



# FACT SHEET

**In-Situ  
Testing**

**Geotechnical  
Investigations**

The GeoGroup has branches located in Gauteng, Eastern Cape, KwaZulu-Natal, Western Cape, Uganda, Botswana, and Sweden.

[www.geogroup.co.za](http://www.geogroup.co.za)





## Testing Methods

GeoGroup offers a variety of In-Situ testing services:

**PIEZOCONE PENETRATION TESTING (CPT<sub>u</sub>)**

**SEISMIC PIEZOCONE PENETRATION TESTING (S-CPT<sub>u</sub>)**

**MOSTAP SOIL SAMPLING (UNDISTURBED)**

**SEISMIC DILATOMETER TESTING (SDMT)**

**ELECTRONIC VANE SHEAR TESTING (eVST)**

**DYNAMIC PROBE SUPER HEAVY (DPSH)**

**PRESSUREMETER TESTING**

**LUGEON TESTING**

Each of these methods provides unique information about the soil or rock being tested, such as its strength, stiffness, and compressibility.

In-situ testing is particularly useful in situations where obtaining soil or rock samples are difficult or nearly impossible, such as in deep foundations or underwater structures. By providing detailed data about the site's properties, In-Situ testing allows engineers to design structures that are safe, stable, and efficient. Overall, in-situ testing is an important tool for geotechnical engineers and plays a critical role in ensuring the safety and reliability of infrastructure projects.

GeoGroup currently has five CPT pusher rigs that can be utilised for a variety of in-situ testing methodologies. Additionally, all in-situ testing methodologies can also be carried out using Sonic rigs to advance the testing apparatus into the soil.

### Testing Equipment

- 5 x Pagani CPT Pusher Rigs
- 10 x Pagani Compression Type CPT<sub>u</sub> Cones
- 2 x Pagani S3X Seismic Modules
- 2 x Marchetti DMT modules
- 1 x Marchetti SDMT module
- 3 x DPSH Units  
(1 x Trailer-mounted & 2 x Portable Units)
- 2 x A.P van den Berg eVST modules
- 2 x Geopro Lugeon testing equipment
- 2 x Apageo Menard Pressuremeter testing equipment

## CPTu Testing

Piezococone penetration testing (CPTu) is an in-situ soil testing method used to measure a wide range of geotechnical parameters including strength, stiffness, and soil behaviour. CPTu is preferred when testing sensitive environmental areas as it does not require the use of drill cuttings or other invasive methods.

The CPTu test involves inserting a cone-shaped probe into the soil at a constant rate of penetration, while recording the:

- *cone tip resistance ( $q_c$ ),*
- *sleeve friction ( $f_s$ ) and*
- *dynamic pore water pressure ( $u_2$ ).*



Figure 1: Basic Piezococone Parameters



This rapid testing method is employed in a variety of fields including geotechnical engineering, civil engineering, and construction projects, especially for the design and evaluation of foundation structures and tailings storage facilities.

With over 5 years experience, the GeoGroup has successfully completed several CPT tests for various clients.

## S-CPTu Testing

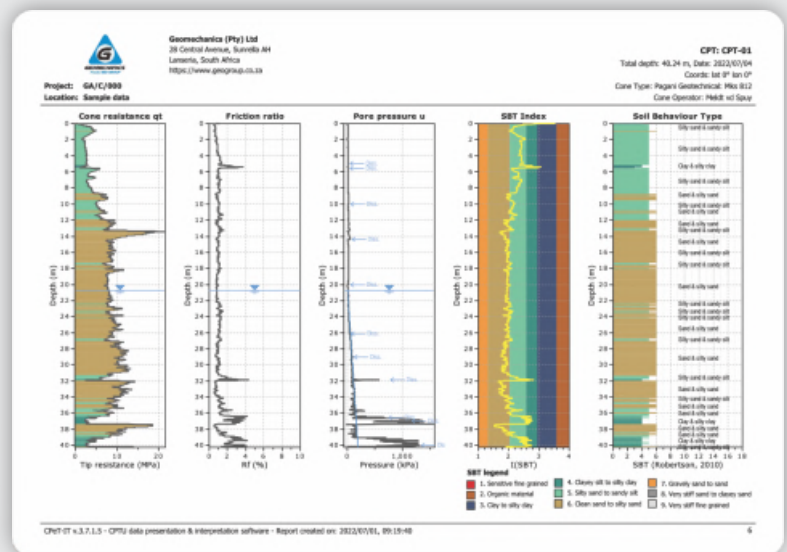
Seismic Piezococone penetration testing (S-CPT) is a geophysical investigation method used to measure the shear wave velocity of soils. This method is widely used in the field of engineering and geology, particularly for the assessment of liquefaction potential and the design of foundations for structures.





