

# Particle Size Analysis

Date: \_\_\_\_\_

\* IS classification :- (1498-1970)

0.002	0.075	0.425	2.0	4.75	20	80	300	
Clay	Silt	F	M	C	F	C	Cobble	Boulder
		Sand			Gravel			

(All in mm).

## Mechanical Analysis

↓  
Sieve Analysis

or

Dry Analysis

↓

P.S. > 75  $\mu$  sieve.

↓

Coarse  
Sieve Analysis

↓

Size > 4.75 mm

↓  
Wet

Analysis

↓

Particle Size

< 75  $\mu$  sieve

↓  
Hydrometer

method

↓  
Pipette

method

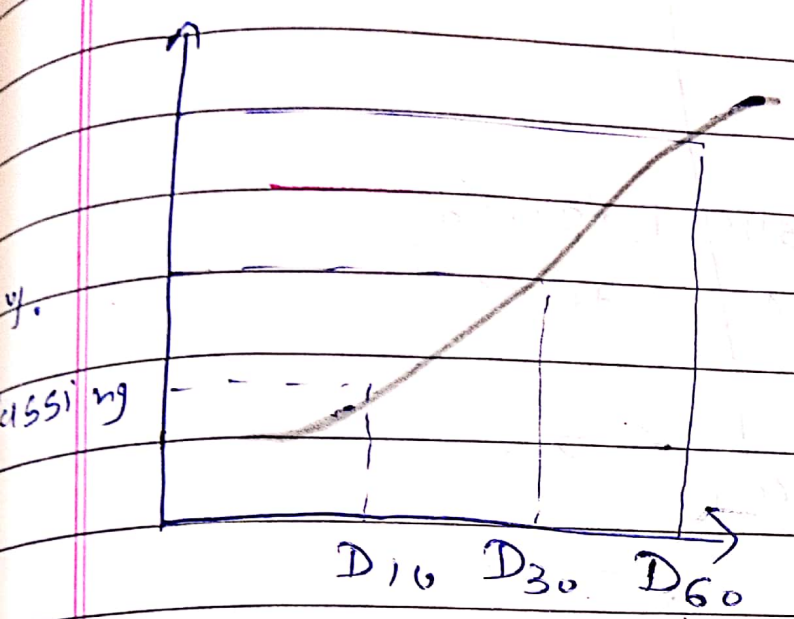
↓  
Fine sieve

Analysis

↓

Size (75  $\mu$  & size < 4.75 mm)

# Sieve Analysis :-



Cumulative Curve

Particle Size  $\rightarrow$   
mm (log scale)

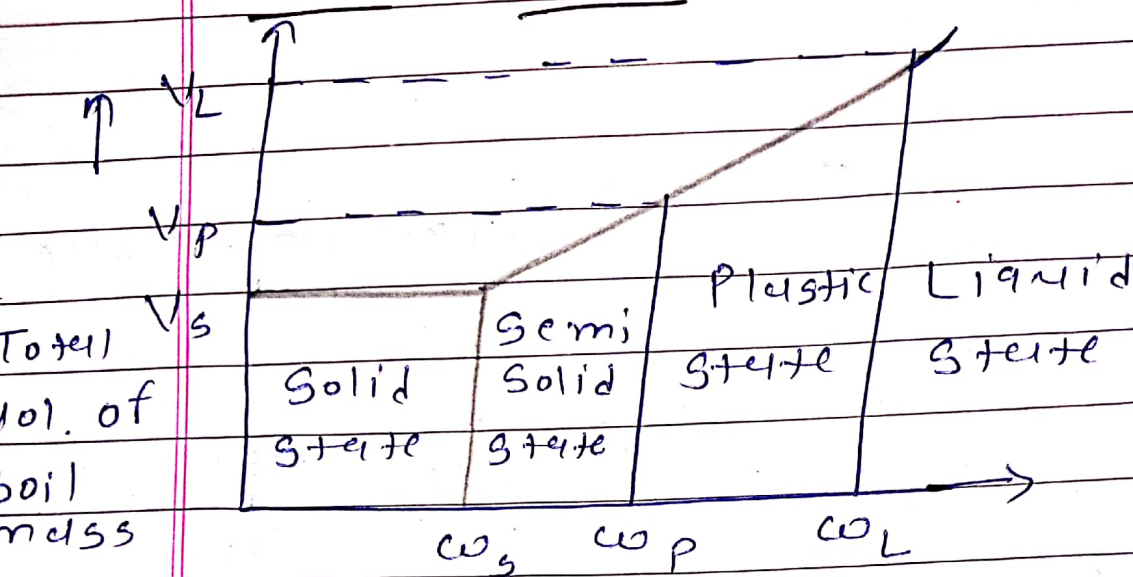
1)  $C_u = \frac{D_{60}}{D_{10}}$

2)  $C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}}$

$C_u$	Type of Soil
$\leq 5$	Uniform size particles
5-15	Medium graded soil
$> 15$	Well graded soil

$1 < C_c < 3 \Rightarrow$  Well graded soil.

