

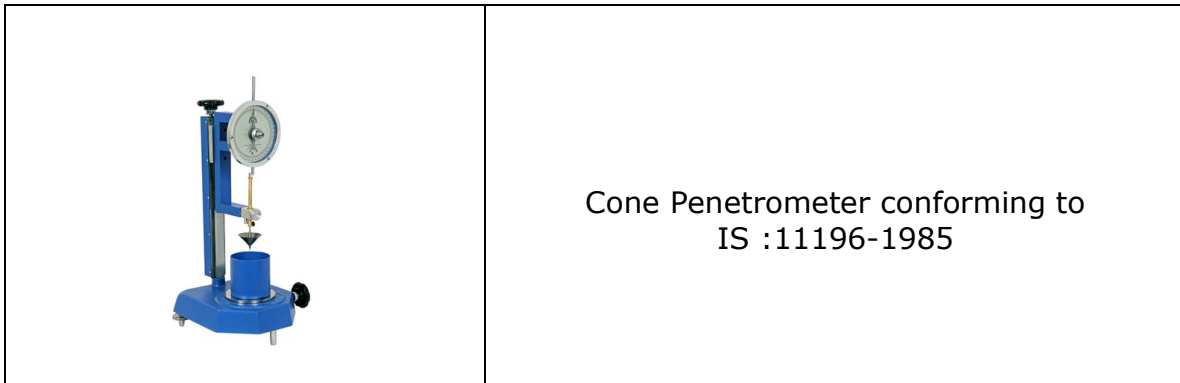
DETERMINATION OF LIQUID LIMIT BY CONE PENETRATION METHOD

1. Objective: From Liquid limit, the compression index may be estimated, which is used in settlement analysis. If the natural moisture content of the soil is more than Liquid limit, the soil can be considered as soft and if the moisture content is lesser than Liquid limit, the soil is brittle and stiffer. The value of liquid limit is used in classification of the soil and it gives an idea about plasticity of the soil.

Since the depth of penetration in an indirect reflection of shear strength at different water contents, it has been found, within the framework of a scientific base that w/w_L against $\log D$ or D is unique and independent of soil. The resulting linear relation enables to determine liquid limit water content corresponding to 20mm penetration of the cone.

2. Apparatus Required:

2.1 Cone Penetrometer



2.2 Weigh Balance, sensitive to 0.01g

2.3 Containers, non-corrodible and air tight for moisture determination.

2.4 Hot Air Oven, thermostatically controlled, capable of maintaining temperature of 105⁰ to 110⁰ C.

3. Reference: IS 2720 (Part-5): 1985 (Reaffirmed 2020) **“Test for the determination of Liquid Limit by Cone penetration method”**

4. Procedure: Take about 150 g of soil sample, passing from 425 micron, and work it well into a paste with addition of distilled water. In the case of highly clayey soils, to ensure uniform moisture distribution, it is recommended that the soil in the mixed state is left for sufficient time (24 hours) in an air-tight container.

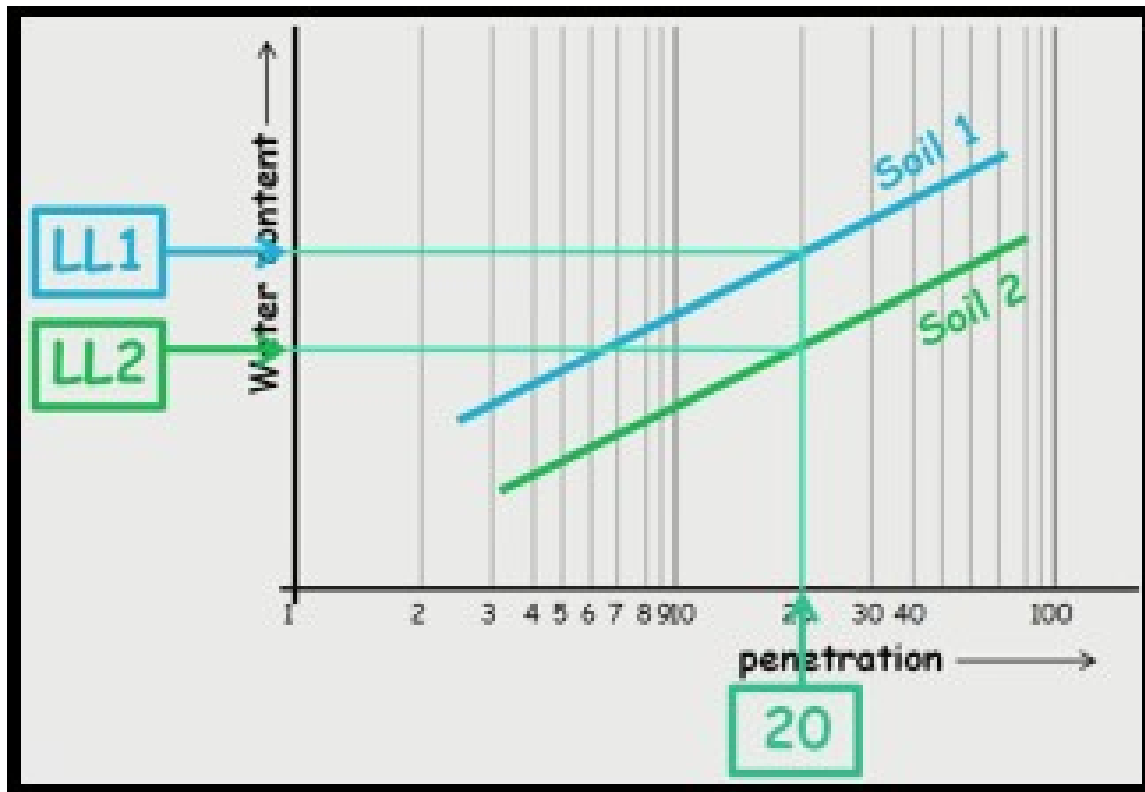
The wet soil paste shall then be transferred to the cylindrical cup of cone penetrometer apparatus, ensuring that no air is trapped in this process. Finally, the wet soil is levelled up to the top of the cup and placed on the base of the cone penetrometer apparatus.

The penetrometer shall be so adjusted that the cone point just touches the surface of the soil paste in the cup clamped in this position. The initial reading is either adjusted to zero or noted down as is shown on the graduated scale. The vertical clamp is then released allowing the cone to penetrate into the soil paste under its own weight. The penetration of the cone after 5 seconds shall be noted to the nearest millimetre.

If the difference in penetration lies between 14 and 28 mm, the test is repeated with suitable adjustments to moisture either by addition of more water or exposure of the spread paste on a glass plate for reduction in moisture content.

The test shall then be repeated at least to have four sets of values of penetration in the range of 14 to 28 mm. The exact moisture content of each trial shall be determined.

5. Observation and Recording: A graph representing water content on the Y-axis and the cone penetration on the X-axis shall be prepared. The best fitting straight line is then drawn. The moisture content corresponding to cone penetration of 20 mm shall be taken as the liquid limit of the soil and shall be expressed to the nearest of the first decimal place. The history of sample, that is, natural state, air dried, or unknown, the pre-treatment, if any to the soil shall be reported.



7. Video:

8. Download: