

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Contractor use of site
- B. Location of Work
- C. Description of Work
- D. Owner Occupancy
- E. Work by Others

1.02 CONTRACTOR USE OF SITE

- A. Limit use of site and premises to allow:
 - 1. Owner occupancy.
 - 2. Work by others and Owner.

1.03 LOCATION OF WORK

- A. The work is located at the seawall at the street ends of the following streets in the Town of Surfside, FL:
 - a. Southern Terminus of Carlyle Ave.
 - b. Southern Terminus of Froude Ave.
 - c. End of 88th St. (Biscaya Dr.) on Biscaya Island
 - d. Southern Terminus of Bay Dr.
 - e. Western Terminus of 90th St.
 - f. Western Terminus of 92nd St.
 - g. Western Terminus of 93rd St.
 - h. Western Terminus of 94th St.
 - i. Western Terminus of 95th St.
 - j. Seawall along Surfside Park

1.04 DESCRIPTION OF CONTRACT

The following is a general list of the work included. It is not intended to be complete. Consult the contract drawings and specifications for all contract requirements.

- A. Site work: Site preparation, demolition, earth work, drainage facilities, utilities coordination
- B. Demolition of the existing cap and tie-back system for seawalls
- C. Seismic monitoring of construction operations
- D. Construction of king pile and concrete panel seawalls with batter pile supports and riprap per plans
- E. Extension of concrete and DIP drainage pipes
- F. Furnish and install Rip-Rap
- G. Furnish and install manatee grates

1.05 WORK SEQUENCE

- A. Construct Work in stages to accommodate Owner's occupancy requirements during the construction period, coordinate construction schedule and operations with Owner.
- B. Coordinate utility work to maintain service during construction.

1.06 OWNER OCCUPANCY

- A. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.
- B. Schedule the Work to accommodate this requirement.

1.07 WORK BY OTHERS

- A. The Contractor is advised that work by others will take place during the duration of the contract time. It shall be the Contractor's responsibility to coordinate and schedule all work as not to delay or hinder his work or the work by others.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01025

MEASUREMENT FOR PAYMENT

PART 1 - GENERAL

1.01 SCOPE

- A. Payment for the project will be made on a Lump Sum basis with a Schedule of Values for additive and deductive alternates.
- B. Payment for the various items of the Schedule of Values, as further specified herein, shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies, and manufactured articles, labor, operations, permit fees, licenses, taxes, insurances, bonds, overhead and retrofit, and incidental appurtenant to the items of work being described, as necessary to complete the various items of the work all in accordance with the requirements of the Contract Documents including all appurtenances thereto, and including all costs of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Administration of the U.S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Schedule of Values, and all costs therefore shall be included in the prices named in the Schedule for the various appurtenant items of work.

1.02 SCHEDULE OF VALUES

- A. Submit schedule on Owner's Standard form, as outlined in Section 01152 - Applications for Payment.
- B. Reference paragraphs 2.05, 2.07 and 14.01 of Section 00700 - General Conditions.
- C. Except as otherwise specified, unit prices shall apply to both deductive and additive variations of quantities.
- D. Lump sum and unit prices in the Agreement shall remain in effect until date of final completion of the entire Work.

1.03 LUMP SUM

- A. Unless otherwise stated, payment for lump sum items will be based upon the completion of the entire lump sum item, complete in place, all in accordance with the requirements of the Contract Documents.

1.04 PAYMENT AND PERFORMANCE BOND

- A. Payment of performance bond and payment bond and for consideration for indemnification of Owner and Engineer as stated under the General Conditions and Supplementary Conditions shall be included in the Grand Total Bid.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01030

SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.01 OBSTRUCTIONS

- A. The attention of the Contractor is drawn to the fact that during digging at the Project site, the possibility exists of the Contractor encountering various water, sewer, petroleum, gas, telephone, electrical or other lines not shown on the Drawings. The Contractor shall exercise extreme care before and during digging to locate and flag these lines so as to avoid damage to the existing lines. Should damage occur to an existing line, The Contractor shall repair the line at the no cost to the Owner, except as outlined under paragraph 4.3.2 of Section 00700 - General Conditions.

1.02 PROVISIONS FOR SEISMIC SURVEY/MONITORING

Pre-construction Inspections

- A. Notice shall be made to all property owners with structures within one-hundred (100) feet of seawall construction to request permission for a pre-construction inspection to be performed. The notification shall be provided by U. S. Mail, Certified, Return Receipt in order to provide documentation of the receipt of the notification. Correspondence shall be provided giving a general summary of the project, work to be completed and the notification that the residence may inspected prior to work starting at no cost to the owner. A copy shall be retained in the event of future need.
- B. Pre-construction inspections shall be completed on structures within one-hundred (100) feet of seawall construction areas as measured from the construction in a radius outward. The inspections shall be completed under the supervision of a third-party seismologist or vibration consultant having a minimum of 5-years' experience in the evaluation of structures prior to vibration work commencement. The inspections shall consists of interior and exterior examination of existing cracks, separation and any other defect and shall be document in a written diagram format plus photographs of the defects shall be taken. The diagram information shall detail the location, general length and width of the defects. This shall be taken for all walls, ceilings and floors of the structure for each room. Notations shall be made if access is not permitted to sections of the structure.
- C. Upon completion of inspection work a summary report shall be prepared and submitted to the Town or authorized agent documenting the inspection procedure, structures notified, those inspected and copies of reports and photographs will be provided. A copy of the report completed shall be provided with photographs to the owner of the property inspected.

Vibration Measurement:

- A. During heavy construction or any pile driving activity ground vibration levels shall be measured and recorded. Vibration levels shall be recorded with Instruments capable of measurement of time history and long term vibration and frequency measurements as necessary to document levels. Units shall be operated by a third-

party seismologist or vibration consultant having a minimum of 5-years' experience in the measurement and evaluation of vibration effects upon structures. Measurements shall be made with instruments meeting the criteria of the International Society of Explosives Engineers, Performance Specifications for Blasting Seismographs and Seismograph Field Guidelines as published within the ISEE Blasters' Handbook 18th Edition, with consideration made for semi-continuous sources such as compaction and pile driving sources.

- B. Prior to commencement of construction activity a qualified seismologist, vibration consultant shall be retained to provide site specific limitations on vibration based upon soil boring for the site and taking into consideration the adjacent structures. Levels shall be developed in order to preclude or at least minimize the potential for vibration created defects within the structures. The limit shall be provided to the Town with sufficient documentation to allow for approval by the Town of Surfside and be accepted for the project.
- C. Vibration level measurements shall be reported to the Town on a semi-monthly basis with the maximum per day measured and the comparison to the limit developed and approved.

Claims of Damage:

- A. Claims of damage reported by property owners shall be evaluated and a conclusion on relationship to vibration established with 60-days of the completion of work within the area of the complaint.

1.03 MAINTENANCE OF EXISTING WATER AND WASTEWATER FACILITIES OPERATION

- A. The Contractor shall take notice that existing water and wastewater facilities are operated in the construction area. It is the responsibility of the Contractor to contact the Owner's utility operator and ascertain the extent of any specific service area.
- B. The Contractor shall fully cooperate at all times with the Owner in order to maintain the operation of the existing facilities with the least amount of interference and interruption possible. Continuous service, public health and safety considerations shall exceed all others and the Contractor's schedule, plans and work shall at all times be subject to alteration and revision if necessary for above considerations.
- C. The Engineer and Owner reserve the right to require the Contractor to work 24 hours per day in all cases where, in their opinion, interference with operation of the system may result.
- D. In no case will the Contractor be permitted to interfere with the existing system until all materials, supplies, equipment, tools and incidentals necessary to complete the interfering portion of the work are on the site. All existing utilities shall be potholed located prior to construction of conflicting yard piping.

1.04 CONNECTIONS TO EXISTING SYSTEMS

- A. The Contractor shall perform all work necessary to locate, excavate and prepare for connections to the terminus of the existing drainage culverts all as shown on the Drawings or where directed by the Owner. The cost of this work and for the actual connection of the existing mains shall be included in the bid price for the pipe installation and shall not result in any additional cost to the Owner.

1.05 RELOCATIONS

- A. The Contractor shall be responsible for the relocation of structures, including but not limited to light poles, signs, sign poles, fences, piping, irrigation conduits and drains that interfere with the positioning of the work as set out on the Drawings. The cost of all such relocations shall be included in the bid for the project and shall not result in any additional cost to the Owner.

1.06 WARRANTIES

- A. All equipment supplied under these Specifications shall be warranted by the Contractor and the equipment manufacturers for a period of one (1) year, unless otherwise specified. Warranty period shall commence on the date of Owner acceptance.
- B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced in the machine(s) and the unit(s) restored to service at no expense to the Owner.
- C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. The Contractor shall be responsible for obtaining equipment warranties in accordance with Section 01740 from each of the respective suppliers or manufacturers for all the equipment specified under Divisions 11 through 16.
- D. In the event that the manufacturer is unwilling to provide a one year warranty commencing at the time of Owner acceptance, the Contractor shall obtain from the manufacturer a two (2) year warranty commencing at the time of equipment delivery at the job site.

1.07 HURRICANE PREPAREDNESS PLAN

- A. Within thirty days of the date of Notice to Proceed, the Contractor shall submit to the Engineer and Owner a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the Owner in case of a hurricane warning. The plan shall detail these measures with specific action items defining responsible personnel.
- B. In the event of inclement weather, or whenever Engineer shall direct; Contractor will cause Subcontractors to protect carefully the Work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any portion of Work or materials shall have been damaged or injured by reason of failure on the part of Contractor or any Subcontractor to so protect the Work, such Work and materials shall be removed and replaced at the expense of the Contractor.

1.08 EQUIPMENT, TESTING & INSPECTION

- A. Regardless of the number of days specified in the individual sections for the manufacturer's representative to be present on the site for inspection and testing, if the equipment fails to perform as specified then the representative shall remain on site until the malfunction is corrected and the Owner received specified days of inspection or testing.
- B. The cost for the additional days required shall not be added to the cost of the Owner, but shall be to the account of the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01046

MODIFICATIONS TO EXISTING STRUCTURES, PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, equipment and incidentals required to modify, alter and convert existing structures as shown or specified and as required for the installation of new mechanical equipment, piping and appurtenances. Work shall be performed within the requirements of Special Project Procedures in Section 01030 and required Construction Scheduling in Section 01310. Existing piping and equipment shall be removed and dismantled as necessary for the performance of structural alterations in accordance with the requirements herein specified.

1.02 RELATED WORK

- A. Section 01045: Cutting and Patching
- B. Section 03300: Cast-In-Place Concrete

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall cut, repair, reuse, excavate, demolish or otherwise remove parts of the existing structures or appurtenances, as indicated on the Contract Drawings, herein specified, or necessary to permit completion of the work under this Contract.
- B. The above work shall include the cutting of grooves and chases in existing masonry to permit the proper bonding of new masonry to old, repainting of existing masonry, the drilling of holes into bolts, or other appurtenances, and the cutting of holes in masonry for the installation of pipe, conduits, and other appurtenances. The work shall include all necessary cutting and bending of reinforcing steel, structural steel, or miscellaneous metal work found embedded in the existing structures.
- C. Blasting with explosives will not be permitted to complete any work under this Contract. Care shall be taken not to damage any part of existing buildings, foundations and exterior structures both below and above ground.
- D. No existing structure, equipment, or appurtenance shall be shifted, cut, removed, or otherwise altered except with the express approval of and to the extent approved by the Engineer.
- E. When removing materials or portions of existing structures and when making openings in walls and partitions, the Contractor shall take all precautions and use all necessary barriers and other protective devices so as not to damage the structures beyond the limits necessary for the new work, not to damage the structures or contents by falling or flying debris.
- F. Materials and equipment removed in the course of making alterations and additions shall remain the property of the Owner, except that items not salvageable, as

determined by the Engineer and the Owner shall become the property of the Contractor to be disposed of by him off the site of the work at his own place of disposal.

- G. All work of altering existing structures shall be done at such time and in such manner as will comply with the approved time schedule. So far as possible before any part of the work is started, all tools, equipment, and materials shall be assembled and made ready so that the work can be completed without delay.
- H. All workmanship and new materials involved in constructing the alterations shall conform to the General Specifications for the classes of work insofar as such specifications are applicable.
- I. All cutting of existing masonry or other material to provide suitable bonding to new work shall be done in a manner to meet the requirements of the respective section of these specifications covering the new work. When not covered, the work shall be carried on in the manner and to extent directed by the Engineer.
- J. Where holes in existing masonry are required to be sealed, unless otherwise herein specified, they shall be sealed with cement mortar or concrete. The sides of the openings shall be provided with keyed joints and shall be suitably roughened to furnish a good bond and make a watertight joint. All loose or unsound material adjacent to the opening shall be removed and, if necessary, replaced with new material. The method of placing the mortar seal shall provide a suitable means of releasing entrapped air.
- K. Surfaces of seals visible in the completed work shall be made to match as nearly as possible the adjacent surfaces.
- L. Nonshrink grout shall be used for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete and elsewhere as shown.
- M. Operating equipment shall be thoroughly cleaned and then lubricated and greased for protection during prolonged storage.
- N. The Contractor shall provide flumes, hoses, piping, etc. to divert or provide suitable plugs, bulkheads or other means to hold back the flow of wastewater, water or other liquids, all as required in the performance of the work under this Contract.

3.02 CONNECTING TO EXISTING PIPING AND EQUIPMENT

- A. The Contractor shall verify exact location, material, alignment, joint, etc. of existing piping and equipment prior to making the connections called out in the Drawings. The verifications shall be performed with adequate time to correct any potential alignment or other problems prior to the actual time of connection.
- B. The Contractor shall dismantle and remove all existing equipment, piping and other appurtenances required, he shall cut existing pipelines for the purpose of making connections thereto. Anchor bolts for equipment and structural steel removed shall be cut off one inch below the concrete surface. Surface shall be finished as specified in Division 3.
- C. At the time that a new connection is made to an existing pipeline, additional new piping, extending to and including the most convenient new valve, shall be installed.
- D. here necessary or required for the purpose of making connections, the Contractor shall cut existing pipe lines in a manner to provide an approved joint. Where

required, he shall weld beads, flanges or provide Dresser Couplings, all as specified and required.

END OF SECTION

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SECTION 01050

FIELD ENGINEERING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide and pay for field engineering services required for Project as follows:
 - 1. Surveying work required for the lay-out and execution of Work.
 - 2. Surveying work required to identify and maintain existing control points, bench marks and property line corners.
 - 3. Surveying work required to verify existing utility locations.
 - 4. Surveying work as required to create Project Record Documents.
 - 5. Civil, structural, or other professional engineering services specified, or required to execute the Contractor's construction methods.
 - 6. Testing, sampling, calibrating and training services specified, or required to execute the Contractor's construction methods including soils, concrete, material, etc.

1.02 RELATED WORK

- A. Section 01410 - Testing Laboratory Services
- B. Section 01720 - Project Record Documents
- C. Other Sections as applicable.

1.03 QUALIFICATIONS OF PROFESSIONAL

- A. Florida Registered Professional Surveyor and Mapper, acceptable to the Owner and the Engineer.
- B. Florida Registered Professional Engineer(s) of the specialty required for on the Project, acceptable to the Owner and the Engineer.

1.04 SURVEY REFERENCE POINTS

- A. Horizontal and vertical control points for the Project are to be established by the Engineer and provided to the Contractor.
- B. Locate and protect control points prior to starting work, and preserve all permanent reference points during construction.
 - 1. Make no changes or relocations without prior written notice to the Engineer.
 - 2. Report to the Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
 - 3. Require surveyor to replace project control points which may be lost or destroyed.
 - 4. Establish replacements based on original survey control.

1.05 PROJECT SURVEY REQUIREMENTS

- A. Establish a minimum of two temporary bench marks on site, referenced to data by survey control points.
- B. Record locations, with horizontal and vertical data, on Project Record Documents.
- C. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means:
- D. Site Improvements
 - 1. Line and grade of pipe and structure installation; top of pipe, invert, slope, etc.
 - 2. Grading for fill and topsoil placement, roadway sub-base and base installation.
 - 3. Controlling lines and levels required for all trades.
 - 4. From time to time, verify layouts by same methods.

1.06 RECORDS

- A. Maintain a complete, accurate log of all control and survey work as it progresses in accordance with Section 01720.

1.07 SUBMITTALS

- A. Submit name and address of Professional Surveyor and Mapper or Professional Engineer to the Engineer.
- B. On request of the Engineer, submit documentation to verify accuracy of field engineering work.
- C. Submit certificate signed by registered surveyor certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.
- D. Submit Project Record Documents in accordance with Section 01720.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

PART 4 - ADVANCE INVESTIGATIONS

- A. The Contractor shall be responsible for uncovering and exposing existing utilities sufficiently in advance of pipe laying operations to confirm elevation, size, material and clearance separation(s). If, upon excavation, an existing utility is found to be in conflict with the proposed construction or be of a size or material different from what is shown on the plans, the Contractor shall immediately notify the Engineer, who will in turn prepare a recommendation. Failure of the Contractor to perform the advance investigation shall not relieve it of any claims for delay or damages.

END OF SECTION

SECTION 01100

ALTERNATES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. This section identifies procedures for proposing Alternates, and describes the basic changes to be incorporated into the Work, only when that Alternate is made a part of the Work by specific provisions in the Owner-Contractor Agreement.

1.02 RELATED REQUIREMENTS

- A. Bidding Documents: Method of quotation of the cost of each Alternate, and the basis of the Owner's acceptance of Alternates.
- B. Owner-Contractor Agreement: Incorporation of Alternates into the Work.
- C. Sections of the Specifications as listed under the respective Alternates.
- D. Referenced sections of Specifications stipulate pertinent requirements for products and methods to achieve the work stipulated under each Alternate.
- E. Coordinate pertinent related work and modify surrounding work as required to integrate the work under each Alternate, and to provide the complete construction required by Contract Documents.

1.03 PROCEDURES

- A. Alternates will be exercised at the option of the Owner.
- B. Coordinate related work and modify surrounding work as required to complete the Work, including changes under each Alternate, and to provide the complete construction required by Contract Documents.
- C. The Bidders may offer optional proposals in the part of the Bid form titled "Document 00400, Appendix C" for manufacturers and suppliers of equipment other than those required to be used in the base bid which they believe meets the Specifications for the Owner's consideration. After the Contract has been awarded, the Owner will determine whether any or all of the equipment options will be accepted and a Change Order will be issued to revise the contract price for options desired. Offering an option shall bind the Contractor to accepting the Change Order, but the Owner is in no way bound to accept any option. If any option is offered, the model number and brand name must be submitted.
- D. If an equipment option is proposed, the option price must reflect any additional installation and engineering costs required because of differences in equipment installation requirements. No extra cost will be paid to the Contractor for modification of concrete piping, electrical, etc., in the event the Owner elects to accept an option. All revisions required shall be subject to the approval of the Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01152

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Submit Applications for Payment to the Engineer in accordance with the schedule established by Conditions of the Contract and Agreement Between Owner and Contractor.

1.02 RELATED REQUIREMENTS

- A. Agreement between Owner and Contractor consisting of an approved payment schedule by the Town of Surfside Finance Director.
- B. Conditions of the Contract: Progress Payments, Retainages, Final Payment, schedule of values and Record Documents.
- C. Section 01050: Field Engineering
- D. Section 01310: Construction Schedules
- E. Section 01370: Schedule of Values
- F. Section 01380: Construction Photographs
- G. Section 01720: Project Record Documents

1.03 FORMAT AND DATA REQUIRED

- A. Submit applications typed on forms provided by the Owner, Application for Payment, with itemized data typed on 8 1/2 inch x 14 inch white paper and continuation sheets.
- B. Payment forms shall show significant detail to substantiate request. Additional detail may be required by the Engineer.

1.04 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 summary of dollar values to agree with respective totals indicated on continuation sheets.
 - 3. Execute certification with signature of a responsible officer of Contract firm.

- B. Continuation Sheets:
1. Fill in total list of scheduled component items of work, with item number and scheduled 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.
 - a. Round off values to nearest dollar, or as specified.
 3. List each Change Order Number, and description, as for an original component item or work.
 - a. List by Change Order Number, and description, as for an original component item or work.
 4. Payment for Material and Equipment stored, but not yet incorporated into the Work, will be allowed.

1.05 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

- A. When the Owner or the Engineer requires substantiating data, 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 copy of data cover letter for each copy of application.
- C. As a prerequisite for payment, Contractor is to submit a "Surety Acknowledgment of Payment Request" letter showing amount of progress payment which the Contractor is requesting.
- D. The Contractor shall maintain an updated set of drawings to be used as a record drawings in accordance with Section 01720. As a prerequisite for monthly progress payments, the Contractor shall submit the updated record drawings for review by the Engineer per Section 01050.
- E. Construction schedule in accordance with 01310
- F. Aerial photographs in accordance with 01380.

1.06 PREPARATION OF APPLICATION FOR FINAL PAYMENT

- A. Fill in Application form as specified for progress payments.
- B. Use continuation sheet for presenting the final statement of accounting as specified in Section 01700 - Contract Closeout.
- C. Submit final record drawings.

1.07 SUBMITTAL PROCEDURE

- A. Submit Applications for Payment to the Engineer at the times stipulated in the Agreement.
- B. Number: Five copies of each Application.
- C. When the Engineer finds Application properly completed and correct, he will transmit certificate of payment to Owner, with copy to Contractor.

PART 2 - PRODUCTS (NOT USED).

PART 3 - EXECUTION (NOT USED).

END OF SECTION

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SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. The Engineer shall schedule and administer preconstruction meetings, periodic progress meetings, and specially called meetings throughout the progress of work. The Engineer shall:
 - 1. Prepare agenda for meetings.
 - 2. Make physical arrangements for meetings.
 - 3. Preside at meetings.
 - 4. Record the minutes; include significant proceedings and decisions.
 - 5. Reproduce and distribute copies of minutes within five working days after each meeting.
 - a. To participants in the meeting.
 - b. To parties affected by decisions made at the meeting.
- B. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
- C. The Contractor shall attend meetings to ascertain that work is executed consistent with Contract Documents and construction schedules.

1.02 RELATED REQUIREMENTS

- A. Document 00100: Instructions to Bidders.
- B. Section 01310: Construction Schedules.
- C. Section 01340: Shop Drawings, Working Drawings, and Samples.
- D. Section 01720: Project Record Documents.

1.03 PRECONSTRUCTION MEETING

- A. Schedule a preconstruction meeting no later than 15 days after date of Notice to Proceed.
- B. Location: A central site, convenient for all parties designated by the Owner.

- C. Attendance:
 - 1. Owner's Representative.
 - 2. Engineer and his Professional Consultants.
 - 3. Resident Project Representative.
 - 4. Contractor's Superintendent.
 - 5. Major Subcontractors.
 - 6. Major Suppliers.
 - 7. Utilities.
 - 8. Others as appropriate.

- D. Suggested Agenda:
 - 1. Distribution and discussion of:
 - a. List of major subcontractors and suppliers.
 - b. Projected Construction Schedule.
 - 2. Critical work sequencing/critical path scheduling.
 - 3. Major equipment deliveries and priorities.
 - 4. Project Coordination.
 - a. Designation of responsible personnel.
 - 5. Procedures and processing of:
 - a. Field decisions.
 - b. Proposal requests.
 - c. Submittals.
 - d. Change Orders.
 - e. Applications for Payments.
 - 6. Adequacy of Distribution of Contract Documents.
 - 7. Procedures for maintaining Record Documents.
 - 8. Use of Premises:

- a. Office, Work and Storage Areas.
- b. Owner's Requirements.
- 9. Construction facilities, controls and construction aids.
- 10. Temporary Utilities.

1.04 PROGRESS MEETINGS

- A. Schedule regular periodic meetings. The progress meetings will be held as required by progress of the work.
- B. Hold called meetings as required by progress of the work.
- C. Location of the meetings: Project field office of the Contractor or Engineer.
- D. Attendance:
 - 1. Engineer, and his professional consultants as needed.
 - 2. Subcontractors as appropriate to the agenda.
 - 3. Suppliers as appropriate to the agenda.
 - 4. Others as appropriate.
- E. Suggested Agenda:
 - 1. Review, approval of minutes of previous meeting.
 - 2. Review of work progress since previous meeting.
 - 3. Field observations, problems, conflicts.
 - 4. Problems which impede Construction Schedule.
 - 5. Review of off site fabrication, delivery schedule.
 - 6. Corrective measures and procedures to regain projected schedule.
 - 7. Revisions to Construction Schedule.
 - 8. Progress, schedule, during succeeding work period.
 - 9. Coordination of schedules.
 - 10. Review submittal schedules; expedite as required.
 - 11. Maintenance of quality standards.

12. Pending changes and substitutions.
 13. Review proposed changes for:
 - a. Effect on Construction Schedule and on a completion date.
 - b. Effect on other contracts of the Project.
 14. Other business.
 15. Construction schedule.
 16. Critical/long lead items.
- F. The Contractor is to attend progress meetings and is to study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics such as deliveries of materials and equipment, progress of work, etc.
- G. The Contractor is to provide a current submittal log at each progress meeting in accordance with Section 01340.

PART 2 - PRODUCTS (NOT USED).

PART 3 - EXECUTION (NOT USED).

END OF SECTION

SECTION 01311

CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. The project management-scheduling tool "Critical Path Method" commonly called CPM, shall be employed by CONTRACTOR for the planning and scheduling of all work required under the Agreement.
- B. Submit revised progress schedules on a monthly basis.
- C. No partial payments shall be approved by the Engineer until there is an approved up to date construction progress schedule on hand.
- D. The Contractor shall designate an authorized representative of his firm who shall be responsible for development and maintenance of the schedule and of progress and payment reports. This representative of the Contractor shall have direct project control and complete authority to act on behalf of the Contractor's schedule.

1.02 RELATED REQUIREMENTS

Document 00700	Conditions of the Contract
Section 01010	Summary of Work
Section 01200	Project Meetings
Section 01340	Shop Drawings, Working Drawings, and samples

1.03 QUALIFICATIONS

- A. CONTRACTOR shall submit evidence of CPM capability for TOWN'S acceptance within ten days of TOWN'S request for same. If, in the opinion of the TOWN, the evidence does not demonstrate acceptable CPM capability, CONTRACTOR will employ a CPM consultant who is so qualified.
- B. Capability shall be verified by description of construction projects to which CONTRACTOR or its consultant has successfully applied computerized CPM and shall include at least two (2) projects valued at least half the expected value of this project, and at least one project which was controlled throughout the duration of the project by means of computerized, periodic, systematic review of the CPM schedule.

1.04 CONTENT OF CONSTRUCTION PROGRESS SCHEDULE

- A. Show the complete sequence of construction by activity.
- B. Show the dates for the beginning of, and completion of, each major element of construction in no more than a two-week increment scale. The Schedule should list, but not limited to:
 - 1. Site Clearing
 - 2. Site Utilities
 - 3. Foundation Work
 - 4. Structural Framing

5. Subcontractor Work
 6. Equipment Installations
 7. Finishings
 8. Instrumentation
 9. Testing
 10. Startup
 11. Receipt of Spare Parts
 12. Site Work
 13. Record Drawings
 14. Restoration
 15. Float
- C. Show projected percentage of completion for each item, as of the first of each month.
 - D. Show projected dollar cash flow requirements for each month of construction.
 - E. Use of float suppression techniques such as preferential sequencing or logic, special lead/lag logic restraints, and extended activity times are prohibited, and use of float time disclosed or implied by use of alternate float-suppression techniques shall be shared to proportionate benefit of the Owner and Contractor.
 - F. Pursuant to above float-sharing requirement, no time extensions will be granted nor delay damages paid until a delay occurs which (i) impacts Project's critical path, (ii) consumes available float or contingency time, and (iii) extends work beyond contract completion date.
 - G. If the Contractor provides an accepted schedule with an early completion date, the Owner reserves the right to reduce the duration of the work to match the early completion date by issuing a deductive Change Order at no change in Contract Price.

1.05 CPM SUBMITTAL PROCEDURES

- A. Submittal Requirements
 1. Narrative description of the logic and explanation of the schedule.
 2. Time scaled logic network, computer generated.
 3. Tabulated Schedule Reports
 - a. Activities sorted by Early Start dates, organized by related elements
 - b. Activities sorted by Float, organized by related elements
 - c. Activities sorted by Activity, showing all predecessors and successors
 - d. Resource allocations by Activity
 - e. Activity Costs sorted by Activity
 4. All schedule submittals including revisions and updates shall include two (2) copies of the schedule data on compact disk (CD) with label(s) identifying the file name and revision number. The CD(s) shall be properly packaged

and shipped to prevent damage or loss of data.

