



*Florida Department of Transportation*

RON DESANTIS  
GOVERNOR

605 Suwannee Street  
Tallahassee, FL 32399-0450

KEVIN J. THIBAUT  
SECRETARY

June 18, 2019

Khoa Nguyen  
Director, Office of Technical Services  
Federal Highway Administration  
3500 Financial Plaza, Suite 400  
Tallahassee, Florida 32312

Re: State Specifications Office  
Section: **455**  
Proposed Specification: **4550102DB Structures Foundations.**

Dear Mr. Nguyen:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

The changes are proposed by Juan Castellanos of the State Construction Office to modify the language.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to [stefanie.maxwell@dot.state.fl.us](mailto:stefanie.maxwell@dot.state.fl.us).

If you have any questions relating to this specification change, please call me at 414-4140.

Sincerely,

Signature on file

Stefanie D. Maxwell, P.E.  
Manager, Program Management Office

SM/dt

Attachment

cc: Florida Transportation Builders' Assoc.  
State Construction Engineer

**STRUCTURES FOUNDATIONS (DESIGN BUILD).**

(REV ~~11-5-18~~ ~~4-25-19~~ ~~6-17-19~~) (FA ~~12-17-18~~) (7-19)

SUBARTICLE 455-1.2.1 is deleted and the following substituted:

**455-1.2.1 Abutment (End Bent) Fill:** Place and compact the fill before installing end-bent piling/shafts, except when driving specified test piling in end bents or when the Plans show uncased piles through proprietary retaining wall fills.

When installing piles/shafts or casing prior to placing fill, take necessary precautions to prevent displacement of piles/shafts during placing and compacting fill materials within 15 feet of the piles/shafts or casing. Reference and check the position of the piles/shafts or casing at three approximately equal intervals during construction of the embankment.

Place embankment material in 6 inch ~~loose~~ **compacted** lifts in the 15 foot area around the piles/shafts or casing. Compact embankment material within the 15 foot area adjacent to the piles/shafts or casing to the required density with compaction equipment weighing less than 1,000 pounds. When installing piles/shafts prior to the completion of the surrounding fills, do not cap them until placing the fills as near to final grade as possible, leaving only the necessary working room for construction of the caps.

When shown in the Plans, provide permanent casings installed prior to placement of the fill, for all drilled shafts through mechanically stabilized fills (for example, behind proprietary retaining walls) for shafts installed after fill placement. Install temporary casings through the completed conventional fill when permanent casings are not required.

Provide permanent casings, if required, before the fill is placed extending a sufficient distance into the existing ground to provide stability to the casings during construction of the abutment fill.

SUBARTICLE 455-5.11.4 is deleted and the following substituted:

**455-5.11.4 Set-checks and Pile Redrive:**

1. Set-checks: Set-checks consist of re-driving the pile after certain period of time, typically up to 24 hours. Perform set-checks as required and at the waiting periods shown in the Contract Documents. Provide an engineer's level or other suitable equipment for elevation determinations to determine accurate pile penetration during the set-checks. A pile may be accepted when a set-check shows that it has achieved the minimum required pile bearing and has met all other requirements of this Section.

2. Pile Redrive: Pile redrive consists of re-driving the pile after the following working day from initial driving to determine time effects, to reestablish pile capacity due to pile heave, or for other reasons.

3. Uninstrumented Set-Checks and Uninstrumented Pile Redrive: ~~A pile may be considered to have sufficient bearing resistance when the specified set-check criteria is met through the last 10 to 20 blows of the hammer at the specified minimum stroke and the total penetration is less than six inches with less than 1/4 inches rebound per blow. When the total penetration is greater than six inches or pile rebound exceeds 1/4 inches per blow, Piles may be accepted based on uninstrumented set-checks or uninstrumented pile redrives only when the piles are redriven for at least 24 inches. In these cases,~~ the piles may be considered to have sufficient

bearing resistance when the specified blow count criteria is achieved in accordance with 455-5.11.1 and 455-5.11.2. ~~Set check criteria shall be based on dynamic testing specifically performed at similar penetrations and driving interruption time as the set check criteria is applied. If dynamic test data under these conditions are not available, an instrumented set check or redrive must be performed.~~ Unless practical refusal is obtained as defined in 455-5.11.3, set checks or redrives for piles redriven less than 24 inches must be instrumented for pile acceptance.

4. Instrumented Set-Checks and Instrumented Pile Redrive: Use ~~D~~dynamic load tests using at least 6 hammer blows ~~may be used~~ to determine whether the pile bearing is sufficient. The pile may be considered to have sufficient bearing resistance when dynamic measurements demonstrate the static pile resistance exceeds the required pile resistance for at least one hammer blow and the average static pile resistance during the next five hammer blows exceeds 95% of the required pile resistance. If the pile is advanced farther, the static pile resistance during all subsequent blows must exceed 90% of the required pile resistance.

