

(see average value of the physico-mechanical properties - table 5). The main characteristics of the layer are as follows :

Wet density	$\gamma_w$	=	1.951 g/cm <sup>3</sup>
Unconfined compressive strength	$q_u$	=	1.925 Kg/cm <sup>2</sup>
Compression index	$C_c$	=	0.302 cm <sup>2</sup> /kg
Coefficient of consolidation	$C_v$	=	7.06 x 10 <sup>-4</sup> cm <sup>2</sup> /s
Coefficient of volumetric compressibility	$m_v$	=	2.72 x 10 <sup>-5</sup> cm <sup>2</sup> /g

**1.7 . Layer 4b: Medium dense, yellowish brown grey CLAYEY GRAVEL with SAND (GC).**

Was found at borehole DBN-2. The thickness 2.3m and the depth of the layer bottom is 4.8m. Standard penetration resistance N from 10 to 12. One sample were taken from this layer, the obtained physical, mechanical properties of the samples have shown that, natural moisture is 20.37%, wet density 2.012g/cm<sup>3</sup>, liquid limit is 42.9%, plasticity index 20.1%, (see average value of the physico-mechanical properties - table 6). The main characteristics of the layer are as follows :

Wet density	$\gamma_w$	=	2.012 g/cm <sup>3</sup>
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**1.8 . Layer 4c: Medium stiff, high plasticity, yellowish whitish SILT (MH).**

Was found at borehole DBN-2. Thickness is 2.5m and the depth of the layer bottom is 8.5m. Standard penetration resistance N from 7 to 10. With one sample was taken from this layer, the obtained physico-mechanical properties of the sample has shown that, natural moisture is 55.60%, wet density 1.630g/cm<sup>3</sup>, liquid limit is 65.0%, plasticity index 16.7%, (see average value of the physico-mechanical properties - table 7). The main characteristics of the layer are as follows :

Wet density	$\gamma_w$	=	1.630 g/cm <sup>3</sup>
Unconfined compressive strength	$q_u$	=	0.563 Kg/cm <sup>2</sup>
Compression index	$C_c$	=	0.7326 cm <sup>2</sup> /kg
Coefficient of consolidation	$C_v$	=	4.43 x 10 <sup>-4</sup> cm <sup>2</sup> /s
Coefficient of volumetric compressibility	$m_v$	=	5.42 x 10 <sup>-5</sup> cm <sup>2</sup> /g

**1.9 . Layer 4d: Loose, yellowish whitish grey CLAYEY SAND (SC).**

Was found at all the boreholes. Thickness is from 4.5m (SS-11) to 14.0m (SC-01) and the depth of the layer bottom is from 9.5m (SS-10) to 23.0m (SC-01). Standard penetration resistance N from 7 to 10. In total, 10 samples were taken from this layer, the obtained physical, mechanical properties of the samples have shown that, natural moisture is from 14.95% to 22.40%, wet density from 1.900 to 2.113g/cm<sup>3</sup>, liquid limit from 18.0 to 33.3%, plasticity index 4.3% to 17.7%, (see

average value of the physico-mechanical properties - table 8). The main characteristics of the layer are as follows :

Wet density	$\gamma_w$	=	2.057 g/cm <sup>3</sup>
Unconfined compressive strength	$q_u$	=	0.394 Kg/cm <sup>2</sup>
Compression index	$C_c$	=	0.271 cm <sup>2</sup> /kg
Coefficient of consolidation	$C_v$	=	4.54 x 10 <sup>-4</sup> cm <sup>2</sup> /s
Coefficient of volumetric compressibility	$m_v$	=	5.81 x 10 <sup>-5</sup> cm <sup>2</sup> /g

**1.10 . Layer 4e: Medium dense, yellowish brownish grey SILTY SAND (SM).**

Was found at all the boreholes. Thickness is from 13.5m (DEN-2) to more 22.5 (SC-03) and the depth of the layer bottom is from 28.5m (DBN-2) to more 30.0m (SC-01, SC-03, SS-10, SS-11 and DBN-4). Standard penetration resistance N from 13 to 27. In total, 23 samples were taken from this layer, the obtained physical, mechanical properties of the samples have shown that, natural moisture is from 12.42% to 18.66%, wet density from 1.903 to 2.160g/cm<sup>3</sup> (see average value of the physico-mechanical properties - table 9).

