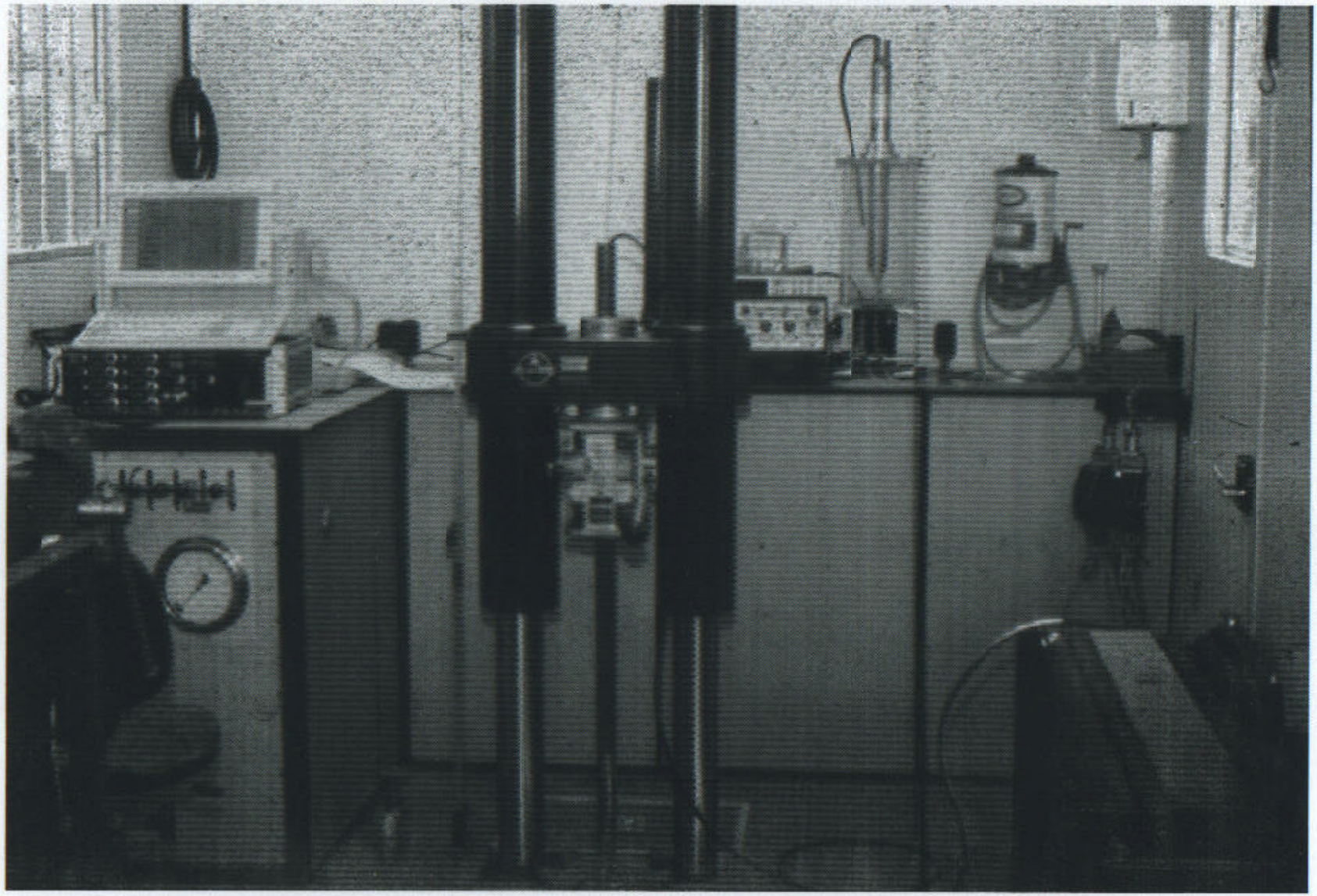


CONE PENETROMETER

Principle

- Penetrate 60° cone tip into ground 2cm/s 1.78"
- Measure:
  - Tip resistance
  - Sleeve resistance (Friction ratio)
  - Pore pressures
  - Other signals/indices
- Interpret:
  - Stratigraphy
  - Mechanical properties
  - Hydraulic properties
  - Contaminants.
- Application:
  - Soils only
  - Depths to 150'+?
- Advantages
  - Fast ∴ inexpensive
  - Large coverage
  - Some hydraulic props
- Disadvantages:
  - No direct samples taken. Lithology inferred.

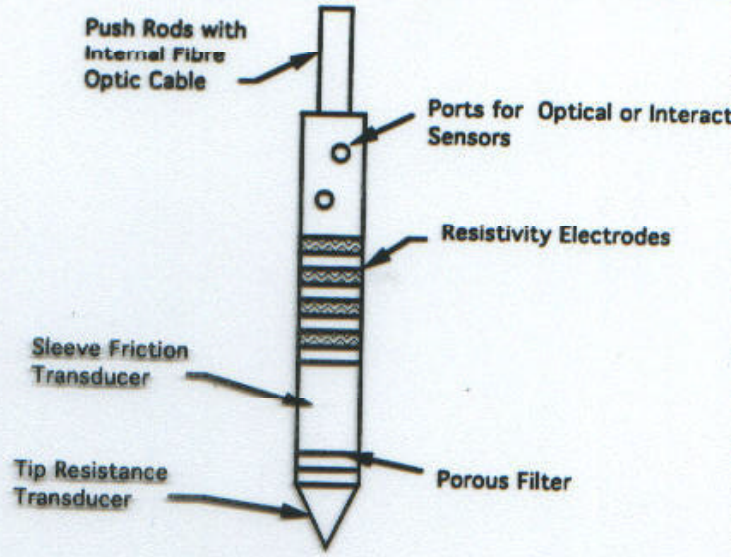


Figure 1. Cone Penetrometer with Geoenvironmental Sensors. Not to scale.