## Data Processing

Data interpretation is done by using Geologismiki's CPeT-IT & SPAS software to interpret CPTu data and S-CPTu data respectively. The software takes the CPTu data and performs basic interpretation in terms of soil behaviour type (SBT) and various geotechnical parameters using current published empirical correlations based on the comprehensive review by leading experts in the field such as Dr. Peter K. Robertson.



### DERIVABLE PARAMETERS

- Equivalent N60
- Unit weight
- Undrained shear strength
- Soil sensitivity
- Stress history (OCR)
- In-situ stress ratio
- State parameter
- Friction angle
- Stiffness and modulus
- Permeability
- Consolidation characteristics from dissipation data
- Shear wave velocities

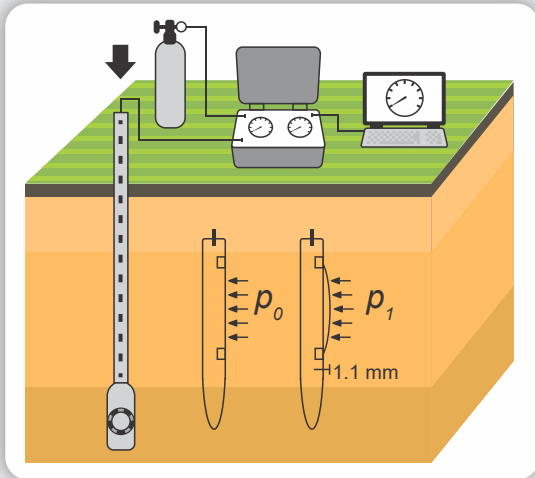
The final CPTu digital log can be fully customised to show whatever correlations are required and to allow any preferred changes to correlation factors e.g. Nkt

## MOSTAP

First introduced as a service in 2017, MOSTAP soil sampling is a fixed-piston sampler which minimises soil disturbance and is able to obtain undisturbed samples of various diameters at any given depth.

MOSTAP soil sampling involves driving a steel sampler into the ground using a standard CPT pusher rig. Once at the target depth, the MOSTAP is activated allowing the cone tip to stay stationary as the MOSTAP is advanced by one meter. The soil sample is captured in a sampling tube providing the user with a one-meter undisturbed sample of either a 35mm or 65mm diameter.





## Dilatometer Testing (DMT)

Flat plate dilatometer testing (DMT) is a geotechnical method used to determine the in-situ horizontal deformation and strength characteristics of soils. The test involves inserting a flat plate probe, with a circular membrane, into the soil, which is then inflated with a controlled pressure. The resulting membrane expansion is measured and used to determine various geotechnical properties of the soil.

One of the primary benefits of DMT is its ability to provide incremental measurements of soil properties over a large depth range. This allows geotechnical engineers to accurately model the behaviour of the soil under different loading conditions, and to design foundations and other structures accordingly. The test can also be used to estimate the strength and stiffness of the soil, which is important for assessing the stability of slopes, embankments and tailings storage facilities.

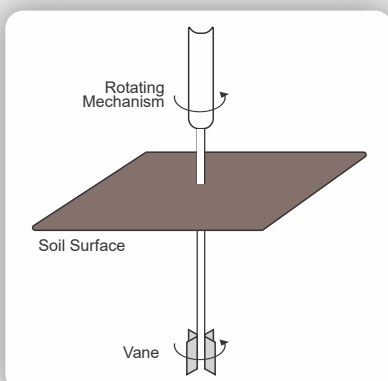
## Seismic Dilatometer Testing (SDMT)

Seismic dilatometer testing, also known as SDMT, is a geophysical method used to determine the mechanical and dynamic properties of soils, by analysing the shear wave velocity similar to the S-CPTu.

SDMT testing provides valuable data about the soil's dynamic properties. This information is useful in a variety of geotechnical applications, including foundation design, earthquake engineering, and soil liquefaction potential.



## Electronic Vane Shear Testing (eVST)



Electronic Vane Shear Testing (eVST) is a widely used method for measuring the undrained shear strength and remoulded shear strength of soil. This technique involves pushing the apparatus into the soil and rotating it, using an electronic motor situated above the vanes, at a controlled rate while measuring the torque required to cause shear failure. eVST is a quick, easy, and non-destructive way to measure soil shear strength. Additionally, eVST is a relatively inexpensive testing method that can be performed quickly on-site, reducing the need for laboratory testing and associated costs.



