Florida Department of Transportation

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GOVERNOR

605 Suwannee Street
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JIM BOXOLD
SECRETARY

April 22, 2015

Khoa Nguyen
Director, Office of Technical Services
Federal Highway Administration
545 John Knox Road, Suite 200
Tallahassee, Florida 32303

Re: State Specifications and Estimates Office
Section **455**
Proposed Specification: **4551501 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 ensure the CSL access tubes in drilled shafts are properly grouted and to ensure SID has proper measuring devices.
Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to SP965DS or daniel.scheer@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 414-4130.

Sincerely,

Signature on file

Daniel Scheer, P.E.
State Specifications Engineer

DS/ot
Attachment
cc: Florida Transportation Builders' Assoc.
State Construction Engineer

STRUCTURES FOUNDATIONS.
(REV 3-*1*6-15)

SUBARTICLE 455-15.1.2 is deleted and the following substituted:

455-15.1.2 Drilled Shaft Installation Plan: At the preconstruction conference submit a drilled shaft installation plan for review by the Engineer. Final approval will be subject to satisfactory performance. Include in this plan 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 a minimum of one year of experience of installing drilled shafts of the size and depth shown in the Plans and a minimum of three years experience in the construction of drilled shafts using the following methods:
    a. Mineral 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 cranes, drills, augers, bailing buckets, final cleaning equipment, desanding equipment, slurry pumps, core sampling equipment, tremies or concrete pumps, casings, etc.
3. Details of sequence of construction operations and sequence of shaft construction in bents or shaft groups.
4. Details of shaft excavation methods.
5. Details of slurry, including proposed methods to mix, circulate, desand, test methods, and proposed testing laboratory to document test results.
6. Details of proposed methods to clean shaft after initial 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. Provide 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) Specialty Engineer to perform, log, analyze, 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.

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. Other information shown in the Plans or requested by the Engineer.

18. For drilled shafts for sign, signal, lighting and ITS structures constructed using polymer slurry, identify the polymer slurry meeting the requirements of 455-15.8.2, 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 (MSDS) for the product, and certifications that the polymer slurry and components meet the requirements of 455-15.8.2. Submit the contact information for the manufacturer's representative available for immediate contact during shaft construction and the representative's schedule of availability.

19. Procedure for grouting CSL access tubes.

The Engineer will evaluate the drilled shaft installation plan for conformance with the Contract Documents. Within 20 days after receipt of the plan, the Engineer will notify the Contractor of any 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 seven days 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 installation plan is for the Contractor to explain the approach to the work and allow the Engineer an opportunity to comment on the equipment and procedures chosen before field operations begin. The Engineers 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 455-15.11.3 is deleted and the following substituted:

455-15.11.3 Shaft Inspection Device (SID): When shown in the Plans, furnish all power and equipment necessary for the Engineer to inspect the bottom conditions of a drilled shaft excavation and to measure the thickness of bottom sediment or any other debris using a SID. Provide a means to position and lower the SID into the shaft excavation to enable the bell housing to rest vertically on the bottom of the excavation. Include all cost related to the inspection device in the cost of drilled shaft items.

Furnish a SID meeting the following requirements:

(a) A remotely operated, high resolution, color video camera sealed inside a watertight bell housing.

(b) Provides a clear view of the bottom inspection on a video monitor at the surface in real time.

(c) Provides a permanent record of the entire inspection with voice annotation on a quality DVD with a resolution of not less than 720 x 480.

(d) Provides a minimum field of vision of 110 square inches, with a*t least two* graduated measuring device*s* to record the depth of sediment on the bottom of the shaft excavation to a minimum accuracy of 1/2 inch and a length greater than 1-1/2 inches.

(e) Provides sufficient lighting to illuminate the entire field of vision at the bottom of the shaft in order for the operator and inspector to clearly see the depth measurement scale on the video monitor and to produce a clear recording of the inspection.

(f) Provides a compressed air or gas system to displace drilling fluids from the bell housing and a pressurized water system to assist in determination of bottom sedimentation depth

Obtain the Engineer's approval of the device in advance of the first inspection contingent on satisfactory field performance. Notify the Engineer for approval before a different device is used for any subsequent inspection.

