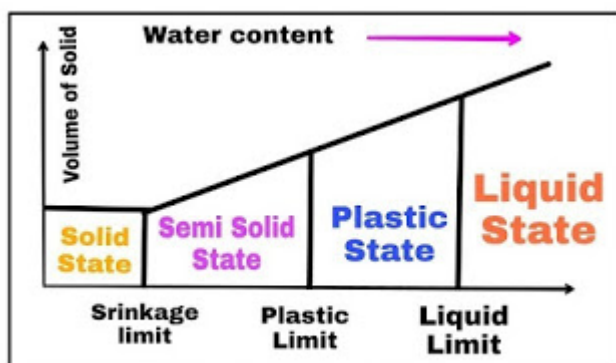


# Numerical to calculate the plastic limit of soil | Plasticity index

Here, we are going to calculate the plastic limit of soil. Also, we will learn here how to calculate the plasticity and plasticity index of soil.

Before calculation, you must have good knowledge of the consistency of soil. The physical state of fine-grained soil at particular water content is known as its consistency. The consistency limit was determined by Atterberg an Agronomist for the first time, Therefore this is also known as Atterberg's limit.



**Fig:- States of Consistency**

According to Atterberg, the water content soil has various state of consistency i.e., liquid state, plastic state, a semi-solid state, and solid-state have different consistency limits than each other.

Atterberg limits are the first steps with which the critical water content, shrinkage limit, plastic limit, and liquid limit of soil mass can be taken out easily. It is also used to distinguish between different types of clay and silts.

# Types of the liquid limit of soil.

## 1) Liquid Limit(LL)

The boundary of water between the liquid and plastic state of the soil is known as the liquid limit. The soil possesses very low shear strength at this stage.

## 2) Plastic Limit (PL) (plastic limit of soil)

The boundary of water between the plastic states and semi-solid states of the soil is known as a plastic limit.

## 3) Shrinkage limit

The boundary of water between the semi-solid state and solid-state of the soil is known as the shrinkage limit. Besides this, for the calculation of numerical value, we have to know some list of Atterberg indices. So let's discuss them below.

Also Read,

Relation between Discharge velocity and Seepage velocity in soil mass

Different between compaction and consolidation of soil

Types of retaining wall

# Atterberg indices

## 1) Plasticity index

The plasticity index is defined as the difference between the liquid limit and the plastic limit.

$$PI = (LL - PL)$$

Soils having high plasticity index tend to be clay and the soil having a low plasticity index are tends to be silt. There will be zero plastic where there are in little amount or no

silt or clay.

## **2) Flow index**

The slope of the flow curve obtained by plotting water content as ordinate on a natural scale against a number of blows as abscissa on a logarithmic scale is known as flow index.

i.e.  $\text{Flow index} = (W' - W'') / \log(N' / N'')$

Where  $W'$  is water content corresponding to the number of blows  $N'$  And  $W''$  is water content corresponding to the number of blows  $N''$

## **3) Toughness index**

The toughness index is defined as the ratio of the plasticity index to the flow index.

i.e.  $\text{Toughness index} = (\text{Plasticity index} / \text{Flow index})$

## **4) Liquidity index (LI)**

The liquidity index is defined as the ratio of the difference between natural water content and the plastic limit to the plasticity index.

i.e.  $LI = (W - PL) / (LL - PL)$  where  $W$  is the natural water content.

## **5) Consistency index (CI)**

The consistency index is defined as the ratio of difference liquid limits and natural water content to the plasticity index.

i.e.  $CI = (LL - W) / (LL - PL)$

## **5) Activity of clay**

It is defined as the ratio of plasticity index to the percentage of particle finer than 2 microns or 0.002 mm.

i.e.  $A = PI / (\% \text{ finer than 2 microns})$

The soil has high activity tends to large volume change when they are wetted or dried. Also, types of soil are chemically high in reaction. The soil having activity between 0.25 to 1.25 is called normal soil.

## **6) Thixotropy of soil**

The phenomena in which the clays change their strength either by strength loss or strength gain with respect to time without changing its volume and water content in it is known as the Thixotropy of soil.

Now, learning all the data given above you are prepared to calculate numerical regarding the liquid limit of soil and index properties of soil. Let's have some questions to be solved.

## **Numericals to Calculate plastic limit and plasticity index of soil**

Q) A sample of soil with a liquid limit of 72.8% was found to have a liquidity index of 1.21 and a water content of 81.3%. What are its plastic limit of soil and plasticity index?

Solution:-

Given;

Liquid limit (LL) = 72.8%

Liquidity index (LI) = 1.21

Water content (w) = 81.3%

Now we have,

Plasticity index = LL - PL

= 72.8 - PL

Also,

$$LI = (w-PL)/PI$$

Put the value of all terms and you will get the value of  
(PL)=32.32%                      And of (PI)= 40.48%

Q) The liquid limit of clay soil is 57% and its plasticity index is 16%. In what state of consistency is this material at a water content of 45%? What is the plastic limit of soil?

Solution:-

Given;

Liquid limit(LL)=57%

Plasticity index(PI)=16%

Plastic limit (PL) =?

We have

$$PI = LL - PL$$

$$\text{or, } 16 = 57 - PL$$

$$\text{or, } PL = 41\%$$

Hence, these are the required solution. I Hope friends, you liked my written article on the "plastic limit of soil" and remains helpful. Please comment below if you have any questions regarding it. I will try to answer as soon as possible.