- B. Time of Submittals: Submittal of Schedules shall be made at the times indicated herein with a preliminary Project Schedule, submitted within thirty (30) days after the Notice to Proceed with the Design Services under this Agreement.
- C. Revised Original CPM Schedule Submittals: The TOWN shall initially review the Preliminary CPM Schedule to determine that the work planned is in conformance with the Design Criteria Package. If it is found in general compliance, comments will be given to the CONTRACTOR for any required or recommended changes to the schedule. A Revised Project Schedule shall be submitted within 45 days of the Notice to Proceed for Design Services under this Agreement. This project schedule shall function as the starting point for all design and construction activities and shall be updated on a regular basis as specified herein.
- D. The following reports must be included:
 - 1. Four (4) tabular schedule listings, sorted by Activity number: Early Start; Later Start; Total Float; Responsibility Code. Each Schedule Listing shall contain the following data elements:
 - a. Activity number/ID
 - b. Activity description
 - c. Duration
 - d. Early start date
 - e. Early finish date
 - f. Late start date
 - g. Late finish date
 - h. Free float
 - i. Total float
 - j. Criticality
 - k. Budget amount of activity
 - l. Responsibility
 - m. Other resources including special equipment hours by type, serial manpower by craft or crew, and unique materials by units. (On resource report)
 - 2. A Successor/Predecessor Report which shall identify the successor and predecessor activities for each activity, and ties between schedule activities.
 - 3. A Critical Path Report, identifying all activities with zero (0) duration.
 - 4. A Project Bar Chart, sorted by Activity number.
 - 5. A Project Bar Chart, sorted by Early Start.
 - 6. A Milestone Bar Chart.
 - 7. A Network Diagram, showing the Critical Path clearly highlighted.
- E. Upon acceptance of the Project Schedule, the Early Start and Early Finish dates for

all activities shall be fixed as Planned Start and Planned Finish dates, except where Late Start and Late Finish dates are specifically agreed to by TOWN for future variance calculations.

- F. Following acceptance of the Project Schedule, the CONTRACTOR shall monitor the progress of the work and adjust the schedule each month to reflect actual progress and any changes in planned future activities. Progress shall be evaluated monthly by the CONTRACTOR and the TOWN. Not less than seven (7) days prior to submittal of each monthly Request for Payment, they shall meet at the jobsite and jointly evaluate the status of each activity on which work has started or is due to start, based on the preceding construction schedule; to show actual progress, to identify those activities started and those completed during the previous period; to show the estimated time required to complete or the percent complete of each activity started but not yet completed; and to reflect any necessary changes to the schedule, network analysis or report to accurately reflect progress. Activities shall not be considered "complete" until they are, in fact, 100 percent complete.
1. In addition, each update shall include the following tabular report formats:
 - a. Completed Tasks (a Current Activities Report)
 - b. Should Have Started Tasks (a Current Activities Report)
 - c. Tasks in Progress (a Current Activities Report)
 - d. Slipping Tasks (a Current Activities Report)
 - e. Resource Usage (a Workload Report). This report shall identify any over-allocation of labor and/or equipment resources, and identify measures to correct/alleviate the over-allocation.
 - f. Itemized list of all changes to the network logic, activity durations, responsibility, or any data elements since the previous submission.
 - g. Variance report comparing Planned Start and Finish Dates to Actual Start and Finish Dates.
 2. Neither the submission nor the updating of the CONTRACTOR's Project Schedule submittal, nor the submission, updating, change or revision of any other report, curve, schedule or narrative, shall have the effect of amending or modifying or limiting in any way the CONTRACTOR's obligations under the Agreement. Only a signed, fully executed Change Order can modify these obligations.
 3. Upon approval of a Change Order, or upon receipt by the CONTRACTOR of authorization to proceed with additional work, the change shall be reflected in the next submittal of the CPM Schedule by the CONTRACTOR. The CONTRACTOR shall utilize a sub-network in the schedule depicting the changed work and its effect on other activities. The sub-network shall be tied to the main network with the appropriate logic so that a true analysis of the critical Path can be made.
 4. Monthly schedule updates shall be submitted with the Request for Payment.
- G. During Construction, a three (3) week rolling schedule shall be provided for each weekly meeting showing the items worked the previous week and those scheduled to be in progress during the next two (2) weeks. The three-week rolling schedule

shall use a bar chart format and be accompanied by a tabular report of the activities included. The previous week's schedule shall be indicated as a "target" schedule for comparison.

- H. A vendor submittal schedule shall be provided.
- I. The TOWN'S review and acceptance of the CONTRACTOR's project schedule is for conformance to the requirements of the Contract Agreement only. Review and acceptance by the TOWN of the CONTRACTOR's project schedule does not relieve the CONTRACTOR of any of its responsibility whatsoever for the accuracy or feasibility of the project schedule, or of the CONTRACTOR's ability to meet the interim milestone date(s) and the Substantial or Final Completion Date, nor does such review and acceptance expressly or impliedly warrant, acknowledge or admit the reasonableness of the logic, durations, manpower or equipment loading of the CONTRACTOR's project schedule.
- J. Revised Schedules: CONTRACTOR, if requested by TOWN, shall provide a revised schedule if, at any time, TOWN considers the completion date to be in jeopardy because of "activities behind schedule." "Activities behind schedule" are all activities behind the accepted WORK plan regardless of the existence of positive float on the activity. The revised schedule shall conform to the requirements of Paragraph 1.04, "CPM Submittal Procedures" and show how CONTRACTOR intends to accomplish the WORK to meet the completion date or milestones. TOWN may require CONTRACTOR to modify any portions of the WORK schedule that become unfeasible because of "activities behind schedule" or for any other valid reason. An activity that cannot be completed by its original or latest completion date shall be deemed to be behind schedule. No change may be made to the sequence, duration, or relationships of any activity without the express written acceptance of the TOWN.

1.06 CHANGE ORDERS

- A. Upon approval of a Change Order, the approved change shall be included in the next schedule submittal. If an associated Impact Schedule has been accepted, it shall become the new Project Schedule. All added or deleted WORK shall be reflected, including revised vendor submittal procedures, material and equipment procurement, the WORK, costs, and resources added or subtracted as a result of the change. If not accepted as a part of an Impact Schedule, a Revised Schedule shall be submitted within ten days of approval of the Change Order.

1.07 CPM STANDARDS

- A. Definition
CPM, as required by this Section, shall comply with the standards outlined in the Associated General Contractor's publication, "The Use of CPM in Construction" unless specifically changed by this section.
- B. Construction WORK Schedules
Construction WORK schedules shall include a graphic network and tabulated schedule reports as described below. To be acceptable the schedule must demonstrate the following:
 - 1. A logical succession of WORK, from start to finish. This logical succession, when accepted, is the CONTRACTOR's WORK plan.

2. Show all WORK activities and interfaces (restraints) including all submittals and major material and equipment deliveries.

C. Networks

1. The CPM network, or diagram, shall be in the form of a time-scaled diagram of the customary activity-on-node type, and may be divided into any number of separate pages, with suitable notation relating the interface points among the pages. Individual pages shall not exceed 3 foot by 5 foot. Notation on each activity shall include a brief WORK description and a duration estimate.
2. All construction activities and procurement activities shall be indicated in a time-scaled format, and a calendar shall be shown on all sheets along the entire sheet length. Each activity shall be plotted so the beginning and completion dates of said activity can be determined graphically by comparison with the calendar scale. All activities shall be shown using symbols that clearly distinguish between critical path activities, non-critical activities, and float for each non-critical activity. All non-critical path activities shall show estimated performance time and float time.

D. Duration

1. The duration indicated for each activity shall be in calendar days and shall represent the single best time considering the scope of the WORK and resources planned for the activity including time for inclement weather.
2. Except for certain non-labor activities, such as design and permitting activities, curing concrete or delivering materials, activity durations shall not exceed fourteen days, be less than one day, nor exceed \$50,000 in value unless otherwise accepted by TOWN.

E. Project Information

Each tabulation shall be prefaced with the following summary data:

1. Project Name
2. Contractor
3. Type of Tabulation (Initial or Updated)
4. Project Duration
5. Project Scheduled Completion Date
6. Projected Completion Date
7. Variance Analysis per Activity (on updates)

1.08 PROJECT MILESTONES

In order for the project to be completed within the time specified in the Agreement, and so that critical items are completed before related and dependent items can begin, the following milestones are established. The CONTRACTOR shall determine their own sequence of activities to meet the required milestones. The CONTRACTOR shall also determine a reasonable time to complete each item.

Milestone Time to Complete

No	Item	Date to Complete
1	Begin Design Activities	
2	Submit Project Schedule	
3	Submit 100% Construction Documents	
4	Permits Obtained	
5	Notice to Proceed for Construction	
6	Substantial Completion of Construction	
7	Record Drawings	
8	Complete and Submit O&M Manuals	
9	Complete All Required Training	
10	Complete All Testing for Substantial Completion	
11	Permit Compliance / Certifications	
12	Final Completion and Project Closeout	

1.09 DISTRIBUTION

A. Distribute copies of the reviewed schedules to:

1. Engineer (two copies)
2. Job Site File
3. Sub-contractors
4. Other Concerned Parties
5. Owner (Two Copies)

B. Instruct recipients to report promptly to the Contractor, in writing, any problems anticipated by the projections shown in the schedule.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01340

SHOP DRAWINGS, WORKING DRAWINGS AND SAMPLES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. The contractor shall submit to the Engineer for review, such working drawings, shop drawings, test reports and data on materials and equipment (hereinafter in this article called data), and material samples (hereinafter in this article called samples) 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. The Contractor shall submit five (5) copies of shop drawings or other data to the Engineer.
- C. Within thirty (30) calendar days after the effective date of the Agreement, the Contractor shall submit to the Engineer a complete list of preliminary data for which Shop Drawings are to be submitted. Included in this list shall be the names of all proposed manufacturers furnishing specific items. Review of this list by the Engineer shall in no way expressed or implied relieve the Contractor from submitting complete Shop Drawings and providing materials, equipment, etc., fully in accordance with the Specifications. This procedure is required in order to expedite final review of Shop Drawings.
- D. The contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the Owner and Engineer. This log should include the following items:
 - 1. Submittal-Description and Number assigned.
 - 2. Date to Engineer.
 - 3. Date returned to Contractor (from Engineer).
 - 4. Status of Submittal (Approved/Resubmit/Rejected).
 - 5. Date of Resubmittal and Return (as applicable).
 - 6. Date material released (for fabrication).
 - 7. Projected date of fabrication.
 - 8. Projected date of delivery to site.
 - 9. Status of O & M submittal.

1.02 RELATED REQUIREMENTS

- A. Section 00700 - Standard General Conditions of the Construction Contract
- B. Section 01310 - Construction Schedules

- C. Section 01720 - Project Record Documents
- D. Section 01730 - Operating and Maintenance Data

1.03 CONTRACTOR'S RESPONSIBILITY

- A. It is the duty of the Contractor to check all drawings, data and samples prepared by or for him before submitting them to the Engineer for review. Each and every copy of the Drawings and data shall bear Contractor's stamp 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.
- B. Determine and verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Catalog numbers and similar data
 - 4. Conformance and Specifications
- C. The Contractor shall furnish the Engineer a schedule of Shop Drawing 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. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that reviewed Shop Drawings, Working Drawings and Samples will be needed.
- E. 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 him, approved by the Engineer.
- F. The Contractor shall submit to the Engineer all shop drawings, working drawings and samples sufficiently in advance of construction requirements and shall account for Engineers Shop Drawing review time accordingly.
- G. The Contractor shall submit two (2) copies of descriptive or product data submittals to complement shop drawings for the Engineer plus the number of copies which the Contractor requires. The Engineer will retain two (2) sets. All blueprint shop drawings shall be submitted with one (1) set of reproducible and four (4) sets of print. The Engineer will review the drawings and return to the Contractor the set of marked-up drawings with appropriate review comments.
- H. The Contractor shall be responsible for and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of work prior to the review and Approval by Engineer of the necessary Shop Drawings.

1.04 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 exception 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 for 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 schedule as submitted describe variations and/or show a departure from the Contract requirements which Engineers finds to be in the interest of the Owner and to be minor as not to involve a change in the 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 "REJECTED" and with required corrections shown will be returned to the Contractor for correction and resubmittal.
- E. Resubmittals will be handled in the same manner as the 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. The Engineer will review one submittal and one re-submittal after which cost of review will be borne by the Contractor. The cost of engineering shall be equal to the Engineer's charges to the Owner under 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, and will not be considered "Rejected" until resubmitted.
- J. The Engineer shall return Shop Drawing submittals to the Contractor within twenty-one (21) days calendar days from the date the Engineer receives them.

1.05 SHOP DRAWINGS

- A. When used in the Contract Documents, the term "Shop Drawings" shall be considered to mean Contractor's plans for material and equipment which become an integral part of the Project. These drawings shall be complete and detailed. Shop Drawings shall consist of fabrication, erection and setting drawings and schedule drawings, manufacturer's scale drawings, 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.
- B. Drawings and schedules shall be checked and coordinated with 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.
- C. Each Shop Drawing, shall have a blank area 3 1/2 inches by 3 1/2 inches, located adjacent to the title block. The title block shall display the following:
 - 1. Number and title of the drawing.
 - 2. Date of drawing or revision.
 - 3. Name of project building or facility.
 - 4. Name of contractor and subcontractor submitting drawing.
 - 5. Clear identification of contents and location of work.
 - 6. Specification title and number.
- D. If drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations he shall not be relieved of the responsibility for executing the work in accordance with the Contract, even though such drawings have been reviewed.
- E. 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.
- F. 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 spare parts can be readily obtained. In addition, a maintenance and lubrication schedule for each piece of equipment shall be submitted along with each shop drawing submittal.
- G. All manufacturers or equipment supplier who proposes to furnish equipment or products under Divisions 11, 12, 13, 14, 15 and 16 shall submit an installation list to the Engineer along with the required shop drawings. The installation list shall include at least five installations where identical equipment has been installed and has been in operation for a period of at least five (5) years.

- H. Only the Engineer will utilize the color "red" in marking Shop Drawing submittals.
- I. Before final payment is made, the Contractor shall furnish to Engineer two (2) sets of record shop drawings all clearly revised, complete and up to date showing the permanent construction as actually made for all reinforcing and structural steel, miscellaneous metals, process and mechanical equipment, piping, electrical system and instrumentation system.

1.06 WORKING DRAWINGS

- A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's plans 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 subparagraph 1.06A above, shall be submitted to the Engineer where required by the Contract Documents or requested by the Engineer, and shall be submitted at least thirty (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, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the Engineer, which review will be for general conformance and will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. The Contractor assumes all risks of error; the Owner and Engineer shall have no responsibility therefore.

1.07 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 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
(Samples of finished materials shall have additional marking that will identify them under the finished schedules.)

- D. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required in subparagraph 1.07B above. He 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 named 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 the 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 his expense, if so requested at time of submission.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

DOCUMENT 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Submit to the Engineer a Schedule of Values allocated to the various portions of the Work, within 21 days after the effective date of the Agreement.
- B. Upon request of the Engineer, support the values with data which will substantiate their correctness.
- C. The Schedule of Values shall be used as the basis for the Contractor's Applications for Payment.

1.02 RELATED REQUIREMENTS

- A. Document 00700: Conditions of the Contract
- B. Section 01152: Application for Payment

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

- A. Type schedule on an 8-1/2 inch x 11 inch or 8-1/2 inch x 14 inch white paper; Contractor's standard forms and automated printout will be considered for approval by the Engineer upon Contractor's request. Identify schedule with:
 - 1. Title of Project and location
 - 2. Engineer and Project number
 - 3. Name and Address of Contractor
 - 4. Contract designation
 - 5. Date of submission
- B. Schedule shall list the installed value of the component parts to include earthwork/foundation, reinforced concrete, masonry, hollow core roof, roofing material, painting/coatings, individual equipment, piping, electrical, paving, of the Work (as required) in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. For the various portions of the Work:
 - 1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.

- D. The sum of all values listed in the schedule shall equal the total Contract Sum.
- E. Schedules are subject to Engineer's approval wherein additional line item detail may be required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

The minimum requirements for the schedule of values are as follows:

**TOWN OF SURFSIDE SEAWALL REPLACEMENT
UNIT PRICE BID SCHEDULE**

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
I. GENERAL					
1	Mobilization/Demobilization	1	LS	_____	_____
2	General Conditions/Temporary Facilities	1	LS	_____	_____
3	Maintenance of Traffic per FDOT including temporary striping and signage, barricades, barriers, arrow panels, etc. as required.	1	LS	_____	_____
4	Utility Coordination	1	LS	_____	_____
5	Preconstruction seismic survey and video	1	LS	_____	_____
6	F&I Turbidity Curtain(s) and Silt Fencing, Hay Bales	1	LS	_____	_____
7	Clearing & Grubbing	1	LS	_____	_____
8	Restoration (S/W, Driveway, Asphalt, Landscaping, Fencing, PMS, Etc.)	1	LS	_____	_____
9	Testing (density, soil, concrete, etc., as-builts)	1	LS	_____	_____
GENERAL SUBTOTAL					_____
II. CIVIL					
A	Demolition/Site Preparation	1	LS	_____	_____
10	NPDES Compliance	1	LS	_____	_____
11	Seismic monitoring of houses	1	LS	_____	_____

	adjacent to seawalls during construction				
12	Grading/Fine Grading	1	LS	_____	_____
13	Sodding	1	LS	_____	_____
14	Landscaping	1	LS	_____	_____
15	Demolition of Existing Seawalls as required (Cap, Wall, Tieback, King Piles, etc.)	731	LF	_____	_____

SUBTOTAL

B Earthwork

16	Jet excavation of FPL lines	2	EA	_____	_____
17	Excavation behind walls	731	LF	_____	_____
18	Unsuitable Soil Removal & Disposal	1	LS	_____	_____
19	Clean Fill / Import Material (in-place)	1	LS	_____	_____

SUBTOTAL

C Seawall Construction

20	F&I 20' King Piles	107	EA	_____	_____
21	F&I 20' Batter Piles	107	EA	_____	_____
22	Test Pile	10	EA	_____	_____
23	Pile Splices	-	EA	_____	_____
24	Pile Cutoff	107	EA	_____	_____
25	F&I Concrete Panels	731	LF	_____	_____
26	Filter Fabric	883	LF	_____	_____
27	Weep Holes	92	EA	_____	_____
28	Concrete Endwalls (with reinforcement)	20	EA	_____	_____
29	Extend Drainage Culverts with Fittings	7	EA	_____	_____
30	Form and Pour Concrete Cap (with reinforcement)	731	LF	_____	_____
31	F&I Manatee Grates	7	EA	_____	_____
32	F&I Rip-Rap	731	LF	_____	_____
33	Irrigation Repairs	1	LS	_____	_____

SUBTOTAL

GRAND TOTAL (Items 1-33)

END OF SECTION

DOCUMENT 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Employ competent photographer to take construction record photographs for preconstruction conditions, periodically during course of Work, and post-construction.

1.02 RELATED REQUIREMENTS

- A. Section 01152: Application for Payment
- B. Section 01720: Project Record Documents

1.03 PHOTOGRAPHY REQUIRED

- A. Provide photographs taken on cutoff date for each scheduled Application for Payment.
- B. View and Quantities Required:
 - 1. Take a minimum of 24 exposures of the site and adjacent property at preconstruction, monthly, and post-construction.
- C. Negatives:
 - 1. Remain property of photographer
 - 2. Require that photographer maintain negatives for a period of two years from Date of Completion of entire project.
 - 3. Photographer shall agree to furnish additional prints to Owner and the Engineer at commercial rates applicable at time of purchase.

1.04 COSTS OF PHOTOGRAPHER

- A. Contractor shall pay costs for specified photography and prints.
 - 1. Parties requiring additional photography or prints will pay photographer directly.

PART 2 - PRODUCTS

2.01 PRINTS

- A. Color:
 - 1. Paper: Single weight, color print paper
 - 2. Finish: Smooth surface, glossy
 - 3. Size: 8-inch x 10-inch
- B. Identify each print on back, listing:
 - 1. Name of Project
 - 2. Orientation of View

3. Date and time of exposure
4. Name and address of photographer
5. Photographer's numbered identification of exposure.

PART 3 - EXECUTION

3.01 TECHNIQUE

- A. Factual presentation
- B. Correct exposure and focus
 1. High resolution and sharpness
 2. Maximum depth-of-field
 3. Minimum distortion

3.02 VIEWS REQUIRED

- A. Photograph from locations to adequately illustrate condition of construction and state of progress.
 1. At successive periods of photography, take at least one photograph from the same overall view as previously.
 2. Consult with the Engineer at each period of photography for instructions concerning views required.

3.03 DELIVERY OF PRINTS

- A. Deliver 3 sets of prints to the Engineer to accompany each Application for payment.

END OF SECTION

SECTION 01385

COLOR AUDIO-VIDEO CONSTRUCTION RECORD

PART 1 - GENERAL

1.01 SCOPE

- A. Prior to the commencement of any work, including DESIGN/BUILDER mobilization, the DESIGN/BUILDER shall have a continuous color digital audio-video DVD recording taken along the entire length and width of the proposed project route to serve as a record of preconstruction conditions. The CD/DVD recording shall be suitable for viewing on standard laptop and/or desk top computers used by the CITY. Two copies of the CD/DVD recording shall be kept at the site, one with the CITY and one with the DESIGN/BUILDER until completion of the work.

1.02 CONSTRUCTION SCHEDULE

- A. Digital recordings shall not be made more than 30 days prior to construction in any area. No construction shall begin prior to review and approval of the digital recordings, covering the construction area, by the CITY. The DESIGN/BUILDER shall reschedule unacceptable coverage within five (5) days after being notified. All master CD/DVD's and written records shall be well maintained without any damage and shall become the property of the City.

1.03 PROFESSIONAL VIDEO-GRAPHERS

- A. The DESIGN/BUILDER shall engage the services of a professional video-grapher. The color audio-video digital recordings shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business of pre-construction color audio-video digital documentation. The video-grapher shall furnish to the DESIGN/BUILDER for submittal to the CITY a list of all equipment to be used for the audio-video recording, i.e., manufacturer's name, model number, technical specifications and other pertinent information. Additional information to be furnished by the video-grapher shall include the names and addresses of two (2) references that the video-grapher has performed color audio-videotaping for on projects of a similar nature, including one (1) within the last twelve (12) months.

PART 2 - PRODUCT

2.01 GENERAL

- A. The total audio-video digital recording system and the procedures employed in its use shall be such as to produce a finished product that will fulfill the technical requirements of the project. The video portion of the recording shall produce bright, sharp, and clear pictures with accurate colors and shall be free from distortion or any other form of picture imperfection. All video recordings shall, by electronic means, display on the screen the day, the time, the month, and the year of

the recording. This date and time information must be continuously and simultaneously generated with the actual recording. The audioportion of the recording shall produce the commentary of the camera operator with proper volume, clarity, and be free from distortion.

2.02 EQUIPMENT

- A. Audio/Video Recorder: Digital voice and video recorder, MPEG-4 recording technology for TV quality video recording, built-in microphone for high quality voice and sound recording, 3.15 Mega Pixel CDD Sensor with up to 640x480 video resolution, 4X digital zoom, 16MB internal memory, SD/MMC compatible, compatible with software needed and cabling provided to interface with a Windows XP based computer for creating high quality CD/DVD file records.
- B. Video CD/DVDs: Used to create and store digital video, audio and multimedia files. Stores up to 4.7GB or more than two hours of MPEG2 Video, compatible for playback with most DVD players and DVD-ROM drives on Windows XP based computers. The DVDs shall be new and shall not have been used for any previous recording.

PART 3 - EXECUTION

3.01 COVERAGE

- A. The recordings shall contain coverage of all surface features located within the construction areas inside the plant and shall include but not be limited to: all roadways, pavements, detention ponds, ditches, walls, piping, equipment, curbs, driveways, sidewalks, culverts, headwalls, retaining walls, buildings, landscaping, trees, shrubbery, fences, and electrical power poles and equipment. Of particular concern shall be the existence of any faults, fractures, or defects.
- B. Recording coverage shall be grouped by structure providing both exterior and interior coverage for all areas that will be affected by the work. The outside areas of the work for the general plant grounds shall be covered in grid format to cover the property for the existing plant and new site area for portions of both properties that will be affected by the work. Coverage shall include all surface conditions located within the zone of influence of construction supported by appropriate audio description.

3.02 AUDIO CONTENT

- A. Accompanying the video recording shall be a corresponding and simultaneously recorded audio recording. This audio recording, exclusively containing the commentary of the camera operator, shall assist in viewer orientation and in any needed identification, differentiation, clarification, or objective description of the features being shown in the video portion of the recording including the location relative to construction activities planned. The audio recording shall be free from any conversations between the camera operator and any other production technicians. Panning, zoom-in and zoom-out rates shall be sufficiently controlled to

maintain a clear view of all subjects.

3.03 VIDEO CD/DVD LABELING

- A. Video CD/DVD Identification: All CD/DVD's for the digital video recordings shall be permanently labeled using commercial CD labeling software and labels. CD/DVD's shall be properly identified by disc number, project title, and date recorded.
- B. Video CD/DVD Logs: Each video recording digital file shall have a log of that video recording's contents and what CD/DVD the recording file is stored on. The log shall describe the various segments of coverage contained on that video recording in terms of the location within the plant, extent of coverage, beginning and end points, directions of coverage, and date.

3.04 TIME OF EXECUTION

- A. Visibility: All recording shall be performed during times of good visibility. No recording shall be done during periods of significant precipitation, mist, or fog. The recording shall only be done when sufficient sunlight is present for outdoor recordings to properly illuminate the subject, and to produce bright, sharp video recordings of those subjects. For indoor recordings, the DESIGN/BUILDER shall provide adequate lighting to produce bright, sharp video recordings. No recording shall be performed when more than 10% of the area to be recorded contains debris or obstructions unless otherwise authorized by the CITY.

3.05 CONTINUITY OF COVERAGE

- A. In order to increase the continuity of the coverage, the coverage shall consist of a single, continuous, unedited recording which begins at one end of a particular construction area and proceeds uninterrupted to the other end of that area. Coverage shall reflect an organized, interrelated sequence of recordings from one construction area to another.

3.06 COVERAGE RATES

- A. The rate of travel during a particular segment of coverage shall be related to the amount of the surface features within a construction area being recorded. For interior and exterior of existing structures, average rate of travel shall not exceed thirty feet per minute from approximately 10 feet from subject. For open areas within the existing plant, average rate of travel shall not exceed forty-eight feet per minute. For open areas within the new property area, average rate of travel shall not exceed sixty feet per minute

3.07 CAMERA OPERATION

- A. Camera Stability: Camera shall be firmly held such that movement of the camera during the recording process does not cause an unsteady picture.
- B. Camera Control: Camera pan, tilt, zoom-in, and zoom-out rates shall be sufficiently controlled such that recorded objects will be clearly viewed during video playback.

In addition, all other camera and recording system controls such as lens focus and aperture, video level, pedestal, chroma, white balance, and electrical focus shall be properly controlled or adjusted to maximize picture quality.

- C. Viewer Orientation Techniques: The audio and video portions of the recording shall maintain viewer orientation. To this end overall establishing views and visual displays of all visible building distinguishing characteristics shall be incorporated at the beginning of each recording. The narrator shall regularly call out changes in direction, viewing angle, focus zoom, and distinguishing subjects as the video recording progresses.
- D. Operator Experience: The operator in charge must have had previous experience with audio-video documenting preconstruction work. Any apprentice operator(s) must be continuously supervised by an experienced operator.

3.08 DVD VIEWING

- A. The CD/DVD recordings shall be suitable for playing and video and audible recordings on standard computer desktop or laptop computers as well as conventional DVD players.

END OF SECTION

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Contractor shall employ and pay for the services of an Independent Testing Laboratory to perform materials testing of the type and frequency specified in the Contract Documents including, but not limited to, Geotechnical Testing Services and concrete testing.
- B. The engineer may, at any time, elect to have materials and equipment tested for conformity with the Contract Documents.
- C. Contractor shall include cost of testing in the Contract Price.

1.02 RELATED SECTIONS

- A. Section 01050 – Field Engineering
- B. Section 02200 – Earthwork
- C. Section 03300 – Cast-In-Place Concrete

1.03 REFERENCES

- A. FDOT Design Standards.
- B. FDOT Standard Specifications for Road and Bridge Construction.
- C. Broward County Traffic Engineering Division (BCTED) Minimum Standards and the BCTED Pavement Markings & Signs Detail Sheet.

1.04 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

- A. Laboratory is not authorized to:
 - 1. Release, revoke, alter or enlarge on requirements of Contract Documents
 - 2. Approve or accept any portion of the Work
 - 3. Perform any duties of the Contractor

1.05 CONTRACTOR'S RESPONSIBILITIES

- A. Provide all testing required by the Contract Documents as well as laws, ordinances, rules, regulations, orders, or approvals of public authorities.