SUBARTICLE 455-17.6.1 is deleted and the following substituted:

455-17.6.1 Cross-Hole Sonic Logging (CSL) Tests: Perform all CSL testing in accordance with ASTM D6760. Test all drilled shafts in bridge bents or piers considered nonredundant in the Plans, using CSL. For all other drilled shafts, perform CSL testing only on drilled shafts selected by the Engineer. The minimum number of shafts tested is the number of shafts indicated in the Plans. The Engineer may increase the number shafts tested as deemed necessary.

Engage a qualified Specialty Engineer to perform the CSL testing. The qualified CSL Specialty Engineer must have a minimum three years experience of CSL testing and have a Florida Licensed Professional Engineer supervising the collection and interpretation of data. The Contractor shall provide all necessary assistance to the CSL Specialty Engineer to satisfactorily perform the testing.

When a shaft contains four tubes, test every possible tube combination. For shafts with five or more tubes, test all pairs of adjacent tubes around the perimeter, and one-half of the remaining number of tube combinations, as chosen by the Engineer.

After acceptance of production shafts by the Engineer, remove all water from the access tubes or core holes and fill the tubes or core holes with a structural non-shrink grout meeting the requirements of Section 934 *from the bottom ~~to the top~~ via tremie tube*. *Place the grout utilizing enough pressure ~~head~~ to fill the tubes or core holes completely.*

If the Contractor determines at any time during the non-destructive testing and evaluation of the drilled shaft that the drilled shaft should be replaced, no further testing or evaluation of that shaft is required.

455-17.6.1.1 Equipment: Furnish CSL test equipment as follows:

1. Include ultrasonic transmitter and receiver probes for 1.5 inch I.D. pipe which produce measurements with consistent signal strength and arrival time in uniform, good quality concrete with all tube spacings on the project.

2. Include a microprocessor based data acquisition system for display, storage, and transfer of data. Graphically display first pulse Arrival Time (FAT) during data acquisition.

3. Electronically measure and record the relative position (depth) of the probes in the tubes with each CSL signal.

4. Print the CSL logs for report presentation.

5. Provide report quality plots of CSL measurements that identify each individual test.

6. Electronically store each CSL log in digital format, with shaft identification, date, time and test details, including the transmitter and receiver gain.

455-17.6.1.2 Procedure: Perform CSL testing between 72 hours and 25 calendar days of shaft concrete placement and after the concrete compressive strength exceeds 3,000 psi. Furnish information regarding the shaft, tube lengths and depths, construction dates, and other pertinent shaft installation observations and details to the Department at the time of testing. Verify access tube lengths and their condition in the presence of the Department, at least 24 hours prior to CSL testing. If the access tubes do not provide access over the full length of the shaft, repair the existing tube(s) or core additional hole(s), as directed by the Engineer, at no additional cost to the Department.

Pull the probes simultaneously, starting from the bottoms of the tubes, over an electronic depth measuring device. Perform the CSL tests with the source and receiver probes in the same horizontal plane. Continuously record CSL signals at depth intervals of 2.5 inches or less from the bottom of the tubes to the top of each shaft. Remove all slack from the cables prior to pulling to provide accurate depth measurements in the CSL records.

Report any anomalies indicated by longer pulse arrival times and significantly lower amplitude/energy signals to the Engineer and conduct further tests as required to evaluate the extent of possible defects. Conduct offset CSL measurements between all tube pair combinations in any drilled shafts with 30% or greater in velocity reduction. Record offset measurements with source and receiver vertically offset in the tubes. These measurements add four measurements per tube combination to the horizontal measurements described in this section. Offset measurements are described by the angle (in degrees) and direction the signal travels between the probes with respect to the horizontal plane: plus 45, plus 22.5 (source below receiver), and minus 45, minus 22.5 (source above receiver). Record offset measurements from the point where the higher probe is at least 5 feet below the velocity reduction to the point where the lower probe is at least 5 feet above the velocity reduction. Provide offset CSL logs and 3-D tomographic analysis of all CSL data at no additional cost to the Department in the event 30% or greater in velocity reductions are detected.

455-17.6.1.3 Required Reports: Present the CSL testing and analysis results to the Engineer in a report. Include CSL logs with analyses of first pulse arrival time (FAT) versus depth and pulse energy/amplitude versus depth. Present a CSL log for each tube pair tested with any defect zones identified on the logs and discussed in the test report as appropriate. When offset measurements are required, perform 3-D tomographic analysis using all offset data, and include color coded 3-D tomographic images in the report.

