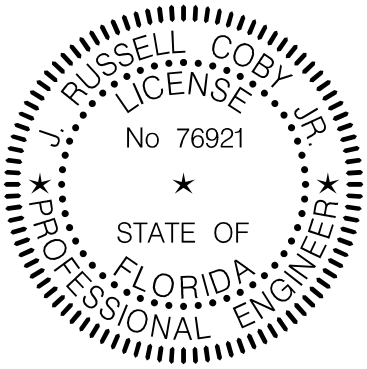
NORTHSIDE BAY ADDITION

TECHNICAL SPECIFICATION – SECTION VIII
CIVIL AND STRUCTURAL

REVISION: 0

Date: August 1, 2017

PROFESSIONAL ENGINEER



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SECTION VIII – TECHNICAL SPECIFICATION – CIVIL, STRUCTURAL, ARCHITECTURAL

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SECTION VIII – TECHNICAL SPECIFICATION – CIVIL, STRUCTURAL, ARCHITECTURAL

1. GENERAL

1.1. SECTION INCLUDES

This is a general specification that covers the civil, structural, and architectural work requirements for substation construction. Any equipment, material or methods listed which does not apply to this particular project shall be disregarded. The Drawings shall be used to determine the type of work and associated specifications intended for use on this project.

1.2. RELATED SECTIONS

1.2.1. Specific Instructions (Section VII)

1.2.2. Technical Specifications (Section IX) – Electrical

1.3. REFERENCES

1.3.1. The latest edition and published addenda of the referenced publications within the attached Appendix effective on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference.

1.3.2. Where the codes and standards referenced herein contain recommendations in addition to requirements, consider the recommendations as requirements and follow unless stated otherwise by this Specification.

1.3.3. In the event of any conflict between codes, or this Specification and codes, the more stringent requirement applies.

2. SITE PREPARATION

2.1. INSPECTION AND PREPARATION

2.1.1. Locate and identify existing structures, fences, paving, vegetation, and other features that remain.

2.1.2. Notify utility companies to remove and relocate utilities as required. Locate, identify, stake and flag utilities that remain.

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

2.1.4. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

2.1.5. Horizontal and vertical control monuments are shown on the existing site drawings. Contractor shall verify the accuracy of the existing monuments and locate the Work from these monuments. If existing site control monuments are not adequate to perform the Work, Contractor shall be responsible for establishing new ones as required to complete the Work. Assume responsibility for dimensions and elevations taken from the control monuments. Protect established reference control monuments, baselines and benchmarks. Replace any monument that is disturbed or removed.

2.2. SOIL EROSION AND SEDIMENT CONTROL

2.2.1. For all land-disturbing construction activities, Contractor shall furnish, install, inspect, and maintain erosion and sediment control measures conforming to current Land Development Procedures of the City of Jacksonville, Florida, the State of Florida "Erosion and Sediment Control Designer and Reviewer Manual," and the Florida DEP "Florida Stormwater Erosion and Sedimentation Control Inspector's Manual".

2.2.2. Furnish, install, provide, inspect, and maintain the following erosion and sediment control measures during construction as shown on the Drawings until the Contractor is relieved by the Owner or until permanent measures are completed and functioning in a satisfactory manner:

A. Silt fence and/or filter socks

B. Stabilized construction exit

C. Temporary and permanent seeding and mulch (see Landscaping section)

D. Sediment containment filter bag

2.2.3. Submittals:

A. Filter sock manufacturer and data sheet.

B. Aggregate data report including particle size analysis, aggregate color, type, and size.

C. Manufacturer and product data for geotextiles, including silt fence and sediment filter bag.

2.2.4. Construct or provide ditches, berms, basins, site grading, sumps, and pumping facilities to direct, collect, and remove water from working areas. Convey water to areas away from work in a manner to prevent erosion, damage to adjacent structures or utilities, and in accordance with the Soil Erosion and Sediment Control Plan.

2.2.5. Conduct visual inspections weekly and within 24 hours after each precipitation event during construction that yields 0.5" or more to ascertain that the erosion and sediment control measures are operational and effective in preventing sedimentation to drainage ways, properties and rights of ways beyond the site. Repair and/or replace facilities as required, replace any silt fence and/or filter socks that have been undermined or topped immediately. Remove sediment accumulations from all facilities as required, and dispose of the material removed at an approved disposal area.

2.2.6. Once the project area has been permanently stabilized, all temporary erosion and sediment control measures shall be removed from the site by the Contractor.

3. EARTHWORK

3.1. SUBMITTALS

3.1.1. Sample and sieve analysis for each Fill material

3.1.2. Proposed mix design, slump, and compressive strengths (3-day and 28-day) for Flowable Fill

3.1.3. Geotextile Data Sheets

3.1.4. Soil Test Reports

3.1.5. Soil Compaction Reports

3.1.6. Dewatering Plan

3.1.7. Sheeting and shoring plan if excavation bracing is required

3.2. GEOTEXTILES & GEOGRIDS

3.2.1. Silt Fence geotextile shall be Propex Geotex 2130 or engineer approved equal.

3.2.2. Geotextiles below foundations for stabilization of wet subgrades shall be Propex Geotex 4x4 or approved equal.

3.2.3. For geotextiles beneath aggregate surfaced and asphalt paved areas, refer to the Site Surfacing section.

3.2.4. For geotextiles and geogrids associated with the Gravel Access Drive, refer to the Cellular Confinement for Gravel Access Drive section.

3.2.5. Geotextiles below concrete pavement and sidewalks for subgrade stabilization shall be Propex Geotex 2x2HF or approved equal.

3.3. FILL MATERIAL

3.3.1. Site and Structural Fill:

A. All soil for fill (if required) shall be of a quality acceptable to the Engineer and shall be free from roots, rubbish or other extraneous material. The fill material shall be sand similar to materials classified in the A-3 group as

shown in AASHTO M145. The fill material below rocked areas (aggregate fill) shall be sand with less than 5% fines similar to materials classified in the A-3 group as shown in AASHTO M145.

B. The fill material in structural areas (Structural Fill) shall be sand with less than 5% fines similar to materials classified in the A-3 group as shown in AASHTO M145. This material shall also contain less than 4% organic material.

C. No fill material shall be placed until receipt of a Letter of Certification from an independent testing company stating that the fill materials meet the requirements presented herein

D. Borrow material, where necessary, shall be provided from sources off the site in areas provided by the Contractor. The borrow pit shall be available for inspection by the Engineer.

3.3.2. Aggregate Surfacing:

A. Refer to the Site Surfacing section for aggregate fill information.

3.3.3. Flowable Fill:

A. Flowable Fill shall consist of an approved mix that complies with the material requirements of ACI 229. Provide a mix with a slump between 8 and 12 inches, an air content of 15% (+/- 5%) and that is pumpable under the required pressure. Provide a mix with a 3-day compressive strength of at least 25 psi and a 28-day compressive strength between 50 and 100 psi unless otherwise shown on the Drawings. Maximum particle size is 0.5 inch.

3.3.4. Trench Backfill:

A. Use Site Fill for trench bedding and backfill Storage of excavated material shall be the responsibility of the Contractor. Material deemed unsatisfactory for use in backfilling shall be disposed of by the Contractor.

3.4. DISPOSAL OF MATERIALS

3.4.1. Disposal of materials resulting from clearing and grubbing shall consist of:

A. All trees, stumps, roots, root mat, branches, brush, shrubs, logs, vines, wood structures and other debris or obstructions that are the products of the clearing and grubbing work shall be completely removed from Owner's property.

B. No burning shall be permitted on the site.

3.4.2. Excavation: Any surplus excavated materials shall become the property of the Contractor and are to be disposed of by the Contractor to the satisfaction of the Owner and in compliance with the requirements for solid waste disposal for Duval County.

A. All rubbish such as tires, roofing materials, concrete, etc., resulting from clearing shall be considered to be property of the Contractor and shall be removed from the job site for proper disposal. All fees for disposal of rubbish and/or other items related to clearing shall be paid by the Contractor.

B. The Contractor shall dispose of the following solid wastes if found on the property: anti-freeze containers, aerosol lubricant and solvent cans, rusted 55 gallon drums, automobile gasoline tanks and batteries, domestic trash, oil filters and containers, appliances, demolition debris, tires, concrete, roofing materials, boards, metal, soil piles, etc.

C. All solid wastes shall be disposed in accordance with FAC 62-701 (Solid Waste/Construction and Demolition Debris), 62-710 (Used Oil and Used Oil Filters), 62-711 (Tires) and 62-730 (Hazardous Waste). Several of these materials (whole tires, appliances, batteries, oil filters, non-empty containers) are prohibited from disposal in permitted, non-hazardous solid waste landfills.

D. Any liquids discovered on-site must be properly screened (sampled and analyzed) before developing a disposal plan. Containers may be required to be crushed or cut open to demonstrate that they are empty.

E. If asbestos is determined to be present, proper precautions should be followed when removing and transporting the material (wet material, use Type C respirators, and transport in covered vehicle).

F. The Owner has approved the following facilities for disposal of non-hazardous solid waste:

- Trail Ridge (Waste Management), Baldwin, FL
- Pecan Row (GeoWaste), Valdosta, GA
- Okeechobee Farms (Chambers), Okeechobee, FL
- Springhill Regional (Waste Management) Graceville, FL
- Use of any other landfills is subject to approval by the Owner.

3.5. SITE EXCAVATION

3.5.1. Perform excavation of every type of material encountered within the limits of the Work to the lines, grades and elevations indicated on the Drawings, and/or as required for foundation or other subsurface construction.

3.5.2. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.1 foot, unless over-excavation is required. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

3.5.3. Compact excavated area to 95% of maximum density per ASTM D 698 before filling operations are commenced.

3.5.4. Soil stockpiles should be located, constructed, and maintained to minimize unwanted changes in the natural moisture content of the excavated soils, i.e., protect soils near optimum moisture from becoming too wet to be readily reused for backfill, or prevent soils drier than optimum from further drying. Stockpiles can be protected from saturation by sloping and compacting the surface and side slopes to promote rainfall runoff. If additional protection is required, cover stockpile with plastic membranes. Failure to protect stockpiled soil shall not be accepted as a reason to replace the material with imported fill materials at the Owner's cost.

3.5.5. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials and obstructions. If excavated materials intended for fill and backfill include unsatisfactory materials and rock, replace with satisfactory soil materials as described herein.

3.5.6. Conduct excavation operations so that material outside the excavation limits is not disturbed or loosened. Restore material disturbed or loosened to its original condition.

