Liquid & Plastic Limit
2/3/2010

A. Objective:

To determine liquid limit (LL) and plastic limit (PL) of the given soil sample.

B. List of Equipment:

- Casagrande's liquid limit device
- Grooving tool
- Moisture content cans
- Grounded glass plate
- Electric balance
- Oven
- Pair of tongs
- Water pitcher

C. Procedure:

(Liquid Limit - 1-4)

1. Record the weight in grams of each moisture content can using an electrical balance (weight of empty can)
2. Mix soil and water in a small bowl until the mixture attains the consistency of a paste.
3. Scrape the soil paste in Casagrande's liquid limit device until it covers half the cup in the liquid limit device.
4. After flattening the soil in the cup, use the grooving tool to cut through the center of the soil pat.
5. Blow at least 25 times using the crank on the liquid limit device until there is a half-inch groove closure in the soil. Count the exact number of blows until this point is achieved. Record the number of blows.
6. Place a sample of the soil into a moisture content can and record its weight in grams (weight of can + wet soil) using an electrical balance. Place can into an oven that has been heated to 110°C. (Trial 1)
7. Repeat the same process for another sample of soil, except mix the soil with a little more water and blow the liquid limit device at least 25 times until goal stated above is reached. (Trial 2)
8. Repeat the same process for another sample of soil, except add a little more water to the mix and blow the liquid limit device at most 25 times until goal stated above is reached. (Trial 3)
9. Repeat the same process for the last sample of soil, except add a little more water to the mix and blow the device at most 25 times until goal stated above is reached. (Trial 4)
10. After 24 hours, remove all four moisture content cans from the oven, let them sit for a minute, and then weigh each of them in grams using an electrical balance (weight of can + dry soil).

(Plastic Limit - 5)

11. Record the weight in grams of another moisture content can using an electrical balance (weight of empty can).
12. Mix soil and water in a small bowl. Take a sample of the soil-water mixture and begin rolling it into a ball on a grounded glass plate.
13. Keep rolling the soil mass until it reaches a cylindrical shape of 1/8 in. thick in diameter.
14. Place the soil into the moisture content can, and then record its weight in grams (weight of can + wet soil) using an electrical balance. Place the can into an oven that has been heated to 110°C.
15. After 24 hours, remove the moisture content can from the oven, let it sit for a minute, and then weigh it in grams using an electrical balance (weight of can + dry soil).

D. Data:

	Can #	Weight of Empty Can (gms)	Weight of Can + Wet Soil (gms)	# of Blows	Weight of Can + Dry Soil (gms)	Weight of Water (W_w) (gms)	Weight of Dry Soil (W_s) (gms)	Water Content (w) %
LL	V-287	10.34	23.17	58	20.24	2.93	9.90	29.6
	V-65	11.28	24.49	29	20.92	3.57	9.64	37.0
	CE-112	12.36	32.53	17	26.89	5.64	14.53	38.8
	CE-8	11.43	29.51	10	24.26	5.25	12.83	40.9
PL	CE-27	12.15	13.20		12.99	0.21	0.84	25.0