SUBARTICLE 455-8.9 is deleted and the following substituted:

**455-8.9 Filling Pipe Piles:** Ensure closed-end pipe piles are watertight. The Engineer may reject closed end pipe piles that exhibits water leakage or require pile extraction to investigate integrity defects. When required by the Plans, fill pipe piles with the specified materials. Use clean concrete sands and concrete meeting the requirements of Section 346. Place concrete in open ended pipes containing water using methods in accordance with 455-15.9 with modified tremie and pump line sizes. Concrete may be placed directly into pipes which are dry. Construct and place reinforcement cages in accordance with 455-16, except the minimum number of spacers per level is three. Reinforcement cages may be installed before concrete placement or after concrete placement is completed if proper alignment and position is obtainable.

SUBARTICLE 455-12.10 is deleted and the following substituted:

**455-12.10 Static Load Tests:** Price and payment will be full compensation for all labor, equipment, ~~and materials,~~ and incidentals required to perform this work, including instrumentation, data collection and professional services to prepare the report.

SUBARTICLE 455-15.1.2 is deleted and the following substituted:

**455-15.1.2 Drilled Shaft Installation Plan (DSIP):** At the preconstruction conference or at least 15 days prior to constructing the first drilled shaft, submit a Drilled Shaft Installation Plan (DSIP) for review and acceptance by the Engineer. The DSIP will be used to govern all drilled shaft construction activities. In the event that deviations from the DSIP are observed, the Engineer may perform Independent Verification Testing/Review of the Contractor's equipment, procedures and personnel at any time during production drilled shaft construction. If, as determined by the Engineer, drilled shaft construction equipment, procedures or personnel is deemed inadequate to consistently provide drilled shafts meeting the contract

requirements, the Contractor's DSIP may be withdrawn pending corrective actions. All drilled shaft construction activities shall then cease and not restart until corrective actions have been taken and the DSIP has been re-accepted.

Include in the DSIP the following details:

1. Name and experience record of drilled shaft superintendent or foreman in responsible charge of drilled shaft operations. Ensure the drilled shaft superintendent or foreman in responsible charge of the drilled shaft operations has the experience requirements of 105-8.13 installing drilled shafts of the size and depth shown in the Plans using the following methods:

- a. Wet Method (mineral and polymer slurry),
- b. Casings up to the length shown in the Plans,
- c. Shaft drilling operations on water under conditions as

shown in the Plans.

2. List and size of proposed equipment, including, but not limited to, cranes, drills, augers, bailing buckets, final cleaning equipment, desanding equipment, slurry pumps, core sampling equipment, tremies or concrete pumps, and casings and equipment to install and remove casing.

3. Details of sequence of construction operations and sequence of shaft construction in bents or shaft groups.

4. Details of shaft excavation methods, including casing installation procedures.

5. Details of slurry, including proposed methods to mix, circulate, desand, test methods, and proposed CTQP certified technicians that will perform and document the fluid tests.

6. Details of proposed methods to clean the shaft excavation.

7. Details of shaft reinforcement, including methods to ensure centering/required cover, cage integrity during placement, placement procedures, cage support, and tie downs.

8. Details of concrete placement, including elapsed concrete placement times and proposed operational procedures for concrete tremie or pump, including initial placement, raising during placement, and overfilling of the shaft concrete. Include provisions to ensure proper final shaft cutoff elevation.

9. Details of casing removal when removal is required, including minimum concrete head in casing during removal.

10. Required submittals, including shop drawing and concrete design mixes.

11. Details of any required load tests, including equipment and procedures, and recent calibrations for any jacks or load cells.

12. Proposed Cross-Hole Sonic Logging (CSL) and Thermal Integrity Testing for Drilled (TITDS) Specialty Engineer to supervise field testing and report the test results.

13. Methods and equipment proposed to prevent displacement of casing and/or shafts during placement and compaction of fill.

14. Provide the make and model of the shaft inspection device, if applicable, and procedures for visual inspection.

15. Details of environmental control procedures used to prevent loss of slurry or concrete into waterways or other protected areas.
16. Proposed schedule for test shaft installation, load tests and production shaft installation.
17. For drilled shafts for constructed using polymer slurry, identify the polymer slurry meeting the requirements of 455-15.8.3, the pH and viscosity ranges recommended by the manufacturer for the materials to be excavated and a description of the mixing method to be used. Submit the Material Safety Data Sheets (SDS) for the product, and a current certifications that the polymer slurry and components meet the requirements of 455-15.8.3. The certification shall be attested to within the past one year by a person having legal authority to bind the manufacturing company. Submit the contact information for the manufacturer's representative available for immediate contact during shaft construction and the representative's schedule of availability.
18. Methods to identify and remediate drilled shaft deficiencies.
19. Names of the CTQP qualified inspectors assigned to inspect the drilled shaft installation.
20. The name and contact information for the single representative of the Contractor, independent of field operations personnel, to resolve to the Engineer's satisfaction, conflicts in the drilled shaft installation procedures. This person shall be available within two hours notice, and shall have the authority to refer issues to higher levels (corporate, if needed).
21. Procedure for grouting non-destructive testing access tubes.
22. A letter from the GFDEOR certifying concurrence with the

DSIP.

