with Engineer and Contractor; provide qualified personnel promptly on notice.

B. Perform specified inspections, sampling and testing of materials and methods of construction:

1. Comply with specific standards; ASTM, other recognized authorities, and as specified.

2. Determine and report on compliance with requirements of Contract Documents.

C. Promptly notify the Engineer and Contractor of material or operations which do not meet the Specifications.

D. Promptly submit one (1) original and (1) electronic copy of reports of inspections and tests to the Engineer including:

1. Date issued.

2. Project title and Engineer's job number.

3. Testing Laboratory name and address.

4. Name and signature of inspector.

5. Date of inspection of inspector.

6. Date of inspection or sampling.

7. Date of test.

8. Identification of product and Specification section.

9. Location in project.

10. Type of inspection or test.

11. Compliance with Contract Documents or not.

E. Laboratory is not authorized to:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Approve or reject any portion of work.

3. Perform any duties of the Contractor.

1.8 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel; provide access to Work and manufacture's operations.

B. Secure and deliver to the laboratory adequate representational samples of materials purposed to be used and which require testing.

C. Provide to the laboratory the preliminary design mix proposed to be for concrete, and other materials mixes which require control by the testing laboratory.

D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacturer of fabrication. Standard Specifications for quality and workmanship are indicated in the Contract Documents. The Engineer may require the Contractor to provide statements or certificates from the manufacturers and fabricators that in full accordance with the standard Specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the Owner shall be allowed on account of such testing and certification.

E. Furnish incidental labor and facilities:

1. To provide access to Work to be tested.

2. To obtain and handle samples at the Project site or at the source of the product to be tested.

3. To facilitate inspections and tests.

4. For storage and curing of test samples.

5. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 014529

SECTION 017113 – MOBILIZATION

PART 1 - GENERAL

1.1 DEFINITION AND SCOPE

A. Mobilization shall include the obtaining of all permits, insurance, and bonds; moving onto the site of all plant and equipment; furnishing and erecting plants, temporary buildings, and other construction facilities; all as required for the proper performance and completion of the Work. Mobilization shall include, but not be limited to, the following principal items.

1. Move onto the site all Contractors' material and equipment required for first month operations.

2. Install temporary construction power, wiring, and lighting facilities.

3. Establish fire protection plan and safety program.

4. Secure construction water supply.

5. Provide field office trailers for Contractor and as may be specified for Owner and Engineer.

6. Provide on-site sanitary facilities and potable water facilities as specified.

7. Arrange for and erect Contractor's work and storage yard and employee's parking facilities.

8. Submit all required insurance certificates and bonds.

9. Obtain all required permits.

10. Post all OSHA, EPA, Department of Labor, and all other required notices.

11. Have Contractor's superintendent at the job site full time.

12. Submit a detailed construction CPM schedule acceptable to the Engineer as specified.

13. Submit a schedule of values of the Work.

14. Submit a schedule of submittals.

1.2 DEMOBILIZATION

A. Demobilization is the timely and proper removal of all Contractor-owned material, equipment or plant, from the job site and the proper restoration or completion of work necessary to bring the site into full compliance with the contract documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 017113

SECTION 017833 – BONDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work:

1. Compile specified bonds as specified in these Specifications.

2. Co-execute submittals when so specified.

3. Review submittals to verify compliance with Contract Documents.

4. Submit to Engineer for review and transmittal to Owner.

1.2 SUBMITTAL REQUIREMENTS

A. Assemble bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Number of original signed copies required: Two (2) each.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product of work item.

2. Firm, with name of principal, address and telephone number.

3. Scope.

4. Date of beginning of bond or service and maintenance contract.

5. Duration of bond or service maintenance contract.

6. Provide information for Owner's personnel:
   a. Proper procedure in case of failure.
   b. Instances which might affect the validity of warranty or bond.

7. Contractor, name of responsible principal, address and telephone numbers.

D. Bonds are required to be recorded with the applicable County Clerk of Court.

1.3 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8 ½ inches x 11 inches, punch sheets for standard three-post binder.
   a. Fold larger sheets to fit into binders.

2. Cover: Identify each packet with typed or printed title "BONDS". List:
   a. Title of Project.
   b. Name of Contractor.

C. Binders: Commercial quality, three-post binder, with durable and cleanable plastic covers and maximum post width of two inches.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 017833

SECTION 017836 – WARRANTIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work:

1. Compile specified warranties as specified in these Specifications.

2. Co-execute submittals when so specified.

3. Review submittals to verify compliance with Contract Documents.

4. Submit to Engineer for review and transmittal to Owner.

5. Resubmittals to Engineer for review and transmittal to Owner when required.

1.2 SUBMITTAL REQUIREMENTS

A. Assembly warranties and service and maintenance contracts, executed and certified by each of the respective manufacturers, suppliers, and subcontractors. Organize by Specification section number and the name of the product, work item, or subcontractor.

B. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product of work item.

2. Supplier and manufacturer firm, point of contact, address and telephone number.

3. Scope.

4. Date of beginning of warranty or service and maintenance contract.

5. Duration of warranty or service maintenance contract.

6. Provide information for Owner's personnel:
   a. Proper procedure in case of failure.
   b. Instances which might affect the validity of warranty.

7. Contractor, name of responsible principal, email address, mailing address and telephone numbers.

1.3 FORM OF SUBMITTALS

A. Electronic copy in PDF format.

B. Final warranty shall be provided as required by the Specifications.

1.4 WARRANTY SUBMITTALS REQUIREMENTS

A. For all major pieces of equipment, submit a warranty issued from the equipment manufacturer. Manufacturer's warranty period shall be concurrent with Contractor's for one (1) year, unless otherwise specified, commencing at the time of final acceptance by Owner.

B. Contractor shall be responsible for obtaining certificates for equipment warranty for all major equipment which has at least a 1 hp motor or which lists for more than $2,500. Engineer reserves the right to request warranties for equipment not classified as major. Contractor shall still warrant equipment not considered to be "major" in the Contractor's warranty period even though certificates of warranty may not be required.

C. In the event that the equipment manufacturer or supplier is unwilling to provide a one-year warranty commencing at the time of Owner final acceptance, the Contractor shall obtain from the manufacturer a two (2) year warranty commencing at the time of equipment delivery to the job site. This two (2) year warranty from the manufacturer shall not relieve the Contractor of the one-year warranty starting at the time of Owner acceptance of the equipment.

D. Owner shall incur no labor or equipment cost during the guarantee period.

E. Guarantee shall cover all necessary labor, equipment and replacement parts resulting from faulty or inadequate design, improper assembly or erection, defective workmanship and materials, leakage, breakage or other failure of all equipment and components furnished by manufacturer.

F. Warranties specified for materials and equipment shall be in addition to, and run concurrent with, both Contractor's general warranty and the correction period requirements.

G. Disclaimers and limitations in specific materials and equipment warranties do not limit Contractor's general warranty, nor does such affect or limit Contractor's performance obligations under the correction period.

1.5 WARRANTY WORK

A. Reinstatement of warranty

1. When work covered by a warranty has failed and has been corrected by replacement or rebuilding, the Contractor shall reinstate the warranty by written endorsement.
    a. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

1.6 IMPLIED WARRANTIES

A. Warranty of title and intellectual rights:

1. Except as may be otherwise indicated in the Contract Documents, implied warranty of title required by Laws and Regulations is applicable to the Work and to materials and equipment incorporated therein.

2. Provisions on intellectual rights, including patent fees and royalties, are in the General Conditions, as may be modified by the Supplementary Conditions.

B. Implied warranties: Duration in accordance with Laws and Regulations.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 017836

SECTION 017839 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Maintain at the site for the Owner one record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications of the contract.
5. Engineer's Field Orders or written instructions.
6. Approved Shop Drawings.
7. Field Test records.
8. Construction photographs, preconstruction videos, and pipeline videos.
9. Preliminary as-built drawings.

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI format with section numbers as provided herein.

C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the Engineer.

E. As a prerequisite for monthly progress payments, the Contractor shall provide the currently updated "Record Documents" for review by the Engineer and Owner.

1.3 MARKING DEVICES

A. Provide felt tip marking pens for recording information in the color code designated by the Engineer.

1.4 RECORDING

A. Label each document. "PROJECT RECORD" in neat large printed letters.

B. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

C. Drawings: Legibly mark to record actual construction:

1. Depths of various elements of foundation in relation to finish first floor datum.

2. All underground piping with elevations and dimensions. Change to piping location. Horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements. Actual installed pipe materials, class, etc.

3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.

4. Field changes of dimensional and detail.

5. Changes made by Field Order or by Change Order.

6. Details not on original contract drawings.

7. Equipment and piping relocations.

8. Major architectural and structural changes including relocation of doors, windows, etc.

9. Architectural schedule changes according to Contractor's records or shop drawings.
   a. Contractor shall provide copies of all such recordings to the Contractor’s surveyor for incorporation into the preliminary and final as-builts drawings.

D. Specifications and Addenda: Legibly mark each section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.

2. Changes made by Field Order or by Change Order.

E. Shop Drawings (after final review and approval): Provide four (4) sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

1.5 SUBMITTAL

A. Accompany <u>each</u> submittal with transmittal letter in duplicate, containing:

1. Date.

2. Project title and number.

3. Contractor's name and address.

4. Title and number of each Record Document.

5. Signature of Contractor of their authorized representative.

B. Preliminary As-built Drawings: The Contractor shall submit to the Engineer two (2) paper copies of preliminary as-built drawings prepared and signed/sealed by the Contractor's surveyor with each monthly progress payment request. Preliminary as-built drawings shall conform to the requirements of final as-built drawings and shall represent the completed work to date. Preliminary as-built drawings shall include all work which the Contractor is requesting to be paid for.

