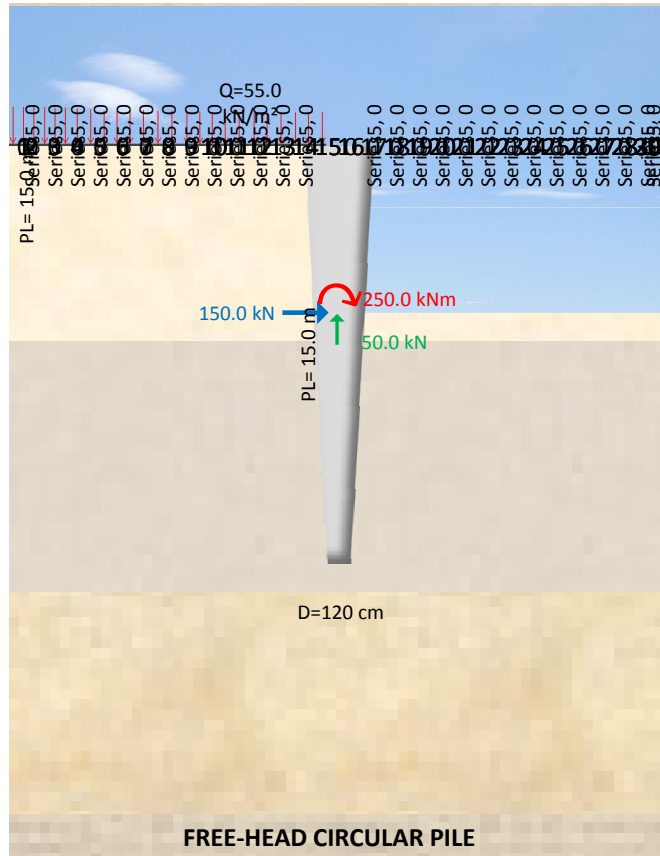
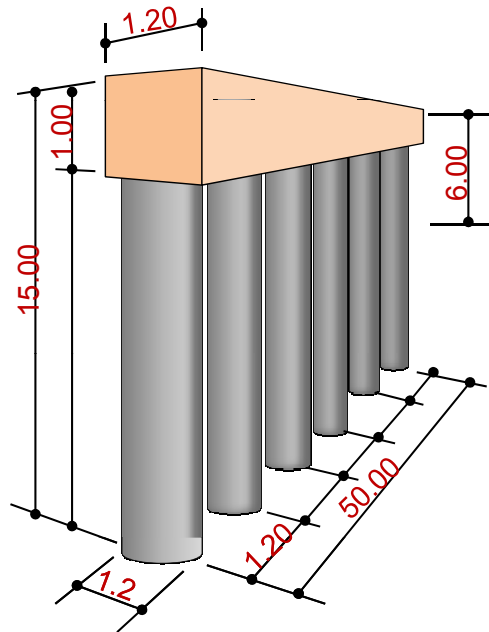


System :



Wall Sizes

Wall Length, WL :	50.0	m
Pile Spacing, Ps :	1.2	m
Wall Height, Hw :	15.0	m
Pile Cap Height, Hpc :	1.0	m
Pile Cap Width, Bpc :	1.2	m
Pile Diameter, D :	120.0	cm
Pile Cover, Cp :	75	mm
Excavation Depth, Ed :	6.0	m
L :	9	m



Wall Materials

Steel :

$f_{yd} = 435000 \text{ kN/m}^2$

$E_s = 2.10E+08 \text{ kN/m}^2$

Concrete :