#### **455-15.1.2.1 Acceptance of the Drilled Shaft Installation Plan (DSIP).**

The Engineer will evaluate the DSIP for conformance with the Contract Documents. Within five working days, excluding weekends and Department observed holidays, after receipt of the plan, the Engineer will notify the Contractor of any comments and additional information required and/or changes that may be necessary in the opinion of the Engineer to satisfy the Contract Documents. The Engineer will reject any part of the plan that is unacceptable. Submit changes agreed upon for reevaluation. The Engineer will notify the Contractor within two working days, excluding weekends and Department observed holidays, after receipt of proposed changes of their acceptance or rejection. All equipment and procedures are subject to trial and satisfactory performance in the field.

Acceptance by the Engineer does not relieve the Contractor of the responsibility to perform the work in accordance with the Contract Documents. The Engineer's acceptance is not a guarantee that the chosen methods and equipment are capable of obtaining the required results, this responsibility lies with the Contractor.

SUBARTICLE 455-17.6.1.3 is deleted and the following substituted:

**455-17.6.1.3 Required TITDS Reports:** ~~Present~~ Submit the TITDS data and analysis to the Engineer in a signed and sealed report, together with all electronic data, within 48 hours of testing. The report shall include as minimum the following items:

1. Graphs displaying all temperature measurements and average temperature versus depth.

2. Indication of unusual temperatures, including cooler local deviations from the average at any depth from the overall average over the entire length.
3. A graph displaying the average temperature and theoretical temperature versus depth.
4. Variations in temperature between access tubes which may indicate variations in cage alignment.
5. The calculated radius of the shaft throughout the entire depth.
6. Alignment of the reinforcing cage along the shaft.
7. Calculated concrete cover throughout the entire depth.
8. Shaft Details, Probe Details, Environmental Details, Tube Run Selection and Shaft Adjustment Data that show the measurements, inputs and adjustments to the data. Screen captures of these pages from the "TIP Reporter" software will be acceptable.
9. A conclusion stating whether the tested shaft is free from integrity defects and meets the minimum concrete cover and diameter requirements by the specifications. When anomalies are detected, include in the report a three-dimensional rendering of the shape of the shaft.

SUBARTICLES 455-24.7 through 455-24.10 are deleted and the following substituted:

**455-24.7 Load Tests:** Price and payment will include all ~~costs related to the performance of the load test~~ labor, equipment, material and incidentals required to perform this work, including instrumentation, data collection and professional services to prepare the report.

**455-24.8 Instrumentation and Data Collection:** ~~Price and payment will include all labor, equipment, and materials incidental to the instrumentation and data collection, and, when required, the load test report.~~

**455-24.9 Thermal Integrity Testing for Drilled Shafts and Cross-Hole Sonic Logging:** Price and payment will include all costs related to the performance of the TITDS and CSL testing and incidentals to the thermal integrity and cross-hole sonic tests.

**455-24.10<sup>9</sup> Payment Items:** Payment will be made under:

- Item No. 455- 88- Drilled Shaft - per foot.
- Item No. 455-107- Casing - per foot.
- Item No. 455-111- Core (Shaft Excavation) - per foot.
- Item No. 455-119- Test Loads - each.
- Item No. 455-122- Unclassified Shaft Excavation - per foot.
- ~~Item No. 455-129- Instrumentation and Data Collection - lump sum.~~
- Item No. 455-147- Thermal Integrity Testing for Drilled Shafts - each.

ARTICLE 455-40 is deleted and the following substituted:

**455-40 Materials.**

Meet the following material requirements:

- Portland Cement and Blended Cement .....Section 921
- ~~Pozzolans and Slag~~ Supplementary Cementitious Materials Section 929
- Fine Aggregate (Sand)\* .....Section 902
- Admixtures.....Section 924

Water .....	Section 923
Fluidifier** .....	ASTM C 937
Reinforcing Steel.....	Section 415

- \* The Engineer will only permit Silica Sand except as provided in 902-5.2.3.
- \*\* The fluidifier shall not contain chlorides

ARTICLE 455-41 is deleted and the following substituted:

#### 455-41 Grout Mix Proportions.

Use a ~~cement~~ grout mix consisting of a mixture of cementitious materials, admixtures, sand and water. ~~p~~Proportioned and mixed to produce a grout capable of maintaining the solids in suspension without appreciable bleed water which may be pumped without difficulty and will fill open voids in the adjacent soils and rock. The grout mix may ~~also~~ include a fluidifier ~~if desired.~~ Add the fluidifier without exceeding the speed of application, dosage, or any other limits contained used in accordance with the manufacturer's technical data sheet representative. Proportion these materials to produce a hardened grout of the required strength.

