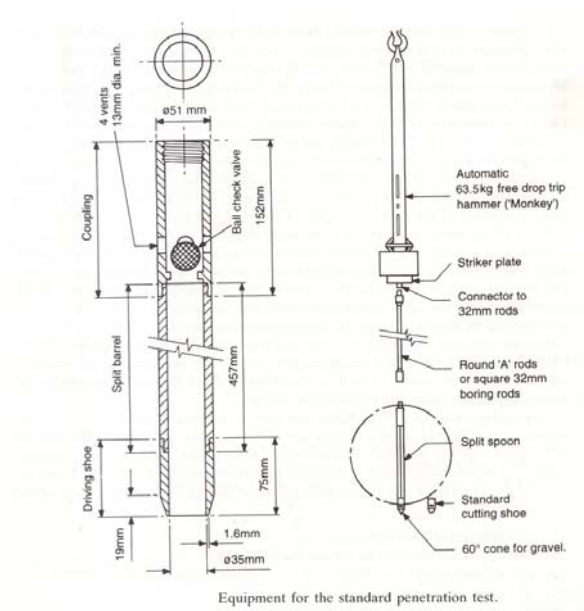


3.2 Standard Penetration Test (SPT)

(1) General



- The SPT is carried out in a borehole, by driving a standard split spoon sampler using repeated blows of a 63.5 kg hammer falling through 762 mm.
- The penetration resistance (N) is the number of blows required to drive the split spoon for the 30cm penetration.

(2) Influence factors on test results (N values)

i) Hammer efficiency

- SPT N values should be converted to N_{60} equivalent to a delivered energy of 60%

$$N_{60} = N_{measured} \times \frac{E_{measured}}{E_{60}}$$

ii) Rod length

- Overestimate N value when rod length < 10 m

Variation of η_R

| Rod length | | η_R |
|------------|-------|----------|
| m | ft | |
| >10 | >30 | 1.0 |
| 6-10 | 20-30 | 0.95 |
| 4-6 | 12-20 | 0.85 |
| 0-4 | 0-12 | 0.75 |

iii) Overburden effective stress – cohesionless soil

$$N' = C_N \times N$$

$$\text{Liao and Withman (1986)} \quad C_N = 9.8 \sqrt{\frac{1}{\sigma_v'}}$$

$$\text{Skempton (1986)} \quad C_N = \frac{2}{1 + \frac{\sigma_v'}{95.6}}$$

$$C_N = \frac{3}{2 + \frac{\sigma_v'}{95.6}}$$

$$C_N = \frac{1.7}{0.7 + \frac{\sigma_v'}{95.6}}$$

Other factor

- Borehole diameter
- Difference water-table between borehole and original ground
- Sampler liner

● **Corrected N values → N'**

$$N' = N_{60} \times C_N \times \eta_1 \times \cdots \times \eta_n$$

(3) Determination of soil parameters

i) D_r and ϕ'

| N | Soil condition | D_r (%) | Friction angle (ϕ') | |
|---------|----------------|-----------|----------------------------|----------|
| | | | Peck | Meyerhof |
| 0 ~ 4 | Very loose | 0 ~ 20 | < 28.5 | < 30 |
| 4 ~ 10 | Loose | 20 ~ 40 | 28.5 ~ 30.0 | 30 ~ 35 |
| 10 ~ 30 | Medium | 40 ~ 60 | 30.0 ~ 36.0 | 35 ~ 40 |
| 30 ~ 50 | Dense | 60 ~ 80 | 36.0 ~ 41.0 | 40 ~ 45 |
| 50 이상 | Very dense | 80 ~ 100 | >41.0 | > 45 |

Peck(1974), Meyerhof (1956)

ii) Consistency and q_u of clayey soils

● Terzaghi & Peck (1948)

| Consistency | N | q_u (kPa) |
|-------------|---------|-------------|
| Very soft | < 2 | < 25 |
| Soft | 2 ~ 4 | 25 ~ 50 |
| Medium | 4 ~ 8 | 50 ~ 100 |
| Stiff | 8 ~ 15 | 100 ~ 200 |
| Very stiff | 15 ~ 30 | 200 ~ 400 |
| Hard | > 30 | > 400 |

cf) Estimation of q_u or s_u based on SPT results, can be erratic and thus, is recommended careful. s_u values estimated from SPT N values are used as a reference values, not design parameters.