

# Pile Load Test

Pile foundation can be constructed depending on the stiffness of subsurface soil and ground water conditions and using a variety of construction techniques. The most common techniques are in-situ casting and pre-augering. Due to the extensive nature of the subsurface mass that it influences, the degree of uncertainty regarding the actual working capacity of a pile foundation is generally much higher than that of a shallow footing.



Pile load testing is the most definitive method of determining load capacity of a pile. Testing a pile for failure provides valuable information to the design engineer and is recommended for load tests performed prior to the foundation design. We at Struct Geotech follow [IS: 2911 \(Part 4\) – 1985](#), [IS: 14893-2001](#) load test on piles method. This method is applicable to all kinds of deep foundations that function in a manner similar to piles regardless of their method of installation. It does not specify a particular method to be used, but rather provides several optional methods. These tests involve the application of a load capable of displacing the foundation and determining its capacity from its response.

Struct Geotech engineers constantly seek more and more effective techniques of monitoring pile construction to estimate as accurately as possible the ultimate field capacity of piles. In addition, our engineers are also interested in monitoring methods that would reveal information leading to,

- *On-site determination of pile capacity*
- *Distribution of pile load between the shaft and tip, and*
- *Detection of possible pile.*

Struct Geotech has well defined and experienced engineers who conduct pile load test using standardized methods, It has *advanced* in house ( Main and Supports ) equipments required to conduct pile load test.

## Services:

- i) Pile Integrity Testing/ Low strain Integrity Testing
- ii) Dynamic Pile Testing/ High strain dynamic pile analyzer
- iii) Static pile load testing:
  - (a) Kenteledge load test Method
  - (b) Reaction beam load test Method/ Rock Anchoring Method
  - (c) Bi-Directional load testing
- iv) Lateral load test
- v) Pullout load test

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## **Description:**

### **File Integrity Testing/ Sonic Echo Testing:**

Struct Geotech Research Laboratories P.L. is *accredited under National Accreditation Board for Testing and Calibration Laboratories (NABL) & ISO 17025 – 2005 & ISO 9001 - 2008 certified, to perform pile integrity testing since 2006.*



Pile Integrity Testing -PIT performs Low Strain integrity testing, also called Sonic Echo or Pulse Echo Testing. The PIT may be used for auger cast-in-place (CFA) piles, drilled shafts, driven concrete piles, concrete filled pipes and timber piles. It detects potentially dangerous defects such as major cracks, necking, soil inclusions or voids on any type of concrete foundations prior to construction of the superstructure. It may also test piles integrity in the structure, such as those supporting existing bridges, towers or any high rise structures and determine their length.

- *Comparing records from several piles on the same site*
- *Analyzing data from foundations of existing structures*
- *Assessing unknown foundation length*
- *Evaluating the severity and location of anomalies along the shaft*

### **Dynamic Pile Testing:**

Struct Geotech Research Laboratories P.L. is *accredited under National Accreditation Board for Testing and Calibration Laboratories (NABL) & ISO 17025 – 2005 & ISO 9001 - 2008 certified, to perform Pile Dynamic Analyzing since 2006.*



Dynamic pile testing constitutes a comprehensive and economical means to quantitatively evaluate the hammer-pile-soil system based on the measurement of pile force and velocity records under hammer impacts. Measurements, data processing and analysis are performed in real time in the field by state-of-art dedicated [Pile Driving Analyzer ASTM D4945.96 \(PDA\)](#) equipment from PDITM. Testing results include estimation of pile load capacity, dynamic pile stresses and structural integrity & driving system performance. The Pile Driving Analysis is applicable on Bored cast-in-situ, drilled shafts, continuous flight auger & driven piles, this applies for either test pile or working pile.

Dynamic pile monitoring for construction quality control and verification testing are routinely performed on hundreds of project sites annually in India and around the world. Main objectives of dynamic pile testing include obtaining information on the following:

- *Hammer and driving system performance for productivity and construction control*
- *Dynamic pile stresses during and after installation. To reduce the possibility of pile damage, stress must be kept within certain bounds*
- *Pile integrity during and after installation*
- *Static pile bearing capacity, at the time of testing. For the evaluation of long term capacity, piles are generally tested during re-strike some time after installation*

We use an enhanced analysis, called **CAPWAP**, which enables us to correlate the measured data with the known pile / soil model elements. The end result of CAPWAP, via a rigorous and repeated signal matching solution, produces a pile driving summary that contains pile capacity, percent end bearing / skin friction, measured pile compression and tension stresses. Using this type of empirical and analytical data assistance, we can validate a project's design requirements with superior accuracy and speed.

