اللجنة الأكاديمية للهندسة المدنية

تقارير لاب السويل

علي جراروة

Name : ALiwasel Jararweh ID No: 1837542	Geotechnical Engineering Lab	Exp.Title: **Water Content and Specific Gravity**

Data and Results

Table 1

	can#	can wt. (g)	can+wet soil (g)	can+oven dry soil(g)	wc%(near the number to two decimal)
Fine soil	1A	30.94	64.21	56.31	31.1 %
	2A	31.21	60.8	53.82	30.8 %
	3A	30.63	51.16	46.29	31.09 %
				average	30,996 %
Coarse soil	3B	30.95	62.27	58.95	11.4 %
	6B	31.47	76.77	71.99	11.79 %
	12B	30.59	70.85	66.74	11.3 %
				average	11,63 %

Sample of Calculations

$$wc\%_{(1A)} = \frac{64,21 - 56,31}{56,31 - 30,9} * 100 = 31,2\ \%$$

$$wc\%_{\text{average,Fine}} = \frac{30,996\ \% + 11,63\ \%}{2} = 21,313\ \%$$

- Specific Gravity

Hint A mean correction factor

Temperature (T_x°C)	A	Temperature (T_x°C)	A
16	1.0007	24	0.9991
17	1.0006	25	0.9988
18	1.0004	26	0.9986
19	1.0002	27	0.9983
20	1.0000	28	0.9980
21	0.9998	29	0.9977
22	0.9996	30	0.9974
23	0.9993		

Sample of calculation

Mbw= 635.33, Ms= 100 ,Temp=25°c

Mbws= 697.97, correction=

$$GS = \frac{100}{100 + (635.3 - 697.9)} * 0,998$$

GS = 2,81

Why using vacuum pump in our experiment?

used to remove the entrapped air.

CIVIL ENGINEERING

Sieve and Hydrometer Analysis

Student Name: Ali wasel Jararweh

ID#: 1837542

Section: 1

Date: 23/3/2021

Objective:

* Using hydrometer analysis to classify the soil to silt or clay.
* Using sieve analysis to classify the soil into sand and Gravel by sieve
* Using sieve analysis to classify the soil to coarse or fine grain soil by seive ∴ according to the size Particles

Equipment:

* Mechanical sieve analysis
- sieves
- sieve shaker
- Balance

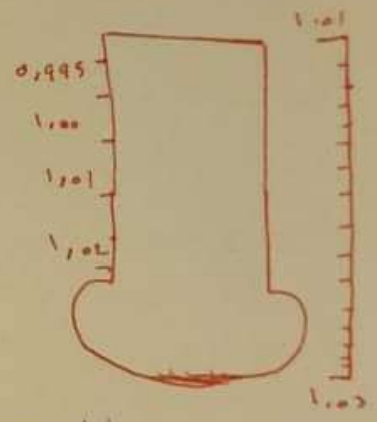
* Hydrometer analysis
- Timer
- $NaPO_3$
- The hydrometer
- Glass tank
- Graded glass
- Thermometer

Draw free sketch for hydrometer device and give me one reading at it is.

$1\ Div = \frac{0.01}{20} = 0.0005$

$1.01 + 7(Div) = 1.01 + 7 * 0.0005$

$= 1.0135$



Procedure:

mechanical sieve analysis (ASTM-421)

hydrometer analysis (ASTM-422)

Sieve analysis:

Sieve No	Sieve Diameter (mm)	Sieve Mass (g)	Sieve Mass + Soil Mass (g)	Retained Soil Mass (g)	Cumulative Retained	%Retained soil	Percentage of Finer Soil Mass %
1	25	551.52	620.41	68,89	68,89	6,899	93,11
(3/4)	19	555.1	558.55	3,45	72,34	7,234	92,766
(1/2)	12.500	543.19	588.59	45,4	117,74	11,77	88,226
(3/8)	9.5000	542.89	545.89	3	120,74	12,074	87,926
# 4	4.7500	511.71	516.35	4,64	125,38	12,538	87,462
# 10	2.00	486.74	637.47	150,73	276,11	27,61	72,389
# 20	.85	420.56	509.55	88,99	365,1	36,51	63,49
# 40	.425	385.96	418.5	32,54	397,64	39,76	60,23
#60	.25	358.08	373.96	15,88	413,52	41,35	58,64
# 100	0.1500	354.72	363.76	9,04	422,56	42,25	57,74
# 200	0.0750	339.66	349.39	9,73	432,29	43,229	56,771
pan		368.81	368.81	0	432,29	43,229	56,77

Elapsed time (min)	Actual Hydrometer reading	Composite correction	R corrected	Temperature (C°)	L (cm)	K	D	%of finer	Actual % of finer
.25	1.02+15 div =1.027	0,001	1,026	26°c	9,05	0,0125	0,0752	94,103	53,37
.5	1.02+14 div =1,027	0,001	1,026	26°c	9,2	0,0125	0,0536	92,518	52,47
1	1.02+12div =1,025	0,001	1,025	26°c	9,4	0,0125	0,0389	89,34	50,67
2	1.02+9 div =1,024	0,001	1,023	26°c	9,85	0,0125	0,0277	84,6	47,97
4	1.02+7div =1,025	0,001	1,022	26°c	10,1	0,0125	0,0198	81,42	46,17
8	1.02+2 div =1,021	0,001	1,02	26°c	10,7	0,0125	0,014	73,5	41,69
15	1.01+19div =1,0195	0,001	1,018	26°c	11,2	0,0125	0,0107	68,74	38,98
20 hours	1.01+5 div =1,0125	0,001	1,011	26°c	13	0,0125	0,0087	46,54	26.39

R_1=1+2 div , R_2=1

Hydrometer analysis

Sample of calculation: - ***** Hydrometer sample *****
@ 8 min

Temp(C°)	G_w
4	1
16	.99897
17	.99880
18	.99862
19	.99844
20	.99823
21	.99802
22	.99780
23	.99757
24	.99733
25	.99708
26	.99682
27	.99655
28	.99627
29	.99598
30	.99568

*actual Hydrometer reading = Div.

= 1,02 + 0,v

= 1,02 + (2 * 0,005)

= 1,021

**Composite Correction @ $R_1 - R_2 = 1 + 2 div - 1$

= 2 div

= 2 * 0,005

= 0,001

c = (W of water + disp) – (Wof water)

*** Hydrometer reading with composite correction applied
= Actual hydraulic – Composite

= 1,021 - 0,001

= 1,02

**** Effective depth of hydrometer L (cm) – from table 7-4 = (151H)

L = 10,7 cm

***** Value of (K) from (table 7.3)

density $G_s = 2,7$

T = 26°

K = 0,01253

****** Diameter of soil particle D (mm) = K*(L/T) ^.5 hint: T is time in minutes

$D = k * \sqrt{\frac{L}{T}} = 0,01253 * \sqrt{\frac{10,7}{8}} = 0,01449\ mm$

******* Soil in Suspension

Note W= 50 g GS = 2.7 G_w =

$$P = \{ ((100,000/W) * GS /(GS - G_w))\} * (Rcor - G_w)$$

P = 73,4%

Actual P = P * 0,5677

= 41,7 %

Actual P = P * (% passing sieve No 200)

Passing = 56 77 From sieve analysis

****** Mechanics Sample ******

@sieve # 100

Weight sieve empty = 354,72

Weight sieve full = 363,76

Weight retained = W full - W empty

= 363,76 − 354,72 = 9,04

% of Retained = $\frac{422,56}{1000} * 100\%$ = 42,256%

Commutative of retained = 413,52 + 9,04 = 422,569

% passing = 100% − % of Retained

= 100% − 42,256%

= 57,744%

Discussion and conclusion

*% Gravel the fetained sieve #4
=12,539 %

**%sand Passed sieve #4 and retained on sieve #200
⇒ 43,229 - 12,539 = 30,691 %

***%silt Passed sieve #200 and retained on D=0,002
56,77 - 36,2 = 20,57 %

****%clay 36,2 % for D=0,002

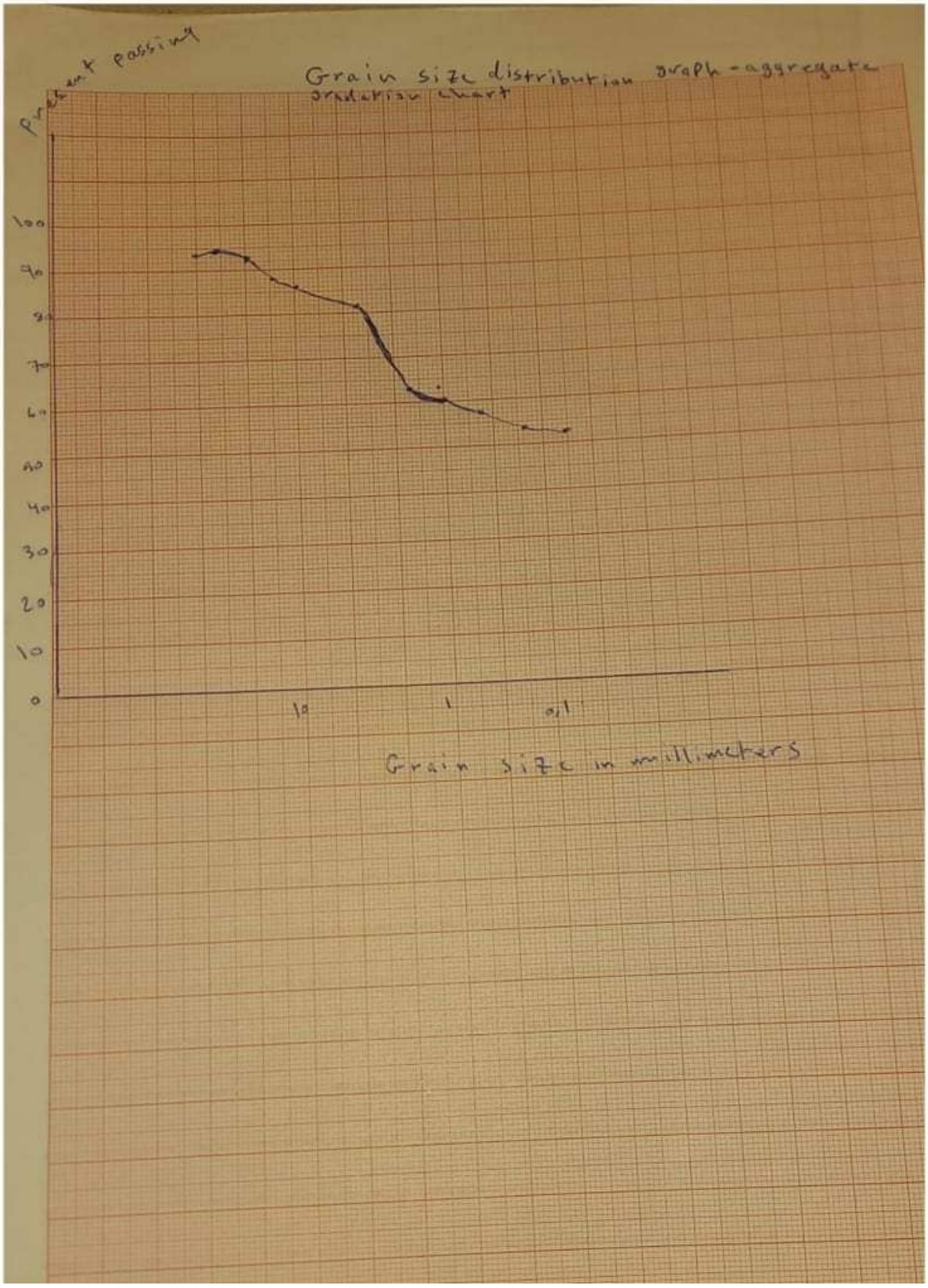
*****D10= can't be determined , D60= 0,5 , D30= can't be determined