ARTICLE 455-43 is deleted and the following substituted:

#### 455-43 Testing Cement Grout.

Prepare three 4 inches x 8 inches cylinders for each LOT in accordance with ASTM C31, except pour grout in a single lift into cylinders molds without rodding ~~for each LOT~~. Plastic properties in accordance with ASTM C31 are not required. A LOT is defined as the lesser of 50 cubic yards of cement grout placed or one day of pile placement. Prepare ~~one two~~ additional QC "hold" cylinders on the ~~lot that is~~ LOT selected by the Engineer for Verification. Provide curing facilities for all QC and Verification test cylinders in accordance with ASTM C31. Test the cylinders at 28 days, in accordance with ASTM C39.

When one of the three QC cylinders from a LOT is lost, missing, damaged or destroyed, determination of compressive strength will be made by averaging the remaining two cylinders. If more than one QC cylinder from a LOT is lost, missing, damaged or destroyed, core the structure at no additional expense to the Department to determine the compressive strength. Acceptance of LOT may be based on verification data at the discretion of the Engineer. Obtain the approval of the Engineer to core, and of the core location prior to coring. Repair core holes after samples are taken with a product meeting the approval of the Engineer, at no additional cost to the Department.

For each QC cylinder that is lost, missing, damaged or destroyed, payment for that LOT will be reduced by \$750.00 per 1,000 psi of the specified design strength [Example: For  $f'_c=5,500$  psi, and the loss of two auger cast pile grout QC cylinders that have no verification data will require the element to be cored and a pay reduction will be assessed  $(5,500 \text{ psi} / 1,000 \text{ psi}) \times \$750 \times 2 = \$8,250$ ]. This reduction will be in addition to any pay adjustment for low strength.

The Engineer will ~~also~~ cast three verification cylinders and ~~one two~~ "hold" cylinders from one of every four consecutive lots, randomly selected. The Engineer will compare QC and

Verification results in accordance with Section 346. If the results do not compare, the Engineer will initiate a Resolution Investigation in accordance with Section 346.

Personnel making/curing grout cylinders shall be certified as ACI Concrete Field Testing Technician Grade I. Personnel performing tests on hardened properties of grout, such as strength determination of cylinders or beams, shall be certified as ACI Concrete Strength Testing Technician.

All low strength cement grout accepted by the Engineer will be subject to reduced payment as follows: \$0.80 per cubic yard for each 10 psi of strength test value below the specified minimum strength. The Engineer will use the average compressive strength of the LOT tests for the computation of this pay reduction.

The Engineer will compute the volume of grout for which the reduction will be applied as 115% of the theoretical volume of the auger cast pile diameter required in the Contract Documents. Reduction in pay will be applied to the entire length of all piles containing low strength cement grout, in any quantity. The quantity of cement grout affected by the payment reduction may exceed the quantity of cement grout contained in the LOT.

When a cement grout acceptance strength test falls more than 500 psi below the specified minimum strength, perform one of the following:

1. Remove and replace the piles affected fully or partially by the low strength LOT at no additional cost to the Department, or
2. Submit a structural analysis performed by the Contractor's Engineer of Record. If the results of the analysis, approved by the Department, indicate adequate strength to serve the intended purpose with adequate durability, the concrete may remain in place.

Otherwise, abandon and install additional piles to the foundation, or remove and replace the piles affected fully or partially by the low strength LOT of grout at no additional cost to the Department. When installing additional piles to resolve the strength deficiency, submit a foundation redesign to add piles into pile caps or footings, at no expense to the Department in accordance with 455-46.

ARTICLE 455-47 is deleted and the following substituted:

**455-47 Auger Cast Pile Installation Plan (ACPIP).**

No later than 15 days before ACP construction begins, submit the ACP/IP for acceptance by the Engineer. The ACP/IP shall govern all ACP construction activities. In the event that deviations from this installation plan are observed, the Department may perform Independent Verification Testing/Review of the Contractor's equipment, procedures, personnel and ACP construction at any time during ACP construction. If, as determined by the Department, construction equipment, procedures and/or personnel is deemed inadequate to consistently provide auger cast piles meeting the contract requirements, the Contractor's ACP/IP acceptance may be withdrawn pending corrective actions. All ACP construction activities shall then cease and not restart until corrective actions have been taken and the ACP/IP has been re-accepted.

Provide the following detailed information on the ACP/IP:

1. Name and experience record of ACP superintendent or foreman in responsible charge of ACP operations. Place a person in responsible charge of day to day ACP operations meeting the experience requirements of 105-8.13 constructing ACP similar to those described in the Contract Documents. The Engineer will give final acceptance subject to satisfactory performance in the field.