$\gamma_c = 25 \text{ kN/m}^3$

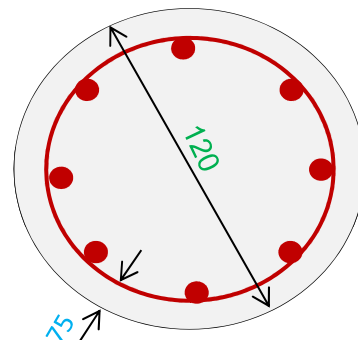
$f'c = 30 \text{ N/mm}^2$

$f_{ck} = 20000 \text{ kN/m}^2$

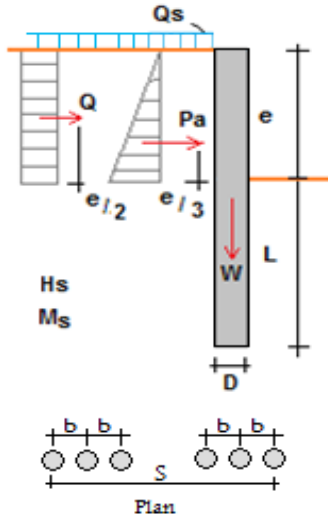
$E_c = 3.2E+07 \text{ kN/m}^2$

$I_c = 1.0E-01 \text{ m}^4$

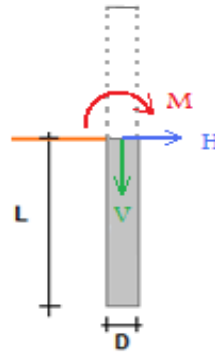
$E_c I_c = 3.2E+06 \text{ kNm}^2$



Soil load :



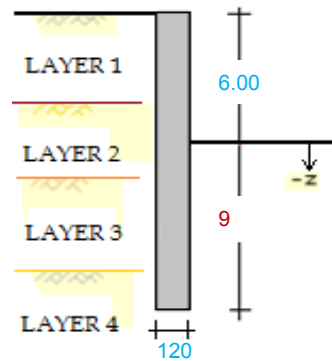
Extra Cap Loads :



$Q_s = 55.00 \text{ kN/m}^2$
 $Pa = 273.7 \text{ kN}$
 $Q = 278.8 \text{ kN}$
 $H_s = 552.6 \text{ kN}$
 $M_s = 1384.0 \text{ kNm}$
 $W = -424.1 \text{ kN}$