- B. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract.
- C. Cooperate with laboratory personnel, and provide access to Work and to Manufacturer's operations.
- D. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
- E. Provide to the laboratory the preliminary design mix proposed to be used for concrete and other materials mixes which require control by the testing laboratory.
- F. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or 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 the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contractor 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.
- G. 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
- H. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.
 - 1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.
- I. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling, and testing required for the Contractor's convenience.
- J. If the Owner requests tests in addition to those specified in the contract, and if the test results indicate the material or equipment complies with the Contract Documents, the Owner shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the Contractor may pay for the laboratory costs directly to the testing firm or the total of such costs shall be deducted from any

payments due the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01505

CONTROL OF WORK

PART 1 - GENERAL

1.01 QUALITY OF WORK

- A. The Contractor shall furnish personnel and equipment which will be efficient, appropriate and a quantity large enough to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated in the Proposal. If at any time such personnel appear to the Engineer to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character or increase the personnel and equipment, and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.02 PRIVATE LAND

- A. The Contractor shall not enter or occupy private land outside of easements, except by written permission of the Owner.

1.03 1.03 PIPE LOCATIONS

- A. Pipeline shall be located substantially as indicated on the Drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons.

1.04 1.04 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and save bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures such a limiting the length of open trench, prohibiting stacking excavated material in the street, and requiring that the trench shall not remain open overnight.
- B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.

1.05 TEST PITS

- A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at his cost at the direction of the Engineer. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineers.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 COOPERATION WITHIN THIS CONTRACT

- A. All firms or persons authorized to perform any work under this Contract shall cooperate with the General Contractor and his subcontractors or trades, and shall assist in incorporating the work of other trades where necessary or required.
- B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

3.02 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at his own expense.
- B. All structures shall be protected in a manner approved by the Engineer. Should any of the floors or other parts of the structures become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor at his own expense and to the satisfaction of the Engineer. Special attention is directed to substructure bracing requirements described in Section 02220. If, in the final inspection of the work, any defects, faults or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the contract.
- C. Further, the Contractor shall take all necessary precaution to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.

END OF SECTION

SECTION 01510

TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Furnish, install and maintain temporary utilities required for construction, remove on completion of work.

1.02 RELATED REQUIREMENTS

- A. Section 01010: Summary of Work
- B. Section 01590: Field Offices

1.03 REQUIREMENTS OF REGULATORY AGENCIES

- A. Comply with National Electric Code.
- B. Comply with Federal, State and Local codes and regulations and with utility company requirements.
- C. Comply with County Health Department and Environmental Regulations.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

- A. Arrange with utility company, provide service required for power and lighting, and pay all costs for service and for power used in the construction, testing and trial operation prior to final acceptance of the work by the Owner.
- B. Install circuit and branch wiring, with the area distribution boxes located so that power and lighting is available throughout the construction by the use of construction type power cords.
- C. Provide adequate artificial lighting for all areas of work when natural light is not adequate to work, and all areas accessible to the public.

2.03 TEMPORARY WATER

- A. Arrange with the Owner, as described in the Supplemental Conditions to provide water for construction purposes.
- B. Install branch piping with taps located so that water is available throughout the construction by the use of hoses.
- C. Install at each and every connection to the Owner water supply a backflow preventor meeting the requirements of ANSI A40.6, latest revision. Contractor shall be required to meter and pay for all water used.

2.04 TEMPORARY SANITARY FACILITIES

- A. Provide sanitary facilities in compliance with laws and regulations.
- B. Service, clean and maintain facilities and enclosures.

2.05 TEMPORARY HEAT AND VENTILATION

- A. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature or humidity.
- B. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.
- C. Portable heaters shall be standard approved units complete with controls.
- D. Pay all costs of installation, maintenance, operation and removal, and for fuel consumed.
- E. Provide connections to existing facilities, extend and supplement with temporary units as required to comply with requirements. Pay all costs of installation, maintenance, operation and removal. Owner will pay costs of fuel used from the existing system.

2.06 TEMPORARY TELEPHONE SERVICE

- A. Arrange with local telephone service company, provide direct line telephone service at the construction site for the use of personnel and employees. Service required:
 - 1. One direct line instrument in Contractor's Field Office for Broward County.
 - 2. One direct line instrument in Field Office of Engineer with local access from Broward County.
 - 3. One direct line facsimile (FAX) machine in Contractor's Field Office.

4. Other instruments at the option of the Contractor, or as required by regulations.
- B. Pay all costs for installation, maintenance and removal, and service charges for local calls. Toll charges shall be paid by the party who places the call.

PART 3 - EXECUTION

3.01 GENERAL

- A. Comply with applicable requirements specified in Division 15 - Mechanical and in Division 16 - Electrical.
- B. Maintain and operate systems to assure continuous service.
- C. Modify and extend systems as work progress requires.

3.02 REMOVAL

- A. Completely remove temporary materials and equipment when their use is no longer required.
- B. Clean and repair damage caused by temporary installations or use of temporary facilities.
- C. Restore permanent facilities used for temporary services to specified condition.

END OF SECTION

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SECTION 01540

SECURITY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Security Program
- B. Entry Control
- C. Personnel Identification
- D. Miscellaneous Restrictions

1.02 RELATED SECTIONS

- A. Section 01010 - Summary of Work
- B. Section 01510 - Temporary Utilities

1.03 SECURITY PROGRAM

- A. Protect Work, existing premises and Owner's operations from theft, vandalism and unauthorized entry.
- B. Initiate program in coordination with Owner's existing security system at job mobilization.
- C. Maintain program throughout construction period until Owner occupancy as directed by Engineer.

1.04 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into project site and existing facilities.
- B. Allow entrance only to authorized persons with proper identification.
- C. Maintain log of workmen and visitors, make available to Owner on request.
- D. Coordinate access of Owner's personnel to site in coordination with Owner's security forces.

1.05 PERSONNEL IDENTIFICATION

- A. Become familiar with Owner and Engineer representatives.
- B. Restrict access to job site to these representatives.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01550

SITE ACCESS AND STORAGE

PART 1 - GENERAL

1.01 HIGHWAY LIMITATIONS

- A. The Contractor shall make his own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the work.

1.02 TEMPORARY CROSSINGS

- A. All areas disturbed by the construction activities shall be restored to proper grade, cleaned up, including the removal of debris, trash, and deleterious materials. All construction materials, supplies, or equipment, including piles of debris shall be removed from the area. All temporarily restored areas shall be maintained by the Contractor. These areas shall be kept clean and neat, free of dust and dirt, until final restoration operations are completed. The Contractor is responsible to utilize dust abatement operations in the temporarily restored areas as required, to the satisfaction of the Engineer.
- B. Final restoration shall include final grading, placement of sod, etc., all complete and finished, acceptable to the Engineer.

1.03 CONTRACTOR'S WORK AND STORAGE AREA

- A. The Contractor shall make his own arrangements for any necessary off-site storage or shop areas necessary for the proper execution of the work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01570

TRAFFIC REGULATION

PART 1 - GENERAL

1.01 DESCRIPTION:

The Work to be performed under this section shall include furnishing all materials and labor necessary to regulate vehicular and pedestrian traffic.

1.02 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS:

The Work under this Contract shall be in strict accordance with the following codes and standards.

- A. Local, county and municipal codes.
- B. Florida Department of Transportation Specifications (DOT)

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 TRAFFIC AND VEHICULAR ACCESS:

- A. Emergency Vehicles: No multi-family residence, apartment, commercial building or place of employment shall be without access to emergency vehicles for a period longer than three hours. The Contractor shall notify in writing the Engineer, the police, fire and other emergency departments and agencies when and where work is to be accomplished that will affect their operations at least two days in advance of such work.
- B. Major Road and Streets: No major roads or streets shall be blocked to traffic without adequate detour facilities for a period of more than 30 minutes or as directed by the governing authority.
- C. Commercial Properties: Access to commercial property shall not be blocked for a period of more than 30 minutes during the time such properties are open for business.
- D. Residential Property: Access to residential property shall not be blocked for a period of more than 24 hours.

3.02 CONSTRUCTION IN STATE HIGHWAY RIGHT-OF-WAY:

Construction within all State highway right-of-way shall be made in full compliance with all requirements and to the satisfaction of the Florida Department of Transportation. All necessary barricades, detours, lights and other protective measures shall be provided for the protection of both pedestrian and vehicular traffic.

3.03 CONSTRUCTION IN OTHER THAN STATE HIGHWAY RIGHT-OF-WAY:

Construction within right-of-way other than State highway shall be made in full compliance with all requirements of the Florida Department of Transportation and to the satisfaction of the local governing bodies. All necessary barricades, detours, lights and other protective measures shall be provided for the protection of both pedestrian and vehicular traffic.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDE

- A. Material and equipment incorporated into the Work.
 - 1. Conform to applicable specifications and standards.
 - 2. Comply with size, make, and type and qualify specified, or as specifically approved in writing by the Engineer.
 - 3. Manufactured and Fabricated Products.
 - a. Design, fabricate, and assemble in accord with the best engineering and shop practices.
 - b. Manufacture like part of duplicate units to standard sizes and gauges, to be interchangeable.
 - c. Two or more items of the same kind shall be identical, by the same manufacturer.
 - d. Products shall be suitable for service conditions.
 - e. Equipment capacities, sizes, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
 - 4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.02 RELATED REQUIREMENTS

- A. Section 01030: Special Project Procedures
- B. Section 01340: Shop Drawings, Product Data, and Samples
- C. Section 01720: Project Record Documents

1.03 APPROVAL OF MATERIALS

- A. Only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Engineer. No material shall be delivered to the work without prior approval of the Engineer.
- B. Within 30 days after the effective date of the Agreement, the Contractor shall submit to the Engineer, data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the

specifications. The data shall comply with Paragraph 1.07 of this Section.

- C. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during progress of the work, the Contractor shall submit samples of materials for such special tests as may be necessary to demonstrate that they conform to the specifications. Such samples shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for the tests.
- D. The Contractor shall submit data and samples sufficiently early to permit work. Any delay of approval resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of claim against the Owner or the Engineer.
- E. In order to demonstrate the proficiency of workmen or to facilitate the choice among several textures, types, finishes, and surfaces, the Contractor shall provide such samples of workmanship or finish as may be required.
- F. The materials and equipment used on the work shall correspond to the approved samples or other data.

1.04 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

- A. When Contract Documents require that installation of work shall comply with manufacturer's printed instruction, obtain, and distribute copies of such instructions to parties involved in the installation, including copies to the Engineer.
 - 1. Maintain one set of complete instructions at the job site during installation and until completion.
- B. Handle, install, connect, clean, condition, and adjust products in strict accord with such instructions and in conformity with specified requirements.
 - 1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.
 - 2. Do not proceed with work without clear instructions.
- C. Perform work in accord with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.05 TRANSPORTATION AND HANDLING

- A. Arrange deliveries of Products in accord with construction schedules; coordinate to avoid conflict with work and conditions at the site.
 - 1. Deliver Products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 - 2. Immediately upon delivery, inspect shipments to assure compliance with

requirements of Contract Documents and approved submittals, and that Products are properly protected and undamaged.

- B. Provide equipment and personnel to handle Products by methods to prevent soiling or damage to Products or packaging.

1.06 STORAGE AND PROTECTION

- A. The Contractor shall furnish a covered, weather-protected storage structure, providing a clean, dry, noncorrosive environment for all mechanical equipment, valves, electrical and instrumentation equipment, and special equipment to be incorporated into this project. Storage of equipment shall be performed to allow easy access and be in strict accordance with the "instructions for storage" of each equipment supplier and manufacturer including weather/humidity protection, connection of heaters, placing of storage lubricants in equipment, blocking, or skid storage, etc. Corroded, damaged, or deteriorated equipment and parts shall be replaced before acceptance of the project.
- B. Store Products in accord with manufacturer's instructions, with seals and labels intact and legible.
 - 1. Store products subject to damage by the elements in weather-tight enclosures.
 - 2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.
 - 3. Store fabricated products above the ground, on blocking or skids, to prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
 - 4. Store loose granular materials in a well drained area on solid surfaces to prevent mixing with foreign matter.
- C. All materials and equipment to be incorporated in the work shall be handled and stored by the Contractor before, during, and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.
- D. Cement, sand, and lime shall be stored under a roof, off the ground, and shall be kept completely dry at all times. All structural and miscellaneous steel and reinforcing steel shall be stored off the ground, or otherwise, to prevent accumulations of dirt or grease, and to minimize rusting. Brick, block, and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking, and spalling to a minimum.
- E. Moving parts shall be rotated a minimum of once weekly to insure proper lubrications, and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half-load, once weekly, for an adequate period of time to insure that the equipment does not deteriorate from lack of use.

- F. All materials which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified, shall be promptly removed from the site of the work, and the Contractor shall receive no compensation for the damaged material or its removal.
- G. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored Products to assure that Products are maintained under specific conditions, and free from damage or deterioration.
- H. Contractor shall be responsible for protection after installation by providing substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations.
- I. The Contractor shall be responsible for all materials, equipment, and supplies sold and delivered to the Owner under this Contract, until final inspection of the work and acceptance thereof by the Owner. In the event any such material, equipment, and supplies are lost, stolen, damaged, or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.
- J. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.

1.07 SUBSTITUTIONS AND PRODUCT OPTIONS

- A. Products List
- B. Within 30 days after the effective date of the Agreement, submit to the Engineer a complete list of major products proposed to be used, with the name of the manufacturer and the installing subcontractor.
- C. Contractor's Options
 - 1. For Products specified only by reference standard, select any product meeting that standard.
 - 2. For Products specified by naming several products or manufacturers, select any one of the products or manufacturers named, which complies with the specifications, subject to the base bid procedures outlined under Document 00400 – Supplemental Bid Form.
 - 3. For products specified by naming one or more Products or Manufacturers and an "or equal", the Contractor must submit a request for substitutions of any Product or Manufacturer not specifically named.
- D. Substitutions
 - 1. For a period of 30 days after the effective date of the Agreement, the

Engineer will consider written requests from Contractor for substitution of Products.

2. Submit a separate request for each Product, supported with complete data, with drawings and samples as appropriate, including:
 - a. Comparison of the qualities of the proposed substitution with that specified
 - b. Changes required in other elements of the work because of the substitution
 - c. Effect on the construction schedule
 - d. Cost data comparing the proposed substitution with the Product specified
 - e. Any required license fees or royalties
 - f. Availability of maintenance service, and source of replacement materials
3. The Engineer shall be the judge of the acceptability of the proposed substitution.
4. No substitutions will be considered by the Engineer after 30 days from the Contract Date.

E. Contractor's Representation

1. A request for a substitution constitutes a representation that Contractor:
 - a. Has investigated the proposed Product and determined that it is equal to or superior in all respects to that specified
 - b. Will provide the same warranties or bonds for the substitution as for the Product specified
 - c. Will coordinate the installation of an accepted substitution into the Work, and make such other changes as may be required to make the Work complete in all respects
 - d. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
- F. The Engineer will review requests for substitutions with reasonable promptness, and notify Contractor, in writing, of the decision to accept or reject the requested substitution.

1.08 SPECIAL TOOLS

- A.** Manufacturers of equipment and machinery shall furnish any special tools (including grease guns or other lubricating devices) required for normal adjustment, operations and maintenance, together with instructions for their use. The Contractor shall preserve and deliver to the Owner these tools and instructions in good order no later than upon completion of the Contract.

1.09 STORAGE AND HANDLING OF EQUIPMENT ON SITE

- A. Because of the long period allowed for construction, special attention shall be given to the storage and handling of equipment on site. As a minimum, the procedure outlined below shall be followed.
1. Equipment shall not be shipped until approved by the Engineer. The intent of this requirement is to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer, unless upon arrival it is to be stored as specified in Paragraph 1.06. Operation and maintenance data, as described in Paragraph 1.08 of Section 01730 shall be submitted to the Engineer for review prior to shipment of equipment.
 2. All equipment having moving parts, such as gears, electric motors, etc. and/or instruments, shall be stored in a temperature and humidity controlled building approved by the Engineer, until such time as the equipment is to be installed.
 3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.
 4. Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed with the Engineer by him. These instructions shall be carefully followed and a written record of this kept by the Contractor.
 5. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication, and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half-load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.
 6. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. Mechanical equipment to be used in the work, if stored for longer than ninety (90) days, shall have the bearings cleaned, flushed, and lubricated prior to testing and start up, at no extra cost to the Owner.
 7. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested, and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.10 WARRANTY

- A. For all major pieces of equipment, submit a warranty from the equipment

manufacturer as specified in Section 01740.

1.11 SPARE PARTS

- A. Spare parts for certain equipment provided under Division 11 through 16 have been specified in the pertinent sections of the Specifications. The Contractor shall collect and store all spare parts so required in an area to be designated by the Engineer. In addition, the Contractor shall furnish to the Engineer an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier, and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivered cost.

1.12 LUBRICANTS

- A. During testing and prior to acceptance, the Contractor shall furnish all lubricants necessary for the proper lubrication of all equipment furnished under this Contract.

1.13 GREASE, OIL AND FUEL

- A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of the equipment supplied under Division 11 through 16.
- B. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment after initial break-in of the equipment, which in no event shall be any longer than three weeks of operation.

1.14 PROTECTION AGAINST ELECTROLYSIS

- A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

1.15 FASTENERS

- A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the Contractor. Bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.
- B. All bolts, anchor bolts, nuts, washers, plates, and bolt sleeves shall be Type 316 stainless steel unless otherwise specifically indicated or specified.
- C. Unless otherwise specified, stud, tap, and machine bolts shall be of the best quality refined bar iron. Hexagonal nuts of the same quality of metal as the bolts shall be used.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01701

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

- A. General provisions of Contract, including General and Supplementary Conditions.
- B. Warranty and bond submittal.
- C. Closeout submittals, warranties and bonds required for specific products of work.

1.02 SECTION INCLUDES

- A. Administrative and procedural requirements for project closeout.
 - 1. Inspection procedures.
 - 2. Project record document submittal.
 - 3. Final cleaning.

1.03 SUBSTANTIAL COMPLETION

- A. Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - 1. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 2. Advise Owner of pending insurance change-over requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
 - 5. Submit record drawings, maintenance manuals, and similar final record information.
- B. When the Contractor considers the Work to be substantially complete, he shall submit a written notice to the Engineer that the Work, or designated portion of the Work, is complete and ready for inspection.
- C. Within a reasonable time of receipt of a request for inspection, the Engineer will either proceed with inspection or advise the Contractor of unfulfilled requirements. When the Engineer and Owner concur that the Work, or designated portion of the Work, is substantially complete, the Engineer will prepare the Certificate of Substantial Completion following inspection.
- D. Should the Engineer determine that the Work is not substantially complete, he will advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
 - 1. The Engineer will repeat inspection when requested and assured that the

Work has been substantially completed.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.04 FINAL COMPLETION

- A. When Contractor considers the Work to be complete, he shall submit written certification to the Engineer that the Work is completed and ready for final inspection. Include the following:
 1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 3. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, the list has been endorsed and dated by the Engineer.
 4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
 5. Submit consent of surety to final payment.
 6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. The Engineer will inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.
 1. Upon completion of inspection, the Engineer will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete, or of obligations that have not been fulfilled but are required for final acceptance.
 2. If necessary, reinspection process will be repeated.

1.05 RECORD DOCUMENT SUBMITTALS

- A. Maintain at the site one complete set of record documents; protect from deterioration and loss in a secure, fire-resistive location.
 1. Provide access to record documents for the Engineer's reference during normal working hours.
 2. Label each document "PROJECT RECORD" in 2 inch high printed letters.
 3. Do not use for construction purposes.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as

originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that was not shown on Contract Drawings or Shop Drawings.
3. Note related Change Order numbers where applicable.
4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

The record drawings shall correctly and accurately show all changes from the Contract Documents made during construction and shall reflect surveyed information which shall be verified and certified by an independent Professional Land Surveyor registered in the State of Florida. The drawings shall be neat and legible. Show all elevations and horizontal control of all pipes and structures, as defined below:

- a. Record Drawings Submittal Requirements: Record drawings to be submitted shall consist of:
 - 1) Three sets of signed and sealed sets of prints.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction.
 1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
 2. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation.
 3. Note related record drawing information and Product Data.
- D. Record Product Data: Maintain one copy of each Product Data submittal.
 1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations.
 2. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation.
 3. Note related Change Orders and mark-up of record drawings and Specifications.
- E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Engineer and the Owner to determine which of the submitted Samples that have been maintained during

progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.

- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work.
- G. At Contract close-out, deliver one copy of Record Documents to Engineer for Owner. Accompany submittal with transmittal letter in duplicate containing the following information:
 - 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 or his authorized representative.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. Remove temporary protection and facilities installed for protection of the Work during construction.
- B. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
- C. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

SECTION 01710

CLEANING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Execute cleaning, during progress of the Work, and at completion of the Work, as required by General Conditions.

1.02 RELATED REQUIREMENTS

- A. Conditions of the Contract.
- B. Each Specification Section: Cleaning for specific Products or work.

1.03 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations to comply with applicable codes, ordinances, regulations, and anti-pollution laws.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

- A. Execute periodic cleaning to keep the Work, the site and adjacent properties, free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.
- B. Provide on-site containers for the collection of waste materials, debris and rubbish.
- C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

END OF SECTION

DOCUMENT 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 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 to the Contract
 - 5. Engineer's Field Orders or Written Instructions
 - 6. Approved Shop Drawings, Working Drawings, and Samples
 - 7. Field Test Reports
 - 8. Construction Photographs

1.02 RELATED REQUIREMENTS

- A. Section 01050: Field Engineering
- B. Section 01340: Shop Drawings, Working Drawings and Samples
- C. Section 01700: Contract Closeout
- D. Section 01152: Applications for Payment

1.03 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store documents and samples in Contractor's field office apart from documents used for construction.
- B. File documents and samples in accordance with CSI format number system.
- 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 is to exhibit the currently updated "record documents" for review by the Engineer and the Owner.

1.04 RECORDING

- A. Label each document "PROJECT RECORD" in neat large printed letters.
- B. Record information concurrently with construction progress.
- C. Drawings; Legibly mark 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. Changes to piping location. Horizontal and vertical locations of underground utilities and

- appurtenances, referenced to permanent surface improvements. Actual installed pipe material, 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 dimensions and details.
 5. Changes made by Field Order or by Change Order.
 6. Details not on original contract drawings.
 7. Equipment and piping relocations.
 8. Building and tank locations.
- 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):
1. One set of record shop drawings for each process equipment, piping, (including casings) electrical system and instrumentation system.
- F. Certified site survey and line elevations, and stationing at increments per Section 01050, by registered surveyor.

1.05 SUBMITTAL

- A. At Close-out, deliver Record Documents to the Engineer for the Owner.
- B. Accompany 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 or his Authorized Representative
- C. Submittal of Record Drawings shall be in accordance with Section 01050, 1.06.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Compile specified warranties and bonds, as in Articles 5 and 13 of the General Conditions and Section 01030 of these Specifications.
- B. Co-execute submittals when so specified.
- C. Review submittals to verify compliance with Contract Documents.
- D. Submit to the Engineer for review and transmittal to Owner.

1.02 RELATED REQUIREMENTS

- A. Instructions to Bidders: Bid or Proposal Bonds
- B. Conditions of the Contract: Performance Bond and Payment Bond
- C. Section 01030: Special Project Procedures
- D. Section 01700 Contract Closeout

1.03 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bond, service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Number of original signed copies required: two each.
- C. Table of Contents: neatly typed, in orderly sequence. Provide complete information for each item.
 - 1. Product or work item
 - 2. Firm, with name of principal, address and telephone number
 - 3. Scope
 - 4. Date of beginning of Warranty, bond or service and maintenance contract
 - 5. Duration of warranty, 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 number

1.04 FORM OF SUBMITTALS

A. Prepare in duplicate packets

B. Format:

1. Size 8 1/2 inches x 11 inches, punch sheets for standard 3-post binder

2. Cover: Identify each packet with typed or printed title "WARRANTIES AND 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 2 inches.

1.05 WARRANTY SUBMITTAL REQUIREMENTS

A. For all major pieces of equipment, submit a one-year warranty from the equipment manufacturer, unless otherwise specified. The manufacturer's warranty period shall be concurrent with the Contractor's for one (1) year commencing at the time of acceptance by the Owner (see Section 01030).

B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under division 11, 13, 14, 15 and 16 and which has a 1 HP motor or which lists for more than \$1,000. The Engineer reserves the right to request warranties for equipment not classified as major. The Contractor shall still warrant equipment not considered to be "major" in the Contractor's one-year 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 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-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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 02200
EARTHWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Earthwork operations necessary to achieve the Work including, but not limited to, excavation of soil, grading, removal and replacement of unsuitable soil, fill, backfill, embankment and compaction more specifically described as follows:
 - 1. Earthwork operations project generally consists of excavation and embankment of soil materials from the existing elevations to the proposed elevations.
 - 2. Embankment necessary to achieve the proposed elevations may consist of in situ soils, whether classified as suitable or unsuitable, or imported suitable soil material. All imported soil material for embankment is to be included in the Contract price.
 - 3. Soil material categorized as sub-grade is to be imported suitable soil. The Owner reserves the right to decline imported sub-grade material should in-situ suitable material be encountered and seek a credit for imported, placed and compacted sub-grade per the Unit Price Schedule.
 - 4. Where unsuitable soil materials are encountered under or around sidewalks or structural elements, the Owner reserves the right to specify removal and replacement of unsuitable soil with imported suitable soil. All imported suitable soil material for placement under of around structural elements is to be paid out of the Owners Contingency.

1.02 RELATED SECTIONS

- A. Section 01410 – Testing Laboratory Services

1.03 REFERENCES

- A. FDOT Standard Specifications for Road and Bridge Construction
- B. FDOT Design Standards
- C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- D. AASTHO M-145 - Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

1.04 PROJECT CONDITIONS

- A. Locate existing underground utilities in areas of work. Provide adequate means of support and protection during earthwork operations.
- B. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
- C. Do not interrupt existing utilities serving occupied facilities.
- D. Use of Explosives is prohibited.
- E. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. Satisfactory or Suitable Soil Materials: ASTM D2487 soil classification groups GW, GP, SW, and SP.
- B. Unsatisfactory or Unsuitable Soil Materials: ASTM D2487 soil classification groups GM, GC, SM, SC, CL, ML, OL, CH, MH, OH and PT.
- C. Satisfactory and unsatisfactory soil materials for roadway embankment, including pipe trench backfill under roadways, shall meet the requirements as defined in AASHTO M-145 soil classification groups and FDOT index 505.
- D. Satisfactory materials encountered during excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Engineer, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials.
- E. Sub-base material:
 - 1. Satisfactory materials may be Select, Structural or Common fill.
- F. Select or Structural Fill or backfill:
 - 1. Select or structural fill material shall be a satisfactory soil material, well graded, consisting of a minimum of 60 percent clean medium fine grain sized quartz sand, free of organic, deleterious and/or compressible percent clean medium fine grain sized quartz sand, free of organic, deleterious and/or compressed material. Rock in excess of 2 inches in diameter shall not be permitted.

- G. Common Fill:
1. Common fill material shall be a satisfactory soil material containing no more than 20 percent by weight finer than No. 200 mesh sieve. It shall be free from organic matter, muck, marl, and rock exceeding 2 1/2 inches in diameter.
- H. Course Aggregate:
1. Course aggregate, or gravel, shall be used for rock bedding, drainage rock or as otherwise depicted in the Drawings. Unless otherwise noted, course aggregate shall consist of washed and graded crushed limerock meeting FDOT specification 901, size number 57 or approved equal.
- I. Sand
1. Where specified, sand, clean sand, silica sand or other nomenclature shall refer to silica sand meeting FDOT specification 902-2.
- J. Satisfactory or suitable soil materials shall free of muck, clay, rock or gravel larger than 2-1/2 inches in any dimension, debris, trash, waste, frozen materials, broken concrete, masonry, rubble, vegetable or other similar materials or deleterious matter. Materials of this nature encountered during the excavation which, in the opinion of the Engineer, is not suitable for reuse shall be stockpiled for disposal as unsuitable materials.
- K. Material substitutions may be permitted if accompanied by a geotechnical engineers report substantiating the proposed substitution which is approved by the Engineer and is at no cost to the Owner.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. The contractor shall perform trench excavations in accordance with applicable trench safety standards and is responsible to determine any safety or safety related standards that apply to the Project. The Owner and Engineer are not responsible to review and/or assess safety precautions, programs and costs, and the means, methods, techniques or technique adequacy, reasonableness of cost, sequences and procedures of any safety precaution, including, but not limited to, compliance with any and all requirements of Florida Trench Safety Act.
- B. Excavation is Unclassified, and includes excavation to sub-grade elevations indicated, regardless of character of materials and obstructions encountered.
- C. Unauthorized Excavation: Removal of materials beyond indicated sub-grade elevations or dimensions without specific direction. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.
- D. Additional Excavation:

1. Where unsuitable soil materials are encountered under or around structural elements, the Owner reserves the right to specify removal and replacement of unsuitable soil with imported suitable soil. All imported suitable soil material for placement under or around structural elements is to be paid out of the Owners Contingency.
- E. Stability of Excavations:
1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction.
 2. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
 3. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- F. Shoring and Bracing:
1. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
 2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- G. Dewatering:
1. The bottom of the excavations shall be firm and dry and in all respects acceptable to the Engineer.
 2. Prevent surface water and sub-surface or ground water from flowing into excavations. Do not allow water to accumulate in excavations.
 3. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 4. The Contractor shall obtain all dewatering permits as required from agencies having jurisdiction
- H. Stockpile satisfactory excavated materials where directed, until required for embankment, backfill or fill. Place, grade and shape stockpiles for proper drainage.
- I. Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide minimum 6 in. clearance on each side of pipe or conduit.
1. Excavate trenches to depth indicated or required for indicated flow lines and invert elevations.

