Static Load Testing

Benefits of Static Load Testing

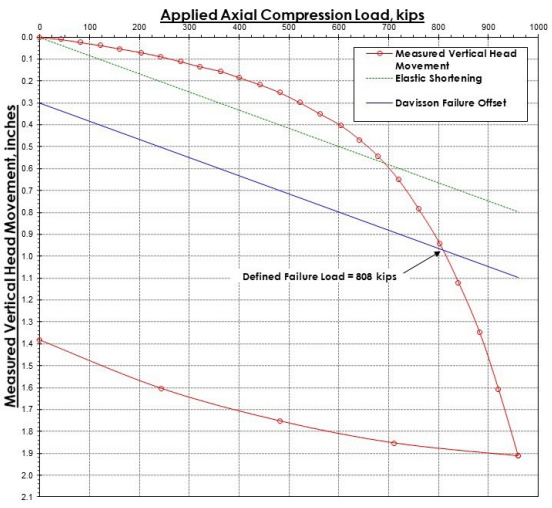
- Static load tests provide information that can be used for deep foundation design confirmation and design refinement
- Static load tests often allow the use of a lower safety factor (Allowable Stress Design), or higher resistance factor (Load and Resistance Factor Design), saving construction time and money
- Designs can be optimized from detailed load transfer information (shaft resistance distribution, and toe resistance) when tests include embedded strain gage instrumentation
- The deflected foundation shape versus depth can be obtained from lateral load tests instrumented with Shape Arrays or multiple in-place inclinometers
- Load test results can be used to calibrate static analysis methods, dynamic test results, or computer simulations of lateral load performance thereby extending load test benefits across a site

What Is Static Load Testing

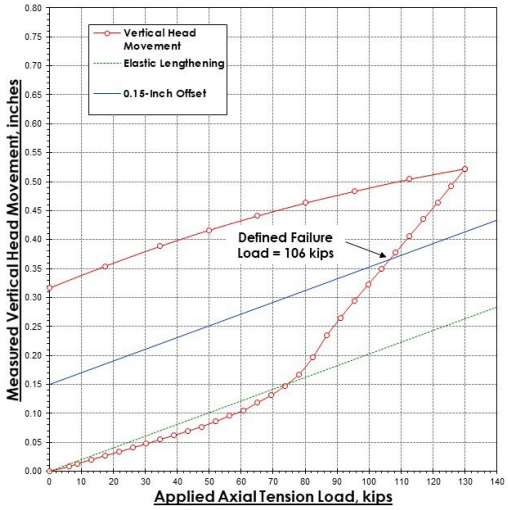
Static load testing applies load incrementally to a deep-foundation element, while measuring foundation movement. Types of static load tests include axial compression (ASTM D1143), axial tension (ASTM D3689), and lateral (ASTM D3966). Static tests are typically performed to a maximum applied load equal to a multiple of the foundation's design load or to geotechnical failure. Compression tests utilize an overhead reaction beam and frame with resistance to the applied loads provided by reaction piles or dead weight. Tension tests may also utilize an overhead reaction beam and frame or they may use only a reaction beam supported on mats. Lateral tests can use a variety of reaction systems, and often push or pull against another lateral load test pile to simultaneously perform two tests.

Data Collection and Presentation

For static axial compression and tension load tests, applied load and head movement are measured. Applied loads are determined using a load cell and hydraulic jack pressure. The foundation's head movement can be measured using digital or mechanical dial gages, a number of types of displacement transducers, string potentiometers, or a combination of these devices. Instrumentation can be read with a datalogger or recorded manually. The applied load vs. head movement is plotted and interpreted to define the foundation's geotechnical failure load.