C. Final As-built Drawings: Upon project closeout and as a prerequisite to the final pay request, the Contractor shall submit to the Engineer final as-built drawings Administrative Code, pursuant to Section 472.027 of the Florida Statutes. The Engineer shall supply the Contractor copies of AutoCAD files for the Contractor's use in the as-built drawing preparation. Final as-built drawings shall include all work which the Contractor is requesting to be paid for. The final as-built drawing submittal shall include:

1. Two (2) sets of paper plans signed and sealed by a professional land surveyor licensed in the State of Florida and CD(s) or other media containing AutoCAD, version 2015 or higher, drawing files.

2. AutoCAD drawing files shall include as-built information on layers separate from the original drawing layers and shall be named descriptively to represent the as-built features. (i.e. - Layer "wat ab" and "wat ab txt" for water as-built line work and text, respectively.) Drawing entities are to be shown on the correct layer. All as-built entities shall have color and line type set "by-layer". Text sizes shall be relative to the plotted scale. Additional details or exploded views shall be include to accurately and fully represent the as-built conditions.

3. Certification by surveyor that the as-built information shown is accurate and that all improvements shown were constructed within or on public rights-of-way, easements or property specifically owned by the Owner. Certification shall be to the Owner, Engineer and applicable Water Management District (if applicable.)

4. No line work and text shall be erased from the original design (construction) drawings during the as-built drawing preparation. Original line work or text shall be circled if accurate or stricken (not erased) if not with the accurate information noted/shown. New line work and text shall be provided to accurately show the as-built information for the constructed improvements. Revisions to design dimensions alone will not be permitted.

5. Pressure Pipeline and Utility Conduit Improvements: For utility improvement projects, horizontal locations of the constructed pipelines with respect to the right-of-way lines or other readily visible, permanent features at 100-foot minimum intervals and at critical locations such as road intersections shall be shown. For treatment plant and pump station

improvements, horizontal locations shall be provided at 20-foot intervals. Vertical locations of the constructed pipelines by elevation of centerline of pipe for above ground/exposed pipe or with respect to finished grade over buried pipe shall be shown at 100 feet minimum intervals. (i.e. final cover) For underground piping, all valves, blow-offs, stub-outs, pigging stations, fire hydrants, backflow preventers and services shall be located horizontally in relation to readily visible, permanent features with three-way horizontal dimensions less than 100 feet, each. Three-way dimensions to all buried fittings on treatment plant and pump station improvement projects shall be provided. If adequate features are not available, a station and offset dimensioning system can be used if prior approval is obtained from the Engineer. For above ground/exposed pipe, as-built dimensions between fittings or flanges shall be provided. Separations between "sanitary hazards" to potable water and reclaimed water mains per FDEP shall be shown.

6. Gravity Pipeline Improvements: Show elevations for all inverts, manhole tops, inlet throats/weirs, grate tops, etc. Show size and type of each structure. As-built length, size and type of pipes between the structures shall be shown. All service laterals and cleanouts shall be located horizontally to readily visible, permanent features with three-way horizontal dimensions less than 100 feet, each. If adequate features are not available, a station and offset dimensioning system can be used if prior approval is obtained from the Engineer. A labeling and dimension table scheme is recommended for the three way or station/offset dimensioning. (i.e. - constructed feature labeled as "A", permanent feature labeled as "B", "A"- "B" dimension shown in table for distance measured between the two. Use continuous labeling and complete single table per plan sheet.) Separations between gravity "sanitary hazards" to potable water and reclaimed water mains per FDEP shall be shown.

7. Roadway Improvements: Elevation, size and location of swales, ditches, gutter flowlines, edge of pavement, and road crown on both sides of the road if applicable shall be provided at 100-foot minimum intervals and at critical areas such as intersections and inlets/flumes. As-built points of curvature, tangent and vertical intersection, along with radii of road alignment, intersecting streets and driveways and other alignment information shall be provided.

8. Stormwater Improvements: The limits, slopes and bottom depths of stormwater ponds, swales and other retention areas shall be provided. All stormwater piping information shall conform to the Gravity Pipeline Improvement requirements. Size, type, material, and elevations of all stormwater structures, including appurtenances such as weirs, orifices, skimmer plates, etc. shall be shown. As-built information shall conform to applicable Water Management District requirements.

9. Treatment Facility Improvements: Location, size, number, and type of treatment equipment and structures shall be shown. Applicable requirements of as-built information listed herein for similar improvements shall be required.

10. Building Improvements: Finished floor elevations, ceiling heights, building locations, wall opening dimensions, equipment (electrical, mechanical, plumbing) locations, etc. shall be provided. Change of material shall be specifically noted as such.

11. Landscaping Improvements: Number, type, size, and general location of installed plant material shall be provided. Change of material shall be specifically noted as such. Location of irrigation meters, services, manual valves, automatic valves, controllers, rain

shut off switches, etc. shall be shown. Changes to the designed irrigation system shall be shown.

12. Other Improvements: Changes from the original design of other improvements such as electrical, mechanical and structural improvements shall be noted as such on the as-built drawings with the size, number, type and location of the constructed/installed improvements noted.

13. Contractor may be required to reimburse the Owner for services rendered by the Engineer for review of multiple resubmittals.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 017839

SECTION 033000 – CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The work included under this section consists of furnishing all materials, forms, transportation, and equipment, and performing all necessary labor to do all the plain and reinforced concrete work shown on the Drawings, or incidental to the proper execution of the work, or as herein specified.

B. Composition: Concrete shall be composed of cement, fine aggregate, coarse aggregate, and water so proportioned and mixed as to produce a plastic workable mixture in accordance with all requirements under this section suitable to the specific conditions of placement.

1.2 SUBMITTALS

A. All materials specified shall be certified by the producer or manufacturer that the furnished material meets the specific requirements of the Specifications. Concrete mix designs shall be submitted for approval prior to placement.

1.3 CODES AND STANDARDS

A. ACI 301 "Specifications for Structural Concrete for Buildings", ACI 318” Building Code Requirements for Structural Concrete”, ACI 347 "Recommended Practice for Concrete Formwork"; ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete"; comply with applicable provisions except as otherwise indicated.

1.4 TESTING

A. Air content shall be in accordance with American Society for Testing Materials Standard Methods C 173, one for each set of compressive strength specimens.

B. Sampling of freshly mixed concrete shall be in accordance with ASTM C172.

C. Slump: ASTM C-143

D. Test results will be reported in writing to Engineer, Contractor, Owner, and Concrete producer on same day tests are made.

E. Laboratory Reports: Submit two (2) copies of laboratory test or evaluation reports for concrete materials and mix designs.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT

A. Shall comply with the standard specifications for Portland Cement, A.S.T.M. designation C-150, Type II, or Type III (high-early), where indicated on Drawings.

2.2 CONCRETE AGGREGATE

A. Shall conform to standard specifications for concrete aggregate, A.S.T.M. Designation C-33 or to ASTM C-330. Maximum size of aggregate shall not exceed one-fifth of the narrowest dimension between reinforcing bars.

B. Fine Aggregate - Fine aggregate shall be clean, hard, strong, durable, uncoated particles of natural sand known as Lake Wales, Interlachen, or approved equal. The source, composition, quality, and gradation of the fine aggregate shall be subject aid the approval of the Engineer. Samples of the sand shall be furnished, together with certified copies of the gradation and analysis from the recognized testing laboratory.

1. The weight of extraneous or deleterious substances shall not exceed the following percentages:

Loss by Decantation	3%
Shale	1%
Clay Lumps	1%
Coal and Lignite	1%

2. The fine aggregate shall be reasonable well graded from coarse to fine and when tested by means of laboratory sieves shall meet the following requirements in percent of total weight:

Total Retained On	Percent Retained
No. 4 Sieve	0 – 5
No. 10 Sieve	3 – 30
No. 30 Sieve	30 – 70
No. 50 Sieve	65 – 95
No. 100 Sieve	95 – 100

C. Deficiencies in the percentages of the fine aggregates passing the No. 50 and No. 100 Sieves may be remedied by the addition of pozzolanic or cementitious materials excepting Portland cement. Such materials must meet the approval of the Engineer.

D. Coarse Aggregate

1. Coarse aggregate shall consist of hard, tough, durable components free from adherent coatings and vegetable matter, and shall not contain soft, friable, thin or elongated particles in quantities considered deleterious by the Engineer. Coarse aggregate shall be properly graded from fine to coarse to produce concrete of desired strength, density, and workability. The source, composition, quality, and gradation of the coarse aggregate shall be subject to the approval of the Engineer. Samples of the coarse aggregate shall be

furnished together with certified copies of the gradation and analysis from a recognized testing laboratory.

2. All coarse aggregate shall be washed and shall be free from disintegrated pieces, salt, alkali, vegetable matter and adherent coatings. The total percentage of all deleterious substances shall not exceed five percent (5%) by weight. The substances designated shall not be present in excess of the following amounts.

Loss by Decantation	1%
Clay Lumps or Other Soluble Materials	3%
Soft Fragments	5%

3. Where the cover over reinforcing is 2 inches or more, the maximum size of aggregate shall be 1/2 inches. Where the cover over reinforcing is less than 2 inches, the maximum size of aggregate shall be 3/4-inch. The maximum size of aggregate shall not exceed one-fifth of the narrowest dimension between forms nor three-fourths of the minimum clear spacing between reinforcing bars. The grading of the coarse aggregate in the concrete shall be within the following limits.

