GTQ-342-NGI

Geotechnigues

Lab Section: [redacted]

LAB REPORT

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Student number: [redacted]

Date Submitted:

October 17th, 2018

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Lab Report

Purpose:

The purpose is to determine the fine-grained Particle size distribution with a Hydrometer Analysis, and identify the plastic and liquid limits with the Atterberg limits test.

Sample Description (MIT)

- Hydrometer Sample

Low dry strength with Light brown colour and slow Dilatancy, smooth with some shine and low plasticity. (ML)

- Atterberg Limits

No dilatancy with high plasticity and low dry strength, Some grittiness and no shine. (MP)

Apparatus and procedure:

- Hydrometer Apparatus
    1. Hydrometer jar
    2. Hydrometer type (152 H)
    3. Mechanical mixer and mixing cup
    4. Wash sieve (No 200)
    5. Thermometer (°C)
    6. Electronic balance (accurate to 0.01 g)
    7. Beaker, spatula, plastic graduated cylinder (waiting jar for bulb), water bottle
    8. Sodium hexametaphosphate (deflocculant)
- Hydrometer Procedure

1. Place 50 g of prepared (dried, crushed & sieved) fine-grained sample into a beaker.
2. Add 5.00 g of deflocculant (soap).
3. Add water to beaker until it is about half full and stir well. Ensure spatula is rinsed clean before removing from the beaker.
4. Transfer solution to metal mixing cup, ensuring all soil particles are rinsed out of the beaker.
5. Add water to cup until it is about half full.
6. Mix for one minute. Rinse mixing blades into mixing cup.
7. Transfer solution to hydrometer jar, ensuring all soil particles are rinsed out of the mixing cup.
8. Add clean tap water to the jar, up to the 1,000 ml mark.
9. Placing a stopper over the mouth of the jar, turn the jar end over end for approximately one minute (approximately 30 half turns, 1 every 2 seconds).
10. Set jar down carefully – immediately record this time as the START time.
11. Take temperature and hydrometer readings at the following elapsed times: 1, 2, 4, 8, 15, 30, 60, 120, 240 and 1440 minutes after the START time.

- Atterberg Apparatus

    1. Plastic Limit Test

        - Liquid limit device
        - Glass plate
        - Mixing equipment (bowl, spatula, water bottle)

- Dry soil containers
- Electronic balance (Accurate to 0.01g)

2. Liquid Limit Test

- Label 4 containers and obtain their mass.
- Using the left over sample from the plastic limit test
- Press and spread sample into liquid limit cup, to a depth of 1 cm.
- Using the grooving tool, carve a groove from top to bottom in a single motion.
- While rotating handle at approximately 2 rotations per second, record the number of drops necessary to close the groove to a length of 13mm.
- Take a moisture content sample from the point of closure, place it into the container and record the moist soil mass.
- Remove the remaining soil from the cup and return it to the bowl.
- Wipe the cup clean.
- Carefully add more water to sample, mix and repeat test.
- At least 4 trials are required with drop counts between 5 and 50. You must have some trails with blow counts above 25 and some below 25.

- Place moisture samples into oven on low heat for 24 hours.

