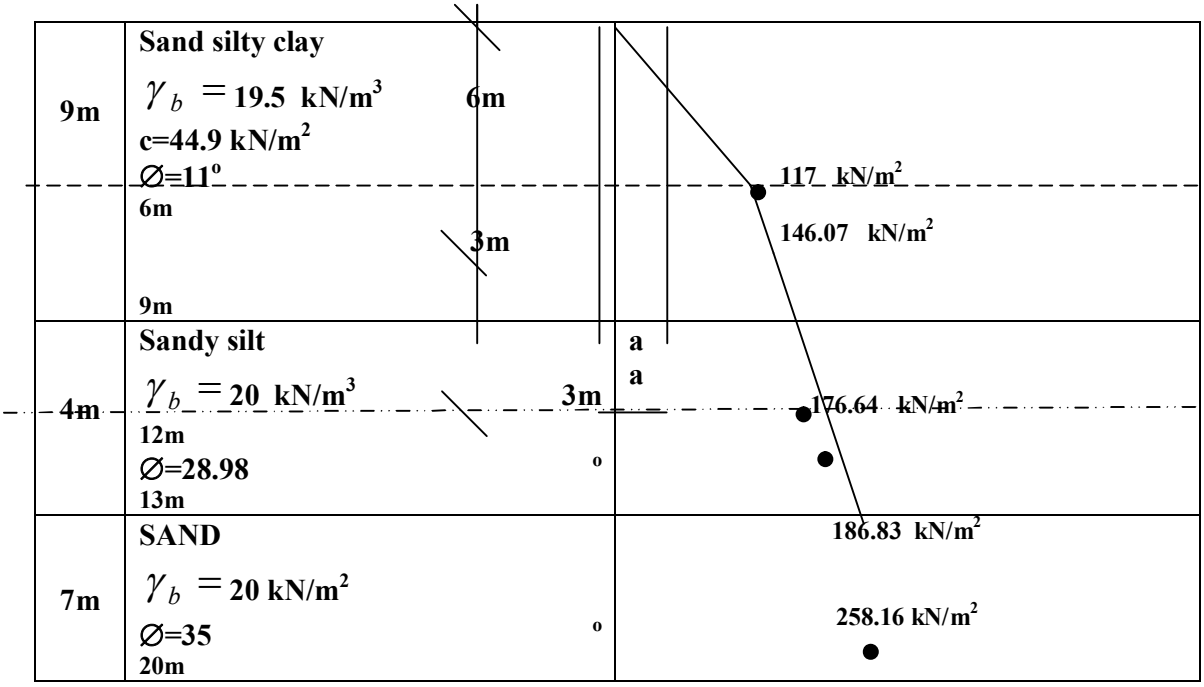
APPENDIX D
THE CLASSICAL METHOD FOR CALCULATING PILE LOAD CAPACITY

A- Pile length 12.0m and pile diameter 1.0m in Burri Power Station Site



$Q_p = A_p q_p = A_p q' N_q^* \le A_p q_1$ ……..…… from Eq. 2.5 and 2.6

$A_p = \frac{\pi}{4} D^2 = \frac{\pi}{4} * (1.0)^2 = 0.7854 \ m^2$

$q' = 176.64 kN/m^2$

$Nq^* = 45$ …… from Fig 2.6

$q_1 = 50 N_q^* \tan\phi$ ……..… from Eq. 2.7

=50 *45*tan 28.98^0 =1246.169 kN/m²

Q_p=0.7854 m² * 176.64 kn/m² * 45 = 6242.988 kN

$A_p q_1$=0.7854m² * 1246.169kn/m² = 978.741 kN

So Q_p = 978.741 kN

$Q_s = Q_{S1} + Q_{S2}$

In Clay layer

$Q_s = \sum fp\Delta L = \sum \alpha C_U p\Delta L$ …… .from Eq. 2.18

$Q_{s1} = \alpha C_U (\pi D) L_1$

C_U = 44.9 kN/m^2

So α = 0.9 …… from Fig. 2.10

Q_{s1} = 0.9 * 44.9 * π * 1.0m * 9 = 1142.566 kN

<u>In Sand layer</u>

$Q_s = \sum p \Delta 1 f$ …… from Eq. 2.9

$L' \cong 15D$ …… from Eq 2.10

=15 * 1.0m = 15m > length pile =12m

$$\sigma'_V = \frac{146.07 + 176.64}{2} = 161.355\, kN/m^2$$

So

$f = k\sigma'_V \tan\delta$ ……... from Eq. 2.11

k $\cong 1.2(1-\sin\phi)$ …….. from Table 2.1

= 1.2 (1- sin 28.98) = 0.6186

$\delta \cong 0.65\phi = 18.837^o$