******Cc= $\frac{(D_{30})^2}{(D_{10})(D_{60})}$ ⇒ can't be determined

*******Cu= $\frac{D_{60}}{D_{10}}$ ⇒ can't be determined

Plot(%of passing)versus(diameter in(mm))for both sieve and hydrometer analysis on the same figure.

Why using the sodium hexameta phosphate (calgon)?
-to neutralize the negtive charge on the soil particles in fine grained soil to prevent soil lumps



Name : Ali wasel Jawarneh ID No: 1837542	Geotechnical Engineering Lab	Exp.Title: **Liquid and Plastic Limits of a Soil**

Data and Results

PLASTIC LIMIT :

Table 1

Trial #	Can #	Can Wt. (g)	Can+Wet Soil (g)	Can+Dry Soil (g)	W %
1	1a	30.92	33.55	32.93	30,84
2	2a	31.21	33.83	33.21	17
3	3a	30.62	33.92	33.15	30,43
				$W\%_{AVG}$ = 26,09	

Sample of Calculations and Results

$wc\% = \frac{M_w}{M_s} \times 100\% = \frac{(33.55 - 32.93)}{(32.93 - 30.92)} \times 100\% = 30.84\%$

$P.L = Avg(wc\%) = \left(\frac{30.845 + 17 + 30.43}{3}\right) = 26.09\%$

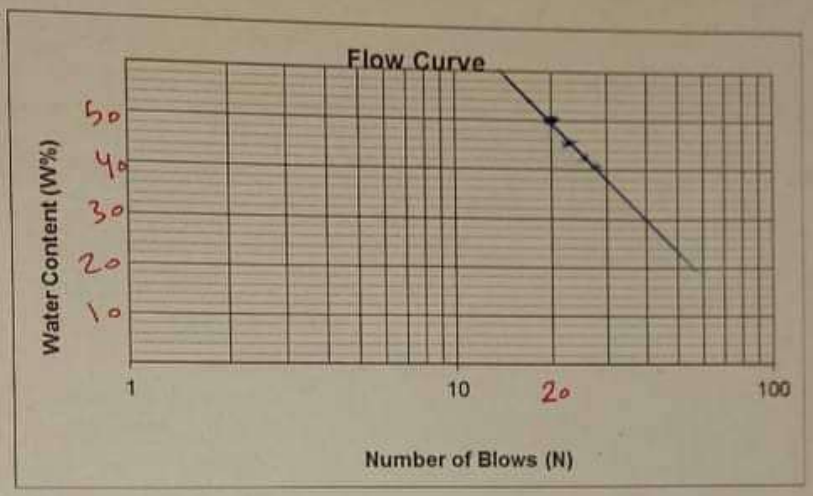
what is the P.L of the soil sample?

LIQUID LIMIT:

Table 2

Trial #	Can #	Can Wt. (g)	Can+Wet Soil (g)	Can+Dry Soil (g)	Blows #	W %
1	5b	30.67	71.97	58.20	20	50,02
2	6b	30.96	58.41	49.80	23	45.7
3	11b	30.59	73.16	60.87	27	40,55
4	12b	31.46	69.17	59.45	33	34.72

$w_c\% = \frac{M_w}{M_s} = \frac{(71,97 - 58,20)}{(58,20 - 30,67)} = 50,02\%$



A) Determine L.L by using multi-point method.

from chart

$N = 25$

$w_{2\%} = 44\%$

B) Determine L.L by using one point method.

$N = 27$

$w_{1\%} = 40,58$

$$\Rightarrow L.L = w_{1\%} * \left(\frac{N}{25}\right)^{0,121}$$

$$= 40,58 * \left(\frac{27}{25}\right)^{0,121} = 40,9$$

CIVIL ENGINEERING

Compaction

Student Name: ALi wasel Jararweh

ID#: 1837542

Section: 1

Date: 13/4/2021

Objective

To determine Maximum density and optimum water content of soil that we obtain from compaction test.

Equipment

- Compaction mold
- mold base
- moisture cans
- Hammer
- Mixing Pan
- oven
- steel wool
- Graduated cylinder

Procedure

According to ASTMD-1557

Dried sample of soil passed through sieve used the Proctor mould (1/30) placed compact soil in layer.

Data and Results

Table 1

Group #	M_m (g)	M_{m+s} (g)	Can #	Can Wt. (g)	Can+Wet Soil (g)	Can+Oven Dry Soil (g)
1	3282	4773	A1	30.84	172.05	150.85
2	3287	4905	12B	30.72	130.90	113.24
3	3311	5087	5A	31.22	137.00	114.94
4	3322	5045	B9	30.99	182.00	146.25

Table 2

Group #	W %	ρ_{wet} (g/cm^3)	ρ_{Dry} (g/cm^3)
1	17.6	1,57	1,53
2	21,3	1,71	1,40
3	26,3	1,84	1,48
4	31	1,82	1,38

Table3: Zero-air voids curve Determination

Group #	W % Assume >omc	ρ_{Dry} (g/cm^3)
1	32	1,448
2	33	1,427
3	34	1,407
4	35	1,388

Sample of calculations

#1 Hint: volume =944cm^3
GS=2.7

$$wc\% = \frac{Mw}{Ms} * 100\% = \frac{172,05 - 150,89}{150,85 - 30,84} = 17,6\ \%$$

$$\rho_{wet} = \frac{w_2 - w_1}{V} = \frac{4773 - 3258}{944} = 1,57\ g/cm^2$$

$$\rho_{dry} = \frac{\rho_{wet}}{1 + wc\%} = \frac{1,57}{(1 + 17,6\%)} = 1,33$$

table 3

Assumtne = 32%

$$\rho_{dry} = \frac{Pw\ G.S}{Grs\ *(w*1)} = \frac{1*2,7}{1+(2,7*0,32)} = 1,448\ g/cm^3$$

Plot dry density (ρ_{Dry})versus moisture content%(W %) and in the same figure plot the zero air voids curve.

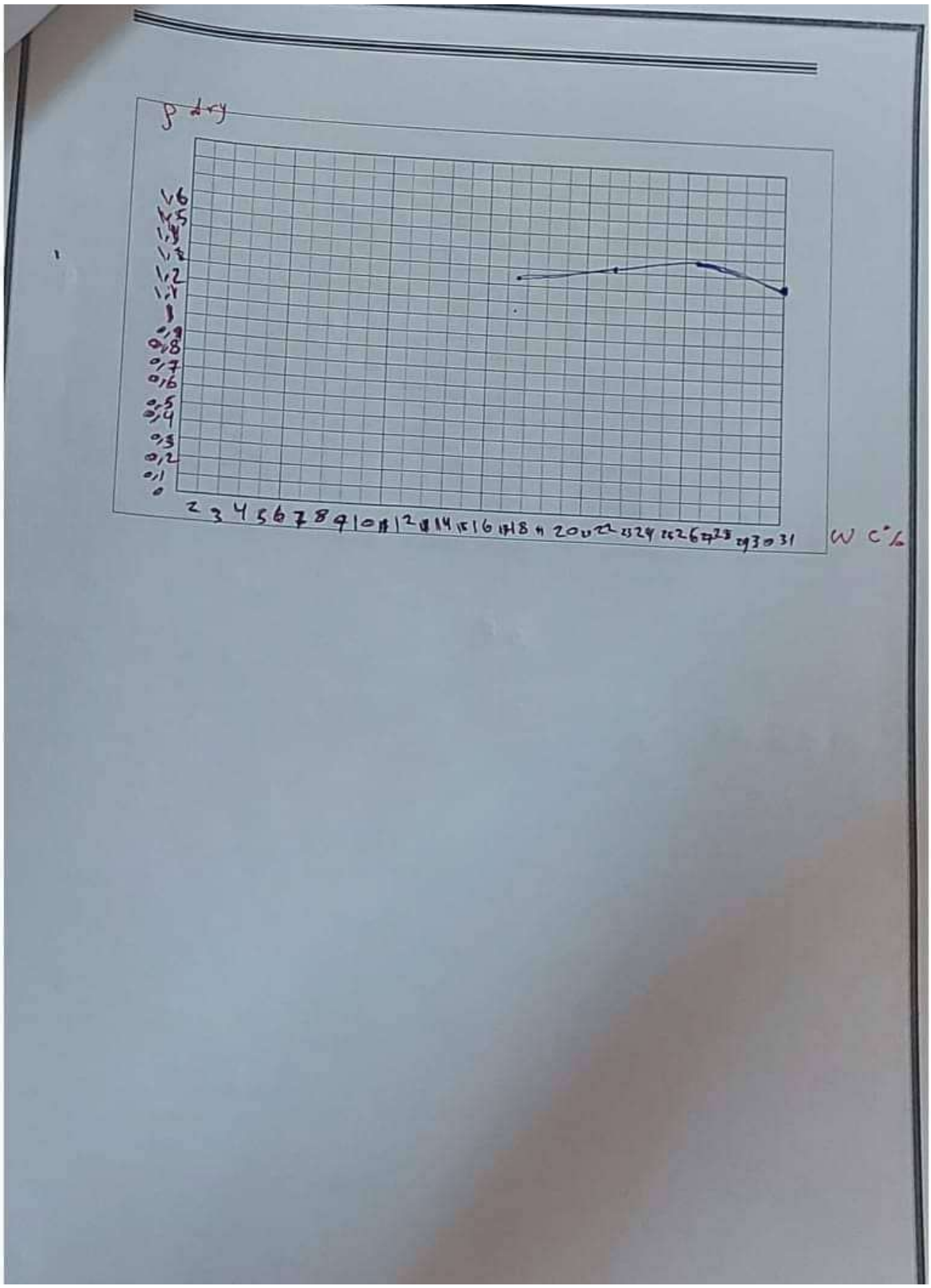
Conclusion and Discussion

Owc = 26,5

ρ_{Dry}maximum = 1,48

Why the value of dry density will be increase up to the maximum then it will be decrease?