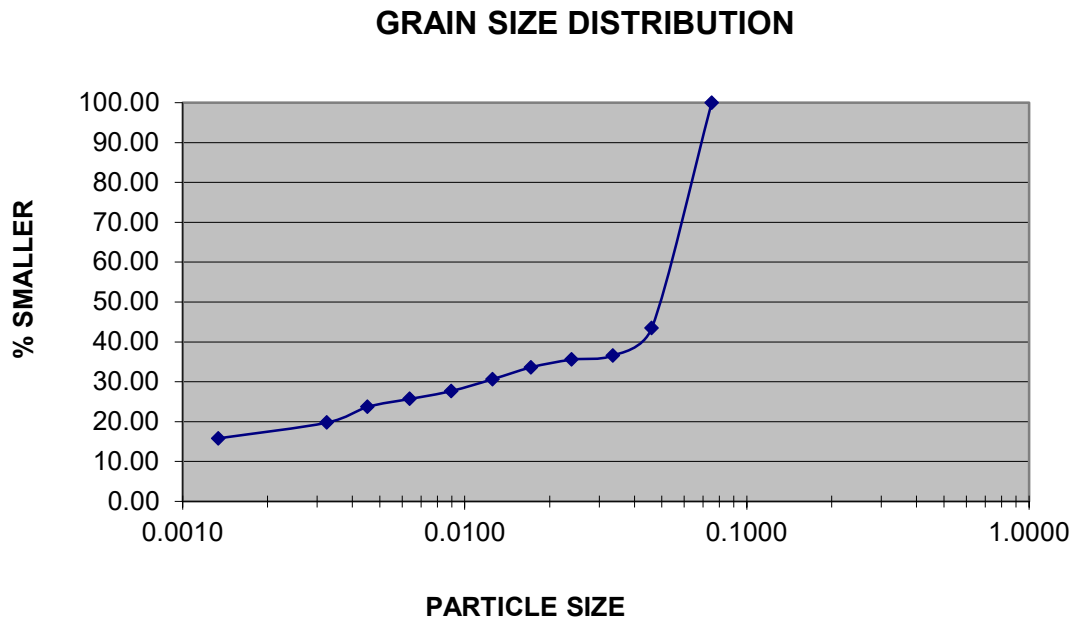
Obtain mass of dry samples.

Results:

More then 50% of both samples from lab 4 and 5 pass sieve 200, therefore the samples are fine grained soils. According to USCS (Table 5.2) the sample is ML

Table #1 Hydrometer Analysis Results

Elasped Time	Temp. °C	Hyd. R'	Hyd-Correction	Corrected-Hyd R	L	K	Dia. D	% smaller P
							0.0750	100.000
1	23	28	-6	22	12.7	0.0129	0.0460	43.534
2	22.5	25	-6.5	18.5	13.25	0.013	0.0335	36.608
4	22	25	-7	18	13.3	0.0131	0.0239	35.619
8	22	24	-7	17	13.7	0.0131	0.0171	33.640
15	22	22.5	-7	15.5	13.75	0.0131	0.0125	30.672
30	22	21	-7	14	14	0.0131	0.0089	27.703
60	22	20	-7	13	14.2	0.0131	0.0064	25.725
120	22	19	-7	12	14.3	0.0131	0.0045	23.746
240	22	17	-7	10	14.7	0.0131	0.0032	19.788
1440	22	15	-7	8	15	0.0131	0.0013	15.831



Graph #1: Hydrometer Analysis Graph

Table #2: Plastic Limit Test

Trial #	1	2	3	4
Container ID	148	262	151	302
Container Mass(g)	4.8	5.6	4.8	5.4
Mass of cont. & moist soil	7.5	8.3	8.9	7.9
Mass of cont. & dry soil	7.22	8.07	8.42	7.56