455-17.6.1.4 Evaluation of CSL Test Results: The Engineer will evaluate the observations during drilled shaft construction and CSL test results to determine whether or not the drilled shaft construction is acceptable. Drilled shafts with velocity reduction exceeding 30% are not acceptable without an engineering analysis.

455-17.6.1.5 Coring and/or Repair of Drilled Shafts: If the Engineer determines a drilled shaft is unacceptable based on the CSL tests and tomographic analyses, or observes problems during drilled shaft construction, core the shaft to allow further evaluation and repair, or replace the shaft. If coring to allow further evaluation of the shaft and repair is chosen, one or more core samples shall be taken from each unacceptable shaft for full depth of the shaft or to the depth directed by the Engineer. The Engineer will determine the number,

location, and diameter of the cores based on the results of 3-D tomographic analysis of offset and horizontal CSL data. Keep an accurate log of cores. Properly mark and place the cores in a crate showing the shaft depth at each interval of core recovery. Transport the cores, along with five copies of the coring log to the Engineer. Perform strength testing by an AASHTO certified lab on portions of the cores that exhibit questionable concrete as determined by the Engineer. If the drilled shaft offset CSL testing, 3-D tomographic analyses and coring indicate the shaft is defective, propose remedial measures for approval by the Engineer. Such improvement may consist of, but is not limited to correcting defective portions of the shaft, providing straddle shafts to compensate for capacity loss, or providing a replacement shaft. Repair all detected defects and conduct post repair integrity testing using horizontal and offset CSL testing and 3-D tomographic imaging as described in this Section. Engage a Specialty Engineer to perform gamma-gamma density logging to verify the integrity of the shaft outside the reinforcing cage in the same locations offset CSL data was/is required. Submit all results to the Engineer within five days of test completion for approval. Perform all work described in this Section at no additional cost to the Department, and with no increase in Contract Time.

STRUCTURES FOUNDATIONS.
(REV 3-16-15)

SUBARTICLE 455-15.1.2 is deleted and the following substituted:

455-15.1.2 Drilled Shaft Installation Plan: At the preconstruction conference submit a drilled shaft installation plan for review by the Engineer. Final approval will be subject to satisfactory performance. Include in this plan 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 a minimum of one year of experience of installing drilled shafts of the size and depth shown in the Plans and a minimum of three years experience in the construction of drilled shafts using the following methods:

a. Mineral 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 cranes, drills, augers, bailing buckets, final cleaning equipment, desanding equipment, slurry pumps, core sampling equipment, tremies or concrete pumps, casings, etc.

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

4. Details of shaft excavation methods.

5. Details of slurry, including proposed methods to mix, circulate, desand, test methods, and proposed testing laboratory to document test results.

6. Details of proposed methods to clean shaft after initial 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. Provide 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) Specialty Engineer to perform, log, analyze, 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.

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. Other information shown in the Plans or requested by the Engineer.

18. For drilled shafts for sign, signal, lighting and ITS structures constructed using polymer slurry, identify the polymer slurry meeting the requirements of 455-15.8.2, 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 (MSDS) for the product, and certifications that the polymer slurry and components meet the requirements of 455-15.8.2. Submit the contact information for the manufacturer's representative available for immediate contact during shaft construction and the representative's schedule of availability.

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SUBARTICLE 455-15.11.3 is deleted and the following substituted:

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Furnish a SID meeting the following requirements:

(a) A remotely operated, high resolution, color video camera sealed inside a watertight bell housing.

(b) Provides a clear view of the bottom inspection on a video monitor at the surface in real time.

(c) Provides a permanent record of the entire inspection with voice annotation on a quality DVD with a resolution of not less than 720 x 480.

(d) Provides a minimum field of vision of 110 square inches, with at least two graduated measuring devices to record the depth of sediment on the bottom of the shaft excavation to a minimum accuracy of 1/2 inch and a length greater than 1-1/2 inches.

(e) Provides sufficient lighting to illuminate the entire field of vision at the bottom of the shaft in order for the operator and inspector to clearly see the depth measurement scale on the video monitor and to produce a clear recording of the inspection.