E. Analysis of Data:

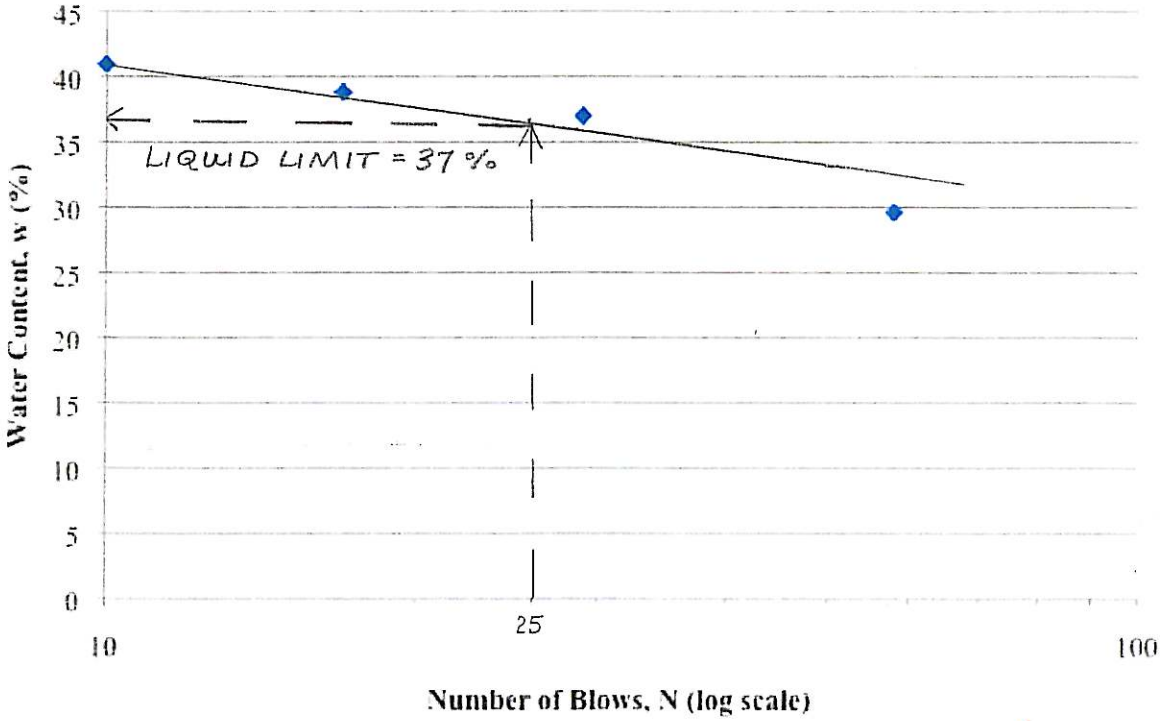
1) Weight of Water (W_w) = (Weight of Can + Wet Soil) – (Weight of Can + Dry Soil)
   Ex: 23.17 gms – 20.24 gms = 2.93 gms

2) Weight of Dry Soil (W_s) = (Weight of Can + Dry Soil) – (Weight of Empty Can)
   Ex: 20.24 gms -10.34 gms = 9.90 gms

3) Water Content (w) = $\frac{Ww}{Ws}$ x 100
   Ex: [(2.93 gms) / (9.90 gms)] x 100 = 29.6%

4) Plasticity Index (PI) = Liquid Limit (LL) *(from flow curve below)* – Plastic Limit (PL) *(from data chart above)*
   Ex: 37% - 25% = 12%

Flow Curve of Water Content vs. Number of Blows



F. Conclusion:

From the results of this lab, I can conclude that as water content increases, the number of blows decreases. In addition, the liquid limit (obtained from the graph above) came out to be approximately 37%. This means that 37% is the moisture content required to close a distance of 0.5 in. along the bottom of the groove in the liquid limit device after 25 blows. In addition, the plastic limit (obtained from the data chart above) came out to be 25%. Using the equation in the Analysis of Data section, the plasticity index was calculated to be 12%. This value indicates the range of water content within which our soil sample behaves like a plastic mass. According to the textbook, *Principles of Geotechnical Engineering*, a soil with a plasticity index of 12% is qualitatively described as having a low plasticity.

Liquid & Plastic Limit Determination

February 13th, 2010

Objective:
To determine the liquid limit and plastic limit of the given soil sample.

Equipment:
Casagrande's liquid limit device
Grooving tool
moisture content can
grounded glass plate
electronic balance
oven
pair of tongs
water pitcher

