DMT – Flat Dilatometer

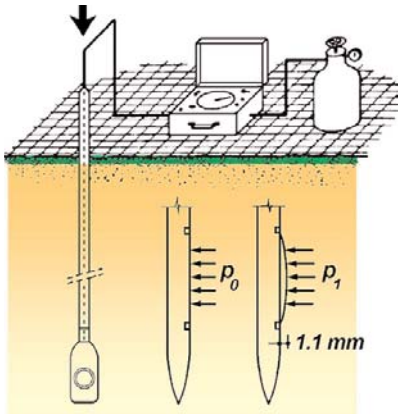
EUROCODE 7 (1997). Standard Test Method, European Committee for Standardization Part 3: Design Assisted by Field Testing, Section 9: FLAT DILATOMETER TEST (DMT), 9 pp.

ASTM (2002). Standard Test Method D6635–01, American Society for Testing and Materials The standard test method for performing the Flat Dilatometer Test (DMT), 14 pp.

TC16 (2001). "The DMT in soil Investigations", a Report by the ISSMGE Technical Committee TC16 on Ground Property, Characterization from in–situ testing, 41 pp.

DMT – FLAT DILATOMETER

Settlements and moduli



ADVANTAGES

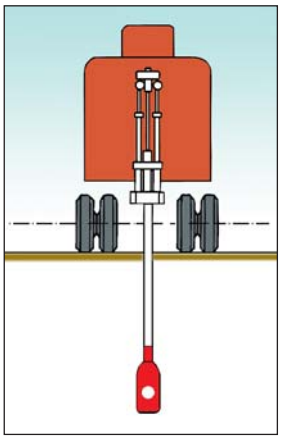
- quick, simple and economical
- quantitative design parameters
- highly reproducible results
- usable with most insertion machines
- used in over 40 countries
- international standards

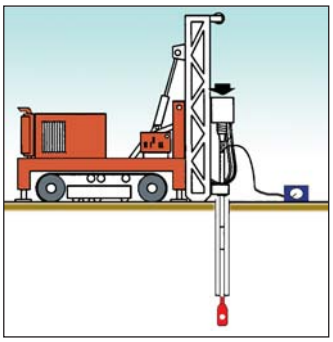
APPLICATIONS

- Settlement Prediction
- Operative moduli M
- Undrained shear strength Cu (clays)
- Soil Stratigraphy (sand, silt, clay)
- Compaction control
- Detects slip surfaces in clay slopes
- P–y curves for laterally loaded piles
- Sand liquefaction
- Coefficient of consolidation and permeability (clay)
- Φ in sand
- OCR and K_O in clay
- Subgrade K_h for diaphragms
- FEM/Plaxis parameters
- Pavement subgrade modulus

