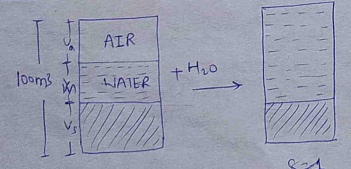
Lecture ②
4/11/19

Page NO - ⑥ W.B

(13)



$e = 0.67$
$w = 12\%$
$G = 2.65$

$\gamma_B =$

① Method

Volm of water added $= V_a$

$\eta_a = \frac{V_a}{V_T} = \eta q_c = \frac{e}{1+e}(1-S)$

$= \frac{e}{1+e}\left(1 - \frac{w_1}{e}\right)$

$\frac{V_a}{100} = \frac{0.67}{1+0.67}\left(1 - \frac{0.12 \times 2.65}{0.67}\right)$

$V_a = 21.06\ m^3$

Method ② $w_2 - w_1 = \frac{\Delta wt\ of\ water}{wt\ of\ solids} = \frac{(\Delta V)_w f_w}{W_s}$

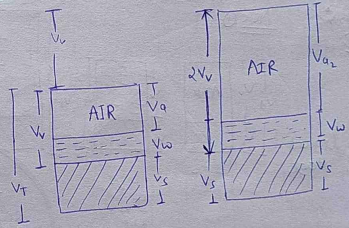
$W_s = \frac{G\gamma_w}{1+e} \times V_T = \frac{2.65 \times 9.81 \times 100}{1+0.67}$

$\gamma_d = \frac{G\gamma_w}{1+e} = \frac{W_s}{V_T}$

$S = 1,\ w_2 = \frac{Se}{S} = \frac{1 \times 0.67}{2.65}$

$w_2 = 0.25 = 25\%$

Ques - (15)



$\eta_{a_2} = \frac{V_{a_2}}{V_{T_2}} = \frac{V_a + V_v}{V_T + V_v}$

$= \frac{V_v\left(\frac{V_a}{V_v} + 1\right)}{V_v\left(\frac{V_T}{V_v} + 1\right)}$

$= \frac{q_c + 1}{\eta + 1}$

$= \frac{q_c + 1}{\eta q_c + 1}$

$= \frac{(q_c + 1)\eta_a}{(q_c + \eta_a)}$

$q_c = \frac{V_a}{V_v}$

$\eta_a = \frac{V_a}{V_T} = \eta . q_c$

Ans ©

Ques - (19)

$V_s = \frac{(G-1)\gamma_w}{18\mu} d^2$

$V_s \propto d^2$

$V_{s_1} = K d_1^2$ --- ①

$V_{s_2} = K d_2^2$ --- ②

$\frac{V_{s_1}}{V_{s_2}} = \frac{d_1^2}{d_2^2}$

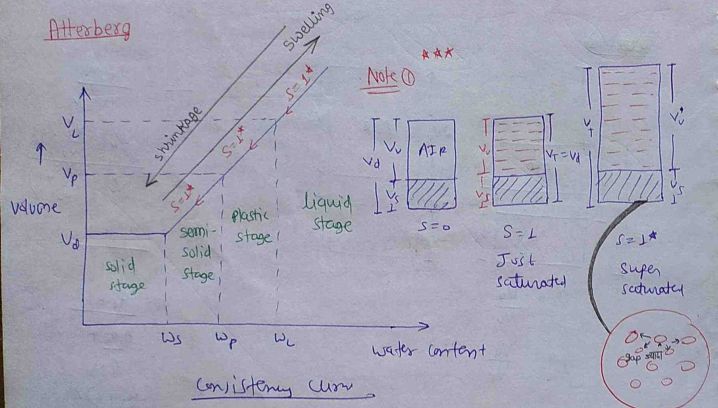
$\frac{0.5}{V_{s_2}} = \frac{(0.075)^2}{(0.005)^2}$

$V_{s_2} = 0.005\ mm/s$

CONSISTENCY OF SOIL

Consistency means Relative ease with which the soil can be deformed. It also denote the degree of firmness of soil which may be termed as Soft, Stiff, hard in directly in term of represent in strength of soil this termed is used only for fine grained soil and it is Related to water content.