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After acceptance of production shafts by the Engineer, remove all water from the access tubes or core holes and fill the tubes or core holes with a structural non-shrink grout meeting the requirements of Section 934 from the bottom via tremie tube. Place the grout utilizing enough pressure to fill the tubes or core holes completely.

If the Contractor determines at any time during the non-destructive testing and evaluation of the drilled shaft that the drilled shaft should be replaced, no further testing or evaluation of that shaft is required.

455-17.6.1.1 Equipment: Furnish CSL test equipment as follows:

1. Include ultrasonic transmitter and receiver probes for 1.5 inch I.D. pipe which produce measurements with consistent signal strength and arrival time in uniform, good quality concrete with all tube spacings on the project.

2. Include a microprocessor based data acquisition system for display, storage, and transfer of data. Graphically display first pulse Arrival Time (FAT) during data acquisition.

3. Electronically measure and record the relative position (depth) of the probes in the tubes with each CSL signal.

4. Print the CSL logs for report presentation.

5. Provide report quality plots of CSL measurements that identify each individual test.

6. Electronically store each CSL log in digital format, with shaft identification, date, time and test details, including the transmitter and receiver gain.

455-17.6.1.2 Procedure: Perform CSL testing between 72 hours and 25 calendar days of shaft concrete placement and after the concrete compressive strength exceeds 3,000 psi. Furnish information regarding the shaft, tube lengths and depths, construction dates, and other pertinent shaft installation observations and details to the Department at the time of testing. Verify access tube lengths and their condition in the presence of the Department, at least 24 hours prior to CSL testing. If the access tubes do not provide access over the full length of the shaft, repair the existing tube(s) or core additional hole(s), as directed by the Engineer, at no additional cost to the Department.

Pull the probes simultaneously, starting from the bottoms of the tubes, over an electronic depth measuring device. Perform the CSL tests with the source and receiver probes in the same horizontal plane. Continuously record CSL signals at depth intervals of 2.5 inches or less from the bottom of the tubes to the top of each shaft. Remove all slack from the cables prior to pulling to provide accurate depth measurements in the CSL records.

Report any anomalies indicated by longer pulse arrival times and significantly lower amplitude/energy signals to the Engineer and conduct further tests as required to evaluate the extent of possible defects. Conduct offset CSL measurements between all tube pair combinations in any drilled shafts with 30% or greater in velocity reduction. Record offset measurements with source and receiver vertically offset in the tubes. These measurements add four measurements per tube combination to the horizontal measurements described in this section. Offset measurements are described by the angle (in degrees) and direction the signal travels between the probes with respect to the horizontal plane: plus 45, plus 22.5 (source below receiver), and minus 45, minus 22.5 (source above receiver). Record offset measurements from the point where the higher probe is at least 5 feet below the velocity reduction to the point where the lower probe is at least 5 feet above the velocity reduction. Provide offset CSL logs and 3-D tomographic analysis of all CSL data at no additional cost to the Department in the event 30% or greater in velocity reductions are detected.

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455-17.6.1.4 Evaluation of CSL Test Results: The Engineer will evaluate the observations during drilled shaft construction and CSL test results to determine whether or not the drilled shaft construction is acceptable. Drilled shafts with velocity reduction exceeding 30% are not acceptable without an engineering analysis.

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location, and diameter of the cores based on the results of 3-D tomographic analysis of offset and horizontal CSL data. Keep an accurate log of cores. Properly mark and place the cores in a crate showing the shaft depth at each interval of core recovery. Transport the cores, along with five copies of the coring log to the Engineer. Perform strength testing by an AASHTO certified lab on portions of the cores that exhibit questionable concrete as determined by the Engineer. If the drilled shaft offset CSL testing, 3-D tomographic analyses and coring indicate the shaft is defective, propose remedial measures for approval by the Engineer. Such improvement may consist of, but is not limited to correcting defective portions of the shaft, providing straddle shafts to compensate for capacity loss, or providing a replacement shaft. Repair all detected defects and conduct post repair integrity testing using horizontal and offset CSL testing and 3-D tomographic imaging as described in this Section. Engage a Specialty Engineer to perform gamma-gamma density logging to verify the integrity of the shaft outside the reinforcing cage in the same locations offset CSL data was/is required. Submit all results to the Engineer within five days of test completion for approval. Perform all work described in this Section at no additional cost to the Department, and with no increase in Contract Time.