

1.7 . Layer 4b: Medium dense, reddish brown, yellowish brown SILTY, SAND (SM)

Was found at all the boreholes. The thickness is from 6.5 (SP-02) to more 13.0m (SP-03) and the depth of the layer bottom is to 39.0m (SP-01). Standard penetration resistance from 13 to 18. In total, 22 samples were taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is from 12.93% to 19.21%, wet density from 1.825 to 2.043g/cm³, liquid limit from 16.9 to 17.4%, plasticity index from 3.5 to 3.9% (see average value of the physico-mechanical properties - table 6). The main characteristics of the layer are as follows :

Wet density	γ_w	=	1,953 g/cm ³
Unconfined compressive strength	q_u	=	0.716 Kg/cm ²
Compression index	C_c	=	0.1380
Coefficient of consolidation	C_v	=	6.09 x 10 ⁻⁴
Coefficient of volume compressibility	mv	=	2.60 x 10 ⁻⁵

1.8 . Layer 4c: Medium dense, yellowish brown poorly graded SAND with Silt (SP-SM)

Was found at the boreholes SP-02 and SP-03. The thickness is 1.5m and the depth of the layer bottom is 25.5m. Standard penetration resistance from 18 to 21. In total, 2 samples were taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is from 12.80% to 14.78%, wet density from 1.904 to 1.963g/cm³, (see average value of the physico-mechanical properties - table 7)

1.9. Layer 4d: Medium dense, reddish brown well graded SAND with Silt (Sw-SM)

Was found at the boreholes SP-01, SP-02 and SP-04. The thickness is 2.0m and the depth of the layer bottom is from 24.5m (SP-04) . Standard penetration resistance from 13 to 19. In total, 3 samples were taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is from 11.76% to 15.86%, wet density from 1.832 to 1.966g/cm³, (see average value of the physico-mechanical properties - table 7) The main characteristics of the layer are as follows :

Wet density	γ_w	=	1,893 g/cm ³
Compression index	C_c	=	0.3784
Coefficient of consolidation	C_v	=	5.35 x 10 ⁻⁴
Coefficient of volume compressibility	mv	=	2.68 x 10 ⁻⁵

1.10 . Layer 5: Hard, high plasticity brownish grey CLAY (CH)

Was found at only the boreholes SP-01. The thickness is more 7.5m and the depth of the layer bottom is more 50.0m. At the boreholes with 50.0m depth, its thickness has not been determined yet. Standard penetration resistance from 36 to 46. In total, 3 samples were taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is from 18.96% to 22.60%, wet density from 2.051 to 2.080g/cm³, liquid limit from 56.7 to 62.5%, plasticity index from 34.0 to 37.3% (see average value of the physico-mechanical properties - table 9).

Hydrogeological conditions

At the surveying area, the groundwater level is affected by the tide and changeable according to seasons. The depth of the groundwater level in the boreholes during the investigation time is from 1.0m (SP-01 and SP-02) to 1.5m (SP-04).

STT	Borehole number	groundwater level (m)	Measure date	Remark
1	SP-01	1.0	12/7/1999	From surface
2	SP-02	1.0	11/7/1999	From surface
3	SP-03	1.2	10/7/1999	From surface
4	SP-04	1.5	7/7/1999	From surface

AVERAGE VALUE OF PHYSICO - MECHANICAL PROPERTIES
Layer 2 : Very soft, high plasticity blackish grey ORGANIC CLAY. (OH)

Table : 1

No	Property	Sign	Average value.	Maximum value	Minimum value	Number of test
1	Sieve Analysis, % Passing					
	3/4" (19 mm)					
	1/2" (12.5 mm)					
	3/8" (9.5 mm)					
	#4 (4.75 mm)					
	#8 (2.36 mm)		100.0	100.0	100.0	10
	#16 (1.18 mm)		99.7	100.0	99.0	10
	#30 (0.6 mm)		98.3	100.0	94.6	10
	#50 (0.3 mm)		97.6	100.0	92.6	10
	#100 (0.15 mm)		95.9	100.0	86.7	10
	#200 (0.075 mm)		91.5	97.9	83.2	10
	< 0.005 mm		66.9	72.1	57.8	10
2	Natural moisture content (%)	w	99.27	111.87	74.31	10
3	Natural unit weight (g/cm ³)	γ	1.410	1.489	1.367	10
4	Dry unit weight (g/cm ³)	γ _d	0.746	0.854	0.645	10
5	Specific gravity	G _s	2.589	2.645	2.562	10
6	Porosity	n	0.71	0.75	0.67	10
7	Void ratio	e _o	2.498	2.993	2.011	10
8	Degree saturation (%)	S	93.2	99.9	87.2	10
9	Liquid limit (%)	LL	94.0	115.2	76.4	5
10	Plastic limit (%)	LP	48.5	57.2	44.0	5
11	Plastic index (%)	PI	45.4	63.7	32.4	5
12	Water plasticity ratio (%)	B	0.99	1.37	0.80	5
13	Unconfined compression (Kg/cm ²)	qu	0.106	0.168	0.058	5
14	Compression index	C _c	1.199	1.277	1.143	3
15	Coefficient of consolidation (cm ² /Kg)	C _v	1.94E-04	2.57E-04	1.49E-04	3
16	Preconsolidation pressure (kg/cm ²)	P _c	0.633	0.956	0.469	3
17	Coefficient of volum compressibility (cm ² /g)	M _v	1.58E-04	1.71E-04	1.42E-04	3
18	Permeability (cm/sec)	k ₂₀	3.28E-08	4.90E-08	2.40E-08	3

AVERAGE VALUE OF PHYSICO - MECHANICAL PROPERTIES
Layer 3 : Soft, low plasticity brown, greenish grey CLAY. (CL)

Table :

No	Property	Sign	Average value.	Maximum value	Minimum value	Number of test
1	Sieve Analysis, % Passing					
	3/4" (19 mm)					
	1/2" (12.5 mm)					
	3/8" (9.5 mm)					
	#4 (4.75 mm)					
	#8 (2.36 mm)		100.0			1
	#16 (1.18 mm)		99.5			1
	#30 (0.6 mm)		98.6			1
	#50 (0.3 mm)		95.1			1
	#100 (0.15 mm)		83.2			1
	#200 (0.075 mm)		74.5			1
	< 0.005 mm		45.7			1
2	Natural moisture content (%)	w	22.48			1
3	Natural unit weight (g/cm ³)	γ	1.947			1
4	Dry unit weight (g/cm ³)	γ _d	1.590			1
5	Specific gravity	G _s	2.688			1
6	Porosity	n	0.41			1
7	Void ratio	e _o	0.691			1
8	Degree saturation (%)	S	87.5			1
9	Liquid limit (%)	LL	36.3			1
10	Plastic limit (%)	LP	20.5			1
11	Plastic index (%)	PI	15.8			1
12	Water plasticity ratio (%)	B	1.01			1
13	Unconfined compression (Kg/cm ²)	qu	0.313			1
14	Compression index	C _c				
15	Coefficient of consolidation (cm ² /Kg)	C _v				
16	Preconsolidation pressure (kg/cm ²)	P _c				
17	Coefficient of volum compressibility (cm ² /g)	M _v				
18	Permeability (cm/sec)	k ₂₀				