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Geotechnical Engineers
Merarhias 56
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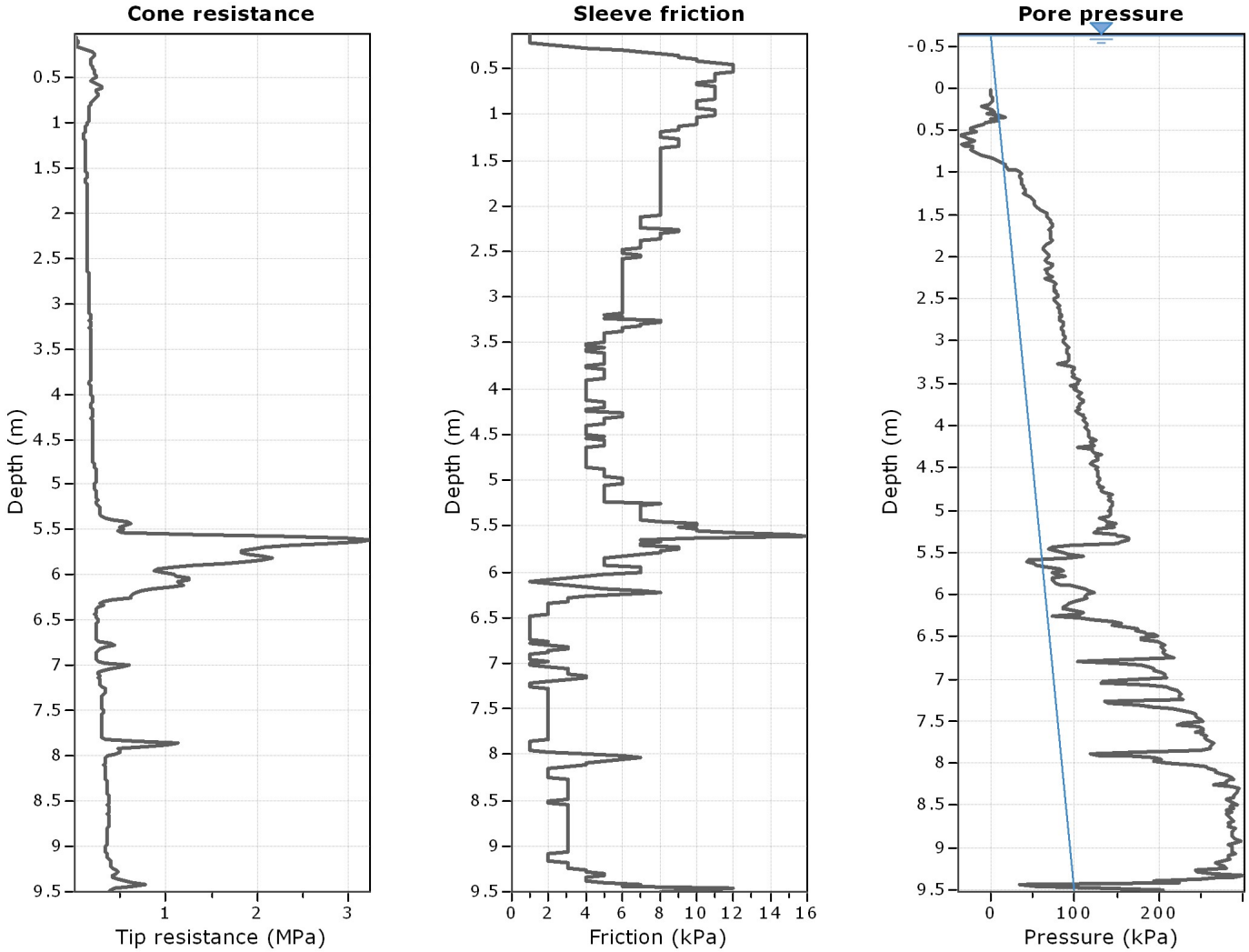
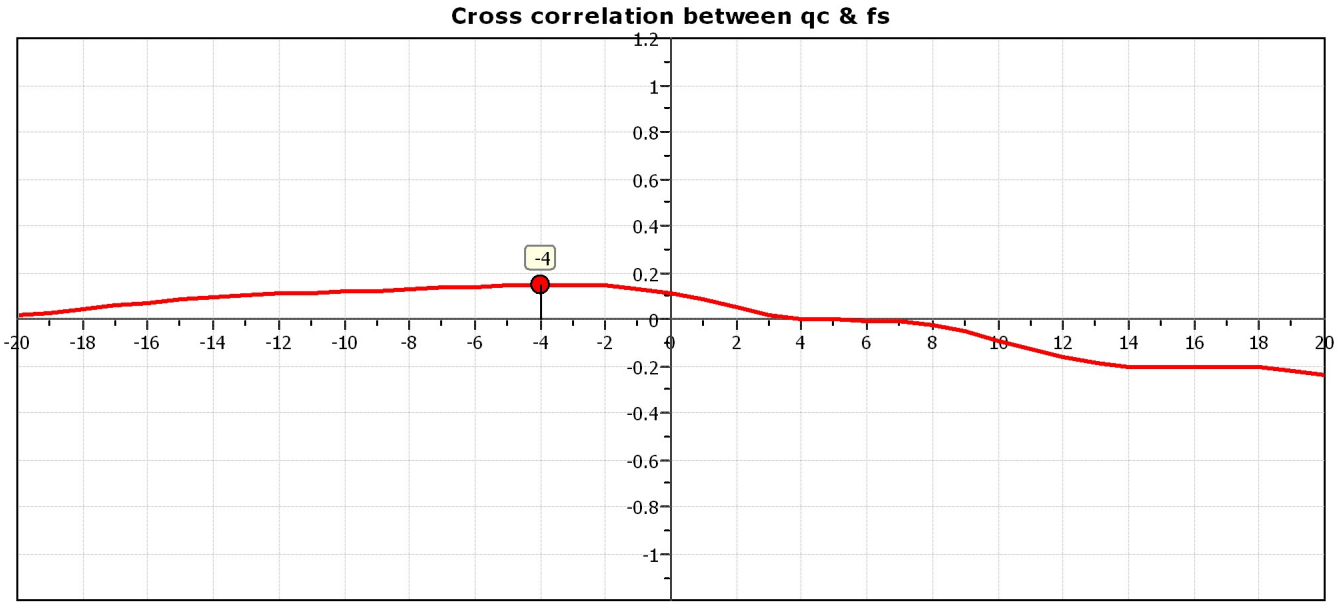
CPT: Eura_3-GRU
Total depth: 9.50 m, Date: 14-11-2014
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