$H = 150.0 \text{ kN}$
 $V = 50.0 \text{ kN}$
 $M = 250.0 \text{ kNm}$

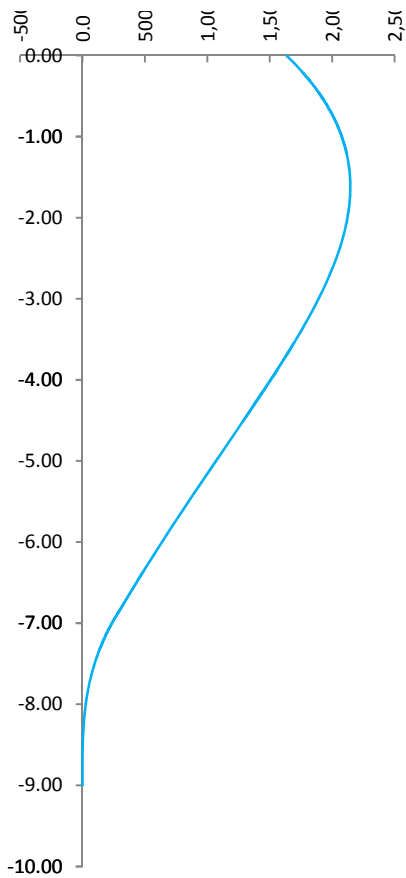
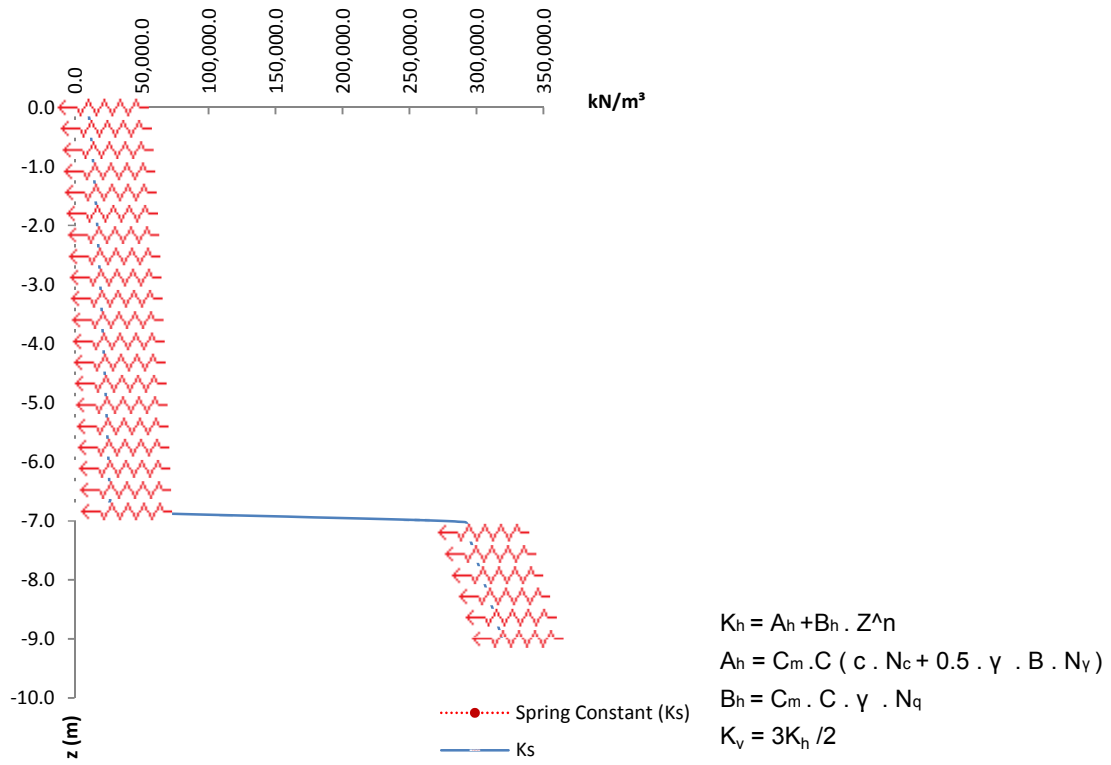
Parameter	Layer 1	Layer 2	Layer 3	Layer 4
Elev. (m)	0.0	-7.0	-10.0	-18.0
γ_s (kN/m ³)	18.0	19.0	19.0	20.0
c' (kN/m ²)	10.0	35.0	70.0	120.0
Φ	10.0	30.0	30.0	35.0
α	0.0	0.0	0.0	0.0
δ	3.3	21.0	10.0	11.7
n	0.70	0.70	0.55	0.55
C_m	1.70	1.85	1.50	1.50
σ_s (kN/m ²)	150.0			
Cort (kN/m ²)	58.75			
K_o	0.826	0.500	0.500	0.426
K_a	0.704	0.333	0.333	0.271
K_p	1.420	3.000	3.000	3.690
N_c	8.34	30.10	30.10	46.40
N_q	2.50	18.40	18.40	33.35
N_y	1.20	22.40	22.40	48.10



D.W.T. = -7.00 m

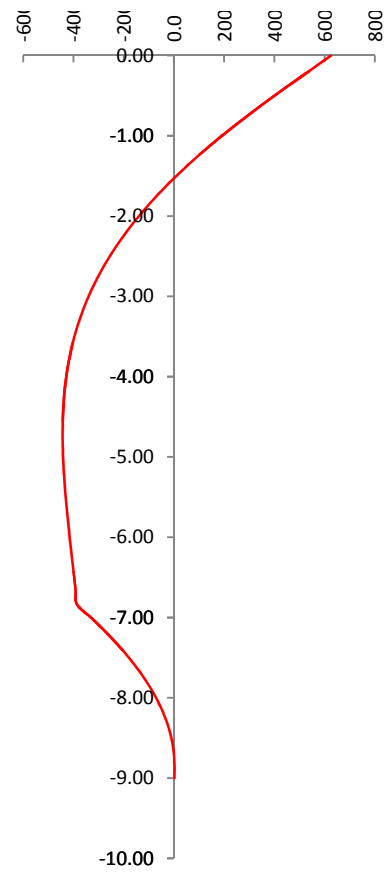
$D = 1.20 \text{ m}$ $L : 9.00 \text{ m}$
 then $L_m : 5.64 \text{ m}$ $L > L_m \dots \text{Successful.}$