2. List and size of the proposed equipment, including cranes, augers, concrete pumps, mixing equipment etc., ~~including details of proposed pump calibration procedures.~~
3. Details of grout mixing procedures and proposed pump calibration procedures.
4. Details of pile installation methods.
45. Details of reinforcement placement and method of centering in pile, including details of all temporary supports for reinforcement, anchor bolts, precast columns, etc.
56. Details of how and by whom the grout volumes will be determined, monitored and documented.
67. Required submittals, including shop drawings and cement grout design mixes.
78. Equipment and procedures for visual inspection, and any methods to identify and remediate auger cast pile deficiencies.
89. Name of the inspectors assigned to monitor the installation of the auger cast piles, including evidence of the inspectors having taken and passed the CTQP computer based training course for auger cast piles.
910. Other information requested by the Engineer.
101. A letter from the GFDEOR certifying concurrence with the ACPIP.

The Engineer will evaluate the ACPIP for conformance with the Contract Documents. Within five working days after receipt of the plan, excluding weekends and Department observed holidays, the Engineer will notify the Contractor of any comments and additional information required and/or changes that may be necessary to satisfy the Contract Documents. The Engineer will reject any part of the plan that is unacceptable. Submit changes agreed upon for reevaluation. The Engineer will notify the Contractor within two working days, excluding weekends and Department observed holidays, after receipt of proposed changes of their acceptance or rejection. All equipment and procedures are subject to trial and satisfactory performance in the field. Acceptance by the Engineer does not relieve the Contractor of the responsibility to perform the work in accordance with the Contract Documents. The Engineer's acceptance is not a guarantee that the chosen methods and equipment are capable of obtaining the required results, this responsibility lies with the Contractor.

**STRUCTURES FOUNDATIONS (DESIGN BUILD).**  
**(REV 6-17-19)**

SUBARTICLE 455-1.2.1 is deleted and the following substituted:

**455-1.2.1 Abutment (End Bent) Fill:** Place and compact the fill before installing end-bent piling/shafts, except when driving specified test piling in end bents or when the Plans show uncased piles through proprietary retaining wall fills.

When installing piles/shafts or casing prior to placing fill, take necessary precautions to prevent displacement of piles/shafts during placing and compacting fill materials within 15 feet of the piles/shafts or casing. Reference and check the position of the piles/shafts or casing at three approximately equal intervals during construction of the embankment.

Place embankment material in 6 inch compacted lifts in the 15 foot area around the piles/shafts or casing. Compact embankment material within the 15 foot area adjacent to the piles/shafts or casing to the required density with compaction equipment weighing less than 1,000 pounds. When installing piles/shafts prior to the completion of the surrounding fills, do not cap them until placing the fills as near to final grade as possible, leaving only the necessary working room for construction of the caps.

When shown in the Plans, provide permanent casings installed prior to placement of the fill, for all drilled shafts through mechanically stabilized fills (for example, behind proprietary retaining walls) for shafts installed after fill placement. Install temporary casings through the completed conventional fill when permanent casings are not required.

Provide permanent casings, if required, before the fill is placed extending a sufficient distance into the existing ground to provide stability to the casings during construction of the abutment fill.

SUBARTICLE 455-5.11.4 is deleted and the following substituted:

**455-5.11.4 Set-checks and Pile Redrive:**

1. Set-checks: Set-checks consist of re-driving the pile after certain period of time, typically up to 24 hours. Perform set-checks as required and at the waiting periods shown in the Contract Documents. Provide an engineer's level or other suitable equipment for elevation determinations to determine accurate pile penetration during the set-checks. A pile may be accepted when a set-check shows that it has achieved the minimum required pile bearing and has met all other requirements of this Section.

2. Pile Redrive: Pile redrive consists of re-driving the pile after the following working day from initial driving to determine time effects, to reestablish pile capacity due to pile heave, or for other reasons.

3. Uninstrumented Set-Checks and Uninstrumented Pile Redrive: Piles may be accepted based on uninstrumented set-checks or uninstrumented pile redrives only when the piles are redriven for at least 24 inches. In these cases, the piles may be considered to have sufficient bearing resistance when the specified blow count criteria is achieved in accordance with 455-5.11.1 and 455-5.11.2. Unless practical refusal is obtained as defined in 455-5.11.3, set-checks or redrives for piles redriven less than 24 inches must be instrumented for pile acceptance.

4. Instrumented Set-Checks and Instrumented Pile Redrive: Use dynamic load tests using at least 6 hammer blows to determine whether the pile bearing is sufficient. The pile may be considered to have sufficient bearing resistance when dynamic measurements demonstrate the static pile resistance exceeds the required pile resistance for at least one hammer blow and the average static pile resistance during the next five hammer blows exceeds 95% of the required pile resistance. If the pile is advanced farther, the static pile resistance during all subsequent blows must exceed 90% of the required pile resistance.

SUBARTICLE 455-8.9 is deleted and the following substituted:

**455-8.9 Filling Pipe Piles:** Ensure closed-end pipe piles are watertight. When required by the Plans, fill pipe piles with the specified materials. Use clean concrete sands and concrete meeting the requirements of Section 346. Place concrete in open ended pipes containing water using methods in accordance with 455-15.9 with modified tremie and pump line sizes. Concrete may be placed directly into pipes which are dry. Construct and place reinforcement cages in accordance with 455-16, except the minimum number of spacers per level is three. Reinforcement cages may be installed before concrete placement or after concrete placement is completed if proper alignment and position is obtainable.