3.5.7. Excavation Precautions

A. Excavation Safety: Contractor shall comply with all requirements of all applicable OSHA excavation safety standards and regulations. Contractor shall comply with all applicable trench safety standards. Contractor shall adhere to special shoring requirements, if any, of the state or other political subdivisions, which may be applicable to this project scope. For any project that contains a trench excavation deeper than four (4) feet, the Contractor shall submit with his bid the cost of compliance with the applicable trench safety standards.

B. Sheeting and Shoring: The stability of previously constructed structures and facilities shall not be impaired or endangered by excavation work. Previously constructed structures and facilities include both structures and facilities existing when the work under these specifications begins and structures and facilities already provided under these specifications.

Adequate sheeting and shoring in accordance with OSHA regulations 29 CFR Part 1926 shall be provided to protect and maintain the stability of previously constructed structures and facilities and the sides of excavations and trenches until they are backfilled. Sheeting, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure and shall maintain the shape of the excavation under all circumstances. Certified/stamped Drawings prepared by a registered professional engineer of all shoring details as required by OSHA shall be furnished to the Owner before any excavation begins. When "sloping" of the sides of the excavation or trench is used in lieu of sheeting or shoring the name of the "Competent Person" in charge for the Contractor shall be submitted in writing to the Owner before any excavation begins.

C. Depressions: Where depressions result from, or have resulted from, the removal of surface or subsurface obstructions, remove all debris and soft material as directed by the Owner.

D. Over-excavation: Backfill and compact all over-excavated areas as specified for fill below, and at no additional cost to the Owner.

E. Protection of In-Place Structures: Excavation likely to misalign, damage or impair the strength of structures already in place shall be made only after adequate protection has been provided. The Contractor shall repair any damage that occurs as a result of insufficient protection at no cost to the Owner. The Drawings identify approximate locations of known utilities in the work area. It is the responsibility of the Contractor to coordinate with the utility owners to adjust any utilities conflicting with the work under this contract at no additional cost to the Owner. It is the Contractor's responsibility to locate all underground utilities prior to digging.

F. Underground Utilities: The Contractor shall determine the location of underground piping, conduit and cable before proceeding with the Work. Should any utilities be encountered that were not expected, Work in the area shall be halted and the Engineer and Owner notified immediately.

G. Classification: All material shall be unclassified and considered as excavation regardless of the material encountered and no additional compensation shall be allowed because of difficulties met in removing such materials.

H. Muck and/or Organic Removal: Where muck or other soft material occurs, the Contractor shall remove such material by excavation to suitable foundation soil or to a depth designated by the Engineer and backfill in accordance with this Section.

I. Contaminated Soils: No hazardous materials or contaminated soil are expected to be encountered during excavation. However, in the event contaminants are found, the Contractor shall dispose of them in accordance with Chapters 62-770, 780, and 777 of the Florida Administrative Code (F.A.C.), and any other applicable federal, state, or local rules or regulations. The Contractor shall notify the Engineer and the Owner immediately upon contaminant discovery.

3.5.8. Excavation for Structures

A. General: All excavations shall be carried to foundation subgrade materials satisfactory to the Engineer, regardless of the elevations shown on the Drawings. In the event unsuitable soil is encountered at the required elevation, the Engineer shall determine the depth of removal of such soil.

B. Unless otherwise specified, the bottoms of all excavations shall be compacted to at least 100% of maximum density per ASTM D 698 or 95% of maximum density per ASTM D 1557. Prior to such compaction, the ground water shall be lowered to a depth of at least 2.0 feet below the bottom of the excavation.

C. Footings: To minimize differential settlement, it is essential that earth surfaces upon which footings will be placed be compacted to the approval of the Engineer and Owner and in accordance with the compaction requirements established in this section of these specifications. Excavate to the established lines and grades. Cut off bottoms of excavations level, and remove all loose soil. Where soft spots are encountered, remove all defective material and replace with lean concrete (flowable fill) or suitable backfill at no additional cost to the Owner.

D. Slabs: When undercutting of slabs is required in order to remove unsuitable material, the excavation shall be backfilled to the required elevation and compacted in accordance with this Specification.

E. Trenches:

1. The trench shall be of sufficient width and depth below the proposed final grade to ensure that all conduit/utility spacing is maintained per the details on the Drawings.

2. Trench excavation shall be accomplished so as to ensure the conduit/utility may be laid on a firm, undisturbed, native earth bed. In the event excavation below the required elevation is made, bedding material is to be placed and compacted so as to bring the excavation to grade.

3. Accurately shape trench bottoms so that the pipe or utilities are in continuous and uniform contact with either undisturbed soil or bedding material as shown on the Drawings. Do not backfill any trenches until all joints are made, required tests are performed, pipe encased as necessary, and Owner approval is granted to proceed.

F. Trench Excavation and Backfill

1. Do not damage any structures, pipes, or utilities.
2. Install sheeting, bracing, and shoring, as required, to safely maintain excavations and protect existing structures, utilities, and personnel as required by Federal, State, and local laws and ordinances, including 29 CFR 1926 Subpart P and Owner and site specific requirements.
3. Excavate trenches for pipes or utilities through natural ground or as required within fills. For pipes or utilities to be installed within fills, construct the fill first to a minimum height of 2 feet above the required elevation of the top of the pipe or utility. Excavate the trench into the fill, and the pipe or utility installed as required.
4. Maintain the minimum width of the trench as shown on the Drawings, but not greater than that necessary to permit the Work to proceed.
5. Remove soft or organic material encountered at the bottom of the trench for the full width of the trench to the depths required by the Owner and replace with bedding material required for the pipe or utility.
6. Accurately shape trench bottoms so that the pipe or utilities will be in continuous and uniform contact with either undisturbed soil or bedding material as shown on the Drawings.
7. Do not backfill any trenches until all joints are made, required tests performed, pipe encased as necessary, and Owner approval is granted to proceed.
8. Place bedding and backfill around pipe in accordance with the type and thickness indicated on Drawings and compacted to the minimum density as specified previously in this Section.
9. Place backfill around pipes and utilities so that the elevation of the fill is the same on both sides. Use rammer-type compactors with caution adjacent to pipes or utilities to avoid damage or movement.
10. After backfilling, fine-grade the disturbed areas to blend in with existing contours, left with puddle-free drainage, and seeded or otherwise protected as shown on the Drawings.

3.6. DRAINAGE AND DEWATERING

3.6.1. Prevent surface water and groundwater from entering excavations, from ponding on prepared subgrades, and from flooding construction site and surrounding areas. Provide for the collection and disposal of surface and subsurface water encountered during construction. Dispose of water as approved by the Owner.

3.6.2. Protect subgrades from softening, undermining, washout, and damage by surface or groundwater accumulation. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein.

3.6.3. Dewatering

A. Should groundwater be encountered, the Contractor shall be responsible for utilizing a dewatering system(s) to remove water from the excavations. Prior to any dewatering, Contractor is responsible for applying for all applicable dewatering permits.

B. During Construction, provide and maintain at all times during construction, ample means and devices with which to remove promptly and dispose of all water from every source entering the excavations or other parts of the Work. The Contractor shall utilize quiet pumps and socks, with noise deflectors installed around the pumps, to comply with all allowable night time local noise ordinances. Dewater by means which will ensure dry excavations and the preservation of the final lines and grades of bottoms of excavations. If dewatering is performed by use of a sock system, Contractor shall completely grout fill the abandoned sock(s) upon completion of dewatering activities. Locations of all abandoned socks shall be indicated on Contractor submitted “as-built’ Drawings.

C. Control groundwater and surface runoff flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, and excavation uplift and heave to eliminate all interference with orderly progress of

construction. Remove water by pumping or other suitable methods. Use filters on dewatering devices to avoid removal of fines from soil. Provide erosion protection at discharge locations to avoid erosion. Install dewatering system prior to the excavation reaching the groundwater in order to maintain the integrity of the in-situ material.

D. Verify the groundwater level prior to excavation. While the excavation is open, maintain the water level continuously, at least two (2) feet below the working level. Submit a dewatering work plan, as necessary.

E. Operate the dewatering system continuously until dewatering is no longer required and construction work is complete within two (2) feet of the water level.

F. Should the above requirements not be followed, the Contractor shall be held liable for any fines and/or violations incurred by the Owner.

3.7. HERBICIDE (GROUND STERILIZATION)

3.7.1. Prior to spreading aggregate in the substation area, the Contractor shall have the area treated with DuPont Krovar I DF for selective control of weeds.

3.7.2. Areas **outside** of the fence shall **not** be treated.

3.7.3. Application shall be by a licensed pesticide applicator in accordance with the manufacturer's instructions and precautionary statements. Personal protective equipment recommendations on the MSDS shall be strictly followed. Federal, State and local regulations regarding handling, transportation and spills shall be observed by the applicator.

3.8. FILL PLACEMENT AND COMPACTION

3.8.1. Fill shall be placed true to lines, grades and elevations shown on the Drawings. Elevations after final grading shall be within 0.1 foot above or below plan dimensions.

3.8.2. Rework fill or subgrade conditions that are dried out, excessively wet, or damaged by construction equipment. Scarify surface to minimum depth of 6 inches where additional fill or structures are to be placed. Bring fill to the specified moisture content and re-compact to the required density prior to the placement of additional fill or structure.

3.8.3. Rework fill not meeting moisture content requirements. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 3 percent of optimum moisture content.

A. Remove and replace, or scarify to minimum depth of 6 inches and air-dry, soil material that exceeds moisture content requirements and is too wet to compact to specified dry unit weight.

B. Add water, if required, by sprinkling, by only amount needed. Ponding or flooding is not permitted.

3.8.4. Cease placing fill in areas during inspection, sampling and testing.

3.8.5. Prior to backfilling around structures, verify that anchoring (for underground structures), sub-drainage, dampproofing, or waterproofing installations are complete.

3.8.6. Direct hauling equipment and operations to avoid rutting, if possible, and to provide uniform compaction over areas traversed. Remove rutting, if any, prior to placement of fill or concrete.

3.8.7. Use compaction equipment compatible with types of placed materials and of type and size required to produce the required compaction. Compaction by manual methods or small drop weights, by using an excavator bucket as a “ram”, or by other similar measures using “non-compaction” equipment, is not acceptable.

3.8.8. Use sheepsfoot or rubber-tired rollers to compact cohesive soils and smooth-wheel vibratory rollers to compact granular materials, unless approved otherwise.

3.8.9. Within 3 feet of structures or subsurface walls, place fill material in maximum 6-inch loose lifts and use compaction equipment weighing less than 200 pounds. The use of large equipment close to subsurface walls must be restricted a minimum distance equal to about two-thirds of the unbalanced height of fill at any time

(resulting in a line beginning at the toe of the wall back face sloping approximately 60 degrees upwards from horizontal).