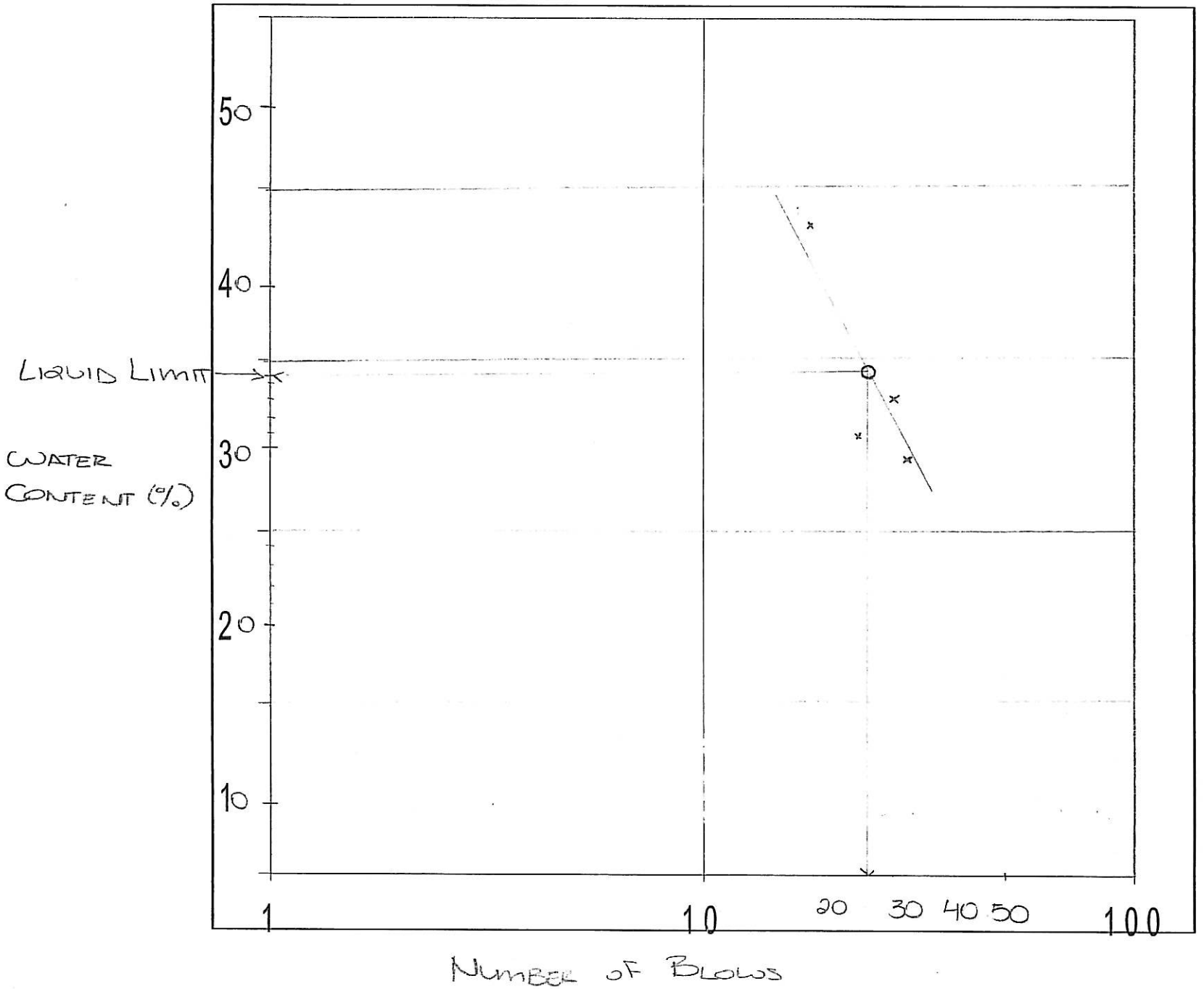
Procedure:
1. Take a soil sample and add enough water to put the sample in its plastic state.
2. Push the soil sample into Casagrande's liquid limit device, molding the sample somewhat to the shape of the bowl.
3. Using the grooving tool, make a groove down the center of the sample.
4. Turn the crank on Casagrande's liquid limit device until the groove closes to a width of about ½ centimeter (will be approximately 25 turns)
5. Put the sample into a moisture content can whose weight has been measured, and put the can into the oven. Leave for 24 hours.
6. After 24 hours, weigh the moisture content can with the dry soil sample, and record the weight.
7. Determine the moisture content, and graph the results vs. the number of blows needed to close the groove to ½ centimeter.
8. Repeat for three more soil samples.
9. For the 5th soil sample, roll it into 1/8 inch rods, until the sample starts to crumble slightly.
10. Put the sample into a moisture content can whose weight is known, and put it in the oven for 24 hours.
11. After 24 hours, weigh the moisture content can with the dry soil sample, and determine the water content.

Data:

Can #	Weight of Empty Can (g)	Weight of can + wet soil sample (g)	No. of Blows	Weight of can + dry soil (g)	Weight of Water (g)	Water Content (%)
1	33.22	51.47	30	47.27	4.2	29
2 (108)	22.49	68.75	23	57.65	11.1	31.6
3	11.33	31.22	28	26.27	4.95	33.1
4	33.03	49.82	19	44.75	5.07	43.3
5 (72)	11.51	13.32	0	12.97	0.35	24

Conclusion:
This soil sample was fairly consistent with the water content and number of blows needed to close the groove in Casagrande's liquid limit device. The liquid limit is the water content at 25 blows, which for this sample is 34%.

PL = ? = 24.1.


50
40
30
20
10
LIQUID LIMIT
WATER CONTENT (%)
1
10
20
30
40
50
100
NUMBER OF BLOWS