$K_h : 319154 \text{ kN/m}^3$
 $K_v : 478731 \text{ kN/m}^4$



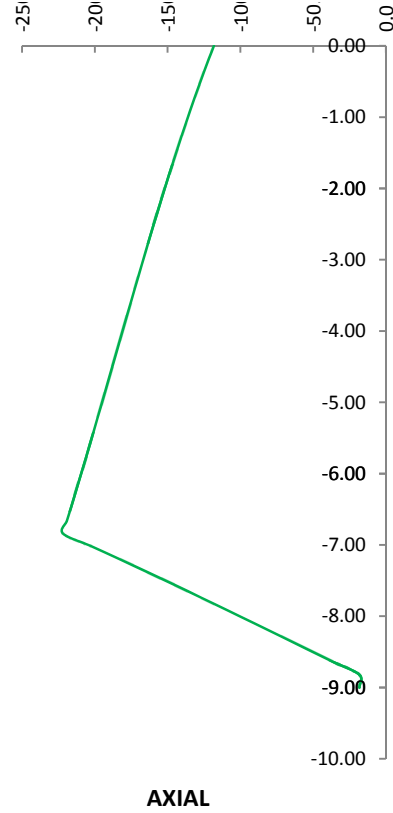
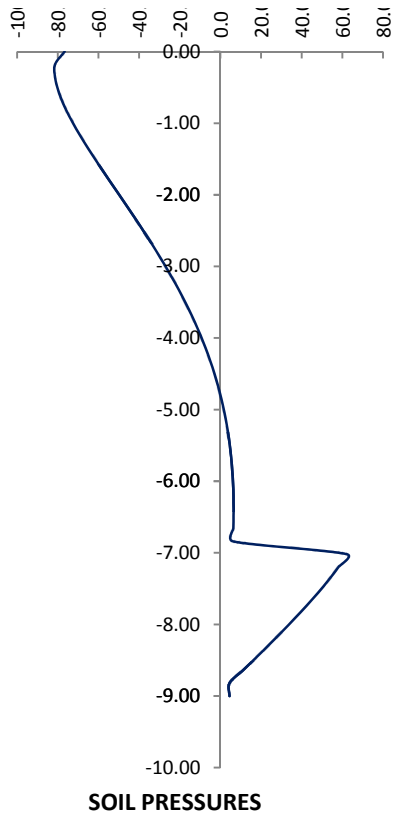
MOMENT