3.8.10. Site Fill

A. Use under sidewalks, aggregate surfaced, grass surfaced, planted, and general areas unless otherwise shown on the Drawings.

B. Site fill shall be placed in successive layers of not more than twelve (12) inches in thickness, loose measure, compacted to 90% of maximum density as determined by Modified Proctor Test (ASTM D 1557) or 95 percent of the maximum dry density, as determined by Standard Proctor Test (ASTM D 698); maintain moisture content at time of compaction within + or - 3% from the optimum moisture content.

C. Place backfill around pipes and utilities so that the elevation of the fill is the same on both sides. Use rammer-type compactors with caution adjacent to pipes or utilities to avoid damage or movement.

3.8.11. Structural Fill

A. Use under pavements and structural slabs, footings, and foundations unless otherwise shown on the Drawings.

B. Structural backfill shall be deposited in layers not exceeding six (6) inches in thickness and shall be compacted to a density of not less than 95% of the maximum density as determined by Modified Proctor Test (ASTM D 1557) or 100 percent of the maximum dry density, as determined by Standard Proctor Test (ASTM D 698); maintain moisture content at time of compaction within + or - 2% from the optimum moisture content.

C. No backfill shall be placed against masonry or concrete walls and piers until the structure has been in place five (5) days or until permission has been given by the Engineer. When backfilling against masonry walls, each side shall be backfilled simultaneously to prevent excessive stress.

3.8.12. Aggregate Surfacing

A. Refer to the Site Surfacing section for aggregate surfacing information.

3.8.13. Aggregate Base Course

A. Refer to the Site Surfacing section for aggregate base course information.

3.8.14. Flowable Fill

A. Comply with ACI 229 and ACI 304 when mixing, transporting and placing flowable fill unless otherwise required herein.

B. Place flowable fill in lifts of no more than three (3) feet thick unless otherwise approved by the Owner. Remove excess bleed water from each lift prior to placing additional lifts. Do not place the additional lift within 24 hours of placement of the underlying lift unless otherwise approved by the Owner.

C. Protect pipes or utilities against displacement or flotation if flowable fill is used.

3.9. GEOTEXTILE PLACEMENT

3.9.1. Ensure the subgrade on which the geotextile is to sit is smooth, free of obstructions, depressions, debris, and soft or low density pockets of material.

3.9.2. Lay the geotextile smooth and free of tension, stress, folds, wrinkles, or creases.

3.9.3. With the exception of temporary sediment fence, overlap the adjacent sheets of geotextiles a minimum of 1-foot unless otherwise shown on Drawings.

3.9.4. Perform backfilling operations in a manner which prevents damage to the geotextile. Replace any geotextile damaged during backfilling operations.

3.10. SOIL TESTING AND INSPECTION

3.10.1. The Contractor shall engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

3.10.2. Submittals

A. Alternative test procedures

B. Test Reports

3.10.3. Inspection and Preparation

A. Test laboratory procedures and equipment:

1. Inspect at intervals of not more than 3 years by a qualified national authority.

2. Submit a copy of the certification. The AASHTO Material Reference Laboratory established by the National Institute of Standards and Technology is a qualified national authority.

3. Request copies of test equipment certification and calibration records as appropriate

B. Provide all necessary sampling, sample making, and inspection equipment in sufficient quantities to support the Work.

3.10.4. Personnel Requirements

A. Laboratory, testing, and inspection personnel:

1. Meet the minimum qualifications in ASTM D 3740.

2. Provide professional supervising geotechnical engineer registered in the State of Florida.

3.10.5. Testing Requirements

A. Provide sufficient number of personnel, per working shift, at the site to support the construction operations.

B. Conduct tests per the methods and frequencies indicated below, and submit per the requirements of this Section. The frequencies indicated are a minimum and are subject to change.

C. Include in the test reports at least the following information:

1. Project description and Job No

2. Sample or Test No.

3. Description of material

4. Location of sample or test [horizontal - within 5 feet, elevation - within 0.5 feet]

5. Tested by

6. Date of testing

7. Temperature and weather conditions

8. References to any other tests used in the analysis

9. Results of the test

10. Any deviations from specified testing procedure

11. Any difficulties in performing test

12. Whether material or test passes or fails, if applicable

D. Transport all samples to the offsite laboratory and store prior to testing per the applicable codes and standards.

E. Test results and inspections which meet project requirements shall be presented to the Owner within 2 days following completion of test.

F. Test results or inspections which do not meet project requirements shall be presented to the Owner immediately verbally followed by written report within 2 days.

G. Compaction tests shall be made no sooner than one day before the placing of a succeeding layer of fill or the pouring of a foundation, as the case may be. The intent of the time stipulation is to minimize the loss of compaction due to moisture loss after the compaction test has been made.

3.10.6. Required Tests and Inspections

A. Subgrade Inspection

1. Soil Description – ASTM D 2488 every time a test/inspection is performed on the subgrade
2. Verification of all subgrade preparation, including list of equipment utilized
    - Visual (A report or summary form shall be prepared on the observations made for the subgrade preparation).
3. Proctor Density Test and Specific Gravity Test – ASTM D 1557 or D 698 and ASTM D 854
    - One test for each type of material. At least five (5) dry density/moisture content points to adequately plot the curve, including the "zero air voids" line, which requires that the specific gravity of soil solids be determined.
4. Field Density and Moisture Content Tests – Sand-Cone Method ASTM D 1556, Balloon Method ASTM D 2167, or Nuclear Method ASTM D 6938
    - One test "pair" per lift of fill for each 5000 ft^2 of subgrade or at least one test "pair" at the bottom of each excavation, whichever is more frequent. If the nuclear method is employed, the device shall be calibrated by comparison with immediately-adjacent sand-cone tests at least once a month or as frequent as the Engineer deems appropriate.

B. Site and Structural Fill

1. Proctor Density Test - ASTM D 1557 or D 698
    - Test at beginning of project and each time the type or source of fill material is changed
2. Gradation - ASTM D 6913
    - Test at beginning of project, each time the type or source of fill material is changed, and whenever a problem appears to exist in the gradation of the material
    - Three (3) additional Particle Size and Permeability tests shall be performed on truck loads of fill material randomly selected by the the Owner. If any of the truck loads tested do not comply with the fill requirements, the material shall be rejected, and the Contractor shall perform six (6) additional sets of tests on material in place. Any material in place that does not comply with the fill requirements shall be removed and replaced with acceptable material at no additional cost to the Owner. The Contractor shall pay for all of the above testing.
3. Specific Gravity – ASTM C 127
    - Whenever necessary as part of ASTM D 1557.
4. Liquid and Plastic Limit – ASTM D 4318
    - Test at beginning of project and each time the type or source of fill material is changed.
5. Field Density and Moisture Content Tests – Sand-Cone Method ASTM D 1556, Balloon Method ASTM D 2167, or Nuclear Method ASTM D 6938
    - Five (5) tests per layer of site fill at locations determined by the Owner for site compaction. If the nuclear method is employed, the device shall be calibrated by comparison with immediately-adjacent sand-cone tests at least once a month or as frequent as the Engineer deems appropriate.

6. Lift Thickness – Visual/Manual; One test per lift

3.10.7. Coarse Aggregate

A. Gradation - ASTM D 6913

1. Whenever it appears that a problem exists in the gradation of the material

B. Lift Thickness – Visual/Manual; One test per lift

4. BELOW GRADE FACILITIES

4.1. MANHOLES

Not Used

4.2. DIRECT BURIED CONDUIT

4.2.1. Contractor shall furnish and install direct buried conduits according to JEA Standard UG-V-1 – Direct Buried Conduit, this specification, and the Construction Drawings.

4.2.2. The Contractor shall excavate trenches as indicated on the Drawings for installing conduit.

4.2.3. The Contractor shall furnish and install conduits in the locations shown on the Drawings. The conduits shall be electrical grade meeting the standards listed in the Electrical Specifications (Section IX).

4.2.4. All conduits shall be installed in a workmanlike manner and comply with industry standards for conduit installation. When installing PVC conduit, the proper grade of PVC cement shall be applied in accordance with the manufacturer's instruction.

4.2.5. The Contractor shall install conduit a minimum of three (3') feet from other utilities (e.g. water, phone, etc.) running parallel to the conduit.

4.2.6. The PVC conduit shall be sufficiently flexible to allow it to conform to minor changes in trench direction or elevation. PVC 5 degree bend couplings shall not be used. Any other bends shall be made using factory made PVC ells or sweeps.

4.2.7. The Contractor shall furnish a pull cord in each conduit. The pull cord shall be blown by compressed air into all runs of conduit and attached to the conduit at each end. Open ends of conduits shall be plugged with foam to prevent debris from entering the conduit.The Contractor shall backfill and compact the trench as prescribed by the Earthwork section.

4.2.8. Upon completion of installation, the Contractor shall pull a mandrel and swab train through each high-voltage and medium-voltage duct. The mandrel shall be sized to prove roundness of the pipe. The Contractor shall schedule each inspection with the Owner. Where evidence of the lack of smoothness or roundness is discovered, all measures necessary shall be taken to eliminate the irregularities. Under no circumstances shall any roughness be permitted to remain within the installed pipe.

4.2.9. After installation of the conduit, the Contractor shall place Owner supplied red underground electrical warning tape throughout the trench during the back-filling operation. Warning tapes shall be installed twelve (12") inches below final grade in earth and eighteen (18") inches above conduit in pavement.

4.2.10. The Contractor shall back-fill and compact the trench as prescribed by the Earthwork Section.

4.3. CABLE TRENCH

4.3.1. Excavate trenches to a minimum width consistent with the stability of the sides. Excavate completely to the bottom of the framing members and correct any points of over-excavation by returning to grade with mechanically compacted backfill to form a smooth trench bottom. Remove all excess excavated material as required for proper alignment and elevation of work.

4.3.2. Install the concrete trench system in earth trenches with covers extending above the surrounding crushed rock surfacing as shown on the drawings.

4.3.3. Component members shall be set only on firm, compacted, backfill. Prior to setting the trench section, place geotextile fabric the full length of the trench excavation, overlapping a minimum of two (2') feet at each joint of the fabric. The width of the fabric shall be sufficient to cover the bottom and both sides of the cable trench to finish grade. Geotextile fabric shall be Mirafi 140N, a non-woven water permeable fabric.

4.3.4. After setting the component trench sections, back fill along sides with the geotextile fabric flush against the sides. Hand tamp the backfill along the outside walls of the trench.