Percent Passing:	
Maximum Size Square Mesh Screen	97 – 100%
2 Maximum Size Square Mesh Screen	40 – 70%
No. 4 Sieve	0 – 6%

2.3 WATER

A. Water shall be clean and free from oil, acids, alkalis, organic materials or other injurious substances.

2.4 REINFORCEMENT

A. Reinforcing Bars: ASTM A615, Grade 60, deformed bars of USA manufacture.

B. Welded Wire Fabric: ASTM A185, gauges, spacing, and dimensions as indicated.

C. Metal Bar Supports: CRSI MSP-1, Chapter 3, Class 2, Type B, Stainless Steel Protected Bar Supports, or otherwise approved by the Engineer. Use concrete supports for reinforcement in concrete placed on grade.

D. Tie Wire: 16 gauge minimum, black, soft annealed.

E. Coupler Splice Devices: Cadweld tensions couplers, capable of developing the ultimate strength of the bar as manufactured by Erico Products, Incorporated, Solon, Ohio, or equal.

F. Epoxy coated or FRP rebar shall be used for all marine applications.

2.5 FORM WORK

A. Lumber: Douglas Fir or Larch, No. 2 grade, seasoned and surfaced on four sides.

B. Plywood: Plyform, Class 1, BB-Exterior type, mill oiled, and edge sealed, with thickness not less than 3/4-inch.

C. Medium Density Overlay (MDO) Plywood Forms: PS-1, B-B High Density Concrete Form Overlay, Class I, unoiled.

1. Butt form panels, make contact surface fully flush and seal butting holes with sponge form tape. Chamfer edges of beams and ceilings.

2. Where MDO plywood is used to form beams, do not use MDO plywood that has been patched or damaged.

D. Drip Forms: Varnished ponderosa pine or equally rigid non-staining plastic, 2-inch wide on each leg.

E. Steel Forms. Uncoated steel, 3/16-inch minimum thickness, fabricated to close tolerances, protected only by the specified release agent, braced so as not to bend, dent, or dimple under wet concrete load, vibrator impact, and tool impact. Maintain steel form in rust-free condition by use of steel wood and light grinding, followed by coats of specified release agent. Use forms that can be adjusted into true alignment without stops or ridges.

F. Glass Fiber Reinforced Plastic (FRP) Forms: Smooth coated forms, braced so as not to bend, dent or dimple under wet concrete loads, vibrator impact and tool impact, and at least 0.11 inch thick. Design forms for external bracing at piers and columns, without use of form ties.

G. Plugged Cone Form Ties: Rod type, with ends or end fasteners which can be removed without spalling the concrete and which leave a hole equal in depth to the required reinforcement clearance. Form ties shall be of a design in which the hole left by the removed end or end fastener is easily filled to match the surface of the hardened concrete. Provide removable cones 13 inches in diameter by 12 inches deep. Provide preformed mortar plugs to match the color of the concrete, recessed 3 inches, adhered with an approved two-part epoxy.

H. Weep Hole Forms: PVC polyethylene, or ABS pipe, matching color of the concrete, 4 inch inside diameter, with outlet projecting 12 inches form wall and cutoff in a plane parallel to it.

I. Circular and Elliptical Column Forms: Fabricate of two (2) pieces, clamped watertight using gaskets and without horizontal joints. Install horizontal construction joints only where indicated or as directed by the Engineer.

J. Beam Forms: Provide in one length without form joints and suitable for cambering up to 1/160 of span without distortion of profile or opening of seams.

K. Forms of Hammerhead Pier Caps: Provide in one length with adjustable soffits, bulkheads and screens as necessary to accommodate different hammerhead beam configurations. Provide no construction joints in hammerhead pier caps. Where three or fewer identical hammerhead pier caps occur within a line section, steel braced HDO plywood forms may be substituted for steel forms if:

1. Working drawings of formwork are submitted.

2. Internal form ties are regularly spaced no less than 48 inches each way and are made watertight.

3. Form ties have removable cones, which are filled to match concrete.

4. Joints in panels are fully watertight.

5. The resulting surface matches the appearance of steel formed hammerhead caps, with no visible discoloration due to form leakage.

L. Styrofoam Board: Expanded polystyrene extruded into board form, closed cell, moisture resistant, capable of maintaining indicated clear space between concrete structures.

M. Control Joint Filler: Use epoxy joint filler equal to BurkEpoxy Joint Filler to fill voids left by saw cuts and to resist against spalling caused by vehicle traffic in concrete slabs.

N. Inserts: Galvanized cast steel or galvanized welded steel, complete with anchors to concrete and fittings such as bolts, wedges and straps. Provide hanger inserts spaced to match grid of suspended ceilings.

O. Shoring: As designed and executed by Contractor to support all loads.

P. Chamfer Strips: Polyvinyl strips designed to be nailed in the forms to provide a 3/4-inch chamfer at exposed edges of concrete members.

Q. Form Release Agent: A blend of natural and synthetic chemicals that employs a chemical reaction to provide quick, easy and clean release of concrete from forms, and equal to Eucoslip, by the Euclid Chemical Company, or Release #1, by The Burke Company. Use a non-staining release agent that leaves the concrete with a paintable surface.

2.6 ADMIXTURES

A. Air Entraining Admixture: ASTM C260.

B. Water Reducing and Retarding Admixture:

1. Concrete Without Superplasticizer:
   a. Water Reducing Admixtures: ASTM C494, Type A, equal to Eucon WR-75 by the Euclid Company, Pozzolith 200N by Master Builders, Plastocrete 161 by Sika Chemical Corporation, and containing no calcium chloride.
   b. Water Reducing and Retarding Admixtures: ASTM C494, Type D, equal to Eucon Retarder-75 by the Euclid Company, Pozzolith 100 XR by Master Builders, Plastiment by Sika Chemical Corporation, and containing no calcium chloride.
   c. Accelerating Admixtures: ASTM C494, Type C or E, equal to Accelguard 80 by the Euclid Company, Darex Set Accelerator by W.R. Grace, and containing no calcium chloride.

2. Concrete with Superplasticizer:
   a. Water Reducing, High Range Admixtures: ASTM C494, Type F or G, equal to Eucon 37 by the Euclid Company, Rheobild 716 by Master Builders, Daracem 100 by W.R. Grace, Sikament by Sika Chemical Corporation, and consisting of a second generation admixture, free of chlorides and alkalis (except for those attributable to water) composed of a synthesized sulfonated complex polymer, enabling the concrete to maintain its rheoplastic state in excess of two (2) hours if necessary.
   b. Manufacturer's Job Site Representation: Provide the services of a competent field service representative from the manufacturer of each of the admixtures selected for use to provide at the job site advice and consultation on the use of the admixture materials, including the effect on the concrete in place, including recommending maximum discharge time for superplasticizer method and procedure to induce superplasticizer into mixer, quantities of admixtures to be used if variations are required because of temperature/humidity, wind or other environmental considerations, and to be available on short call at any time requested by the Owner, Contractor, or concrete producer.

3. Concrete used in Marine Applications:
   a. Micro Silica admixtures shall be used for concrete installed in marine and coastal applications. Concrete designs shall meet the appropriate requirements of EN206-1, BS 8500 and BS 5075. Contractor shall provide plant certification for all mix designs used in marine and coastal applications.

2.7 GROUT

A. Nonshrink, Nonmetallic Grout: The Burke Company's Non-Ferrous, Non-Shrink Grout, Sauereisen F-100 Level Fill, Master Builders Masterflow 713, Euclid NS Grout, or equal pre-mixed type.

B. Nonshrink Metallic Grout: The Burke Company's Metallic Spec Grout, Master Builders Embeco 636 Grout pre-mixed type, or equal.

C. Epoxy Grout: Sikadur 42 Grout-Pak, or equal, for grouting sleeves for anchor bolts, etc.

D. Clarifier Basin Grout: Class B concrete of coarse aggregate shall pass the 3/4-inch sieve.

2.8 MEMBRANE CURING COMPOUND

A. Membrane curing compound shall be wax-free, pigmented, 100 percent resin base compound such as A.C. Horn's "Horncure 30 C", Hunt Process Corporation; Southern's "All-Resin", or equal.

2.9 BONDING AGENT

A. Bonding agent shall be Colma Fix, as manufactured by Sika Chemical Corporation, of Passaic, New Jersey or equal. To be considered equal, the material must be a two-component epoxy-polysulphide resin system, and it must have a demonstrated record of strong adhesion to both wet and dry concrete in either the hardened or the plastic state. It must also be of equal strength.

2.10 ACCESSORIES

A. Precast Concrete Block Supports for Reinforcing Bars: Comply with ACI 315. Provide blocks with No. 4 dowels bent 90° to support top bars.

B. Membrane: 6 mil polyethylene film.

C. Water Stops: Polyvinyl chloride meeting all requirements of U.S. Army Corps of Engineer's Specification CRD-C-572 and equal to Burke Water Stops as manufactured by The Burke Company. Provide flat dumbbell type and center bulb type, 9 inches x 3/8-inch at wall thickness of 12 inches or greater, and 6 inches x 3/8-inch at wall thickness less than 12 inches. Provide 6-inch split-ribbed with center bulb type at connections of new concrete structures with existing concrete. Provide water stops as indicated on the Drawings.

D. Preformed Expansion Joint Filler:

1. Bituminous type conforming to the requirements of ASTM D994.

2. Nonextruding type, self-expanding cork, 3/4-inch thick or as otherwise shown on the Drawings, conforming to the requirements of ASTM D1752, Type III, and compatible with the specified joint sealant compound.

