C/w 07/3/13

e = 0.765

iii) $n = \frac{V_v}{V}$

$n = \frac{V_w}{V} = \frac{0.433V}{V} = 0.433$

iv) $w = \frac{W_w}{W_s}$

$w = \frac{27.05\,V}{95.45\,V}$

$w = 0.2834$

$w = 28.34\%$

∴ CONSISTENCY OF SOIL (NEW CHAPTER).

Consistency means the ease with which the soil can be deformed.

OR

It means the state of soil which it attains at certain moisture content. The term consistency is used for find grained soil to express its behaviour when its moisture content changes.

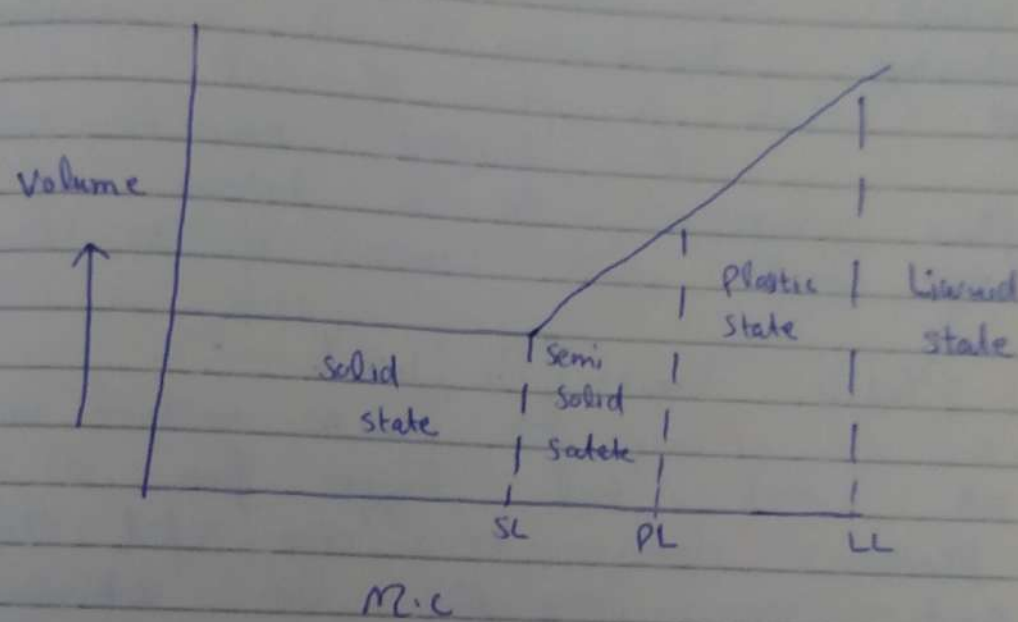
STATES OF CONSISTENCY OR STAGES:-

Depending upon water content a soil

C/W 28/3/13

may have the following stages

a) solid state
b) Semi solid.
c) Plastic state.
d) Liquid state.



CONSISTENCY LIMITS (Atterberge LIMITS):.

The moisture/water content at which a fine grained soil. changes from one state of consistency to another state of consistency are termed as consistency limits or Atterberge limits. There are three Atterbage limits.

1) LIQUID LIMIT (LL or W_L):. It is a

C/W 28/3/13

moisture content at which soil changes from Plastic to liquid state and vice versa.

OR

It is a moisture content beyond which soil acts like a liquid. For laboratory determination, it is a m.content at which a part of soil of standard dimension will flow together for a distance of half inch under impact of 25 blows.

2) Plastic limit:- (P.L / W_P):-

It is a moisture content at which soil changes from its plastic state to semi solid state and vice versa. For lab determination Plastic limit is a m.c at which a soil will just begin to crumble (cracks) when rolled into a thread of approx $\frac{1}{8}$th" in diameter.

3) SHRINKAGE LIMIT (SL, W_s):-

It is a moisture content at which soil changes from its semi solid state to solid state and vice versa. It is a moisture content at which soil attains constant volume i.e no reduction in volume on

C/w 28/3/13

further drying.

PLASTICITY:

It is defined as the property of soil due to which it can be rapidly deformed without rupture, and without elastic rebound.

PLASTICITY INDEX:

The difference between liquid limits and plastic limits is called plasticity index.

P.I = LL − PL (Expressed as +ve value).

PI gives the range within which soil shows plastic properties. On the basis of P.I various codes/oblique organization has divided soil into non plastic, slightly plastic, low plastic, medium plastic, high plastic and very high plastic.

MECHANICAL ANALYSIS OF SOIL / PARTICLE SIZE DISTRIBUTION ANALYSIS:

It is the determination of percentages of various sizes of particles in the sample (sand, silt, clay etc). Two methods are generally used to find particle

C/w 28/3/13

size of distribution

1) Sieve Analysis for Particles larger than 0.075 mm in size.
2) Sedimentation analysis for particle smaller than 0.075 mm in size.

SIEVE ANALYSIS:.