As water content increase, the particales develop larger water film around them which tend to make the particle easier to move and reoriented into a tenser confit



Name : Ali wadeL Karamleh ID No: 1837542	Geotechnical Engineering Lab	Exp Title Field Density Test

Data and Results

Table 1

density=	1.37
weight of(bottle+cone+sand)before=	7498
weight of(bottle+cone+sand)after=	4066
weight of sand in cone=	1440g
weight of tray=	235
weight of tray+ wet soil=	2544
weight of tray oven+ dry soil=	2308
Dry density in lab from compaction test	1.49

Sample of Calculations and Results

Volume= $\frac{(7498-4066-1440)}{(1.37)} = 1454.01$ cm³

wc%= $\frac{(2309-2073)}{(2073)} * 100\% = 11.38\%$

Total density= $\frac{(2309)}{(1454.01)} = 1.588$ g/cm²

Dry density= $\frac{(1.588)}{(1+0.1138)} = 14257$

RC= $\frac{1.4257}{1.49} * 100\% = 95.68\%$

Name : Ali wasel Jararweh ID No: 1837542	Geotechnical Engineering Lab	Exp.Title: Permeability

Data and Results

D= 7 cm Temp. = 23°c ρ_w=0,997578/cm3 A (cm^2)= 38.4846

L= 7 cm

Group #	H_1 (cm)	H_2 (cm)	Mass of water (g)	Time (sec)	Mass/ρ_w Q (cm^3)	H_2-H_1 ΔH h (cm)	(QL)/(AHt) K (cm/sec)
1	31.9	58	713	30	714,73	26,1	0,16603
2	31.9	58	1182	45	1184,87	26,1	0,18349
3	31.9	58	1587	60	1590,86	26,1	0,18477

Sample of Calculations and Results

$$K=\frac{Q*L}{A*H*T}=\frac{714,73*7}{38,4846*26,1*30}=0,16603$$

$$Kavg=\frac{(K_1+K_2+K_3)}{3}=\frac{0,16603+0,18349+0,18477}{3}$$

Kavg = 0,17809

k@20c= Kavg * Correction

= 0,17809 * 1

K@20c = 0,17809

Temp(C°)	ρ_w
4	1
16	.99897
17	.99880
18	.99862
19	.99844
20	.99823
21	.99802
22	.99780
23	.99757
24	.99733
25	.99708
26	.99682
27	.99655
28	.99627
29	.99598
30	.99568

Temp(C°)	Correction factor
15	1.135
16	1.106
17	1.077
18	1.051
19	1.025
20	1
21	.976
22	.953
23	.931
24	.91
25	.889
26	.869
27	.85
28	.832
29	.814
30	.797

CIVIL ENGINEERING

Consolidation

Student Name: ALi Wasel Jararweh

ID#: 1837542

Section: 1

Date: 29/4/2021

Hint: all report must be print out and solve it manually not accepted word or exel sheet.

Hint: nearest to two decimal any number in the report

Objective

- Determine the coefficient of Permeability :

1. Voids ratio (e) compression index (Cc) , Recompression index (Cr) Pressure (σ'), coefficient of Permeability (k)
2. determine the coefficient of consolidation and O.C.R

3. Permeability by row method, (Casagrande, Taslum)

Equipment

1 - Loads 2 - Stop watch 3 - balance

4 - can 5 - Consolidation test apparatus odometer test

Procedure

Consolidation test ASTM P - 2435

Sample of calculation

$Hs=Ms/(Gs*A*\rho_w)$	$e_0=(H_t-H_s)/H_s$	$Stress_{(MPa)}=P/A$
$Hs=\frac{140}{2,7*38,467*1}$ $=13,5\ mm$	$e_o=\frac{20-13,5}{13,5}$ $=0,481$	$stress_{(MPa)}=\frac{50*9,81}{0,003847}$ $=0,128\ MPa$

$Hf=H_t$.deformation	$Hv=H_f-H_s$	$e=H_v/H_s$
$Hf=20-(0,41*59)$ $=19,42\ mm$	$Hv=(19,42-13,5)$ $=5,92\ mm$	$e=\frac{5,92}{13,5}$ $=0,438$

g Gs=2.70 H= 2cm
D=7cm

38.465 cm^2
0.003847 m^2

*.01)=Deformation in (mm)

Time min	Time sec	Dial Reading Div	Time (min)	Time$^{0.5}$ (min$^{0.5}$)	Deformation (mm)	Hf	Hv	e
0	8	58	0.13	0.37	0,58	19,42	5,458	0,39
0	15	64	0.25	0.50	0,64	19,36	5,398	0,39
0	30	69	0.5	0.71	0,69	19,31	5,348	0,38
1	0	75.5	1	1.00	0,75	19,24	5,283	0,38
2	0	80	2	1.41	0,8	19,2	5,238	0,38
4	0	85.5	4	2.00	0,85	19,14	5,183	0,37
8	0	90.75	8	2.83	0,907	19,09	5,1307	0,37
16	0	95	16	4.00	0,95	19,05	5,088	0,36
30	0	99	30	5.48	0,99	19,01	5,048	0,36
0	0	102	60	7.75	1,02	18,98	5,018	0,36
0	0	104	120	10.95	1,04	18,96	4,998	0,36
0	0	106	240	15.49	1,06	18,94	4,978	0,36
0	0	107	480	21.91	1,07	18,93	4,678	0,36
0	0	108	1440	37.95	1,08	18,92	4,958	0,36

Time min	Time sec	Dial Reading Div	Time (min)	Time$^{0.5}$ (min$^{0.5}$)	Deformation (mm)	Hf	Hv	e
0	8	115	0.13	0.37	1,15	18,85	4,888	0,35
0	15	117	0.25	0.50	1,17	18,83	4,868	0,35
0	30	120	0.5	0.71	1,2	18,8	4,838	0,35
1	0	123	1	1.00	1,23	18,77	4,808	0,34
2	0	127	2	1.41	1,27	18,73	4,768	0,34
4	0	131	4	2.00	1,31	18,69	4,728	0,34
8	0	135.5	8	2.83	1,355	18,645	4,683	0,34
16	0	140	16	4.00	1,4	18,6	4,638	0,32
30	0	144	30	5.48	1,44	18,56	4,598	0,33
0	0	148.5	60	7.75	1,485	18,51	4,553	0,33
0	0	152	120	10.95	1,52	18,48	4,518	0,32

0	0	155	240	15.49	1,55	18,45	4,488	0,32
0	0	158	480	21.91	1,58	18,42	4,458	0,32
0	0	161	1440	37.95	1,61	18,39	4,428	0,32

Time min	Time sec	Dial Reading Div	Time (min)	Time$^{0.5}$ (min$^{0.5}$)	Deformation (mm)	Hf	Hv	e
0	8	170	0.13	0.37	1,7	18,3	4,338	0,31
0	15	175	0.25	0.50	1,75	18,25	4,298	0,31
0	30	179	0.5	0.71	1,79	18,21	4,248	0,3
1	0	183	1	1.00	1,83	18,17	4,208	0,3
2	0	187.5	2	1.41	1,875	18,125	4,163	0,3
4	0	192.5	4	2.00	1,925	18,075	4,113	0,29
8	0	199	8	2.83	1,99	18,01	4,048	0,29
16	0	206.5	16	4.00	2,065	17,935	3,888	0,28
30	0	215	30	5.48	2,15	17,85	3,788	0,28
0	0	225	60	7.75	2,25	17,75	3,703	0,27
0	0	233.5	120	10.95	2,335	17,665	3,648	0,27
0	0	239	240	15.49	2,39	17,61	3,648	0,26
0	0	241.5	480	21.91	2,415	17,585	3,623	0,26
14	0	243	1334	36.52	2,43	17,57	3,608	0,26

Time min	Time sec	Dial Reading Div	Time (min)	Time$^{0.5}$ (min$^{0.5}$)	Deformation (mm)	Hf	Hv	e
0	8	250	0.13	0.37	2,5	17,5	3,538	0,25
0	15	253	0.25	0.50	2,53	17,47	3,508	0,25
0	30	255	0.5	0.71	2,55	17,45	3,488	0,25
1	0	258	1	1.00	2,58	17,42	3,458	0,25
2	0	261.5	2	1.41	2,615	17,385	3,423	0,25
4	0	265.5	4	2.00	2,655	17,345	3,383	0,24
8	0	270.5	8	2.83	2,705	17,295	3,333	0,24
16	0	276.5	16	4.00	2,765	17,235	3,273	0,23
30	0	285	30	5.48	2,85	17,15	3,188	0,23
0	0	296	60	7.75	2,96	17,04	3,078	0,22
0	0	310	120	10.95	3,1	16,9	2,938	0,21
0	0	319	240	15.49	3,19	16,81	2,848	0,2
0	0	327	480	21.91	3,27	16,73	2,768	0,2