Wet density	$\gamma_w$	=	2.008 g/cm <sup>3</sup>
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**1.11 . Layer 4f: Medium dense, pinkish yellow well graded SAND with SILT (SW-SM).**

Was found at boreholes DBN-1, DBN-2 and DBN-3. Thickness is more 2.0m and the depth of the layer bottom is more 30.0m. Standard penetration resistance N from 18 to 27. In total, 2 samples were taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is 10.65%, wet density from 1.877 to 2.037g/cm<sup>3</sup>, liquid limit from 20.5 to 22.5%, plasticity index 3.7% to 5.9%, (see average value of the physico-mechanical properties - table 10).

**Hydrogeological conditions**

At the surveying area, the groundwater level is affected by the tide and changable according to seasons. The groundwater level in the boreholes during the investigation time is from -0.5m to -0.9m. (The underground water level measured from ground surface).

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

Table : 1

No	Properties	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	2
	#16 (1.18 mm)		99.4	100.0	98.7	2
	#30 (0.6 mm)		98.8	100.0	97.5	2
	#50 (0.3 mm)		97.6	100.0	95.1	2
	#100 (0.15 mm)		96.3	100.0	92.6	2
	#200 (0.075 mm)		94.5	98.4	90.5	2
	< 0.005 mm		75.8	77.1	74.4	2
2	Natural moisture content (%)	w	63.11	82.83	43.39	2
3	Natural unit weight (g/cm <sup>3</sup> )	$\gamma$	1.481	1.512	1.449	2
4	Dry unit weight (g/cm <sup>3</sup> )	$\gamma_d$	0.924	1.054	0.793	2
5	Specific gravity	G <sub>s</sub>	2.589	2.592	2.586	2
6	Porosity	n	0.640	0.690	0.590	2
7	Void ratio	e <sub>o</sub>	1.861	2.263	1.451	2
8	Degree saturation (%)	S	85.90	94.70	77.10	2
9	Liquid limit (%)	LL	79.6	98.4	60.8	2
10	Plastic limit (%)	LP	49.6	62.6	36.5	2
11	Plastic index (%)	PI	30.1	35.8	24.3	2
12	Water plasticity ratio (%)	B	0.42	0.57	0.28	2
13	Unconfined compression (Kg/cm <sup>2</sup> )	qu	0.241	0.369	0.112	2
14	Compression index (cm <sup>2</sup> /kg)	C <sub>c</sub>	0.8660	1.0280	0.7050	2
15	Coefficient of consolidation (cm <sup>2</sup> /s)	C <sub>v</sub>	3.53E-04	4.30E-04	2.75E-04	2
16	Preconsolidation pressure (kg/cm <sup>2</sup> )	P <sub>c</sub>	1.019	1.402	0.635	2
17	Coefficient of volum compressibility (cm <sup>2</sup> /g)	M <sub>v</sub>	9.32E-05	1.25E-04	6.13E-05	2
18	Permeability (cm/sec)	k <sub>20</sub>	2.67E-08	2.81E-08	2.58E-08	2
						2

AVERAGE VALUE OF PHYSICA - MECHANICAL PROPERTIES  
 Layer 2a : Medium stiff, high plasticity, yellowish brown CLAY (CH)

Table : 2

No	Properties	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)		99.0			1
	#30 (0.6 mm)		97.3			1
	#50 (0.3 mm)		95.0			1
	#100 (0.15 mm)		92.8			1
	#200 (0.075 mm)		90.8			1
	< 0.005 mm		72.5			1
2	Natural moisture content (%)	w	45.68			1
3	Natural unit weight (g/cm <sup>3</sup> )	$\gamma$	1.728			1
4	Dry unit weight (g/cm <sup>3</sup> )	$\gamma_d$	1.186			1
5	Specific gravity	G <sub>s</sub>	2.692			1
6	Porosity	n	0.560			1
7	Void ratio	e <sub>o</sub>	1.270			1
8	Degree saturation (%)	S	96.90			1
9	Liquid limit (%)	LL	78.7			1
10	Plastic limit (%)	LP	33.2			1
11	Plastic index (%)	PI	45.5			1
12	Water plasticity ratio (%)	B	0.27			1
13	Unconfined compression (Kg/cm <sup>2</sup> )	qu	0.371			1
14	Compression index (cm <sup>2</sup> /kg)	C <sub>c</sub>	0.3935			1
15	Coefficient of consolidation (cm <sup>2</sup> /s)	C <sub>v</sub>	3.71E-04			1
16	Preconsolidation pressure (kg/cm <sup>2</sup> )	P <sub>c</sub>	0.515			1
17	Coefficient of volum compressibility (cm <sup>2</sup> /g)	M <sub>v</sub>	5.90E-05			1
18	Permeability (cm/sec)	k <sub>20</sub>	2.14E-08			1
						1