



**INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR**  
**Department of Civil Engineering**  
**Soil Mechanics Laboratory**

**b) PLASTIC LIMIT TEST**

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

**THEORY:**

The plastic limit (PL) is determined by rolling out a thread of the fine portion of a soil on a flat, non-porous surface. The plastic limit is defined as the moisture content where the thread breaks apart at a diameter of 3 mm. A soil is considered non-plastic if a thread cannot be rolled out down to 3 mm at any moisture content.

**NEED AND SCOPE:**

Plastic Limit (PL or  $W_p$ ) is the water content of the soil at the boundary between the plastic and semi-solid states. The plastic limit is used for the classification of soils. In addition, the plastic limit of soil is also used, either individually or with other soil properties to correlate engineering properties such as compressibility, permeability, compactability, shrink-swell, and shear strength.

**APPARATUS REQUIRED:**

1. Porcelain dish
2. Squeeze Bottle and Spatula
3. Balance of capacity 200 gm and sensitive to 0.01 gm
4. Ground glass plate for rolling the specimen
5. Containers to determine the moisture content
6. Oven thermostatically controlled with the interior of non-corroding material to maintain the temperature around 105° and 110°C
7. Metal rod of 3 mm diameter and about 10 cm long

**PROCEDURE:**

1. Take 20 gm of oven-dried soil, passed through the **425-micron** sieve (In accordance with I.S. 2720: part-1), into an evaporating dish. Add distilled water into the soil and mix it thoroughly to form uniform paste (the soil paste should be plastic enough to be easily molded with fingers).
2. Prepare several ellipsoidal-shaped soil masses by squeezing the soil between your fingers. Take one of the soil masses and roll it on the glass plate using your fingers. The pressure of rolling should be just enough to make thread of uniform diameter throughout its length. The rate of rolling shall be between 60 to 90 strokes per min.
3. Continue rolling until you get the thread diameter of 3 mm.
4. If soil thread does not crumble at a diameter of 3 mm, knead the soil together to make an uniform soil mass and re-roll.
5. Continue the process until the thread crumbles when the diameter is 3 mm.
6. Collect the pieces of the crumbled thread for moisture content determination. (Prepare threads at least with 10gm of soil for water content measurement).
7. Repeat the test at least 3 times and take the average of the results calculated to the nearest whole number.



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**PRESENTATION OF DATA:**

Description	Trial 1	Trial 2	Trial 3
Container No.			
Wt. of container + lid, $W_1$			
Wt. of container + lid + wet sample, $W_2$			
Wt. of container + lid + dry sample, $W_3$			
Wt. of dry sample = $W_3 - W_1$			
Wt. of water in the soil = $W_2 - W_3$			
Water content (%) = $(W_2 - W_3) / (W_3 - W_1) \times 100$			
Average Plastic Limit, (%)			

Plasticity Index, ( $I_P$ ) =  $(LL - PL)$

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Toughness Index =  $I_P / I_F$

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**Interpretation:**

- 1- Soil classification according to their plasticity index,  $I_P$

Plasticity index, $I_P$ (%)	Soil description
0	Non-plastic
<7	Low plastic
7-17	Medium plastic
>17	Highly plastic



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2- Relationship between plasticity index ( $I_p$ ) and swelling potential

Plasticity index, $I_p$ (%)	Swelling potential
0 - 15	Low
10 - 35	Medium
20 - 35	High
35 and above	Very high