BLADE INSERTION

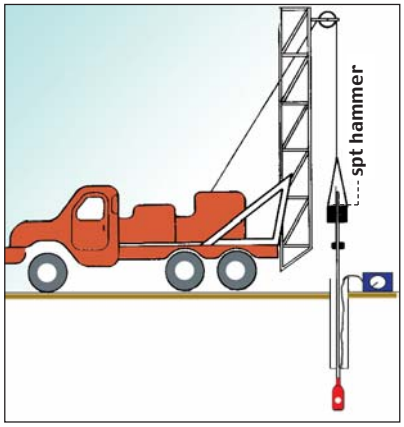
Pushed by truck



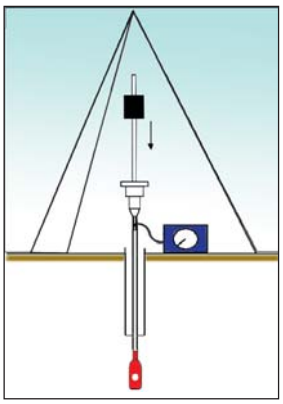


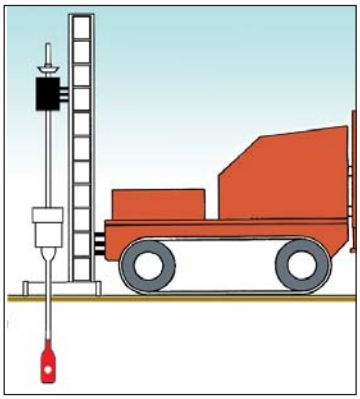
Pushed by drill rig

Driven by drill rig



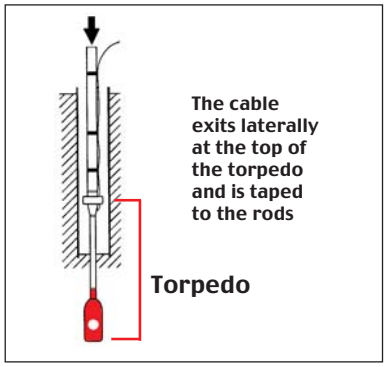
Driven by Spt Tripod





Driven or pushed by light static/dynamic penetrometer

Torpedo mode of advancing the blade

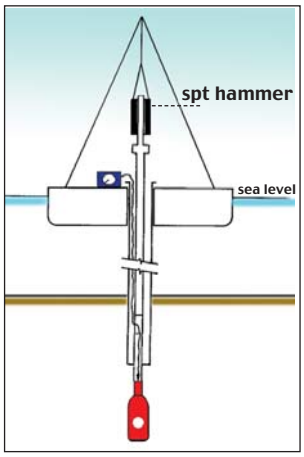


OFFSHORE

Pushed by a fixed platform

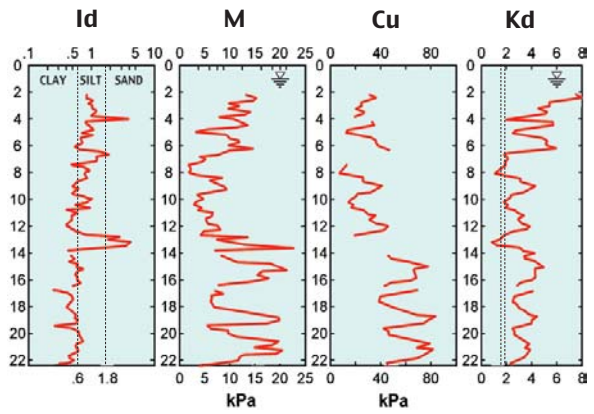

DMT tests in Venice Lagoon

Driven from a barge

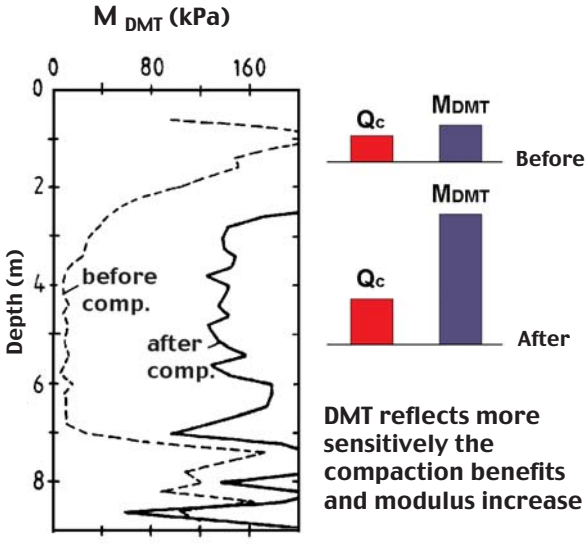


APPLICATIONS