## \* Soil consistency :-



W.C. (%) →

\* Liquid limit ⇒ liquid to plastic

\* Plastic limit ⇒ plastic to Semi Solid

\* Shrinkage limit ⇒ Semi Solid to Solid

$$* I_p = w_L - w_p$$

$$* I_s = w_p - w_s$$

$$* I_L = \frac{w - w_p}{I_p} \times 100$$

$$* I_c = \frac{w_L - w}{I_p} \times 100$$

Activity :-  $A = IP/F$

Sensitivity :-  $S_t = \frac{q_u \text{ (undisturbed)}}{q_u \text{ (disturbed)}}$

Soil classification System :-

- 1) Particle Size classification
- 2) Textural classification
- 3) Unified Soil classification
- 4) IS classification

USCS :-

Gravel	=	G
Sand	=	S
clay	=	C
Silt	=	M.

Well graded = W

Poorly graded = P

Silty = M.

clayey = C

low plasticity = L

High Plasticity = H.

## Course grained Soils



Gravels (G)

Sands (S)



50% or > 50%

> 50%

~~Passing~~

Passing through

Retained on 4.75mm

4.75mm

## Fine grained Soils



Silts & clays

Silts & clays



50% or < 50%

50% or < 50%

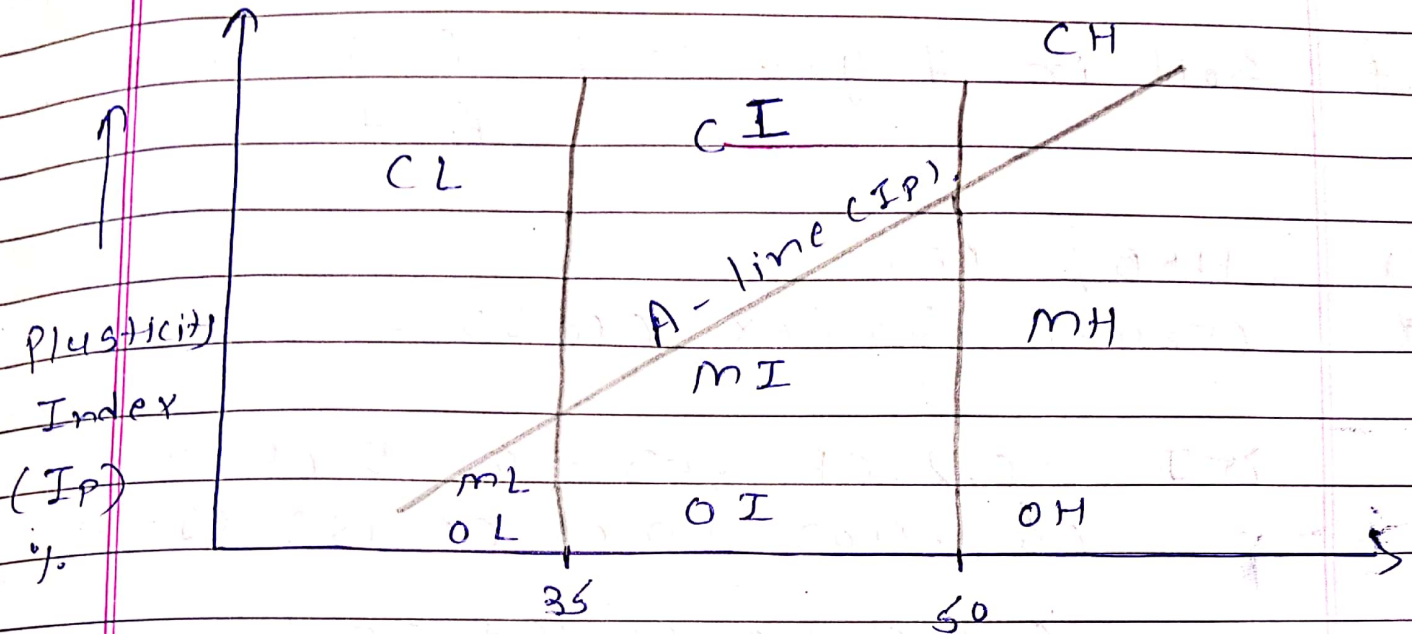
> 50% liquid limit

Liquid limit

MH, CH, OH

ML, OL, CL

## Plasticity Chart:-



Liquid limit ( $W_L$ )%  $\rightarrow$

$$A - \text{line } I_p = 0.73 (W_L - 20)$$

- \*  $LL > 50\% \Rightarrow$  above A-line  $\Rightarrow$  CH.
- \*  $35 < LL < 50 \Rightarrow$  Above A-line  $\Rightarrow$  CI.
- \*  $LL < 35 \Rightarrow$  Above A-line  $\Rightarrow$  CL.

## AASHTO Classi. System :-

⇒ Soil in 7 groups :- A-1 to A-7

HRB / PRA

Group Index (GI) :-

$$\begin{aligned} \text{GI} &= 0.2 (F-35) + 0.005 (F-35) \\ &\quad (\omega_L - 40) + 0.01 (F-15) (I_p - 10) \\ &= 0.2 a + 0.005 ac + 0.01 bd. \end{aligned}$$

Where,

$$a = F - 35 \quad (\text{max. } 40)$$

$$b = F - 15 \quad (\text{max. } 40)$$

$$c = \omega_L - 40 \quad (\text{max. } 20)$$

$$d = I_p - 10 \quad (\text{max. } 20)$$

Higher the value of GI =  
Poor the quality of the material