## Dynamic Probe Super Heavy (DPSH)

Dynamic Probe Super Heavy (DPSH) is a geotechnical testing method that is used to evaluate the strength and stiffness of soils. The DPSH test involves driving a heavy cone-shaped probe into the ground, typically using a hydraulic hammer or a drop hammer. As the probe penetrates the soil or rock, it measures the resistance it encounters, which is then used to determine the soils properties.

The DPSH test is particularly useful in large-scale construction projects, such as high-rise buildings, bridges, and dams, where the soil must be able to support significant weight and stress. The test provides a quick and cost-effective way to assess the site's properties, allowing engineers to design the structure accordingly.

One of the major advantages of the DPSH test is that it can be performed rapidly and efficiently, with minimal disturbance to the surrounding area. This makes it an ideal testing method for sites with limited access or where drilling is not feasible.



The Pressuremeter test is a widely used geotechnical testing method that is used to determine the in-situ stress-strain characteristics of soil. This test involves the insertion of a cylindrical probe, called a pressuremeter, into a borehole at a specified depth. The pressuremeter is then inflated with a fluid, such as water or oil, which exerts pressure on the surrounding soil. The pressuremeter measures the pressure required to inflate the probe and the corresponding volume change of the soil.

The results of the Pressuremeter test can be used to determine the compressibility, shear strength, and modulus of deformation of the soil. These parameters are essential in the design of foundations, tunnels, and other underground structures. The test is particularly useful in evaluating the strength and deformation characteristics of soft soils and clays.

## PRESSUREMETER CASE STUDY

### *Pressuremeter Testing at Khanyisa Power Station*

The Apageo Pressure Meter test and other In-Situ tests were done to determine the soil characteristics to be used for assessment of excavation methods and for detailed design of foundations, ground improvement and earthworks.

185 Pressuremeter tests were done in 18 boreholes with test depths ranging from 1 meter to 38.5 meters.

## Pressuremeter Testing



## Lugeon Testing

Lugeon testing is a type of packer test that is commonly used to assess the permeability of rock or soil. The lugeon test involves drilling a borehole into the rock or soil and inserting a single packer or a double packer system, which is an inflatable tube or sleeve, at a specific depth. The packer is then inflated to create a seal, and water is pumped into the borehole at a known pressure. The rate at which water flows into the borehole is measured, and this flow rate is used to calculate the lugeon value, which is a measure of the permeability of the rock or soil.

Lugeon testing is widely used in the construction industry to assess the suitability of rock or soil for various types of infrastructure, such as tunnels, dams, and foundations. It can also be used to identify potential sources of groundwater, as well as to monitor the effectiveness of grouting and other types of remediation work.



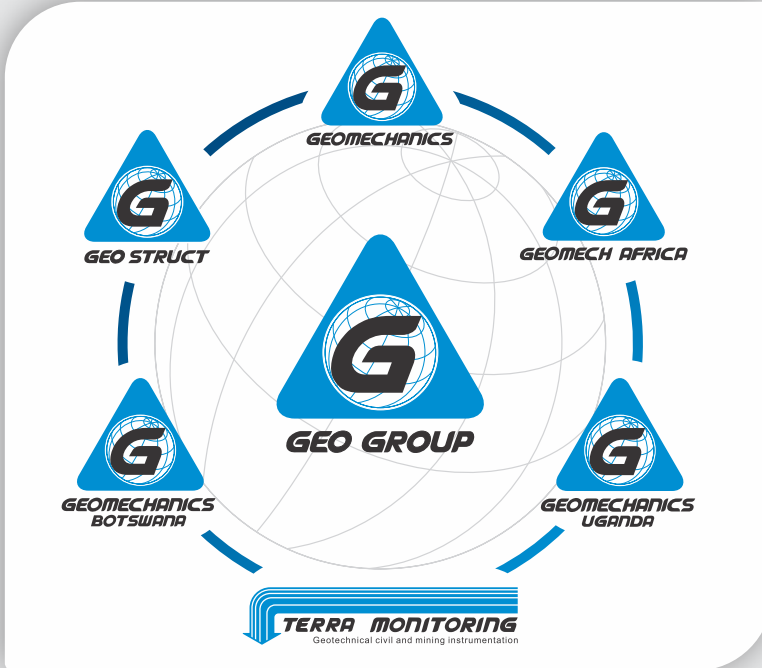


# GeoGroup Companies



## The GeoGroup CONTACT US

The GeoGroup comprises of a group of companies, each a leader in its own field, that provide a range of services to the Geotechnical, Civil, Exploration, and Mining industries.



### Services

- Geotechnical investigations
- CPTu & In-situ testing
- Exploration drilling
- Sonic drilling
- Water boreholes
- Geotechnical monitoring and testing
- Metal welding and fabrication

### Products

- Geotechnical Instrumentation
- Lighting towers

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