2. Where rock is encountered, carry excavation 6 in. below scheduled elevation and backfill with a 6 in. layer of crushed stone or gravel prior to installation of pipe.
 3. For pipes or conduit 5 in. or less, excavate to indicate depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
 4. For pipes or conduit 6 in. or larger, tanks and other work indicated to receive sub-base, excavate to sub-base depth indicated, or, if not otherwise indicated, to 6 in. below bottom of work to be supported.
 5. Except as otherwise indicated, excavate for exterior water-bearing piping so top of piping is minimum 3'-6" below finished grade.
 6. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.
- J. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Engineer.

3.02 COMPACTION

- A. Areas to be compacted shall be moistened and compacted by either rolling, tamping or any other approved method by the Engineer in order to obtain the desired density.
- B. The Contractor shall inspect all compacted areas prior to further construction operations to ensure that satisfactory compaction has been obtained.
- C. All sub-grade shall be compacted as indicated on the Drawings unless otherwise stated in the FDOT Standard Specifications for Road and Bridge Construction
- D. All embankment shall be compacted by proof-rolling to achieve 95% of AASHTO T-99.
- E. All soil beneath structures shall be compacted to 98% of AASHTO T-180.
- F. Hydraulic compaction shall be permitted if accompanied by a geotechnical engineers report substantiating the proposed methods. The geotechnical engineers report shall be submitted to the Engineer prior to any work and shall be at no cost to the Owner.
- G. The frequency of testing shall be as indicated on the Drawings unless otherwise stated in the FDOT Standard Specifications for Road and Bridge Construction
- H. All earthwork testing shall be at the expense of the Contractor unless otherwise stated in the Contract Documents.
- I. The Contractor shall instruct the testing laboratory to forward copies of all test reports to the Engineer.

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

3.03 EMBANKMENT, BACKFILL AND FILL

- A. Place specified soil material in layers required to achieve proposed elevations:
 - 1. Place materials in layers of 8 inches loose depth for material compacted by heavy compaction equipment and 4 in. in loose depth for material compacted by hand operated tampers.
 - 2. Place materials in layers of 12 inches loose depth for material compacted by proof rolling equipment.
 - 3. Under grassed areas, use satisfactory or unsatisfactory excavated or imported soil material if approved by the Engineer.
 - 4. Under walks and pavements, use sub-base material, or satisfactory excavated or borrow material, or combination of both. Place shoulders along edges of sub-base course to prevent lateral movement with satisfactory excavated or borrow material.
 - 5. Under steps, use sub-base material.
 - 6. Under building slabs, use drainage fill material.
 - 7. Under piping and conduit, use sub-base material where sub-base is indicated under piping or conduit; shape to fit bottom 90 degrees of cylinder.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Acceptance of construction below finish grade including waterproofing and perimeter insulation.
 - 2. Inspection, testing, approval, and recording locations of underground utilities.
 - 3. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
- C. Remove all trash, roots, vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
- D. When existing ground surface has a density less than that specified for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

- E. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- F. Place backfill and fill materials evenly adjacent to structures, without wedging against structures or displacement of piping or conduit. Compaction equipment used within 10 ft. of buried walls and soil supported structures shall not exceed 2000 lbs.

3.04 GRADING

- A. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding and as follows:
 - 1. Finish to within not more than 0.10 ft. above or below required sub-grade elevations.
 - 2. Walks: Shape surface to line, grade and cross-section, with finish surface not more than 0.10 ft. above or below required sub-grade elevation.
 - 3. Pavements: Shape surface to line, grade and cross-section, with finish surface 1/2 in. above or below required sub-grade elevation.
 - 4. Sod: Where sod abuts pavement, sidewalks, etc., finish surface below as required to accommodate thickness of sod as not to prohibit drainage.
- B. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to 1/2 in. below required elevation.

3.05 QUALITY CONTROL

- A. Perform earthwork in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Contractor will engage soil testing and inspection service for quality control testing during earthwork operations.
- C. Allow testing service to inspect and approve sub-grades and fill layers before further construction work is performed.
- D. If in opinion of Engineer, based on testing service reports and inspection, sub-grade or fills which have been placed below specified density, provide additional compaction and testing at no additional expense to Owner.

3.06 CLEANING AND PROTECTION

- A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

- C. Remove excess excavated and waste materials, including unacceptable excavated material, trash and debris, and legally dispose of it at no cost to the Owner.

END OF SECTION

SECTION 02221

TRENCHING, BEDDING, AND BACKFILL FOR PIPE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Furnish labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, fill, grading, and slope protection required to complete the piping work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to, manholes, vaults, duct conduit, pipe, roadways, paving, bedding, backfilling, fill, required borrow; grading, disposal of surplus and unsuitable materials, and all related work such as sheeting, bracing, and dewatering

1.02 RELATED SECTIONS

- A. Section 01340 – Shop Drawings, Working Drawings and Samples
- B. Section 02200 - Earthwork

1.03 REFERENCES

- A. FDOT Standard Specifications for Road and Bridge Construction
- B. FDOT Design Standards
- C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- D. AASTHO M-145 - Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

1.04 JOB CONDITIONS

- A. The Contractor shall examine the site and review the available test borings or undertake his own soil borings prior to submitting his bid, taking into consideration all conditions that may affect his work. The Owner and Engineer will not assume responsibility for variations of sub-soil quality or conditions at locations other than places shown and at the time the available test borings were made.
- B. Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
 - 1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Engineer and the Owner of such piping or utility immediately for directions.
 - 2. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
 - 3. Demolish and completely remove from site existing underground utilities indicated on the drawings to be removed.
- C. Protection of Persons and Property: Contractor shall barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights

as recommended by authorities having jurisdiction.

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

1.05 SUBMITTALS

- A. The Contractor shall furnish the Engineer, for approval, a certificate of origin and compliance with specifications for any fill material obtained from off-site sources.
- B. At the discretion of the Engineer, the Contractor shall furnish the Engineer, for approval, a representative sample of fill material obtained from on-site sources weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.
- C. At the discretion of the Engineer, for each material obtained from off-site sources, the Contractor shall notify the Engineer of the source of the material and shall furnish the Engineer, for approval, a representative sample weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Satisfactory Soil Materials: ASTM D2487 soil classification groups GW, GP, SW, and SP.
- B. Unsatisfactory Soil Materials: ASTM D2487 soil classification groups GM, GC, SM, SC, CL, ML, OL, CH, MH, OH and PT.
- C. Satisfactory and unsatisfactory soil materials for roadway embankment, including pipe trench backfill under roadways, shall meet the requirements as defined in AASHTO M-145 soil classification groups and FDOT index 505.
- D. Satisfactory materials encountered during excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Engineer, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials.
- E. Sub-base material:
 1. Refer to roadway section and/or specifications.
- F. Select or Structural Fill or backfill:
 1. Select or structural fill material shall be a satisfactory soil material, well graded, consisting of a minimum of 60 percent clean medium fine grain sized quartz sand, free of organic, deleterious and/or compressible percent clean medium fine grain sized quartz sand, free of organic, deleterious and/or compressed material. Rock in excess of 1 inches in diameter shall not be permitted.
- G. Common Fill:
 1. Common fill material shall be a satisfactory soil material containing no more than 20 percent by weight finer than No. 200 mesh sieve. It shall be free

from organic matter, muck, marl, and rock exceeding 2 1/2 inches in diameter.

- H. Course Aggregate:
 - 1. Course aggregate, or gravel, shall be used for rock bedding, drainage rock or as otherwise depicted in the Drawings. Unless otherwise noted, course aggregate shall consist of washed and graded crushed limerock meeting FDOT specification 901, size number 57 or approved equal.
- I. Sand
 - 1. Where specified, sand, clean sand, silica sand or other nomenclature shall refer to silica sand meeting FDOT specification 902-2.
- J. Satisfactory soil materials shall free of muck, clay, rock or gravel larger than 2-1/2 inches in any dimension, debris, trash, waste, frozen materials, broken concrete, masonry, rubble, vegetable or other similar materials or deleterious matter. Materials of this nature encountered during the excavation which, in the opinion of the Engineer, is not suitable for reuse shall be stockpiled for disposal as unsuitable materials.
- K. Material substitutions may be permitted if accompanied by a geotechnical engineers report substantiating the proposed substitution which is approved by the Engineer and is at no cost to the Owner.

PART 3 - EXECUTION

3.01 GENERAL

- A. All excavation, backfill and grading necessary to complete the work shall be made by the Contractor and the cost thereof shall be included in the Contract price.
- B. Material shall be furnished as required from off-site sources and hauled to site.
- C. The Contractor shall take all necessary precautions to maintain the work area in a safe and workable condition.
- D. The Contractor shall protect his work at all times by flagging, marking, lighting and barricading. It shall also be the Contractor's responsibility to preserve and protect all above and underground structures, pipe lines, conduits, cables, drains, or utilities which are existing at the time he encounters them. Failure of the Drawings to show the existence of these obstructions shall not relieve the Contractor from this responsibility. The cost of repair of damage which occurs to these obstructions during or as a result of construction shall be borne by the Contractor without additional cost to the Owners.

3.02 DEWATERING

- A. The bottom of the excavations shall be firm and dry and in all respects acceptable to the Engineer.
- B. Prevent surface water and sub-surface or ground water from flowing into excavations. Do not allow water to accumulate in excavations.
- C. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from

excavations.

- D. The Contractor shall obtain all dewatering permits as required from agencies having jurisdiction

3.03 TRENCH EXCAVATION

- A. Excavation for all trenches required for the installation of pipes shall be made to the depths indicated on the Drawings. Excavate trench to provide minimum of 30-inch clear cover over the pipe bell unless otherwise noted on the Drawings. Excavate in such manner and to such widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting and for pumping and drainage facilities. The trench width at the top of the pipe shall not exceed the allowable as determined by the depth of cut and indicated on the Drawings.
- B. Rock shall be removed to a minimum 8-inches clearance around the bottom and sides of all the pipe or ducts being laid.
- C. Where pipe is to be laid in limerock bedding or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench remains undisturbed.
- D. Where the pipes or ducts are to be laid directly on the trench bottom the lower part of the trenches shall not be excavated to the trench bottom by machinery. The last of the material being excavated shall be done manually in such a manner that will give a flat bottom true to grade so that pipe can evenly and uniformly supported along its entire length on undisturbed material or bedding rock. Bell holes shall be made as required manually so that there is no bearing surface on the bells and pipes are supported along the barrel only.
- E. The bottom of the excavations shall be firm and dry and in all respects acceptable to the Engineer. Excavate any organic soil material from the bottom of the trench and replace with rock bedding, at least 6 inches thick.

3.04 TRENCH PROTECTION

- A. The contractor shall perform trench excavations in accordance with applicable trench safety standards and is responsible to determine any safety or safety related standards that apply to the Project. The Owner and Engineer are not responsible to review and/or assess safety precautions, programs and costs, and the means, methods, techniques or technique adequacy, reasonableness of cost, sequences and procedures of any safety precaution, including, but not limited to, compliance with any and all requirements of Florida Trench Safety Act.
- B. The Contractor shall construct and maintain sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, existing piping, and foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids form, they shall be immediately filled and compacted.
- C. For pipe trench sheeting, no sheeting is to be withdrawn if driven below mid-diameter of any pipe, and no wood sheeting shall be cut off at a level lower than 1 foot above the top of any pipe unless otherwise directed by the Engineer. If during the progress of the work the Engineer decides that additional wood sheeting should

be left in place, he may direct the Contractor in writing. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given by the Engineer for an alternate method of removal.

- D. All sheeting and bracing not left in place, shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. All voids left or caused by withdrawal of sheeting shall immediately be refilled with sand or rammed with tools especially adapted to that purpose, by watering or otherwise as may be directed.
- E. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

3.05 PIPE INTERFERENCES AND ENCASEMENT

- A. The contractor shall abide by the following schedule of criteria concerning interferences with other utilities.
 - 1. In no case shall there be less than 0.5 feet between any two pipe lines and structures.
 - 2. Class I Concrete Encasement: Wherever there is more than 0.5 foot, but not less than 1.5 foot clearance between water mains or water services, then a concrete encasement shall be provided in accordance with the typical detail as shown on the Drawings.
 - 3. Class II Concrete Encasement: Wherever there is more than 0.5 foot, but less than 1.0 foot clearance between any two pipe lines, or between pipe lines and structures, then a concrete encasement shall be provided in accordance with the typical detail as shown on the Drawings.
- B. The Engineer shall have full authority to direct the placement of the various pipes and structures in order to facilitate construction, expedite completion and to avoid conflicts.

3.06 BACKFILLING

- A. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Engineer.
- B. Perform backfill in lifts and compact as specified in the Drawings.
- C. Backfilling over pipes shall begin as soon as practical after the pipe has been laid, jointed, and inspected and the trench filled with suitable compacted material to the mid-diameter of the pipe.
- D. Backfilling over ducts shall begin not less than three days after placing concrete encasement.
- E. All backfilling shall be prosecuted expeditiously as detailed on the Drawings.
- F. Any space remaining between the pipe and sides of the trench shall be packed full by hand shovel with selected earth and thoroughly compacted with a tamper as

fast as placed, up to a level of one foot above the top of pipe.

- G. The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.
- H. The Contractor shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.
- I. In areas where unsuitable soil is discovered in the pipe bedding, the unsuitable soil shall be removed and stockpiled for disposal by the contractor. Suitable soils shall be substituted at a depth as directed by the Engineer. If gravel is required by the Engineer as suitable bedding, the gravel shall be wrapped in filter fabric prior to backfill operations.
- J. Gravel bedding shall not be used under any circumstances as a drain for ground water.
- K. In locations where pipes pass through building walls, the Contractor shall take the following precautions to consolidate the refill up to an elevation of at least 1 foot above the bottom of the pipes:
 - 1. Place structural fill in such areas for a distance of not less than 3 feet either side of the centerline of the pipe in level layers not exceeding 6-inches in depth.
 - 2. Wet each layer to the extent directed and thoroughly compact each layer with a power tamper to the satisfaction of the Engineer.

3.07 COMPACTION

- A. Perform compaction and compaction tests as specified in the Drawings.
- B. Hydraulic compaction shall be permitted if accompanied by a geotechnical engineers report substantiating the proposed methods. The geotechnical engineers report shall be submitted to the Engineer prior to any work and shall be at no cost to the Owner.

3.08 GRADING

- A. Grading shall be performed at such places as are indicated on the Drawings, to the lines, grades and elevations shown or as directed by the Engineer and shall be made in such manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.
- B. If at the time of excavation it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled in approved areas for later use. No extras will be considered for the stockpiling or double handling of excavated material.
- C. The right is reserved to make minute adjustments or revisions in lines or grades if found necessary as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction.

- D. Stones or rock fragments larger than 2 1/2 inches in their greatest dimensions will not be permitted in the top 6 inches of the subgrade line of all fills or embankments.
- E. All fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings, or as directed by the Engineer.
- F. In cut, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings or as specified by the Engineer.
- G. No grading is to be done in areas where there are existing pipe lines that may be uncovered or damaged until such lines which must be maintained are relocated, or where lines are to be abandoned, all required valves are closed and drains plugged at manholes.
- H. The Contractor shall replace all pavement cut or otherwise damaged during the progress of the work as specified elsewhere herein or as shown on the Drawings.

3.09 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

- A. All surplus and unsuitable excavated material shall be disposed of at the Contractor's cost in one of the following ways as directed by the Engineer.
 - 1. Transport to soil storage area on Owner's property and stockpile or spread as directed by the Engineer.
 - 2. Transport from Owner's property and legally dispose of. Any permit required for the hauling and disposing of this material beyond Owner's property shall be obtained prior to commencing hauling operations. Copies of all required permits shall be provided to the Engineer.
- B. Suitable excavated material may be used for fill if it meets the specifications for common fill and is approved by the Engineer. Excavated material so approved may be neatly stockpiled at the site where designated by the Engineer provided there is an area available where it will not interfere with the operation of the facility nor inconvenience traffic or adjoining property owners.

END OF SECTION

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SECTION 02223

EXCAVATION BELOW NORMAL GRADE AND GRAVEL REFILL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. If in the opinion of the Engineer, the material at or below the normal grade of the bottom of the trench (0.7 feet below the invert of the pipe) is unsuitable for foundation, it shall be removed to the depth directed by the Engineer and replaced by drain rock, as specified in Section 02221 - Trenching, Bedding, and Backfill for Pipe.
- B. It shall be the Contractor's responsibility to provide trench safety systems such as sheeting and bracing in accordance with state and local regulations.

1.02 RELATED WORK

- A. Section 0221: Trenching, Bedding and Backfill for Pipe.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Drain rock shall be 3/8 inch to 3/4 inch washed and graded limerock. The rock shall be graded so that 99% will pass a 3/4 inch screen and 80% will be retained on a No. 8 screen. Material meeting the Florida Department of Transportation Standard Specifications for No. 57 stone shall be acceptable.

PART 3 - EXECUTION

3.01 EXCAVATION AND DRAINAGE

- A. Whatever the nature of unstable material encountered or the groundwater conditions, trench drainage shall be complete and effective.
- B. If the Contractor excavates below grade through error or for his own convenience, or through failure to properly dewater the trench, or disturbs the subgrade before dewatering is sufficiently complete, he may be directed by the Engineer to excavate below grade as set forth in the preceding paragraph, in which case the work of excavating below grade and finishing and placing the refill shall be performed at his own expense.

3.02 REFILL

- A. If the material at the level of trench bottom consists of fine sand or sand and silt which may work into the drain rock prohibiting effective drainage, the subgrade material shall be removed to the extent directed and the excavation refilled with coarse sand, or a mixture graded from coarse sand to fine peastone, to form a filter layer preserving the voids in the gravel bed of the pipe. The composition and gradation of gravel shall be approved by the Engineer prior to placement. Gravel shall be placed in 6 inch layers thoroughly compacted. If directed by the Engineer, drain rock shall be used for refill of excavation below grade.

END OF SECTION

SECTION 02276

SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Designing, providing, maintaining, and removing temporary erosion and sedimentation controls as necessary.
- B. Temporary erosion controls may include, but are not limited to, mulching, netting, and watering, on site surfaces and spoil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations that will ensure erosion during construction will be either eliminated or maintained within acceptable limits as established by the Owner.
- C. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, booms/curtains, and appurtenances at the foot of sloped surfaces and other areas that will ensure sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the Owner.
- D. Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

1.02 SUBMITTALS

- A. Submit schedule for temporary erosion and sedimentation control.

PART 2 - PRODUCTS

2.01 EROSION CONTROL

- A. Mulch: FDOT type per Section 981-3.2, Green Mulch
- B. Netting: Fabricated of material acceptable to the Owner.

2.02 SEDIMENTATION CONTROL

- A. Bales: Clean, seed free cereal hay type
- B. Netting: Fabricated of material acceptable to the Owner
- C. Filter stone: Crushed stone conforming to Florida Department of Transportation specifications.

PART 3 - EXECUTION

3.01 EROSION CONTROL

- A. Minimum procedures for mulching and netting are:
 - 1. Apply mulch loosely to a thickness of between 3/4 inch and 1 1/2 inches.
 - 2. Apply netting over mulched areas on sloped surfaces.

3.02 SEDIMENTATION CONTROL

- A. Install and maintain silt dams, traps and barriers, and booms/curtains as shown on the approved schedule. Hay bales and fabric that deteriorates and filter stone that becomes dislodged shall be replaced as required.

3.03 PERFORMANCE

- A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results that comply with the requirements of the Owner, Contractor shall immediately take any and all necessary steps to correct the deficiency at his own expense.

END OF SECTION

SECTION 02313

PRESTRESSED CONCRETE PILING

PART 1 - GENERAL

1.01 SCOPE

- A. Under this heading shall be included the furnishing of all plant, equipment, labor, and materials and performing of all operations in connection with the manufacture and installation of prestressed concrete piling in accordance with these Specifications and applicable Drawings.

1.02 APPLICABLE STANDARDS

- A. Where any material or operation is specified by reference to the following published specifications or standards or the specifications or standards of any other organizations, the referenced specification or standard shall be as much a part of this Section as if quoted in full herein.
 - 1. American Society for Testing and Materials (ASTM)
01143 Load Settlement Relationship for Individual Vertical Piles Under Static Axial Load
 - 2. American Welding Society (AWS)
01.0.66 Code for Welding in Building Construction

PART 2 - PRODUCTS

2.01 TYPES AND PROPERTIES

- A. Types.
 - 1. Piles shall be of the type and dimensions shown on the Plans.
- B. Properties.
 - 1. All materials used for the manufacture of the piles shall meet the requirements of Section 03701, Prestressed Concrete.

2.02 MANUFACTURE

- A. The piles shall be cast of concrete and shall be controlled, prestressed, formed and cured in accordance with the provisions of Section 03701, Prestressed Concrete.

2.03 LENGTHS OF PILES

- A. The lengths of piles shall be as directed by the Engineer. The lengths of piles shown

on the Plans are for bidding purposes only and actual order length will be based on the Engineer's evaluation of load tests or driving tests or a combination thereof. The cost of furnishing and driving all piling shown on the Plans and to the lengths shown on the Plans shall be included in the unit price cost given in the proposal for all work. Adjustments in compensation for variation in materials used and operations performed will be made on the basis of the appropriate unit prices given in the proposal and the methods of measurements and conditions of payment contained in Article 14 of this Section. The Engineer will determine the number of over-length piles, if any, to be cast to provide for variation in subsurface conditions.

PART 3 - EXECUTION

3.01 PLACING

- A. Piles shall be driven accurately in the correct locations, true to line both laterally and longitudinally and to the vertical lines, all as indicated on the Plans. A lateral deviation from the correct location at the cut-off elevation of not more than 2 inches will be permitted, unless shown otherwise on the Plans. A variation in slope of not more than 1, 4 inch per foot of longitudinal axis will be permitted. Any pile driven out of correct location shall be pulled and re-driven by the Contractor at no additional cost to the Owner.

3.02 DRIVING

- A. Piles shall be driven to the cut-off elevation and to either the plan driving objective capacities as shown on the Plans or to refusal. Refusal is defined as the number of blows per foot which will produce an allowable bearing capacity of 2 times the plan driving objective capacity as calculated by the appropriate formula given in Section 3.08.0 of these Specifications.

When refusal is encountered at elevations higher than the plan tip elevation plus 15 percent of the order length, the Engineer will determine the course of action to be used to obtain the proper capacity. This will consist of removal and probing or the driving of an additional pile.

- B. Piles shall be driven by an approved steam, air or diesel hammer of a size and type suitable for the work. The weight of the moving parts of the hammer shall be at least 1/3 the weight of the pile to be driven. The hammer shall be operated at all times at the steam or air pressure and at the speed recommended by the manufacturer. Boiler or compressor capacity shall be sufficient to operate the hammer continuously at full rated speed. Piles shall be protected during driving by a cushion and cap of approved design. Where reinforcing rods project above the pile head, the cushion and cap shall be so arranged that the reinforcing bars will not be displaced or injured during the driving. Pile drivers shall have firmly supported, fixed leads extending to the lowest point the hammer must reach to drive the piles to cut-off elevation without the use of a follower. A pile shall not be driven until it is approved for driving. Approval will be based on the conditions of curing and on its compressive strength as indicated by the test cylinders. Each pile shall be driven continuously and without voluntary interruption until the required depth of penetration has been attained. Deviation from this procedure will be permitted only

in case the driving is stopped by causes which could not have been anticipated. A pile which cannot be driven to the required depth because of an underground obstruction shall be pulled, the hole probed, and the pile re-driven. The penetration per blow, which is used as an indication of the bearing capacity of the pile is dependent upon the type of driving equipment used and other factors and it will in every case be determined by the Engineer.

- C. Probing or spudding may be required in order for piling to be driven to plan tip elevation. Probes shall be so sized that they will create a hole having a maximum dimension in a horizontal plane that is no larger than the sectional dimension of the pile. Probing shall be terminated at an elevation which will permit driving to be resumed. Probing depths and maximum penetration per blow will be determined by the Engineer based on results of consecutive driven piles. These values may be changed during pile driving operations when such changes are required to obtain the design bearing capacities of the piles. Probes shall at all times be maintained vertical in location by the use of suitable templates or guides. Piles which have uplifted after driving shall be re-driven to grade after conclusion of other driving activity in that general area. Unless otherwise authorized by the Engineer, no pile shall be driven within 100 feet of concrete less than 7 days old.
- D. In locations approved by the Engineer, piles may be jetted into position. The jetting equipment shall be of a type and capacity approved by the Engineer. Piling shall be carefully advanced during jetting to maintain specified alignment. After one half of the required penetration is obtained, the entire weight of the pile shall be used to advance the pile during jetting. Piles jetted beyond the specified cut-off will be left in position and spliced to the cut-off elevation as directed by the Engineer.

3.03 REDRIVING

- A. In the event that a pile has been driven to within 3 feet of the cut-off elevation and the number of blows per foot demonstrate a capacity less than that specified, the Contractor shall cease driving for a period of time to be determined by the Engineer. Upon resumption of driving, the Contractor shall drive the pile to the cut-off elevation. Should re-driving operations indicate, in the opinion of the Engineer, that sufficient friction has developed, the pile will be approved, if not, the pile will be spliced with a length to be determined by the Engineer and driven to the cut-off elevation or to refusal. No separate or additional payment will be made for re-driving within order-lengths of piles.

3.04 INSPECTION AND RECORDS

- A. Marking.
 - 1. All piles shall be marked by the Contractor at 12 inch intervals with a non-permanent marking prior to driving. Marks shall consist of straight lines perpendicular to the longitudinal axis of the pile with Arabic Numerals ascending from the pile tip.
- B. Inspection.
 - 1. The Engineer will inspect all pile driving, keep all pile driving records and

prepare daily reports of pile driving operations. The Contractor shall notify the Engineer for inspection of pile driving no sooner than 36 hours prior to commencing operations. Piles that are driven without such notification will not be accepted in the work if not inspected by the Engineer.

3.05 DAMAGED AND MISPLACED PILES

- A. Any pile which is cracked or broken because of internal defects or by improper handling or driving, or which is otherwise injured so as to impair it for its intended use, or any pile driven out of proper location, shall be removed and replaced. All work of removal and cost of replacement shall be borne by the Contractor or at no additional expense to the Owner.

3.06 CUT-OFFS

- A. When for any reason, approved by the Engineer, a pile head has not been driven to the cut-off elevation, the pile shall be cut-off perpendicular to the axis of the pile at the cut-off elevation. Cutting methods shall be used which will not damage the portion of the pile to be left in place nor the pile reinforcement.

3.07 SPLICING

- A. When directed by the Engineer, the Contractor will be required to lengthen piles by splicing. Splices shall be made per FDOT index 20601.

3.08 TEST PILES

- A. Test piles conforming to the requirements for permanent piles as specified herein shall be furnished and driven at locations indicated on the Plans. Confirmation of the assumed allowable working loads of single piles shall be made by static loading and measuring each test pile in the manner described below unless test piles have the designation of Driving Test. Test piles indicated or directed to be driven in permanent locations may be incorporated into the work if, after satisfactory completion of the Driving or Load Test, they are approved for inclusion in the work by the Engineer. Every facility shall be provided for the Engineer to inspect and measure the deflection or settlement of the pile under Load Test. However, furnishing of measuring equipment and making measurements of deflection or settlement will be the responsibility of a laboratory retained by the Owner.
- B. Test piles shall be driven with the same size and type hammer, operating with the same effective energy and efficiency as that to be used in driving the permanent piles.
- C. Loading frames and equipment shall be ready to place in operation as soon as a test pile has been driven. The loading equipment shall be of sufficient capacity to apply a maximum load of not less than 2.5 times the design working load of the pile. Loading of any test pile shall be started when directed by the Engineer. Test loading shall be in accordance with ASTM 01143. Test piles shall be loaded to 2 times the design working load of the pile. Application of the loads shall be the responsibility of the Contractor. In the event that any reaction structure other than a loaded platform is used, deflections of the loading frame will be measured in the same

manner and to the same unit of measurement as for the test pile.

- D. The ultimate test load shall be maintained for not less than 24 hours and then unloaded in accordance with ASTM 01143. The design working load as confirmed by the results of load tests shall be the lesser of the 2 values presented below:

One-half of the load that causes a net settlement after rebound of not more than 0.01 inch per ton of total test load.

One-half of the load that causes a gross settlement of not more than 1 inch, provided no sign of failure is indicated by the load settlement curve.