SUBARTICLE 455-12.10 is deleted and the following substituted:

**455-12.10 Static Load Tests:** Price and payment will be full compensation for all labor, equipment, materials, and incidentals required to perform this work, including instrumentation, data collection and professional services to prepare the report.

SUBARTICLE 455-15.1.2 is deleted and the following substituted:

**455-15.1.2 Drilled Shaft Installation Plan (DSIP):** At the preconstruction conference or at least 15 days prior to constructing the first drilled shaft, submit a Drilled Shaft Installation Plan (DSIP) for review and acceptance by the Engineer. The DSIP will be used to govern all drilled shaft construction activities. In the event that deviations from the DSIP are observed, the Engineer may perform Independent Verification Testing/Review of the Contractor's equipment, procedures and personnel at any time during production drilled shaft construction. If, as determined by the Engineer, drilled shaft construction equipment, procedures or personnel is deemed inadequate to consistently provide drilled shafts meeting the contract requirements, the Contractor's DSIP may be withdrawn pending corrective actions. All drilled shaft construction activities shall then cease and not restart until corrective actions have been taken and the DSIP has been re-accepted.

Include in the DSIP the following details:

1. Name and experience record of drilled shaft superintendent or foreman in responsible charge of drilled shaft operations. Ensure the drilled shaft superintendent or foreman in responsible charge of the drilled shaft operations has the experience requirements of 105-8.13 installing drilled shafts of the size and depth shown in the Plans using the following methods:

- a. Wet Method (mineral and polymer slurry),
  - b. Casings up to the length shown in the Plans,
  - c. Shaft drilling operations on water under conditions as shown in the Plans.
2. List and size of proposed equipment, including, but not limited to, cranes, drills, augers, bailing buckets, final cleaning equipment, desanding equipment, slurry pumps, core sampling equipment, tremies or concrete pumps, and casings and equipment to install and remove casing.
  3. Details of sequence of construction operations and sequence of shaft construction in bents or shaft groups.
  4. Details of shaft excavation methods, including casing installation procedures.
  5. Details of slurry, including proposed methods to mix, circulate, desand, test methods, and proposed CTQP certified technicians that will perform and document the fluid tests.
  6. Details of proposed methods to clean the shaft excavation.
  7. Details of shaft reinforcement, including methods to ensure centering/required cover, cage integrity during placement, placement procedures, cage support, and tie downs.
  8. Details of concrete placement, including elapsed concrete placement times and proposed operational procedures for concrete tremie or pump, including initial placement, raising during placement, and overfilling of the shaft concrete. Include provisions to ensure proper final shaft cutoff elevation.
  9. Details of casing removal when removal is required, including minimum concrete head in casing during removal.
  10. Required submittals, including shop drawing and concrete design mixes.
  11. Details of any required load tests, including equipment and procedures, and recent calibrations for any jacks or load cells.
  12. Proposed Cross-Hole Sonic Logging (CSL) and Thermal Integrity Testing for Drilled (TITDS) Specialty Engineer to supervise field testing and report the test results.
  13. Methods and equipment proposed to prevent displacement of casing and/or shafts during placement and compaction of fill.
  14. Provide the make and model of the shaft inspection device, if applicable, and procedures for visual inspection.
  15. Details of environmental control procedures used to prevent loss of slurry or concrete into waterways or other protected areas.
  16. Proposed schedule for test shaft installation, load tests and production shaft installation.
  17. For drilled shafts for constructed using polymer slurry, identify the polymer slurry meeting the requirements of 455-15.8.3, the pH and viscosity ranges recommended by the manufacturer for the materials to be excavated and a description of the mixing method to be used. Submit the Material Safety Data Sheets (SDS) for the product, and a current certification that the polymer slurry and components meet the requirements of 455-15.8.3. The certification shall be attested to within the past one year by a person having legal

authority to bind the manufacturing company. Submit the contact information for the manufacturer's representative available for immediate contact during shaft construction and the representative's schedule of availability.

18. Methods to identify and remediate drilled shaft deficiencies.
19. Names of the CTQP qualified inspectors assigned to inspect the drilled shaft installation.
20. The name and contact information for the single representative of the Contractor, independent of field operations personnel, to resolve to the Engineer's satisfaction, conflicts in the drilled shaft installation procedures. This person shall be available within two hours notice, and shall have the authority to refer issues to higher levels (corporate, if needed).
21. Procedure for grouting non-destructive testing access tubes.
22. A letter from the GFDEOR certifying concurrence with the

DSIP.

**455-15.1.2.1 Acceptance of the Drilled Shaft Installation Plan (DSIP).**

The Engineer will evaluate the DSIP for conformance with the Contract Documents. Within five working days, excluding weekends and Department observed holidays, after receipt of the plan, the Engineer will notify the Contractor of any comments and additional information required and/or changes that may be necessary in the opinion of the Engineer to satisfy the Contract Documents. The Engineer will reject any part of the plan that is unacceptable. Submit changes agreed upon for reevaluation. The Engineer will notify the Contractor within two working days, excluding weekends and Department observed holidays, after receipt of proposed changes of their acceptance or rejection. All equipment and procedures are subject to trial and satisfactory performance in the field.