f = 0.6186 * 161.355 * tan 18.837^0 = 34.051 kN/m^2

Q_{s2} = p ΔL f

= π * 1.0m * 3.0 m * 34.051 kN/m^2

= 320.923 kN

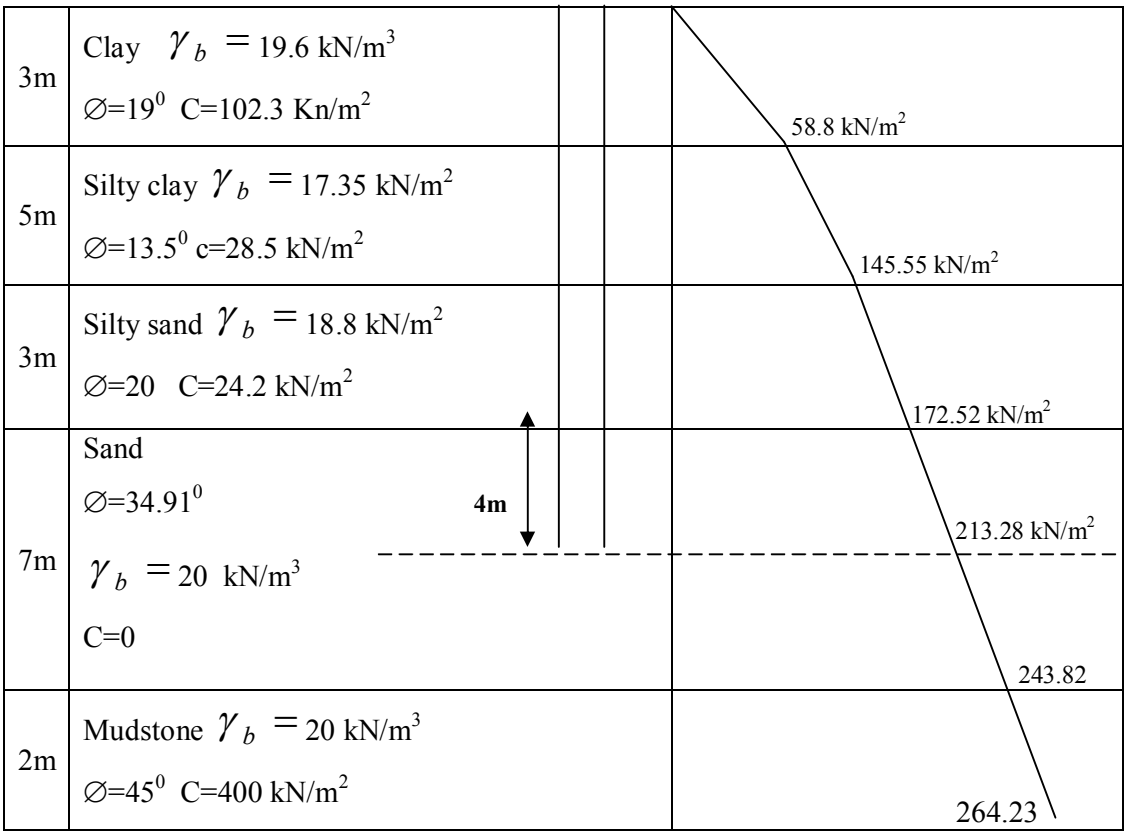
$Q_s = Q_{s1} + Q_{s2}$

= 1142.566 + 320.923 = 1463.489 kN

$Q_u = Q_p + Q_s$ …….. from Eq. 2.2

= 978.741 + 1463.489 = 2442.230 kN

B- Pile length 15.0m and pile diameter 1.0m in N.E.C Head Quarter Site



$Q_p = A_p q_p = A_p q' N_q^* \le A_p q_1$ …….…… from Eq. 2.5 and 2.6

$A_p = \frac{\pi}{4} D^2 = \frac{\pi}{4} * (1.0)^2 = 0.7854 \ m^2$

$q' = 213.28 kN/m^2$

$Nq^* = 133$ …… from Fig 2.6

$q_1 = 50 N_q^* \tan\phi$ …… from Eq. 2.7

$= 50 * 133 * \tan 34.91^0 = 4640.83 \ kN/m^2$

$Q_p = 0.7854 \ m^2 * 213.28 \ kN/m^2 * 133 = 22278.845 \ kN$

$A_p q_l = 0.7854 \ m^2 * 4640.83 \ kN/m^2 = 3644.907 \ kN$

So

Q_p = 3644.907 kN

In Clay layer

$Q_s = \sum fp\Delta L = \sum \alpha C_U \, p\Delta L$ …… .from Eq. 2.18

$Q_{S1} = \alpha_1 \, C_{U1} \, (\pi \, D) \, \Delta L_1$

C_{U1} = 102.3 kN/m^2

So α_1 = 0.50 …… from Fig. 2.10

ΔL_1 = 3.0 m

Q_{S1} = 0.5 * 102.3 kN/m^2 * π * 1.0 m * 3.0 m = 482.078 kN

$Q_{S2} = \alpha_2 \, C_{U2} \, (\pi \, D) \, \Delta L_2$

C_{U2} = 28.5 kN/m^2

So α_2 = 1.00 …… from Fig. 2.10