Mmax = 2144.844 kNm



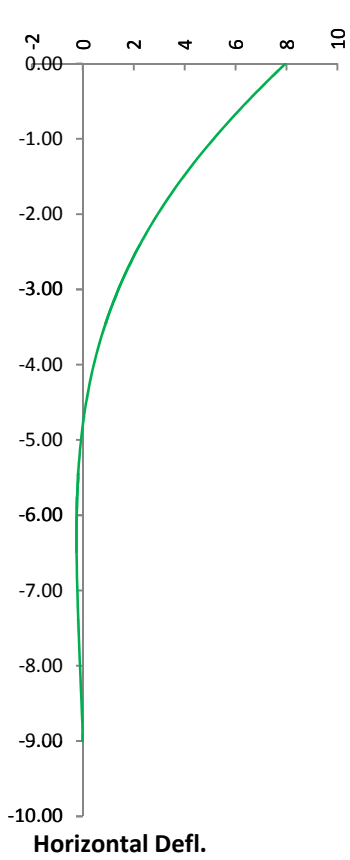
SHEAR

Vmax = 625.9156 kN

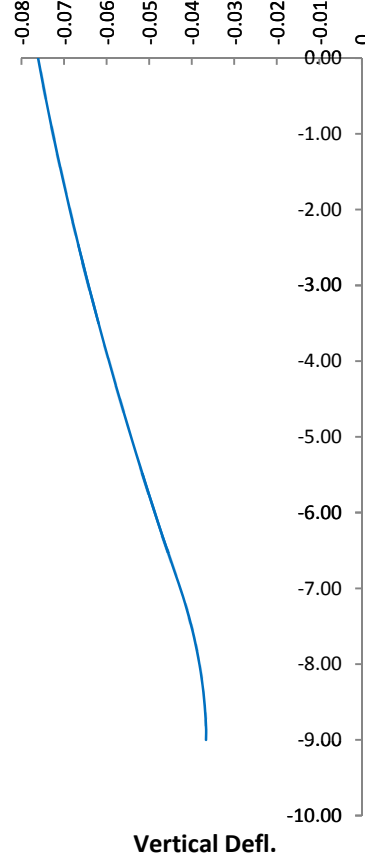


$\sigma_{max} = 81.38461 \text{ kN/m}^2$

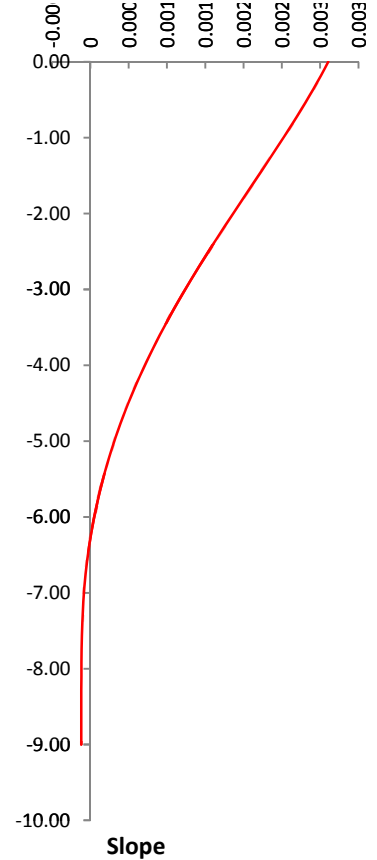
$P_{max} = 221.962 \text{ kN}$



$u_{max} = 7.964788 \text{ mm}$



$v_{max} = 0.076101 \text{ mm}$



$\theta_{max} = 0.003106 \text{ rad.}$

Ultimate horizontal load capacity:

T + D = 2.79 m
 Hu (c') = 627.75 kN
 Hu (Φ) = 351.39 kN
 Hu = 979.15 kN
 Hmax = 625.92 kN

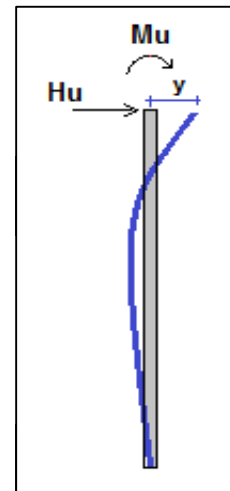
$T = (EI / K_s)^{1/5}$
 $H_u = 9 C_u D (L_m - 1.5D)$
 $H_u = 0.5 \gamma D L_m^3 K_p$
 $H_u = H_u (c') + H_u (f)$

Hu > Hmax Successful.

Ultimate Moment capacity:

Mu = 3581.97 kNm
 Mmax = 2144.84 kNm

Mu > Mmax Successful.



