

Cone Penetration Test (CPT)

The cone penetration test, or CPT in short, is a soil testing method which will provide a great deal of high quality information.

In the Cone Penetration Test (CPT), a cone on the end of a series of rods is pushed into the ground at a constant rate of 2 cm /sec. and continuous or intermittent measurements are made of the resistance to penetration of the cone. Measurements are also made of either the combined resistance to penetration of the cone and outer surface of a sleeve or the resistance of a surface sleeve. Pore pressure measuring is also becoming a standard within CPT.

The method was developed in Holland during the twenties mainly to avoid settlements and to build better foundations. The method builds on the principle of measuring the thrust used to press down a probe into the soil with constant speed. Later, a system with dual rods was developed which would also measure the force on the cone tip itself, and local friction. In the late seventies, probes with electrical sensors were taken into use. This led to the advantage that the resistance could be measured at the cone tip and there were also possibilities to register additional parameters.

Today, it's common to measure, in addition to the cone resistance and the sleeve friction, also the generated pore pressure which develops in the soil when the probe is pressed down the so called CPTU.

There are many reasons for the wide spread use of the CPT method. The most important being the in-situ measurement, it measures the soil properties in its right environment, in the soil as it is, where it is.

CPT is a fast method and therefore cost effective. It also gives a good over-view of the soil topographic, because of the continuous measures. Because there is no spoil, as when drilling, CPT is used for many environmental studies.

CPT(u) Probes

Geotech offers three different ways to transfer the data from the probe to the surface, two cordless and one by cable. The cordless CPT uses radio waves or acoustic signals to send the measurement to a receiver at the surface.

The Geotech CPT probes are equipped with individual sensors for point resistance (qc), sleeve friction (fs), pore pressure (u) and a tilt sensor.

The data measured by the sensors is digitized, multiplexed and encrypted with an error detecting code in the probe before it is forwarded to the transmitter or cable adapter for transmission to the surface. To back-up the data transmission, the cones can also be delivered with a back-up memory of 8 hours capacity, with 18 bits resolution on all channels.

The readings from the three channels are corrected for temperature drift by a temperature sensor and a processor in the electronic part of the probe. The probes have therefore a very low temperature sensitivity sensors and with adapters for electric conductivity or seismic CPT. The data measured by the sensors is digitized, multiplexed and encrypted with an error detecting code in.



CPT NOVA System

The CPT GEOTECH NOVA has four different options. The same probe can be used for all four configurations. The four options of CPT GEOTECH NOVA are; RW NOVA, ACOUSTIC NOVA, CABLE NOVA and MEMORY NOVA.

Joint for all four systems are that they can be used with memory/back-up memory. The NOVA system you buy today can easily be upgraded to any of the other NOVA systems. The new smaller NOVA cone has a length of 23 cm and the weight is only 1,25 kg.

The unique cordless system makes the CPT sounding quicker and easier.

Save yourself from trouble with the cord, just put the rods together. With RW NOVA the rod can be extended during penetration (provided that you are using a chuck or clamp to push and pull). This saves time, money and manpower.



	Point resistance (qc)	Sleeve friction (fs)	Dynamic pore pressure (u)	Tilt
Range	20, 50, 100 MPa	0.5 & 1.0 MPa	1.0, 2.5, 5.0 MPa	0-40 deg.
Accuracy	< 0.2% FS	< 0.2% FS	< 0.4% FS	0.5 deg.
Resolution	< 0.0025% FS	< 0.0025% FS	< 0.0025% FS	0.1 deg.
Net area factor	0.82	0		

CPT Classic System

Geotech CPT Classic System was developed in the late seventies and has been continuously upgraded into the present fifth version. The Classic system has two different

ways for transmission of data, acoustic signals and cable.



Electric Conductivity Adapter

The Geotech electric conductivity channel adapter is mounted on 10 or 15 cm² CPT(U) probes. The adapter consists of an array of four ring electrodes (Wenner configuration, i.e. with equal spacing between the electrodes) and a sound transmitter. The diameter is 44 mm. The CPT(U) probe with the electric conductivity adapter is used with the traditional Geotech cordless data transmission. The probe is pressed into the ground in the same way as other Geotech CPT probes and readings are made every second.

Technical specifications	
Measurement range	0,5-10 000 mS/m (millisiemens per meter) or 0,3-2 000 omh / meter
Section area	15 cm ²
Total length	500 mm
Weight	3,5 kg
Power supply	4 alkaline batteries, type C



Seismic profiling

A seismic piezocone is pushed progressively into the ground. Each metre or so it is stopped. A hammer is used at the surface, to produce seismic waves. For shallow saturated soil the compressional (P) wave velocity is normally primarily a function of the bulk modulus of the pore water, and is not sensitive to changes in the stiffness of the soil skeleton. Shear waves are usually used, and are typically generated by placing a wooden sleeper under the wheel of the penetrometer truck and striking it horizontally with a large hammer.

The striking of the block with the hammer triggers an armed seismograph, and this records the arrival of the seismic waves at the cone tip. If the site is noisy, the signal- to-noise ratio can be improved by repeating the process and stacking the signals. The travel time from the surface to each cone position is determined from the seismograph traces, and the time taken for the wave to travel between each cone position is determined by subtraction. The so-called 'interval velocity' is then determined by dividing this difference in travel time by the distance between the two cone positions. Better results can be obtained by using a cone with two sets of geophones, mounted a metre or so apart, in it. Finally, the very small strain shear modulus of the soil can be determined from the equation.

Seismic CPT adapter

The Geotech seismic CPT acquisition is done with a seismic channel adapter, equipped with one, two or three accelerometers (uni-, bi- or

triaxial SCPT cones), mounted on any of the Geotech CPT(U) probes.

Uniaxial SCPT soundings are carried out to determine risks of liquefaction, triaxial SCPT for the evaluation of the elastic constants (Shear modulus G_0 , Elasticity modulus E , Bulk modulus, Poisson's ratio ν , Lamé's constant λ), attenuation analysis.



CPT Sounding Rods

Geotech offer CPT sounding rods with all different threads available on the market today for example, standard tapered threading and speed lock type.

The rods are made from the best quality steel accessible, and thanks to automatized production they can be sold at a bargain price.



CPT Software

CPT-Log

User friendly software which logs point resistance (q_c), sleeve friction (f_s), pore pressure (u), tilt angle, electric conductivity, temperature,

penetration speed and dissipation test in the "Penetration Module". It furthermore calculates in semi-real time the friction ratio R_f . On the screen up to four graphs can be displayed. The choice of displayed channels can be changed during a sounding. Zeroes are checked on all channels before and after tests and all scales can be chosen manually.

CPT-Pro










































CPT-pro is a multi module program designed for complex analysis, interpretation and presentation of CPT soundings, and also for elaborating geotechnical documentation. Read more in the datasheet.

Conrad

Interpretation and presentation software designed by Swedish Geotechnical Institute

RIGS

Geotech manufactures site investigation rigs and penetrometers, designed for all purposes. All rigs are prepared for quick mounting of Geotechs sounding tools.

Method:	RIG	RIG	RIG	RIG	RIG
	220	604	605	607	707
Static Penetration					
Dynamic Sounding					
Weight Sounding					
Rotary / Percussion					
Diamond Coring					
Info:					
Stroke					
Weight					
Dimensions, mast lowered					
Diesel engine					

Upgrade your Classic CPT system to NOVA CPT system and be able to use both Classic and NOVA probes. For more information please contact us at sales@geotech.se or call +46 31 289920.