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Geotechnical Properties for Soil Alghlabia Area in Diyala Governorate /North Baghdad/ Iraq

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Abstract

The research aims, to find out the geotechnical properties for soil Alghlabia area, locate within the near (HibHib) in Khalis/Diyala, northeast of Iraq. Just (17) km from the district center, (46) km from the center of Baghdad, five samples were taken from five sites in the area. Physical properties show that the types of soils, (CL-ML, CL) according to the classification. Activity of soil values normal, Liquid limit (L.L.) and plasticity index(P.I)and depending on plasticity chart the soils type respectively (ML, ML, CL-ML, ML, CL-ML), while the specific gravity (G_s) values converge, because resources of same sediments, porosity (n%) & voids ratio (e_0) values for three site are different , dry density (ρ_d) values approximate for values set by Mechanical properties, direct shear test show that the values cohesion C & angle of internal frication (Ø) are with the natural range of known values of clay soils, while the consolidation test for sites shows that the normal values, Pre consolidation pressure (p_c), compression index (c_c) & swelling index (c_r), then the values of Over Consolidation ratio (OCR) greater than 1, which indicate over consolidation soils. Chemical analysis .Total dissolve salts (T.D.S) for sites is higher exceeded 0.5%, Gypsum content less than 0.5%.Organic Matter content (O.M.C) less than (0.5%)& (pH) the result show that the soil is basic. According to standard, it was suitable, for different Engineering construction.

Keywords: Cohesion, Pre consolidation, Swelling, pH values.

1. Introduction

QuAaternary sediments that cover Alghalbia area, locat within the near(HibHib) in Khalis/Diyala, northeast of Iraq. Just (17) km from the district center, (46) km from the center of Baghdad, at latitudes (33˚43'30˝- 33˚45'00) north, longitudes (44˚28'30˝- 44˚30'00˝) to the east (Fig. 1)[1]. Five sites of research area are selected, for taken sub surface samples, to Study Geotechnical properties of soils, in Alghlabia area.Generally the area represented by Slopes deposit (Pleistocene – Holocene) alluvial fans. In addition to the flood plain, is flat bed flooded, large amount of silt[2].Temperature, evaporation, and wind speed have an impact on soils, data for period 1991- 2010 [3]monthly average temperatures 22.09 °C, average wind speed2.45 m /s, rainfall summation 172.16 mm, that

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it means; research area is drying area, due to rain fall summation less than 500 mm, also evaporation 172.41 mm, greater than rain fall