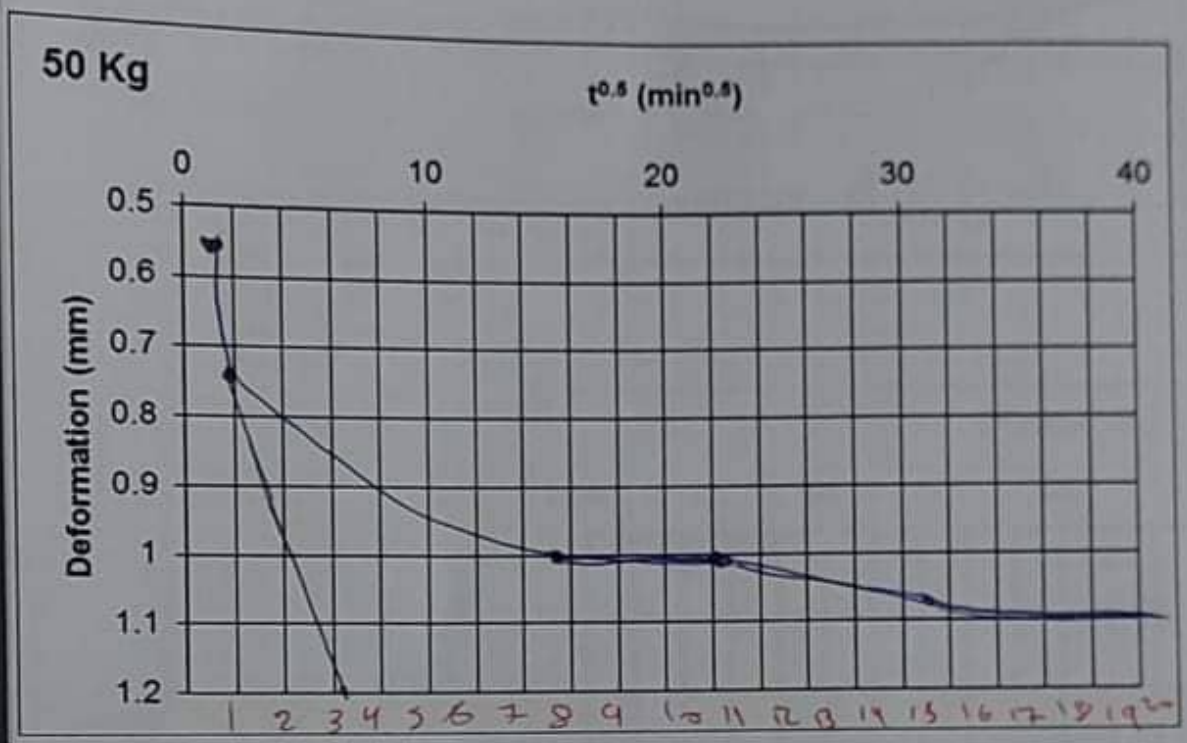
30	0	331	1410	37.55	3,31	16,69	2,729	0,2

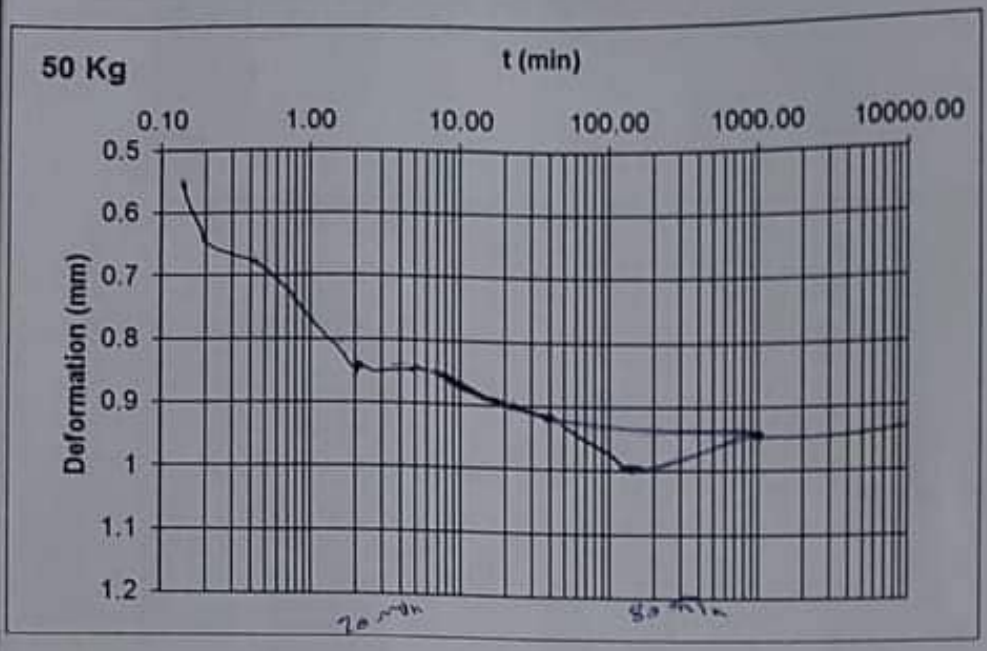
Time min	Time sec	Dial Reading Div	Time (min)	Time$^{0.5}$ (min$^{0.5}$)	Deformation (mm)	Hf	Hv	e
0	8	341	0.13	0.37	3,41	16,59	2,628	0,19
0	15	344	0.25	0.50	3,44	16,56	2,598	0,19
0	30	347	0.5	0.71	3,47	16,53	2,568	0,18
1	0	351	1	1.00	3,51	16,49	2,529	0,18
2	0	357	2	1.41	3,57	16,43	2,468	0,18
4	0	363	4	2.00	3,63	16,37	2,408	0,17
8	0	370	8	2.83	3,7	16,3	2,338	0,17
16	0	380	16	4.00	3,8	16,2	2,239	0,16
30	0	390	30	5.48	3,9	16,1	2,138	0,15
0	0	403	60	7.75	4,03	15,97	2,008	0,14
0	0	412	120	10.95	4,12	15,88	1,918	0,14
0	0	418	240	15.49	4,18	15,82	1,858	0,13
0	0	420	480	21.91	4,2	15,8	1,838	0,13
0	0	422	1440	37.95	4,22	15,78	1,818	0,13

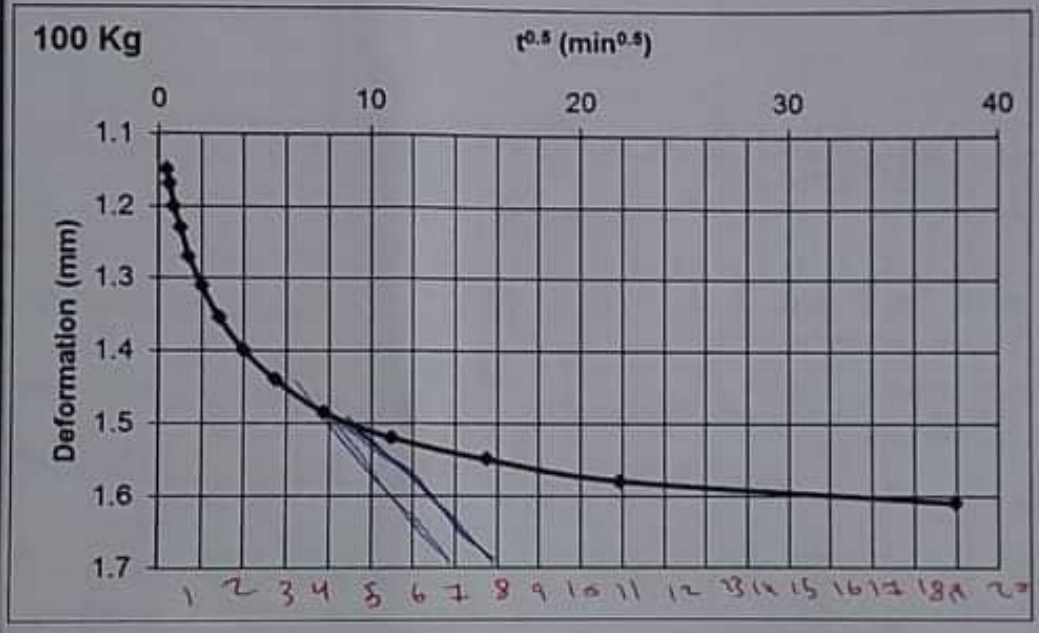
d / a	Final Height H_F (mm)	Height of voids (mm)	Final voids ratio	Avg. Height (mm)	Fitting Time (Min) t_{90}	Fitting Time (Min) t_{50}	Cv (mm^2/min) from t_{90}	Cv (mm^2/min) from t_{50}
	18,92	4,96	0,136	19,46	1	2	8 0,28	9,32
5	18,34	4,43	0,32	18,65	2	8	40,93	2,14
51	17,57	3,61	0,26	17,98	2	10	34,27	1,59
7	16,69	2,73	0,2	17,14	1,7	44	40,81	0,33
3	15,78	1,82	0,13	16,25	1	20	55,84	0,65