Soil parameters

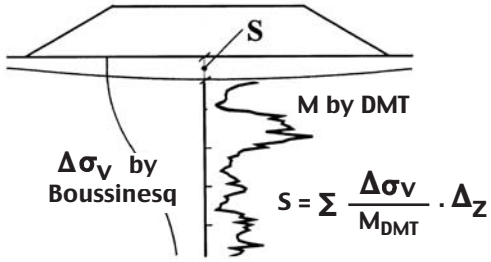


Compaction control

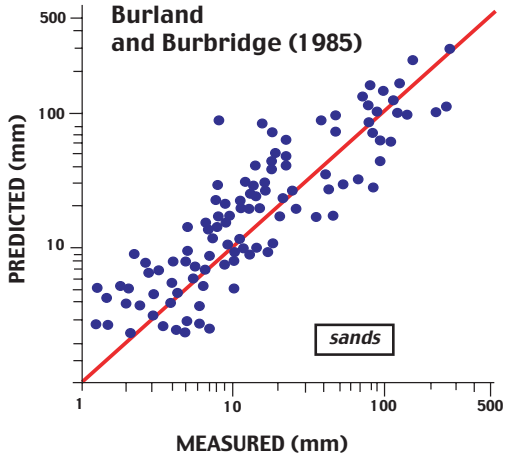


DMT reflects more sensitively the compaction benefits and modulus increase

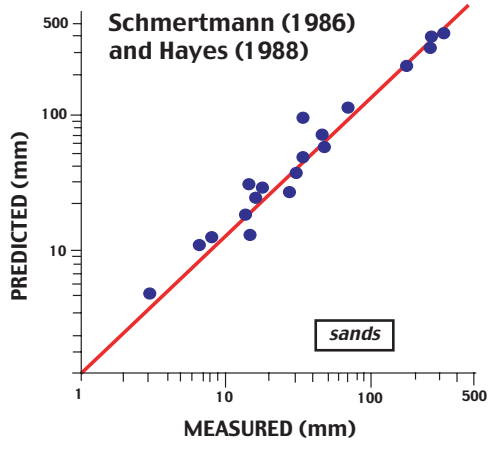
Settlement prediction



SPT predicted Settlements

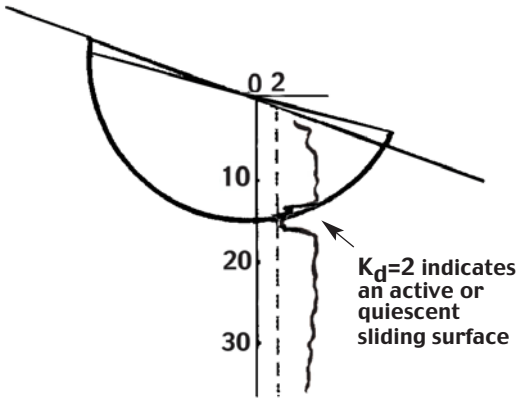


DMT predicted Settlements

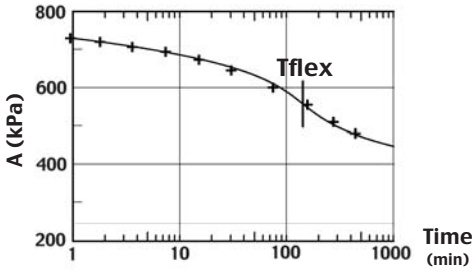


Bullock and Failmezger (Porto 2004)

Locating slip surfaces

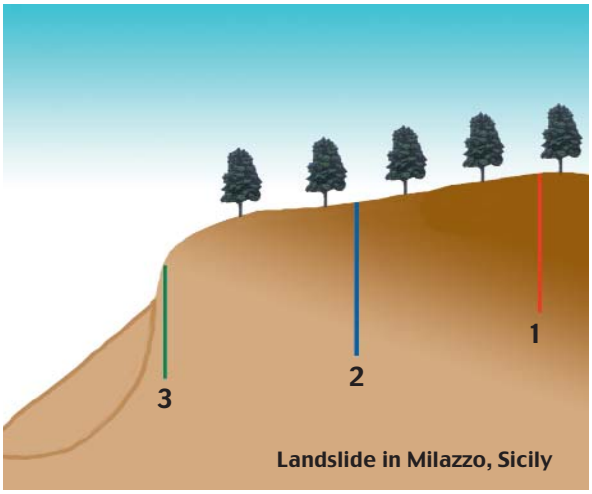


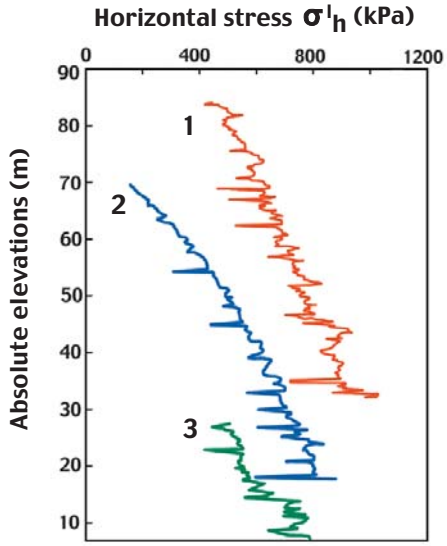
Consolidation & permeability coefficients