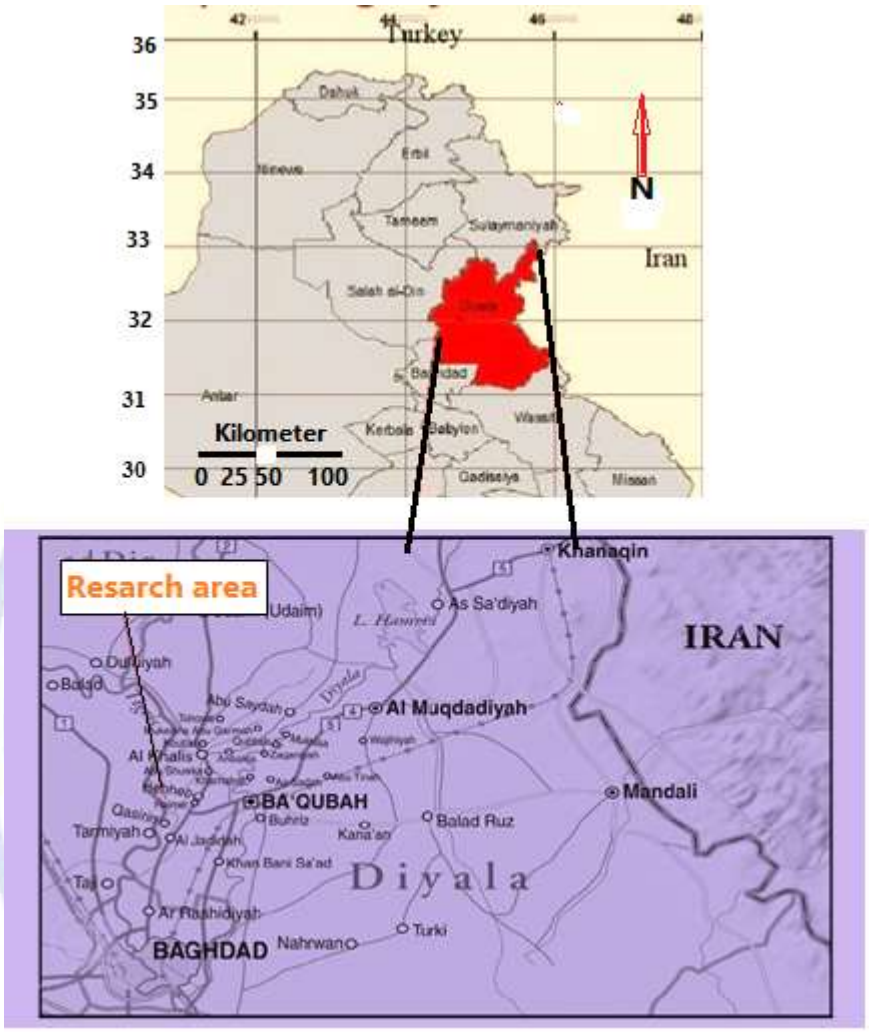

Fig.1. Location Map of Research Area[1]

2.previous studies: many previous studies in the research area were done:

[4]The first study is conduct on the soil of Iraq in general, agricultural purposes, which showed that the soil Sedimentary basin, as a result of the accumulation of sediment in the meanders of rivers during times of flood.

[5] Modern formation zone by deposits that (Tigris River and Diyala River).

[6] The preparation of preliminary geotechnical maps of soil for some selected areas in Diyala province, including Khalis area.

[7] Hydrogeological in Iraq is divided into five sector reflected the conditions for the storage and movement of groundwater.

[8]Indicated the abundance of groundwater in the area.

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[9]The study area lies on Mesopotamian sector. cross Diyala river, with influence of Tigris southeast of Baghdad and a number of branches organized mediated dam Diyala regulator,(Mahrot, Khreisan, wandlee, Rose, and Khali's channel) Water table in this area about(0.8 - 2.1) m, in April.

3 .Materials and Methods

Many tours current out, five sites selected in the research area, for pointed field noticed and sampling. Sites must be near index points, in the region, as a school, a dispensary ... etc. Empty areas, represent five sites, for drilling subsurface, plate1, 2. Samples sent to the laboratories, many tests and analysis were done (physical, Engineering tests, and chemical analysis), at (N.C.C.L.) (National Center for Laboratories &Research construction Kirkuk laboratory construction), according to international standards (American and British).

Plate 1. Hand auger tool using in drilling

Plate 2. Disturbed Samples

4- Results & Discussion

Moisture Content. According [10]That this feature may help to create problems for the engineering construction underground with respect to reducing the internal friction of the granules and liquefaction of sand. This method shows that moisture content values are shown in a table1, about 19% -22% and this ratio is due to the soft texture, and plastic nature, its low permeability.

Specific Gravity. According to [11]Represents the rate of the specific weight values of soil constituents, the values are shown in table 1 about 2.66 - 2.74. **Grain Size Analysis**, According to[12] .

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Sieving Analysis. Coarse grains (gravel and sand) using a set of standard American sieves. Fine grains (silt, clay) soil, Size grains less than 75 microns more than (50%), shall be fine soil. results in table1,then drawn figures, passing%, versa diameter (mm) figures 2, 3, 4, 5, 6. Curves show that the high percentages for fine soil and sand represented low percentages.

Plasticity Limits Tests. According to [13]liquid Limit, Plastic Limit& Plasticity Index, results arranged in table 1, soils classified to (CL-ML, CL) as, in figure 7 Plasticity chart, this results concerned with grain size results in soils.