4.3.5. The Contractor shall protect the trench against entrance of construction debris, rock, and earth during the construction. The trench shall be cleaned out of any such foreign material prior to placing of covers.

5. CONCRETE

5.1. SUBMITTALS

5.1.1. Pre-molded Expansion Joints data sheets

5.1.2. Joint Sealant data sheets

5.1.3. Concrete Mix Design - Proportions of concrete ingredients

5.1.4. Strength Test results

5.1.5. Batch tickets for each concrete delivery truck

5.2. MATERIALS

5.2.1. Cement: Cement shall be Portland cement conforming to ASTM C 150, Type I.

5.2.2. Fine Aggregate: Sand for concrete shall conform to ASTM C 33.

5.2.3. Coarse Aggregate: Coarse aggregate shall be natural gravel, crushed stone or slag conforming to ASTM C 33.

5.2.4. Water: Mixing water for concrete shall be potable water, clean and free from injurious amounts of oils, acids, alkalis, organic materials or other deleterious substances.

5.3. CONCRETE PROPORTIONING

The concrete mix design for the class of concrete specified for use under this contract shall be prepared and submitted to the Engineer for approval. No concrete shall be placed without prior approval of the mix design.

5.3.1. Composition: The concrete shall be composed of Portland cement, fine aggregate, coarse aggregate and water. The ingredients shall be proportioned to produce a dense, workable concrete, free from voids. The concrete shall be designed in accordance with applicable ACI standards to attain the properties of strength, slump and rate of hardening required by these specifications.

5.3.2. Maximum Size of Coarse Aggregate: Maximum size of coarse aggregate shall not be larger than 3/4 the minimum clear spacing between the reinforcing bars.

5.3.3. Strength and Slump: The following are the minimum compressive strengths and slump ranges for the various types of concrete construction. All slump tests shall be in accordance with ASTM C143 and shall be performed by the Contractor as directed by the Owner.

Type of Construction	Compressive Strength 28 Day (PSI)	Slump (in)
Footings, Slabs, Bond Beam, Lintel	4,500	3+/-1
Headwalls, Drop Inlets, Duct Banks, Pavement, Sidewalk	3,000	5+/-1
Curb and Gutter, Fence Footing	2,500	3+/-1
Drilled Shafts	5,000	8+/-1

5.3.4. Air Content: The air content in the concrete shall be maintained in accordance with the following requirements:

Course Aggregate Maximum Size (in)	Air Content By Percent Volume
1 1/2	3 +/- 1
3/4 to 1	4 +/- 1
3/8 to 1/2	5 +/- 1

5.3.5. Admixtures: Air entrainment shall be produced by the addition of an air-entraining admixture meeting the requirements of ASTM C 260. Air entraining cement shall not be permitted. If required, an approved water reducing retarder may be used in the proportions recommended by the manufacturer conforming to ASTM C 494.

5.3.6. Proportioning of Ingredients: Proportions, including water-cement ratio, shall be established on the basis of either laboratory trial batches or of field experience with the materials to be employed. The mix design together with supporting data shall be submitted to the Engineer for approval. The Engineer may, at his discretion, require only a letter from the concrete supplier indicating compliance with the specifications in lieu of submission of a mix design.

5.4. REINFORCING STEEL

5.4.1. Reinforcing Bars: Reinforcing bars shall conform to ASTM A 615, Grade 60.

5.4.2. Welded Wire Fabric: Welded wire fabric shall conform to ASTM A 185.

5.4.3. Shop Drawings: Shop drawings for fabrication and placing of the reinforcing steel and accessories shall be submitted to the Engineer for approval.

5.4.4. Cleaning and Bending: Metal reinforcement at the time concrete is placed shall be free from loose, flaky rust, loose scale, mud, oil or other coatings that will destroy or reduce the bond. All bars shall be bent cold. Details of hooks and bends for reinforcement shall be in accordance with ACI 318.

5.4.5. Placing Reinforcement: Metal reinforcement shall be accurately placed and adequately secured in position by concrete or metal chairs and spacers. After being placed, the reinforcing bars shall be maintained in a clean condition until they are completely embedded in the concrete. Reinforcing steel shall be handled and placed in accordance with ACI 318. No metal reinforcement shall be placed within COJ Right-of-Way.

5.5. EMBEDDED ITEMS

All sleeves, inserts, anchors, ground rods and other embedded items shall be placed prior to concreting. Anchor bolts shall be set to the exact horizontal dimensions shown. The Contractor shall provide adequate protection for all threaded sections of the anchor bolts above the surface of the concrete. Any threaded section of the anchor bolts above the surface of the concrete which becomes damaged or encrusted with concrete during and/or after pouring shall be returned to their original threaded condition at no cost to the Owner. Apply cold galvanizing after re-threading and again after setting structures in their final position.

5.6. MIXING AND DELIVERY OF CONCRETE

5.6.1. Mixer: Unless otherwise authorized, the mixing of concrete shall be done in a batch mixer of approved AGC type or in ready-mix equipment conforming to ASTM C 94. The volume of the mixed material for each batch shall not exceed the manufacturer's rated capacity of the mixer.

5.6.2. Mixing Time: The concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged. For job-mixed concrete, the mixer shall be rotated at the speed recommended by the manufacturer and mixing shall be continued for at least one and one-half (1-1/2) minutes after all materials are in the mixer. For mixers larger than one cubic yard capacity, the minimum mixing time shall be increased 15 seconds for each additional 1/2 cubic yard of concrete or fraction thereof.

5.6.3. Delivery: Each batch of concrete shall be delivered to the site of the work and discharged completely within 90 minutes after addition of the cement to the aggregates. Exceptions to this 90 minute time limit will be permitted only upon special permission from the Engineer. A ticket or time slip shall accompany each batch, showing the

time of the batching of the cement. The production and delivery of ready-mixed concrete shall be such that not more than 20 minutes shall elapse between the depositing of successive batches of concrete in any monolithic unit of concrete.

5.6.4. Cold Weather Batching: When the temperature is below 40°F or is likely to fall below 40°F during the 24-hour period after placing, adequate equipment shall be provided for heating the concrete materials. No frozen material or materials containing ice shall be used. Temperatures of the separate materials, including the mixing water, when placed in the mixer, shall not exceed 140°F. When placed in forms, the concrete shall have a temperature of between 50°F and 90°F.

5.6.5. Addition of Water: Indiscriminate addition of water to increase slump is prohibited. When concrete arrives at the site with slump below that suitable for placing, water may be added only if neither the maximum water-cement ratio nor the maximum slump is exceeded. The concrete supplier must submit, at the time of delivery of each batch of concrete, a signed letter stating the maximum amount of water that may be added to the **entire** load of concrete in the truck. This shall be a **one time** addition of water. The letter must also state that addition of the specified amount of water shall not affect the design requirements of the approved concrete mix design. Acceptance of this by the Owner does not relieve the Contractor from meeting the design specifications required herein. If addition of water results in a failure of any test of any kind of the concrete placed, the Contractor shall remove and replace the concrete at no cost to the Owner.

5.7. FORMS

5.7.1. Installation: Forms shall conform to the shape, lines and dimensions of the members as called for on the Drawings, shall be substantially free from surface defects and sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together to maintain position and shape.

5.7.2. Removal: Forms shall be removed in such a manner and at such a time as to insure the complete safety of the structure. In no case shall the supporting forms or shoring be removed until the members have acquired sufficient strength to safely support their own weight and the load thereon.

5.7.3. Footings: Earth cuts may be utilized for forms provided the sides are stable at time of placing.

5.7.4. Chamfers: Exposed corners of columns, beams and piers shall be chamfered 3/4" unless otherwise noted on the Drawings.

5.8. PLACING OF CONCRETE

5.8.1. Vapor Barrier: All floor slabs on grade or fill shall be waterproofed with one ply of polyvinyl chloride (PVC) 15 mils thick. The PVC sheet shall be laid on the subgrade after it has been dressed and compacted. Joints shall be lapped six (6) inches and sealed continuously with a pressure-sensitive tape, especially made for this purpose, or with an approved water-resistant adhesive. PVC sheets shall be turned up four (4) inches at walls, columns, and all other items projecting above the slab. Before concrete is placed, the sheets shall be carefully inspected and all punctures shall be patched with the pressure-sensitive tape or additional plies of strips of PVC sheeting laid down on approved adhesive.

5.8.2. Preparation of Equipment and Place of Deposit: Before placing concrete, all equipment for mixing and transporting the concrete shall be cleaned; all debris and ice shall be removed from the spaces to be occupied by the concrete and all reinforcement shall be thoroughly cleaned of ice or other coatings. Water shall be removed from the place of deposit before concrete is placed unless otherwise permitted by the Engineer.

5.8.3. All reinforcement, forms, fillers and ground with which the concrete is to come in contact shall be free from frost. Concrete shall not be deposited during rain unless adequately protected and, in any case, preparations shall be on hand to protect newly placed concrete from rain until it has hardened sufficiently so that it will not be damaged.

5.8.4. Conveying: Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of the materials. Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery end and without separation of the materials.

5.8.5. Placing: No concrete shall be placed until the Engineer or his authorized representative has inspected forms, reinforcing and conditions incidental to the pour. Concrete shall be deposited as nearly as practicable in its final position to avoid separation due to re-handling or flowing.

5.8.6. All concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around the reinforcement and embedded items and into the corners of forms.

5.9. FINISHING

5.9.1. Patching: Immediately after stripping forms, all defective areas shall be patched with mortar similar to the concrete mix. Proprietary compounds for patching may be used provided they are used in accordance with the manufacturer's recommendations.

A. Major defective areas, including those resulting from leakage of forms, excessive honeycomb, large bulges and large offsets at form joints shall be chipped away to expose sound material and the surfaces that are to be patched shall be coated with an epoxy-polysulfide adhesive. The patching mortar shall be pressed in for a complete bond and finished to match adjacent areas.

B. Minor defective areas, including honeycomb, air bubbles, holes resulting from removal of ties and those resulting from leakage of forms shall be patched with grout without resorting to chipping.

5.9.2. Finishing: After patching, finish exposed-to-view surfaces as follows:

A. Standard Finish: Trim remaining bulges and offsets to remove fins and form blemishes, and dress rough edges. Rub with carborundum and water as necessary to achieve this finish. The result shall be a solid concrete surface in a true and accurate plane.

B. Rubbed Finish: In addition to the work required for a "standard finish," rub all the surfaces with carborundum and water to provide the hereinafter specified results. Wood grain pattern from wood forms need not be removed but shall be rubbed to provide uniformity of surface. Smooth surfaces resulting from overlaid plywood and metal shall be rubbed to remove the glaze. The result should be a solid concrete surface in a true and accurate plane, having a uniformly rubbed finish and free of glazed areas.