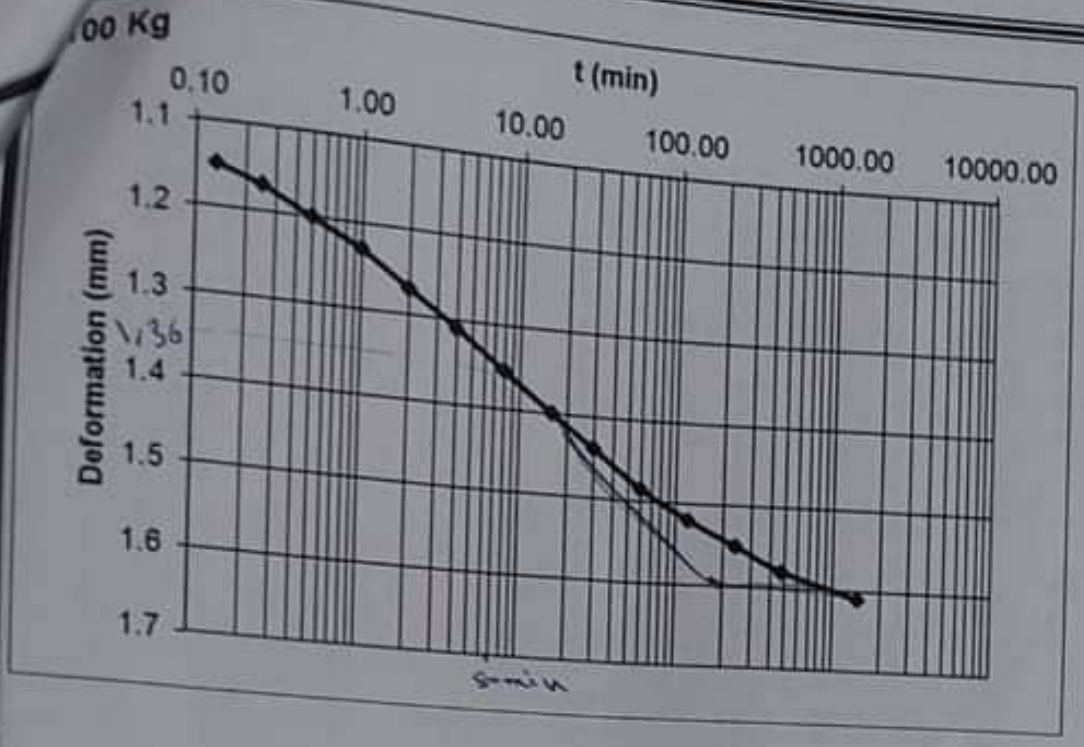
Cv average=

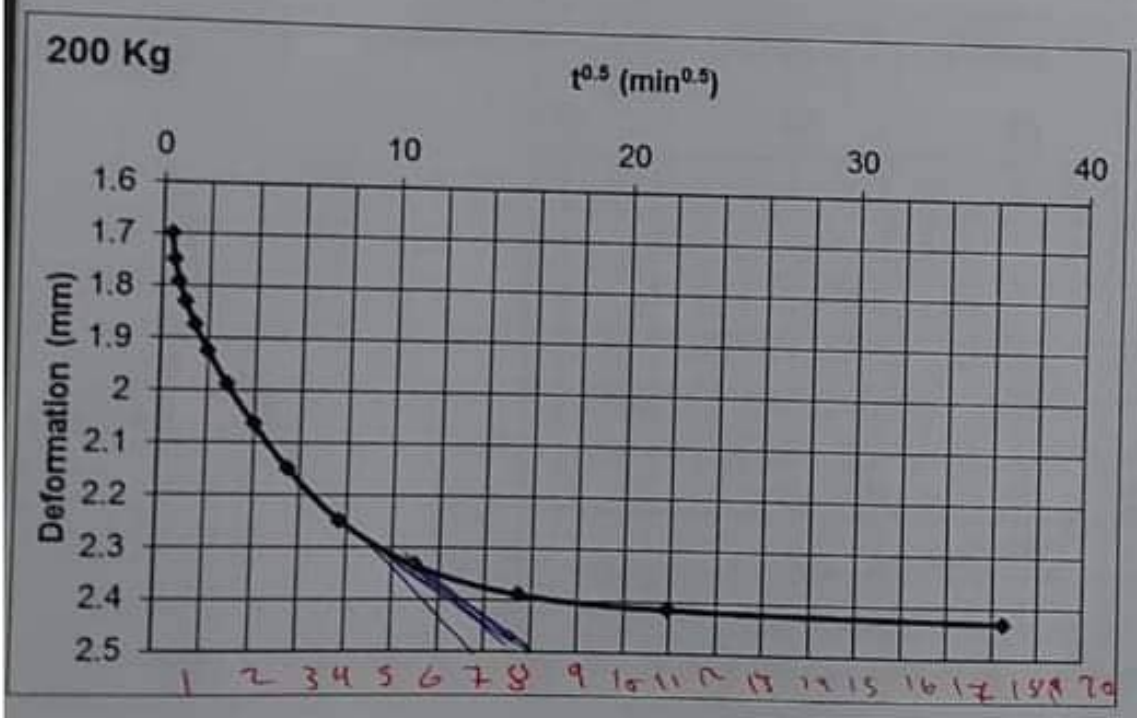
Hint: the figures shown must be very clear points, how works on it, and show me in details how t
compute CV.