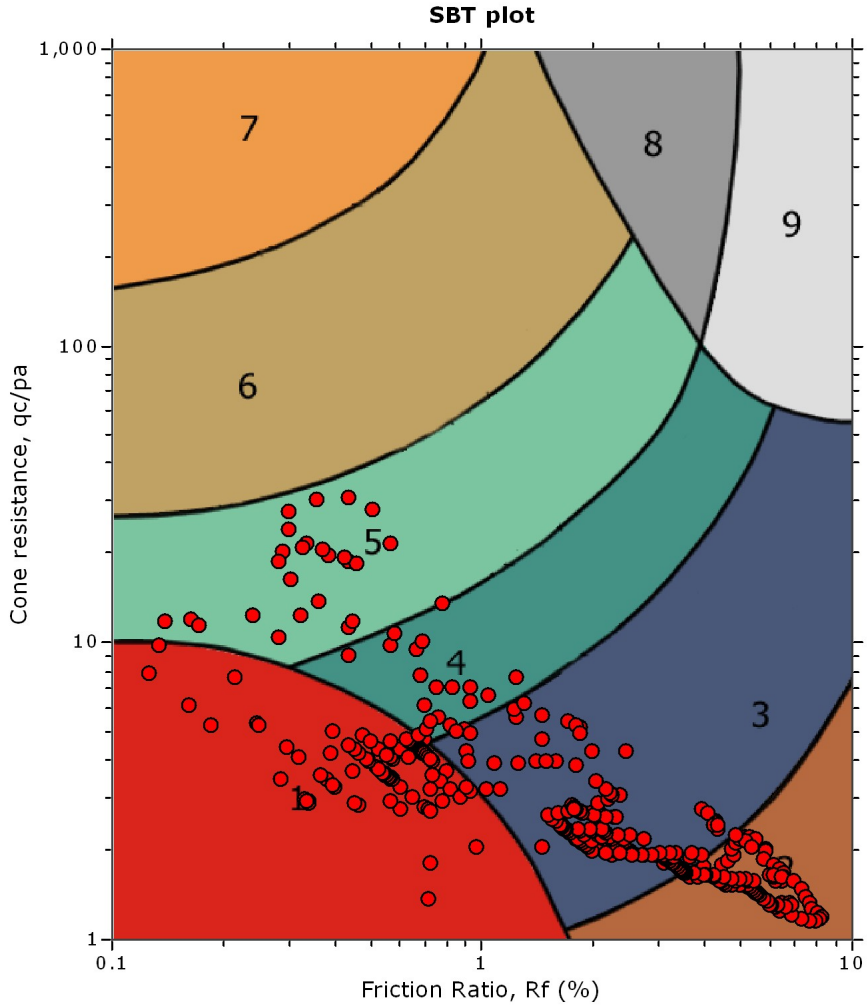
Project:
Location:

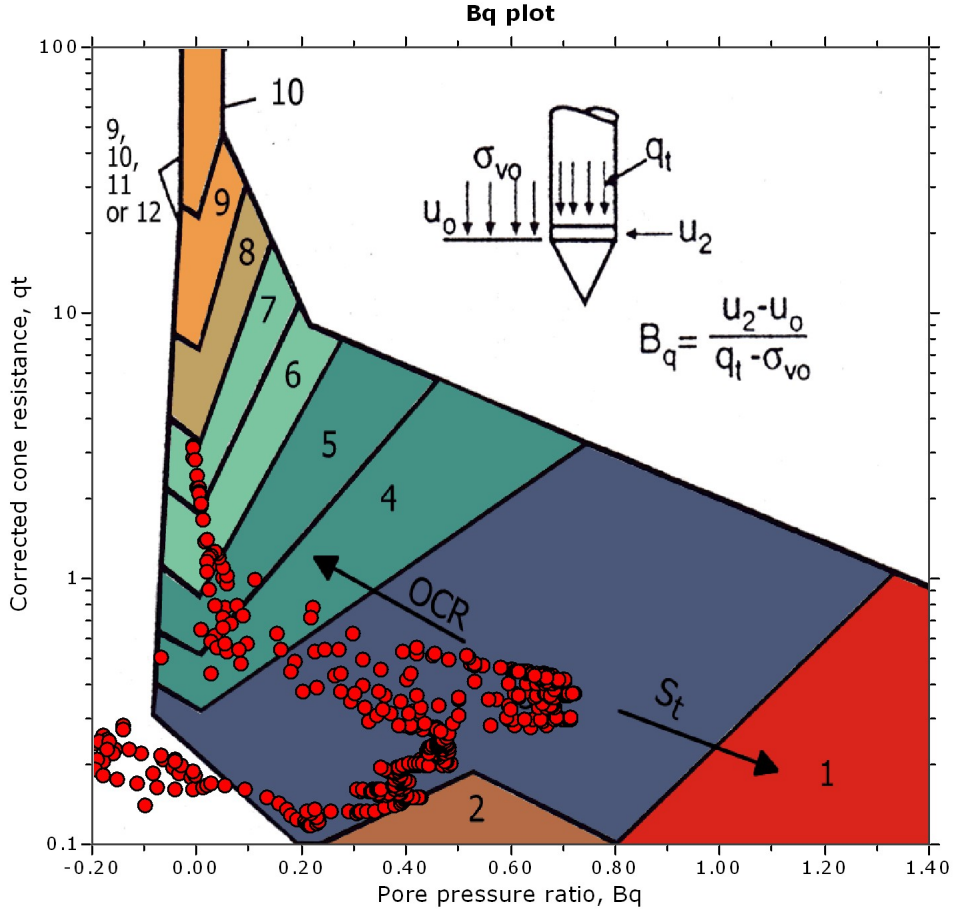


The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



SBT - Bq plots

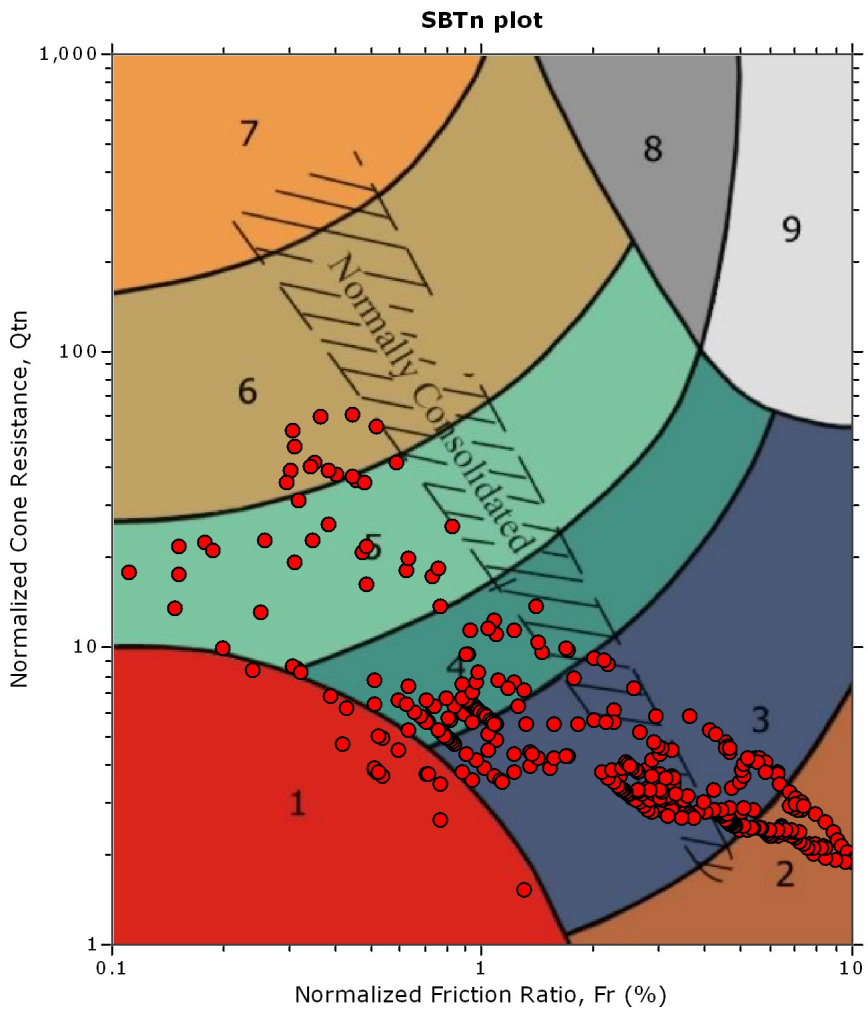


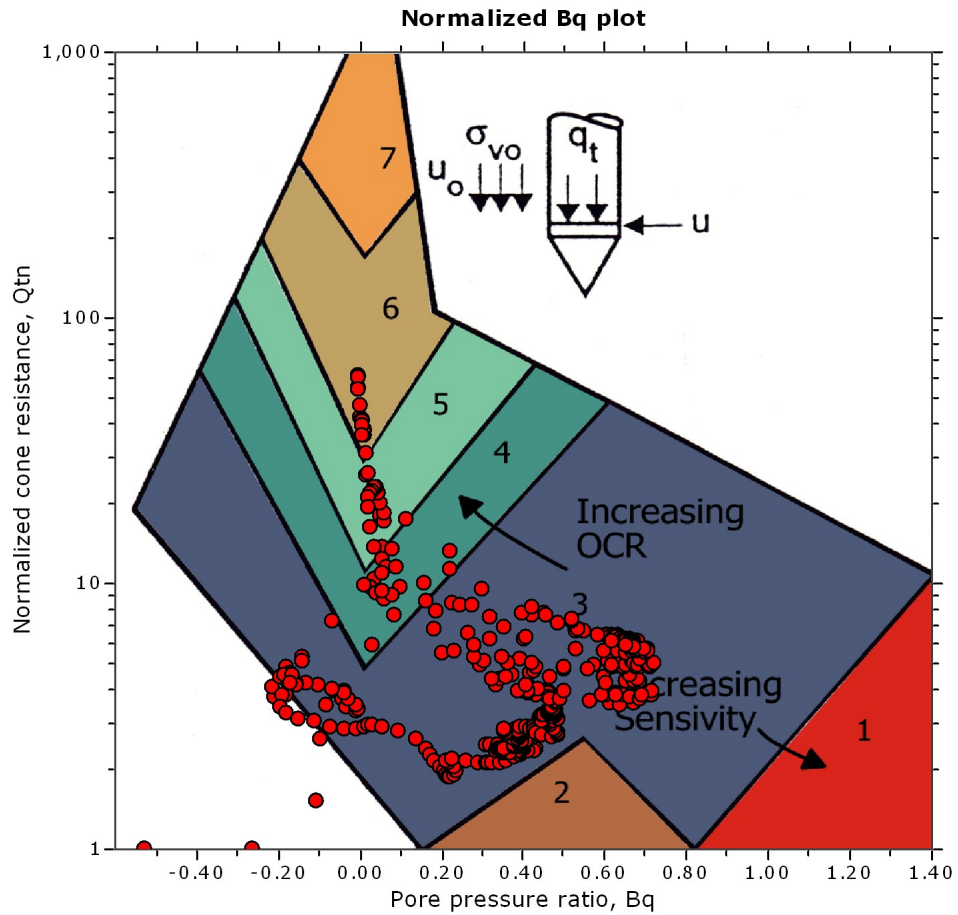


SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

SBT - Bq plots (normalized)





