

**ND T 90 – DETERMINING THE PLASTIC LIMIT AND  
PLASTICITY INDEX OF SOILS**

Conduct this procedure according to ND T 90.

Consult the current edition of AASHTO for procedure in its entirety and equipment specification details.

**SCOPE**

The plastic limit of a soil is the lowest water content at which the soil remains plastic.

The plasticity index of a soil is the numerical difference between the liquid limit and the plastic limit. It is the moisture content at which the soil is in a plastic state.

**REFERENCED DOCUMENTS**

ND T 87 and AASHTO T 87, Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test  
ND T 89 and AASHTO T 89, Determining the Liquid Limit of Soils  
AASHTO T 90, Determining the Plastic Limit and Plasticity Index of Soils  
ND T 265 and AASHTO T 265, Laboratory Determination of Moisture Content of Soils

**APPARATUS**

Mixing dish  
Spatula  
Ground glass plate or unglazed paper  
Plastic Limit Rolling device with unglazed paper (optional)  
Moisture proof sample cans (3 oz. capacity)  
Balance  
Oven  
Distilled water

**PROCEDURE**

Record information on SFN 9987 or SFN 10086.

Material passing the No. 40 (0.425 mm) sieve prepared according to ND T 87 is needed for this test.

If both the liquid and the plastic limits are required, take a test sample of approximately 8 g from the thoroughly wet and mixed portion of the soil prepared for ND T 89, the liquid limit. Take the sample at any stage the sample is plastic enough to be shaped into a ball without sticking to the fingers. Set aside and allow to air dry until completion of the liquid limit test. If the sample is too dry, add more water and re-mix.

If only the plastic limit is required, take a quantity of air-dried soil weighing about 20 g and mix with distilled or tap water in the mixing dish until the sample becomes plastic enough to be easily shaped into a ball. Use a portion of this ball that weighs approximately 8 g for the test sample.

Squeeze and form the 8-g test sample into an ellipsoidal-shaped mass. Sub-sample to 1.5g to 2 g portions and roll between the palm or fingers and the ground glass plate or piece of paper with sufficient pressure to roll the sample into a uniform thread about 1/8" in diameter throughout its length. Roll at a rate of 80 to 90 strokes per minute. A stroke is a complete forward and back motion, returning to the starting place. A plastic limit rolling device may also be used. The rolling procedure should be completed in two minutes.

When the diameter of the thread reaches 1/8", break the thread into six or eight pieces and squeeze the pieces together between the thumbs and fingers of both hands into a roughly uniform ellipsoidal shape and re-roll. Continue this procedure until the thread crumbles under the pressure required for rolling and the soil can no longer be rolled into a thread. The crumbling may occur when the thread has a diameter greater than 1/8". This is considered a satisfactory end point provided that the soil has been previously rolled into a thread 1/8" in diameter.

Do not attempt to produce failure at exactly 1/8" in diameter by allowing the thread to reach 1/8", then reducing the rate of rolling or the hand pressure, or both, and continuing the rolling without further deformation until the thread falls apart. It is permissible to reduce the total amount of deformation for feeble plastic soils by making the initial diameter of the ellipsoidal shaped mass near the required 1/8" final diameter.

Gather the portion of the crumbled soil together and place in a container and cover.

Repeat this procedure until the entire 8-g specimen is completely tested. Weigh to the nearest 0.01 g and record. Determine the moisture content according to ND T 265.

## CALCULATIONS

Calculate the percent moisture as follows:

$$A = [(B - C)/C] \times 100$$

*A = Percent moisture*

*B = Mass of original sample*

*C = Mass of dry sample*



Calculate moisture to the nearest 0.1%.

The percent moisture is the plastic limit.

Report the plastic limit to the nearest whole number.

## PLASTICITY INDEX CALCULATION

The plasticity index of soil is the difference between its liquid limit and its plastic limit.

$$\text{Plasticity Index} = \text{Liquid Limit} - \text{Plastic Limit}$$

Report the plasticity index to the nearest whole number.

## NOTES

Report the plastic limit as non plastic (NP) when the plastic limit is equal to or greater than the liquid limit, or when the liquid limit or plastic limit cannot be determined.

## CALIBRATION

A calibration check of the equipment should be performed annually as a minimum, or whenever damage or repair occurs.