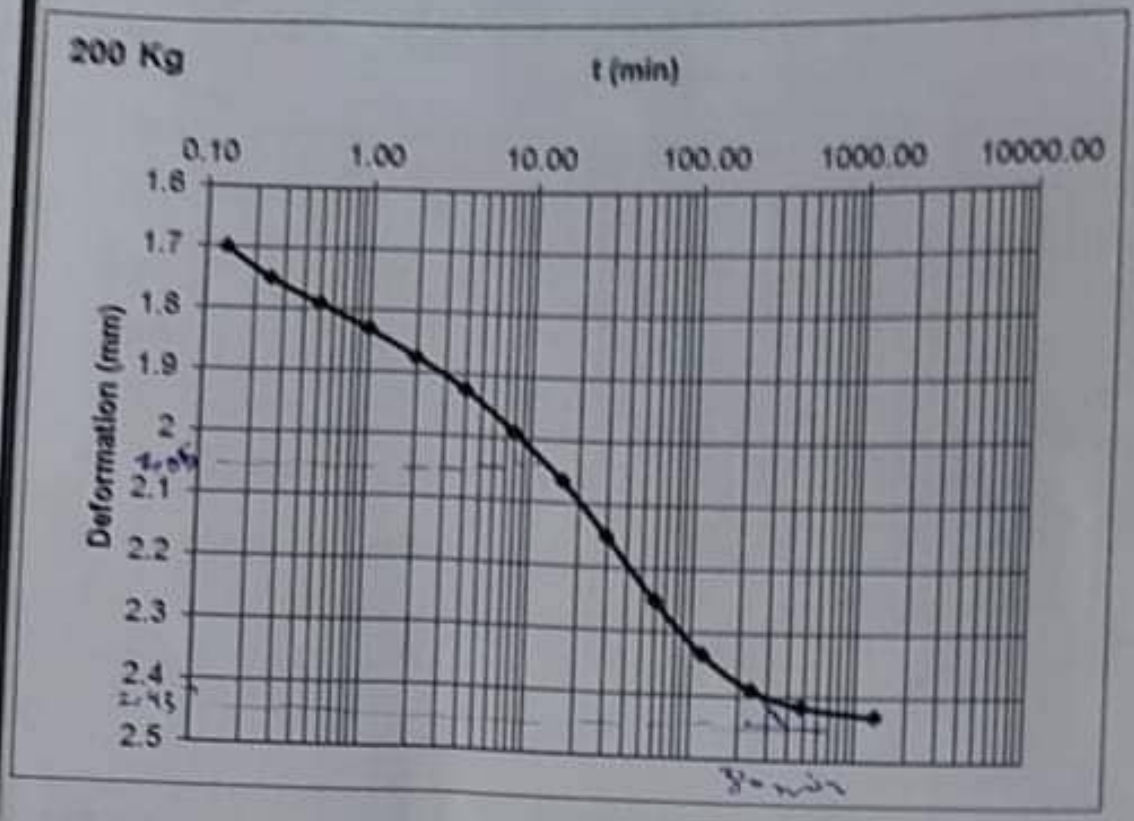


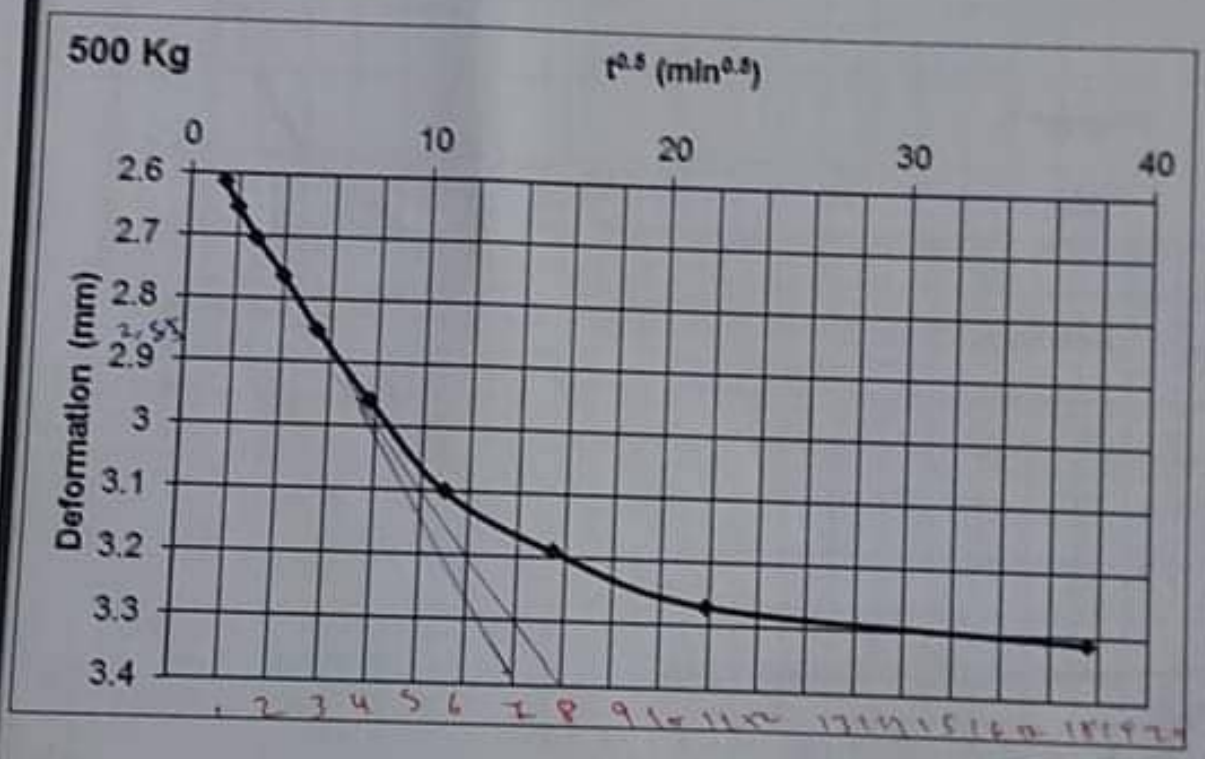


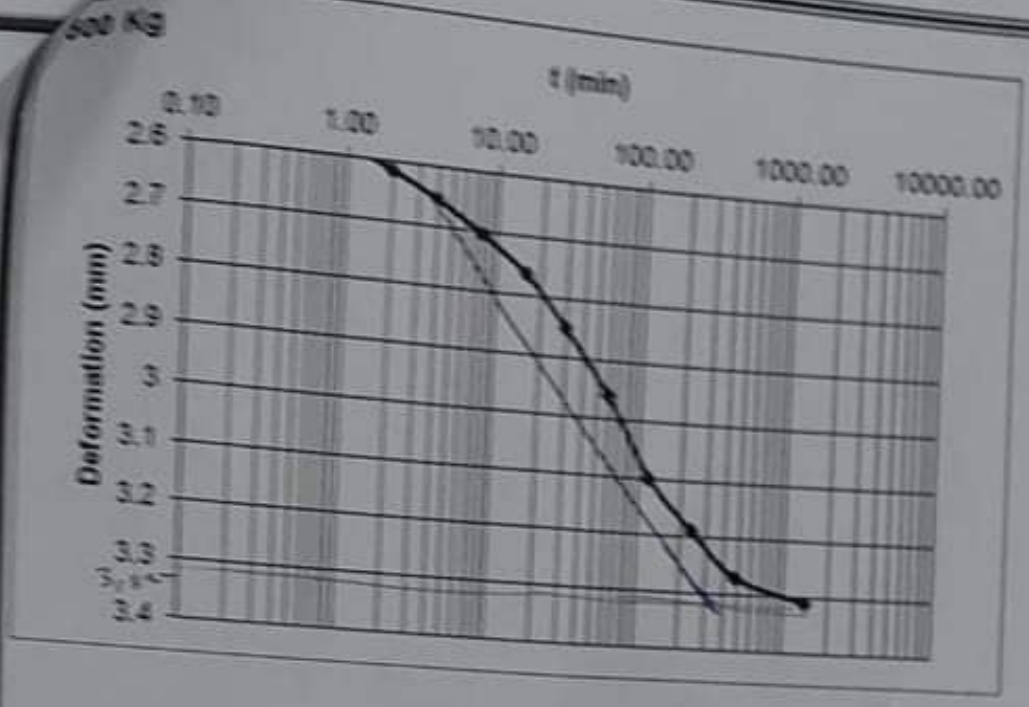


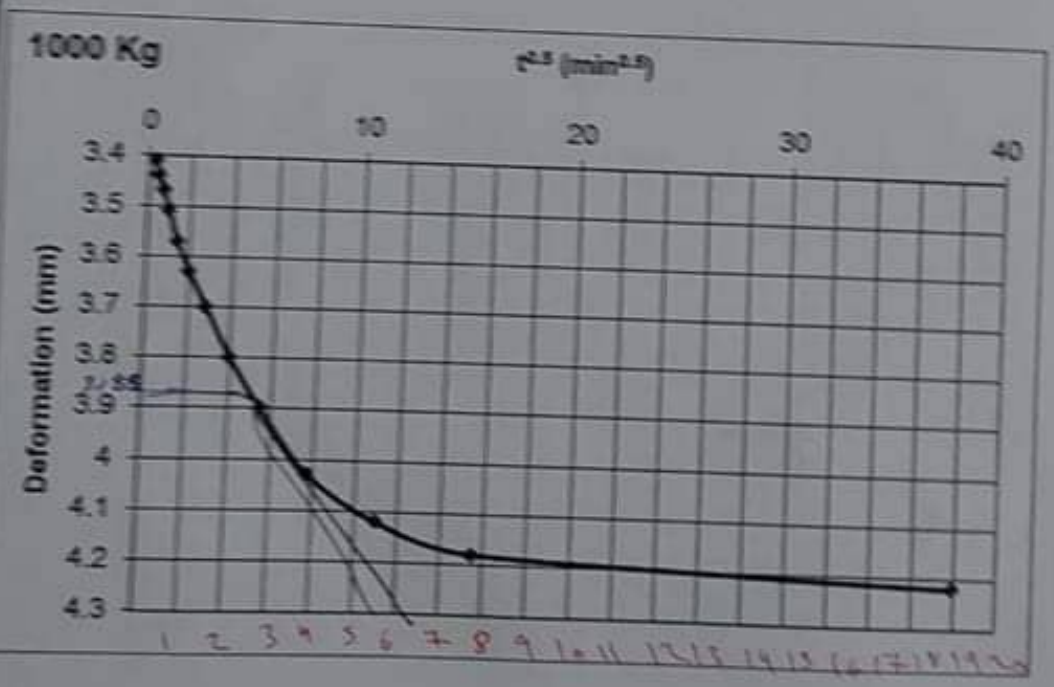


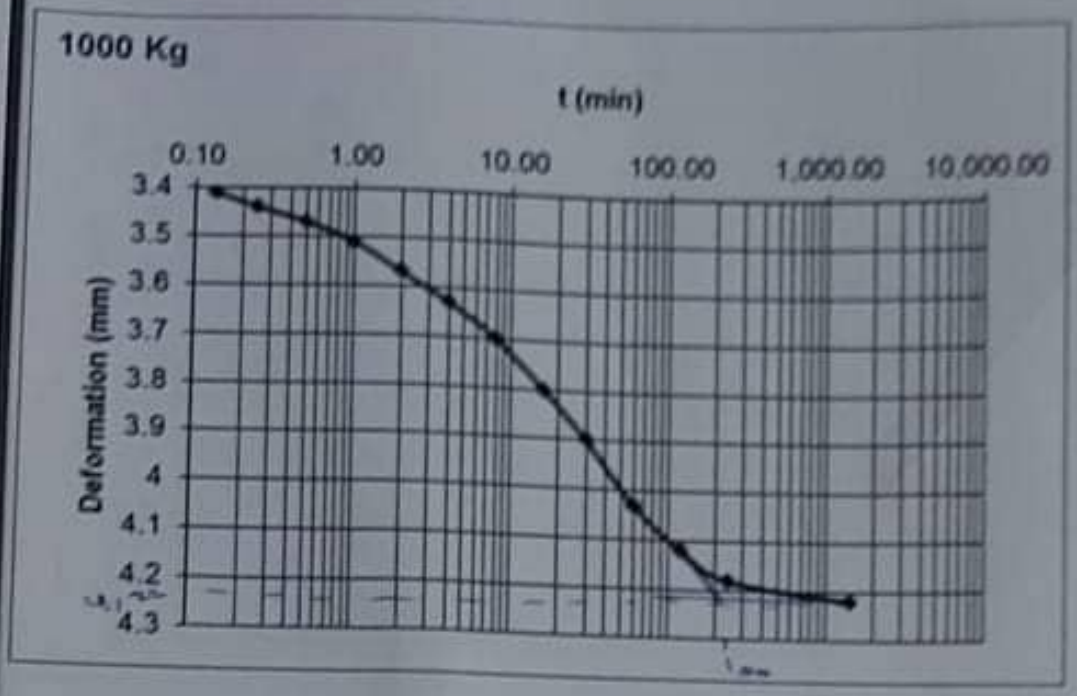




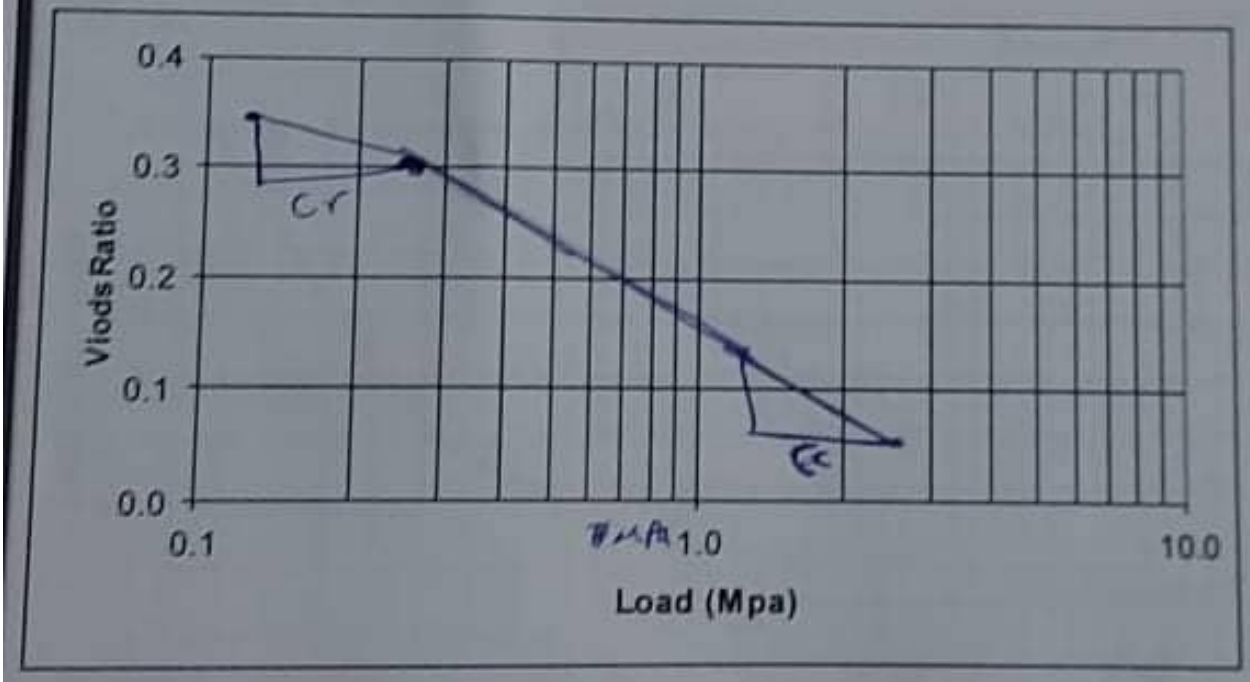








Compute the value of CC, Cr, and maximum past pressure value in clear steps.