Table1. Physical Properties of research area

Physical Properties	Site1Depth 1.5 m	Site2Depth 2.0 m	Sit3Depth 2.0 m	Site4Depth 1.5 m	Site5Depth 2.0 m
W %	21.68	21.65	19.32	22.23	19.89
G.s	2.86	2.66	2.72	2.70	2.74
Silt %	58	71	52	62	64
Clay%	35	20	41	33	32
Sand %	7	9	7	5	4
L.L%	30.54	29.84	30.83	32.87	29.22
P.L%	23.96	23.50	22.82	24.10	22.31
P.I%.	6.58	6.34	8.01	8.77	6.91
A%	1.02	0.57	0.58	1.17	1.15
P_t gm/cm^3	1.94	2.06	2.11	1.97	2.01
P_d gm/cm^3	1.56	1.72	1.69	1.56	1.61

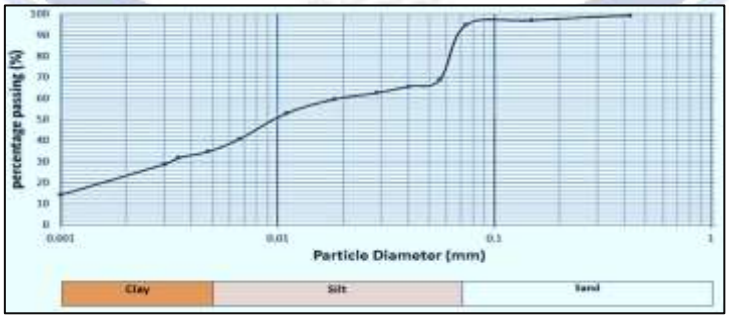

Figure 2 grain size analysis of site 1

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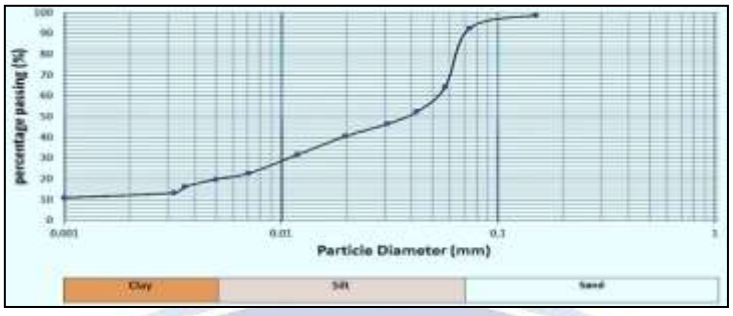