Atterberg



Consistency Curve

Note ① Statement ① If soil is Partially saturated (S=0 Just saturation) any change in water content leads to no change in volm of voids, total volm of soil, void ratio (or) Porosity

② If soil is super saturated (S=1* then any change in water content lead to corresponding change in volm of voids and total volm of soil.

Note ② $\frac{dy}{dx} = \frac{V_L - V_P}{W_L - W_P} = \frac{V_P - V_d}{W_P - W_s} = \frac{V_L - V_d}{W_L - W_s}$ = Constant

(slope will constant)

Atterberg Analysed the consistency of soil in four stages AS-

a) Liquid b) Plastic c) semi-solid d) solid stage

→ The water content at which soil passes from one stage of consistency to another stage of consistency is termed as - consistency limit (or) Atterberg limit

① Liquid limit (W_L)

→ It is defined as minm water content at which soil has tendency to flow.

→ At liquid limit soil posses (Negligible) Sheas Strength of 2.7 Kn/m²

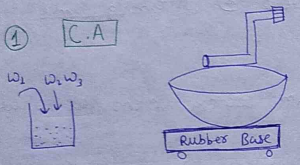
TYPE OF SOIL	Liquid limit %	Note
Gravel	Non-Plastic	Higher is W_L
Sand	Non-Plastic	Higher is the compressibility
Silt	30-40	
clay (Alluvial)	40-150	
clay (Black soil)	400-500	
clay (Bentonite)	400-800%	

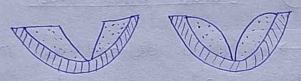
Imp	W_L	Description
	$W_L < 35\%$	Low compressible
	$35 \le W_L \le 50$	Intermediate compressible
	$W_L > 50$	High compressible

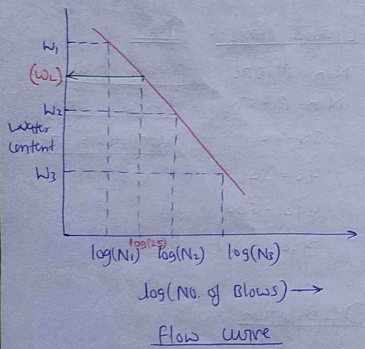
DETERMINATION OF W_L

1) Casgrande Apparatus
2) One point Method
3) Cone penetrometer Mtd

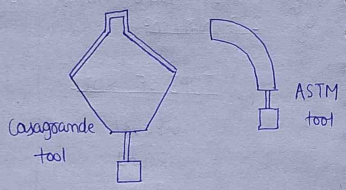
① C.A







Flow curve



(25 = No. of blows)
(W_L = liquid limit)

→ In order to find liquid limit no. of blows required by the soil to flow a distance of $\frac{1}{2}$ inch (approx. 12mm) corresponding to particular water content is noted

→ The test is repeated for same size of different water content and corresponding No. of Blows is noted

Note① the result of test are represented in form of a curve known as Flow curve from which water content corresponding to 25 No of blows is interpolated and is called as liquid limit

Note② the slope of flow curve is termed as Flow index which represent the rate of loss of shear strength with increase in water content

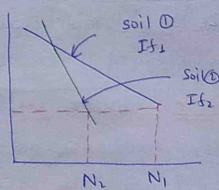
$$\text{Slope of flow curve } \left(\frac{dy}{dx}\right) = \frac{w_1 - w_2}{\log N_1 - \log N_2}$$

$$\text{Flow index } (I_f) = \left|\frac{w_1 - w_2}{\log N_1 - \log N_2}\right| = \frac{w_1 - w_2}{\log N_2 - \log N_1}$$

$$I_f = \frac{w_1 - w_2}{\log\left(\frac{N_2}{N_1}\right)} \quad \star \quad \text{——} ①$$

Note-③ Higher will be value of flow index for a particular soil lower will be it's shear strength corresponding to same water content

$$(I_f)_2 > (I_f)_1 = (\text{shear strength})_1 < (SS)_2$$



Note④ If Rubber base is replace by Metal base then flow index will increase

$$I_f)_{metal} > I_f)_{Rubber} > I_f)_{Soft\ Base}$$