The following formulas are presented as a guide to aid in establishing the controlling penetration per blow which, together with the minimum depth of penetration, will serve to determine the required depth of penetration of each test pile. A value of refusal or the maximum required number of blows per foot for individual piles will be determined by the Engineer based on the results of the tests:

For single-acting hammers:

$$R = 2WH$$

$$S + 0.1 PFW$$

For double-acting hammers:

$$R = 2E$$

$$S + 0.1 PFW$$

Where:

R is the allowable pile load in pounds

W is the weight of the striking part of the hammer in pounds

H is the effective height of fall in feet

E is the actual energy delivered by the hammer per blow in foot-pounds P is the weight of the pile in pounds

If P is less than W, PIW shall be taken as unity

For friction piles:

S is the average net penetration in inches per blow for the last 5 blows after the pile has been driven to a depth where successive blows produce approximately equal net penetration for a minimum distance of 3 feet.

For end-bearing piles:

S is the average net penetration in inches per blow for the last 5 blows after the pile has been driven to a depth where successive blows produce approximately equal net penetration.

END OF SECTION

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SECTION 02617

REINFORCED CONCRETE PIPE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install in the locations as shown on the drawings, the reinforced concrete pipe (R.C.P.) and appurtenances as described herein.

1.02 RELATED WORK

- A. Section 02221: Trenching, Bedding and Backfill for Pipe

1.03 DESCRIPTION OF SYSTEM

- A. Piping shall be installed at the location shown on drawings.

1.04 QUALIFICATIONS

- A. All R.C.P. and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.05 SUBMITTALS

- A. Shop drawings shall be submitted to the Engineer for approval and shall include dimensioning and technical specification for all piping to be furnished.

1.06 TOOLS

- A. Special tools, solvents, lubricants, and caulking compounds required for normal installation shall be furnished with the pipe.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforced Concrete Pipe (R.C.P. or RCP) shall conform to the requirements of FDOT Standard Specifications (latest edition), Section 430 and Section 449. Pipe Joints shall be Rubber Gasket Joints. Pipe Joints and Rubber Gaskets shall conform to the requirements of FDOT Standard Specifications (latest edition), Section 942.
- B. All pipe shall be bundled or packaged in such a manner as to provide adequate

protection for the ends, threaded, or flanged, during transportation from the manufacturer.

- C. Round R.C.P. shall meet the requirements of ASTM C 76 as modified in FDOT Standard Specifications, Section 449.
- D. Elliptical R.C.P. shall meet the requirements of ASTM C 507, Class HE-III, latest revision, except for the exceptions and modifications as specified in FDOT Standard Specifications, Section 449.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Pipe and fittings shall be installed in accordance with the requirements of the Manufacturer and Section 430 of FDOT Standard Specifications, (latest edition), and the requirements of construction plans or drawings.
- B. Bedding shall conform to the detail drawings and specifications. Blocking under the pipe is not allowed.

END OF SECTION

SECTION 02931

SODDING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, equipment and incidentals required to prepare lawn bed and install sodding as shown on contract drawings and as specified herein.
- B. Area to receive sodded grass lawns within the landscape limits shown on the drawings except as noted herein shall be as designated on the Drawings.

1.02 SUBMITTALS

- A. Provide technical data as specified in Section 01340 for shop drawings on all materials or installation procedures required under this Section.
- B. Submit representative topsoil samples for analysis by a private laboratory to determine nutrient deficiencies and outline a proper fertilization program.
- C. Submit as provided in Section 01720 certifications required for all sodding supplied.

PART 2 - PRODUCTS

2.01 SOD

- A. Sod shall be St. Augustine Floritam of firm texture having a compacted growth and good root development as approved.
- B. Sod shall be certified to meet Florida State Plant Board specifications, absolutely true to varietal type, and free from weeds or other objectionable vegetation, fungus, insects and disease of any kind.
- C. Before being cut and lifted, the sod shall have been mowed 3 times with the final mowing not more than a week before cutting into uniform dimensions.

2.02 SOIL CONDITIONERS

- A. Fertilizer:
 - 1. Fertilizer shall be a complete fertilizer, the elements of which are derived from organic sources. Fertilizer shall be a standard product complying with State and Federal fertilizer laws.
 - 2. Percentages of nitrogen, phosphorus and potash shall be based on laboratory tests on soils outlined in Paragraph 1.02B and approved by the Engineer. For purpose of bidding, assume 6% nitrogen, 6% phosphorus and 6% potash by weight. At least 50% of the total nitrogen shall contain no less

than 3% water-insoluble nitrogen.

3. Fertilizer shall be delivered to the site, mixed as specified, in the original unopened standard size bags showing weight, analysis and name of manufacturer. Containers shall bear the manufacturer's certificate of compliance covering analysis shall be furnished to the Engineer. Store fertilizer in a weather-proof place and in such a manner that it will be kept dry and its effectiveness will not be impaired.
- B. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than 20% available phosphoric acid.

PART 3 - EXECUTION

3.01 LAWN BED PREPARATION

- A. Areas to be sodded shall be cleared of all rough grass, weeds and debris, and the ground brought to an even grade as approved.
- B. The soil shall then be thoroughly tilled to a minimum 8-inch depth.
- C. Superphosphate at a rate for bidding purposes of 5 pounds per 1000 square foot and complete fertilizer at a rate for bidding purposes of 16 pounds per 1000 square foot shall be evenly distributed over entire area and cross-disced in to a depth of 4-6 inches.
- D. The areas shall be brought to a proper grade, free of sticks, stones, or other foreign matter over 1-inch in diameter or dimension. The surface shall conform to finish grade, less the thickness of sod, free of water-retaining depressions, the soil friable and uniformly firm texture.

3.02 SOD HANDLING AND INSTALLATION

- A. During delivery, prior to planting, and during the planting of the lawn areas, the sod panels shall at all times be protected from excessive drying and unnecessary exposure of the roots to the sun. All sod shall be stacked during construction and planting so as not to be damaged by sweating or excessive heat and moisture.
- B. After completion of soil conditioning as specified above, sod panels shall be laid tightly together so as to make a solid sodded lawn area. On mounds and other slopes, the long dimension of the sod shall be laid perpendicular to the slope. Immediately following sod laying the lawn areas shall be rolled with a lawn roller customarily used for such purposes, and then thoroughly watered.
- C. Bring the sod edge in a neat, clean manner to the edge of all paving and shrub areas. Top dressing with approved, clean, weed free, sand may be required at no additional cost to the Owner if deemed necessary by the Engineer.

3.03 MAINTENANCE

- A. The Contractor shall produce a dense, well established lawn. The Contractor shall be responsible for the repair and resodding of all eroded or bare spots until project acceptance. Repair sodding shall be accomplished as in the original work except that fertilizing may be omitted.
- B. Sufficient watering shall be done by the Contractor to maintain adequate moisture for optimum development of the lawn areas. Sodded areas shall receive no less than 1.5 inches of water per week.

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATIONS

- A. Lawn areas planted under this Contract and lawn areas outside the designated areas damaged by Contractor's operations shall be repaired at once by proper sod bed preparation, fertilizing and resodding, in accordance with these specifications.

END OF SECTION

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SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SUMMARY

- A. The extent of formwork is indicated by the concrete structures shown on the drawings.
- B. The Work includes formwork, and shoring for architectural and structural cast-in-place concrete, and the installation into formwork of items furnished under other divisions, such as anchor bolts, setting plates, bearing plates, anchorages, inserts, frames, nosings and other items to be imbedded in concrete (but not including reinforcing steel).
- C. Related Work
 - 1. Section 03200
 - 2. Section 03300

1.02 CODES AND STANDARDS

- A. Unless otherwise shown or specified, design, construct, erect, maintain and remove forms and related structures for cast-in-place concrete Work in compliance with the American Concrete Institute Standard ACI 347, "Recommended Practice for Concrete Formwork".

1.03 SUBMITTALS

- A. Comply with the General Conditions.
- B. Product Data
 - 1. Form Coatings
 - 2. Form Ties
 - 3. Accessories
- C. Shop Drawing
 - 1. Formwork

1.04 DESIGN OF FORMWORK

- A. Design, erect, support, brace and maintain formwork so that it will safely support all vertical and lateral loads that might be applied until such loads can be supported by

the concrete structure. Carry vertical and lateral loads to the ground by the formwork system and by in-place construction that has attained adequate strength for that purpose. Construct formwork so that concrete members and structures are of the correct size, shape, alignment, elevation and position.

1.05 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Standards: In addition to complying with pertinent regulations of governmental agencies having jurisdiction, comply with pertinent provisions of ACI 347.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pertinent provisions of the General Conditions.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

- A. Except for metal forms, use new materials. Materials may be re-used during progress of the Work, provided they are completely cleaned and reconditioned, recoated for each use, and capable of producing formwork of the required quality.
- B. For footings and foundations, use Douglas Fir boards or planks secured to wood or steel stakes, substantially constructed to shapes indicated and to support the required loads.
- C. For studs, walers, and supports, use Standard grade or better Douglas Fir, dimensions as required to support the loads but not less than 2"x 4" (nominal).

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

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

3.02 GENERAL

- A. Construct forms complying with ACI 347 to the exact sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, grades, and level and plumb work in the finished structure. Provide necessary camber in forms and account for all deflections.

- B. Provide for openings, offsets, keyways, recesses, dovetails, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features as required.
- C. Locate control joints as indicated on the Drawings and where required but not shown on the Drawings, as accepted by the Architect.
- D. Provisions for Other Trades
 - 1. Provide openings in concrete formwork to accommodate work of other trades.
 - 2. Verify size and location of openings, recesses, and chases with the trade requiring such items.
 - 3. Accurately place and securely support items to be built into the concrete.

3.03 FORM COATINGS

- A. Coat form contact surfaces with form coating compound before reinforcement is placed.
 - 1. Do not allow excess form coating material to accumulate in the forms or to come in contact with surfaces which will bond to fresh concrete.
 - 2. Apply the form coating material in strict accordance with its manufacturer's recommendations.

3.04 FORMWORK TOLERANCES

- A. Construct formwork to comply with the following tolerances which are to be adhered to in the construction of all concrete work. Where not specifically indicated herein, completed concrete surfaces complying with the tolerances specified in ACI 347, Section 2.4 shall be provided, after removal of forms and prior to patching and finishing of cast-in-place formed surfaces.
- B. Tolerances
 - 1. Variation from the plumb:
 - a. In the lines and surfaces of columns, piers, and walls 1/4 inch per 10 feet, but not more than 1/2 inch (totally).
 - 2. Variation from the level or from the grades indicated on the drawings.
 - a. For exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines: In any bay or 20 ft. maximum - 1/4 inch in 40 ft. or more - 1/2 inch.
 - b. For slabs on grade or elevated: 1/8 inch in 10 ft. cumulative, and no ponding in excess of thickness of a standard United States 25-cent coin.

3. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls.
 - 1) Minus - 1/4 inch.
 - 2) Plus - 1/2 inch.
4. Footings
 - a. Variation in dimensions in plan:
 - 1) Minus - 1/2 inch.
 - 2) Plus - 2 inches.
 - b. Misplacement or eccentricity: Two percent (2%) of the footing in the direction of misplacement but not more than two inches (2").
 - c. Reduction in thickness: Minus - five percent (5%) of specified thickness.
- C. Check formwork during concrete placement to ensure that forms, shores, falsework, ties and other features have not been unduly disturbed by concrete placement methods or equipment. Report in writing to the Architect/Engineer any deviations from the allowable tolerances.

3.05 FORMWORK CONSTRUCTION

A. General

1. Construct forms, complying with ACI 347, to the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in the finished structures. Provide for openings, offsets, keyways, moldings, rustications, recesses, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required on the Work. Use selected materials to obtain the required finishes.
2. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
3. Control Joints
 - a. Locate where shown or directed. See Section 03300 for treatment of control and construction joints, including wood screeds, metal keyways and sawcuts.
4. Provisions for Other Work
 - a. Provide openings in concrete formwork to accommodate other work. Size and location of openings, recesses and chases are the responsibility of those requiring such items. Accurately place and securely support items to

be built into forms.

5. Construction Joints

a. Provide construction joints as shown on plans and as required by field conditions. Construction joints in concrete slabs shall be preformed metal with a keyway and slats to allow reinforcement to extend through the joint. Construction joints in beams shall be composed of a similar material as the side forms, contain a keyway, and permit all continuous reinforcement to extend through.

3.06 PREPARATION OF FORM SURFACES

A. Coat the contract surfaces of forms with a form-coating compound before reinforcement is placed. Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds. Thin form-coating compounds only with the thinning agent of the type and in amount, and under the conditions of the form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed.

3.07 REMOVAL OF FORMS

A. Formwork not supporting the weight of concrete, such as sides of beams and similar parts of the Work, may be removed 24 hours after placing the concrete, provided the concrete is sufficiently hard to not be damaged by the form removal operations, and provided that curing and protection operations are maintained.

3.08 RE-USE OF FORMS

A. Clean and repair the surfaces of forms that are to be reused in the Work, except that split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to all concrete contact for surfaces as specified for new formwork.

B. When forms are intended for re-use in successive concrete placement, thoroughly clean surfaces, remove fine and laitance, and tighten forms to close all joints. Align and secure all joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to the Owner and Architect/Engineer.

3.09 STRUCTURAL NOTES AND INSPECTION PLAN

A. Refer to drawings for additional data and requirements.

END OF SECTION

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SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, equipment and incidentals required to install all steel bars, epoxy coated bars, steel wire, and wire fabric required for the reinforcement of concrete, as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Concrete is included in Section 03300.
- B. Waterstops are included in Section 03251.

1.03 REFERENCES

- A. ACI 318-89 - Building Code Requirements for Reinforced Concrete.
- B. ASTM A615 - Reinforcement Bars
- C. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- D. ASTM A82 - Cold-Drawn Steel for Concrete Reinforcement.

1.04 SUBMITTALS

- A. Submit complete detailed working drawings and schedules of all reinforcement required in accordance with Section 01340.
- B. Submit 12 inch long samples of each size bar with epoxy coating and samples of other forms of reinforcement.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in performing the work of this Section.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 01600.
- B. Store and protect products under provisions of Section 01600.
- C. Protect bars and wire from distortion or damage.

1.07 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on Drawings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Florida Steel Corporation.
- B. Substitutions: Under provisions of Section 01600.

2.02 MATERIALS

- A. Unless otherwise specified or required, the design, materials, workmanship, and erection shall conform to the requirements of the latest local Building Code and the latest ACI 318 Code. In case of conflict, the latest local Building Code shall govern.
- B. Concrete reinforcement for panels and cap in sizes No. 3 (3/8 inch) and larger shall be MFX₂ per Section 05101. Concrete reinforcement for piles shall be in accordance with FDOT Index 20614.
- C. Rail-steel bars will not be allowed in the Work.
- D. Reinforcement shall be accurately fabricated to the dimensions indicated on the Drawings. Particular care shall be exercised not to have stirrups oversized in order to maintain proper coverage of concrete. Stirrups and tie bars shall be bent around a revolving collar having a diameter not less than 2 times the minimum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than 6 times the minimum thickness of the bar except for bars larger than 1 inch, in which case the bends shall be made around a pin of 8 bar diameters. All bars shall be bent cold. Bars reduced in section with kinks or bends not shown on the Drawings will not be accepted.
- E. Wire fabric shall conform to ASTM A185 for Welded Steel Wire Fabric for Concrete Reinforcement.
- F. Steel wire shall conform to ASTM A82 for Cold-Drawn Steel for Concrete Reinforcement. Wire ties shall be zinc coated annealed iron of not less than No. 18 gauge.

2.03 HANDLING MATERIALS

- A. Reinforcement shall be shipped to the site with bars of the same size and shape fastened in bundles with metal identification tags giving size and mark securely wired on. The identification tags shall be labeled with the same designation as shown on the submitted bar schedules and shop drawings.
- B. All bars shall be stored off the ground and shall be protected from moisture and be kept free from dirt, oil, or injurious contaminants.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Reinforcing bars shall not be welded, either during fabrication or erection, without prior written approval from the Engineer. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work.
- B. Unless otherwise shown, splices in reinforcement shall be lapped not less than 24 bar diameters. All bar splices shall be staggered wherever possible. When splicing bars of different diameters, the length of lap is based on the larger bar.
- C. Before being placed in position, reinforcement shall be thoroughly cleaned of loose mill and rust scale, dirt, and other coatings that reduce or destroy bond. Where there is delay in depositing concrete after reinforcement is in place, bars shall be reinserted and cleaned when necessary. Epoxy coated bars shall be inspected for flaws in the coating. All suspect areas will be relocated in the field by methods approved by the rebar manufacturer.
- D. Reinforcement shall be accurately positioned as indicated on the Drawings, and secured against displacement by using wire ties or suitable clips at intersections.
- E. Accessories such as chairs, chair bars, and the like are an integral part of the reinforcement and shall be furnished and installed in sufficient quantity to satisfactorily position all steel, and in accordance with the latest (ACI 315) Manual of Standard Practice for Detailing Reinforced Concrete Structures.
- F. Except as otherwise indicated on the Drawings, bars in slabs, beams and girders shall be spliced as per requirements in ACI 315. Splices and laps in columns, piers and struts shall be sufficient to transfer full stress by bond. Splices in adjacent bars shall be staggered if required.
- G. Except as otherwise indicated on the Drawings, reinforcement shall be installed with clearance for concrete coverage as follows:
- | | |
|--|--------|
| Footing bottoms | 3 inch |
| Formed surfaces in contact with soil or exposed to the weather | 3 inch |
| Columns, beams and shearwalls | 3 inch |
| Bottom steel of interior slabs | 3 inch |
| Top steel of interior slabs | 3 inch |
| Bottom steel in grid slabs | 3 inch |
| Interior face of walls | 3 inch |
- H. All slab reinforcing shall be supported on concrete cubes or wafers of the correct height. Wafers shall contain soft steel wires embedded therein for fastening to reinforcing. Wafers shall have a minimum compressive strength of 3,500 psi and shall have been cured as specified for concrete. Masonry units will not be permitted for supporting steel in bottom mats or elsewhere. For supporting the top steel in slabs, the Contractor shall furnish extra steel supports such as channels if required and shall construct blocks of concrete, having the same quality as specified for the structure, for use in supporting both top and bottom mat steel. Wood blocks, stones, brick chips, etc., cinder blocks or concrete building blocks will not be

allowed. Alternate methods for supporting top steel in slabs, such as vertical reinforcing fastened to bottom and top mats, may be used if approved by the Engineer.

- I. Alternate methods of supporting bottom reinforcement for slabs and beams not exposed to the weather (such as plastic chairs, but not plastic tipped bolsters) may be used only if specifically approved by the Engineer.
- J. Reinforcement for vertical surfaces (beams, columns, walls) shall be properly and firmly positioned from the forms at all points by means of stainless steel (tipped) bolsters or equal, subject to Engineer's approval.
- K. Reinforcement which is to be exposed for a considerable length of time after being placed shall be painted with a heavy coat of neat cement slurry.
- L. In no case shall any reinforcing steel be covered with concrete until the amount and position of the reinforcements has been checked by the Engineer and his permission given to proceed with the concreting. The Engineer shall be given ample prior notice of the availability of set reinforcement for checking.

END OF SECTION

SECTION 03251

JOINTS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish all materials, labor, equipment and incidentals required to make all joints tight in the concrete as detailed on the Drawings and as specified herein.

1.02 SUBMITTALS

- A. Submit shop drawings showing placement of forms, form joints major inserts and blockouts in accordance with Section 01340.

1.03 RELATED WORK

- A. Section 03300: Cast-In-Place Concrete
- B. Section 03350: Concrete Finishes

PART 2 - PRODUCTS

2.01 EXPANSION JOINTS - FLOOR

- A. Floor expansion joints shall be types UX-F100 and UX-J100 1-inch joint systems as manufactured by Metraflex, Mercer, EBAA Iron or approved substitution.
- B. Retainers shall be extruded aluminum alloy 6063-T5. Aluminum retainers shall be chemically treated to prepare surfaces for complete adhesion of the sealant.
- C. Sealant shall be an elastomeric material capable of allowing multi-directional movement while maintaining cohesion and adhesion capabilities. The sealant shall have a maximum hardness of Shore A25 with tensile strength and elongation to meet ASTM D412. The sealant shall perform between temperatures of -20AF and 150AF. Moisture vapor transmission shall meet ASTM C355.
- D. The joint assembly shall be capable of a minimum of 50 percent movement in any direction from the normal position.
- E. All aluminum surfaces in contact with concrete or masonry shall receive one sprayed-on, factory applied coat of baked-on epoxy primer.
- F. Sealant color shall be selected by the Engineer.

2.02 EXPANSION JOINTS - OTHER

- A. Premolded joint filler shall be 3/4-inch thick or as shown on the Drawings and shall be a self-expanding cork, Servicised Products, W.R. Grace and Company, Code No.

4324 equal by W.R. Meadows, Inc., or approved substitution.

- B. Joint sealant shall be a two component synthetic rubber compound based on Thiokol liquid polysulphide polymer by W.R. Grade and Company, Toch Bros., Tremco Co., or equal. Sealant shall develop a Shore Hardness of at least 30 after seven days curing. Back-up material where required shall be approved closed cell polyethylene foam rods of diameters to suit joint conditions.
- C. Primer shall be as recommended by sealant manufacturer.

2.03 WATERSTOPS

- A. Waterstops for construction joints, where indicated, shall be 8 or 12 inches x 1/8-inch steel and be hot-dipped galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Steel waterstops shall have all joints fully welded and shall be carefully set and held in place so that 4-inches extends straight into concrete placement at each side of joint.
- B. Premolded joint fillers shall be installed at all locations shown on the Drawings.
- C. Joint sealant for all joints indicated on the Drawings shall be placed to the depths shown. Preparation of surfaces, priming, and the handling and preparation of materials shall be in complete compliance with the manufacturer's instructions as approved.
- D. Flex-Seal systems shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals required to place cement and concrete masonry, reinforcing steel, forms, waterstops and miscellaneous related items including sleeve, reglets, anchor bolts, inserts and embedded items specified under other Section.

1.02 RELATED WORK

- A. Section 01410 – Testing and Testing Laboratory Services
- B. Section 03200 - Concrete reinforcement.
- C. Section 03251 - Joints.
- D. Section 05101 - MMFX2 Uncoated Corrosion Resistant Steel

1.03 REFERENCE

- A. ASTM C-150 Portland Cement
- B. FS SS-C-1960/3 Portland Cement
- C. ASTM C-94 Ready-Mix Concrete
- D. ACI 318-89 Reinforced Concrete
- E. ASTM C-143 Concrete Mix
- F. ASTM C-231 Concrete Testing
- G. ASTM C-33 Concrete Aggregates
- H. ASTM C-87 Mortar Strength
- I. ASTM C-40 Concrete Aggregates
- J. ASTM C-494 Concrete Ad Mixtures
- K. ACI 304 Truck Mixers
- L. ASTM C-31 Field Testing
- M. ASTM C-39 Concrete Testing
- N. ASTM C-42 Concrete Testing

1.04 DESCRIPTION

- A. Concrete shall be of portland cement, ASTM C-94, fine aggregate, coarse aggregate, water and admixtures as specified and shall be ready-mixed, or transit-mixed concrete. All constituents, including admixture, shall be batched at the central batch plant.
- B. Concrete shall meet FDOT Section 346 for Extremely Aggressive Environment. Maximum Water Cement Ratio is 0.4%. Concrete shall receive curing compound meeting requirements of FDOT Section 925 applied in accordance with Section 400-16 or Section 520.8 as applicable. Concrete cap and panels shall have cylinder 28 day strength of 5000 psi. Concrete piles shall have cylinder 28 day strength of 6,000 psi.
- C. The concrete panels and cap shall be reinforced by MFMX₂ steel as depicted in the drawings.
- D. Field testing and inspection services required will be provided by the Owner. Cost of such work, except as specifically stated otherwise, will be paid for by the Owner. Methods of test will comply in detail with the latest applicable ASTM Methods of Testing.
- E. Samples of constituents and of concrete as placed will be subjected to laboratory tests. Materials incorporated in the work shall conform to approved samples.
- F. Under special circumstances, the Engineer may allow minor deviations from the material requirements specified, provided the resulting concrete quality is not adversely affected or provided a suitable adjustment in cement content is made to compensate for such deviations without cost to the Owner.

1.05 SUBMITTALS

- A. Submit, as provided in the General Conditions and Section 01340, shop drawings showing placement of forms, form joints, major inserts and blockouts.

1.06 QUALITY ASSURANCE

- A. The actual acceptance of aggregates and development of mix proportions to produce concrete conforming to the specific requirements shall be determined by means of prior laboratory tests made by the Concrete Supplier or the Contractor at his expense with the constituents to be used on the work.
- B. The Concrete Supplier shall submit through the Contractor to the Engineer for approval the concrete mix he intends to use, designed within the limits of these specifications, listing the brand of cement, source and results of tests of aggregates and admixtures not later than 14 days prior to the beginning of placing concrete.
- C. The limiting strengths, water-cement ratios and cement factors as shown on Table A shall apply. Maximum water-cement (#/#) for structures shall be 0.53 by weight.

TABLE A

<u>Minimum Comp. Str. psi at 28 days</u>	<u>Maximum Net Water Content gals/100 lbs*</u>	<u>Minimum Cement Factor 100 lbs/cu yd**</u>
2500	7.4	4.3
3000	7.0	4.8
3500	6.4	5.64
4000	5.85	5.64
5000	4.0	5.64

*Maximum; decrease if possible. This represents total water in mix at time of mixing, including free water on aggregates, and water in admixture solution.

**Minimum; increase as necessary to meet other requirements. These cement factors apply to "controlled" concrete subject to specific inspection.

- D. When high-early-strength Portland cement is permitted, the same strength requirements shall apply except that the indicated strengths shall be attained at seven (7) days instead of twenty-eight (28) days.
- E. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the desired properties. All changes so ordered shall be made at the Contractor's expense.
- F. If, during the progress of the work, the Contractor desires to use materials other than those originally approved, or if the materials from the sources originally approved change in characteristics, the Contractor shall, at his own expense, have made new acceptance tests of aggregates and establishment of new basic mixtures and submit them to the Engineer for approval.
- G. Consistency of the concrete as measured by the ASTM Designation C143 shall be as shown in Table B.

TABLE B

<u>Portion of Structure</u>	<u>Slump Max.*</u>	<u>(inches) Min.</u>
Pavement and slabs on ground	3	2
Plain footings, gravity walls, slabs and beams	3	2
Heavy reinforced foundation walls and footings	4	2
Thin reinforced walls and columns	4	2

* May be increased 1-inch if proper method of consolidation is used.

- H. Concrete shall be of such consistency and mix composition that it can be readily worked into the corners and angles of the forms and around the reinforcement, inserts, and wall castings without permitting materials to segregate or free water to collect on the surface, due consideration being given to the methods of placing and compacting.
- I. No excessively wet concrete will be permitted, and if at any time concrete of such consistency beyond the limits of Table B is delivered to the job, the Engineer may direct the Contractor to reject same or to add extra cement for which no additional payment will be made. A supply of the approved cement shall be kept available at the site for this purpose. No additional water shall be added by drivers of transit-mix trucks except that established for the design. Failure to comply with this requirement shall be justification for rejecting the concrete.
- J. The entrained air, as measured by the Pressure Method, ASTM C231, shall be as shown in Table C.

TABLE C

<u>Nominal Maximum Size of Coarse Aggregate(in)</u>	<u>Total Air Measured at Discharge from truck (%)</u>
2"	2.5 - 5.5
1"	6.5
3/4"	4.0 - 8.0

1.07 ACCEPTANCE TESTS

- A. Conformity of aggregates to these Specification, and the actual proportions of cement, aggregates, and water necessary to produce concrete conforming to the requirements set forth in Table A, shall be determined by tests made with representative samples of the materials to be used on the work. Tests will be made by an accredited testing laboratory, and approved by the Engineer.
- B. Cement may be subject to testing to determine that it conforms to the requirements of this Specification. Methods of testing shall conform to the appropriate specification, but the place, time, frequency and method of sampling will be determined by the Engineer in accordance with the particular need.
- C. Water content of the concrete shall be based on a curve showing the relation between water content and 7 and 28-day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age, and shall have a range of values sufficient to yield the desired data, including all the compressive strengths called for on the Drawings, without extrapolation. The water content of the concrete to be used, as determined from the curve, shall correspond to the test strengths of the laboratory trial mixtures as shown on Table D

TABLE "D"

<u>Design Strength</u>	<u>Min. Lab. 7 Days*</u>	<u>Strength 28 Days**</u>
3000	2500	3500
3500	3000	4100
4000	3500	4600
5000	4500	5600

* May be employed by preliminary design.