Figure 3 grain size analysis of site 2

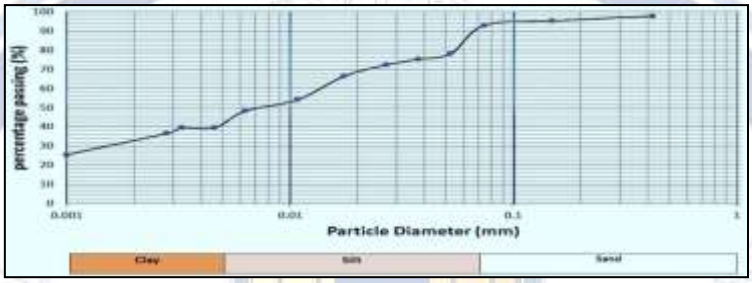

Figure 4 grain size analysis of site 3

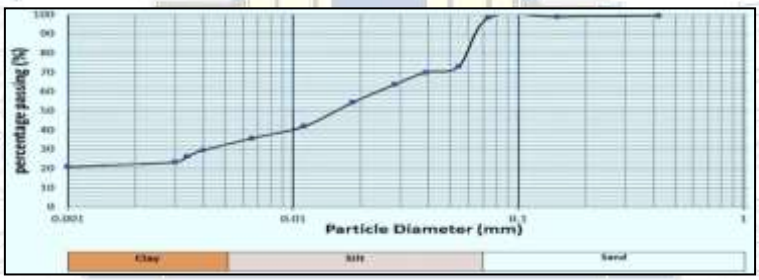

Figure 5 grain size analysis of site 4

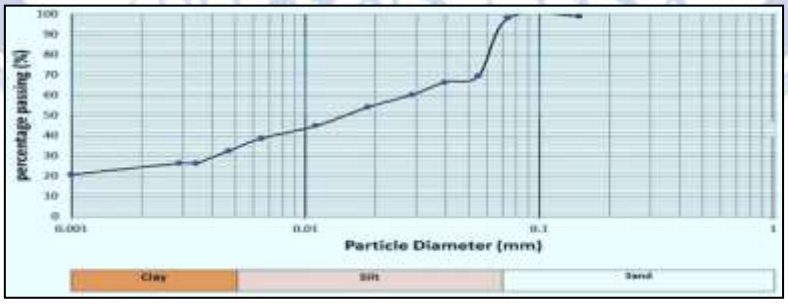

Figure 6 grain size analysis of site 5

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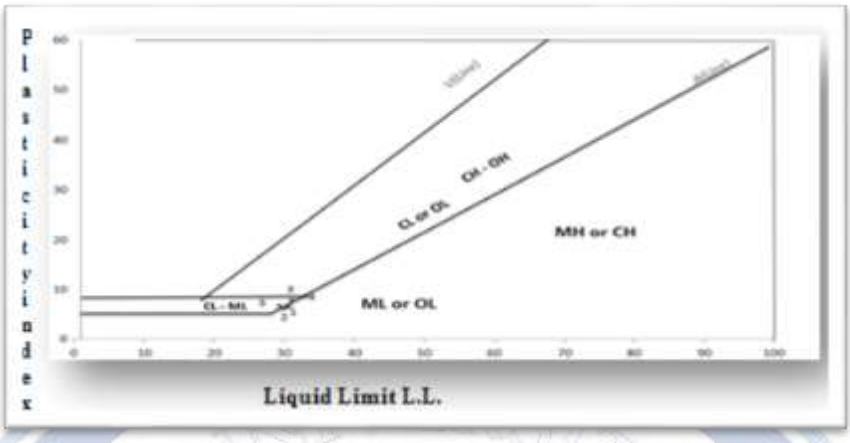

Figure 7 plasticity chart of sites 1,2,3,4,5

Engineering Properties Direct Shear Test.

According to[14]three species result values were taken for each sample, first sample has 105.80, 140.12, 194.26, second sample 38.57, 41.04, 84.21, third sample 57.38, 62.63, 68.29 fourth sample 60.15,72.89, 90.58, fifth sample 49.18, 62, 55, 78.5 shear stress values 70.77, 141.54, 212.32 kN/m^2 ,versa the normal stress, horizontal axis 100,200,400 kN/m^2 figures 8, 9, 10,11,12, elements of shear strength Ø, C, were calculated, for each sample, table 2, determined by using shear box, not through the weakest level aligned to the soil body[15] direct shear test types (CD,CU) ,Consolidated drain and Consolidated un drained.

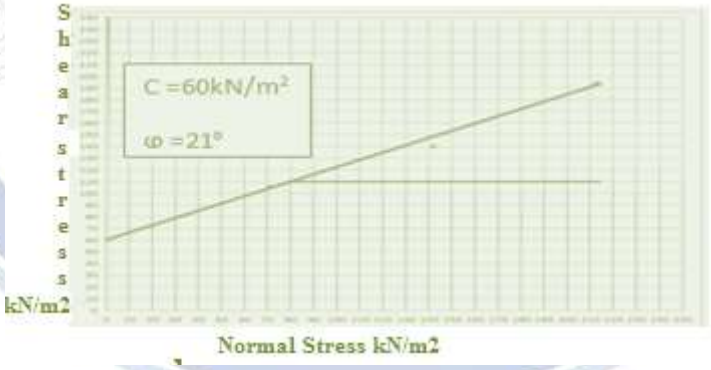

Figure 8: direct shear test site 1

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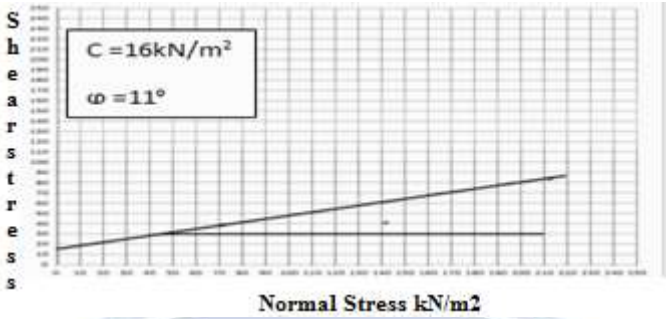

