

State of Nevada
Department of Transportation
Materials Division

**METHOD OF TEST FOR DETERMINING THE PLASTIC LIMIT AND
PLASTICITY INDEX OF SOIL**

SCOPE

The plastic limit of a soil is the lowest water content determined in accordance with the following procedure at which the soil remains plastic. The plasticity index of a soil is the range in water content, expressed as a percentage of the mass of the oven dried soil, within which the material is in a plastic state. The plastic index value is the numerical difference between the liquid limit and the plastic limit of the soil.

APPARATUS

1. Ground glass plate (Figure 1), to roll the sample out.
2. Watch glass (Figure 1), approximately 75 mm (3.0 in.) in diameter.
3. Balance (Figure 1), having a 500 g minimum capacity, accurate to 0.01 g.

SAMPLE PREPARATION

Obtain a sample with a mass of 8 g from the thoroughly mixed and hydrated portion of the soil from the 1st shock range (35 – 25) while completing Test Method Nev. T210. Set the sample aside under watch glass # 4 on top of the ground glass plate to avoid loss of moisture until Test Method Nev. T210 has been completed.

PROCEDURE

1. Weigh the watch glass and record as “Tare Weight” on NDOT form 040–014, to the nearest 0.01 g.
2. Squeeze and form the 8 g sample into an ellipsoidal shaped mass. Divide the sample into 1.5 g to 2.0 g portions. Cover the remainder of the sample with a watch glass, to prevent moisture loss.
3. Place the ground glass plate on a smooth horizontal surface. Roll each portion into a 3 mm (1/8 in.) thread at a rate of 80 to 90 strokes per minute, counting a stroke as one complete motion of the hand forward and back to the starting position again. Roll the mass between the palm or fingers and the ground glass plate, with just sufficient pressure to roll the mass into a thread of uniform diameter throughout its length. The thread shall be further deformed on each stroke until its diameter reaches 3 mm (1/8 in.). The amount of hand or finger pressure required will vary greatly, according to the soil.

4. When the entire 8 g sample has been rolled into 3 mm (1/8 in.) threads, collect the 3mm (1/8 in) threads together and squeeze between the thumb and fingers of both hands into a uniform mass of an ellipsoidal in shape, divide the sample into 1.5 g to 2.0 g portions and reroll. Continue this alternate rolling into a thread 3 mm (1/8 in.) in diameter, gathering together, kneading and rerolling, 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 3 mm (1/8 in.). This shall be considered a satisfactory end point, provided the mass has been previously rolled into a thread 3 mm (1/8 in.) in diameter and the entire sample crumbles.

The crumbling will manifest itself differently with the various types of soils. Some soils fall apart in numerous small aggregations of particles; others may form an outside tubular layer that starts splitting at both ends. The splitting progresses toward the middle, and finally, the thread falls apart in many small platy particles. Heavy clay soils require much pressure to deform the thread, particularly as they approach the plastic limit, and finally, the thread breaks into a series of barrel shaped segments each about 6 mm to 9 mm (1/4 in. to 3/8 in.) in length. At no time shall the operator attempt to produce failure at exactly 3 mm (1/8 in.) diameter by allowing the thread to reach 3 mm (1/8 in.), 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, however, to reduce the total amount of deformation for feebly plastic soils by making the initial diameter of the ellipsoidal shaped mass nearer to the required 3 mm (1/8 in.) final diameter.

If the soil will not roll out to the required 3 mm (1/8 in.) diameter and sufficient moisture has been added, the plastic limit will be reported as N/A and the plasticity index will be reported as NP.

5. Repeat step #2, #3 and #4 above until the entire 8 g sample is completely tested.
6. Place the crumbled soil on watch glass # 4. Weigh and record the “Wet Weight” on NDOT form 040–014 to the nearest 0.01 g.
7. Dry the crumbled soil on watch glass # 4 with the other three watch glasses obtained during Test Method Nev. T210 per “PROCEDURE – METHOD A (THREE POINT METHOD)” step # 10.

CALCULATIONS

1. Calculate the plastic limit, expressed as the water content in percentage of the mass of the oven dry soil, as follows:

$$\text{Plastic Limit} = \frac{\text{mass of water}}{\text{mass of oven dry soil}} \times 100$$

Calculate the plastic limit to the nearest 0.1 g.

2. Calculate the plasticity index of a soil as the difference between its liquid limit and its plastic limit, as follows:

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

When the liquid limit or plastic limit cannot be determined, report the plasticity index as NP (non-plastic), on NDOT form 040-014, 040-013 and 040-010.

When the plastic limit is equal to, or greater than, the liquid limit, report the plasticity index as NP (non-plastic), on NDOT form 040-014, 040-013 and 040-010.