Maximum pile head displacement :

Disp. Crit. = L/1000

yu = 9.00 mm
 ymax = 7.96 mm

yu > ymax Successful

Bearing Capacity Factors

Load = 374.12 kN
 L/D = 7.50
 Nq = 18.16
 Nc = 28.74
 σb = 151.38
 σs = 75.69

Total Resistance

Total resistance 7443.93 kN
 Allowable Load (Qa) 2977.57 kN
 Overall fact. of saf. 19.90

Actual Nd ≤ Allowable Load

OK

Shaft Resistance S.F. = 2.5

Qs = fs · As Aps = 33.93 m²
 fs = 71.48 kN/m²
 Qs = 2425.10 kN

Settlement Control

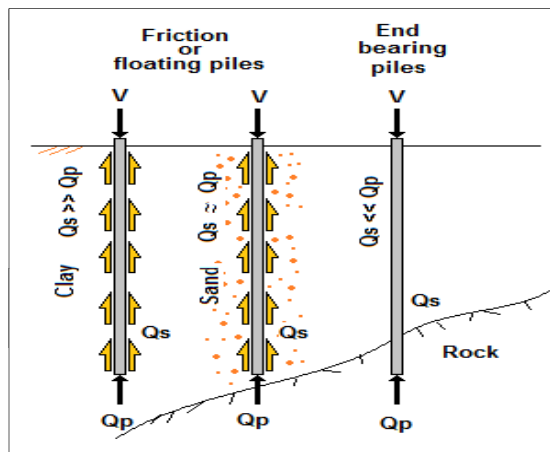
Max. Settlement 0.64 mm
 Curr. Settlement 0.08 mm

Sett.max ⇒ Sett.curr

OK

Base Resistance S.F. = 2.5

Qb = qu · Ap Apb = 1.13 m²
 qu = 4437.62 kN/m²
 Qb = 5018.83 kN
 σ1 = 150.00 kN/m²
 capacity qu · sf = 1775.05 kN/m²
 σs < qu · sf OK



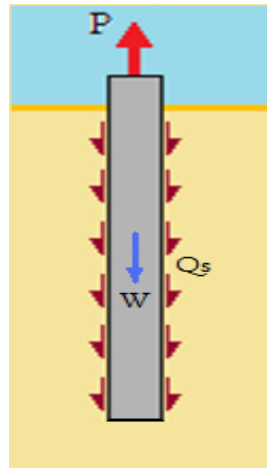
P = 50.00 kN
 \$ Wp = 424.12 kN
 Qs (p) = 1818.82 kN

F.S. 3.00

\$ Ppull = 1030.39 kN

Actual P < Pullout Load

OK



Shear Capacity :

ϕ : 0.85
 Ac' : 0.99 m²
 Vu : 625.92 kN

 Vc : $0.85 \cdot 0.166 \sqrt{f_c} Ac'$

 Vc : 768.21 kN
 ϕVc : 652.98 kN

Checks :

Nd = 374.12 kN
 0.5 Ac fck = 11309.73 kN
 0.5 Ac fck > Nd Ok

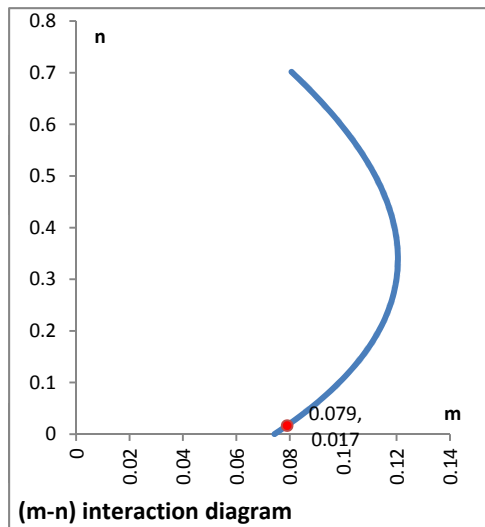
 Ac = 1.13 m²
 Nd / (0.75 fck) = 0.025 m²
 0 Nd / 0.75 fck OK

Vu < ϕVcSuccessful

Mechanical reinforcement ratio

Rmin : 0.00800
 Rmax : 0.02000

 m : 0.079
 n : 0.017
 n < 0.35 0.248
 0.35 < n < 0.7 0.011
 0.70 < n 0.570
 Ψ : 0.248
 Rm : 0.011

