

November 9, 2018

**SPECIAL PROVISION****AMENDMENT TO SECTION 510 -- BEARING PILES****Item 510.22 – High-Strain Dynamic Testing**

*The purpose of this special provision provides for High-Strain Dynamic Testing for driven piles to ensure their capacity and integrity and neither amends nor modifies the provision of this section except as noted below*

**Add** to Description:

**1.2** This work shall consist of high-strain dynamic testing of driven piles, performed by a qualified Dynamic Testing Consultant engaged by the Design-Build Team. The work includes furnishing all required equipment and appurtenances, installation of transducers, monitoring of pile driving and any re-driving, and reporting of results in accordance with ASTM D4945.

**1.2.1** High-strain dynamic testing will be used by the Engineer to evaluate driving criteria, pile capacity, hammer performance and pile integrity. The number of piles subjected to dynamic testing will be determined by the Engineer. It is anticipated that one pile per substructure will be tested; however, testing may be required on additional piles including piles that are suspected of being damaged or piles that do not reach expected embedment depths.

**1.2.2** Dynamic testing shall be provided at the onset of pile driving for each tested pile. Dynamic testing under this specification is not required during advancement of piles using non-impact hammers, if permitted according to 2.2.1.3. The frequency and duration of dynamic testing shall be as ordered by the Engineer.

**Add** to Materials & Equipment:

**2.3 Equipment for High-Strain Dynamic Testing.** Dynamic testing shall include at least two strain transducers and two accelerometers attached to the pile near the pile head or other approved location and connected by cable or wireless transmitter to an apparatus for recording, processing, and displaying the data (also known as a Pile Driving Analyzer (PDA)). All equipment shall be furnished by the Dynamic Testing Consultant and shall conform to ASTM D4945. Calibration documents verifying that system components have been calibrated to the standards of the manufacturer within 24 months of the date of dynamic testing shall be provided to the Engineer. Equipment shall include all hardware and tools required to connect transducers and cables to the pile.

**2.3.1** The Contractor shall provide an adequate power supply for the PDA at all times during testing.

**Replace** 3.4.2 with the following:

### **3.4.2 High-Strain Dynamic Testing.**

**3.4.2.1 Testing Plan.** The Design-Build Team shall submit a High-Strain Dynamic Testing Plan (hereinafter referred to as the Testing Plan) to the Engineer for approval at least 30 days prior to driving piles. The Testing Plan shall be separate from the pile driving equipment submittal specified in 2.2.3 with a separate approval required. As a minimum, the Testing Plan shall include the following information:

- a) Name and qualifications of the Dynamic Testing Consultant. The Dynamic Testing Consultant shall not be an employee of, or affiliated with, the pile-driving contractor and shall have documented experience on at least ten (10) projects conducting high-strain dynamic testing, wave equation analysis, data quality checks (also known as signal matching analysis), and reporting in accordance with ASTM D4945. The submittal shall clearly state the name, qualifications, and roles of all individuals who will be conducting the tests and/or performing the analyses with resumes provided. All aspects of the work shall be overseen by a Licensed Professional Engineer registered in the State of New Hampshire.
- b) Description of all equipment used to perform the testing including manufacturer, model numbers, and calibration verification.
- c) Description of all software used to perform the analyses, including version.
- d) Procedures for installation of transducers and cables, performance of dynamic testing, in-test analyses, post-processing, and reporting.

**3.4.2.2 Coordination meeting.** Subsequent to approval of the Testing Plan and at least 5 days prior to pile driving, the Dynamic Testing Consultant shall schedule a meeting with the Contract Administrator, the Design-Build Team, and the Geotechnical Section of the Materials and Research Bureau to review the dynamic testing and reporting procedures. Discussion points will include, but not be limited to, general procedures and logistics, frequency and duration of dynamic testing, required pile tip elevations, nominal pile resistance, allowable pile stresses, hammer performance, and protocols for suspending the pile driving in the event that dynamic testing indicates excessive pile stresses, non-axial driving, hammer inefficiencies, or other critical occurrences.

**3.4.2.3** The Design-Build Team shall provide a safe location for the PDA no further than 150 feet from the pile being driven. Access to the pile shall be provided to the Dynamic Testing Consultant when the pile is on the ground and in the leads to enable the Dynamic Testing Consultant to properly set up and perform the testing.

**3.4.2.4** High-strain dynamic testing, including periodic data quality checks, shall be performed in accordance with ASTM D4945. A signal matching analysis shall be performed at least once for each tested pile.

**3.4.2.5** If pile splices are required during dynamic testing, sensors shall be disassembled and reassembled to the new pile section.

**3.4.2.6** At the conclusion of each day's testing, the Dynamic Testing Consultant shall provide the following information to the Engineer (for each blow from the dynamic driving records): depth, maximum transferred energy, blows per minute (including strokes, fuel settings, bounce chamber pressures, etc. as applicable), maximum tensile stress, maximum compressive stress, and pile resistance. A summary of any signal matching analysis performed shall be provided.

**3.4.2.7** Based on the results of the dynamic testing, the Engineer may require the Design-Build Team to modify the pile driving system if the driving operation is found to be in non-conformance with Section 510.

**3.4.2.8** A Dynamic Pile Testing Report shall be provided within 5 days of completion of dynamic testing on each tested pile in accordance with Section 7 of ASTM D4945.