E. Joint Sealant: A multipart gray polyurethane sealant, meeting U.S. Federal Specification TT-S-00227E (3) Type 1, Class A self-leveling for horizontal joints, and Type II, Class A, non-sag for vertical joints, and recommended by the manufacturer for continuous immersion in water. Provide sealants as manufactured by Products Research and Chemical Corporation, Mameco International, The Burke Company, W.R. Meadows, or equal.

F. Tongue and Groove Joint Forms: 24-gauge steel forms complete with steel stakes and splice plates, designed for joints not to receive a poured seal, and equal to Burke Keyed Kold Joint as manufactured by The Burke Company.

G. Inserts: Galvanized steel to fit the proposed hanger or support.

H. Mortar for Repair of Concrete: Same materials as used for concrete, except omit coarse aggregate and use not more than one-part cement to two and one-half parts sand by damp loose volume. Use no more mixing water than is necessary for handling and placing.

I. Burlap Mats: Conform to AASHTO Specification M182.

J. Epoxy Bonding Agent: Euco #452, BurkEpoxy MV, Sikadur Hi Mod, Concresive 1001-LPL, or equal.

K. Powered Epoxy Coating for Anchor Bolts: Powdered epoxy resin as manufactured by the 3M Company, Scotchkote No. 213, Armstrong No. R349.

2.11 CONDUITS AND PIPES EMBEDDED IN CONCRETE

A. Conduits, pipes and sleeves of any material not harmful to concrete shall be permitted to be embedded in concrete with approval of the Engineer, provided they are not considered to replace structurally the displaced concrete.

B. Conduits and pipes of aluminum shall not be embedded in structural concrete unless effectively coated or covered to prevent electrolytic action between aluminum and steel.

C. Conduits and pipes, with their fittings, embedded within a column shall not displace more than four percent (4%) of the area of cross section on which strength is calculated or which is required for fire protections.

D. Conduits, pipes, sleeves passing through a slab, wall or beam shall not impair significantly the strength of the construction.

E. Except when plans for conduits and pipes are approved by the Engineer, conduits and pipes embedded within a slab, wall, or beam shall satisfy the following:

1. They shall not be larger in outside dimension than one-third overall thickness of slab, wall, or beam in which they are embedded.

2. They shall not be spaced closer than three diameters or widths on center.

2.12 PIPES CONTAINING LIQUID, GAS, OR VAPOR

A. Pipes that will contain liquid, gas, or vapor may be embedded in structural concrete under the following conditions:

1. Pipes and fittings shall be designed to resist effects of the material, pressure, and temperature to which they will be subjected.

2. No liquid, gas, or vapor, except water not exceeding 90°F (32C) nor 50 psi (345 kPa) pressure, shall be placed in the pipes until the concrete has attained its design strength.

3. Concrete cover for pipes, conduits, and fittings shall be not less than 12 inches (38 mm) for concrete exposed to earth or weather or in contact with ground.

4. Reinforcement with an area of not less than 0.002 times area of concrete section shall be provided normal to piping.

5. Piping and conduit shall be so fabricated and installed that cutting, bending, or displacement of reinforced from its proper location will not be required.

PART 3 - EXECUTION

3.1 PROPORTIONING

A. The proportions of aggregate to cement shall be such as to produce a thoroughly plastic mixture which will work readily into the corners and angles of the forms and around the reinforcement but without permitting the materials to segregate or excess free water to collect on the surface. The percentage of sand shall not be less than thirty percent (30%) nor more than fifty percent (50%) of the total weight of the aggregate.

B. The total content, including the surface water contained in the aggregate, shall not exceed 5.7 gallons per sack of cement. The slump shall not exceed 4 inches. Air entraining admixture shall be Darex AEA as manufactured by the Dewey and Almy Chemical Company.

C. The amount of air entrained in the freshly mixed concrete shall not be less than three percent (3%) nor more than six percent (6%). The minimum cement content in sacks per cubic yard of concrete shall not be less than 6 sacks per cubic yard for Class "A" concrete.

D. Concrete materials shall be accurately measured by weight. Measurement of materials for ready mixed concrete shall conform to the "Standard Specifications for Ready Mixed Concrete", (A.S.T.M. designation C 94).

1. Class "A" concrete for all structures shall have minimum compressive strength of 4000 psi at 28 days.

2. Class "B" concrete for sidewalks shall have minimum compressive strength of 3000 psi at 28 days.

3. All concrete shall be Class "A" unless otherwise shown on the Drawings.

3.2 MIXING AND PLACING

A. Concrete shall be mixed, conveyed and deposited in accordance with the "A.C.I. Building Code" (A.C.I. 318).

B. Prior to placing any concrete, the Contractor shall submit for the Engineer's approval a design mix, calculated by a recognized testing laboratory, and using the approved aggregates to produce a workable mix of the desired strength, together with certified copies of 7 days and 28 day tests of cylinders taken from concrete made according to the design mix. The mixes shall be designed to secure concrete having a minimum compressive strength at age 28 days.

C. Ready mixed concrete delivered shall be accompanied by delivery tickets showing the following:

1. Date and time leaving plant Additives (if any)

2. Type of cement and weight Site arrival time

3. Quantity of water and time added Site leaving time

D. Concrete

1. Ready mixed concrete shall be used. All mixing requirements specified herein shall be enforced, and the Owner's laboratory representative and the Engineer shall have free access to the mixing plant at all times.

2. Except for materials and/or procedures otherwise specified herein, ready mixed concrete shall be mixed and delivered in accordance with the requirements of ASTM C 94.

3. No water shall be added to the concrete after it leaves the plant except where part of the design water was purposely omitted at the plant, and then only as approved by the Engineer.

E. Mixer Speed

1. Neither the speed of any mixer nor the quantity of material loaded into any mixer shall exceed the recommendations of the manufacturer.

2. Excessive over mixing, required additions of water to preserve the required consistency, shall be cause for rejection of the batch.

3. Concrete shall not remain in a transit mixer or agitator truck more than ninety (90) minutes after the water has been introduced, and not for more than forty-five (45) minutes if any approved retarding agent is not used.

4. Minimum mixing time shall be fifty (50) revolutions of drum at rated speed.

F. Measurement

1. Equipment necessary to determine and control the actual amounts of all materials entering the concrete shall be provided by the concrete manufacturer.

2. All materials shall be measured by weight, except that water may be measured by volume calculated at 8 1/3 pounds per gallon. One bag of cement will be considered as 94 pounds in weight.

G. Mixes

1. Mix Design: Conform to ACI 318, Section 4.3. Submit data on consecutive tests and standard deviation.

2. Maximum Water-Cement Ratio:
   .37 (lbs/lb) – Concrete with superplasticizer
   .38 (lbs/lb) – Concrete in Marine Environments
   .45 (lbs/lb) – Class A concrete without superplasticizer
   .55 (lbs/lb) – Class B concrete without superplasticizer
   .65 (lbs/lb) – Class C concrete without superplasticizer

3. Air Content: 5 percent plus or minus 1.5 percent (Class A and B).

4. Slump: 4 inches plus or minus 1-inch for Class A and B without superplasticizer.
   7 inches plus or minus 1-inch for Class A and B with superplasticizer.

8 inches plus or minus 1-inch for tremie concrete or as specified by details.

H. Placing Concrete.

1. All concrete shall be placed in clean, damp forms that are not hot to the touch.

2. To prevent segregation, concrete shall be deposited as nearly as practicable in final position and not allowed to drop freely more than necessary and in no case more than five feet, except in an approved funnel or tremie. All concrete shall be placed during daylight unless otherwise authorized at least four (4) hours in advance. Where the reinforcing steel above the top of the concrete being placed becomes coated with laitance or partially set up concrete, all such concrete shall be removed from the reinforcing steel prior to placing concrete around the bars.

3. Concrete shall be packed carefully and tightly around pipe and other items to secure maximum adhesion.

4. Concrete shall be placed in layers not over 12 inches deep before compacting. Concrete shall be compacted by internal vibrating equipment supplemented by spading and hand rodding between reinforcing steel and form to eliminate air bubbles and honeycomb. Vibrators shall not be used to move the concrete laterally inside the forms. Duration of vibration shall be limited to the time necessary to provide satisfactory consolidation without causing segregation, not less than five and not more than 15 seconds per square foot of exposed top surface. The vibrator shall be constantly relocated and shall be placed in each specific spot only once for each layer. The Contractor shall take steps to assure that sufficient personnel are available to devote full time to operating vibrator, spading, and rodding.

5. Wall concrete shall be placed in layers as indicated above, with the first lift preceded by a 1-inch minimum layer of 1:2 1/2 cement sand grout, with a 6-inch to 8-inch slump, placed on existing concrete not more than twenty (20) minutes before concrete placement. The surface of previously placed hardened concrete shall be clean and wet before grouting or shall be treated with a bonding agent as required. Puddles of water in horizontal recessed keys shall be avoided by the use of drain recesses to outside edge of concrete. Concrete in walls and deep beams shall be placed in lifts not to exceed three layers at 12 inches each for the full length of the pour before proceeding higher. The placing of concrete shall not be delayed more than twenty (20) minutes between layers or lifts.

6. Slab forms shall be thoroughly cleaned after placing wall concrete below. Concrete in beams or walls shall be placed to bottom of floor slab. After concrete in walls below floor slab has been in place for approximately thirty (30) minutes, the concrete for the floor slab and upper portion of the beam shall be placed and vibrated.

7. When concrete is conveyed by chutes, the equipment shall be of proper size and design to ensure a continuous flow in the chute. The chutes shall be metal or metal lined, and the different portions shall have approximately the same slope. The slope shall not be less than one vertical to three horizontal or more than one vertical to two horizontal, and there shall be provision for a baffle at the discharge end of the chute to prevent segregation. If the vertical distance between the discharge end of the chute and the surface of the concrete is more than five feet, a spout shall be used. The lower end of the spout shall be kept as near

the surface of the deposit as is practicable. All chutes and spouts shall be thoroughly cleaned before and after each run. All debris and water shall be discharged outside the forms.