Table #3: Water Content For Plastic Limit Test

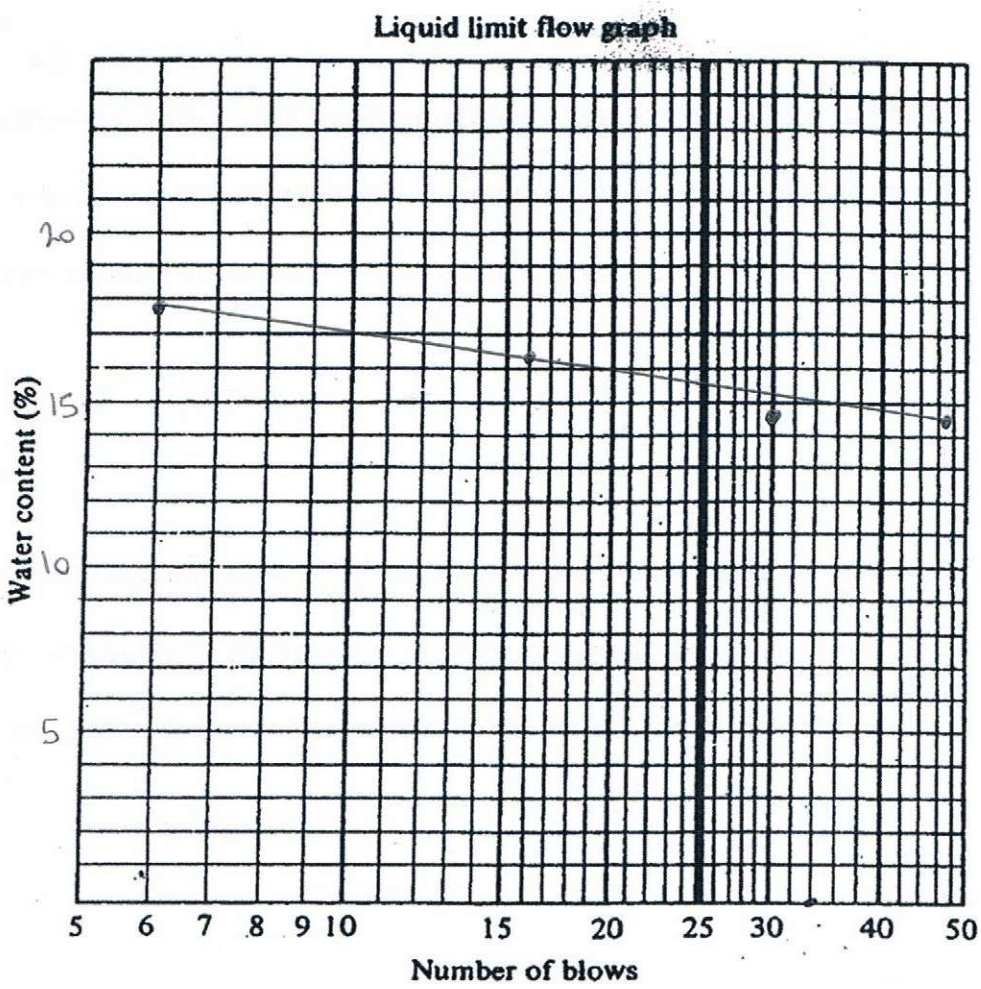
Trial #	1	2	3	4
Water Content (%)	11.57	9.31	18.32	15.74

Table #4 Liquid Limit Test

Trial #	1	2	3	4
Container ID	184	48	251	76
Container Mass (g)	4.3	4.8	5.7	4.4
Blow count at closure	6	30	16	47
Mass of cont. & moist soil	12.6	17.6	15.1	15.8
Mass of cont. & dry soil	11.35	15.97	13.78	14.36

Table #5: Water content for Liquid limit test

Trial #	1	2	3	4
Water Content (%)	17.73	14.59	16.34	14.46



Graph #2: Liquid Limit Flow

W_P = 13.74 %

W_L = 15.78 %

P_I = 2.04 %

Discussion:

Both the hydrometer analysis and the Atterberg limits test was completed successfully. In the plastic limit test for the Atterberg limits, I and my group members could have presided with more cautions; because the liquid limit flow graph is not a 100% accurate.

Conclusion:

In conclusion both hydrometer analysis and the Atterberg limits test was completed successfully and accurately. By looking at the Plasticity chart, with a Liquid limit of 15.78% and a plasticity index of 2.04%, we concluded that the sample is silt with low plasticity (ML)

