ALABAMA DEPARTMENT OF TRANSPORTATION

General Application Special Provision

DATE: June 21, 2023 GASP No. 22-GA0033

EFFECTIVE DATE: January 1, 2024

SUBJECT: Static Load Test Procedure (ASD).

Alabama Standard Specifications, 2022 Edition, SECTION 505 shall be modified as follows:

SECTION 505
PILING

505.03 Construction Requirements.

(f) Pile Driving.

3. Test Pile with Static Load Testing.

Item 505.03(f)3 shall be replaced by the following:

3. Test Pile with Static Load Testing.

Test piles without dynamic testing shall be driven to the minimum tip elevation when provided. Test piles shall be driven to a hammer blow count given on the blow count/bearing capacity graph. This graph shall be used as an estimate of the test pile's bearing capacity which uses the required minimum bearing capacity (equal to twice the design load) and stroke to obtain the required blow count for the test pile. Once the required blow count (and minimum tip elevation, when provided) is reached, the bearing capacity shall be proven (after a 7 day wait for concrete piles and a 36 hour wait for steel piles) with a Static Load Test. This blow count and stroke, or the equivalent blow count and stroke, recorded during the last foot {300 mm} of driving of a passing Static Load Test Pile shall be used as the acceptance criteria for the production piling represented by this test pile. A revised bearing graph will be provided by the Materials & Tests Engineer that reflects the actual capacity of the test pile which shall be used to determine the bearing capacity of all production piles represented by this test pile.

The Static Load Test indicates a failure if the bearing capacity determined from the load test is not equal to or greater than the required minimum bearing capacity. If the load test is a failure, the test pile shall be redriven. The blow count for the redrive shall be obtained by determining the blow count required for a theoretical increased bearing capacity. The blow count for the redrive shall be taken from the blow count/bearing capacity graph in accordance with the following formula:

Load For Obtaining Redrive Blow Count = [2 X (A – B)] + A

A = Minimum Bearing Capacity, B = Load At Failure

The test pile shall then be reloaded. This process shall be repeated as many times as necessary until the load test is determined to be a passing load test.

Test piles driven to plan grade and not having the hammer blow count required may also be spliced and driven until the required bearing is obtained. Concrete splices must be approved by the Engineer.

4. Test Pile with Dynamic Load Testing.

Item 505.03(f)4 shall be replaced by the following:

4. Test Pile with Dynamic Load Testing.

Dynamic load testing may be used to supplement static load testing. All dynamic load tests shall be correlated by a minimum of one representative static load test.

If shown on the plans or in the proposal or a change is requested by the contractor and approved by the Materials and Tests Engineer, dynamic measurements will be taken by the Engineer during the driving of piles designated as dynamic load test piles.

The Contractor shall notify the Engineer when the Contractor is ready to drive a dynamic test pile seven days in advance of driving the test pile. If the Contractor changes or delays the date of the dynamic testing, then the Contractor shall pay for all costs associated with the time delay to the dynamic testing Engineer.

Test piles shall be driven to the minimum tip elevation when provided. Test piles shall be driven to the depth at which the dynamic test equipment indicates the required bearing capacity has been achieved unless directed otherwise by the Materials and Tests Engineer. The stress in the piles will be monitored during driving with the dynamic testing equipment to ensure that the values determined do not exceed the values in Item 505.03(d)2. If deemed necessary by the Engineer, the Contractor shall reduce the driving energy transmitted to the pile by using additional cushions, reducing the energy output of the hammer, or other appropriate methods in order to maintain stresses below the values in Item 505.03(b)2. If non-axial driving is indicated by dynamic test equipment measurements, the Contractor shall immediately realign the hammer system. The Engineer will notify the Contractor or their pile driving Subcontractor if their pile driving procedures violated any of the referenced requirements during the installation of the dynamically tested pile.

