Bi-directional static load test (BDSLMT)

A highly effective static load testing technique that delivers accurate and reliable data.
James Fisher Testing Services’ (JFTS) BDSLT method is a highly effective static load testing technique that delivers accurate and reliable data.

BDSLT provides high resolution results for design engineers to confidently optimise pile design, based on achieved test results. In comparison to traditional methods of load testing, BDSLT is safer, faster and provides more accurate data. It is often the only solution for restricted access or low headroom situations where installation of anchor piles or other reaction systems are not possible.

Using a combination of hydraulic, high-capacity bi-directional jacks to deliver the required test load, BDSLT provides separate measurements of a pile’s end-bearing and skin friction along the pile’s length.

JFTS has utilised BDSLT for over 15 years, having successfully completed over 2,000 tests worldwide. During this time, JFTS has refined the equipment used and techniques deployed on-site to ensure reliable and accurate results.

A part of James Fisher and Sons plc (James Fisher), JFTS’s highly skilled testing team can provide a tailored service, using the latest innovative James Fisher products. JFTS’s global presence and depth of experience enables it to deliver a rapid response service for quick on-site evaluations and remote monitoring services.
Applications

BDSLT is suitable for a range of both commercial and non-commercial applications, including the assessment of cast in-situ piles for (but not limited to):

- Bridges
- Structures
- Railway lines
- High-rise housing

JFTS’s BDSLT method is fully compliant with the ASTM D8169 / D8169M – 18 standard.

Benefits of BDSLT

HSE benefits

- Enhanced safety and reliability in comparison to traditional load testing methods
- No risk of oil contamination in the event of fluid spills during testing as standard mineral water is used for the hydraulic fluid
- Greatly reduced risk for larger test loads without the need to stack Kentledge blocks above the test pile (BDSLT loads in excess of 10,000T have been successfully achieved)

Cost benefits

- BDSLT eliminates the need for overhead beams or reaction piles making the test more mobile and space efficient in comparison to other methods
- Preparation for the installation of the pre-manufactured bi-directional hydraulic jack(s) can be completed within a few days, saving time on tight building schedules
- Proven to be more cost-effective as loads increase in comparison to traditional load testing methods due to the fixed costs of materials, jacks, plates and installation time

Time benefits

- Precision testing provides engineers with separate data on the end-bearing and friction resistance of the shaft
- BDSLT is a versatile method that can be applied to barrette, bored piles (compression or tension), inclined piles or belled shafts. The test pile can be reused to carry working loads after testing by grouting the pile, creating value for money
- Installation process forms part of the rebar cage fabrication which speeds up installation time
- Minimal workspace required during testing in comparison to conventional tests, meaning other works can continue on-site and at the same time
- No soil stabilisation is required prior to set-up/testing
- All test results are automated and streamed to a site laptop at a sampling rate of one per minute
- Only need to cast the pile to cut-off level, eliminating the need for a king post or hacking back a test pile when testing is complete
How BDSLT works

BDSLTL methodology

Set up
Hydraulic jacks are positioned between two load bearing plates and attached to the reinforced steel cage prior to lowering. Positioning is calculated to provide equal capacities above and below the hydraulic jack assembly. Concrete casting is performed as normal, with cube tests indicating when testing can commence. A full method statement is provided prior to installation to outline the test design and procedure.

During testing
Hydraulic pressure is applied to the jack assembly. As load is applied, the hydraulic jacks begin to move in two directions - upward against upper skin friction and downward against lower skin friction and base resistance. Types of tests include:

1. An ultimate load test (ULT) includes strain gauges installed along the pile length, with the pile being loaded until either the shear resistance or base resistance of the pile has been fully mobilised. Strain gauge data is used to plot the load distribution along the pile length which is used to determine the ultimate soil capacity of the test pile.

2. A working load test (WLT) loads the pile within the acceptable working load limits. This type of test is used to validate whether the pile head displacement for the given load conforms to the allowable pile head settlement criteria.