Appendix

$D = K\sqrt{\frac{L}{T}}$

$D_1 = 0.0129\sqrt{\frac{12.7}{1}} = 0.046\ mm$

$D_2 = 0.013\sqrt{\frac{13.25}{2}} = 0.0335\ mm$

$D_4 = 0.0131\sqrt{\frac{13.3}{4}} = 0.0239\ mm$

$D_8 = 0.0131\sqrt{\frac{13.7}{8}} = 0.0171\ mm$

$D_{15} = 0.0131\sqrt{\frac{13.75}{15}} = 0.0125\ mm$

$D_{30} = 0.0131\sqrt{\frac{14}{30}} = 0.0089\ mm$

$D_{60} = 0.0131\sqrt{\frac{14.2}{60}} = 0.0064\ mm$

$D_{120} = 0.0131\sqrt{\frac{14.3}{120}} = 0.0045\ mm$

$D_{240} = 0.0131\sqrt{\frac{14.7}{240}} = 0.0032\ mm$

$D_{1440} = 0.0131\sqrt{\frac{15}{1440}} = 0.0013\ mm$

$P = \frac{Ra}{Ms}$

$P_1 = \frac{22 \times 0.99}{50.03} \times 100 = 43.834\ \%$

$P_2 = \frac{18.5 \times 0.99}{50.03} \times 100 = 36.608\ \%$

$P_3 = \frac{18 \times 0.99}{50.03} \times 100 = 35.619\ \%$

$P_4 = \frac{17 \times 0.99}{50.03} \times 100 = 33.640\ \%$

$P_5 = \frac{15.5 \times 0.99}{50.03} \times 100 = 30.672\ \%$

$P_6 = \frac{14 \times 0.99}{50.03} \times 100 = 27.703\ \%$

$P_7 = \frac{13 \times 0.99}{50.03} \times 100 = 25.725\ \%$

$P_8 = \frac{12 \times 0.99}{50.03} \times 100 = 23.746\ \%$

$P_9 = \frac{10 \times 0.99}{50.03} \times 100 = 19.788\ \%$

$P_{10} = \frac{8 \times 0.99}{50.03} \times 100 = 15.831\ \%$

HYDROMETER ANALYSIS – DATA SHEET

Members: Youssef Chokre
Talya Khashaba

Sample Description (MIT): Dry strength low, light brown in colour. slow dilatancy, some shine, and smooth. Low plasticity. ML.

Mass of Container (g): 108.01 **Mass of cont. & dry soil (g):** 158.04

Mass of dry soil (g): 50.03 **Relative Density:** 2.70

Start Time (clock time) _____ **Hydrometer Correction:** _____

Elapsed Time (min)	Temp (°C)	Hydrometer R′	Elapsed Time (min)	Temp (°C)	Hydrometer R′
1	23	28	30	22	21
2	22.5	25	60	22	20
4	22	25	120	22	19
8	22	24	240	22	17
15	22	22.5	1440	22	15

Washed Sample:

Mass of Container (g): — **Mass of cont. & dry soil (g):** —

Mass of dry soil (g): 5 g

VALUES FOR EFFECTIVE DEPTH, *L*, FOR TYPE 152H HYDROMETER*

Actual Hydrometer Reading	*L (cm)*	*Actual Hydrometer Reading*	*L (cm)*
0	16.3	31	11.2
1	16.1	32	11.1
2	16.0	33	10.9
3	15.8	34	10.7
4	15.6	35	10.6
5	15.5		
6	15.3	36	10.4
7	15.2	37	10.2
8	15.0	38	10.1
9	14.8	39	9.9
10	14.7	40	9.7
11	14.5	41	9.6
12	14.3	42	9.4
13	14.2	43	9.2
14	14.0	44	9.1
15	13.8	45	8.9
16	13.7	46	8.8
17	13.5	47	8.6
18	13.3	48	8.4
19	13.2	49	8.3
20	13.0	50	8.1
21	12.9	51	7.9
22	12.7	52	7.8
23	12.5	53	7.6
24	12.4	54	7.4
25	12.2	55	7.3
26	12.0	56	7.1
27	11.9	57	7.0
28	11.7	58	6.8
29	11.5	59	6.6
30	11.4	60	6.5