3.3 CURING AND PROTECTION

A. Curing:

1. Immediately after surface defects have been repaired, apply a spray coat of curing compound to all exposed surfaces, including slabs, walls, beams, and columns in accordance with the manufacturer's recommendations. Protect exposed steel keyways and other embedded items from the curing compound. Water cure, as specified in paragraph B hereunder, all concrete surfaces that are to be exposed to wastewater, surfaces that are to be coated with a coal tar epoxy system, and concrete floors requiring a bond for special finishes.

2. Do not apply compound during periods of rainfall. Should the film become damaged from any cause within the required curing period, immediately repair the damaged portions with additional compound. Upon removal of forms, immediately coat the newly exposed surfaces to provide a curing treatment equal to that provided for the surface.

3. Curing and Sealing Compound: Use clear compound conforming to Federal Specification TT-C-800A, thirty percent (30%) solids content minimum, having test data from an independent laboratory indicating a maximum moisture loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft per gallon, and equal to Super Floor Coat or Super Pliocure by The Euclid Chemical Company or Masterseal 66 by Master Builders. Furnish manufacturer's certification as required.

4. Apply specified clear curing and sealing compound to all horizontal areas so noted on the Drawings or in the Specifications. Apply immediately after final finishing. Apply this compound to non-structural construction joints of slabs on grade to act as a bond breaker prior to placement of adjacent concrete.

B. Water Curing Method: Cure all concrete that is to be water cured by either the wet burlap method, by continuous fogging or by covering with waterproof sheet.

1. Wet Burlap Method: Cover concrete surface with a double thickness of burlap, cotton mats, or other approved material, kept thoroughly saturated with water. Keep the forms wet until removed and upon removal, start the curing specified herein immediately. Cure the concrete for a period of seven (7) days for normal Portland cement or four (4) days for high early strength cement. Do not submerge concrete poured in the dry until it has attained sufficient strength to adequately sustain the stress involved and do not subject it to flowing water across its surface until it has cured four (4) days.

2. Continuous Fogging: Perform continuous fogging by fogging with a nozzle which so atomizes the flow of water that a mist, and not a spray, is formed. Fog the concrete surface regularly without allowing any part of the surface to become dry. Take all necessary precautions to prevent erosion of the concrete surface by the water.

3. Covering with Waterproof Sheets: Keep the entire area to be cured continuously wet by fogging, as specified in the fogging paragraph above, for at least eighteen (18) hours and then immediately cover with waterproof curing sheet conforming to ASTM C171, waterproof paper and polyethylene film, free of holes or tears. Keep sheet fully flat, without wrinkles or air bubbles, held down tautly at all edges. Do not use this method on slabs which will be exposed to view.

3.4 PLACING REINFORCEMENT

A. All reinforcement shall be detailed, fabricated and erected in accordance with the A.C.I. "Manual of Standard Practice for Detailing Reinforced Concrete Structure", (A.C.I. 315), including bar supports and spacers. At splices all reinforcing bars shall be lapped a minimum of 24 bar diameters but not less than 12 inches.

B. The reinforcing shall be fabricated to the shapes and dimensions shown and shall be placed where indicated on the Drawing. Before placing, all reinforced steel shall be thoroughly cleaned of rust, mill scale or coatings, which would reduce or destroy the bond. Reinforcing bars shall conform to the requirements of the latest editions of the A.C.I. Code and the CRSI Manuals.

C. Wire mesh, unless otherwise shown on the Drawings or specified, shall be 6-inch x 6-inch No. 10 woven or electrically welded wire fabric conforming to the requirements of ASTM Designation A185, latest revision.

D. Space chairs and bolsters in accordance with ACI 315 and 318 using height to furnish cover over reinforcing required. Chairs with plastic feet or stainless steel shall be used in all beams and elevated slabs. Chairs for other concrete adjacent to or on the ground may be pieces of concrete block or concrete brick compressed into subgrade with the rebars bearing directly on the pointed edge of the masonry supports, or chairs set on precast concrete pads compressed into the subgrade.

E. When placed in the forms, reinforcement shall be clean and free of all loose rust, scale, dust, dirt, paint, oil or other foreign material, and shall be accurately and securely positioned both laterally and vertically before placing concrete. Minimum clearances between the steel and face of concrete shall be maintained as shown.

F. The rebars shall be fastened together at every intersection or at intervals not greater than 24 bar diameters by wire ties or by some alternate method acceptable to the Engineer. In areas where large bars are closer together, the wire ties may be spaced not more than 30 bar diameters apart, rather than as specified above.

3.5 FORMS

A. Installation and erection shall be in accordance with ACI 347 and as specified hereinafter.

B. Forms shall conform to shape, lines and dimensions of numbers indicated, and shall be sufficiently tight to prevent leakage of mortar. They shall not deflect under dead load weight of construction as a liquid or of construction load. Forms shall be properly braced or tied together so as to maintain position and shape within specified tolerances. Construct forms so that they can be removed steadily without hammering or prying against the concrete. Forms for exposed concrete shall be carefully made and accurately placed to obtain correct shape and line.

C. Forms shall be of wood, metal, or other approved materials. Metal forms shall be of a type and manufacture acceptable to the Engineer. Plywood, fiberboard, or absorptive type form linings may be used where appropriate. Sectional forms shall produce a uniform surface and shall be assembled in a modular pattern. Pours will not be scheduled until all erection and bracing is complete. Walers, ties, and braces shall be required for all forms.

D. Chamfer strips made from nominal dimensional 1-inch x 1-inch lumber cut on the diagonal shall be installed at the top of the forms on all exposed edges of walls, slabs, beams and other structures above grade.

E. Drip edge shall be made from wood quarter round and installed where shown. Extruded plastic fillets shall be used where detailed. Circular structures shall be formed with special care, and attention to the appearance of the finished structure. Random location of fillers, non modular sections, and excessive deviations from true circular segments shall be cause for rejection of the forms.

F. The Contractor shall be fully responsible for the adequacy of formwork in its entirety. Forms shall support required loads and shall maintain their dimensional and surface correctness to produce members required by Drawings.

G. Slots, chases, recesses, or other openings as shown on the Drawings or as needed for the work of any other trades shall be boxed out.

H. Box out for all temporary openings and build forms to seal them up when and as required.

I. After sealing and immediately before the placing of reinforcing, faces of all forms in contact with the concrete shall receive a thorough coating of the liquid form releasing agent, applied in compliance with the manufacturer's instructions.

J. Reused forms shall be thoroughly cleaned out of dirt, debris, concrete, and foreign matter. Forms shall not be reused if they have developed defects which would affect their tightness and strength or desired surface finish. Used forms shall not be used for architectural concrete.

K. Forms shall be removed in a manner that will prevent injury to concrete. Supporting forms or shoring shall not be removed until the members have acquired sufficient strength to support their weight and any load thereon.

L. Removal shall be in sequence as approved by the Engineer. Unless test cylinders warrant another procedure, the forms shall not be removed from members prior to the time listed in the schedule hereinafter unless otherwise directed.

M. Bonding to Existing Surfaces: Clean existing concrete surfaces that are to have new concrete bonded thereto of all grease, oil, dust, dirt, and loose particles and coat with an epoxy bonding agent just prior to placing of the new concrete. Apply the bonding agent as recommended by the manufacturer and allow the agent to become tacky before the new concrete is placed. Do not allow the bonding agent to overlap or be spilled on the surfaces to be exposed after the work is completed.

3.6 FORM REMOVAL

A. Maintain formwork in place for the following structural conditions until the concrete has attained the minimum percentage of indicated design compressive strength or for the period of time specified in the following table.

Note: Time periods in the table include all days except those in which the temperature falls below 40°F.

Structural Member or Condition	Normal Strength Concrete	Normal High-Early Strength Concrete	Minimum Compressive Strength for Form Removal (% Design Strength)
Cantilevers	12 days	7 days	90
Over 20 feet between supports	12 days	7 days	90
Stairway	10 days	5 days	80
Floor Slabs	5 days	3 days	70
Free standing walls, columns, and piers	5 days	3 days	70
Walls, piers columns, sides of beams, footings slabs on grade, and vertical surfaces	24-48 hours	12-24 hours	70
Front face form of curbs	6-24 hours	6 hours	70

3.7 CONCRETE FINISHINGS

A. Repair of Surface Defects:

1. General: Repair surface defects, including tie holes immediately after form removal. Dampen the area to be patched and an area at least 6 inches wide surrounding it to prevent absorption of water from the patching mortar. Notify the Engineer prior to commencing operations.

2. Removal of Defective Concrete: Remove all honeycombed and other defective concrete down to sound concrete. Cut edges perpendicular to the surface or slightly under cut. Sand blast surfaces to receive repair.

3. Bonding Grout: Thoroughly dampen surfaces to be patched and apply a coat of bonding grout consisting of one-part cement to one part fine sand passing a No. 30 sieve and having the consistency of thick cream.

4. Placing Patching Mortar: After the bonding grout begins to lose its water sheen, apply a premixed patching mortar, thoroughly consolidating it into place and striking it off so as to leave the patch slightly higher than the surrounding surface. Leave mortar undisturbed for one hour to permit initial shrinkage and then finally finish.