The Materials & Tests Engineer may use dynamic measurements to adjust tip elevations after ensuring that minimum tip requirements are satisfied. The Materials & Tests Engineer will review the dynamic test data and provide the acceptance criteria for the production piling that are represented by the test pile. A revised bearing graph will be provided by the Materials & Tests Engineer that reflects the actual capacity of the test pile which shall be used to determine the bearing capacity of all production piles represented by this test pile.

For correlation of a static load test with a dynamic load test the Contractor shall, within 48 hours of the static load test, perform a restrike dynamic load test. A cold hammer shall not be used for the restrike. The hammer shall be warmed up before restrike begins by applying at least 20 blows to another pile. The sequence shall consist of striking the designated pile for 50 blows or until the pile penetrates an additional three inches {75 mm}, whichever occurs first. In the event the pile movement is less than 1/4 inch {6 mm} during the restrike, the restrike may be terminated after 20 blows. After restrike, the Materials and Tests Engineer will either accept the tip elevation or specify additional pile penetration and testing.

(g) Loading Methods

1. Static Load Testing Method

a. Description.

Subitem 505.03(g)1a shall be replaced with the following.

a. Description.

Static load testing shall be used to verify the axial load bearing capacity of pile groups or individual piles. Static load testing should be used after a test pile has been driven to the minimum tip elevation (if shown on the plans) and has met the bearing capacity estimate based on blow count and hammer stroke from the provided bearing curves or dynamic test results (if applicable). A static load test may also be used in conjunction with a dynamic load test when verifying axial load bearing capacity of piling.

c. Static Load Test Procedure.

Subitem 505.03(g)1c shall be replaced with the following.

c. Static Load Test Procedure.

The apparatus for applying the load shall be subject to the approval of the Engineer and have a capacity of 1000 tons {8900 kN} or 300 percent of the design load, whichever is less. The expected failure load is defined as 300 percent of the design load. Incremental loads of 5% of the expected failure load shall be placed on the pile at 4 minute intervals until continuous jacking is required to maintain the incremental load or the capacity of the load frame is reached.

All loading tests will be continually inspected by the Engineer. Time, load, and settlement data will be recorded on Form C-15B immediately before and after the application of each load increment and at intermediate time intervals as specified. When the maximum load has been applied, readings will be taken and recorded when jacking has stopped. Additional readings will be taken after 4 minutes and again at 8 minutes. If a longer holding period is specified, additional readings will be taken as required. The load shall be removed after the required holding period in 4 equal parts, with time and rebound readings taken at each unloading increment. Readings will be taken immediately following each load removal, allowing 4 minutes between increments. Upon removal of the entire load, time and rebound readings will be taken and recorded. Additional time and rebound readings will be taken after 4 minutes and again at 8 minutes.

Load test data will be plotted by the Engineer in the form of settlement in inches {millimeters} (ordinate, positive down) versus applied load in kips {kN} (abscissa). Ultimate capacity predictions will be based upon Davisson's failure criterion as applied to the aforementioned settlement curve, as per FHWA's Manual on Design and Construction of Driven Pile Foundations. In this method, the elastic shortening of the pile (QL/AE, in inches {millimeters}) is superimposed on the settlement curve. In the elastic shortening equation, "Q" represents load in kips {kN}, "L" represents length of pile from settlement instrumentation to tip elevation in inches {meters}, "A" represents cross-sectional area in square inches {square meters} (at voided section, if a void is present), and "E" represents elastic modulus in ksi {MPa} (elastic modulus for concrete piles is preferably obtained from dynamic load testing, but may be calculated as 60,000 {5000} times the square root of the design compressive strength, in psi {MPa}, when dynamic load testing is not performed. The elastic modulus for steel piles may always be assumed as 29,000 ksi {200,000 MPa}).

The aforementioned elastic shortening curve is then increased or offset, by 0.15+D/120 in inches {3.81+D/120 in millimeters} (where D = pile diameter or width in inches {mm}). The point in which the offset elastic shortening curve intersects the settlement curve is considered the ultimate pile capacity.