Calculate the plasticity index to the nearest 0.1 on NDOT form 040-014 and 040-013.

REPORT

Report the plasticity index to the nearest 0.1 on NDOT form 040-014 and 040-013. Report the plasticity index to the whole number on NDOT form 040-010.

PRECISION STATEMENT

This precision statement applies to soils with a plastic limit range between 15 and 36.

Repeatability (Single Operator): Two results obtained by the same operator on the same sample in the same laboratory using the same apparatus should be considered suspect if they differ by more than 10 percent of their average.

Reproducibility (Multilaboratory): Two results obtained by different operators in different laboratories should be considered suspect if they differ from each other by more than 18 percent of their average.

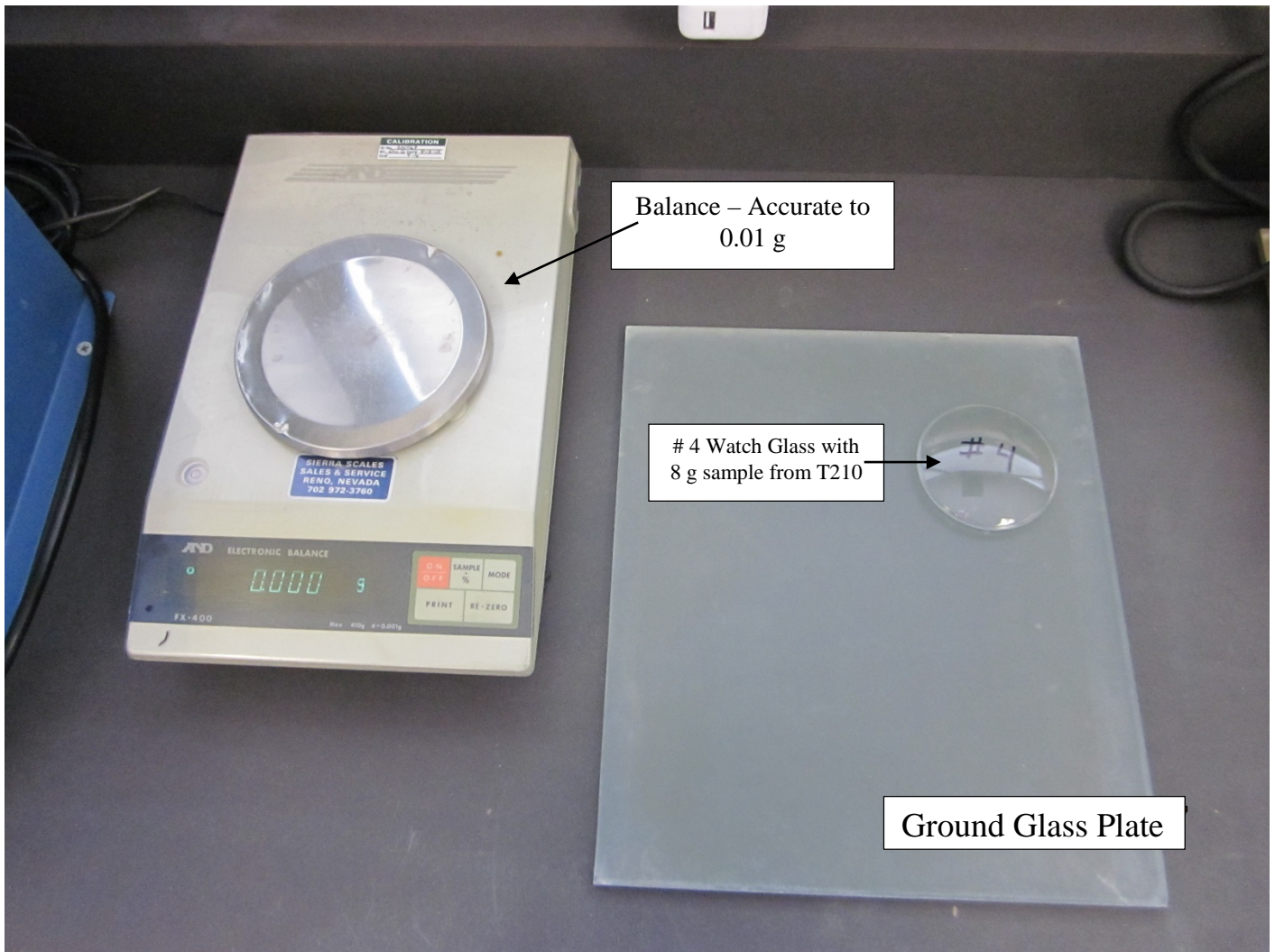


Figure 1