C. Areas to be finished as described above:

- Rubbed Finish: Control building bond beam surfaces.
- Standard Finish: All other exposed-to-view surfaces.

5.10. FINISHING OF UNFORMED SURFACES

5.10.1. General: Grade and screed the surfaces to the exact elevation or slope shown or required. After screeding, tamp the mixture thoroughly to drive the coarse aggregate down from the surfaces and apply the finish below.

5.10.2. Float Finish: Finish the surface with a wood or machine float to a true and uniform plane with no coarse aggregate visible. Dusting to absorb surface water shall not be permitted.

5.10.3. Broom Finish: Finish the surface with a wood or machine float to a true and uniform plane with no coarse aggregate visible. In addition, lightly broom the surface to make skid resistant. Dusting to absorb water shall not be permitted.

5.10.4. Finish Schedule: Apply indicated finish as scheduled below:

	Trowel	Broom	Float
Control Building	X		
Transformer Foundation		X	
Circuit Breaker Foundation		X	
All Other Foundations			X

5.11. JOINTS

5.11.1. Construction Joints: Construction joints shall not be permitted except in the locations shown on the drawings. All reinforcing steel and welded wire fabric shall be continued across joints. Bond shall be obtained by either the use of an approved adhesive or by roughening the surface of the concrete in an approved manner.

5.11.2. Isolation Joints: Isolation joints shall be provided to separate concrete slabs from columns, footings or walls. There shall be no connection across the joint by reinforcement, keyways or bond. Joints shall be filled with preformed joint filler material conforming to ASTM D 994 and sealed with a material compatible to the joint filler.

5.11.3. Control Joints: Control joints made of premolded joint material shall be installed in floor slabs to allow for contraction caused by drying/shrinkage. Joints shall be spaced at a maximum of 20 feet with the joint spacing chosen so that the panels are approximately square. Depths of control joints shall be one-fifth the slab depth.

5.12. CURING AND PROTECTION

Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperatures, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete. The approved practices of cold weather and hot weather concreting are those outlined in ACI 306 and ACI 305, respectively.

5.12.1. The Owner requires, as a part of this Contract, that the Contractor assure and guarantee that the installation of the foundations be complete and cured a minimum of two (2) weeks on or before expected delivery of the abovementioned equipment. The Owner expects to incur significant demurrage/handling charges if the foundations are not ready in time. In the event that the foundations are not ready, cured, and available to set the transformer equipment directly on the foundation at the time of delivery, the Contractor shall be responsible for all costs of providing temporary storage, cribbing, offloading the equipment onto temporary cribbing, then relocating the equipment onto the foundation once the foundations have cured for two (2) weeks and/or meets the minimum concrete strength requirements. The Contractor shall also pay any demurrage, handling, or manufacturer field service charges incurred by the Owner as a result of failure to have the foundation or site ready to accept the equipment.

5.13. TESTING

5.13.1. Testing Laboratory: The Contractor shall, at his expense, employ an approved independent laboratory to prepare cylinders and perform all concrete testing. Two (2) copies of all test reports shall be submitted to the Engineer.

5.13.2. Tests: Each truckload or partial truckload of concrete shall be tested for air content, slump and compressive strength.

A. Air Content: Tests for air content shall be made in accordance with ASTM C 173 or ASTM C 231.

B. Slump: Tests for slump shall be made in accordance with ASTM C 143.

C. Compressive Strength: For each compressive test, one set of four (4) cylinders shall be made. Test cylinders shall be prepared in accordance with ASTM C 31 and ASTM C 172. One cylinder shall be tested at 7 days, two at 28 days and the fourth held in reserve. The 28-day strength shall be the average of the two cylinders tested. The strength level of the concrete shall be considered satisfactory if the average equals or exceeds the required f'c. Compressive strength tests shall be made in accordance with ASTM C 39.

5.13.3. Core Test: If compressive tests do not conform to the requirements of these specifications, approval may be given by the Engineer for the Contractor to have alternate strength tests made, provided that the concrete satisfies all other requirements of these specifications. Alternate strength tests shall be made on specimens secured from the structure in accordance with ASTM C 42 (Core Test). These alternate tests shall be made at the Contractor's expense. If the concrete does not meet the required specifications, the concrete so represented or the entire structure, if concrete not meeting these specifications is a part thereof, shall be removed and replaced by the Contractor at his expense. In structure elements for which the strength of the concrete is not critical and the structural integrity is not affected, the Engineer may, at his discretion, allow the concrete to remain in place.

5.14. GROUT FOR STRUCTURE FOUNDATIONS

It is the intent of the foundation detail Drawings that all structure foundations be poured true and level to the proper elevation without the use of grout; also, that all structure columns be set plumb without the use of leveling nuts or shims. However, if this cannot be accomplished, the Contractor may use shims and a maximum of 1-1/2" of non-metallic, non-shrinking, premixed, inorganic grout. The grout shall be Masterflow 713 (Master Builders) or F-100 (Sauereisen) or an approved equal. The Contractor shall install the grout in strict accordance with the manufacturer's specifications and/or instructions.

6. DRILLED SHAFTS

6.1. SCOPE

6.1.1. This section presents the general technical provisions and requirements for installation of drilled shaft foundations. For purposes of these specifications, a drilled shaft shall be defined as a foundation element constructed by excavating a circular shaft in the soil which subsequently is filled with concrete, reinforcing steel and anchor bolt cage as required.

6.1.2. It is not the intent of these specifications to unnecessarily restrict the contractor in his construction methods, techniques or equipment. However, methods, techniques or equipment herein specified are considered necessary to provide adequate pier installation. Deviations from these techniques or equipment may be made only if approved by the Owner and Engineer in advance. All work shall be done and completed in an acceptable manner in accordance with best modern practices for construction of drilled pier foundations, notwithstanding any omissions from the specifications or Drawings.

6.2. PERSONNEL REQUIREMENTS

6.2.1. Qualifications of the Contractor

A. The Contractor shall be experienced in the construction and load testing of drilled shafts.

B. On-site supervisors shall have a minimum of four (4) years experience in supervising construction of drilled shaft foundations of similar size (diameter and depth) and difficulty to those shown on the Drawings. The work experience shall be direct supervisory responsibility for the on-site drilled shaft construction operations. Project management level positions indirectly supervising on -site drilled shaft construction operations are not acceptable for this experience requirement.

C. Drill rig operators shall have a minimum of two years experience in construction of drilled shaft foundations and drilling in similar subsurface conditions.

6.3. SUBMITTALS

6.3.1. Pre-Construction Submittals

A. Personnel list identifying the Contractor's project manager, drill rig operator, and job site supervisor to be assigned to the project. The personnel list shall contain a summary of each individual's experience and be sufficiently complete for the Engineer to evaluate the qualifications of the individuals.

B. Drilled Shaft Installation Plan

1. Description of overall construction operation sequence and the sequence of drilled shaft construction when in groups or lines.

2. A list, description, and capabilities of proposed equipment, including cranes, drills, augers, casing, bailing buckets, final cleaning equipment, and drilling units. The narrative shall describe why the equipment was selected and its' suitability to the anticipated site and subsurface conditions.

3. Details and procedures for protecting existing structures and utilities during drilled shaft installation.

4. Details of drilled shaft excavation methods, including proposed drilling methods, methods for cleanout of the bottom of the excavation, and a disposal plan for excavated material and slurry (if applicable).

5. Details of the method(s) to be used to ensure drilled shaft hole stability (i.e. prevention of caving, bottom heave, etc., using temporary casing, slurry, or other means) during excavation and concrete placement. The details shall include a review of method suitability to the anticipated site and subsurface geotechnical conditions.

6. Detailed procedures for mixing, using, maintaining, and disposing of slurry, if used. A detailed mix design (including all additives and their specific purpose in the mix design), and a discussion of its suitability to the anticipated subsurface geotechnical conditions, shall also be provided for the proposed

slurry. The submittal shall include a slurry quality control plan, including tests to be performed, test methods to be used, and the minimum and/or maximum property methods which must be met to ensure that the slurry functions as intended, considering the anticipated subsurface conditions and shaft construction methods, in accordance with the slurry manufacturer's recommendations. As a minimum, the slurry quality control plan shall include the following tests: Density, Viscosity, pH, Sand Content.

7. Details of reinforcement placement including the type and location of all splices, reinforcement cage supports and centralization methods, type and location of all instrumentation, and procedures for lifting and setting the reinforcement cage.

8. When casings are proposed or required, casing dimensions and detailed procedures for permanent casing installation, temporary casing installation and removal, and methods of advancing the casing, along with means to be utilized for excavating the drilled shaft hole shall be provided.

9. Details of concrete placement, including proposed equipment and procedures for delivering concrete to the drilled shaft, placement of the concrete into the shaft, including initial placement and the raising of the tremie or pump line during placement, size of tremie and pump lines, and operational procedures for pumping.

10. Concrete mix designs (Note: Provide revised mix design when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments).

11. Methods and materials to be used to fill or eliminate all voids below the top of the shaft between the plan shaft diameter and the excavated shaft diameter, or between the shaft casing and surrounding soil, if permanent casing is specified.

C. Sample drilled shaft inspection logs.

6.3.2. Construction Submittals

A. Mix design and strength-test data certification from concrete supplier.

B. Drilled shaft installation records within one week after completion. Include as-built drilled shaft locations and top elevations.

C. Concrete compression test results within 24 hours of each test.

6.4. PERFORMANCE REQUIREMENTS

6.4.1. Perform all work in compliance with OSHA Standards and other State and local codes and standards and the Owner's site safety requirements.

6.4.2. Perform all work within the schedule established by the Owner.

6.4.3. The contractor shall supply a drilling rig capable of providing sufficient down pressure and torque to drill down to the required length through the site subsurface conditions. The drill rig shall have the capability of drilling at least 20% deeper than the longest shaft length indicated on the Drawings.

6.4.4. Allowable Tolerances

A. The centerline of all drilled shafts shall not be more than three (3") inches from the indicated plan position.

B. Drilled shafts in soil shall not be out of plumb more than 1.0 percent of the shaft length.

C. The minimum diameter of the drilled shaft shall not be less than that specified for its entire length.

D. Top elevation of the concrete shall be within minus 3.0 inches to plus 1.0 inches of that shown on the Drawings.

E. The reinforcing cage shall be concentric with the drilled shaft excavation within a tolerance of 1-1/2 inches.

F. The reinforcing bars shall be no higher than 6.0 inches above or 3.0 inches below the plan elevation.

If these tolerances are exceeded, proper additional construction (including costs of engineering and redesign) as required by the Engineer shall be provided without additional cost to the Owner.