Acceptance by the Engineer does not relieve the Contractor of the responsibility to perform the work in accordance with the Contract Documents. The Engineer's acceptance is not a guarantee that the chosen methods and equipment are capable of obtaining the required results, this responsibility lies with the Contractor.

SUBARTICLE 455-17.6.1.3 is deleted and the following substituted:

**455-17.6.1.3 Required TITDS Reports:** Submit the TITDS data and analysis to the Engineer in a signed and sealed report, together with all electronic data, within 48 hours of testing. The report shall include as minimum the following items:

1. Graphs displaying all temperature measurements and average temperature versus depth.
2. Indication of unusual temperatures, including cooler local deviations from the average at any depth from the overall average over the entire length.
3. A graph displaying the average temperature and theoretical temperature versus depth.
4. Variations in temperature between access tubes which may indicate variations in cage alignment.
5. The calculated radius of the shaft throughout the entire depth.
6. Alignment of the reinforcing cage along the shaft.
7. Calculated concrete cover throughout the entire depth.

8. Shaft Details, Probe Details, Environmental Details, Tube Run Selection and Shaft Adjustment Data that show the measurements, inputs and adjustments to the data. Screen captures of these pages from the “TIP Reporter” software will be acceptable.

9. A conclusion stating whether the tested shaft is free from integrity defects and meets the minimum concrete cover and diameter requirements by the specifications. When anomalies are detected, include in the report a three-dimensional rendering of the shape of the shaft.

SUBARTICLES 455-24.7 through 455-24.10 are deleted and the following substituted:

**455-24.7 Load Tests:** Price and payment will include all labor, equipment, material and incidentals required to perform this work, including instrumentation, data collection and professional services to prepare the report.

**455-24.8 Thermal Integrity Testing for Drilled Shafts and Cross-Hole Sonic Logging:** Price and payment will include all costs related to the performance of the TITDS and CSL testing and incidentals to the thermal integrity and cross-hole sonic tests.

**455-24.9 Payment Items:** Payment will be made under:

- Item No. 455- 88- Drilled Shaft - per foot.
- Item No. 455-107- Casing - per foot.
- Item No. 455-111- Core (Shaft Excavation) - per foot.
- Item No. 455-119- Test Loads - each.
- Item No. 455-122- Unclassified Shaft Excavation - per foot.
- Item No. 455-147- Thermal Integrity Testing for Drilled Shafts - each.

ARTICLE 455-40 is deleted and the following substituted:

**455-40 Materials.**

Meet the following material requirements:

- Portland Cement and Blended Cement .....Section 921
- Supplementary Cementitious Materials .....Section 929
- Fine Aggregate (Sand)\* .....Section 902
- Admixtures.....Section 924
- Water .....Section 923
- Fluidifier\*\* .....ASTM C 937
- Reinforcing Steel.....Section 415

\* The Engineer will only permit Silica Sand except as provided in 902-5.2.3.

\*\* The fluidifier shall not contain chlorides

ARTICLE 455-41 is deleted and the following substituted:

**455-41 Grout Mix Proportions.**

Use a grout mix consisting of a mixture of cementitious materials, admixtures, sand and water. Proportion and mix to produce a grout capable of maintaining the solids in suspension

without appreciable bleed water which may be pumped without difficulty and will fill open voids in the adjacent soils and rock. The grout mix may include a fluidifier used in accordance with the manufacturer's technical representative. Proportion these materials to produce a hardened grout of the required strength.

ARTICLE 455-43 is deleted and the following substituted:

**455-43 Testing Cement Grout.**

Prepare three 4 inches x 8 inches cylinders for each LOT in accordance with ASTM C31, except pour grout in a single lift into cylinders molds without rodding. Plastic properties in accordance with ASTM C31 are not required. A LOT is defined as the lesser of 50 cubic yards of cement grout placed or one day of pile placement. Prepare two additional QC "hold" cylinders on the LOT selected by the Engineer for Verification. Provide curing facilities for all QC and Verification test cylinders in accordance with ASTM C31. Test the cylinders at 28 days, in accordance with ASTM C39.

When one of the three QC cylinders from a LOT is lost, missing, damaged or destroyed, determination of compressive strength will be made by averaging the remaining two cylinders. If more than one QC cylinder from a LOT is lost, missing, damaged or destroyed, core the structure at no additional expense to the Department to determine the compressive strength. Acceptance of LOT may be based on verification data at the discretion of the Engineer. Obtain the approval of the Engineer to core, and of the core location prior to coring. Repair core holes after samples are taken with a product meeting the approval of the Engineer, at no additional cost to the Department.