SBTn legend

- 1. Sensitive fine grained
- 2. Organic material
- 3. Clay to silty clay
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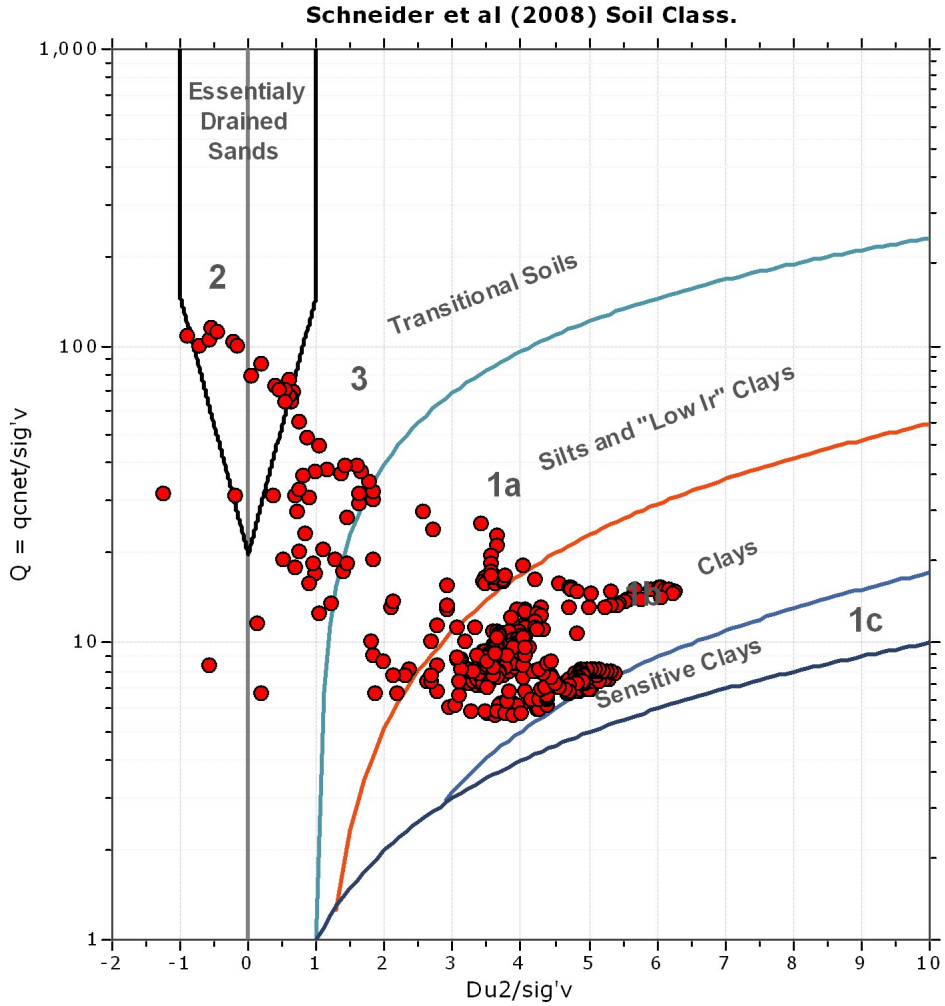
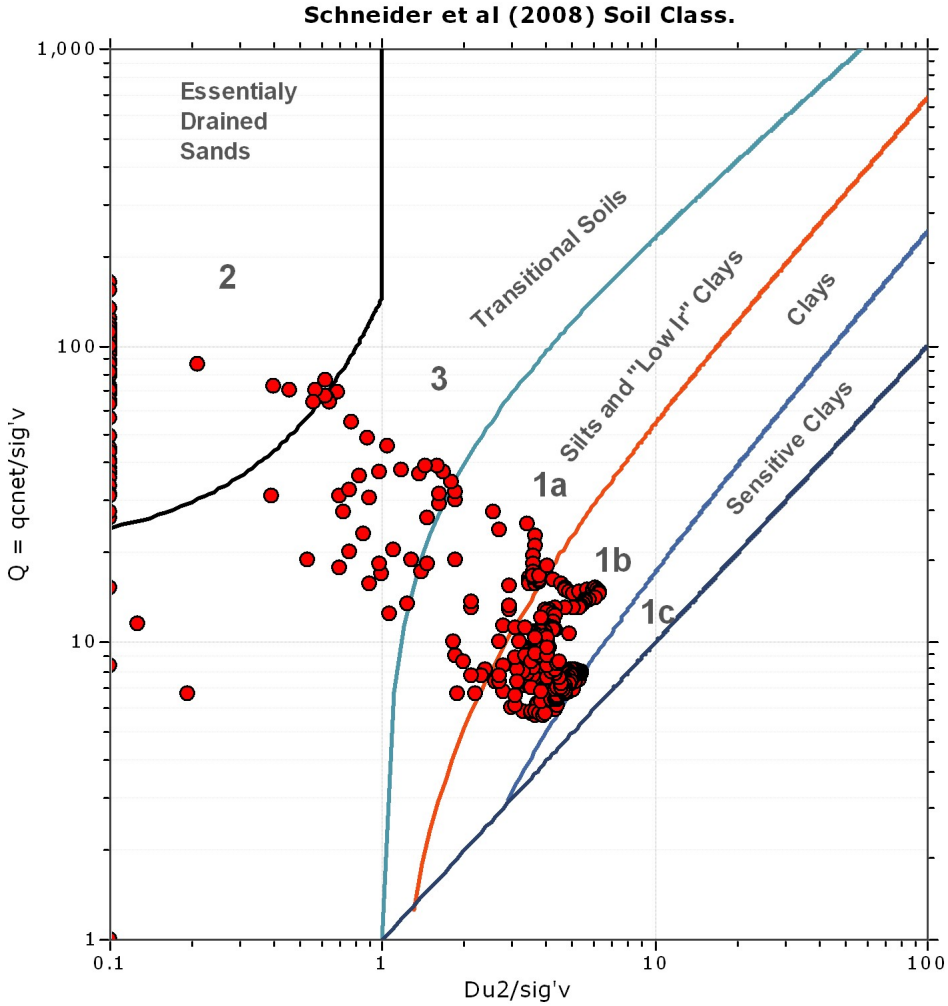
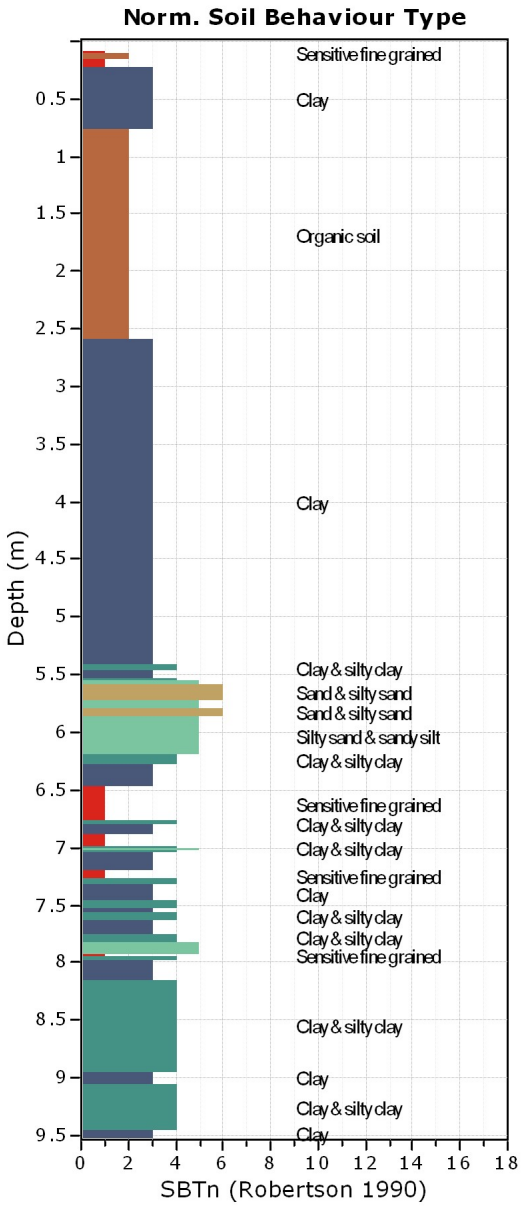
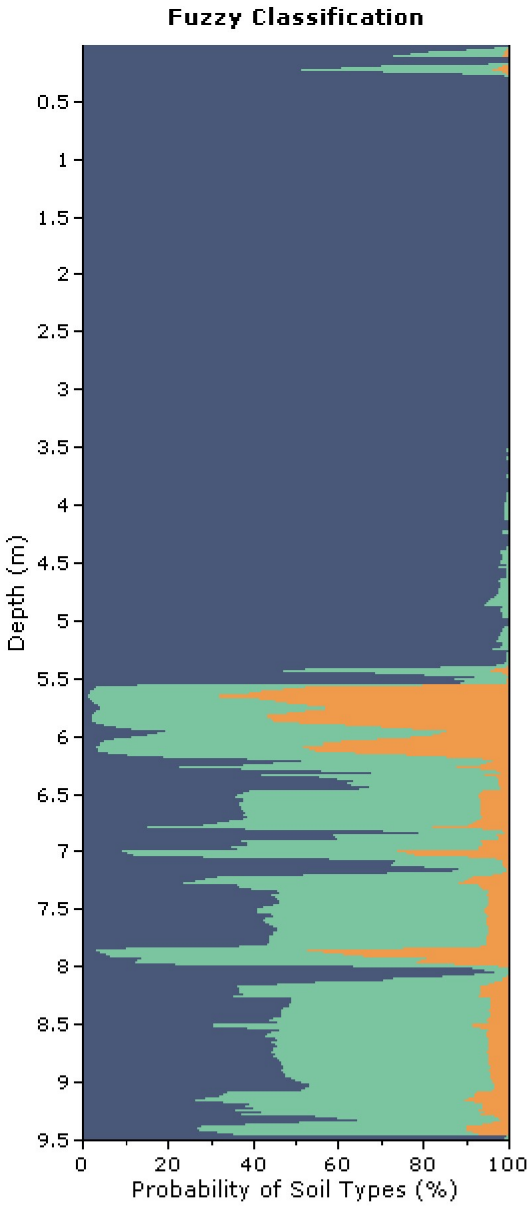
- 9. Very stiff fine grained

Bq plots (Schneider)