5. Tie Holes: After being cleaned and thoroughly dampened, fill the tie holes solid with patching mortar.

B. Concrete Finishes:

1. Formed Surfaces: After removal of forms, chip off all irregular projections, grind flush with adjacent surfaces, and finish concrete surfaces in accordance with the following schedule:

Finish Designation	Area Applied
F-1	Exterior walls below grade not exposed to water: Repair defective concrete, fill depressions deeper than two inches, and fill tie holes.
F-2	Exterior and interior walls exposed to water: Repair defective concrete, remove fins, fill depressions 3 inches or deeper, and fill tie holes.
F-3	Walls of structures of buildings exposed to view and underside of formed floors or slabs: In addition to Finish F-2, fill depressions and airholes in mortar. Dampen surfaces and then spread a slurry consisting of one-part cement and one and one-half parts sand by damp loose volume on the surface with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.
F-4	Tops of walls, beams and similar unformed surfaces occurring adjacent to formed surfaces: Strike smooth after concrete is placed and float to a texture reasonably consistent with that of formed surfaces.

2. Slab Surfaces:

a. General: After concrete has been consolidated, finish all concrete slabs with a floated finish. After floating, trowel finish all concrete slabs, except for areas to receive roofing, insulation, tile or topping, and immediately light broom finish. Where a finish is not indicated, provide a troweled finish.

Finish Designation	Area Applied
S-1	Slabs and floors not water bearing: Smooth steel trowel finish.
S-2	Slabs and floors which are water bearing and slab surfaces on which mechanical equipment moves: Steel trowel finish free from trowel marks and all irregularities.
S-3	Slabs, floors, and stair treads of structures or buildings exposed to view: Steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.
S-4	Slabs and floors at slopes greater than ten percent (10%): Steel trowel finish without local depressions or high points. Apply a stiff bristle broom finish. Leave broom lines parallel to the direction of slope drainage.
S-5	Exposed edges of slabs, floors and tops of walls: Finish with a 3-inch radius edge if a chamfer is not indicated.

C. Floated Finish: After concrete has been placed, consolidated, struck off, and leveled, do not work the surface further until water sheen has disappeared and the surface has hardened sufficiently to permit floating. During the first floating, check the planeness of the slab with a 10-foot straightedge applied at no less than two angles. Cut down all high spots and fill all low spots to produce a surface having the required tolerance. Then refloat the slab to a uniform sandy texture.

D. Light Broomed Finish: After floating, power trowel slabs to receive a light broomed finish to produce a smooth surface, relatively free of defects. Before the surface sets, pass a soft broom drag over the surface to produce a surface uniform in texture and appearance.

E. Troweled Finish: After floating, power trowel slabs to receive a troweled finish to produce a smooth surface, relatively free of defects. Hand trowel after the surface has hardened sufficiently. When a ringing sound is produced as the trowel is moved over the surfaces, perform final troweling by hand to produce a surface which is thoroughly consolidated, free from trowel marks, uniform in texture and appearance and plane to a tolerance of 1/8-inch in 10 feet as determined by a 10-foot straightedge placed anywhere on the slab in any direction.

F. Hardener Finish: Where indicated to receive a troweled hardener finish, water cure slabs without application of curing and sealing agent. When slab is at least twenty (20) days old and thoroughly dry, apply the hardener in accordance with the manufacturer's recommendations. Where dry-shake hardener or slip resistant finish is required, apply the hardener or slip-resistant product prior to complete curing and finishing, in accordance with the requirements and recommendations of the product manufacturer.

G. Saw Cut Joints: Cut joints that are to be saw cut not sooner than two (2) hours after the concrete is poured and not later than eight (8) hours after the pour.

3.8 TESTS

A. Compressive strength tests shall be made by breaking standard 6-inch diameter by 12-inch high test specimens prepared, cured and broken in accordance with the American Society for Testing Materials Standard Methods C 31 and C 39, latest revision. Four (4) specimen test cylinders shall be taken from each pour of five cubic yards or more. One additional test shall be taken from each 30 cubic yards or fraction thereof in each pour in excess of 30 cubic yards.

B. Test specimens shall be taken from manhole bottom pours of less than five cubic yards as directed by the Engineer. Test specimens shall be taken in the presence of the Engineer. One cylinder from each pour shall be broken at seven (7) days, the remainder at twenty-eight (28) days. Additional test cylinders may be ordered for determining the characteristics of a new design mix or changes in equipment or methods, and under adverse weather or curing conditions.

C. Slump test shall be made in accordance with ASTM C143, latest revision, and shall be made with each load and at time of cylinders.

D. The Contractor shall supply all cylinder molds, slump cones, tools and labor for preparing specimen, and shall provide clean, moist sand or burlap for curing. Cylinder shall not be shipped to the testing laboratory until the third day following preparation and shall be protected from accidental damage at all times.

E. The test cylinders shall be tested in a recognized commercial testing laboratory at the expense of the Contractor.

3.9 EXPANSION JOINTS, CONSTRUCTION JOINTS AND WATER STOPS

A. Expansion Joints shall be places as indicated on the Drawings. Joint materials for surfaces exposed to water and sewage shall conform to ASTM D175, Preformed Joint Filler, non extruding and resilient (bituminous type), thickness as shown on the Drawings. Joint materials for isolation joints, slab on grade joints and wall joints not exposed to water and sewage shall conform to ASTM D994, preformed expansion joint filler for concrete (bituminous type), thickness as shown on the Drawings.

B. Construction Joints shall be located in accordance with a schedule of pours which shall be prepared and submitted by the Contractor. Vertical construction joints shall be held to the minimum number consistent with good standard practice.

C. Water Stops. Material for water stops shall be 9-inch PVC multi rib center bulb type for expansion joints, and 1/4-inch x 4-inch and 1/8-inch x 4-inch structural steel sheets for construction joints. PVC joint material shall be as manufactured by The Burke Company, or approved equal.

END OF SECTION 033000

SECTION 321000 – BASES, BALLASTS AND PAVING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The work covered and described in this section includes the furnishing and construction of paved surfaces, including roadways, driveways, bicycle paths, shoulders, and other paved surfaces, or paving work as shown or indicated on the Drawings, specified herein, and as listed in this Contract.

B. All work shall conform to the applicable Technical Specifications of Florida Department of Transportation "Standard Specifications for Road Bridge Construction" latest Edition (Divisions II and III) and Design Standards", latest Edition, including any amendments thereto. The Contractor shall acquire their own copies of the Department of Transportation Standards. In the event of conflict between the Department of Transportation Standards and the Specifications listed in these documents, the Owner/Engineer shall determine which shall govern. Reference to the Department of Transportation Standards, to the Department or its representatives shall be interpreted for this Contract to be the Owner/Engineer or their authorized representative.

PART 2 - PRODUCTS

2.1 SUBBASE

A. The materials used should be high bearing value soil, sand-clay, ground limestone, crushed lime rock, coquina, or any other material suitable for stabilization. Muck shall not be used.

2.2 BASE COURSE

A. The base course material used shall be that specified in the Drawings or Contract Documents. If no base material is specified, limerock shall be used, unless otherwise indicated. All base material shall be approved by the Owner/Engineer and supplied by the Contractor.

B. The lime rock base material shall have a minimum of seventy percent (70%) carbonates, calcium and magnesium and no more than three percent (3%) water sensitive clay. The liquid limit shall not exceed 35 and the plastic index shall not exceed 10. The average LBR value of the material shall be no less than 100, nor be large amounts of extremely hard pieces of clay pockets.

C. Soil-cement base shall be composed of a combination of soil and Portland cement uniformly mixed, moistened, compacted, finished, and cured. The soil shall be either existing in-place material or that brought from borrow locations. All soil must meet the requirements set forth in FDOT Standards and Specifications for Road and Bridge Construction Latest Edition. The cement used shall be Portland cement Type I or I-P and water shall be free from any substances deleterious to hardening of the soils-cement mixture.

1. The soil-cement mixture shall be proportioned in accordance with a design mix prepared by a testing laboratory and approved by the Owner/Engineer. The design mix shall be submitted for approval at least thirty (30) calendar days prior to beginning of soil-cement construction. The cement content shall be expressed in percentage of dry weight of the soil. Rate of application shall be based on the maximum density of the soil, determined in accordance with AASHTO T 99 and a thickness one (1) inch greater than the base course thickness shown on the plans.

D. Asphalt base courses shall have a bituminous material content of asphalt cement, viscosity Grade AC-20 or AC-30, meeting the requirements of FDOT Standards and Specifications for Road and Bridge Construction, Latest Edition. The bituminous mixture shall be composed of a combination of aggregate, bituminous material. The job mix formula, as established by the Contractor, must be approved by the Owner/Engineer. The asphalt base mix shall be within the design ranges specified for mix Type ABC-3 or S-II, (Use of any other mix is subject to the approval of the Owner/Engineer.). The constituents of the mixture shall be combined to produce a mixture having Marshal properties within the limits of Appropriate Table of the FDOT Standards and Specifications for Road and Bridge Construction, latest Edition.

E. Coquina shell used in the base course shall have an organic material of not greater than one-half percent (0.5%) or contain significant quantities of sand or other impurities which would prevent bonding. At least ninety-seven percent (97%) of the coquina used shall pass through a three and one-half (3.5) inch ring.

F. Recycled concrete aggregate used in the base course shall conform to Appropriate Section, graded aggregate base, of the latest revision of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

2.3 PRIME AND TACK COATS

A. Bituminous prime coats shall be applied to previously prepared bases. Bituminous tack coats shall be placed on existing paved surfaces and between successive lifts of asphalt material.

B. The prime coat shall be Cut-back asphalt Grade RC-70 or RC-250;Emulsified Asphalt Grades SS-I , CSS-I, SS-1H or CSS-1H diluted in equal proportion with water or other types and grades of bituminous material specified or approved by the Owner/Engineer.

