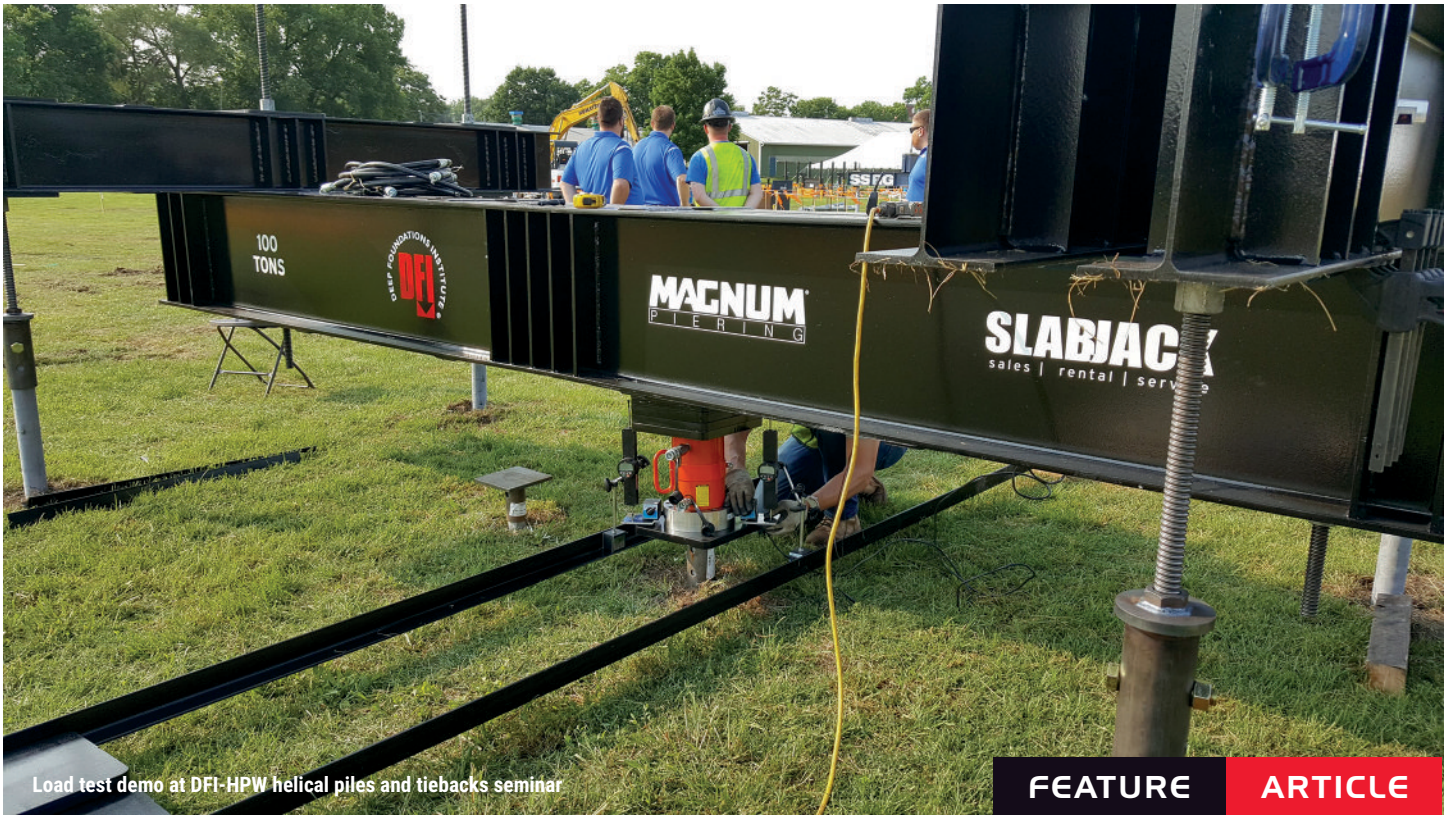
DEEP FOUNDATIONS INSTITUTE

Deep Foundations

JAN/FEB 2021 THE MAGAZINE OF THE DEEP FOUNDATIONS INSTITUTE

U.K. Heavily Burdened Large Diameter Piles



Load test demo at DFI-HPW helical piles and tiebacks seminar

FEATURE ARTICLE

DFI Committee Helps Revise ASTM Standard

Almost everyone involved in deep foundations has either witnessed, designed or utilized the data from a static compressive load test. Invariably, the test is run in accordance with one version or another of the ASTM Standard D1143 of ASTM International (formerly known as American Society for Testing and Materials). During the past 2 years, the DFI Codes and Standards Committee reviewed this standard and advocated a series of useful changes that have been incorporated. The standard's new designation is "ASTM D1143/D1143M – 20, Standard Test Methods for Deep Foundation Elements Under Static Axial Compressive Load," and the updated version is currently available from ASTM.

The DFI committee's vice chair, Robert Simpson, played a key role in the changes in that he is also the chair of ASTM subcommittee D18.11 (Soil and Rock, Deep Foundations); that ASTM subcommittee has jurisdiction over ASTM D1143 and related deep foundation testing standards. The revised standard that became effective in October 2020 has many updates that will likely be viewed as minor changes in terminology. Some of the more important changes will be discussed in this article by the committee members most involved in this project.

Revision History

Imagine a scenario in which you have been told that your load frame design was inadequate because it was not designed to meet the requirement that the load frame "be capable of safely applying at least 120% of the anticipated maximum test load." You may have argued that your load and resistance factor design (LRFD) includes an appropriate load factor that ensures a factor of safety of at least 1.2, but you lost the argument because the language in the standard was ambiguous and could be interpreted in different ways. The revised standard simply states that the load frame "... shall be designed in accordance with recognized standards by a qualified engineer who shall clearly define the maximum allowable load that can be safely applied."