For each QC cylinder that is lost, missing, damaged or destroyed, payment for that LOT will be reduced by \$750.00 per 1,000 psi of the specified design strength [Example: For  $f'_c=5,500$  psi, and the loss of two auger cast pile grout QC cylinders that have no verification data will require the element to be cored and a pay reduction will be assessed  $(5,500 \text{ psi} / 1,000 \text{ psi}) \times \$750 \times 2 = \$8,250$ ]. This reduction will be in addition to any pay adjustment for low strength.

The Engineer will cast three verification cylinders and two "hold" cylinders from one of every four consecutive Lots, randomly selected. The Engineer will compare QC and Verification results in accordance with Section 346. If the results do not compare, the Engineer will initiate a Resolution Investigation in accordance with Section 346.

Personnel making/curing grout cylinders shall be certified as ACI Concrete Field Testing Technician Grade I. Personnel performing tests on hardened properties of grout, such as strength determination of cylinders or beams, shall be certified as ACI Concrete Strength Testing Technician.

All low strength cement grout accepted by the Engineer will be subject to reduced payment as follows: \$0.80 per cubic yard for each 10 psi of strength test value below the specified minimum strength. The Engineer will use the average compressive strength of the LOT tests for the computation of this pay reduction.

The Engineer will compute the volume of grout for which the reduction will be applied as 115% of the theoretical volume of the auger cast pile diameter required in the Contract Documents. Reduction in pay will be applied to the entire length of all piles containing low strength cement grout, in any quantity. The quantity of cement grout affected by the payment reduction may exceed the quantity of cement grout contained in the LOT.

When a cement grout acceptance strength test falls more than 500 psi below the specified minimum strength, perform one of the following:

1. Remove and replace the piles affected fully or partially by the low strength LOT at no additional cost to the Department, or
2. Submit a structural analysis performed by the Contractor's Engineer of Record. If the results of the analysis, approved by the Department, indicate adequate strength to serve the intended purpose with adequate durability, the concrete may remain in place.

Otherwise, abandon and install additional piles to the foundation, or remove and replace the piles affected fully or partially by the low strength LOT of grout at no additional cost to the Department. When installing additional piles to resolve the strength deficiency, submit a foundation redesign to add piles into pile caps or footings, at no expense to the Department in accordance with 455-46.

ARTICLE 455-47 is deleted and the following substituted:

**455-47 Auger Cast Pile Installation Plan (ACPIP).**

No later than 15 days before ACP construction begins, submit the ACPIP for acceptance by the Engineer. The ACPIP shall govern all ACP construction activities. In the event that deviations from this installation plan are observed, the Department may perform Independent Verification Testing/Review of the Contractor's equipment, procedures, personnel and ACP construction at any time during ACP construction. If, as determined by the Department, construction equipment, procedures and/or personnel is deemed inadequate to consistently provide auger cast piles meeting the contract requirements, the Contractor's ACPIP acceptance may be withdrawn pending corrective actions. All ACP construction activities shall then cease and not restart until corrective actions have been taken and the ACPIP has been re-accepted.

Provide the following detailed information on the ACPIP:

1. Name and experience record of ACP superintendent or foreman in responsible charge of ACP operations. Place a person in responsible charge of day to day ACP operations meeting the experience requirements of 105-8.13 constructing ACP similar to those described in the Contract Documents. The Engineer will give final acceptance subject to satisfactory performance in the field.
2. List and size of the proposed equipment, including cranes, augers, concrete pumps, mixing equipment etc.
3. Details of grout mixing procedures and proposed pump calibration procedures.
4. Details of pile installation methods.
5. Details of reinforcement placement and method of centering in pile, including details of all temporary supports for reinforcement, anchor bolts, precast columns, etc.
6. Details of how and by whom the grout volumes will be determined, monitored and documented.
7. Required submittals, including shop drawings and cement grout design mixes.
8. Equipment and procedures for visual inspection, and any methods to identify and remediate auger cast pile deficiencies.
9. Name of the inspectors assigned to monitor the installation of the auger cast piles, including evidence of the inspectors having taken and passed the CTQP computer based training course for auger cast piles.
10. Other information requested by the Engineer.



11. A letter from the GFDEOR certifying concurrence with the ACPIP.

The Engineer will evaluate the ACPIP for conformance with the Contract Documents. Within five working days after receipt of the plan, excluding weekends and Department observed holidays, the Engineer will notify the Contractor of any comments and additional information required and/or changes that may be necessary to satisfy the Contract Documents. The Engineer will reject any part of the plan that is unacceptable. Submit changes agreed upon for reevaluation. The Engineer will notify the Contractor within two working days, excluding weekends and Department observed holidays, after receipt of proposed changes of their acceptance or rejection. All equipment and procedures are subject to trial and satisfactory performance in the field. Acceptance by the Engineer does not relieve the Contractor of the responsibility to perform the work in accordance with the Contract Documents. The Engineer's acceptance is not a guarantee that the chosen methods and equipment are capable of obtaining the required results, this responsibility lies with the Contractor.