6.5. MATERIALS

6.5.1. Reinforcing Materials

A. Reinforcing materials shall conform to the Concrete section of this specification.

6.5.2. Concrete Materials

A. Concrete materials shall conform to the Concrete section of this specification.

6.5.3. Steel Casing

A. All casing shall be watertight and clean prior to placement in the excavation.

B. Temporary steel casing shall be in accordance with ACI 336.1. Casing shall be of ample strength to resist damage and deformation from transportation and handling, installation stresses, and all pressures and forces acting on the casing. The casing shall be capable of being removed without deforming and causing damage to the completed shaft, and without disturbing the surrounding soil. The outside diameter shall not be less than the specified diameter of the shaft.

C. Permanent casing shall be of steel conforming to ASTM A 36 or ASTM A 252 Grade 2 unless otherwise approved by the Engineer. All permanent casing shall be of ample strength to resist damage and deformation from transportation and handling, installation stresses, and all pressures and forces acting on the casing.

6.5.4. Slurry

A. Slurry shall consist of polymers with a history of successful use in drilled shaft construction, mixed with potable water to form a stable colloidal suspension; complying with ACI 336.1 for density, viscosity, and pH. Mineral slurry consisting of pulverized sodium bentonite or pulverized attapulgite shall only be used upon Engineer's approval.

6.6. INSTALLATION PREPARATION

6.6.1. Drilled shafts shall be installed at locations that are precisely established at the site and with the diameters and to the depths shown on the Drawings.

6.6.2. Drilled shaft excavations shall not be left open overnight unless cased full depth or otherwise protected against sidewall instability. The use of slurry to protect a drilled shaft during a drilling stoppage or overnight shall be approved by the Engineer.

6.6.3. The Contractor bears full responsibility for selection and execution of the method(s) of stabilizing and maintaining the drilled shaft excavation. The walls and bottom of the drilled shaft excavation shall be protected so that side wall caving and bottom heave are prevented from occurring, and so that the soil adjacent to the drilled shaft is not disturbed. The Contractor may excavate the drilled shaft without excavation protection provided the Contractor can demonstrate that the soil is stable and above the water table and zones of seepage. Acceptable protection methods include the use of casing, drilling slurry, or both.

6.6.4. Remove known obstructions encountered during drilling using approved method(s) only. Stop drilling immediately when an unknown obstruction is encountered and obtain further direction from the Engineer.

6.6.5. No drilled shaft excavation or casing installation shall be performed within a clear distance of three diameters of a completed drilled shaft until at least 24 hours after concrete placement, and only when the concrete has reached a minimum compressive strength of 1800 psi.

6.6.6. Cover adequately drilled shaft holes remaining open overnight for protection against accidental fall of personnel or objects into the hole.

6.7. TEMPORARY CASINGS

6.7.1. The Contractor shall select the size and wall thickness of temporary steel casing, if used.

6.7.2. Temporary casings will be required at locations where the soil will not stand without support, or where, because of ground water conditions, sloughing of the sides of the piers may seriously delay or endanger the satisfactory

completion of excavation and placement of concrete. The Contractor shall have immediately available for use on the job an ample supply of casings for each size which may be required and shall provide additional amounts, if required, to ensure orderly progress of the work. The casings shall be of such strength and rigidity as to maintain the required excavation lines and to resist crushing due to hydrostatic and/or earth pressure. All temporary casings shall be removed as concrete is placed or immediately thereafter, and in such a manner as to prevent sloughing material from dropping to the bottoms of the piers or falling on top of freshly placed concrete.

6.8. PERMANENT CASINGS

6.8.1. When piers penetrate very soft strata, the contractor may use corrugated metal pipe as forms to maintain the shape of the pier through these layers. The inside diameter of the casing shall be at least the nominal shaft diameter. Insertion into the excavated hole shall not unduly disturb side walls. When such casings are utilized, they shall not be removed, but shall remain in place.

6.9. DRILLED SHAFT EXCAVATION

6.9.1. The Contractor shall use an appropriate means such as a cleanout bucket, air lift, or hydraulic pump to clean the bottom of all drilled shafts.

6.9.2. The excavated drilled shaft shall be inspected and approved prior to proceeding with construction.

6.9.3. The bottom of the excavated drilled shaft shall be sounded with an airlift pipe, a weighted tape, a borehole camera with visual sediment depth measuring gauge, or other means acceptable to the Engineer, to determine if the bottom of the shaft is acceptable.

6.9.4. In soil shafts, the base of the drilled shaft shall be covered by no more than three inches of sediment or loose or disturbed material, just prior to placing concrete.

6.9.5. Excavated materials shall be disposed of in an area designated by the Owner.

6.9.6. At the end of drilling, clean bottom of drilled shaft excavation of all loose or soft material and in such a manner that bottom is horizontal.

6.10. SLURRY INSTALLATION, SAMPLING, AND TESTING

6.10.1. When slurry is used to maintain a stable excavation, the slurry level in the excavation shall be maintained to obtain hydrostatic equilibrium throughout the construction operation at a height required to provide and maintain a stable hole, but not less than 5 feet above the water table. The Contractor shall clean, re-circulate, de-sand, or replace the slurry, as needed, in order to maintain the required slurry properties.

6.10.2. Mineral or polymer slurry shall be mixed and thoroughly hydrated.

6.10.3. The Contractor shall draw sample sets from the slurry and test the samples for conformance with the appropriate specified material properties before beginning slurry placement in the drilled hole.

A. A sample set shall be composed of samples taken at mid-height and within two feet of the bottom of the storage area.

B. Sample sets shall be taken and tested a minimum of every four hours during each shift and immediately prior to placing concrete.

6.10.4. The Contractor shall sample and test all slurry in the presence of the Owner, unless otherwise approved.

A. The date, time, names of persons sampling and testing the slurry, and the results of the tests shall be recorded.

B. A copy of the recorded slurry test results shall be submitted to the Engineer at the completion of each drilled shaft.

6.11. STEEL REINFORCEMENT

6.11.1. Prior to and during fabrication of the steel reinforcing cage, the reinforcing bars shall be supported off the ground surface, and shall be protected from contamination with mud and other deleterious materials.

6.11.2. Do not place reinforcement in a drilled shaft until the excavation is inspected.

6.11.3. The reinforcement cage shall be completely assembled prior to drilling and be ready for adjustment in length as required by the conditions encountered.

6.11.4. The cage shall be lifted using multiple point sling straps or other approved methods to avoid cage distortion or over-stress.

6.11.5. The steel reinforcement cages shall be centered within the drilled shaft and secured to prevent lateral and vertical movement during concrete placement. The Contractor shall attach suitable cage centralizers and attach reinforcement boots to ensure proper cage alignment and clearance for the entire shaft. Centralizers and reinforcement boots shall be placed in accordance with manufacturer's recommendations.

6.12. CONCRETE PLACEMENT

6.12.1. Place concrete in the drilled shaft hole as soon as possible after completion of drilling, preferably on same working day.

6.12.2. The elapsed time for concrete placement shall not exceed the time limit defined in the Concrete section of this specification.

6.12.3. Temporary steel casings, if used, shall be withdrawn as the concrete is placed. A minimum five-foot head of concrete above the bottom of the casing shall be maintained during the casing withdrawal to prevent necking of the drilled shaft and to ensure that no extraneous material enters the drilled shaft concrete.

6.12.4. Concrete shall be placed through a tremie pipe that extends to the bottom of the drilled shaft. The pipe shall have a minimum inside diameter of ten inches and shall be initially plugged with a traveling or bottom plug that will prevent water from mixing with concrete within the tremie pipe. The pipe shall be watertight and shall not be constructed of aluminum. The tip of the pipe shall be maintained at least five feet in the concrete during placement.

6.12.5. The concrete shall be required to overflow the top of the drilled shaft until concrete of the proper consistency is observed. The excess concrete shall be removed to within the allowable tolerances for top of drilled shaft elevation.

6.12.6. When mineral drilling slurries are used, the following additional requirements shall apply:

A. When holes cannot be kept free of groundwater, concrete shall be placed by the use of a tremie pipe. The diameter of the tremie pipe should be as large as possible, but not greater than 1/3 the diameter of the shaft being poured. Drilled shafts less than thirty (30) feet deep may be poured with either a bottom sealed or traveling plug tremie. The traveling plug must be sufficiently tight so as to prevent the mixing of the drill fluid and concrete. The reinforcing steel cage shall be in place before any concrete is placed in the tremie. With the tremie on the bottom of the shaft, the tube shall be filled to the top extending above the ground. The filled tremie shall be picked up approximately one (1) foot off the bottom of the shaft to allow the weight of the concrete to displace the seal at the bottom of the tremie.

B. During this initial pouring operation, the tremie is not to be pulled to such a height so as to clear the surface of the concrete already placed in the shaft. All concrete shall be poured through the now open tremie, with care taken to maintain a sufficient head of concrete to completely displace all drilling mud and suspended cuttings of material and to provide sufficient pressure so as to prevent reduction in pier diameter by earth pressure on the fresh concrete. The concrete in each pier shall be overpoured sufficiently to assure that clean, uncontaminated concrete is present at the top of the shaft.

C. During concrete pouring operations through the tremie, should the surface of the concrete in the pier be breached by the tremie, the tremie tube shall immediately be withdrawn from the hole, resealed and inserted below the surface of the concrete and pouring operations resumed. It may be necessary during large pours to replace the original long tremie with a shorter one. The replacement tremie should be sealed and inserted at least one hole diameter. Should the Engineer deem it necessary, when a breach occurs (and contamination is suspected), the Contractor shall retrieve the reinforcing steel cage, re-drill the shaft to reopen the hole, and begin the concreting operations from the bottom of the pier shaft.

D. Temporary casings shall be withdrawn as the concrete is deposited. A sufficient head of concrete shall be maintained to insure that no extraneous material enters the concrete and that necking has not occurred. An initial jerk of 2 to 4 inches will be permitted to start the lift; thereafter, while being removed from the pier hole, the casing must be kept plumb and must be pulled with a smooth vertical motion, without jerks.

E. The concrete along the full length of the anchor bolts shall be vibrated if the Engineer so directs.

F. Under certain circumstances, construction joints in pier shafts may be permitted. Prior approval must be obtained from the Engineer. Any such construction must be accomplished under dewatered conditions using approved ACI procedures, and must be properly recorded in the drilled pier report.