Norm. Soil Behaviour Type
Depth (m)
SBTn (Robertson 1990)
Sensitive fine grained
Clay
Organic soil
Clay
Clay & silty clay
Sand & silty sand
Sand & silty sand
Silty sand & sandy silt
Clay & silty clay
Sensitive fine grained
Clay & silty clay
Clay & silty clay
Sensitive fine grained
Clay
Clay & silty clay
Clay & silty clay
Sensitive fine grained
Clay & silty clay
Clay
Clay & silty clay
Clay


Fuzzy Classification
Depth (m)
Probability of Soil Types (%)

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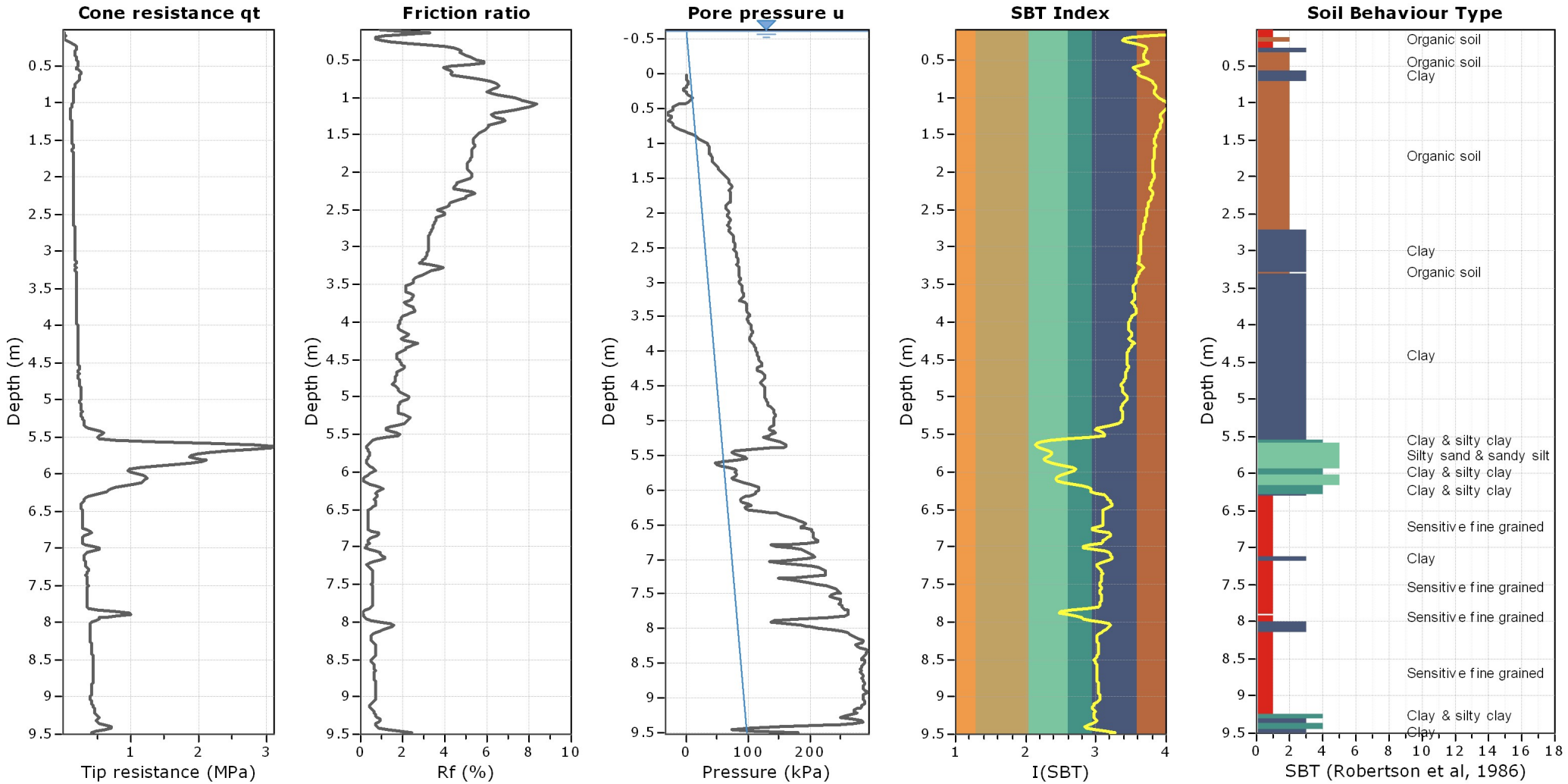

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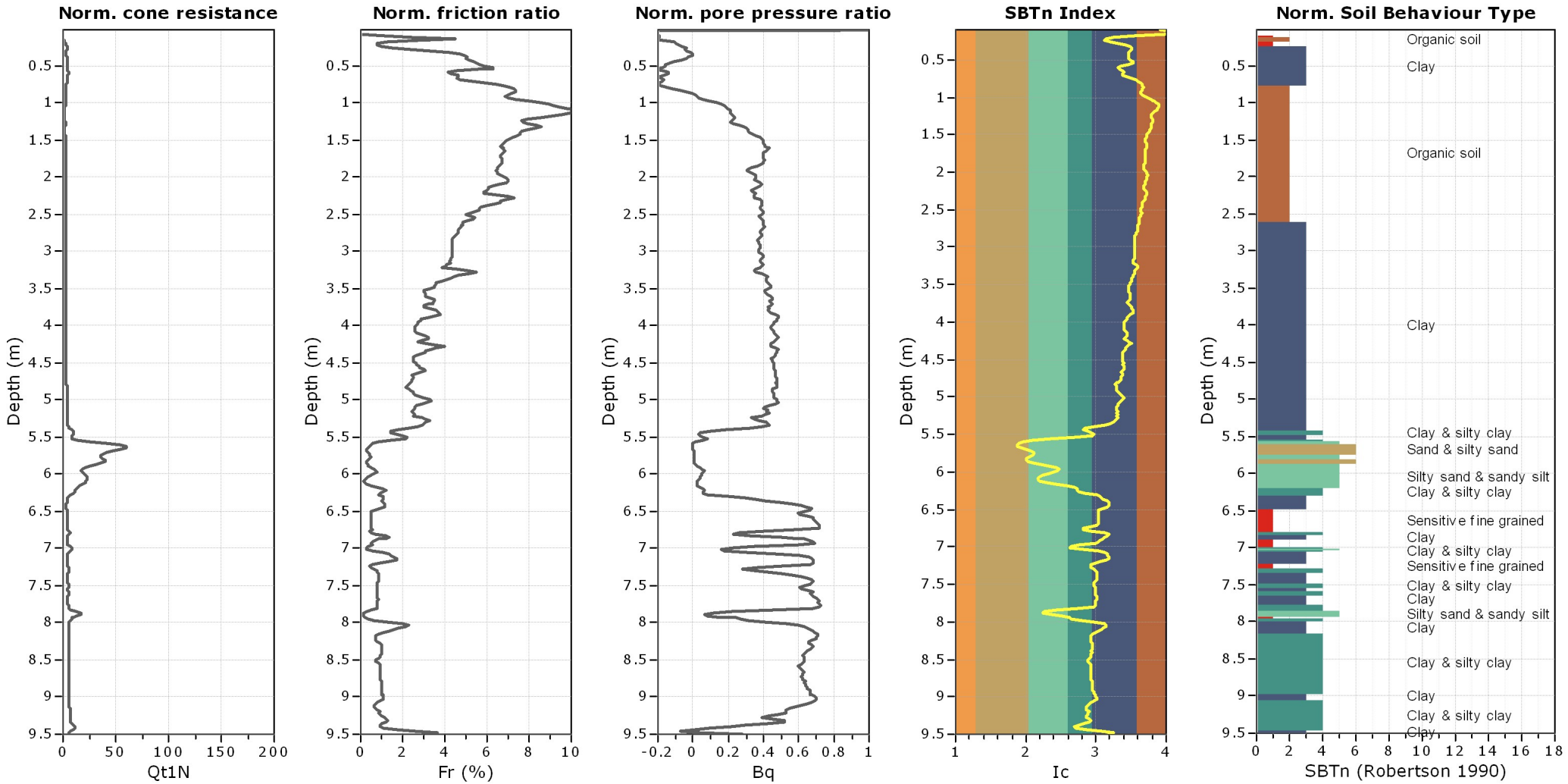