Figure 9 direct shear test site 2

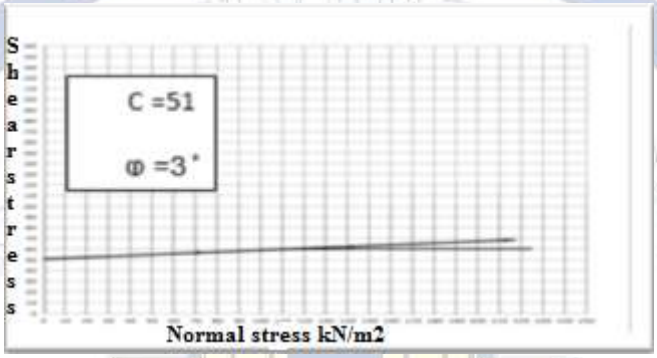

Figure 10 direct shear test site 3

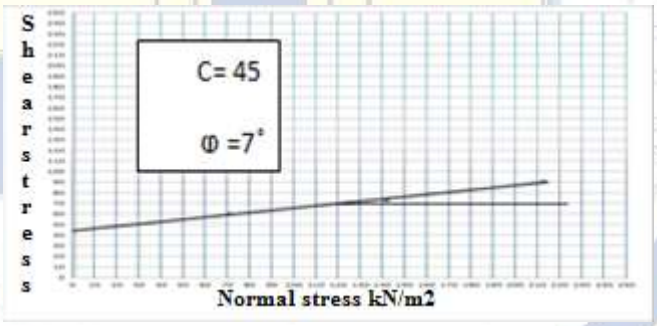

Figure 11 direct shear test site 4

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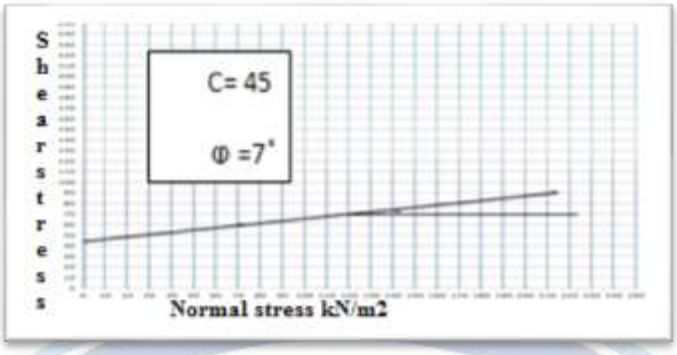

Figure 12 direct shear test site5

Consolidation Properties.

According to[16]It can be known that join between soil particles and decrease in size occur in saturated soil, when exposed to stress resulting from an increased water pressure pore and the movement of water pore out of the soil, based on the stress and the time and the amount of joining [17] stretch accidentally as a result of limited only to the decrease in size, gets mainly in the vertical direction, and expression is used consistently to describe compression of mud or alluvial soil that are naturally low permeability of the soil, lead to increase density, thereby increasing the shear strength. Join happening in the sandy soil is much shorter than the clay soil in advance due to the high permeability of the sand which helps the water out too fast from the gaps when exposed sandy soil to an increase in the effective stress, so it will damage the buildings in the event that the foundations are built on sandy soil because of the little landing compared with soil clay midwife compressible, the amount of decline is based on the ability of soil compressible while landing speed to the permeability of the soil based on a speed passage of water in, and are landing account usually when the soil is saturated with water because it represents the worst case for the stability of facilities as the construction of facilities to be the cause of the increasing the pressure on the soil layers bearing the foundations of these buildings and then work to increase the pressure to reduce the size of the soil foundation, as a result falling buildings, installations happen to depend on the quality of the soil stresses inflicted by (Odometer), measured height variable sample, and as a result of this test can be found proportion of voids (e), through the fee rate change in the blanks with Odometer pressure, curved Pre consolidation pressure, [18]ratio (e_o) of the three sites extracted by the consolidation was almost within ideal limits[19] **Porosity(n).**Through the results of porosity values do not take a certain arrangement**,** while[20]the porosity one of the geotechnical properties that are directly affected by the stresses exerted on the soil.

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Compression Index(Cc).

The results for three sites1, 2, 5 were determined 0.148, 0.196, and 0.235 respectively. **Swelling Index (Cr).**The result for three sites1, 2, 5 were calculated 0.037, 0.021, and 0.045 respectively.

Pre – Consolidation Pressure (P_c).