G. Concrete shall be placed within 30 hours of the start of drilling and within 12 hours of the last 5 feet of drilling. If greater time elapses, then the mud cake buildup on the sides of the shaft shall be removed by using an approved sidewall cleaning tool as required.

H. Drilling slurry that has been contaminated by concrete during the tremie operation shall be disposed of as directed by the Owner.

I. Drilling slurries displaced by the concrete shall be pumped into onsite storage tanks and disposed of off-site, unless otherwise directed by the Owner, when no longer needed.

6.12.7. Perform concrete testing in accordance with the Concrete Testing section.

6.13. CHECKING COMPLETED PIERS

6.13.1. If the engineer has reason to suspect that the concrete was breached by the tremie, or that the pier, for any other reason, may contain extraneous material or otherwise fail the specifications, he may order the pier cored for inspection and/or testing. If the core recovery and/or test results indicate non-compliance with the specifications, the Contractor shall bear the expense of the investigation and/or testing and shall also, at no cost to the Owner, install proper additional construction as required by the Owner. Should the investigation and/or testing indicate compliance with the specifications, the Owner shall bear the cost of such investigation and/or testing.

6.14. REPORTS

6.14.1. A record of each drilled shaft installed shall be made by the Contractor as the activities are being performed and will be the official log for the Contract and shall contain, at a minimum, the following:

A. Location and number of drilled shaft.

B. Driller/Contractor names.

C. Drilling method/equipment used.

D. Elevations of the following:

1. Ground surface.

2. Top and bottom of casing.

3. Water or drilling slurry in casing prior to concrete placement.

E. Concrete placement method.

F. Date and time drilled.

G. Date and time inspected and approved.

H. Date and time concrete placed.

I. Date and time final survey data attained.

J. Hole diameter.

K. Diameter and wall thickness of casing.

L. Size, length, and position of reinforcing steel.

M. Plumbness of shaft.

N. Total volume of concrete and volume of concrete placed compared to theoretical concrete volume versus depth.

O. Concrete slump and strength.

P. Groundwater level and soils encountered during drilling.

Q. Sequential installation log including description of any problems or delays.

R. Top and bottom elevations of obstructions encountered.

S. Drilling slurry test results, if applicable.

T. Other relevant information.

6.15. ACCEPTANCE

6.15.1. The Engineer will determine final acceptance of each drilled shaft based on the test results and analysis for the tested shafts and a review of the visual inspection reports for the subject drilled shaft, and will provide a response to the Contractor within three working days after receiving the test results and analysis submitted.

6.15.2. If the Engineer determines that the concrete for a given drilled shaft is structurally inadequate, the drilled shaft will be rejected, and placement of concrete shall be suspended until the Contractor submits to the Engineer written changes to the methods of drilled shaft construction needed to prevent future structurally inadequate drilled shafts, and receives the Engineer's written approval of the submittal.

6.15.3. If the Engineer determines that additional investigation is necessary, or if the Contractor requests, the Engineer may direct additional testing be performed.

A. At the Engineer's request, the Contractor shall drill a core hole in any drilled shaft of questionable quality.

B. The number, locations, diameter, and depth of the core holes and the lengths of the core runs shall be determined by the Engineer.

C. Coring procedures shall minimize abrasion and erosion of the core samples, and avoid damage to the steel reinforcement.

D. Descriptions of inclusions and voids in cored holes shall be logged and a copy of the log shall be submitted to the Engineer.

E. Recovered core shall be preserved in suitably labeled wood core boxes, identified as to location and depth, and made available to the Engineer for review.

F. The Engineer may direct water pressure testing in the core holes, and/or unconfined compression testing or other laboratory testing on selected samples from the concrete core.

7. STEEL AND EQUIPMENT ERECTION

7.1. HANDLING, STORAGE, AND PROTECTION

7.1.1. Store all materials on platforms, skids, or other supports for protection against water, mud, or other deleterious materials on ground.

7.1.2. Clean surfaces of structural steel shapes and plates contaminated with earth, mud, or other foreign elements during storage prior to erection.

7.1.3. Handle in a manner to minimize damage of primer or steel shapes.

7.2. QUALITY CONTROL

7.2.1. The erector is solely responsible for the quality control of all the erector-supplied materials, installations, and workmanship.

7.2.2. Provide a written Quality Control Program and Inspection Procedures document indicating how compliance with the requirements of this Practice and the shop and erection drawings will be achieved. Maintain a complete up-to-date set of erection drawings at the jobsite.

7.2.3. Provide all inspection tools and inspection access facilities such as platforms, ladders, and scaffolds (per ANSI/ASSE A10.8) as requested by the Owner's inspector.

7.2.4. Maintain and make available inspection tools and tool calibration records for examination by the Owner's inspector.

7.2.5. Inspector Responsibilities

A. Inspect all materials, installations, and workmanship of the erector to ensure conformance with all requirements of this Practice and the contract documents.

B. The inspector may inspect all materials, installations, and workmanship supplied by the erector and has unrestricted right of access to the erector's work areas.

C. Reject any improper, inferior, defective, or unsuitable materials, installations, and workmanship of the erector. Repair or replace any rejected materials, installations, and workmanship by the erector in accordance with the Owner's instructions at no cost to the Owner.

7.3. PERFORMANCE REQUIREMENTS

7.3.1. Safety Program

A. Address the safety measures that the erector will use during steel erection work. Comply with the requirements of the contract documents; AISC Steel Construction Manual; AISC Code of Standard Practice for Steel Buildings and Bridges; applicable portions of OSHA 29 CFR Part 1910 and Part 1926; and any other applicable federal, state, or local requirements.

B. Provide a detailed description of how the erector will prevent injury to all personnel affected by the erector's operations. Include an effective system for initial orientation and education in safety and accident prevention, as well as appropriate records to document compliance.

C. Minimum Requirements

1. Fall prevention
2. Ground-level preassembly to minimize elevated erection
3. Hole covers and opening barriers
4. Access control to incomplete areas of erection
5. Lifting plans and hoisting procedures

7.3.2. Assembly Lift Plan

A. The erector is responsible for assuring that all pre-assemblies that are not specifically shown or noted on the design drawings to be pre-assembled before lifting will maintain structural integrity during lifting.

B. Prepare a written assembly lift plan for assemblies larger than 50 feet in one direction, larger than 2,000 square feet in the plan area, greater than 50 tons, or when required by the contract documents. Demonstrate that the proposed lift will be performed safely and that the assemblies being lifted will remain free from distortion or undue bending, and will maintain structural integrity during the lift.

C. The lift plan shall contain:

1. Detailed data on the extent and weight of the lifted assembly
2. Structural calculations that prove structural stability of the assembled components during lifting operations
3. Verification of the capacity capabilities for any cranes utilized in the lift

4. Location and positioning of the cranes and a description of the rigging to be utilized

D. All assembly lift plans shall be stamped by a qualified Professional Engineer licensed to practice at the project location.

E. Review of the assembly lift plan by the Engineer does not relieve the erector of responsibility required for the safe erection and/or lifting of any component, structural assembly, or any other item under the control of the erector.

7.4. ERECTION

7.4.1. Comply with requirements of OSHA 29 CFR Part 1926.

7.4.2. Erection includes correction of minor misfits and a reasonable amount of reaming and cutting. Report immediately and obtain approval for any method of correction prior to correcting error in shop work which prevents proper assembly and fit-up of parts by moderate use of drift pins, reaming, or cutting.

7.4.3. Before commencing work, the erector must check foundations and other connection points to confirm their location, orientation, elevation, and condition.

7.4.4. Report any circumstances that affect progression, performance, or completion of the erector's work activities such as discrepancies between the erection/shop drawings and the delivered steel members, incorrectly fabricated steel members, or incomplete or unacceptable work of other contractors affecting the erector's work to the Owner in writing.

7.4.5. Report any damage caused during erection to the Owner. Complete corrective measures as directed by the Owner at no cost to the Owner.

7.4.6. Provide holes by punching or drilling.

7.4.7. Determine and provide safe temporary shoring and bracing to support construction loads on work, including construction equipment and operation of such equipment.

7.4.8. Exercise precautions to protect and to avoid overload of finished concrete surfaces and/or adjacent work from damage. Store steel members on pads of timber or other cushioning material.

7.4.9. Unless specified otherwise herein or on Drawings, comply with tolerances of AISC Code of Standard Practice, except use Section 5.23 of AWS D1.1 for welded steel members.

A. Column Base Plates: Set and level at specified elevations within tolerance of 1/16 inch.

B. Column Splices: Gap between column milled surfaces of 1/32 inch or less. Pack gaps between 1/32 and 1/4 inch with non-tapered mild steel shims.

7.4.10. Keep loose timbers, metal sheeting, bolt buckets, tools, debris, and temporary scaffolding restrained or removed from work areas. Secure all equipment and materials within the erector's care, custody, and control during the erection operation.

7.4.11. Maintain the job site in a clean and safe condition at all times and properly dispose of, off the premises, all crating, waste materials, and other refuse that has accumulated as a result of the erector's activities under this Practice.

7.4.12. Lift painted structural members with a nonabrasive choker.

7.4.13. Keep a daily record, by piece number, of all material erected.

7.4.14. Plumb, level, and brace the structure before any final bolted connections are made.

7.4.15. Setting Base Plates

A. Clean the top of bearing surfaces and the bottom of base plates. Set and shim column base plates to correct positions, elevations, and locations as shown on the erection drawings. Provide shims or wedges if required. If setting nuts are used, loosen before grouting.

B. Grout of base plates in accordance with the Concrete Section of this specification – Grout for Structure Foundations and other contract documents if this work is included in the erector's contract.

7.4.16. Setting of Direct Embed Structures

A. Contractor shall install the poles by use of an auger having a drill with a minimum diameter of 18 inches larger than the butt diameter of the pole.

B. The Contractor shall dewater each pole location. The residual water shall be captured by a pumping tanker truck as the pole is set. The Contractor shall dispose of the collected water in accordance with all Local, State and Federal requirements.

C. The setting depth of the poles shall be as indicated on the Construction Drawings. The pole shall be marked for the required setting depth, placed in the hole and made plumb.

D. The auguered hole shall be backfilled with FDOT #57 crushed stone backfill. The fill material shall be continuously compacted from the bottom of the hole to the ground line using multiple Long Stemmed Vibrators

7.4.17. Correction of Errors

A. Avoid the use of fit-up bolts and drift pins to bring improperly fabricated members and parts into place (springing). Limit driving of drift pins with such a force as to injure adjacent metal areas.

B. When approved by the Engineer, the erector may enlarge standard holes by 1/16 inch when necessary to make connections resulting from minor misfit. Correct holes in connections that misfit by more than 1/16 inch as directed by the Engineer.