Post testing
Following test completion, a full test report is supplied including the obtained soil parameters and equivalent top loaded settlement values. Both documents can be sent for professional engineer endorsement, if required.

Test equipment supplied and utilised by JFTS’s experienced engineers, including:

- Combination of hydraulic jacks to apply the test load
- Steel bearing plates to position the hydraulic jacks
- Displacement transducers, connected to tell-tale rods
- Strain gauges installed along pile length
- Fully automated data logger to monitor and record the data signals
- JFTS’s pileSENTINEL software to visually display live readings throughout testing
Case studies

Delivering an industry first in Singapore

JFTS successfully pile tested a 10,000 tonne load – the highest capacity ever tested for Dongah Geological Engineering Co. Ltd in Singapore.

The pile test was conducted at the confluence of different soil formations, making it challenging to design a test which could acquire meaningful data.

JFTS was able to overcome this difficulty using BDSLT together with its experience and understanding of customer requirements.

Accommodating short timeframes in Malaysian residential project

JFTS supported Sunway Group Berhad with its maintain load test requirements on a short time frame of nine months for the construction of its residential condominium in Kelana Jaya.

The high test load and space restrictions made alternative methods, such as the Kentledge test, impossible due to the short time frame.

JFTS was able to surmount these obstacles by carrying out two tests simultaneously using the BDSLT method.

Overcoming height restrictions in Kuala Lumpur

JFTS was brought on board for testing of the TRX Exchange Shopping Mall situated in the heart of the new RM8 billion Lifestyle Quarter under construction in Kuala Lumpur.

The four-storey mall will feature 500 retail lots with a net lettable area of 1.35 million sq. ft.

Due to the height restrictions of the build, JFTS recommended the BDSLT method, as this would prove to be the most cost-efficient method to conduct a maintain load test within these limitations.
BDSL is a fast and effective method of testing which has saved us time on time critical projects. James Fisher Testing Services responded quickly and delivered, installed and completed the test within two weeks of our initial enquiry.

Mr SK Chan, projects director at Progress Piling
Our wider capabilities

JFTS provides a range of inspection, testing and monitoring products and services enabling you to make informed decisions about your project, materials or asset. JFTS is involved throughout the asset life cycle; from site preparation through to construction, operations and decommissioning.

Our capabilities include:

**Foundations testing**
- Bi-directional static load testing (BDSLNT)
- Integrity testing (TDR)
- Dynamic pile testing (SIMBAT)
- Static load testing
- Sonic logging
- Parallel seismic testing
- Zone testing

**Pavement testing**
- Falling weight deflectometer (FWD) and heavy weight deflectometer (HWD)
- Coring
- Dynamic cone penetrometer (DCP)
- Laying records
- Nuclear density gauge (NDG)

**In situ testing**
- Fresh concrete sampling
- Plate/California bearing ratio (CBR) testing
- Nuclear density gauge (NDG)
- Site sampling
- Dynamic cone penetrometer (DCP) testing

**Fresh and hardened concrete**
- Beam flexural strength
- Compressive strength of cores
- Tensile splitting strength
- Water absorption

**Soils and aggregates**
- Grading
- Optimum moisture content (OMC)
- Constituents
- Shear box
- 6F2 and appendix 5/1 schedules
- Waste acceptance clearance (WAC) testing

**Structural health monitoring and asset management**
JFTS integrates monitoring for a wide range of small to large infrastructure assets including bridges, buildings, railways, tunnels and wind turbines.

JFTS’s services includes expert design, assembly, installation, and commissioning. Data hosting, analysis and user configured reporting is provided through its Smart Asset Management System™ (SAMS).

**Environmental monitoring**
JFTS offers a full range of environmental monitoring solutions to monitor noise, dust, wind and vibration. The requirement to monitor and report on the environmental impact of site activity is increasingly mandated in permits and local authority regulations.

JFTS offers a simple, quality, end-to-end service enabling our customers to comply with planning requirements. The system includes bespoke real-time alerts and reporting.