The result for three sites, 56, 66, 120 kN/m^2 respectively. were found (Pc) for the research area, drawing the relationship between void ratio and load logarithmic scale, for Consolidation curve as shown in Figures 13,14,15. Table 2 showed also (OCR) values is greater than one (1), mean over conciliated soils.

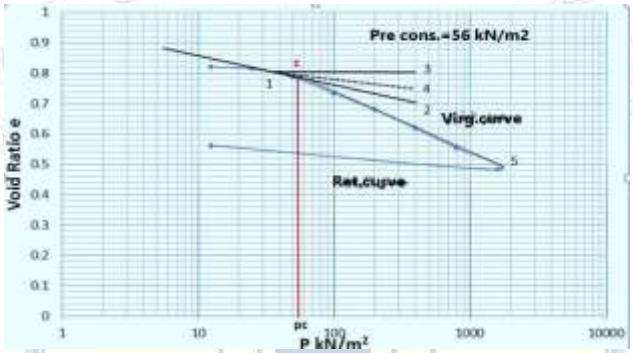

Figure 13 consolidation curve site 1

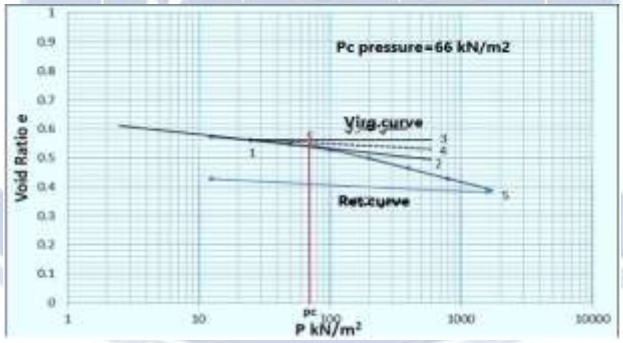

Figure 14 consolidation curve site2

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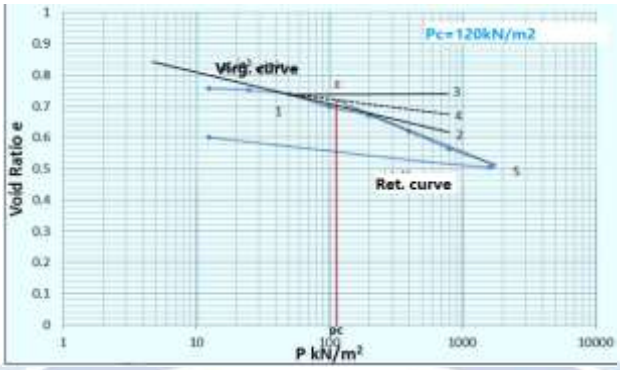

Figure 15 consolidation curve site 5

Table (2) Engineering test results

Engineering Properties	Site 1Depth 1.5m	Site 2Depth 2.0 m	Site Depth 2.0 m	Site 4 Depth 1.5 m	Site 5Depth 2.0 m
Ø°	21 °	11°	3 °	7 °	7 °
C kN/m²	60	16	51	45	37
Cc	0.23	0.14	-	-	0.19
Cr	0.03	0.02	-	-	0.04
P_c kN/m²	56	66	-	-	120
p_o kN/m²	29.10	41.20	-	-	41.12
OCR	1.92	1.60	-	-	2.90
e_o	0.82	0.59	-	-	0.77
n	45	37	-	-	43

Chemical Analysis

Soil chemistry mainly relates, between the liquid phase is a solution soil, the solid phase of the soil contains the organic and inorganic components. Inorganic constituents contain a lot of soil minerals (major and minor) and affect the properties of the soil smaller amounts relative to the inorganic constituents, and chemical tests as follows:

Gypsum Content

According to [21] The analysis of gypsum content showed that the soil of the research area has (very slightly gypsum) and these values low according[22]the results values show in table3, it was not affected in the concrete work as well as not swelling of the soil when exposed to water.

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Organic Material Content (O.M.C.)

According to[21]All samples results values, were shown a lack of organic materials, so was an organic, the value of site1(0.19%). that the ratio of the organic material in all sites less than (0.5%), is not effective on the cement used in the concrete.

Total Dissolved Salts (T.D.S.)