C. Enlarge holes by reaming or drilling only. Flame cutting, burning, gouging, chipping, or drift punching is not permitted.

D. Packing, shimming, filling, or wedging to correct faulty work is not permitted unless approved by the engineer of record.

E. One filler plate up to 1/8-inch thickness may be used as required in spaces between members to be bolted. The Engineer's approval is required for filler plate requirements greater than 1/8 inch.

8. CONCRETE PAVEMENT, CURBS, AND SIDEWALKS

8.1. SUBMITTALS

8.1.1. Mix design for each strength and type of concrete prior to concrete placement. Furnish a complete list of materials including type, brand, source, and amount of cement, fly ash, pozzolan, admixtures, and applicable reference specifications.

8.1.2. Documentation in the form of manufacturer's catalog data describing joint filler, admixtures, curing compounds, fiber reinforcement, and aggregate.

8.2. MATERIALS

8.2.1. Concrete: Concrete shall conform to Subsection 'Concrete' within this Section.

8.2.2. Geotextiles: Geotextiles shall conform to Subsection 'Earthwork' within this Section.

8.3. PLACEMENT

8.3.1. Base Course

A. Provide line and grade stakes for control. Place grade stakes in lanes parallel to centerline of areas to be paved and space for string lining or other control methods.

B. Clean underlying surface of foreign substances and ensure proper compaction and smoothness before placement of course.

C. Recondition, reshape, and recompact areas damaged by freezing, rainfall, or other weather conditions.

D. Mix and place materials to obtain a uniform course.

E. Construct course in one or more layers between 3 and 8 inches in compacted thickness.

F. Compact placed aggregate materials to achieve 98 percent of the maximum density per AASHTO T 180.

G. Compact material inaccessible to rolling equipment by mechanical tamping.

H. Finish surface of the layer by blading and rolling.

I. Blade, roll, and tamp until surface is smooth and free from waves and irregularities.

J. Aerate material excessively moistened by rain during construction.

K. Aerate using blade graders, harrows, or other equipment until the moisture content is that needed to obtain specified density.

L. Place and compact earth at edges of course for at least one foot of the shoulder.

M. Construct course when atmospheric temperature is above 35 degrees F and when weather conditions do not detrimentally affect quality of finished course.

N. When temperature falls below 35 degrees F, protect areas of completed course against freezing.

8.3.2. Preparation

A. Moisten base to minimize absorption of water from fresh concrete

B. Coat surface of catch basins with non-staining mineral oil to prevent bond with concrete.

C. Maintain drainage ditches, gutters, and side drains to drain the subbase during construction.

D. Install Geotextiles as shown on Drawings.

8.3.3. Forms

A. Place and secure forms to correct location, dimension, and profile.

B. Variations:

1. Top face of form: 1/8 inch in 10 feet
2. Lateral: less than 1/4 inch in 10 feet

C. Use forms sufficiently strong to resist pressure of concrete and loads resulting from finishing operations without springing, settling, or losing their shape.

D. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

E. Before placing the concrete, coat the contact surfaces of forms with a non-staining mineral oil, non-staining form coating compound, or two coats of nitro-cellulose lacquer.

F. Check and correct grade elevations and alignment of the forms immediately before placing the concrete.

G. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

H. Clean forms before reuse.

8.3.4. Reinforcement

A. Reinforcement, when placed in concrete, is to be free of mud, oil, scale, or other foreign materials.

B. Reinforcement placing: ACI 301.

C. Interrupt reinforcement at expansion joints.

D. Remove all burrs or projections from the dowel bars.

E. Place dowels or reinforcement to achieve pavement and curb alignment as detailed.

8.3.5. Concrete

A. Concrete installation shall conform to Subsection 'Concrete' within this Specification.

8.3.6. Joints:

A. Place expansion joints as required. Align curb, gutter, and sidewalk joints.

B. Place joint filler between pavement components and building or other appurtenances. Recess top of filler 1/4 inch for sealant placement.

C. Seal joints.

D. Provide sawn joints at 5 foot intervals between curbs and pavement. Saw cut joints 3/16 inch wide 1/3 depth of slab.

8.3.7. Finishing:

A. After surface irregularities have been removed, give the concrete surface a uniformly roughened finish by use of a wire comb or other approved texturing device similar to a wire comb.

B. For median barriers use light broom for finishing. Trowel joint edges.

C. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

8.3.8. Edging:

A. At the time the concrete has attained a degree of hardness suitable for edging, carefully finish slab edges, including edges at formed joints, with an edge having a maximum radius of 1/8 inch.

9. SITE SURFACING

9.1. SYSTEM DESCRIPTION

9.1.1. Refer to the Drawings for the substation surfacing. This section covers asphalt paving and aggregate surfacing. Refer to the Cellular Confinement for Gravel Access Drive section for the gravel access drive description. Refer to the Concrete Pavement, curbs, and sidewalks section for the concrete pavement, curb, and sidewalk description. Refer to the Landscaping section for the permanent and temporary seeding and plant mulch description.

9.2. SUBMITTALS

9.2.1. Provide job-mix formula for all mix types proposed for use on the project. Indicate physical properties of the mix in formulas as shown by tests made by a commercial laboratory approved by the Owner, using materials identical to those to be provided on this project. Furnish a complete list of materials including type, brand, source, quantities of asphalt and aggregate and applicable reference specifications. No changes in the job-mix formula shall be permitted until modified in writing by the Contractor and approved by the Owner. Provide a new job-mix formula for each source change. Job-mix formulas shall include the following:

A. Source and proportions, percent by weight, of each ingredient of the mixture.

B. Correct gradation, the percentages passing each size sieve listed in the specifications for the mixture to be used, for the aggregate and mineral filler from each separate source and from each different size to be used in the mixture and for the composite mixture.

C. Amount of material passing the No. 200 sieve determined by dry sieving.

D. Number of blows of hammer compaction per side of molded specimen.

E. Temperature – viscosity relationship of the asphalt cement.

F. Stability, flow, percent voids in mineral aggregate, percent air voids, unit weight.

G. Asphalt absorption by the aggregate.

H. Effective asphalt content as percent by weight of total mix.

I. Temperature of the mixture immediately upon completion of mixing.

J. Asphalt viscosity grade and/or penetration range.

K. Curves for the wearing courses.

9.2.2. Certificates signed by manufacturers certifying, that paving materials and incidental construction items comply with specification requirements.

9.2.3. Provide aggregate data report including particle size analysis, aggregate color, type, and size.

9.2.4. Manufacturer and product data for geotextiles.

9.2.5. Manufacturer and product data for geogrid.

9.3. MATERIALS

9.3.1. Asphalt Paving:

A. All workmanship, materials, equipment and plant shall be in accordance with the applicable sections of the Florida DOT Standard Specifications for Road and Bridge Construction, Latest Edition, and referred to hereinafter as Standard Specifications.

B. Asphaltic concrete surface shall be SP12.5 asphalt in accordance with Section 334 of the Standard Specifications and as indicated on the Drawings.

1. The asphalt supplier shall be a member of the Asphalt Institute.

C. Prime coat shall be in accordance with the FDOT Standard Specifications for Road and Bridge Construction.

D. Tack coat shall be in accordance with the FDOT Standard Specifications for Road and Bridge Construction.

E. Base course shall consist of an 8-inch thick layer of compacted limerock in accordance with the Standard Specifications and as indicated on the Drawings.

1. Consist of hard, tough, durable, uncoated particles, free of organic matter, clay, or weak, flat, elongated, or decomposed material.

2. Aggregates produced from acid-forming or toxic-forming rock or slag are not acceptable.

F. Geotextile shall be Propex Geotex 2x2HF geotextile (or Engineer approved equal), as indicated on the Drawings.

9.3.2. Aggregate Surfacing:

A. Aggregate surfacing shall be No. 5 blue/gray limestone (natural), as noted on the Drawings, and in accordance with AASHTO M 43 or ASTM D 448 **(Note: Size #57 is not acceptable)**.

1. Aggregate shall be durable and sound gravel or crushed stone, free of lumps or balls of clay or other objectionable matter; and uniform color.

2. Prevent segregation and contamination of aggregate materials during delivery to site and during construction activities.

3. Store sufficient aggregate at the site at all times to permit continuous, uninterrupted aggregate placement.

4. Obtain aggregate from the same source throughout the project.

A representative list of suppliers:

Company	Location	Telephone
Conrad Yelvington	Daytona Beach, FL	(904) 767-5500
Conrad Yelvington	Jacksonville, FL	(904) 358-6740
Vulcan Materials	Birmingham, AL	(205) 877-3086

B. Geogrid shall be Tensar BX-1100 (or Engineer approved equal), as indicated on the Drawings.

C. Geotextile shall be Mirafi 140N (or Engineer approved equal), as indicated on the Drawings.

D. Subbase shall consist of a 4-inch thick compacted layer of A-3 sand in accordance with AASHTO M-145 with less than 5% fines stabilized to LBR 40, and as indicated on the Drawings.

9.4. INSTALLATION

9.4.2. Aggregate Surfacing:

A. Place aggregate surfacing in maximum 8-inch loose lifts and determine compaction on basis of non-movement of material after at least three passes with vibratory plate compactor weighing at least 250 pounds and in accordance with ASTM D 6913 and ASTM D 448.

B. Compacted subbase A-3 sand layer shall be stabilized to LBR 40 and compacted to 98% maximum density per AASHTO T 180.

C. Verify subgrade has been inspected, grades and elevations are correct, and surface is not wet or muddy.

D. Provide line and grade stakes for control.

E. Clean underlying surface of foreign substances and ensure proper compaction and smoothness before aggregate placement.

F. Place materials to obtain a uniform course.

G. Finish surface of the layer by blading and/or rolling to provide a uniform surface within +/- 0.05 feet of design grades as indicated on the Drawings.

H. Construct aggregate when weather conditions are such that are not to detrimentally affect the quality of finished course.

I. Verify that materials have been placed as specified to the lines and grades shown on the Drawings.

J. Tensar BX-1100 geogrid shall be installed per manufacturer's recommendations and as indicated on the Drawings.

K. Mirafi 140N geotextile shall be installed without wrinkles, per the manufacturer's recommendations, and as indicated on the Drawings.

9.11. RESTORATION

The contractor shall, at his expense, restore any vegetative areas damaged during construction to conditions that existed prior to the project. The contractor shall be required to restore area to proper grade, properly amend soil and install vegetation that matches surrounding and/or pre-existing conditions. Contractor shall water area as necessary to permanently establish new vegetation.