13.3
13.275
13.25
13.225
13.2

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VALUES FOR RELATIVE DENSITY CORRECTION FACTOR, a, FOR TYPE 152H HYDROMETER*

RD	*a*
2.80	0.97
2.75	0.98
2.70	0.99
2.65	1.00
2.60	1.01
2.55	1.02

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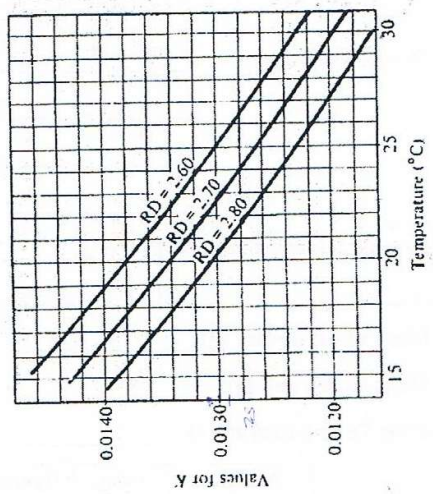
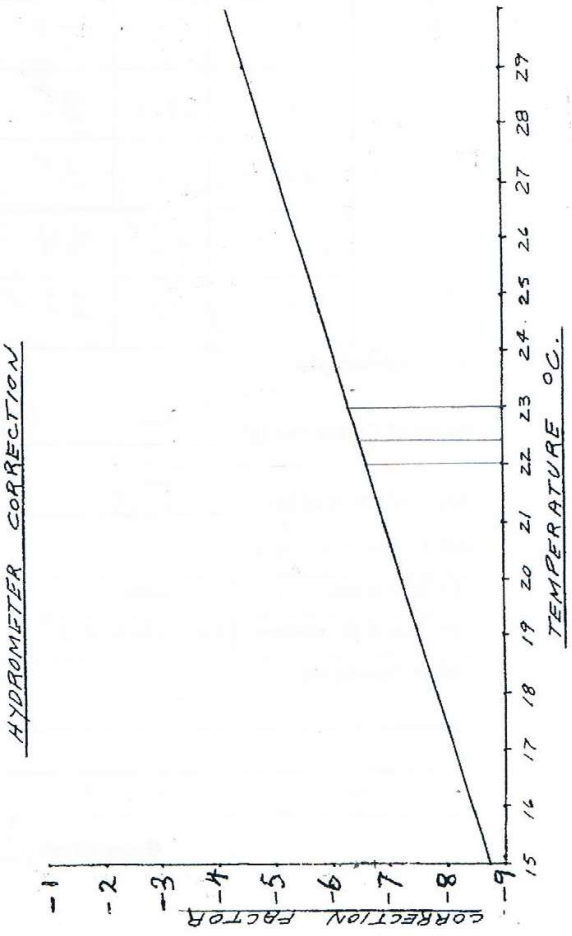




ATTERBERG LIMITS – DATA SHEET

Date: (MM / DD / YYYY)

Members: Youssef Chokr
Talya Khoshaba

Sample Description (MIT): No dilatancy, high plasticity and low dry strength some graininess, no shine. sample soil is MP

Plastic Limit Test:

Trial #	1	2	3	4
Container ID	148	262	151	302
Container mass (g)	4.8 g	5.6 g	4.8 g	5.4 g
Mass of cont. & moist soil	7.5 g	8.3 g	8.9 g	7.9 g
Mass of cont. & dry soil	7.22	8.07	8.07	7.56