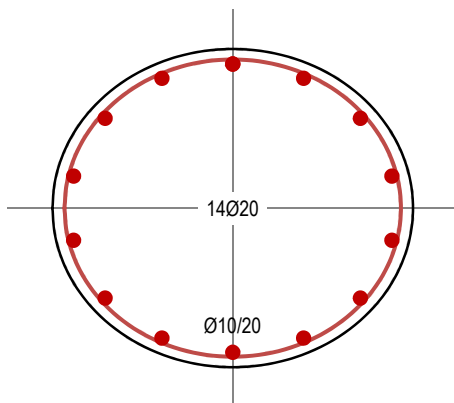
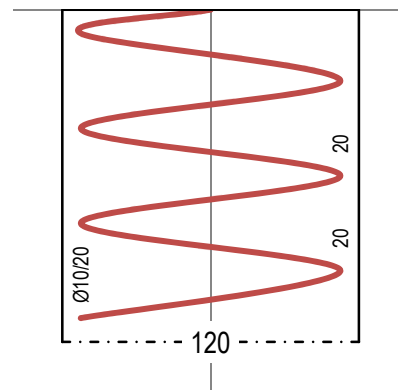
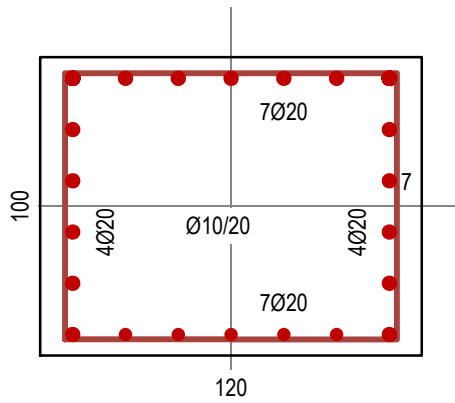


Pile Cap Reinforcement :

pmin :	0.0028			
Asmin :	3310	mm ²	LongSel :	2199 mm ²
Bars (n)	7	pieces		7Ø20
Bars (Ø)	Ø 20	mm		<u>Inadequate Reinforcement</u>
Astr :	276	mm ²	AstrSel :	314 mm ²
Step of Stirrup	25	cm		Ø10/25
Stritup (Ø)	Ø 10	mm		<u>Enough Reinforcement</u>

Pile Reinforcement :

Ash' =	12905	mm ²	Ash =	4398 mm ²
Bars (n)	14	pieces		14Ø20
Bars (Ø)	Ø 20	mm		<u>Inadequate Reinforcement</u>
Ast' =	279	mm ²	Ast =	157 mm ²
Step of Stirrup	20	cm		Ø10/20
Stritup (Ø)	Ø 10	mm		<u>Inadequate Reinforcement</u>



Pile Cap :

Pile Cap L.	51.20 m
Concrete Volume	61.4 m ³

Reinforcement Steel				
Dia(mm) Ø	Unit Length m	Unit Weight Kg/m	Number Of Bars #	Pile Cap Mass
Ø 20	51.20	2.47	22.00	2777.87
Ø 10	4.14	0.62	204.80	522.74
Total Steel (Kg)				3300.62

Piles :

Numbers of pile (NoP)	
NoP = S / b	41

Length		
Dia(cm) Ø	1 Pile Len. Li = L + e	41 Pl.Len. Li x NoP
Ø 120	15.00 m	615.0 m

Concrete Volume	1 Pile Vol. Vi = Ap . Li	41 Pl.Vol. Vi x NoP
	17.0 m ³	695.5 m ³

Reinforcement Steel			
Dia(mm) Ø	1 Pile Length	1 Pile Mass	41 Pile Mass
Ø 20	224.00 m	552.4 Kg	22649.1 Kg
Ø 10	265.07 m	163.4 Kg	6700.5 Kg
Total Steel		715.8 Kg	29349.6 Kg