** To be used for final designs.

- D. In no case, however, shall the resulting mix conflict with the limiting values for maximum water-cement ratios and minimum cement contents as specified in Table A.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials shall conform to these Specifications and any state or local specification requirements.
- B. Cement for all cast in place concrete shall be a domestic Portland cement (ASTM C-150, Type II) or high early strength Portland cement (Type III) free from injurious water soluble salts or alkalies. High early strength cement may only be used, with written approval of the Engineer. Air entraining cements may be used with written approval of the Engineer. Cement brands shall be subject to approval.
- C. Aggregates:
1. Fine aggregate shall consist of washing inert sand conforming to the requirements of ASTM Specification C-33, and the following detailed requirements:

<u>Sieve</u>	<u>% Passing</u>
No. 4	95-100%
16	60-75
50	13-30
100	3-8
Fineness Modulus	2.4-2.6
Organics	Organic Plate 2, per ASTM C-40
Silt	2.0% maximum
Mortar Strength	95% minimum as per ASTM C87, Section 10
Soundness	8% maximum loss, using

magnesium sulfate,
subjected to 5 cycles

2. Coarse aggregate shall consist of well-graded crushed rock or washing gravel conforming to the requirements of ASTM Specification C-33 and the following detailed requirements:

Organics	Organic Plate 1, per ASTM C-40
Silt	1.0% maximum
Soundness	8% maximum loss, using magnesium sulfate, subjected to 5 cycles

3. The following designated sizes* of aggregate shall be the maximum employed in concrete:

2 inch for plain concrete

1 inch for reinforced sections 10 inch and over in thickness

3/4 inch for reinforced sections less than 10 inch in thickness

4. *Note: The "Designated Size" and the corresponding gradations shown represent the end or combined gradation of the coarse aggregate to be used in the final concrete.

D. Water:

1. Water shall be clean and free from injurious amounts of oils, acid, alkali, organic matter or other deleterious substances.
2. When subjected to the mortar strength test described in ASTM C87, the 28 day strength of mortar specimens made with the water under examination and normal Portland cement shall be at least 100 per cent of the strength of similar specimens made with distilled water.
3. Potable tap water will normally fulfill the above requirements.
4. Raw water (groundwater) and canal water shall not be allowed in the mix.

E. Admixtures:

1. A water reducing agent shall be used in all concrete. The admixture shall conform to ASTM Specification C494. Proportioning and mixing shall be as recommended by the manufacturer.
2. Admixtures causing accelerated setting of cement in concrete shall not be used. Air entraining admixtures with demonstrated compatibility with the

concrete mix shall be used as required as a moderate addition to the water reducing agent to obtain the specified percent air in the resultant concrete.

PART 3 - EXECUTION

3.01 MEASURING MATERIALS

- A. Materials shall be measured by weighing except as otherwise specified or where other methods are specifically authorized by the Engineer. The apparatus provided for weighing the aggregates and cement shall be suitably designed and constructed for this purpose. Scales shall have been certified by the local Sealer of Weights and Measures within one year of use. Each size of aggregate and the cement shall be weighed separately. The accuracy of all weighing devices shall be such that successive quantities can be measured to within one percent of the desired amount. Cement in standard packages (sacks) need not be weighed, but bulk cement and fractional packages shall be weighed.
- B. Water shall be measured by volume or by weight. The water-measuring device shall be capable of control to 1/2% accuracy. All measuring devices shall be subject to approval. Admixtures shall be dispensed either manually with use of calibrated containers or measuring tanks, or by means of an approved automatic dispenser designed by the manufacturer of the specified admixture.

3.02 MIXING

- A. Concrete shall be ready-mixed or transit-mixed, as produced by equipment acceptable to the Engineer. No hand-mixing will be permitted. Adding water in controlled amounts during the mixing cycle shall be done only with the express approval of, and under the direction of, the Engineer.
- B. Ready-mix or transit-mixed concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities for the respective conditions as stated on the nameplate. Discharge at the site shall be within 1-1/2 hours and within one hour when ambient temperature is above 85 degree F after cement was first introduced into the mix. Central mixed concrete shall be plant-mixed a minimum of 1-1/2 minutes per batch and then shall be truck-mixed or agitated a minimum of 8 minutes. Agitation shall begin immediately after the pre-mixed concrete is placed in the truck and shall continue without interruption until discharge. Transit-mixed concrete shall be mixed at mixing speed for at least 10 minutes immediately after charging the truck, followed by agitation without interruption until discharged.
- C. All central plant and rolling stock equipment and methods shall conform to the latest Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers' Bureau of the National Ready-Mixed Concrete Association, as well as ACI Standard 304 and ASTM Specification C94.
- D. The retempering of concrete or mortar which has partially hardened, that is, mixing with or without additional cement, aggregate, or water, will not be permitted.
- E. Attention is called to the importance of dispatching trucks from the batching plant

so that they shall arrive at the site of the work just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.

3.03 FIELD TESTS

- A. Sets of four field control cylinder specimens will be taken at random by the Engineer during the progress of the work, in conformity with ASTM Designation C31; the total number of specimens taken on the project may average one set per 150 cu yds, and in general not less than one set of specimens will be taken on any one day when concrete is being placed. When average ultimate 28-day strength of control cylinders in any set falls below the required ultimate strength or below proportional minimum 7 day strengths where proper relation between 7 and 28 day strengths have been established by tests, proportions, water content, or temperature conditions shall be changed to secure the required strength.
- B. The Contractor shall cooperate in the making of such tests to the extent of allowing free access to the work for the selection of samples, providing heated (when required) moist storage facilities for specimens, affording protection to the specimens against injury or loss through his operations, and furnishing material and labor required for the purpose of taking concrete cylinder samples, curing boxes and shipping boxes. All shipping of specimens will be paid for by the Contractor.
- C. Slump tests will be made in the field by the testing laboratory.

3.04 INSPECTION AND CONTROL

- A. The preparation of forms, placing of reinforcing steel, conduits, pipes, and sleeves, batching, mixing, transportation, placing and curing of concrete shall be at all times under the inspection of the Engineer.
- B. The Contractor shall engage the services of an approved testing laboratory to establish the basic mixtures of concrete as required by the specifications.
- C. The Contractor will engage the services of a testing laboratory to test field control cylinder specimens and to conduct other tests as specified herein or as deemed required by the Engineer to insure the quality.
- D. Air entrainment shall be measured by the testing laboratory or his representative at time of concrete deposit in accordance with ASTM Designation C231.

3.05 CONCRETE APPEARANCE

- A. Concrete for every part of the work shall be homogeneous structure which, when hardened, will have the required strength, durability and appearance.
- B. Formwork, mixtures and concrete placement workmanship shall be such that concrete surfaces, when exposed, will require only minimal finishing with no excess honeycombing, voids or irregular color lines.

3.06 FORMS

- A. Forms shall be used for all concrete masonry, including footings. Forms shall be so constructed and placed that the resulting concrete will be of the shape, lines, dimensions, appearance, and to the elevations indicated on the Drawings.
- B. Forms shall be made of wood, metal, or other approved material. Wood forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots; where used for exposed surfaces, boards shall be dressed and matched. Plywood shall be sanded smooth and fitted with tight joints between panels. Metal forms shall be of an approved type for the class of work involved and of the thickness and design required for rigid construction.
- C. Edges of all form panels in contact with concrete shall be flush within 1/32-inch and forms for plane surfaces shall be such that the concrete will be plane within 1/16-inch in 4 feet. Forms shall be tight to prevent the passage of mortar and water and grout.
- D. Forms for walls shall have removable panels at the bottom for cleaning, inspection, and scrubbing-in of bonding paste. Forms for walls of considerable height shall be arranged with tremies and hoppers for placing concrete in a manner that will prevent segregation and accumulation of hardened concrete on the forms or reinforcements above the fresh concrete.
- E. Molding or bevels shall be placed to produce a 3/4-inch chamfer on all exposed projecting corners, unless otherwise shown on the Drawings. Similar chamfer strips shall be provided at horizontal and vertical extremities of all wall placements to produce "clean" separation between successive placements as called for on the Plans.
- F. Forms shall be sufficiently rigid to withstand vibration, to prevent displacement or sagging between supports, and constructed so the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for their adequacy.
- G. Forms, including new pre-oiled forms, shall be oiled before reinforcement is placed, with an approved nonstaining oil or liquid form coating having a non-paraffin base.
- H. Before form material is re-used, all surfaces in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn, all protrusions smoothed and in the case of wood forms pre-oiled.
- I. Form ties encased in concrete shall be designed so that after removal of the projecting part, no metal shall be within 1-inch of the face of the concrete. That part of the tie to be removed shall be at least 1/2-inch diameter or be provided with a wood or metal cone at least 1/2-inch in diameter and 1-inch long. Form ties in concrete exposed to view shall be the cone-washer type equal to the Richmond "Tyscru". Throughbolts or common wire shall not be used for form ties.

3.07 PLACING AND COMPACTING

- A. Unless otherwise permitted, the work begun on any day shall be completed in daylight of the same day.

- B. Concrete is not to be placed until reinforcing steel, pipes, conduits, sleeves, hangers, anchors and other work required to be built into concrete have been inspected and approved by the Engineer. Remove water and foreign matter from forms and excavation. All soil bottom for slabs and footings shall be approved by the Engineer before placing concrete.
- C. Transport concrete from mixer to place of final deposit as rapidly as practicable by methods which prevent separation of ingredients and displacement of reinforcement, and which avoid rehandling. Partially hardened concrete is not to be used.
- D. "Cold joints" are to be avoided, but if they occur, are to be treated as bonded construction joints.
- E. At construction joints the surfaces of the concrete already placed, including vertical and inclined surfaces, shall be thoroughly cleaned of foreign materials and laitance, and weak concrete and roughened with suitable tools to expose a fresh face. At least two hours before and again shortly before the new concrete is deposited, the joints shall be saturated with water. After glistening water disappears, the joints shall be given a thorough coating of neat cement slurry mixed to the consistency of very heavy paste. The surfaces shall receive a coating at least 1/8-inch thick, well scrubbed-in by means of stiff bristle brushes whenever possible. New concrete shall be deposited before the neat cement dries.
- F. Deposit concrete to maintain, until the completion of the unit, a horizontal plastic surface. Vertical lifts shall not exceed 24-inches and preferably 18-inches.
- G. Chutes for conveying concrete shall be of U-shaped designed and sized to insure a continuous flow of concrete. Flat (coal) chutes shall not be employed. Chutes shall be metal or metal-lined and each section shall have approximately the same slope. The slope shall not be less than 25 nor more than 45 degrees from the horizontal and shall be such as to prevent the segregation of the ingredients. The discharge end of the chute shall be provided with a baffle plate or spout to prevent segregation. If the discharge end of the chute is more than 5 feet above the surface of the concrete in the forms, a spout shall be used, and the lower end maintained as near the surface of deposit as practicable. When the operation is intermittent, the chute shall discharge into a hopper. Chutes shall be thoroughly cleaned before and after each run, and the debris and any water shall be discharged outside the forms. Concrete shall not be allowed to flow horizontally over distances exceeding 5 feet.
- H. In thin sections of considerable height, concrete shall be placed using suitable hoppers, spouts with restricted outlets, or otherwise, as required or approved.
- I. Concrete during and immediately after depositing shall be thoroughly compacted by means of suitable tools. Internal type mechanical vibrators shall be employed to produce required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be carried on long enough to produce homogeneity and optimum consolidation without permitting segregation of the solid constituents of "pumping" or migration of air. All vibrators shall be supplemented by proper wooden spade puddling adjacent to forms to removed included bubbles and honeycomb. This is essential for the top lifts of walls. All vibrators shall travel at least 10,000 rpm and be of adequate capacity. At least one

vibrator shall be used for every 10 cubic yards of concrete placed. In addition, one spare vibrator in operating condition shall be on the site.

- J. Concrete slabs on the ground shall be well-tamped into place and foundation material shall be well-tamped, and rolled until thoroughly compacted prior to placing concrete.
- K. Concrete shall be deposited continuously in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the section. If a section cannot be placed continuously, construction joints may be located at points as provided for in the Drawings or approved by the Engineer.

3.08 CURING AND PROTECTION

- A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations. Special curing procedures shall be implemented as described herein to minimize the cracking of concrete in water retaining structures.
- B. Concrete placed at air temperature below 40 degrees F shall have a minimum temperature of 60 degrees F. When the air temperature is below 40 degrees F and falling, the water and aggregates shall be heated before mixing. Accelerating chemicals shall not be used prevent freezing. All concrete shall be so protected that the temperature at the surface will not fall below 50 degrees F for at least 7 days after placing. The Contractor shall submit for approval by the Engineer the methods he proposes to use against low temperatures. No salt, manure, or other chemicals shall be used for protection.
- C. All concrete, particularly exposed surfaces, shall be treated immediately after concreting or cement finishing is completed to provide continuous moist curing above 50 degrees F for at least 7 days, regardless of the ambient air temperature. Walls and vertical surfaces may be covered with continuously saturated burlap, or other approved means; horizontal surfaces, slabs, etc., shall be ponded to a depth of 1/2 inch or kept continuously wet by use of wet burlap.
 - 1. Slabs of water retaining structures shall be wet cured continuously with wet burlap or other approved means for a minimum of 14 days if Type II cement is used for 3 days if Type III cement is used.
 - 2. Walls of water retaining structures shall have all their exposed surfaces covered from direct sunlight and forms left in place for a minimum of 3 days. Curing shall commence within four hours after concrete placement.
- D. In cold weather supplementary continuous warm curing (above 50 degrees F) shall provide a total of 350-day degrees (i.e., 5 days 70 degrees F, etc.) of heat.
- E. In hot weather, concrete when deposited shall have a placing temperature which will not cause difficulty from loss of slump, flash set or formation of cold joints. In no case shall the temperature of concrete being placed exceed 90 degrees F.
- F. Finished surface and slabs shall be protected from the direct rays of the sun to

prevent checking and crazing.

3.09 REMOVAL OF FORMS

- A. Except as otherwise specifically authorized by the Engineer, forms shall not be removed before the concrete has cured as specified above in subparagraph 3.08C and the concrete has attained a strength of at least 30 percent of the ultimate strength prescribed by the design, and not before reaching the following number of day-degrees (whichever is the longer):

<u>Forms for</u>	<u>Day-Degree*</u>
Beams and slabs	500
Walls and vertical surfaces (non-water retaining)	100
Walls and vertical surfaces (water retaining)	150

*Day-degree: Total number of days times average daily air temperature at surface of concrete. For example, 5 days at a daily weighted average temperature of 60 degrees F equal 300 day-degrees. Temperatures below 50 degrees F not to be included.

- B. Shores shall not be removed until the concrete has attained at least 60% of the specified strength and also sufficient strength to support safely its own weight and the construction live loads upon it, but concrete shall be minimum age of 14 days before such removal.

3.10 FAILURE TO MEET REQUIREMENTS

- A. Should the strengths shown by the test specimens made and tested in accordance with the above provision fall below the values given in Table A, the Engineer shall have the right to require changes in proportions as outlined above to apply to the remainder of the work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed, the cost of such additional curing to be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements the Contractor and Engineer shall confer to determine the adjustment, if any, can be made in conformity with Sections 16 and 17 of ASTM Specification C94 for Ready-Mixed Concrete.
- B. When the tests on control specimens of concrete fall below the required strength, the Engineer will permit check tests for structure in accordance with ASTM Methods C42 and C39. In case of failure of the latter, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the

slabs, beams, and columns in which such concrete was used. Test need not be made until concrete has aged 60 days.

- C. Slabs or beams, under load test, shall be loaded with their own weights plus a super-imposed load of 2 times design live load. The load shall be applied uniformly over portion being tested in approved manner, and left in position for 24 hours. The structure shall be considered satisfactory if deflection "D" in feet, at end of 24-hour period does not exceed value:

$$D \text{ equals } 0.001 (L \times L)/t$$

in which "L" is span in feet, "t" is depth of slab or beam in inches.

- D. If deflection exceeds "D" in the above formula, the concrete shall be considered faulty unless within 24 hours after removal of the load, slab or beam under test recovers at least 75% of observed deflection.
- E. Should the strength of test cylinders fall below 60% of the required minimum 28-day strength, the concrete shall be rejected and shall be removed and replaced.

3.11 PATCHING AND REPAIRS

- A. It is the intent of these Specifications to require that forms, mixture of concrete and workmanship shall be such that concrete surfaces, when exposed, will require minimal finishing as specified in Paragraph 3.05 above.
- B. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed, recesses left by the removal of form ties (except where ties are left in place during sandblasting) shall be filled and surface defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Engineer.
- C. Immediately after removal of forms remove plugs and break off metal ties as required by Paragraph 3.06. Holes are then to be promptly filled upon stripping as follows: Moisten the hole with water, followed by a 1/16 inch brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the holes with 1 1.5 mixture of cement and concrete sand mixer slightly damp to the tough (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spider web. Trowel smooth with heavy pressure. Avoid burnishing.
- D. Rub lightly with a fine carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or straining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.
- E. Defective concrete and honeycombed areas shall be chipped reasonably square and at least 1 inch deep to sound concrete by means of hand chisels or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded in the parent concrete, subject to

Engineer's final inspection. If honeycomb exists around reinforcement, chip to provide a clear space at least 3/8 inch wide all around the steel. For areas less than 1 1/2 inch deep, the patch may be made in the same manner as described above for filling for tie holes, care being exercised to use adequately dry (nontrowelable) mixtures and to avoid sagging. Thick repairs will require build-up in successive 1 1/2-inch layers on successive days, each layer being applied (with slurry, etc.) as described above. To aid strength and bonding of the multiple layer repairs, the Engineer may order the use of Embeco non-shrink, metallic aggregate by the Master Builders Company, Cleveland, OH or Ironite by Fox Industries, Madison IL as an additive as follows:

<u>Material</u>	<u>Volumes</u>	<u>Weights</u>
Cement	1.0	1.0
Embeco	0.15	0.25
Sand	1.5	1.5

- F. For very heavy (generally formed) patches; the Engineer may order the addition of pea gravel to the mixture and the proportions modified as follows:

<u>Material</u>	<u>Volumes</u>	<u>Weights</u>
Cement	1.0	1.0
Embeco	0.2	0.33
Sand	1.0	1.0
Pea Gravel	1.5	1.5

- G. In cases where the Embeco is employed in multiple patches and a rusty finish is not desired on the surface, such as exposed faces of walls, etc., the final layer (or at least the final 1/2 inch) shall be composed of the 1 1.5 grout without Embeco. After hardening, rub lightly as described above for form tie holes.

3.12 INSTALLATION SCHEDULE

- A. Concrete for all structures shall have minimum compressive strength at 28 days of 5000 psi unless otherwise indicated on the drawings.

3.13 FIELD CONTROL

- A. The Contractor shall advise the Engineer of his readiness to proceed at least one working day prior to each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing and the alignment and tightness of formwork. No placement shall be made without the prior approval of the Engineer.
- B. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of tests on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work.
- C. The Contractor shall cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding and such incidental equipment

as may be required. The Contractor shall repair all core holes to the satisfaction of the Engineer. The work of cutting and testing the cores will be at the expense of the Owner if cores test satisfactorily and will be at the expense of the Contractor if cores test unsatisfactorily.

END OF SECTION

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SECTION 03350
CONCRETE FINISHES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals required to finish cast-in-place concrete surface as specified herein.

1.02 RELATED WORK

- A. Patching and repair of defective and honeycombed concrete is Specified in Section 03300.

1.03 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.

1.04 SUBMITTALS

- A. Submit, as provided in the General Conditions and Section 01340 shop drawings of the proposed chemical hardener, manufacturer s surface preparation and application procedures.

1.05 SCHEDULE OF FINISHES

- A. Concrete for the project shall be finished in the various specified manners either to remain as natural concrete or to receive an additional applied finish or material under another Section.
- B. The base concrete for the following conditions shall be finished as noted and as further specified herein:
 - 1. Concrete to receive cementitious finish or stucco finish - Off-form finish.
 - 2. Concrete to receive dampproofing - Off-form finish.
 - 3. Interior exposed slab concrete - steel trowel finish (two trowelings to a burnished finish).
 - 4. Bottom slab of exposed tanks - steel trowel finish.
 - 5. Exterior, exposed above water concrete slabs and stairs - Broomed finish.
 - 6. Concrete where not exposed in the finished work and not scheduled to receive an additional applied finish or material - Off-form finish.
 - 7. Gunite areas - wood float with broomed finish.

8. Concrete to receive chemical hardener - wood float finish.

1.06 RESPONSIBILITY FOR CHANGING FINISHES

- A. The surface finishes specified for concrete to receive additional applied finishes or materials are the finishes required for the proper application of the actual products specified under other Sections. Where different products are approved for use, it shall be the Contractor's responsibility to determine if changes in finishes are required and to provide the proper finishes to receive these products.
- B. Changes in finishes made to accommodate products different from those specified shall be performed at no additional cost to the Owner. Submit the proposed finishes and their construction methods to the Engineer for approval.

1.07 MANUFACTURER'S SUPERVISION

- A. The manufacturer of the metallic aggregate hardener material shall make available at no cost, upon 72 hours notification, the services of a qualified field representative to make sure the Contractor is providing the proper application of the product under prevailing job conditions and to observe installation as required.
- B. The Contractor shall make arrangements for the field representative to be present.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Portland cement and component materials required for finishing the concrete surfaces shall be as specified in Section 03300.
- B. Chemical hardener shall be Lapidolith, by Sonneborn, Hornolith, by W.R. Grace or approved substitute, fluorsilicate base material.

PART 3 - EXECUTION

3.01 FORMED SURFACES

- A. Forms shall not be stripped before the concrete has attained a strength of at least 30 percent of the ultimate design strength. This is equivalent to approximately "100-day-degrees" of moist curing.
- B. Care shall be exercised to prevent damaging edges on obliterating the lines of chamfers, rustications or corners when removing the forms or doing any work adjacent thereto.
- C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to the satisfaction of the Engineer.
- D. Off-form finish. Fins and other projections shall be removed as approved. Tie cone holes and other minor defects shall be filled as specified in Section 03300.

3.02 FLOORS AND SLABS

- A. Floors and slabs shall be screeded to the established grades and shall be level with a tolerance of 1/8 inch when checked with a 12 foot straightedge, except where drains occur, in which case floors shall be pitched to drains as indicated. Failure to meet either of above shall be cause for removal, grinding or other correction.
- B. After Paragraph 3.02A procedures are accomplished, floors and slabs for particular conditions shall be completed as scheduled in one of the following finishes:
1. Wood flat finish. Hand wood float with no coarse aggregate visible, maintaining the surface tolerance to provide a grained, non-slip finish as approved.
 2. Broomed finish. Hand wood float maintaining the surface tolerance and then broom with a stiff bristle broom in the direction of drainage to provide a non-slip finish as approved.
 3. Steel trowel finish. Steel trowel to a perfectly smooth, hard even finish free from high or low spots or other defects as approved and described in Paragraph 3.02C herein.
- C. Following screeding as specified above, power steel trowel as follows:
1. Immediately after final screeding a dry cement/sand shake in the proportion of 2 sacks of portland cement to 350 pounds of coarse natural concrete sand shall be sprinkled evenly over the surface at the rate of approximately 500 pounds per 1,000 square feet of floor. Neat, dry cement shall not be sprinkled on the surface. This shake shall be thoroughly floated into the surface with an approved disc type power compacting machine weighing at least 200 pounds if a 20 inch disc is used or 300 pounds if a 24 inch disc is used (such as a "Kelly Float" as manufactured by the Weisner-Rapp Corporation of Buffalo, New York). A mechanical blade-type float or trowel is not acceptable for this work.
 - a. NOTE: This operation (application of the cement/sand shake) may be eliminated at the discretion of the Engineer if the base slab concrete exhibits adequate fattiness and homogeneity, and the need is not indicated.
 2. In lieu of power steel troweling, small areas shall be compacted by hand steel troweling with the dry cement/sand shake as ordered.
 3. The floor or slab shall be compacted to a smooth surface and the floating operation continued until sufficient mortar is brought to the surface to fill all voids. The surfaces shall be tested with a straightedge to detect high and low spots which shall be eliminated.
 4. Compactions shall be continued only until thorough densification is achieved and a small amount of mortar is brought to the surface. Excessive floating shall be avoided.
 5. After the surface moisture has disappeared, surface shall be steel-troweled

to a smooth, even, impervious finish, free from trowel marks. After cement has set enough to ring the trowel, the surfaces of all slabs except concrete roof slabs and bottom tanks shall be given a second steel-troweling to a burnished finish.

3.03 HARDENED APPLICATION

- A. Where floor slabs are not be otherwise coated or covered, a hardener shall be applied to the floor slabs with monolithic finish after 28 days, minimum, concrete cure. The floors shall be thoroughly cured, cleaned, and perfectly dry with all work above them completed. The hardener shall be applied evenly and freely, using three coats, allowing 24 hours between coats. The first coat of fluorsilicate hardeners shall be 1/3 strength, second coat 1/2 strength and third coat 2/3 strength, and each coat shall be applied so as to remain wet on the concrete surface for 15 minutes. Sodium silicate hardener shall be applied in three coats, each at full strength and at the rate of 1/3 gallon per 100 square feet. Approved proprietary hardeners shall be applied in conformance with manufacturer's instructions. After the final coat is completed and dry, surplus hardener shall be removed from the surface by scrubbing and mopping with water.

3.04 WATERTIGHTNESS

- A. All structures to contain water shall be watertight and shall be free from any perceptible leakage.

3.05 APPROVAL OF FINISHES

- A. All concrete surfaces will be inspected during the finishing process by the Engineer.
- B. Surfaces which, in the opinion of the Engineer, are unsatisfactory shall be refinished or reworked until approved by the Engineer.

END OF SECTION

SECTION 03410

PRECAST CONCRETE STRUCTURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all materials, labor and equipment to construct precast concrete structures as shown on the Drawings and as specified herein.
- B. The concrete panels and cap shall be reinforced by MFMX₂ steel as depicted in the drawings.
- C. The forms, dimensions, concrete and construction methods shall be approved by the Engineer in advance of construction.

1.02 RELATED WORK

- A. Trenching, backfill, fill and grading is included in Section 02221.
- B. Concrete is included in Section 03300.
- C. MFMX₂ Uncoated Corrosion Resistant Steel Reinforcement in Section 05101

1.03 SUBMITTALS

- A. Submit to the Engineer, as provided in the General Conditions, and Section 01340 shop drawings showing details of construction, reinforcing and joints.

1.04 INSPECTION

- A. The quality of all materials and the process of manufacture shall be subject to inspection and approval by the Engineer, or other representatives of the Owner. Such inspection may be made at the place of manufacture or at the site after delivery or at both places, and the panels shall be subject to rejection at any time on account of failure to meet any of the Specification requirements. Panels rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All panels which have been damaged after delivery will be rejected and if already installed shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.
- B. At the time of inspection, the panels will be carefully examined for compliance with the ASTM designation specified below and these Specifications, and with the approved manufacturer's drawings. All panels shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.
- C. Imperfections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days, when tested in 3-inch by 6-inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.
- D. Each section of manholes and basins must be inspected and stamped at the casting

yard by an accredited testing laboratory.

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE PANELS

- A. The method of construction shall conform to the detailed Drawings appended to these specifications and the following additional requirements.
 - 1. The minimum wall thickness for the panels shall be 9 inches.
 - 2. Panels shall have grout sock keyways as depicted in the plans. Joints shall be filled with approved non-shrink grout mixture.
 - 3. Concrete shall meet FDOT Section 346 for Extremely Aggressive Environment. Maximum Water Cement Ratio is 0.4%. Concrete shall receive curing compound meeting requirements of FDOT Section 925 applied in accordance with Section 400-16 or Section 520.8 as applicable. Concrete cap and panels shall have cylinder 28 day strength of 5000 psi.
 - 4. Reinforcing steel in panels and cap shall be MMFX₂ as depicted in the drawings.
 - 5. Panels shall be cured by an approved method for at least 28 days prior placement.
 - 6. Reinforcement bars and steel shall be as a minimum what is shown on the Drawings for precast panels.
 - 7. Exposed faces shall be hand troweled using steel trowels. All voids shall be grout filled prior to use. Sheet piles shall be cast so that exposed faces receive troweling.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Panels shall be installed at the orientation and to the depth indicated on the plans.
- B. Panels shall not be driven. Vibration and/or jetting is permitted.
- C. Outfalls and utilities shall be extended to penetrate through new seawalls at same locations. Concrete couplings per FDOT Index 280. End concrete culverts with full pipe section; Do not saw cut final section.
- D. Contractor shall submit shop drawings for each panel penetration for culverts and utilities. Utility penetration panels to be performed to allow for 4" clearance, all edges, sealed with approved grout post-placement.
- E. Wet face of panels may be installed up to 1 foot maximum waterward of existing seawall. Contractor may choose to install panels in existing footprint except where specifically prohibited on the plans.
- F. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides.

END OF SECTION

SECTION 03701

PRESTRESSED CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION:

This Section specifies prestressed concrete, including designing, furnishing concrete, designing prestressing steel, reinforcing steel, anchors, connections, and embedded item; pretensioning; casting and curing; and transporting, storing and erecting members, complete in place.

1.02 QUALITY ASSURANCE:

- A. Sampling and Testing of Concrete: Each design mix will be tested as follows:
 - 1. Compressive tests: ASTM C39
 - 2. Mold one additional set of cylinders for each day's concrete placement for each casting bed and for each prestressed concrete member cast separately. Cure these additional test cylinders in the same manner and environment as the members or structures they represent. For pretensioned members, test set made and cured in environment at casting bed to a minimum of 4,000 psi compressive strength before detensioning.

