

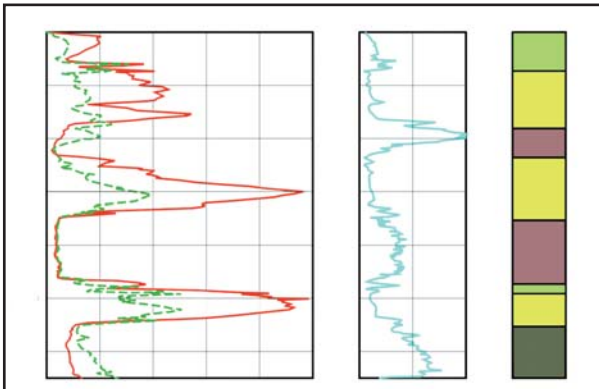
Fugro Engineering Services Limited

SOFT SOILS - INSITU CHARACTERISATION OF GEOTECHNICAL PROPERTIES



SOIL TYPE & STRATIFICATION

- Detailed characterisation of soil types
- On-site determination of strata variations
- UKAS accredited testing procedures
- Continuous real-time data
- Accurate depth control
- Slope indicator
- High production rates (>199m/day)
- Up to 20 tonne thrust capacity.



INSITU STRENGTH

Insitu strength can be determined from the results of cone penetrometer tests and/or insitu vane tests using the Geonor vane deployed from a CPT rig.

CONE VANE

CLAY $q_c = S_u N_k$ $T = f(S_u)$

SAND $q_c = \sigma_v' N_q$

where

q_c = measured cone resistance

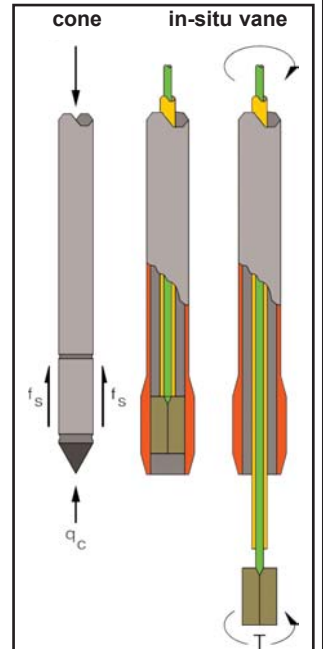
S_u = undrained shear strength

N_k = cone factor

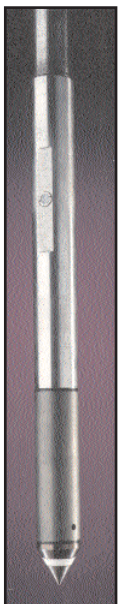
σ_v' = effective overburden pressure

N_q = bearing capacity factor related to friction angle ϕ'

T = measured rotational torque

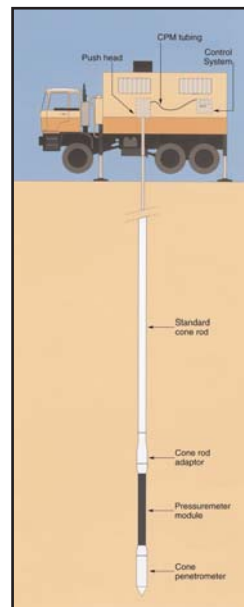


HYDRAULIC BEHAVIOUR



- The piezometer incorporates a porous element in the shoulder of the cone. An internal pressure transducer measures the transient porewater pressure variations during cone penetration.
- Rapid dissipation of porewater pressure is indicative of permeable strata and features, whilst excess porewater pressures are indicative of clays. Features as thin as 1cm can be detected.
- Pore pressure dissipation with time provides data from which estimates of the coefficient of consolidation of the soil can be derived. This data can be used to estimate soil permeability.
- Porewater pressure data can be used to estimate over consolidation ratio in clays.

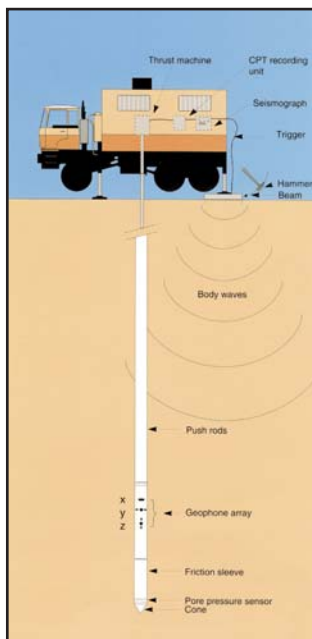
SOIL DEFORMATION



- Fugro Cone Pressure-meter (CPM) provides reliable measurement of the insitu strength and load deformation behaviour of the soil.
- Results from cone pressuremeter tests can be used to derive parameters such as:-
 - undrained shear strength
 - shear modulus
 - effective horizontal stress
 - relative density
- Data from the cone penetrometer can be used to ensure that the pressuremeter is positioned within the zone of the soil interest.

