

<u>INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR</u> <u>Department of Civil Engineering</u> <u>Soil Mechanics Laboratory</u>

a) **LIQUID LIMIT TEST**

IS: 2720 (Part 5) - 1985 (Reaffirmed-2006)

THEORY:

The liquid limit is the moisture content at which the groove, formed by a standard tool into the sample of soil taken in the standard cup, closes for 12 mm on being given 25 blows in a standard manner. This is the limiting moisture content at which the cohesive soil passes from plastic state to liquid state.

NEED AND SCOPE:

Liquid limit is used for soil classification. It gives an idea of the consistency of the soil in the field, if the in-situ moisture content is known. If the in-situ moisture content of soil is closer to liquid limit, the soil can be considered as soft. If the moisture content is lesser than liquid limit, the soil is brittle and stiffer. From the results of the liquid limit, the compression index may also be estimated. The compression index value helps in settlement analysis.

APPARATUS REQUIRED:

- 1. Balance (sensitive to 0.01g)
- 2. Casagrande's Liquid limit device
- 3. Grooving tool (Casagrande or ASTM tool)
- 4. Mixing dishes
- 5. Spatula
- 6. Electrical Oven
- 7. Squeeze Bottle

PROCEDURE:

- Take 250 gm of oven-dried soil, passed through a <u>425 μm IS sieve</u>, into an evaporating dish. Add distilled water into the soil and mix it thoroughly to form a uniform paste. (The paste should have a consistency that would require 30 to 35 drops of the cup to cause a closer of standard groove for sufficient length.)
- 2. The drop of the cup is adjusted to be exactly 1 cm using an adjustment plate. This procedure is called the calibration of the Liquid limit device.
- 3. Place a portion of the paste in the cup of the *Liquid Limit device* and spread it with a few strokes of a spatula.
- 4. Trim it to a depth of 1 cm at the point of maximum thickness and return the excess soil to the dish.
- 5. Using the grooving tool, cut a groove along the center line of the soil pat in the cup, so that a clean sharp groove of proper dimension (11 mm wide at top, 2 mm at bottom, and 8 mm deep for Casagrande's tool) is formed.
- 6. Lift and drop the cup by turning the crank at the rate of two revolutions per second until the two halves of the soil cake come in contact with each other for a length of about 12 mm by flow only, and record the number of blows, N.
- 7. Take a representative portion of soil from the cup for moisture content determination.
- 8. Repeat the test with different moisture contents at least five more times for blows between 15 and 35.



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OBSERVATIONS:

Details of the sample:

Natural moisture content:		Room temperature:					
Determination Number	1	2	3	4	5	6	
Container number							
Weight of container (w ₁)							
Weight of container + wet soil (w ₂)							
Weight of container + dry soil (w ₃)							
Weight of water (W _w =w ₂ -w ₃)							
Weight of dry soil (W _s =w ₃ -w ₁)							
Moisture content (%) =(W _w /W _s)							
No. of blows							

COMPUTATION / CALCULATION:

Plot the relationship between water content (on the y-axis) and the number of blows (on the x-axis) on a semi-log graph. The curve obtained is called the flow curve. The moisture content corresponding to 25 drops (blows) as read from the represents liquid limit. It is usually expressed to the nearest whole number.

Liquid limit, $W_L = (At 25 blows, from semi log- graph of water content Vs. No. of blows)$

Flow index, $I_f = (W_2-W_1) / \log(N_1/N_2)$

= slope of the flow curve

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