- *Estimates total bearing capacity of a pile or shaft*
- *Soil resistance parameters*
- *Resistance distribution along the shaft and at the toe*
- *Static load–settlement curves from the measured force and velocity data*
- *Total computed soil capacity – sum of Skin Friction and Toe Bearing*
- *Computed load against settlement curve*
- *Stresses at any point along the shaft*
- *Energy transferred from the ram (hammer) to the foundation*

### **Static pile load testing:**

Struct Geotech Research Laboratories P.L. has a vast experience in Pile Load Testing. It has an experienced technical staff and latest in-house testing & support equipments required to conduct Static Load Test. The company follows latest methodology accepted & adopted by the International Standards in conducting SLT.



The static pile load test is the most common method of testing the capacity of a pile and it is also considered to be the best measure of foundation suitability to resist anticipated design loads. The static load test involves the direct measurement of pile head displacement in the response to a physically applied test load. This test provides very reliable data for pile capacity. The capacity is actual structural or geotechnical capacities, not calculated from idealized data. This can allow for a lower factor of safety in the design if the pile performs better than expected (and vice versa).

This method is applicable to all kind of pile types, over land or over water, and may be carried out on either production piles or test piles. Test piles are specifically constructed for the purpose

of carrying out load tests and therefore, are commonly loaded to failure. Testing of production piles however, is limited to prove that a pile will perform satisfactorily at the serviceability or design load, plus an overload to demonstrate that the pile has some reserve capacity.

Static load testing includes from the most simple (kentledge) to the complex (bidirectional) method.

### *Static pile load testing:*

- *Kentledge load test Method*
- *Reaction beam load test Method/ Rock Anchoring Method*
- *Bi-Directional load testing*

Providing all equipments allows the company to offer a full package of design, supply, erect, test, strip and demobilize. All the Pile Load Test systems are designed to allow easy interfacing with Struct Geotech range of jacking and testing equipment.

No longer does piling companies have to:-

- *Design a load frame, select the equipment from its yard, crane them onto a hired-in lorry, send additional manpower to site, provide a crane to unload the lorry and erect the frame on site.*
- *Re-mobilize labor and a crane, strip down the frame and load it out, transport back to yard, off-load and store it.*
- *Worry about whether all the equipments have been sent to site or whether that one vital part gets "lost" in transit or damaged on site.*

All these are efficiently taken care of by Struct Geotech, and the piling/ Construction Company can concentrate on its core activity.

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### **Lateral load test:**

Lateral load test is one of the good means of estimating lateral capacity of pile. Piles are generally used to transmit vertical and lateral loads to the surrounding soil media. Piles are sometimes subjected to lateral loads due to wind pressure, water pressure, earth pressure, earthquakes, etc. when the horizontal component of the load is small in comparison with the vertical load (say, less than 20%), it is generally assumed to be carried by vertical piles and no special provision for lateral load is made. Piles that are used under tall chimneys, towers, high rise buildings, high retaining walls, bridges & other concrete elevated structures etc. are normally subjected to high lateral loads. These piles or pile groups should resist not only vertical movements but also lateral movements. Some of the measured are;



- *Efficiency of the pile group loads*
  - *Soil Stiffness Degradation*
  - *Bending Moments*
  - *Lateral pile response*
  - *Pile deflection and soil response*
  - *Ultimate lateral resistance*
  - *Acceptable deflection at working lateral load*
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### **Pull-out load test:**

Many structures are constructed using deep piled foundations in order to transfer structural dead load through unstable ground to a solid stratum. Action of horizontal wind or wave forces on the structure and the behavior of the piles under these loads are much less well documented



The resistance of the concrete piles to pull-out comes from two major sources, skin friction between pile and soil and suctions generated at the base of the pile as movement occurs. Both of these effects are greatly affected by the generation of excess or suction pore pressures in the soil due to movement of the pile. Suctions are generated at the base of the pile in all soils owing to the opening up of a void as the pile moves. At the sides of the pile, un-drained shearing of the soil when the pile is pulled quickly will result in excess pore pressure generation in loose soils and suctions being generated in dense soils. These pore pressures will alter the effective stress state of the soil and will hence have a great impact on the force-displacement behavior of the pile.

One of the most difficult tasks in geotechnical engineering is made easy by Struct Geotech in the determination of skin friction for piers which helps the design engineer in the evaluation of the pile load capacity. Full-scale pile load tests, on the other hand, are too expensive and time-consuming for routine design purposes.

Pull-out tests are the ideal alternative because of their low cost, relative rapid execution, and reliability of results. The actual skin resistance between concrete and in-situ soil can be measured at different elevations within the soil profile. The greater certainty achieved from pullout testing eliminates overly conservative design values, which in turn reduces as-constructed costs. Experience has shown that these savings far exceed the cost of pullout testing.