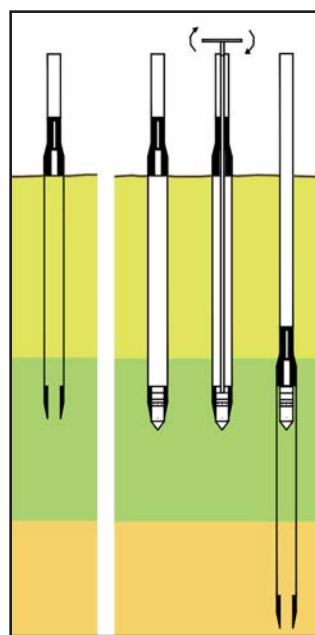
The Fugro Group is an international organisation with around seven thousand staff in over fifty countries. Our major disciplines are Geotechnics, Environmental Services and Survey.

DYNAMIC PROPERTIES



- The Seismic Cone Penetration Test (SCPT) is a reliable, cost effective technique to determine the insitu seismic wave velocity.
- Seismic wave velocities give an indication of ground characteristics such as low strain shear modulus and Poisson's ratio.
- Data from the cone penetrometer is used in delineating the strata changes identified by the seismic results.

SOIL SAMPLING



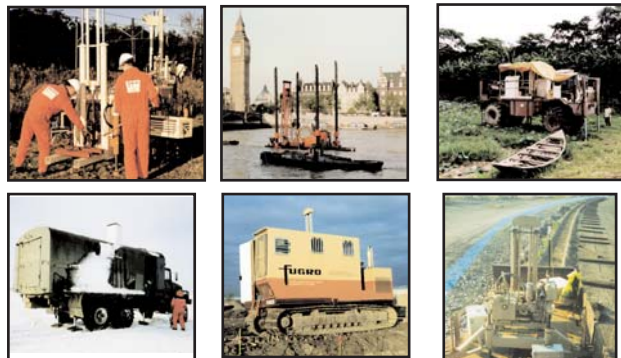
Interpretation of CPT results can be enhanced by the use of site specific correlations. Such correlations are obtained by performing laboratory tests on soil samples obtained from the location of the CPT tests.

Soil samples can be obtained using CPT equipment and proprietary samplers such as the Mostap 35/65 and GMF.

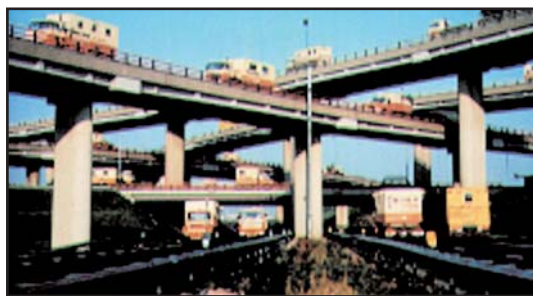
- Soil samples of up to 1.5m in length and 65mm in diameter can be obtained, dependent upon depth and soil conditions encountered.

ACCESSIBILITY & AVAILABILITY

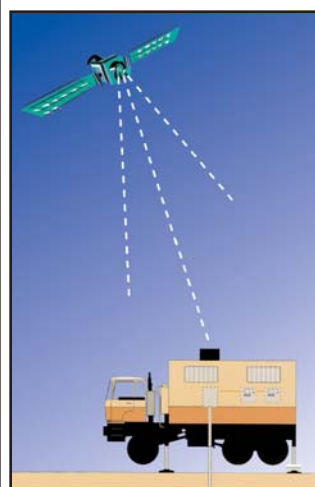
- Fugro operate CPT equipment for a wide range of access and ground conditions.



- Fugro Ltd can draw upon other CPT equipment in Europe.



POSITIONING



- Fugro Ltd's CPT trucks are fitted with OMNISTAR Global Positioning System receivers.
- Receivers are rack mounted alongside other CPT data acquisition systems and provide the CPT operator with the co-ordinates of the test location.
- Accuracy of the standard unit is $\pm 2m$ in the horizontal plane and $\pm 5m$ vertically. When used with a second base station unit, the accuracy can be improved to the order of a few centimetres.



Fugro Engineering Services Limited

Fugro House
Hithercroft Road
Wallingford
Oxfordshire OX10 9RB
Tel: +44 870 4021 400
Fax: +44 870 4021 499
Email: wallingford@fes.co.uk

Armstrong House, Unit 43
Number One Industrial Estate
Medomsley Road, Consett
Co. Durham DH8 6TW
Tel: +44 1207 581120
Fax: +44 1207 581609
Email: consett@fes.co.uk