$$C_h \approx \frac{7cm^2}{Tflex}$$

σ_h relaxation behind a landslide



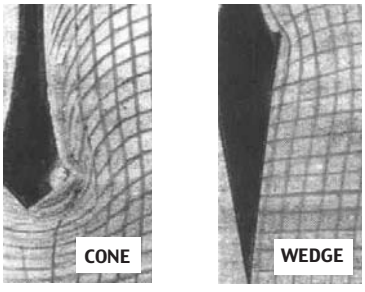


Liquefaction Recommendations

K_d limits for safety vs liquefaction
(for a magnitude = 7.5 earthquake)

Seismicity	a_{max}/g	$K_{d\ min}$
Nonseismic	/	1.7
Low seismicity	0,15	4.2
Average seismicity	0,25	5.0
High seismicity	0,35	5.5

Soil distortions



The Dilatometer test (DMT) provides a method for the rapid, accurate and economical insitu determination of many important geotechnical parameters. Adopted in over 40 countries by Investigation Firms, Consultants, Universities and Research Institutes, it has been extensively used and calibrated in soil deposits around the world. In addition to over 300 research publications, the DMT is standardized in ASTM D6635-01, in EUROCODE 7 and in the ISSMGE Committee TC16 Report.

The DMT is specifically suitable when accurate settlement predictions are important, e.g. in case of strict specifications on settlements (railways) or when the designer must opt for shallow or deep foundations based on settlements. In general, the DMT is suitable when quantitative estimates of the design parameters are needed, in particular M and Cu. M and Cu comparisons in many sites worldwide may be found at the DMT website.

DMTs are performed in sands, clays and silts, and some soft rocks. The blade is able to cross gravel layers of about 0.5 m. Current blades are made of high strength steel and can be safely pushed with a thrust up to 30 tons.

The Dilatometer consists of a steel blade with a thin, expandable, circular steel membrane mounted on one face. The blade is connected to the control box by a flexible tubing running inside the insertion rods. A gas tank supplies pressure to the control box.

The blade is advanced into the ground using standard field equipment:

- Pushed with a cone penetrometer rig (this method yields the highest productivity, up to 100 m of test per day),
- Pushed with the hydraulic capability of a drill rig,
- Driven with SPT or lighter equipment (hammer and rods) ,
- Offshore: pushed from a fixed platform or driven from a floating barge.

The test starts by inserting the dilatometer into the ground at the first test depth. The membrane is then expanded using gas pressure regulated by the valves on the control box and measured by the pressure gage. At each test depth the user determines the first pressure p_0 necessary for the membrane to initiate movement and then the second pressure p_1, required for a fixed displacement (1.1 mm) of the membrane center. The blade is then advanced – normally 20 cm – to the next test depth.

Dilatometer field data are elaborated according to the methods published by Marchetti and Schmertmann, using the Dmt Elab Windows™ program . The program automatically generates Word reports containing graphs and tabular outputs.

The equipment is simple to understand and use, mechanically oriented and contains no 'black box' electronics. It does not require an external electrical source and is fully portable (dimensions are within those of airline luggage).

Key references: (1) TC16 DMT Report by the ISSMGE (2001) (2) DMT Course Notes, Bali (2001). Both are downloadable from the DMT website . The TC16 DMT Report is a comprehensive document incorporating all the most important information on DMT.

DMT Website: www.marchetti-dmt.it

The website contains detailed information on equipment, test execution, machines for blade insertion, interpretation and software. It also contains photographs, diagrams, comparisonos with other tests' results, key papers on DMT.