C. The tack coat shall be RA-500 heated to a temperature of 250°F to 300°F. For undiluted Emulsified Asphalt, Grades RS-1 or RS-2 heated to a temperature of 140°F to 180°F.

D. A cover material must be placed on the prime coat to ensure that the prime coat remains intact until the surface course is placed.

2.4 ASPHALT WEARING SURFACE

A. The bituminous wearing surface applied shall be that specified in the Drawings or Contract Documents. If no asphalt mix is specified, Type SP-9.5 Super Pave asphaltic concrete shall be used as the paving material, unless otherwise indicated.

B. The asphaltic mixture shall be transported to the site at a temperature of 300°F to 350°F. Mixtures that have cooled below 270°F will be rejected. The mix temperature will be taken on the first five loads each day and on an average of once every five (5) loads thereafter.

C. The Contractor is entirely responsible for producing a homogenous mixture, free from moisture and with no segregated materials, and meeting all requirements of the Specifications for the mixture. Prior to the production of any asphalt paving mixture, the Contractor shall submit, in writing, a proposed job mix formula, at least two (2) weeks prior to the beginning of any paving activities. All requests for design mix adjustments, redesigns and new design mixes will be submitted, in writing, to the Owner/Engineer.

PART 3 - EXECUTION

3.1 SUBBASE

A. Prior to installation of base material, the area shall be graded to within two tenth (0.2) feet, and soft, spongy or mucky material removed. Sufficient stabilizing material shall be cut in to achieve a Florida Bearing Value (FBV) in excess of 75 psi or lime rock bearing ratio (LBR) greater than 40 pounds at a minimum density of ninety-eight percent (98%) of a maximum density as defined and measured in AASHTO T 180 (Modified Proctor), to a six-inch minimum depth.

B. Density test for subbase materials shall be taken at 300-foot intervals and around structures as required. If compaction procedures allow testing requirements may be reduced at the Owner/Engineer's discretion.

3.2 BASE COURSE

A. The base course shall be constructed on the prepared subgrade, in accordance with the Specifications and Drawings. All base material shall be placed in accordance with the lines, grades, notes, and typical cross sections shown on the plans. Any deviation from the Drawings is subject to the approval of the Owner/Engineer. Any deviations not approved by the Owner/Engineer shall be repaired to the satisfaction of the Owner/Engineer at no expense to the Owner.

B. Lime Rock Base

1. Lime rock base shall be spread by mechanical spreaders, equipped to produce an even distribution with a uniform thickness. When the specified compacted thickness of the base is greater than six inches, the base shall be constructed in two (2) courses. The thickness of the first course shall be one-half the total thickness of the finished base. After spreading is completed, the entire surface shall be scarified and shaped so as to produce the required grade and cross section after compaction. If two (2) courses are required, each lift shall be prepared as previously described. Prior to spreading of the upper course, density tests will have been taken for the lower and determined to be satisfactory.

2. All materials shall be compacted to a density of not less than ninety-eight percent (98%) of maximum density as determined by AASHTO T 180. Density tests shall be taken in at least three locations on each day's final compaction of each course. Density determinations

shall be made at more frequent intervals, at no extra cost, if deemed necessary by the Owner/Engineer.

3. The finished surface of the base course shall be checked with a template cut to the required crown and a 15-foot straight edge laid parallel to the center line of the road. All irregularities greater than one-quarter (1/4) inch shall be corrected to the satisfaction of the Owner/Engineer.

4. The base material shall extend at least 12 inches outside the edge of the finished paved surface, unless otherwise indicated. Thickness of the base shall be measured at 200-foot intervals at various points in the cross section. Where the compacted thickness is deficient by one-half (1/2) inch or more, the Contractor shall correct the deficiency by scarifying and adding rock for a distance of 100 feet in each direction from the edge of the deficient area. The required thickness, compaction and cross section will then be achieved.

5. Prime coat shall be applied only when the base meets the specified density and the moisture content in the top half of the base does not exceed ninety percent (90%) of the optimum moisture of the base material.

C. Soil Cement Base

1. Soil-cement mixing shall be either mixed-in-place or a central plant mix.

2. If mixed-in-place, the entire width of the base shall be processed in a single operation, where possible. The specified quantity of cement shall be applied at the required rate by means of an approved method. Mixing will begin within sixty (60) minutes after the cement has been applied. Processing may be to full depth in one (1) course, provided that the satisfactory distribution of cement, water, soil and the specified density can be obtained. If not, construction shall be in courses of such thickness to obtain satisfactory results. Adequate bonding between courses must be achieved. After mixing soil and cement, additional water shall be added, if necessary. After all mixing water has been applied, mixing shall continue until a uniform mixture has been obtained. Excessive concentrations of water shall be avoided.

3. Central plant mixtures shall have been mixed for at least thirty (30) seconds. The mixture shall be placed on the moistened subgrade in a uniform layer by an approved spreader. The layer of soil-cement shall be of uniform thickness and surface contour. The completed base will conform to the required grade and cross section.

4. Compaction of the soil-cement mixture shall begin immediately after mixing is complete. The optimum moisture content and maximum density shall be determined in the field by the methods described in AASHTO T 143. The base shall be compacted to not less than ninety-five percent (95%) of the maximum density. The soil-cement mix design shall be 350 psi at 28 days, unless otherwise indicated, and moisture content and density tests shall be taken every 300 lineal feet to a minimum depth of six inches.

5. After compaction, the surface shall be shaped to the required lines, grades and cross section. The moisture content of the surface material shall not be more than two percent (2%) less than the specified optimum moisture content during finishing operations. The finished surface shall be smooth, dense, and free of compaction planes, cracks, ridges and loose material.

6. Construction joints shall be formed by cutting back in the completed work to form a true vertical face. The vertical face shall be a straight transverse line perpendicular to the centerline of the roadway.

7. The finished surface of the base shall be tested with a template and a 15-foot straight edge. All irregularities greater than one-quarter (1/4) inch shall be corrected to the satisfaction of the Owner/Engineer.

8. The finished surface shall be kept continuously moist until the surface is treated with either cut-back asphalt, Grade RC-70 applied at 0.15 to 0.20 gallons per square yard; or a mixture of emulsified asphalt and water applied at a rate of 0.20 of 0.25 gallons per square yard. If the Owner/Engineer deems it necessary, the surface shall be sanded using 10 pounds of clean sand per yard.

D. Asphalt Base Course

1. Asphalt base courses shall be applied in accordance with FDOT Standards and Specifications for Road and Bridge Construction, Appropriate Section. The job mix formula approved for the project shall be used. Any deviation from the approved mix must be submitted to the Owner/Engineer and approved before being implemented.

2. The base course material shall be placed with an approved paving machine. A motor grader may be required if a leveling course is needed. The base mix may be placed when the air temperature is at least 40°F and rising, provided that the sub-grade is not frozen or affected by frost.

3. A paver, equipped with automatic screed control, shall be used for all machine-laid courses. The automatic joint matcher shall be used on the top course of the base after the first pass with a paving machine. All mixtures shall be laid by the string line method, with the exception of areas adjacent to curb and gutter or other true edges. The temperature of the mix shall be between 300°F and 350°F. Any mixture caught by rain in transit may be laid at the Contractor's own risk; if removal and replacement is required, it shall be at the expense of the Contractor. In no case shall the mixture be spread when rain is falling or when there is water on the surface to be covered. The layer thickness for asphalt concrete structure courses shall match those listed in the table below.

E. Recycled Concrete Base Course

1. Recycled concrete base course shall be transported, spread compacted and finished per Appropriate Section, of the latest revision of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

2. The depth of all layers shall be checked every 50 feet. A tack coat, as specified, will be required on existing pavements to be overlaid with an asphalt mix and between successive layers of all asphalt mixes.

F. Compaction

1. After the asphalt mixture has been spread to the proper lines, grades, and cross sections, compaction operations may begin. The Contractor shall establish rolling procedures and submit their sequence of compaction operations to the Owner/Engineer for approval. The

equipment used may include, but is not committed to steel-wheeled rollers, pneumatic tired rollers, and vibratory rollers. Areas which are inaccessible to a roller shall be compacted by the use of hand tamps or other satisfactory means. An entire sequence of compaction operations shall be performed for each layer of applied material, density determinations shall also be made.

2. The in-place density of each course shall be determined through core samples and the nuclear backscatter method. A core sample of a representative paving section shall be taken for each day's production of paved surface; backscatters shall be taken every 30 feet at various locations in the cross section. Additional testing around manholes or other structures may be required.

3. Testing and density requirements shall not apply to the following construction activities: Asphalt patching courses, leveling and intermediate course less than one (1) inch thick, overbuild courses less than one (1) inch thick and open graded friction courses.

G. Shell Base Material

1. Shell base material shall be constructed on the prepared subgrade in accordance with these Specifications and in conformity with the lines, grades and cross sections shown on the plans. The shell base shall be spread uniformly and evenly; during spreading operations the shell shall be thoroughly saturated with water.

2. After spreading the shell shall be compacted, with water being added as required, until the required density is obtained. Compaction and density shall be as required for lime rock base, except that the testing methods shall be modified in the laboratory and in the field. At least three (3) density determinations shall be made on each day's final compaction operations.

3. Upon completion of initial compaction, the entire surface shall be scarified and shaped to exact crown and cross section. The base shall then be re-watered and compacted to the required density. The finished surface shall be tested with a template and 15-foot straight edge. All irregularities greater than one-quarter (1/4) inch shall be corrected to the satisfaction of the Owner/Engineer. The prime coat shall be applied after the base meets all density and finish requirements.