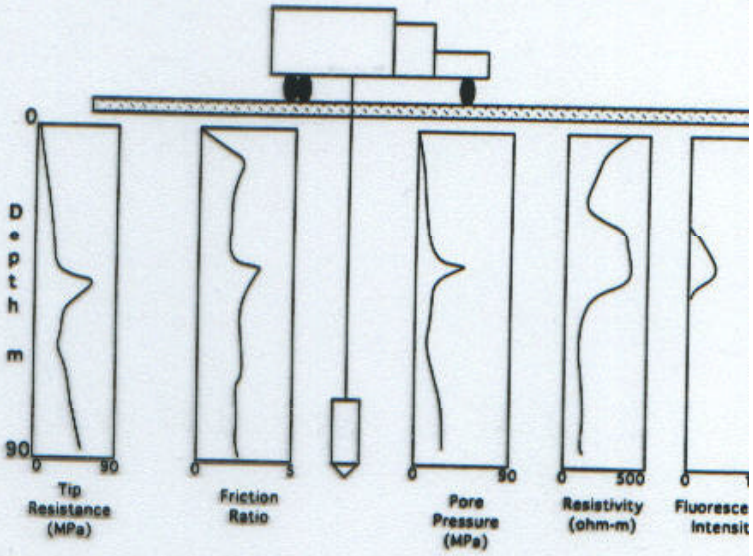


Figure 2. Typical Subsurface Information Resulting from Cone Penetration Test

Measure:

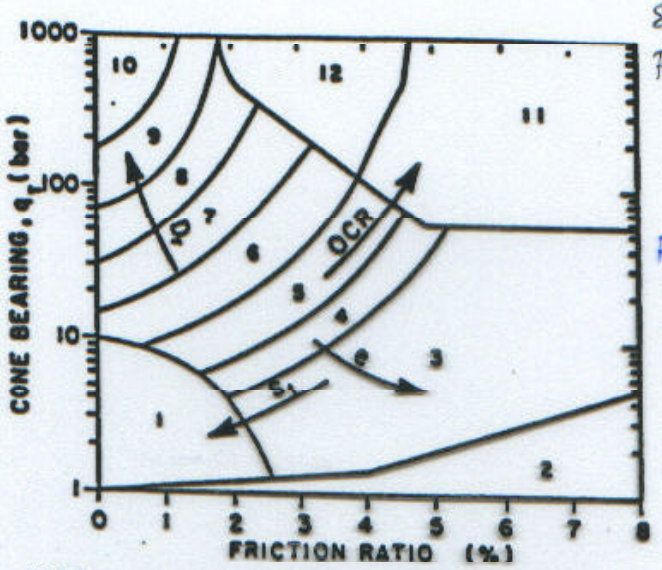
Tip resistance, q_c

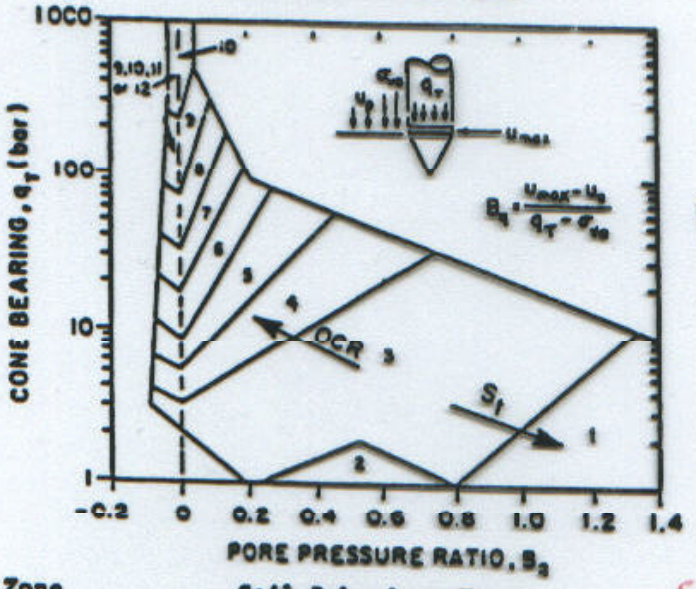
Sleeve friction, F_s

Pore pressure, u

Interpret:

$$F_R = \frac{F_s}{q_T} = \frac{F_s}{q_c - u}$$





$$B_q = \frac{u_{max} - u_0}{q_T - \sigma_{v_0}}$$

1 bar = 100 kPa = 1.02 kg/cm^2

Zone	Soil Behaviour Type
1	sensitive fine grained
2	organic material
3	clay
4	silty clay to clay
5	clayey silt to silty clay
6	sandy silt to clayey silt
7	silty sand to sandy silt
8	sand to silty sand
9	sand
10	gravelly sand to sand
11	very stiff fine grained*
12	sand to clayey sand*

* overconsolidated or cemented.

Some correlations, K.

$$K = \frac{5}{8}\frac{\pi r \rho g}{8(\Delta u)}; \quad U_D < 10$$

$$K = \frac{1}{2}\frac{\rho g c}{\Delta u}; \quad U_D > 10$$

$$U_D = \frac{\pi r}{2c}$$

$$c = \frac{K}{S_c}$$

Figure 8. Proposed soil behavior type classification system (after Robertson et al, 1986)