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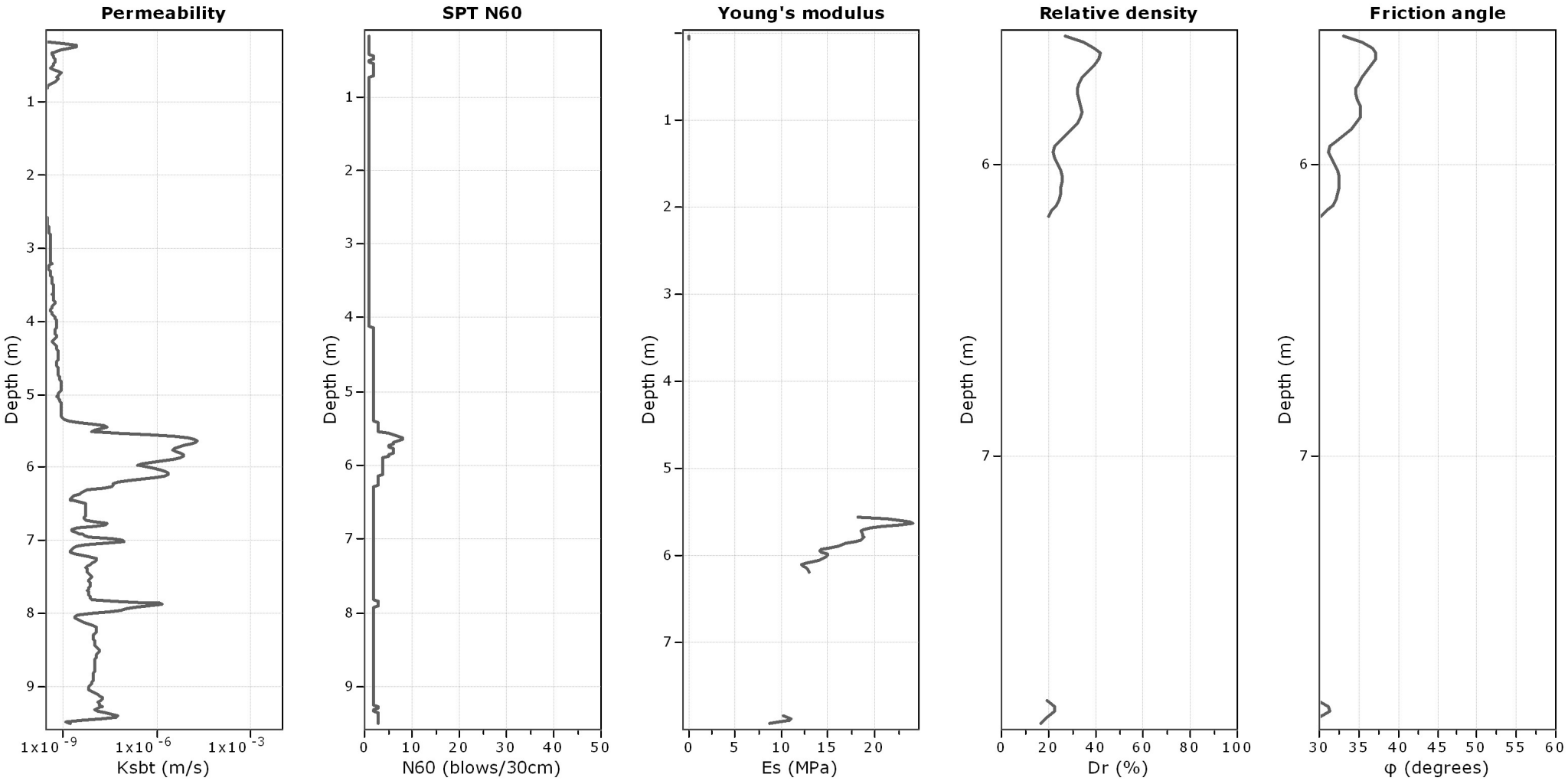