3.3 ASPHALT WEARING SURFACE

A. The asphalt wearing surface shall be constructed on the prepared base in accordance with the Drawings and Specifications and in conformity with the indicated lines, grades, and cross sections. If no asphalt mixture is indicated, the specified mixture shall be Type SP-9.5 Super Pave Asphaltic Concrete. A job mix formula shall be submitted to the Owner/Engineer for approval at least two (2) weeks prior to the application of paved surfaces.

B. The mixture shall be spread only when the base is clean, dry, properly cured, and approved by the Owner/Engineer. The temperature shall be at least 40°F and rising. No paving operations will be permitted if it is raining or rain is imminent. The mix shall be between 270°F and 350°F.

C. The asphalt mixture shall be spread with an approved paving machine to the required width and depth. All mixes, except those adjacent to curb and gutter, shall be laid according to the string line method. The depth of each layer shall be checked every 50 feet.

D. The mixture shall be compacted to its final depth, no less than one and one-quarter (1-1/4) inch and thicker if so indicated. Compaction and layering procedures specified for asphalt base courses shall apply to surface courses. All testing and density requirements will also apply.

E. When laying operations are interrupted, a transverse joint shall be constructed by cutting back on the previous run to expose the full depth of material. Longitudinal joints are to be sloped or rolled over and sealed. When the adjacent strip is constructed, the edge shall be trimmed back to expose the unsealed face. All longitudinal construction joints shall be offset six (6) inches to 12 inches laterally between layers.

F. When fresh mixture is laid against transverse or longitudinal joints, it shall be placed in contact to produce an even, well compacted joint after rolling.

G. The finished surface shall be tested with a template and 15-foot rolling straight edge. Any irregularities shall be repaired to the satisfaction of the Owner/Engineer. The surface shall be of uniform texture and compaction. No sand spots, ripples, or loosened portions shall be evident. No traffic shall be allowed onto the finished surface until it is deemed acceptable by the Owner/Engineer.

3.4 CURING COAT

A. During the period when finishing and surface corrosion of the soil-cement base are being accomplished, the surface of the base shall be kept continuously moist by sprinkling as necessary. As soon as deemed practicable, the curing seal shall be applied to the soil-cement base. The curing seal shall consist of Emulsified Asphalt Grade SS-I or SS-1H, diluted in equal proportion with water, and be applied at the rate of 0.15 to 0.30 gallons per square yard.

B. The actual rate of application shall be as directed and shall provide complete coverage without excessive runoff. At the time the bituminous material is applied, the soil-cement surface shall be dense and free of all loose and extraneous material and shall contain sufficient moisture to prevent excessive penetration to the bituminous materials.

C. Should it be necessary to allow construction equipment or other traffic to use the completed base before the bituminous material has cured sufficiently to prevent pickup or displacement; the bituminous material shall be sanded, using approximately 10 pounds of clean sand per yard.

END OF SECTION 321000

SECTION 329223 – SODDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of subsoil.
2. Placing topsoil.
3. Fertilizing.
4. Sod installation.
5. Maintenance.

1.2 REFERENCES

A. ASTM International:

1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. Turfgrass Producers International:

1. TPI - Guideline Specifications to Turfgrass Sodding.

1.3 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

1.4 SUBMITTALS

A. Product Data: Submit data for sod grass species, fertilizer, mulch, and other accessories.

B. Submit minimum 10 oz sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

C. Test Reports: Indicate topsoil nutrient and pH levels with recommended soil supplements and application rates.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer;

1.6 QUALITY ASSURANCE

A. Sod: Root development capable of supporting its own weight without tearing, when suspended vertically by holding upper two corners.

B. Perform Work in accordance with Florida Department of Transportation standard.

1.7 QUALIFICATIONS

A. Sod Producer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod on pallets or in rolls. Protect exposed roots from dehydration.

B. Do not deliver more sod than can be laid within twenty four (24) hours.

1.9 COORDINATION

A. Coordinate with installation of underground sprinkler system piping and watering heads when applicable.

1.10 MAINTENANCE SERVICE

A. Maintain sodded areas sodded areas for three months from date of Substantial Completion or until Final Completion, whichever is later.

B. Maintain sodded areas immediately after placement until grass is well established and exhibits vigorous growing condition.

C. Repair any damage due to washouts, erosion or other causes which might occur prior to final acceptance of this work.

PART 2 - PRODUCTS

2.1 SOD

A. Furnish materials in accordance with Florida Department of Transportation standard.

B. Sod: Certified grade; cultivated grass sod; type indicated; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 sq ft.

C. Type of sod to match existing. If restoration, type of sod to be shown on Drawings otherwise.

D. The sod shall be taken up in commercial-size rectangles, preferably 16-inch by 24-inch, except where rolled sod is utilized.

E. The sod shall be sufficiently thick to secure a dense stand of live grass. The sod shall be live, fresh and uninjured, at the time of planting.

F. No sod shall be used which is not certified as being free of the imported fire ant and must be obtained from an area outside of the zone of quarantine of the imported fire ant.

2.2 SOIL MATERIALS

A. Topsoil: Imported or excavated on-site, fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay, or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

2.3 ACCESSORIES

A. Fertilizer: Commercial grade; recommended for grass, with fifty percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil to the following proportions: nitrogen 6 percent, phosphoric acid 6 percent, soluble potash 6 percent.

B. Lime: ASTM C602, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

C. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

1. The water used in the grassing operations may be obtained from the reclaimed water system.

2. The water shall be free of excess and harmful chemicals, acids, alkalis, or any substance which might be harmful to plant growth or obnoxious to traffic.

3. Salt water shall not be used.

D. Water-Metering Devices: The vehicle used for applying the water to the grassed areas shall be equipped with an approved metering device installed at such point on the vehicle as to measure the water at the time of its being applied to the grassed areas.

E. Wood Pegs: Softwood, sufficient size and length to anchor sod on slope.

F. Wire Mesh: Interwoven hexagonal plastic mesh of 2-inch size.

G. Edging: Plastic.

H. Rollers: A cultipacker, traffic roller, or other roller approved by the Engineer, will be required for rolling the grassed and mulched areas.

2.4 SOURCE QUALITY CONTROL

A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

B. Provide recommendation for fertilizer and lime application rates for specified sod grass species as result of testing

C. Testing is not required when recent tests are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify prepared soil base is ready to receive the Work of this section.

3.2 PREPARATION OF SUBSOIL

A. Prepare sub-soil and eliminate uneven areas and low spots.

B. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

C. Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be sodded.

D. Remove contaminated subsoil.

E. Scarify sub-soil to depth of 4 inches where topsoil is to be placed.

F. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

3.3 PLACING TOPSOIL

A. Spread topsoil to minimum depth of 3 inches over area to be sodded.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas and to ensure positive drainage.

E. Install edging at periphery of sodded areas in straight lines to consistent depth.

3.4 FERTILIZING

A. Apply lime at application rate recommended by soil analysis. Work lime into top 6 inches of soil.

B. Application:

1. The fertilizer shall be spread or sprayed uniformly over the area to be grassed by use of the approved distributing device, except that on steep slopes or other areas where machine-spreading may not be practicable, spreading may be done by hand or by hose if the Engineer so directs.

2. Immediately after dry fertilizer is spread, it shall be harrowed in and mixed with the soil to a depth of approximately four inches.

3. When liquid fertilizer is sprayed, the soil, if dry, shall be moistened by sprinkling before the liquid fertilizer is applied not later than seven days after the seed is in place.

C. Rate of Application: Apply fertilizer at application rate as determined by soil analysis.

D. Apply fertilizer after smooth raking of topsoil and prior to installation of sod.

E. Apply fertilizer no more than forty-eight (48) hours before laying sod.

F. Mix fertilizer thoroughly into upper 4-inches of topsoil.

G. Lightly water soil to aid dissipation of fertilizer.

H. Fertilizing operations will not be permitted when wind velocities exceed 15 miles per hour.

3.5 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Lay sod within twenty-four (24) hours after harvesting to prevent deterioration.

C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12-inches minimum. Do not stretch or overlap sod pieces.

D. Lay smooth. Align with adjoining grass areas.

E. Place top elevation of sod 1/2-inch below adjoining edging paving or curbs.

F. On slopes and elevations 6 inches per foot and steeper:

1. On slopes 6 inches per foot and steeper, lay sod pieces perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. When using rolled sod, lay sod parallel to slope. Drive pegs flush with soil portion of sod.

2. Prior to placing sod, on slopes exceeding 8 inches per foot, place wire mesh over topsoil. Securely anchor wire mesh in place with wood pegs sunk firmly into ground.

G. Do not place sod when temperature is lower than 32°F.

H. Water sodded areas immediately after installation. Saturate sod to 4 inches of soil.

I. After sod and soil have dried, roll sodded areas to bond sod to soil and to remove minor depressions and irregularities.

J. Roll before first watering.

3.6 MAINTENANCE

1. Mow grass at regular intervals to maintain at maximum height of 2-1/2-inches. Do not cut more than 1/3 of grass blade at each mowing.

2. Neatly trim edges and hand clip where necessary.

3. Immediately remove clippings after mowing and trimming.

4. Water to prevent grass and soil from drying out.

5. The soil shall be maintained in a moist condition for a period of at least two (2) weeks after the planting.

6. Roll surface to remove or irregularities.

7. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

8. Immediately replace sod on areas showing deterioration or bare spots.
   a. i.e. damage due to washouts, erosion or other causes which might occur.

B. Protect sodded areas with warning signs during maintenance period.

END OF SECTION 329223