According to[23]The result analysis show in the table (3) the ratio of all sample (T.D.S) that exceeded (0.5%) based[24]that high ratio of dissolving of the cement compounds, which is conducive to reduce the resistance of concrete to external stresses. **pH-value**. According to [21]the Results, as in table 3, which show that the soil has values 8.67, 8.57, 8.54, 8.64, 8.85, respectively.it means weak alkali soils .

Table 3 Chemical Analysis Results

Chemical Properties	Site 1 Depth 1.5 m	Site 2 Depth 2.0 m	Site 3 Depth 2.0m	Site 4 Depth 1.5 m	Site5 Depth 2.0m
T.D.S.	0.87	0.83	1.74	1.16	0.85
pH	8.67	8.57	8.54	8.64	8.85
Gypsum content	0.32	0.33	0.54	0.33	0.28
Organic Matt..	0.19	0.13	0.11	014	0.15

5.Conclusions

Through properties values for the soil research area, the following conclusions were concluded:

* Most of the soil types of the research area are soft types respectively (CL-ML, ML).

* Moisture content of research area about% (19-22%), with mean moisture content, the reason due to the proximity of groundwater level the surface-The results of the soil activity values ranged(0.5-1.17) within the normal to non-active, that the soil is not affected with increase the water content.

* Direct shear test results show that the internal friction angle between (3º-21º) most samples have low values, except the first sample was a different value for the angle of friction so as to increase the proportion of soft material, which reflected in the cohesion due to (cohesion increases with soft materials), which ranged from (16-60) kN/m².

* By consolidation test, swelling index values showed that low swelling soils ranged between (0.021- 0.045) have attributed the reason for the lack of swelling minerals in samples, depending on the extracted Directory values compression coefficient show,

that soil with a high compression and values ranged between (0.148- 0.235), that these values depend on the size of the granules, by increasing the compression ratio of fine soil to increase sizes, samples test results, over consolidation ratio(OCR) (1) ranged from (1.6-2, 9).

* Results of chemical analysis show that the soil of the research area with an organic content of a few not affecting on the engineering properties, as well as the soils research area, was based (8.54- 8.85) This is a positive factor for the fact that the base concrete, but for total dissolved salts for all samples more than (0.5%), negative effect on the concrete.

6. Recommondations

Recommend the following:
* Studies on preparing geotechnical maps of the research area soil.
* groundwater study at construction project because it is one of the important things that you must take into consideration and to ensure more quality and safety Topsoil more homogeneous and increase the relative density and load-bearing capacity and reduce the compressibility .In the case of the design of facilities in this region must put into consideration soil spate easy being a loose soil as well as the high moisture content of the soils that lead many engineering problems.

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Conflict of Interests.
There are non-conflicts of interest .

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الخلاصة

يهدف البحث الى ايجاد الخواص الجيوتكنيكية لتربة منطقة الغالبية المجاورة لهبهب التابعة لقضاء الخالص في محافظة ديالى – شمال شرق العراق، 17كم عن المنطقة، 46 كم عن مركز بغداد ، جمعت (5) نماذج ولخمسة مواقع في المنطقة . تبين الخواص الفيزيائية ان انواع الترب هي CL–ML,CL، طبقا لتصنيف المواصفات الامريكية ، وقيم الفعالية اعتيادية ، واعتمادا على L.L.و P.I. ومرتسم اللدونة انواعها ML،ML, CL–ML، ML، CL–MLعلى التوالي , بينما قيم الوزن النوعي متقاربة كون الترسبات مصادرها متشابهة, وتختلف قيم المسامية ونسبة الفراغات لثلاث مواقع ، تتقارب قيم الكثافة الجافة مع القيم القياسية . نتائج الخواص الميكانيكية ، قيم القص المباشر C و Ø ضمن الحدود الطبيعية للأطيان ، بينما قيم الانضمام اعتيادية ،وكذلك Pc، Cc، Sc ، ثم O.C.R. اكبر من 1 والتي تؤشر الانضمام المفرط ، وقيم التحاليل الكيميائية ، تجاوزت 0.5% T.D.S.، واقل من0.5% للجبسم والمواد العضوية، بينت نتائج pH ان التربة قاعدية ، طبقا للمواصفات، فهي ملائمة لمختلف المنشآت الهندسية .

الكلمات الدالة: التماسك ، الانضمام المسبق ، الانتفاخ ، قيم دليل الحامضية