- B. Concrete Finish and Dimensional Tolerances:
 - 1. Finish: Finish as specified in Section 03300 CAST-IN-PLACE CONCRETE and contract drawings. Surface of prestressed beam soffits and joists shall have F-1 finish on all surfaces to be exposed after erection.
 - 2. Tolerances:
 - a. Depth, flanges, webs, and fillets: Plus or minus 1/4 inch.
 - b. Width, overall: Plus 3/8, minus 1/4 inch.
 - c. Width, flanges, webs, fillet: Plus 3/8, minus 1/4 inch.
 - d. Length: Plus or minus 1/8 inch in 10 feet, not exceeding plus or minus 1/2 inch total.
 - e. Square ends, deviation from square: Plus or minus 1/8 inch vertical and plus or minus 1/4 inch horizontal per foot of beam.
 - f. Skew ends: Deviation from designated skew: Plus or minus 1/8 inch vertical and plus or minus 1/4 inch horizontal per foot of beam.
 - g. Connections: Plus or minus 1/2 inch in any direction.
 - h. Dowel tubes, tie rods, and side inserts, spacing between centers, and from center to ends and surfaces of members; Plus or minus 1/4 inch.

- i. Bearing surface, deviation from elevation indicated: Plus or minus 1/8 inch bearing seat areas.
- j. Void locations: Plus or minus 1/2 inch.
- k. Position of pretensioning steel: Plus or minus 1/4 inch vertical and horizontal at any point, except as noted in 1.02.B.2.p.
- l. Position of hold-down and hold-up points for depressed strands: Plus or minus six inches.
- m. Center of gravity of tendon: Plus or minus 1/4 inch of the center of gravity of prestressing steel in any member is plus or minus 1/4 inch.
- n. Position of reinforcing steel: Plus or minus 1/4 inch vertical and horizontal at any point; and plus 3/4, minus 1/2 inch from ends or surfaces of members, except plus or minus one inch non-cumulative for longitudinal spacing of stirrups and except as noted in paragraph p below.
- o. Cover: Minus zero.
- p. Position of handling devices: Plus or minus six inches.
- q. Camber differential between adjacent units: 1/4 inch per 10 feet of horizontal span or vertical height, but not greater than 3/4 inch.
- r. Camber deviation from design camber plus or minus 1/8 inch per 10 feet of span, but not to exceed a maximum deviation of plus or minus 1/2 inch.
- s. Alignment: 1/8 inch per 10 feet, vertical and horizontal.
- t. Total width of joined members: Theoretical plus 1/4 inch per joint.

C. Tensioning Measurements:

- 1. Instrument accuracy: Plus or minus 1-1/2 percent at calculated force.
- 2. Tendon elongation: Plus or minus 1/8 inch, or one percent of theoretical elongation, whichever is less.
- 3. Grip slippage: Plus or minus 1/8 inch.
- 4. Movement of anchoring abutments: Plus or minus 1/8 inch.
- 5. Difference in tensioning stress measured by gauges and by elongation: Five percent overstress, zero percent understress.

1.03 SUBMITTALS:

Submit the following: shop drawings and design calculations for review and approval. Prestressed members shall be designed to support the loads specified on the structural drawings. Shop drawings and calculations shall be signed and sealed by a Florida Registered Professional Engineer. The submittals

must include the following.

A. Shop Drawings:

1. Description of the equipment to be used and procedure for constructing prestressed concrete members.
2. Ductwork and method of holding the ducts in position, tendon or bar sizes, splicing of bars, unit weights, materials and stress grade, jack clearances and procedures, stressing sequence, initial tensioning forces, pressure gauge or load cell for determining loads, calculated friction losses and tendon or bar elongation, anchorage details and anchorage slippage losses, bonding and routing procedures, mild steel placement, provisions for camber and clearances and concrete dimensions.
3. Details of the procedures for yard and site, handling, transporting, storage and erecting. Show method of tendon support for post-tensioned systems during tendon placing operations.
4. Details and substantiating calculations of the method and materials proposed for use in the prestressing operations, including additions or rearrangement of reinforcing steel and or prestressing steel from that indicated. Show all camber computations.
5. Stress-strain curve of the tendons and bars and amount of slip normally expected in seating anchorage devices, friction wobble coefficient and friction curvature coefficient expected from the tendons and bars and duct forming material.
6. Bills of materials, erection diagrams and details of connections to other work.

B. Report of concrete tests.

C. Certificates:

1. Tendons: Certificates for each five reels or fraction thereof showing the physical, chemical and stress-strain test properties, including the modulus of elasticity of each size, lot or manufacturer of strand to be used in the work.
2. Hydraulic jacks: Certified calibration curves for each hydraulic jack from a certified testing laboratory. Calibration of jacks and gates shall be repeated at intervals not exceeding 12 months. If, while work is in progress, any jack or gate appears to be giving erratic results, or if gage pressure and elongations indicate materially differing stresses, recalibration will be required

D. Records:

1. Maintain and submit tendon elongation records upon completion of the tensioning of each member.
2. Maintain records of each manufacturing operation including pertinent data which in any way affects or influences the construction procedures or

completed members. Record data and keep records available to the Engineer. Submit records at end of project. The format of records and forms shall be approved by the Engineer prior to production.

3. Maintain and submit after each stressing operation, on an approved form, complete report indicating computed, assumed and measured data relative to the stressing operations, with explanatory notations.

1.04 DELIVERY, STORAGE AND HANDLING OF STEEL:

- A. Package, mark and load steel products as specified in ASTM A700. Tag shop fabricated assemblies and items in accordance with approved erection drawings.
- B. Protect prestressing steel against physical damage and harmful rusts pits or other damaging corrosion from manufacture until grouting or encasing in concrete.
- C. Do not use unidentified, pitted, rusted, or otherwise damaged prestressing steel, anchorage assemblies, or other affected or damaged materials received at the fabrication shop or at the site.

PART 2 - PRODUCTS

2.01 CONCRETE:

Section 03305, PORTLAND CEMENT CONCRETE, Class 6000, as specified in section 03305 with Type I, Type II or Type III cement, air entrained. Unless otherwise indicated, the maximum aggregate size shall be not greater than 75 percent of the minimum clear space between closest-placed steel or between steel and surfaces, whichever is less.

2.02 CONCRETE REINFORCEMENT: SECTION 03200, CONCRETE REINFORCEMENT.

2.03 CHAIRS: ACI 315, CLASS E.

2.04 TENDONS AND WIRE

- A. Steel Strand: ASTM A416, 1/4 inch and 5/16 inch: Grade 250; 3/8 inch through 1/2 inch: Grade 270.
- B. Steel Wire: ASTM A421, Type BA or WA as indicated or approved.

2.05 EPOXY ADHESIVE:

Two component product approved by the Engineer, produced specifically for the intended use, in grouting and patching, mixed in accordance with manufacturer's instructions.

2.06 CURING MATERIALS: ASTM C309, TYPE 2.

2.07 EMBEDDED ITEMS: ASTM A123 HOT-DIPPED GALVANIZED STEEL, MINIMUM COATING 1-1/2 MILS THICK.

2.08 FORMWORK:

Section 03300, CAST-IN-PLACE CONCRETE and as indicated in Article 3.01.

PART 3 - EXECUTION

3.01 GENERAL

- A. Use forms and casting beds of adequate design to withstand pressures due to concrete placement, consolidation and pressures due to tensioning; and unless stripped prior to detensioning, so designed that they induce no stress in the member due to deformation of the concrete, camber, or movement of the member during detensioning. Construct side forms and bottom forms without joints, or join by welding with welds ground smooth and flush with the surface. Similarly weld forms for corbels and similar protrusions, and for exposed surfaces in the finished structure.
- B. Chamfer exposed edges as indicated. Secure chamfer strips in place to prevent movement during subsequent operations.
- C. Thoroughly clean forms of rust or other deleterious materials and coat forms with bond breaker prior to each casting. Prevent coating of tendons by bond breaker. Foam coating and bond breaker shall not affect the finish or color of the finished member.

3.02 EMBEDDED ITEMS

- A. Reinforcing Steel:
 - 1. Submit, in writing, request indicating areas and locations for tack welding of mild reinforcement only in prestressed members. Avoid tack welding if possible.
 - 2. Place reinforcing steel for prestressed members in a manner to prevent it bearing against or interfering with the movement of tendons during tensioning.
 - 3. When reinforcing steel is in place, check for spacing and protective cover as indicated. Check the level and alignment of confinement angles and bearing shoes. Ascertain that the reinforcing steel structure is sufficiently strong and adequately secured so it will remain in place during placement and consolidation of concrete.
- B. Connections: Ascertain that reinforcing bars and stirrups which extend outside of the member and studs, dowels, inserts, and connection angles are properly embedded, extended, aligned, and securely fastened in place.
- C. Installation of Prestressing Steel:
 - 1. Inspect tendons prior to installation. Do not use kinked, nicked, pitted, rolled or otherwise damaged lengths, and lengths incorporating strand splices or points previously gripped by tendon vises. Ascertain that surfaces are free of dirt, oil, harmful rust, and other foreign matter.
 - 2. Prior to stringing tendons for pretensioning, inspect the forms and reinforcing steel for cleanliness and accuracy of alignment. Check gripping devices for condition of checks and replace as necessary. Check hold-down and up-lift devices for freedom of rotation and proper functioning.
 - 3. Position each tendon in a manner and sequence that will avoid entanglement,

kinking, or damage of strands during placement and initial tensioning. Avoid contamination from form bond breaker, hold-down roller lubricant, or any other source.

4. After tendon installation and before initial tensioning, check for conformance with the detailed plans. Where strands pass through stirrups or reinforcement cages, inspect to ascertain free movement and guard against binding.

3.03 TENSIONING

A. Initial Tensioning:

1. Individually tension each strand to 1,500 pounds force unless other force is indicated. Guard against binding and against entanglement of the strands as slack is eliminated.
2. Accomplish initial tensioning by any of the following means, providing the accuracy of measurement is within plus or minus 1-1/2 percent and variation between strand tensions does not exceed four percent of calculated tension:
 - a. Pressure jacks, which may be the same jacks to be used for single strand prestressing if equipped with proper gauging system for initial tensioning.
 - b. Approved dead weight system.
 - c. Fence stretchers with appropriate dynamometer or load cells.

B. Prestressing:

1. After initial tensioning and clamping of the tendons in the jack gripping devices, mark each strand at each end of the bed 1/2 inch from where it emerges from the gripping device, and make such marks or measurements as are required to detect anchoring abutment yield. Establish reference points for measuring tendon elongation. In elongation calculations, use the actual length of strand along its trajectory between the fixed anchorage and the reference point at the jacking end of the strand.
2. With tendons properly gripped and reference points established, use approved single or multiple strand tensioning procedure. If draped tendons are to be jacked in the draped position, single strand tensioning of the draped tendons is required.
3. During tensioning check each strand for unusual binding which would result in restraint of movement.
4. During and throughout the tensioning operation, check the difference between tendon tension computed from elongation measurements and the tension indicated by the gauging system. In the event of discrepancies in excess of five percent, stop the operation and carefully check the entire system to determine and correct the source of error before proceeding.

5. Jack draped tendons from one end only if this can be done without the gauge pressure exceeding the theoretical pressure by more than five percent at required strand elongation. When in doubt, proceed as follows:
 - a. Jack from one end to theoretical pressures.
 - b. Measure elongation and determine remaining elongation required for theoretical elongation.
 - c. Jack the strand from the other end to the remaining required elongation. The gauge reading shall not exceed theoretical by more than five percent.

3.04 CONCRETING

- A. Mixing, Placing and Consolidation:
 1. Place the concrete uniformly in layers not exceeding one foot from end to end of the forms. Fill all parts of the forms. Work coarse aggregate back from the face. Force the concrete under and around the prestressing tendons and reinforcing steel without displacing them.
 2. Use internal vibrators where practicable, but avoid running vibrators against tendons. Use external vibrators of capacity to provide adequate consolidation. Hand spading may be used for deep, narrow sections, if approved.
- B. Connecting Steel: Remove concrete mortar spatter from reinforcing steel, stirrups, studs and connections which extend outside the member and from external surfaces of confinement angles, connection angles and other embedded items.

3.05 CURING AND PROTECTION

- A. General:
 1. Cure and protect as specified in Section 03300, CAST-IN-PLACE CONCRETE, except that either approved steam curing or approved heated bed curing may be used in place of the curing methods therein specified.
 2. If liquid membrane curing method is used, do not allow any compound to be placed, splashed or dripped on bearing surfaces or surfaces for deferred bonding. Use another curing method on such surfaces.
- B. Steam Curing:
 1. Perform steam curing within suitable enclosure. Do not allow enclosure to be in contact with member, forms, or test cylinders.
 2. Position steam jets so that they do not discharge directly on concrete or forms.
 3. Provide not less than one recording temperature indicator for every 200 feet of bed, indicating the time-temperature relationship throughout the entire curing and cooling operation.

4. If ambient temperature is 50 degrees F or above, do not apply steam until four hours after casting.
5. After initial set, and not sooner than four hours after casting, uniformly raise the temperature inside the enclosure to approximately 125 degrees F and not more than 160 degrees F at a rate not exceeding 40 degrees F per hour. Hold the temperature at between 120 degrees F and 160 degrees F until concrete cylinder compressive strength tests indicate a minimum compressive strength not less than 4,000 psi. Do not allow temperature to exceed 160 degrees F at any time.
6. During steam curing, hourly check the ambient temperature inside the enclosure with a hand-held thermometer and not the temperature on the automatic recorder chart.
7. After completion of steam curing, initially reduce the temperature inside the enclosure to ambient temperature at a rate not exceeding 40 degrees F per hour.
8. Do not allow the temperature of the concrete to fall below 50 degrees until detensioned.

C. Heated Bed Curing:

1. Perform heated bed curing by an approved procedure regularly employed by the producer and conforming to the requirements herein specified.
2. Keep the member and test cylinders moist during curing and cool-down operations, by means of wet burlap or cotton mats. Use auxiliary cover over the wet mats to retain heat and moisture. Place test cylinders on the concrete member surface near temperature detector during curing.
3. Apply heat to bed in a manner that will not produce local hot spots or temperature differentials in excess of 50 degrees F.
4. Provide not less than three temperature recording instruments for every 100 feet of bed arranged to continuously record temperature at the top concrete surface and at the approximate hottest and coolest points on the bed forms.
5. Do not raise temperature to more than 50 degrees F until after initial set or before four hours have elapsed after casting; then uniformly raise temperature until one of the recorders indicates a temperature of approximately 95 to 100 degrees F. Increase temperatures at a rate not exceeding 40 degrees F per hour, in a manner that will not allow the difference between the highest and the lowest indicated temperature to exceed 50 degrees F, and that will not allow any indicated temperature to exceed 110 degrees at any time. Hold the temperature at 95 degrees F to 110 degrees F until a minimum test cylinder compressive strength not less than 4,000 psi is attained. Periodical check temperatures with hand thermometers and record on appropriate charts as specified for steam curing.
6. After completion of curing, initially reduce the temperature to ambient at a rate not exceeding 40 degrees F per hour for any indicator and at a rate at which the

difference between the highest and lowest temperature reading does not exceed 50 degrees F.

7. Do not allow the temperature of the concrete to fall below 50 degrees F until detensioned.

3.06 PATCHING AND FINISHING

- A. Sequence: Complete detensioning stress transaction immediately following curing to required compressive strength and prior to starting patching and finishing work.
- B. The surfaces of prestressed concrete shall be uniform color, finish and texture.
- C. As soon as possible after removal of forms and after inspection by the Engineer, thoroughly clean and fill holes left by form ties, hold-down bolts, and other temporary inserts.
- D. Obtain approval of the Engineer before performing repair work other than filling of insert holes. The Engineer will determine whether the defective area is sufficiently critical to warrant rejection of the member.
- E. Remove imperfect texture, laitance, fins and roughness by rubbing affected areas with concrete block or Carborundum Stone until smooth and uniform.
- F. After removal of laitance, and after all hold-down bolt holes, holes exceeding 1/2 inch in diameter, and honeycombed areas are thoroughly cleaned of grease and oil, roughen or key the surface of each hole and depression and thoroughly coat the bottom and sides with an approved epoxy adhesive according to manufacturer's instruction. Honeycomb areas which are considered to be detrimental by the Engineer will cause the member to be rejected. Immediately after applying the adhesive to a hole or depression, fill with a stiff mixture of approved high-strength expanding grout; tamp well; strike off flush with the surrounding surface; and suitably confine the grout surface. If necessary, tint grout material used for filling and patching so that the completed patch will be identical in color to the concrete being patched.
- G. Moist cure for not less than three days before handling or other operations that could cause flexure of the member.

3.07 DETENSIONING: THE REMOVAL OF THE EXTERNAL LOAD ON THE PRESTRESSED STRANDS.

- A. Detension member immediately following curing as soon as initial concrete strength is achieved as determined by attaining 5,000 psi compressive strength test. If steam or warm bed cured, detension while the concrete is still warm and moist.
- B. Strip or loosen all forms which may restrict either vertical or horizontal movement.
- C. In detensioning operations, follow approved procedure that will transfer and keep the prestressing forces symmetrical about the vertical axes of the member, and apply forces in a manner as to prevent sudden or shock-loading.
- D. If there are deflected strands within the member or if the weight of the member is at

least twice the calculated total forces required to hold in the low position draped tensioned strands within the member, remove hold-down bolts, and detension straight and deflected strands by either the single strand or multiple strand method as specified herein.

- E. If there are deflected strands within the member and the weight of the member is less than twice the total of forces required to hold them in the deflected position, do not release hold-down bolts and devices until one or the other of the following conditions has been met:
 - 1. Apply weights or approved vertical restraints, placed directly over the hold-down points of the deflected strands, sufficient to bring the total of beam dead weight and added loading weights or vertical restraining forces to twice the total of all hold-down forces.
 - 2. Release each deflected tendon at both ends of the member by the single strand method specified herein. Then release the hold-down devices and bolts. When deflected tendons and hold-down devices have been released, detension straight tendons by either the single or multiple strand method
- F. Single Strand Release:
 - 1. Gradually release each individual strand, simultaneously at both ends of the member and if long line method of construction, release each individual strand at ends of all members in the long line simultaneously, if practical, in accordance with a fairly large low oxygen flame played along the strand for a minimum of five inches in such a manner that failure will occur slowly and that failure of the first wire will not occur for at least seven seconds after the flame is first applied to the strand.
 - 2. Perform heating of each wire simultaneously at both ends of casting bed, and unless otherwise approved, at spaces between adjacent members in the same bed.
- G. Multiple Strand Release: Take up with the jack the total force from the header of strands to be simultaneously released; then gradually release the jacking pressure.

3.08 HANDLING AND STORAGE

- A. Precast members may be handled immediately after completion of stressing. In the event stressing is not accomplished in a continuous operation, do not handle before they are sufficiently stressed to sustain forces and moments due to handling, and do not handle if unsymmetrically stressed.
- B. When handling beams, maintain them in an upright position. Pick up and support members only at approved pick-up points near the ends unless, under special conditions, approved working drawings specifically indicate otherwise. Use lifting inserts, loops or other approved means.
- C. Store units upright on a smooth, firm well drained surface and on supports. Provide non-staining resilient spacers of uniform thickness between units.

3.09 ERECTION

- A. Ascertain that bearing surfaces are as indicated, within the specified tolerances, and clean. Ascertain that surfaces to be bonded are clean; that bonding material is properly prepared and applied in accordance with manufacturer's instructions. Ascertain that elastomeric bearing pads are properly installed.
- B. Install precast members properly leveled, aligned, braced, and positioned as indicated within the required tolerances.
- C. Ascertain that connections are properly made as indicated.
- D. After erection, remove or bend over lifting loops or cut flush with the surface of the concrete. If the insert material is such as may cause stains or otherwise detract from the appearance of surfaces exposed to view, remove insert and inset cut and patch the concrete as required.
- E. Perform any required joint filling, installation of water stops, grouting in-place topping or other work as indicated.
- F. Bring immediately to the attention of the Engineer defects noted during or after erection. Repair or replace as required as indicated in paragraph 3.06.D & 3.06.F.

END OF SECTION

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SECTION 05101
Uncoated Corrosion Resistant Reinforcement Steel Bars

MICROCOMPOSITE (MMFX₂) STEEL UNCOATED, PLAIN AND DEFORMED BARS
FOR CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SPECIFICATION SCOPE

- A. This specification covers MMFX Microcomposite (MMFX₂) steel uncoated plain and deformed bars for concrete reinforcement in cast-in-place or pre-cast reinforced concrete.

1.02 RELATED WORK

- A. Section 03300 – Cast-in-Place Concrete.
B. Section 03410 – Precast Concrete Structures

1.03 REFERENCES

- A. Codes and Standards
1. American Concrete Institute (ACI)
 - a. Building Code Requirements for Reinforced Concrete (ACI 318-11).
 - b. Details and Detailing of concrete Reinforcement (ACI 315-99).
 - c. ACI Detailing Manual – 1994 (ACI SP-66).
 - d. Standard Tolerances for Concrete Construction and Materials (ACI 117-06)
 2. American Society for Testing and Materials (ASTM)
 - a. ASTM A6/A6M-12a Specification for General Requirements for Rolled Structural, Steel Bars, Plates, Shapes, and Sheet Piling
 - b. ASTM A82-07 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
 - c. ASTM A370-12a – Test Methods and Definitions for Mechanical Testing of Steel Products
 - d. ASTM A510/A 510M-11 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
 - e. ASTM A615/A615M-12 Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
 - f. ASTM A1035/A1035M-13a Specification for Deformed and Plain Low-Carbon, Chromium Steel Bars form Concrete Reinforcement
 - g. ASTM E29-08 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
 3. American Association of State Highway and Transportation Officials (AASHTO)
 - a. AASHTO MP 18 M/MP 18-09 – Specification for Uncoated Corrosion-Resistant, Deformed and Plain Alloy, Billet-Steel Bars for Concrete Reinforcement and Dowels
 - b. AASTHO LFRD Bridge Design Specifications 6th Edition (2013 Interim)

4. Concrete Reinforcing Steel Institute (CRSI)
 - a. CRSI Manual of Standard Practice, 28th Edition, 2009
 - b. Placing Reinforcing Bars (CRSI PRB), 9th Edition, 2011
 - c. CRSI – Specialty and Corrosion-Resistant Steel Reinforcement – Product Guide - July 2013
5. Dubai Central Laboratory
 - a. Marking and Tag Requirements for the Control of Reinforcing Steel Bars
6. International Code Council (ICC)
 - a. ICC-ES AC429 - Acceptance Criteria for High-Strength Steel Reinforcing Bars, June 2012
 - b. ICC ES Evaluation Report ESR 2107 January 2013

1.04 DESIGN REQUIREMENTS

- A. Design of concrete structures reinforced with MMFX₂ bars shall be based in accordance with the provisions of ACI 318-11 as modified by the ACI ITG 6R, AASTHO LFRD Bridge Design Specifications 6th edition (2003 interim); and the guidelines included as part of the ICC ES Evaluation Report ESR 2107.

1.05 SUBMITTALS

- A. Comply with Specification – Submittal Procedures.
- B. Product Data: Submit manufacturer’s product data, including material and mechanical properties.
- C. Test Reports: Submit manufacturer’s mill certifications for material and mechanical properties for each bar size used by the project.
- D. Placing Drawings: Submit MMFX₂ bar placing drawings in accordance with ACI SP-66.
- E. Field Welding Procedures: MMFX₂ steel bars shall not be welded.
- F. Mechanical Couplers: Submit manufacturer’s product data for use with MMFX₂ steel bars.

1.06 DELIVERIES, STORAGE, AND HANDLING

- A. General: Deliver, store, and handle MMFX₂ bars in accordance with manufacturer’s instructions.
- B. Delivery and Storage:
 1. Do not store MMFX₂ bars directly on ground to keep them free from dirt and mud and to provide easy handling. It is recommended that MMFX₂ bars shall be covered when exposed to the elements for longer than 60 days, either during transport or storage and as indicated in CRSI – Specialty and Corrosion - Resistant Steel Reinforcement – Product Guide
 2. Seams, surface irregularities, or mill scale oxidation shall not be cause for rejection, provided the weight, dimensions, and cross-sectional area of a hand-wired-brush test specimen are not less than the requirements of this specification.
- C. Handling
 1. Handing of MMFX₂ bars shall be in accordance with conventional steels bar as noted in CRSI Manual of Standard Practice, and CRSI – Specialty and Corrosion-Resistant Steel Reinforcement – Product Guide

PART 2 - PRODUCTS

2.01 SUPPLIER

1. MMFX Steel Corporation of America, 2415 Campus Drive, Suite 100 – Irvine, CA 92612
Phone (949) 476-7600, Fax (949) 474-1130
E-mail info @mmfx.com Web Site <http://www.mmfx.com>
2. MMFX Steel DMCC (Subsidiary of MMFX Technologies Corporation) - P.O. Box 390292 – Dubai, UAE
Phone (+971) 55 7777394 Fax (+971) 4 395 1537

2.02 MATERIAL

A. MMFX Microcomposite (MMFX₂) Steel Deformed and Plain Bars

1. General:

MMFX₂ bars shall have a minimum chromium composition by weight of 8% and have either a minimum yield strength of 100,000 psi [690 MPa] for Grade 100 [690] or 120,000 psi [830 MPa] for Grade 120 [830] as measured by using the 0.2% offset test method of ASTM A370.

2. Manufacture Process and Bar Sizes:

MMFX₂ bars shall be hot rolled from properly identified mold or strand cast steel. Available bars are standard plain and deformed bar sizes #3 [10], thru #11 [36]. Bar sizes #14 [43] and #18 [57] can be special ordered. Alternate sizes as per the Middle East Standard sizes are available in sizes 12mm through 40mm as per ASTM A1035 Annex A1.

3. Material Composition:

MMFX₂ bars shall meet the requirements of Table 1.

Table 1– Maximum Chemical Constituents (Weight %)

Element	Carbon	^B Chromium	Manga- nese	Nitrogen	Phosphorus	Sulfur	Silicon
Maximum Amount ^A	0.15%	8 to 10.9%	1.5 %	0.05%	0.035%	0.045%	0.50%
Typical MMFX ₂	0.07%	9.3%	0.6%	0.02%	0.01%	0.014%	0.14%

Note A – Maximum unless range indicated,

Note B -- AASHTO MP 18 M/MP 18-09 Minimum 9.2% minimum Cr content -

4. Bar Weight, Dimensions, and Deformation Spacing and Height:

Deformed MMFX₂ bars shall conform to the weight, dimensions and deformation spacing, height, and gap requirements prescribed in ASTM A1035 Table 1 and/or AASHTO MP18 Tables 2 and 3.

5. Bar Deformations:

MMFX₂ bars shall conform to the requirements for bar deformations in ASTM A1035 Section 7 and/or AASHTO MP 18 Section 7 “Requirements for Deformation”.

6. Permissible Variation in Weight [Mass]:

MMFX₂ bars shall conform to the requirements for bar deformations in ASTM A1035 Section 11 and/or AASHTO MP 18 Section 12 “Permissible Variation in Weight [Mass]”.

7. Tensile Properties:

a. MMFX₂ bars shall conform to the requirements for tensile properties prescribed in Table 2.

b. The yield strength shall be determined by the offset method (0.2% offset), described in Test Methods and Definitions A370. The strength corresponding to an extension under load of 0.0035 in./in. (0.0035 mm/mm) shall be minimum of 80,000 psi [550MPa] for Grade 100 [690]; and shall be a minimum of 90,000 psi [620MPa] for Grade 120 [830].

Table 2 - Tensile Properties Requirements

	Grade 100 [690]	^A Grade 120 [830]
Tensile strength, min, psi [MPa]	150,000 [1030]	150,000 [1030]
Yield strength (0.2% offset), min, psi [MPa]	100,000 [690]	120,000 [830]
Strength corresponding to an extension under load of 0.0035 in/in (0.0035 mm/mm), min, psi [MPa]	80,000** [550]	90,000** [620]
Elongation in 8 in. [203.2mm], min. %:		
Bar Designation No.		
3 through 11 [10 through 36]	7	7
14, 18 [43, 57]	6	-

Note A --- AASHTO MP 18 M/MP 18-09 does not include Grade 120 [830]

8. Bend Test Properties:

MMFX₂ bend test specimens shall withstand being bent around a pin without cracking on the outside radius of the bent portion. The requirements for degree of bending and sizes of pins are prescribed in Table 3. When material is furnished in coils, the test sample shall be straightened prior to placement in the bend tester.

Table 3 - Bend Test Requirements

Bar Designation No.	Pin Diameter ^A
3, 4, 5, [10,13, 16,]	3½d ^B
6, 7, 8[19,22, 25]	5d
9,10,11 [29, 32, 36]	7d
14, 18 [43, 57] (90°)	9d

Note A Test Bends 180° unless otherwise noted in { }.

Note B d= nominal diameter of specimen.