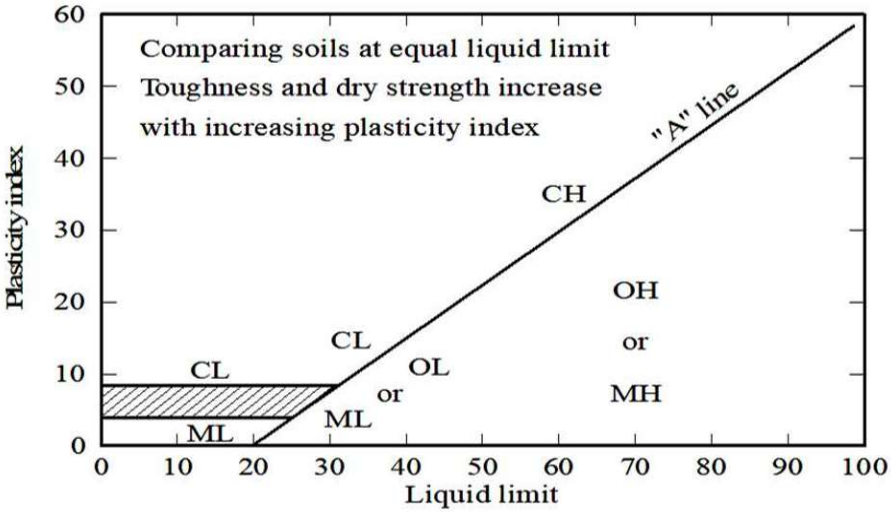
Liquid Limit Test:

Trial #	1	2	3	4
Container ID	184	48	251	76
Container mass (g)	4.3 g	4.8 g	5.7 g	4.4 g
Blow count at closure	6	30	16	47
Mass of cont. & moist soil	12.6 g	17.6 g	15.1 g	15.8 g
Mass of cont. & dry soil	11.35	15.97	13.78	14.36

Table #6: W_D,M_W, and W for Plastic Limit Test

Plastic Limit Test (g)								
	Mass of Cont. & Dry Soil	-	Mass of Cont.	=	W_D			
W_{D1}	7.22	−	4.8	=	2.42			
W_{D2}	8.07	−	5.6	=	2.47			
W_{D3}	8.42	−	4.8	=	3.62			
W_{D4}	7.56	−	5.4	=	2.16			
	Mass of cont. & moist soil	-	Mass of Cont	-	W_D	=	M_W	
M_{W1}	7.5	−	4.8	−	2.42	=	0.28	
M_{W2}	8.3	−	5.6	−	2.47	=	0.23	
M_{W3}	8.9	−	4.8	−	3.62	=	0.48	
M_{W4}	7.9	−	5.4	−	2.16	=	0.34	
(M_W / W_D) x 100 = W								
W_1	0.28	+	2.42	x	100	=	11.57	%
W_2	0.23	+	2.47	x	100	=	9.31	%
W_3	0.48	+	2.62	x	100	=	18.32	%
W_4	0.34	+	2.16	x	100	=	15.74	%
Liquid limit test (g)								
	Mass of Cont. & Dry Soil	-	Mass of Cont.	=	W_D			
W_{D1}	11.35	−	4.3	=	7.05			
W_{D2}	15.97	−	4.8	=	11.17			
W_{D3}	13.78	−	5.7	=	8.08			
W_{D4}	14.36	−	4.4	=	9.96			
	Mass of cont. & moist soil	-	Mass of Cont	-	W_D	=	M_W	
M_{W1}	12.6	−	4.3	−	7.05	=	1.25	
M_{W2}	17.6	−	4.8	−	11.17	=	1.63	
M_{W3}	15.1	−	5.7	−	8.08	=	1.32	
M_{W4}	15.8	−	4.4	−	9.96	=	1.44	
(M_W / W_D) x 100 = W								
W_1	1.25	+	7.05	x	100	=	17.73	%
W_2	1.63	+	11.17	x	100	=	14.59	%
W_3	1.32	+	8.08	x	100	=	16.34	%
W_4	1.44	+	9.96	x	100	=	14.46	%

W_P =	(W1+W2+W3+W4) / 4 =	
	(11.57+9.31+18.32+15.74) / 4 =	13.74%
W_L =	(W1+W2+W3+W4) / 4 =	
	(17.73+14.59+16.34+14.46) / 4 =	15.78%
P_I =	W_L-W_P	
	15.78 - 13.74 =	2.04%



∴ The sample classification for this saple is ML