Calculation parameters

Permeability: Based on SBT_n

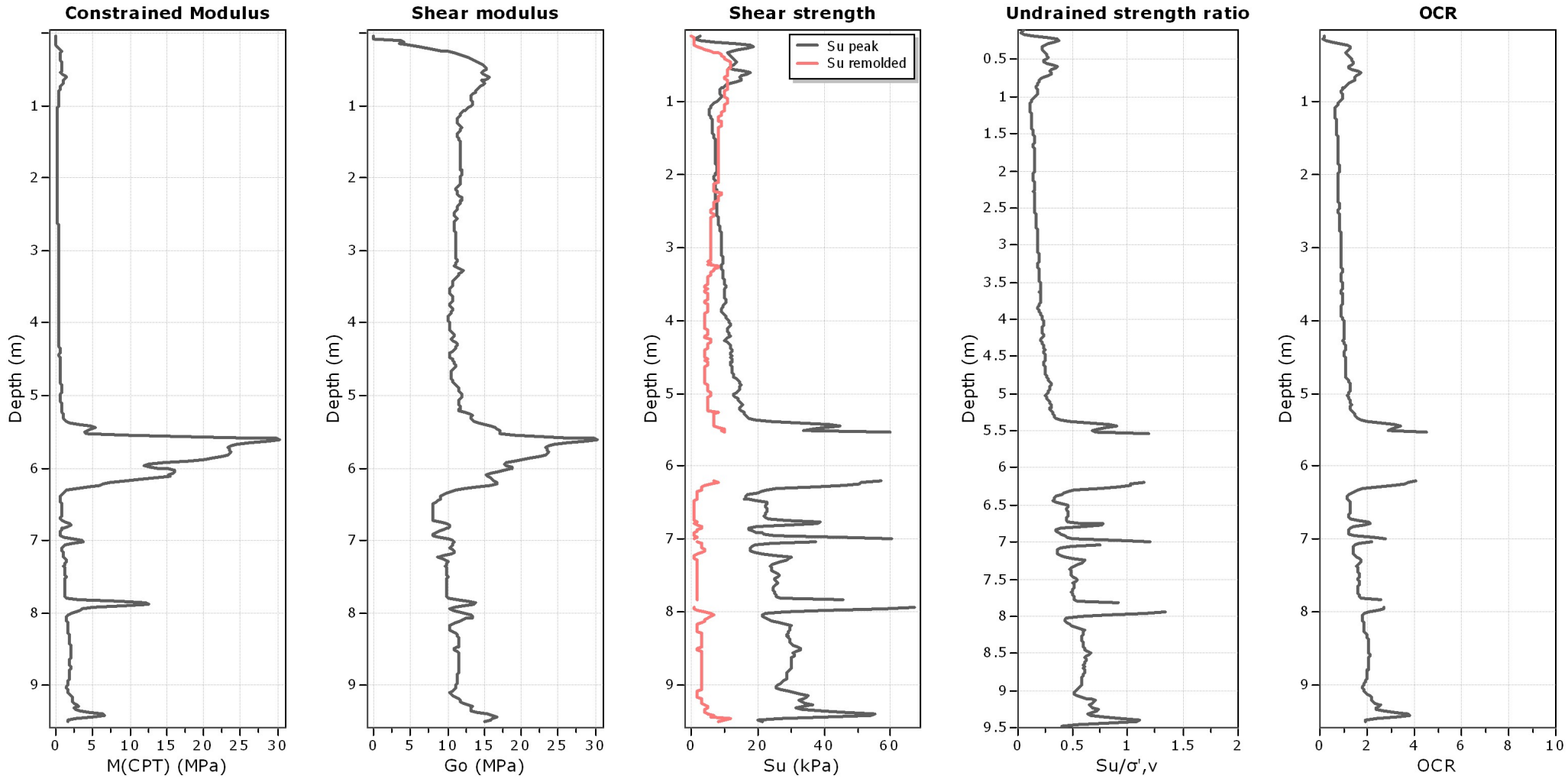
SPT N_{60}: Based on I_c and q_t

Young's modulus: Based on variable alpha using I_c (Robertson, 2009)

Relative desnisty constant, C_{Dr}: 350.0

Phi: Based on Kulhawy & Mayne (1990)

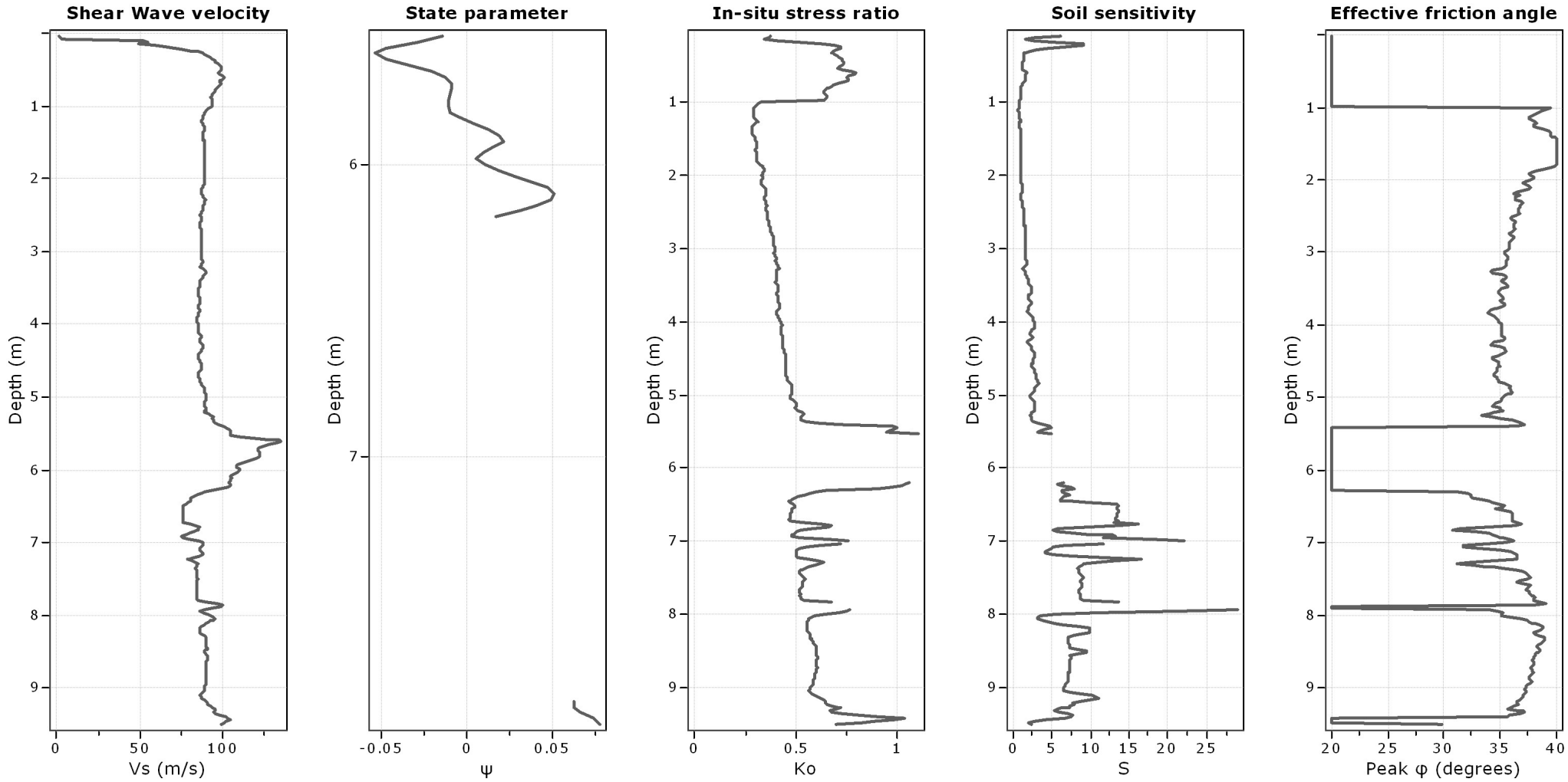
User defined estimation data



Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: Auto

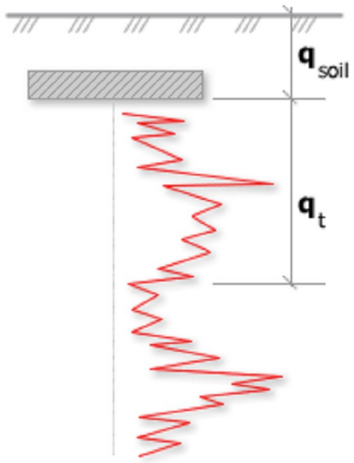
OCR factor for clays, N_{kt}: 0.33
User defined estimation data