9. Bar Identification:

MMFX₂ bars meet the requirements of ASTM A615 Grade 75, ASTM A1035 and AASHTO MP 18 specifications. MMFX₂ bars, excepts plain round bars, which shall be tagged for grade, shall be identified by a distinguishing set of marks legibly rolled onto the surface of one side of the bar to denote the specification in the following order:

- a. *Bar Identifier*- “MMFX” shall indicate a product produced for MMFX Steel meeting the chemical composition of Table 1.
- b. *Point of Origin*- Letter or symbol established as the manufacturer’s mill designation.
- c. *Size Designation*- Arabic number corresponding to bar designation number of Table 2.
- d. *Type of Steel*- Letters CS indicating that the bar was produced to ASTM A1035 and AASHTO MP 18 specification.
- e. *Minimum Yield Designation*- For Grade 100 [690], either the number 100 [6] or three continuous longitudinal lines through at least five spaces offset each direction from the center of the bar. For Grade 120 [830], either the number 120 [8] or four continuous longitudinal lines through at least five spaces offset each direction from the center of the bar.
- f. It shall be permissible to substitute a metric size bar for the corresponding inch pound size bar.
- g. Products produced or sold in the UAE shall comply with Dubai Central Laboratory 'Marking and Tag Requirements for the Control of Reinforcing Steel Bars for ASTM A1035"

B. Bar Supports

1. Bar supports and spacers shall be per recommendations set forth by Chapter 3 of the CRSI Manual of Standard Practice.
2. Ferrous metal bar supports in concrete areas where soffits are exposed to view or are painted shall be Class 1 or Class 2, Types A or B; Class 3 is acceptable in other areas.

C. Tie Wire

1. 1. Metallic ties shall be 16 gauge (1.5 mm diameter) or heavier, black-annealed ferrous metal wire.
2. 2. Non-metallic ties shall be appropriate for the intended application.

D. Mechanical Bar Splice Couplers

1. Couplers shall be made from MMFX₂ steel bars or other approved carbon steel bar material and shall be approved for use with MMFX₂ rebars.

2.03 MATERIAL QUALITY CONTROL

A. Quality Control Testing:

1. MMFX₂ bars shall be furnished with material certifications in accordance with SECTION 1.5 SUBMITTALS.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive MMFX₂ bars. Notify the Engineer if areas are not acceptable. Do not begin placing MMFX₂ bars until unacceptable conditions have been corrected.
- B. Seams, surface irregularities, or mill scale oxidation shall not be cause for rejection, provided the weight, dimensions, and cross-sectional area of a hand-wired-brush test specimen are not less than the requirements of this specification.

3.02 PLACING DRAWINGS

- A. Place MMFX₂ bars accurately in accordance with approved placing drawings, schedules, typical details, and notes.

3.03 FABRICATION

- A. Reinforcing steel shall be accurately fabricated to the dimensions shown in the Contract documents.
 1. Bends shall conform to the dimensions and details in accordance with ACI 315-99 – Chapter 3, ACI SP-66 and/or CRSI Manual of Standard Practice – Chapter 6, unless otherwise shown, with fabricated bends conforming to Table 5 per ACI 315 – Table 7.2.

Table 4 - Minimum Fabricated Bend Diameters

Bar Size	Minimum Bend Diameter
3, 4, 5, 6, 7, 8 [10,13, 16, 19, 22, 25]	6d
9,10,11 [29, 32, 36]	8d
14, 18 [43, 57]	10d

2. Bars shall be bent cold, and shall not be bent or straightened in a manner that will injure the material. Heating of the bars to facilitate bending shall not be permitted.
3. Bar cutting shall be accomplished by shearing or with a fluid-cooled saw. Torch cutting shall not be permitted.
4. Bars shall be fabricated within the tolerances shown in the ACI 315-99 figures 8 and 9, and/or CRSI Manual of Standard Practice – Chapter 7 and/or CRSI PRB – Chapter 6.

- B. Spirals
 - 1. Provide one and one-half finishing turns top and bottom minimum.
 - 2. Splice lap lengths shall be to the length shown on the contract documents.
 - 3. Provide spacers per Chapter 5, Section 10 of the CRSI Manual of Standard Practice.
- C. Field Welding as an aid to fabrication and/or installation shall not be permitted.

3.04 INSTALLATION

A. Placement:

Place MMFX₂ bars in accordance with CRSI PRB – Chapter 10, and to the tolerances given in ACI 117 and/or CRSI PRB, unless otherwise specified or approved by the Engineer. Bars shall be free from loose mill scale oxidation, dirt, oil or other deleterious coatings that could reduce bond with the concrete. When bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits, or embedded items, the resulting arrangement of the bars shall meet the structural requirements of the project as approved by the Engineer.

B. Field Cutting and Bending:

When required, field cutting and bending of MMFX₂ bars shall be per SECTION 3.3 FABRICATION. Reinforcing bars partially embedded in concrete shall not be field bent. Fabricated bent bars shall not be straightened and re-bent in the field.

C. Securing:

Secure MMFX₂ bars in formwork to prevent displacement by concrete placement or workers.

D. Supports and Spacers:

Place and support MMFX₂ bars accurately using specified supports before concrete placement is started, and placed in accordance with the provisions of ACI 315 – Chapter 5 or CRSI PRB.

E. Splicing:

All splicing of reinforcement shall be as indicated in the Contract Documents, unless otherwise permitted. Concrete cover and bar spacing shall conform to ACI 318-11. Mechanical connections shall be made only at locations shown in the Contract Documents or as permitted by the Engineer.

- 1. When required or permitted, mechanical coupler connections shall develop 125 percent of the specified minimum tensile strength of the bars being spliced; and shall be installed per coupler manufacturer's recommendations.

F. Fastening:

Fasten MMFX₂ bars with approved tie wire, or snap ties, in accordance with ACI 315.

G. Cleaning:

Remove form oil or other deleterious materials from MMFX₂ bars before placing concrete.

3.05 TESTING AND INSPECTION

- A. Upon request a certified copy of a mill certification report showing physical and chemical analysis for each heat of reinforcing bars delivered shall be provided.
- B. Field inspection shall be in accordance with local Building Code or agency requirements.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide all labor, materials, tools, fabrications, reinforcement, equipment and services for metal fabrications as specified herein and/or as shown, detailed, scheduled, implied, required or otherwise indicated to provide a complete and proper installation.
- B. Completely coordinate with Work of all other trades.
- C. Related Work
 - 1. General Conditions.
 - 2. Contract Documents

1.02 SUBMITTALS

- A. Product Data
 - 1. Material List.
 - 2. Manufacturers Specifications.
 - 3. Manufacturers Instructions.
- B. Shop Drawings
 - 1. Metal Fabrications

1.03 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
- B. Materials and Operations Standards
 - 1. AAMA, Architectural Aluminum Manufacturer's Association
 - 2. AHDGA, American Hot Dip Galvanizers Association
 - 3. AISC, American Institute of Steel Construction

4. ASTM, American Society for Testing and Materials
5. AWS, American Welding Society
6. F.S., Federal Specifications
7. NAAMM, National Association of Architectural Metals Manufacturers.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Comply with pertinent provisions of the General Conditions.

1.05 JOB CONDITIONS

- A. Provide sleeves, imbedded anchors and other built-in items in time for installation, or pay costs of cutting in items later, and grouting.
- B. Verify field conditions prior to fabrication.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Comply with the General Conditions.
- B. Materials manufacturers as noted.
- C. Comply with standards indicated.
- D. Provide all miscellaneous metals and metals fabrications

2.02 MATERIALS

- A. Structural Steel: ASTM A-36.
- B. Cast Steel: ASTM A-27, Grade 65-35; and A-148, Grade 80-50.
- C. Steel forgings: ASTM A-668.
- D. Rivets steel: ASTM A-502.
- E. Bolts: ASTM A-307.
- F. Filler metal: AWS Standards.
- G. Cast iron: ASTM A-48, Class 30, min. 30,000 PSI tensile.
- H. Malleable iron: ASTM A-47, and A-197.
- I. Steel pipe: ASTM A-53.

- J. Galvanizing: ASTM A-123.
- K. Aluminum: ASTM B-308 for particular alloy in standard shapes and extrusions, B-26 for casting.
- L. Stainless Steel: ASTM A-484 and A-276, Type 302.
- M. Anchorage devices, masonry: Standard manufactured items.
 - 1. Lead expansion shields for machine screws and bolts 1/4 IN (6mm) and smaller: Head out imbedded nut type.
 - 2. For machine screws and bolts larger than 1/4 IN (6mm): Manufacturers' standard.
 - 3. Bolt anchor expansion shields for lag bolts: Zinc alloy, long shield anchors.
 - 4. Bolt anchor expansion shields for bolts: Closed end bottom bearing type.
- N. Fasteners: Zinc coated where built into exterior walls. Selected fasteners for type, grade and class required.
 - 1. Bolts and Nuts: Regular hexagon head ASTM A307, Grade A.
 - 2. Lag Bolts: Square head type.
 - 3. Machine Screws: Cadmium plated steel.
 - 4. Wood Screws: Flat head carbon steel.
 - 5. Plain Washers: Round, carbon steel.
 - 6. Lock Washers: Helical spring carbon steel.
- O. Primer: Tnemec 37 series or Hentzen Chemical Co.
 - 1. Use primer compatible with finish coats of paint.
 - 2. Coordinate metal primer with finish paint requirements specified in Section 09900.
- P. Galvanizing repair paint: High zinc dust content paint for regalvanizing welds and abrasions in galvanized steel.
 - 1. DOD-P-21-35.
 - 2. Z.R.C. by ZRC Co.
- Q. Dissimilar metal protection coating: Tnemec Tnem-Tar 413.
- R. Grout, non-shrink: Por-Rock or Sauereisen.

2.03 FABRICATION

- A. Form to shapes indicated with straight lines, sharp angles, smooth curves.
- B. Drill or punch holes with smooth edges for temporary field connections and attachment of Work by other trades.
- C. Make permanent shop and field connections with continuous fillet type welds.
- D. Grind exposed welds smooth.
- E. Conceal fastenings where practicable.
- F. Shop fabricate in as large assemblies as practicable.
- G. Meet requirements specified under Structural Steel for fabricating items of structural nature or use.
- H. Qualify welding processes and welding operators in accord with AWS.

2.04 SHOP PRIMING

- A. Galvanize all items set in, or on, exterior surface.
- B. Apply shop primer to all ferrous metal not indicated to be set in or receive concrete.
 - 1. Apply two (2) shop coats to metals that will be inaccessible after erection.
 - 2. Do not prime stainless steel, aluminum, copper, brass, or bronze unless specifically indicated.
- C. Remove scale, rust and deleterious materials before priming.
 - 1. Clean off rust and loose mill scale in accord with SSPC SP-2, SP-3, or SSPC SP-7.
 - 2. Remove contaminants in accord with SSPC SP-1.
- D. Immediately after surface preparation, prime in accord with manufacturer's instructions.
 - 1. Provide uniform dry film thickness of 1.0 mil.
- E. Provide dissimilar metal protection coating:
 - 1. When dissimilar metals come in contact.
 - 2. When metal or aluminum is anchored to or in contact with concrete or masonry.
- F. Retouch any scraped, abraded, and unprimed surfaces.

1. Use primer specified for shop coats.
2. Priming does not count as a coat for finish painting.

2.05 METAL FABRICATIONS – PARTIAL LIST

- A. Verify completeness of following listing.
- B. Supply all items required to complete construction and installation.
- C. Anchorage accessories: Required to secure wood to metal, wood to masonry, metals to masonry or concrete, metal to metal or metal to other items.
- D. Support angles, members and loose lintels: ASTM A-36 steel.
 1. Size as galvanized.
 2. Galvanize units in exterior walls.
 3. Galvanize interior units
- E. Miscellaneous Metal Fabrications.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.

3.02 INSTALLATION

- A. Set Work level, true to line, plumb.
- B. Shim and grout as necessary.
- C. Weld field connections and grind smooth.
- D. Where practical, conceal fastenings.
- E. Secure metal to wood with lag screws, of adequate size, with appropriate washers.
- F. Secure metal to concrete with imbedded anchors, setting compounds, caulking and sleeves, or setting grout.
 1. Use expansion bolts, toggle bolts, or screws for light duty service.
- G. Meet structural requirements for erecting items of structural nature.
- H. Do not field splice fabricated items unless size requires splicing.

- I. Weld all splices.
- J. Provide all fabricated items complete with attachment devices as required to install.

END OF SECTION

SECTION 15062

DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Ductile Iron Pipe, Fittings and Appurtenances.
- B. Cast Iron Pipe, Fittings and Appurtenances.

1.02 RELATED WORK

- A. Section 02221: Trenching, Bedding and Backfill for Pipe

1.03 DESCRIPTION OF SYSTEMS

- A. Piping and fittings shall be installed in those locations and depths as shown on the Drawings.
- B. The equipment and materials specified herein are intended to be standard ductile iron pipe and fittings used in transporting water and wastewater.

1.04 QUALIFICATIONS

- A. Iron pipe and fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials. The pipe and fittings shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with the Specifications in all respects.

1.05 REFERENCES

- A. ANSI/AWWA C104/A21.4: American National Standard for Cement-Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water.
- B. ANSI/AWWA C105/A21.5: American National Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
- C. ANSI/AWWA C110/A21.10: American National Standard for ductile iron and gray iron fittings 3 inch through 48 inch for Water and Other Liquids.
- D. ANSI/AWWA C111/A21.11: American National Standard for Rubber Gasket Joints for Ductile and Gray Iron Pressure Pipe and Fittings.
- E. ANSI/AWWA C115/A21.15: American National Standard for Flanged Ductile Iron and Gray Iron Pipe with Threaded Flanges.
- F. ANSI/AWWA C150/A21.50: American National Standard for the Thickness Design of Ductile Iron Pipe.
- G. ANSI/AWWA C151/A21.51: American National Standard for Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lines Molds, for Water or Other Liquids.
- H. ANSI/AWWA C600: American Water Works Association Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.
- I. ANSI/AWWA C606: American Water Works Association Standard for Grooved End Pipe and Fittings
- J. ASME/ANSI B16.1: Cast Iron Pipe Flanges and Flanged Fittings, Class 125.

- K. ASME/ANSI B16.5: Pipe Flanges and Flanged Fittings, Class 150 (Flat Face Flange).
- L. ASME/ANSI B16.42: Ductile Iron Pipe flanges and Flanged Fittings, Class 150 (Flat Face Flange).
- M. ASTM A307 Grade B: Low-Carbon Steel Bolts for Flanged Pipe.

1.06 SUBMITTALS

- A. Submit a list of materials to be furnished, with the names of the suppliers and the date of delivery.
- B. Submit sworn certificates of foundry material and strength tests, and their results. In addition, all ductile iron pipe and fittings may be inspected at the foundry for compliance with the Specifications by an independent testing laboratory selected by the Owners. The manufacturer's cooperation shall be required in these inspections. The cost of foundry inspections requested by the Owner will be borne by the Contractor.
- C. Waiving of the inspection privileges shall not relieve the Contractor or manufacturer of the responsibility of furnishing pipe and fittings meeting the Specification.
- D. Shop Drawings shall be submitted in accordance with Section 01340 and shall include dimensioning, methods and location of supports and all other pertinent technical specifications for all pipe and fittings to be furnished. Shop drawings shall be prepared by the pipe and fittings manufacturer.
- E. Manufacturer shall furnish a laying schedule providing a location, type and size of all pipe joints.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. American Ductile Iron Pipe Company
- B. United States Pipe and Foundry Company
- C. McWane Cast Iron Pipe Company
- D. Union Foundry Company
- E. Clow Water Systems Company
- F. Pacific States Cast Iron Pipe Company
- G. Atlantic States Cost Iron Pipe Company
- H. Griffin Pipe
- I. Tyler Corporation
- J. Or equal

2.02 COMPRESSION JOINT PIPE AND FITTINGS

- A. Pipe shall conform to ANSI/AWWA C151/A21.51 and C150/A21.50.
- B. Fittings shall conform to ANSI/AWWA C110/A21.10.
- C. Rubber gaskets shall conform to ANSI/AWWA C111/A21.11.

- D. Thickness shall be minimum pressure Class 350 through 12" and pressure Class 250 in sizes 14" and larger.
- E. Install compression joint pipe below ground. Provide sufficient quantities of lubricant and gaskets.

2.03 MECHANICAL JOINT PIPE AND FITTINGS

- A. Pipe shall conform to ANSI/AWWA A21.50/C151 and C150/A21.50.
- B. Fittings shall conform to ANSI/AWWA C110/A21.10.
- C. Thickness shall be minimum pressure Class 350 through 12" and pressure Class 250 in sizes 14" and larger.
- D. Rubber gaskets shall conform to ANSI/AWWA C111/A21.11.
- E. Bolts for mechanical joint pipe shall be tee-head design. Nuts and bolts shall be high-strength low alloy steel.
- F. Restrained mechanical joints shall be installed where shown on drawings.
- G. Mechanical joint pipe shall be installed below ground.
- H. Furnish with sufficient supply of accessories, ie., gaskets, bolts, and glands, as required for each joint.

2.04 FLANGED JOINT PIPE AND FITTINGS

- A. Pipe and fittings shall conform to ANSI/AWWA C115/A21.15.
- B. Thickness shall be minimum pressure Class 350 through 12" and pressure Class 250 in sizes 14" and larger.
- C. Flanges and flanged fittings shall be flat face conforming to ANSI/AWWA C110/A21.10. Full face 1/8 inch thick rubber ring gaskets shall conform to ANSI/AWWA C110/A21.10.
- D. Flanges shall be ductile iron. Cast iron flanges will not be allowed.
- E. Flanged ductile iron pipe shall have factory applied screwed long hub flanges. Flanges shall be faced and drilled after being screwed on the pipe, with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe conforming to ANSI B16.1 Class 125.
- F. Bolts for flange pipe shall be low-carbon steel conforming to ASTM A307 Grade B, except where noted.
- G. Flanged joints shall be used for above ground piping and exposed piping in vaults and in indoor pipe galleries.

2.05 GROOVED END PIPE AND FITTINGS

- A. Grooved end pipe and fittings shall be acceptable for above-ground installation.
- B. Pipe shall conform to ANSI/AWWA C606.
- C. Grooved end pipe shall be minimum thickness to conform to former Class 53.
- D. Grooved end joints shall be flexible type, radius cut grooved, conforming to AWWA C606.
- E. Grooved end fittings shall be ANSI B16.1, radius cut grooved, rigid joint, as

manufactured by Victaulic Company, Gustin-Bacon, or approved equal.

- F. Grooved end pipe adapter flanges shall be ductile iron, ASTM A536, Victaulic, Gustin-Bacon, or approved equal.
- G. Bolts shall be manufactured standard.
- H. Gaskets for grooved end joints shall be manufacturer's flush-seal type specifically designed for cast surfaces. Properties shall be as designated in ASTM D 2000. Dimensions shall conform to AWWA C606. Lubricant shall be manufacturer's standard.
- I. Install in accordance with manufacturer's printed instructions. Dress cut ends of pipe for couplings and adapters as recommended.

2.06 LININGS AND COATINGS

- A. Pipe and fittings for wastewater service shall be double cement lined in accordance with ANSI/AWWA C104/A21.4.
- B. Pipe and fittings for water service shall be standard thickness cement mortar lining with bituminous seal coat in accordance with ANSI/AWWA C104/A21.4. Interior linings for water service shall meet EPA, FDEP, and FDA approval for water service use.
- C. Below ground pipe and fittings shall receive a minimum 1 mil thick bituminous coating per AWWA C151 for ductile iron pipe, AWWA C115 for flange pipe and AWWA C110 for fittings.
- D. Pipe and fittings exposed to view in the finished work shall not receive the standard bituminous or asphalt coat on the outside surfaces, but shall be shop primed on the outside with one coat of a rust inhibitive primer. Should portions of the pipe inadvertently be given the outside coating of coal tar enamel instead of the rust inhibitive primer as required for exposed piping, the surfaces shall be sealed with a non-bleeding sealer coat. Sealer shall be a part of the work of this Section. Exposed pipe inside wet well shall be finished with two coats of coal tar epoxy with a minimum DFT of 16 mil. Exposed pipe outside wet well shall be finished with two coats of polyurethane enamel with a minimum DFT of 4 mil.
- E. Pipe and fitting installations in corrosive earth between the limits shown on the drawings or as required by the Engineer shall be fully encased in an 8 mil polyethylene sleeve in accordance with ANSI A21.5 Method "A".

2.07 SPECIAL PIPE AND FITTING

- A. Long span flange pipe shall be minimum pressure Class 350. Gaskets shall be Toruseal type with o-ring or equal.
- B. Wall castings shall be of the size and types shown on the Drawings and bituminous coated.
- C. Flexible joint (ball joint or river crossing) type pipe shall be as shown on the drawings or comply with ANSI/AWWA C151/A21.51 and ANSI/AWWA C110/A21.10. Pipe shall provide a variable deflection of up to 15 degrees. The spherical threaded socket shall be manufactured in conformance with AWWA C110 and ANSI B2.1.

2.08 RESTRAINED JOINTS

- A. Location and number of restrained joints shall be as shown on the drawing or be field determined in accordance with the necessary laying lengths when installing the pipe.
- B. Joint shall be the standard design of the pipe and fitting manufacturer and shall provide a 2:1 safety factor.
- C. Restrained joints shall be designed for a pressure class rating of 350 psi in sizes 4 inch through 12 inch and 250 psi for 14 inch through 64 inch unless shown otherwise on the drawings.
- D. Bolts and nuts for restrained joints shall be low alloy, high strength steel.

PART 3 - EXECUTION

3.01 HANDLING PIPE AND FITTINGS

- A. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be required as directed by the Engineer.
- B. All pipe and fittings shall be subjected to a careful inspection prior to being laid or installed.
- C. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

3.02 LAYING PIPE AND FITTINGS

- A. Ductile iron pipe and fittings shall be installed in accordance with requirements of ANSI/AWWA C600 except as otherwise provided herein.
- B. All pipe shall be sound and clean before laying. When laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plugs or other approved means.
- C. Suitable excavations shall be made in the trench bottom to receive pipe with raised bells.
- D. As soon as the excavation is completed to the normal grade of the bottom of the trench, immediately place screen gravel or crushed stone (where applicable) bedding in the trench, and then the pipe shall be firmly bedded in this material to conform accurately to the line and grade indicated on the Drawings. Blocking under the pipe will not be permitted. Bedding shall conform with minimum AWWA Type 2 condition unless otherwise specified.
- E. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a "Tyton" type bell shall be beveled to conform to the manufactured spigot end. The lining shall remain undamaged.

3.03 JOINTS

- A. Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe is to be aligned with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.
- B. Mechanical joints at valves, fittings, and where designated on the Drawings and as specified, shall be in accordance with the "Notes on Method of Installation" under ANSI A21.11 and the instructions of the manufacturer. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening bolts. Bolts shall be tight to the specified torques. Under no condition shall extension wrenches, pipe over handle or ordinary ratchet wrenches be used to secure greater leverage.
- C. Ball joints, where designated on the drawings and as specified, shall be installed in strict accordance with the manufacturer's instructions. Where ball joint assemblies occur at the face of structures or tanks, the socket end shall be at the structure or tank and the ball end assembled to the socket.
- D. Flanged joints shall be in accordance with ANSI A21.15 including its Appendix "A" and the instructions of the manufacturer. Flanged joints shall be fitted so that the contact faces bear uniformly on the gasket and then are made up with relatively uniform bolt stress.
- E. All valves, hydrants, fittings and other appurtenances needed upon the pipe lines shall be set and jointed as indicated on the Drawings or as required by the manufacturer.
- F. Unless otherwise noted, underground piping shall be push-on joint or mechanical joint with restraints as needed and above ground or exposed piping shall be flanged or grooved end.
- G. Deflected bell pipe shown on the Drawings is shown only as an assistance in illustrating a preferred means of installation in specific locations, and is not intended to indicate all deflected bell pipe necessary to effect the installation as shown in plan and profile views. The cost of all such deflections shall be included within the bid price for furnishing and installing the pipe.
- H. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed deflection recommended by manufacturer.

3.04 PIPE THRUST BLOCKS

- A. Thrust blocks will not be allowed on the project.

3.05 RESTRAINED JOINTS

- A. Section of piping designated on the Drawings as having restrained joints or those requiring restrained joints shall be constructed using mechanical or compression joint pipe and fittings, manufacturer's standard, equal to U.S. Pipe TR-FLEX, or where permitted by the Engineer with Mega-lug, JCM, Dependo-lok, Uniflange, or

equal restraining devices. Mechanical joint ductile iron pipe retainer glands will not be permitted unless approved by the Engineer.

- B. Restrained pipe joints that achieve restraint by incorporating cut out sections in the wall of the pipe shall have a minimum wall thickness at the point of cut out that corresponds with the minimum specified wall thickness for the rest of the pipe.
- C. The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. The formula and parameters given in the latest edition of the Ductile Iron Pipe Handbook shall be used to determine the minimum requirements.

$$L = 1.5PA (1 - \cos X) / fW$$

Where L = length of pipe on each side of fitting or change in direction

P = 150 psi, unless otherwise noted

A = cross-sectional area in square inches based on outside diameter (O.D.) of pipe

X = angle of bend or change in direction in degrees

f = coefficient of friction = 0.4 (maximum)

W = W earth + W pipe + W water in pipe

W earth = (density of soil*) (depth of cover in feet) (O.D. in feet) (2)

* Maximum 120 lbs./C.F. at and above maximum water table elevation and 60 lbs./C.F. below the maximum water table elevation.

- D. The Contractor shall also provide restrained joints in accordance with the above criteria wherever thrust blocks are not used in conjunction with below ground fittings on lines 10 inches in diameter or less.

3.06 PRESSURE & LEAKAGE TESTS

- A. Hydrostatic pressure and leakage test shall conform with AWWA C600, with the exception that the Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the line.
- B. The pressure required for the field hydrostatic pressure test shall be 150 psi. The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure. Corporation cocks at least 3/4 inches in diameter, pipe riser and angle globe valves shall be provided at each pipe dead-end in order to bleed air from the line. Duration of pressure test shall be at least two hours. The cost of these items shall be included as a part of testing.
- C. The leakage test shall be a concurrent test, at the maximum operating pressure as determined by the Engineer, with the pressure test and shall be not less than two hours in duration. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced. The pipe lines shall be tested in such sections as may be directed by the Engineer by shutting valves or installing temporary plugs as required. The pipe

shall be filled with water, all air removed and the test pressure maintained in the pipe for the entire test period by means of a force pump to be furnished by the Contractor. Accurate means shall be provided for measuring the water required at this pressure. The amount of water required is a measure of the leakage.

- D. The amount of leakage which will be permitted shall be in accordance with AWWA C600 for all pressure lines.
- E. The Contractor must submit his plan for testing to the Engineer for review at least ten (10) days before starting the test. The Contractor shall remove and adequately dispose of all blocking material and equipment after completion and acceptance of the field hydrostatic test, unless otherwise directed by the Engineer. Any damage to the pipe coating shall be repaired by the Contractor. Lines shall be totally free and clean prior to final acceptance.

3.07 CLEANING AND FLUSHING

- A. The pipe shall be thoroughly cleaned of all foreign matter before installation. It is the Contractor's responsibility to insure cleanliness of the pipe during installation and backfilling. At the conclusion of the work, the Contractor shall thoroughly clean all of the pipe, if necessary, by flushing with water or other materials which may have entered during the construction period. Debris cleaned from the lines shall be removed from the lowest outlet. If, after this cleaning, obstructions remain, they shall be removed. After the pipe is cleaned, the Engineer will examine the pipe for leaks. If defective pipes or joints are discovered at this time, they shall be repaired by the Contractor.

3.08 DISINFECTING

- A. Before being placed in service, all potable water pipelines shall be chlorinated in accordance with AWWA C601, "Standard Procedure for Disinfecting Water Mains," and Section 01721. The procedure shall be approved by the Engineer. The location of the chlorination and sampling points will be determined by the Engineer in the field. Taps for chlorination and sampling shall be uncovered and backfilled by the Contractor as required.
- B. The general procedure for chlorination shall be first to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages through a tap at one end, while water is being withdrawn at the other end of the line. The chlorine solution shall remain in the pipeline for at least 24 hours.
- C. Following the chlorination period, all treated water shall be flushed from the lines at their extremities and replaced with water from the distribution system. Bacteriological sampling and analysis of the replacement water shall then be made by the Engineer in full accordance with AWWA C601. The Contractor will be required to rechlorinate, if necessary. The line shall not be placed in service until the requirements of the State and County Public Health Department are met.
- D. Special disinfecting procedures shall be used in connections to existing mains, and where the method outlined above is not practical.
- E. The Contractor shall make all arrangements necessary with the County Health Department for the collection and examination of samples of water from disinfected water mains. These samples shall be examined for compliance with Department of Health and Rehabilitative Services requirements. Sampling shall be made daily and

continuously until two successive examinations be found unsatisfactory, the line shall be flushed and disinfected again. The cost of sampling, flushing and disinfecting shall be included in the contract price and no additional charge shall be made to the Owner for this work.

END OF SECTION

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