$Cc = \frac{\Delta e}{\log\left(\frac{\sigma_2}{\sigma_1}\right)} = 0.17$

$Cc = \frac{\Delta e}{\log\left(\frac{\sigma_2}{\sigma_1}\right)} = 0,27$

Name: Ali Wasel Javaweh ID#: 1837542	Geotechnical Engineering Lab	Unconfined Compression Test &Triaxial Compression Test(UU)

Hint: D=38mm, H=2D=76mm, A0 =1134.115mm², 1 Div. = 0.01 mm

LOAD(KN)=DIV*.01*.5364

1. Fill the table below for unconfined compression test

Table 1.1

ΔL (div.)	ΔP (div.)	Div*0.01 ΔL (mm)	Div*0.01 ΔP (mm)	Table ΔP (KN)	ΔL/L ε *10⁻³	$A_0/(1-\varepsilon)$ Ac (mm²)	σ (kpa)
10	24	0,1	0,24	0,13	1,316	1135,6	114,5
20	29	0,2	0,29	0,16	2,603	1137,1	140,71
30	35	0,3	0,35	0,19	2,95	1138,6	166,87

2. Sample of calculation

Strain $\varepsilon = \frac{\Delta L}{L} = \frac{0,2}{76} = 2,63 * 10^{-3}$

Area corrected

$A_1 = \frac{A_0}{1-\varepsilon} = \frac{0,01341 * 10^{-3}}{1-3,15 * 10^{-3}}$

$= 1138,6 \ mm^2$

Figure 1.stress vs. strain

Stress

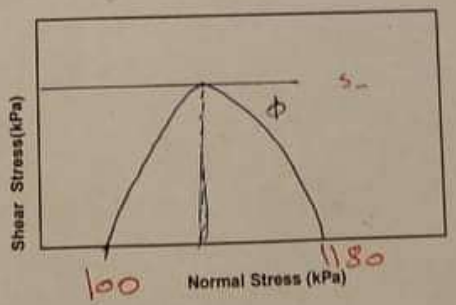
3. From the figure 1.

-Determine deviator stress. deviator stress = 1180 KPA

4. Draw figure 2. Mohr's circle

- Determine σ_1, and Su, $\sigma_{3=100}$.

$\sigma_1 = 1180$ kPA



CIVIL ENGINEERING

Direct Shear

Student Name: ALi wasel Jararweh

ID#: 1837542

Section: 1

Date: 11/5/2021

Objective

1. Determine the shear strength Parameters (ϕ, c) of soil
2. Determine I. f I residual

Equipment

1. loads
2. Pan filled with soil
3. trowel
4. dialgage
5. Mold
6. Balance
7. Callibers
8. Direct Shear device

Procedure

According to ASTMD-3080

Hint: nearest all number to two decimel

load=DIV*.001*2200 N

l=6 cm
w=6 cm

Table (1): load=20 kg

H	V	T	H(.01)mm	V.01mm	T.001mm	T(N)	AC(mm)	τ(Kpa)
10	-3	1	0,1	-0,03	0,001	2,2	3600	0,61
20	-4	10	0,2	-0,04	0,01	22	3600	6,11
30	-5	19	0,3	-0,05	0,019	41,8	3600	11,61
40	-5	26	0,4	-0,05	0,026	57,2	3600	15,89
50	-4	34	0,5	-0,04	0,034	74,8	3600	20,78
60	-4	39	0,6	-0,04	0,039	85,8	3600	23,83
70	-3	45	0,7	-0,03	0,045	99	3600	27,50
80	-3	49	0,8	-0,03	0,049	107,8	3600	29,94
90	-2	54	0,9	-0,02	0,054	118,8	3600	33,00
100	-1	59	1	-0,01	0,059	129,8	3600	36,06
120	1	65	1,2	-0,01	0,065	143	3600	39,72
140	4	70	1,4	0,04	0,07	154	3600	42,78
160	8	75	1,6	0,08	0,075	165	3600	45,83
180	13	79	1,8	0,13	0,079	173,2	3600	48,28
200	18	81	2	0,18	0,081	187	3600	49,39
220	23	85	2,2	0,23	0,085	189,2	3600	51,94
240	27	86	2,4	0,27	0,086	193,4	3600	52,56
260	32	88	2,6	0,32	0,088	198	3600	53,61
270	35	90	2,8	0,35	0,09	200,2	3600	54,22
300	40	91	3	0,4	0,091	207,4	3600	56,83
320	43	92	3,2	0,43	0,092	204,6	3600	57,44
340	47	93	2,4	0,47	0,093	206,8	3600	57,44
360	50	94	3,6	0,5	0,094	206,8	3600	57,44
380	53	94	3,8	0,53	0,094	206,8	3600	57,44
400	56	94	4	0,56	0,094	206,8	3600	57,44
450	63	94	4,5	0,63	0,094	206,8	3600	57,44
500	69	94	5	0,69	0,094	206,8	3600	57,44
550	73	94	5,5	0,73	0,094	206,8	3600	57,44
600	78	94	6	0,78	0,094	206,8	3600	57,44
650	80	94	6,5	0,8	0,094	206,8	3600	57,44
700	81	94	7	0,83	0,094	206,8	3600	57,44
750	83	94	7,5	0,86	0,094	206,8	3600	57,44
800	86	94	8	0,87	0,094	206,8	3600	57,44
850	87	94	8,5	0,89	0,094	206,8	3600	57,44
900	89	94	9	0,89	0,094	206,8	3600	57,44
950	89	94	9,5	0,89	0,094	206,8	3600	57,44
1000	89	94	10	0,89	0,094	206,8	3600	57,44
1050	89	94	10,11	0,89	0,094	206,8	3600	57,44
1100	89	94	11	0,89	0,094	206,8	3600	57,44

m
cm

Table (1): load=20 kg

	V	T	H(.01)mm	V.01mm	T.001mm	T(N)	AC(mm)	τ(Kpa)
10	-3	1	0,1	-0,03	0,001	2,2	3600	0,61
20	-4	10	0,2	-0,04	0,01	22	3600	6,11
30	-5	19	0,3	-0,05	0,019	41,8	3600	11,61
40	-5	26	0,4	-0,05	0,026	57,2	3600	15,89
50	-4	34	0,5	-0,04	0,034	74,8	3600	20,78
60	-4	39	0,6	-0,04	0,039	85,8	3600	23,83
70	-3	45	0,7	-0,03	0,045	99	3600	27,50
80	-3	49	0,8	-0,03	0,049	107,8	3600	29,94
90	-2	54	0,9	-0,02	0,054	118,8	3600	33,00
00	-1	59	1	-0,01	0,059	129,8	3600	36,06
20	1	65	1,2	-0,01	0,065	143	3600	39,72
40	4	70	1,4	0,04	0,07	154	3600	42,78
60	8	75	1,6	0,08	0,075	165	3600	45,83
80	13	79	1,8	0,13	0,079	173,2	3600	48,28
00	18	81	2	0,18	0,081	187	3600	49,50
20	23	85	2,2	0,23	0,085	189,2	3600	51,94
40	27	86	2,4	0,27	0,086	193,4	3600	52,56
60	32	88	2,6	0,32	0,088	198	3600	53,61
80	35	90	2,8	0,35	0,09	200,2	3600	54,22
00	40	91	3	0,4	0,091	202,4	3600	54,83
20	43	92	3,2	0,43	0,092	204,6	3600	55,44
40	47	93	3,4	0,47	0,093	206,8	3600	57,44
60	50	94	3,6	0,5	0,094	206,8	3600	57,44
80	53	94	3,8	0,53	0,094	206,8	3600	57,44
00	56	94	4	0,56	0,094	206,8	3600	57,44
20	63	94	4,5	0,63	0,094	206,8	3600	57,44
40	69	94	5	0,69	0,094	206,8	3600	57,44
60	73	94	5,5	0,73	0,094	206,8	3600	57,44
80	78	94	6	0,78	0,094	206,8	3600	57,44
00	80	94	6,5	0,8	0,094	206,8	3600	57,44
20	81	94	7	0,83	0,094	206,8	3600	57,44
40	83	94	7,5	0,86	0,094	206,8	3600	57,44
60	86	94	8	0,87	0,094	206,8	3600	57,44
80	87	94	8,5	0,89	0,094	206,8	3600	57,44
00	89	94	9	0,89	0,094	206,8	3600	57,44
20	89	94	9,5	0,89	0,094	206,8	3600	57,44
40	89	94	10	0,89	0,094	206,8	3600	57,44
60	89	94	10,11	0,89	0,094	206,8	3600	57,44
80	89	94	11	0,89	0,094	206,8	3600	57,44

1150	89	94	11,5	0,89	0,014	206,8	3600	57,44
1200	89	94	12	0,89	0,014	206,8	3600	57,44

Table (2): load=40 kg

H	V	T	H(.01)mm	V.01mm	T.001mm	T(N)	AC(mm)	r(Kpa)
10	-8	2	0,1	-0,08	0,002	41	3600	1,27
20	-10	7	0,2	-0,1	0,007	15,4	3600	4,26
30	-10	42	0,3	-0,1	0,042	92,4	3600	25,67
40	-11	52	0,4	-0,11	0,052	114,4	3600	31,78
50	-10	64	0,5	-0,1	0,0564	124,08	3600	34,11
60	-10	73	0,6	-0,1	0,073	160,6	3600	44,61
70	-9	82	0,7	-0,09	0,082	180,4	3600	50,11
80	-8	87	0,8	-0,08	0,097	191,4	3600	53,17
90	-6	92	0,9	-0,06	0,092	202,4	3600	56,22
100	-5	97	1	-0,05	0,097	213,4	3600	59,28
120	-1	104	1,2	-0,01	0,104	228,8	3600	63,56
140	3	112	1,4	0,03	0,114	246,4	3600	68,44
160	6	119	1,6	0,06	0,126	261,8	3600	72,72
180	12	126	1,8	0,12	0,131	277,2	3600	77
200	16	131	2	0,16	0,135	288,2	3600	80,06
220	20	135	2,2	0,2	0,139	297	3600	8215
240	25	139	2,4	0,25	0,141	305,8	3600	84,94
260	31	141	2,6	0,31	0,141	310,2	3600	86,17
270	34	141	2,8	0,34	0,141	310,2	3600	86,17
300	37	141	3	0,37	0,144	316,8	3600	88
320	41	144	3,2	0,41	0,144	316,8	3600	88
340	44	144	3,4	0,44	0,144	316,8	3600	88
360	48	144	3,6	0,48	0,144	316,8	3600	88
380	51	144	3,8	0,51	0,144	316,8	3600	88
400	54	144	4	0,54	0,144	316,8	3600	88
450	61	144	4,5	0,61	0,144	316,8	3600	88
500	66	144	5	0,66	0,144	316,8	3600	88
550	71	144	5,5	0,71	0,144	316,8	3600	88
600	77	144	6	0,72	0,144	316,8	3600	88
650	80	144	6,5	0,8	0,144	316,8	3600	88
700	83	144	7	0,83	0,144	316,8	3600	88
750	84	144	7,5	0,84	0,144	316,8	3600	88
800	86	144	8	0,86	0,144	316,8	3600	88
850	88	144	8,5	0,88	0,144	316,8	3600	88
900	88	144	9	0,88	0,144	316,8	3600	88
950	88	144	9,5	0,88	0,144	316,8	3600	88
000	88	144	10	0,88	0,144	316,8	3600	88
050	88	144	10,5	0,88	0,144	316,8	3600	88
100	88	144	11	0,88	0,144	316,8	3600	88
150	88	144	11,5	0,88	0,144	316,8	3600	88