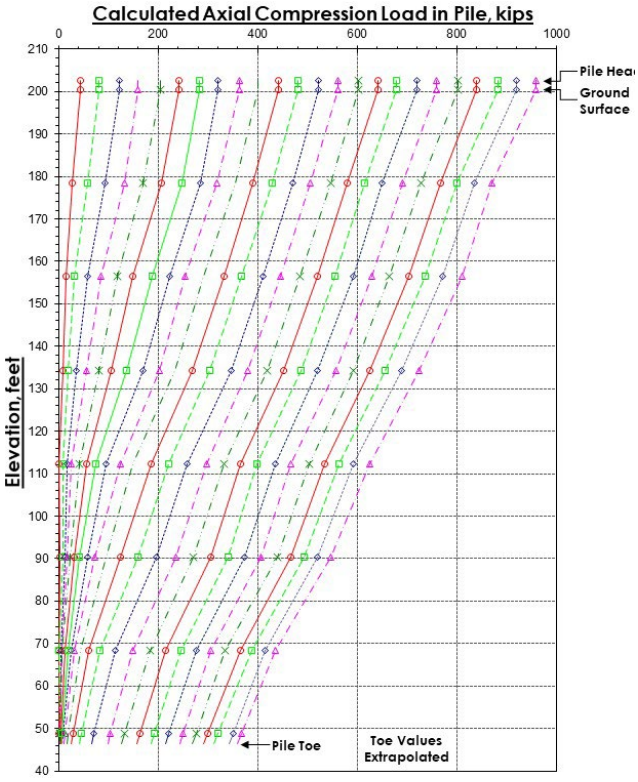


Load-movement result from axial compression test

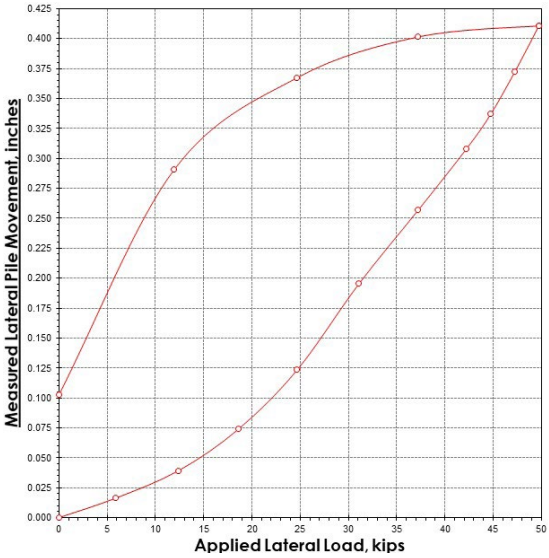


Load-movement result from axial tension test

For axial compression and tension load tests, additional embedded instrumentation consisting of strain gages or telltales can be added to measure foundation strain, from which load in the foundation can be estimated. A key component of this evaluation is determining the foundation's area and elastic modulus. The resulting load transfer profiles present load in the foundation along its length. Unit shaft resistance values along the foundation's length, as well as unit toe resistance, can be determined from the load-transfer profiles. This information can also be used to refine static analysis methods and calibrate dynamic pile monitoring results.



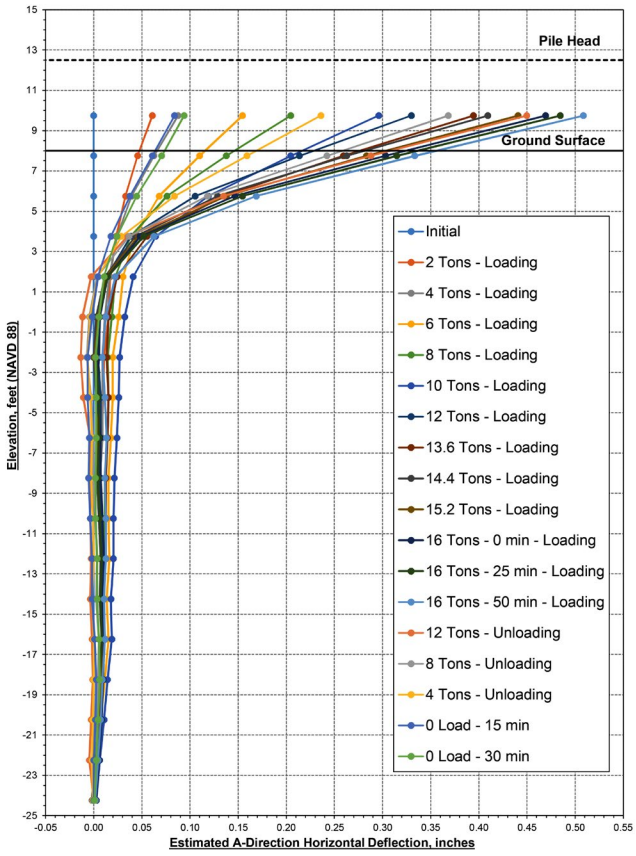
Load-transfer profile from instrumented axial compression test



Load-movement results from lateral load test

For lateral load tests, the applied load and head movement are measured similarly to a compression or tension load test and the applied lateral load vs. head movement is plotted. However, unlike compression and tension tests, lateral load tests generally do not define a geotechnical failure load under lateral load. Instead, the measured load- movement behavior is evaluated using one of a variety of methods to establish a design lateral load.

Additional instrumentation is frequently installed in lateral load tests in order to define the foundation deflected shape under lateral loads. Profiles of foundation deflected shape vs depth can also be obtained during the test using a ShapeArray or multiple in-place inclinometer probes ("IPIs"). An above-grade tiltmeter can also be used to measure foundation head rotation during the test.



Load-deflected shape result from instrumented lateral load test

Data Analysis and Reporting

Following the static load test, a GRL engineer prepares the final report summarizing the load test procedures and test results. This report includes graphical presentations of any load-movement, load-transfer vs depth, or load-deflected shape vs depth plots, associated tabular output, as well as result interpretation.

ASTM Standards

GRL Engineers perform static load testing in general accordance with ASTM D1143, "Standard Test Methods for Deep Foundations Under Static Axial Compressive Load," ASTM D3689, "Standard Test Methods for Deep Foundations Under Static Axial Tensile Load," and ASTM D3966, "Standard Test Methods for Deep Foundations Under Lateral Load."

For additonal information on **Static Load Testing Services** or any other GRL Engineers service, please contact info@GRLengineers.com, or visit us at www.GRLengineers.com.

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