Calculation parameters

Soil Sensitivity factor, N_S: 7.00

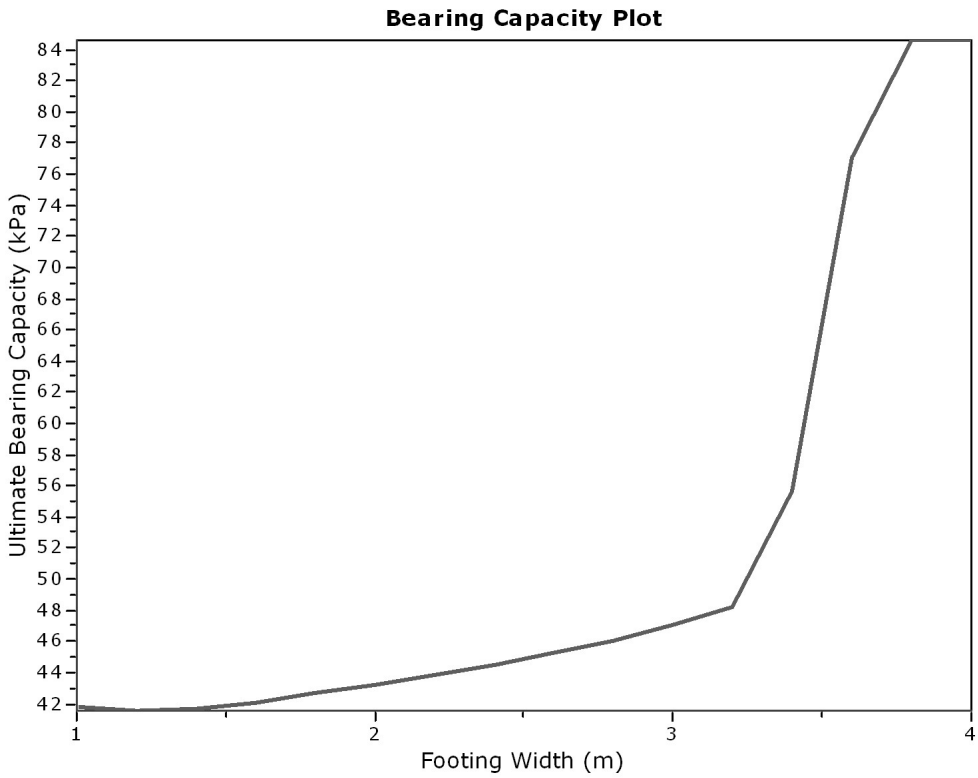
User defined estimation data



Bearing Capacity calculation is perfromed based on the formula:

$$Q_{ult} = R_k \times q_t + q_{soil}$$

where:
R_k: Bearing capacity factor
q_t: Average corrected cone resistance over calculation depth
q_{soil}: Pressure applied by soil above footing



:: Tabular results ::

No	B (m)	Start Depth (m)	End Depth (m)	Ave. q_t (MPa)	R_k	Soil Press. (kPa)	Ult. bearing cap. (kPa)
1	1.00	0.50	2.00	0.16	0.20	9.50	41.75
2	1.20	0.50	2.30	0.16	0.20	9.50	41.56
3	1.40	0.50	2.60	0.16	0.20	9.50	41.66
4	1.60	0.50	2.90	0.16	0.20	9.50	42.10
5	1.80	0.50	3.20	0.17	0.20	9.50	42.68
6	2.00	0.50	3.50	0.17	0.20	9.50	43.28
7	2.20	0.50	3.80	0.17	0.20	9.50	43.89
8	2.40	0.50	4.10	0.18	0.20	9.50	44.51
9	2.60	0.50	4.40	0.18	0.20	9.50	45.28
10	2.80	0.50	4.70	0.18	0.20	9.50	46.08
11	3.00	0.50	5.00	0.19	0.20	9.50	47.11
12	3.20	0.50	5.30	0.19	0.20	9.50	48.26
13	3.40	0.50	5.60	0.23	0.20	9.50	55.64
14	3.60	0.50	5.90	0.34	0.20	9.50	77.02
15	3.80	0.50	6.20	0.38	0.20	9.50	84.57
16	4.00	0.50	6.50	0.38	0.20	9.50	84.59

Presented below is a list of formulas used for the estimation of various soil properties. The formulas are presented in SI unit system and assume that all components are expressed in the same units.

:: Unit Weight, g (kN/m³) ::

$$g = g_w \cdot \left(0.27 \cdot \log(R_f) + 0.36 \cdot \log(\frac{q_t}{p_a}) + 1.236\right)$$

where g_w = water unit weight

:: Permeability, k (m/s) ::

$I_c < 3.27$ and $I_c > 1.00$ then $k = 10^{0.952-3.04 \cdot I_c}$

$I_c \leq 4.00$ and $I_c > 3.27$ then $k = 10^{-4.52-1.37 \cdot I_c}$

:: N_{SPT} (blows per 30 cm) ::

$$N_{60} = \left(\frac{q_c}{P_a}\right) \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

$$N_{1(60)} = Q_{tn} \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

:: Young's Modulus, Es (MPa) ::

$$(q_t - \sigma_v) \cdot 0.015 \cdot 10^{0.55 \cdot I_c + 1.68}$$

(applicable only to $I_c < I_{c_cutoff}$)

:: Relative Density, Dr (%) ::

$$100 \cdot \sqrt{\frac{Q_{tn}}{k_{DR}}}$$

(applicable only to SBT_n: 5, 6, 7 and 8 or $I_c < I_{c_cutoff}$)

:: State Parameter, ψ ::

$$\psi = 0.56 - 0.33 \cdot \log(Q_{tn,cs})$$

:: Peak drained friction angle, φ (°) ::

$$\varphi = 17.60 + 11 \cdot \log(Q_{tn})$$

(applicable only to SBT_n: 5, 6, 7 and 8)

:: 1-D constrained modulus, M (MPa) ::

If $I_c > 2.20$

$\alpha = 14$ for $Q_{tn} > 14$

$\alpha = Q_{tn}$ for $Q_{tn} \leq 14$

$M_{CPT} = \alpha \cdot (q_t - \sigma_v)$

If $I_c \leq 2.20$

$$M_{CPT} = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Small strain shear Modulus, Go (MPa) ::

$$G_0 = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Shear Wave Velocity, Vs (m/s) ::

$$V_s = \left(\frac{G_0}{\rho}\right)^{0.50}$$

:: Undrained peak shear strength, Su (kPa) ::

$N_{kt} = 10.50 + 7 \cdot \log(F_r)$ or user defined

$$S_u = \frac{(q_t - \sigma_v)}{N_{kt}}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Remolded undrained shear strength, Su(rem) (kPa) ::

$S_{u(rem)} = f_s$ (applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Overconsolidation Ratio, OCR ::

$$k_{OCR} = \left[\frac{Q_{tn}^{0.20}}{0.25 \cdot (10.50 \cdot +7 \cdot \log(F_r))}\right]^{1.25}$$ or user defined

$$OCR = k_{OCR} \cdot Q_{tn}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: In situ Stress Ratio, Ko ::

$$K_O = 0.1 \cdot \left(\frac{q_t - \sigma_v}{\sigma'_{vo}}\right)$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Soil Sensitivity, S_t ::

$$S_t = \frac{N_S}{F_r}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Effective Stress Friction Angle, φ' (°) ::

$$\varphi' = 29.5° \cdot B_q^{0.121} \cdot (0.256 + 0.336 \cdot B_q + \log Q_t)$$

(applicable for $0.10 < B_q < 1.00$)

References

- Robertson, P.K., Cabal K.L., Guide to Cone Penetration Testing for Geotechnical Engineering, Gregg Drilling & Testing, Inc., 4th Edition, July 2010
- Robertson, P.K., Interpretation of Cone Penetration Tests - a unified approach., Can. Geotech. J. 46(11): 1337–1355 (2009)