H	V	T	H(.01)mm	V.01mm	T.001mm	T(N)	AC(mm)	τ(Kpa)

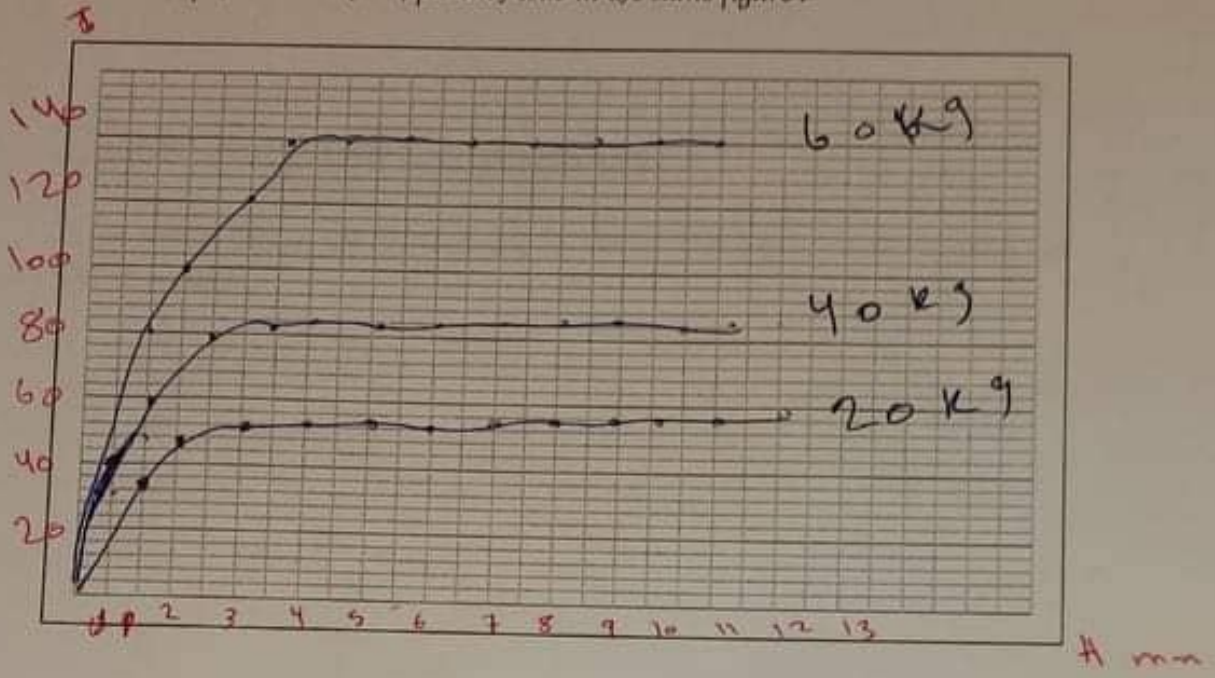
10	-3	4	0,1	-0,03	0,1084	3,8	3600	2,44
20	-4	10	0,2	-0,011	0,101	22	3600	6,11
30	-5	32	0,3	-0,05	0,1032	70,4	3600	19,56
40	-5	48	0,4	-0,05	0,048	105,6	3600	24,33
50	-5	63	0,5	-0,05	0,063	138,6	3600	38,3
60	-5	80	0,6	-0,03	0,08	176	3600	48,84
70	-5	96	0,7	-0,03	0,096	211,2	3600	58,67
80	-5	110	0,8	-0,05	0,11	242	3600	67,22
90	-4	122	0,9	-0,04	0,122	268,4	3600	74,56
100	-3	135	1	-0,03	0,135	297	3600	82,5
120	-1	156	1,2	-0,03	0,156	343,2	3600	95,33
140	2	173	1,4	-0,01	0,173	380,6	3600	105,72
160	6	188	1,6	0,02	0,188	413,6	3600	114,89
180	10	200	1,8	0,06	0,2	440	3600	122,89
200	15	209	2	0,1	0,209	459,8	3600	127,72
220	19	215	2,2	0,15	0,215	473	3600	131,39
240	-1	218	2,4	0,19	0,218	479,6	3600	133,22
260	27	220	2,6	-0,01	0,22	484,8	3600	134,67
270	31	219	2,8	0,27	0,214	495	3600	137,5
300	34	225	3	0,31	0,225	494,4	3600	137,33
320	38	227	3,2	0,34	0,227	500	3600	138,9
340	43	230	3,4	0,38	0,23	506	3600	140,56
360	46	230	3,6	0,43	0,23	506	3600	140,56
380	49	230	3,8	0,46	0,23	506	3600	140,56
400	53	230	4	0,49	0,23	506	3600	140,56
450	58	230	4,5	0,57	0,23	506	3600	140,56
500	62	230	5	0,58	0,23	506	3600	140,56
550	72	230	5,5	0,62	0,23	506	3600	140,56
600	70	230	6	0,72	0,23	506	3600	140,56
650	69	230	6,5	0,7	0,23	506	3600	140,56
700	69	230	7	0,69	0,23	506	3600	140,56
750	70	230	7,5	0,69	0,23	506	3600	140,56
800	70	230	8	0,7	0,23	506	3600	140,56
850	70	230	8,5	0,7	0,23	506	3600	140,56
900	72	230	9	0,7	0,23	506	3600	140,56
950	72	230	9,5	0,72	0,23	506	3600	140,56
000	72	230	10	0,72	0,23	506	3600	140,56
050	64	230	10,5	0,64	0,23	506	3600	140,56
100	62	230	11	0,62	0,23	506	3600	140,56
150	61	230	11,5	0,61	0,23	506	3600	140,56

Sample of calculations

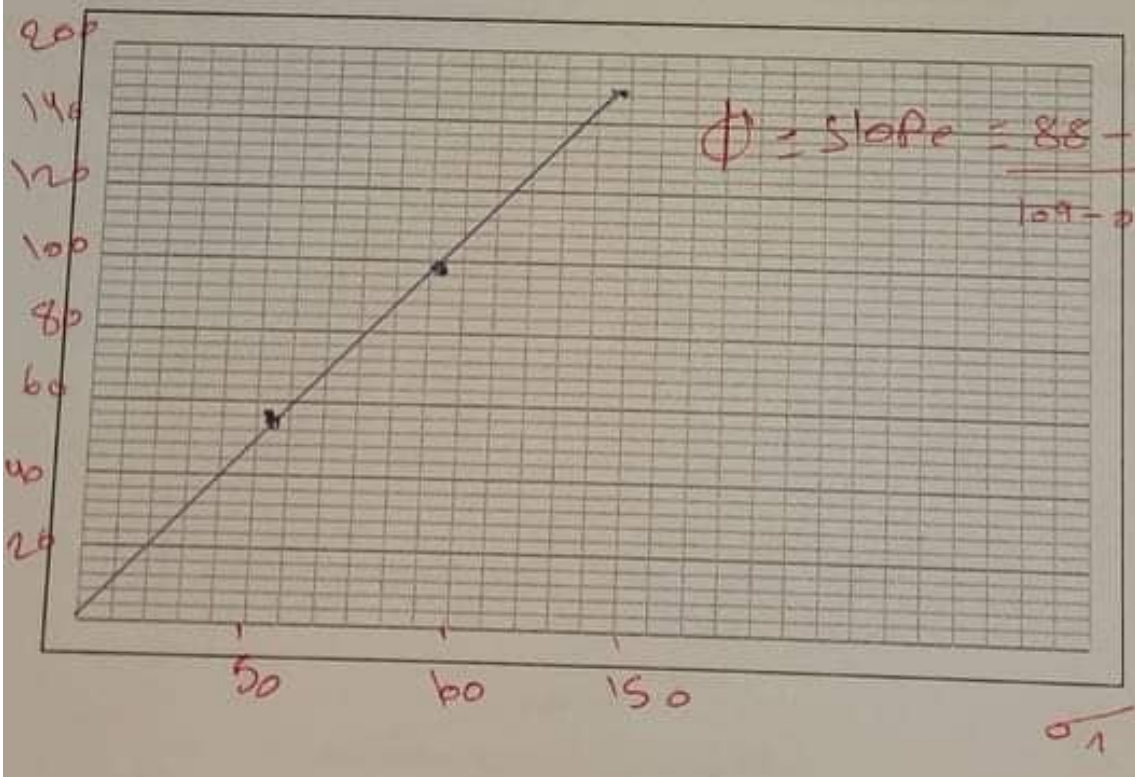
	σn	τ(Kpa)
20	59,5	57,44
40	109	88
60	163,5	140,56

A (mm)	σn	T(N)	τ(Kpa)
$6 * 6 * 10^{-4}$ $= 36 * 10^{-4}\ m^2$	$= \frac{P}{A}$ $= \frac{20 * 9,81}{36 * 10^{-4}}$ $= 54,5$	$T = 0,01 * 2200$ $= 22\ N$	$\tau = \frac{T}{A}$ $= \frac{22 * 10^{-3}}{36 * 10^{-4}}$ $= 6,11\ KPa$

-Plot □(Kpa) versus H(mm) for each load in the same figure .



-Plot □(Kpa) versus □n .

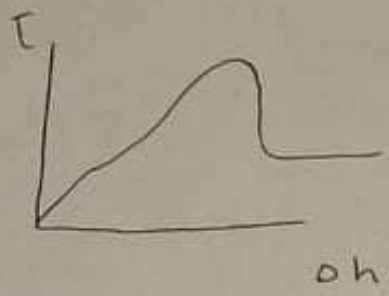


Discussion and Conclusion

1-the value of(c & Ø) discuss these value (the type of soil depend on these value).

C = 0
ϕ = 48.5°

C_{cv} = 0
ϕ_{cv} = 44, 27°



2-draw the free sketch between shear stress versus horizontal displacement curve, and vertical displacement versus horizontal displacement for both (loss sand, normal consolidation clay) & (dense sand, over consolidation clay).