ΔL_2 = 4.0 m

Q_{S2} = 1.0 * 28.5 kN/m^2 * π * 1.0 m * 4.0 m = 358.142 kN

$Q_{S\ clay} = Q_{S1} + Q_{S2}$

= 482.078 kN + 358.142 kN = 840 22 kN

In Sand layer

$Q_s = \sum p \, \Delta l f$ …… from Eq. 2.9

$L' \cong 15D$ …… from Eq 2.10

=15 * 1.0 m = 15m

length pile = 15 m

So

$f = K\sigma'_V \tan\delta$ ……... from Eq. 2.11

$K \cong 1.2(1 - \sin\phi)$ …….. from Table 2.1

K_1 = 1.2 (1- sin 20) = 0.7896

K_2 =1.2 (1- sin 34.91) = 0.513

$\delta \cong 0.65\phi$

δ_1 = 0.65 * 20 ^{o} = 13 ^{o}

δ_2 = 0.65 * 34.91^o = 22.496 ^{o}

$$\sigma'_{V1} = \frac{154.55 + 172.52}{2} = 163.535\, kN/m^2$$

$$\sigma'_{V2} = \frac{172.52 + 213.28}{2} = 192.900\, kN / m^2$$

$$f_1 = K_1 \sigma'_{V1} \tan \delta_1$$

f_1 = 0.79 * 163.535 kN/m^2 * tan 13 = 29.826 kN/m^2

$$f_2 = K_2 \sigma'_{V2} \tan \delta_2$$

f_2 = 0.513 * 192.90 kN/m^2 * tan 22.69^o = 41.374 kN/m^2

$Q_{s\ sand} = f_1\ \Delta L_1\ p + f_2\ \Delta L_2\ p$

= 29.826 kN/m^2 * 3.0 m * π * 1.0 m + 41.374 kN/m^2 * 4.0 m * π * 1.0 m

= 281.103 kN + 519.92 kN = 801.023 kN

$Q_S = Q_{S\ clay} + Q_{s\ sand}$

= 840 22 kN + 801.023 kN = 1641 243 kN

$Q_U = Q_P + Q_S$

= 3644.907 kN + 1641 243 kN = 5286.150 kN