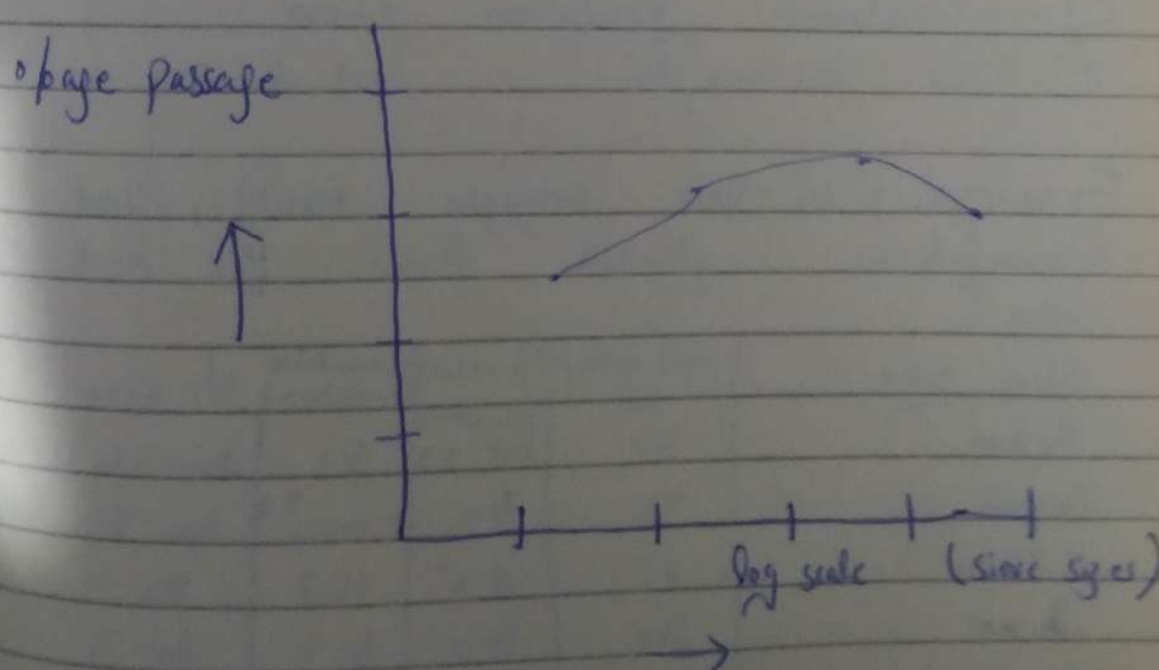
It is shaking of soil sample through a set of sieves that have progressively smaller openings. It is adopted for coursed grained soil. It is done by arranging a set of sieves in such a way that largest sieve is kept at the top and smallest sieve at the bottom. A reciever / Pan is kept at the bottom and cover is kept at the top of sieve assembly.

A soil sample is put on the top sieve and the whole sieve assembly is fitted in sieve shaking machine, and at least 10 minutes shaking given to a sample. After shaking the portion of soil sample retained on each sieve is found. And then percentage of soil retained on each sieve is calculated on

C.W 22/3/13

the basis of total mass of sample taken.

From the %age retained, the %age passing through each sieve is calculated. After obtaining the percentage passing for each sieve, the results are plotted to obtain particle size distribution curve / oblique gradation curve. This gradation curve is obtained by plotting the particle sizes (sieve sizes) on log scale along absica (x-axis) and corresponding %age passing are plotted along y-axis. By joining the points a particle size distribution / gradation curve is obtained.



CALCULATION:.

1) Find Retain on each sieve as R_1, R_2, R_3 ----

2) Find %age retain on each sieve % $\%R_1, \%R_2$, ----

3) Find commulation retain for each sieve as $\%CR_1 = \%R_1$

$$\%CR_2 = \%R_1 + \%R_2$$
$$\%CR_3 = \%R_1 + \%R_2 + \%R_3$$

---

4) Find commulation %age passing (% finer) for each sieve

$$\%CP_1 = 1000 - \%CR_1$$
$$\%CP_2 = 100 - \%CR_2$$
$$\%CP_3 = 100 - \%CR_3$$

---

5) Construct gradation curve.

$W = R_1 + R_2 + R_3$ ---- wt of pan

EXAMPLE:. FOR sieve analysis results, Find commulative percent finer for each sieve?

Sieve size	Soil retain (g)	% retain	Commulative % Retain	% Finer
20 mm	33	$\frac{33}{1000} \times 100 = 3.3$	3.3	100 - 3.3 = 96.7
10 mm	49	4.4	4.4+3.3 = 8.2	100 - 8.2 = 91.8
4.75 mm	85	8.5	16.7	83.2
2 mm	140	14.0	30.7	64.3
1 mm	160	16.0	46.7	53.3
600 micron (0.6mm)	142	14.2	60.4	34.1

C/w 3/4/13

425 micron	118	11.8	72.7	27.3
300 micron	82	8.2	80.9	19.1
212 "	56	5.6	86.5	13.5
150 "	35	3.5	90.0	10.0
75 " (No 200)	23	2.3	92.30	7.7
Pan	77			

$\%R = \frac{R}{W} \times 100$

$\%CR_1 = \%R_1$