In the revised standard, the word *Engineer* is changed to lower case *engineer.* The reason for this change is to take into consideration the fact that most foundation projects have multiple licensed engineers with differing roles. The engineers involved in the test can include the owner's geotechnical and structural engineers, the load frame design engineer and the engineer who is monitoring the test. Each engineer has a specific responsibility. Successful projects generally require that all engineers understand and respect each other's role.

AUTHORS *Daniel Stevenson, P.E., Berkel and Company Contractors; Robert Simpson, Load Test Consulting; and Lawrence Johnsen, GZA GeoEnvironmental*

Testing Updates

The revised standard requires that a load cell or equivalent device must be placed in series with the hydraulic jack. The standard does not specifically discuss which reading to use when readings diverge. Section 1.4 states, "A qualified geotechnical engineer should interpret the test results … ." If the engineer interpreting the results does not monitor the actual test, how do they know which data to trust? Does this mean that it is left to someone's judgment? Many contractors and engineers have found that load cells tend to be more precise when unaffected by environmental and loading conditions. However, load cells tend to be more sensitive to field conditions and can be in greater error when affected by field conditions. Interestingly, some contractors and engineers have found that, on long overnight holds, the load cell reading is often more stable than the hydraulic jack reading. Everyone needs to remember that the calibrations were performed in a laboratory environment. The laboratory will remind you of this when you question the calibration.

Section 10 (Procedure) includes the statement, "Failure as used in this section may be understood to mean such rapid displacement of the element that further loading is not possible." This statement is not meant to replace a proper review and determination of geotechnical capacity after the testing is complete.

In section 10, procedures are provided for three types of load tests that have undergone some modifications: quick test, maintained test and constant rate of penetration test. Meanwhile, four other procedures have been removed: loading in excess of maintained test, constant time interval, and constant time and cyclic loading.

The primary change to the quick test method is that the selected load increment can be between 5% and 10% of the expected failure load. As before, all load increments are the same and all hold times are the same, except that the engineer may consider a longer time interval for the failure load as a way to assess creep, or for the final zero load to assess rebound behavior.

The primary change to the constant rate of penetration test focuses on what directions are given on how to maintain a constant rate. The directions now recommend to "Control the rate of penetration by checking the incremental penetration rate every 15 seconds and then adjusting the jacking accordingly to maintain the selected penetration rate."

Remaining Considerations

The most significant issue that remains unresolved with the revised ASTM D1143 is that the standard does not specifically discuss which load reading to use when readings diverge. Regarding the Section 1.4 wording shared earlier that a qualified engineer should interpret results, how does that engineer know which data to trust if they do not monitor the specific test? The specific issue is that engineers both use, and are comfortable with, load data derived from pressure data with a calibrated jack, and also the data given directly by a load cell. There was strong disagreement about specifying one approach over the other among committee members, reflecting the overall sentiment throughout the deep foundation industry. The DFI Codes and Standards Committee has thus recommended that the institute's Testing and Evaluation Committee investigate this issue. Simpson also serves as the vice chairman of that committee, and is working to gather volunteers for a working group to address this unresolved matter. The group would produce a peer-reviewed white paper for possible publication.

High capacity D1143 load test in Georgia

Standard Renewal Steps

Regardless of headway by that DFI working group, all ASTM Standards must be reapproved every 7 years or they are removed from the ASTM library of standards. A removed standard would not be available for purchase or included in larger collections or volumes.

The process of renewing a standard can be simple in concept. At any time in the 7 years of its lifespan, an ASTM member can request a work item and be named a technical contact. That member then becomes the person in charge of balloting the standard for renewal, with or without making proposed changes to the standard. Changes can be as simple as a small editorial correction, or adding a required caveat or definition — or changes can include major revisions. All ASTM subcommittee members then vote on the renewal request.

For a revised standard to be approved, all subcommittee members must vote affirmative or abstain, with or without comments. This total agreement almost never happens, with a single negative vote stopping the whole process. The technical contact must then address the negative voter's comments and make changes that will not trigger new negatives. The power of the single voter is somewhat unique. But the single

voter cannot hold up a standard forever, with a variety of procedures available to address capricious or unreasonable obstructions (that are beyond the scope of this discussion).

Procuring Revised Standard

The new ASTM D1143 standard can be purchased at **www.astm.org** for $58; or you can become an ASTM member for $75 and receive one entire volume of standards for free.

Acknowledgments

The DFI Codes and Standards Committee member authors would like to recognize the many other committee members who contributed in multiple online meetings in significant ways. Although the extent of influence in standard setting varies by project, DFI members in general are also encouraged to join ASTM or join DFI's Codes and Standards Committee, or both, to have some influence over the standards they are required to use.

The Georgia test involved jack loads from two 40 in (102 cm) beams

Dan Stevenson is the chief structural engineer for Berkel and Company Contractors. He has over 30 years of experience in the design, execution and monitoring of geostructural solutions and has published technical papers for geotechnical conferences and periodicals. Stevenson is chair of the DFI Codes and Standards Committee.

Robert C. Simpson has 25 years of experience in the deep foundation industry with Loadtest, and currently is with Load Test Consulting as co-founder and president. Simpson is the chair of ASTM Subcommittee D18.11 (Soil and Rock, Deep Foundations), and the vice chair of DFI's Testing and Evaluation Committee and Codes and Standards Committee.

Lawrence Johnsen is a senior consultant with GZA GeoEnvironmental in Trumbull, Connecticut, and a licensed engineer in 21 states. He is past chair of the DFI Codes and Standards Committee and the ASCE Geo-Institute Grouting Committee, and a member of the DFI-ADSC Joint Micropile Committee.