CE363 - CE364

A1.

a) W = Natural state weight = 17.75 kN

W_s = Dry weight = 15.08 kN

V = Volume of soil = 1 m^3

$G_s = 2.70$ $\qquad \gamma_w = 10\ kN/m^3$

$$G_s = \frac{\gamma_s}{\gamma_w} \rightarrow \gamma_s = G_s \cdot \gamma_w = 2.70 \cdot 10\,(kN/m^3) = 27\ kN/m^3$$

$$\gamma_s = \frac{W_s}{V_s} \rightarrow V_s = \frac{W_s}{\gamma_s} = \frac{15.08}{27} = 0.5585\ m^3 \cong 0.56\ m^3$$

$$V_v = V - V_s = 1 - 0.56 = 0.44\ m^3$$

$$V_w = \frac{W_w}{\gamma_w} = \frac{17.75 - 15.08}{10} = 0.267\ m^3$$

$$w = \frac{W_w}{W_s} = \frac{17.75 - 15.08}{15.08} = \underline{17.70\ \%}$$

$$e = \frac{V_v}{V_s} = \frac{0.44}{0.56} = \underline{0.786}$$

$$n = \frac{V_v}{V} = \frac{0.44}{1.00} = \underline{0.44}$$

$$S_r = \frac{V_w}{V_v} = \frac{0.267}{0.440} = 0.6068 \cong \underline{61\ \%}$$

b)

$S_r = 100\ \%$

$e = 0.786$

$S_r \cdot e = w\ G_s$

$1.0 \cdot (0.786) = w \cdot 2.70 \longrightarrow w = \frac{0.786}{2.70} = 0.291 = \underline{29\ \%}$

$w = \frac{W_w}{W_s} \longrightarrow W_w = w \cdot W_s = 0.29 \cdot 15.08 = 4.373\ kN$

$\gamma = \frac{W_s + W_w}{V} = \frac{15.08 + 4.373}{1.0} = 19.453\ kN/m^3 = \underline{19.45\ kN/m^3}$

A2.)

$D_2 = \frac{e_{max} - e}{e_{max} - e_{min}}$ $\quad e_{max} = 0.97$ $\quad e_{min} = 0.45$

Let e_1 = void ratio for $D_2 = 0.40$ (before compact

e_2 = void ratio for $D_2 = 0.65$ (after compact

For $D_2 = 0.40$

$0.40 = \frac{0.97 - e_1}{0.97 - 0.45} = \frac{0.97 - e_1}{0.52}$

$e_1 = 0.97 - 0.40 \cdot (0.52) \Rightarrow e_1 = \underline{0.762}$

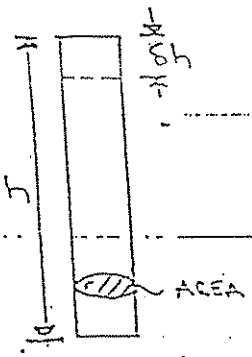
FOR $D_c = 0.65$

$$0.65 = \frac{0.97 - e_2}{0.97 - 0.45} = \frac{0.97 - e_2}{0.52}$$

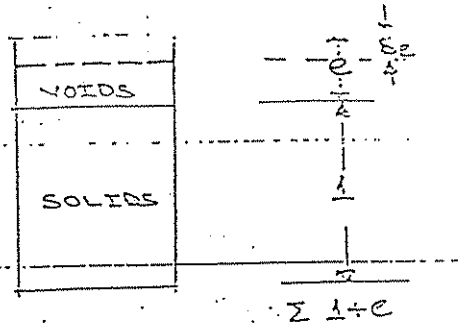
$$e_2 = 0.97 - 0.52(0.65) = \underline{0.632}$$

CHANGE IN VOID RATIO $= e_2 - e_1 = 0.632 - 0.762 = -0.13$

IN SITU COLUMN



DIAGRAM



FROM INSITU SOIL COLUMN,

Change in volume $= \delta h \times A$ — δh = change in height

Original volume $= h \times A$ — h = original height

ALSO FROM DIAGRAM OF SOIL,

$$\frac{\text{Change in volume}}{\text{Original volume}} = \frac{\delta e}{1 + e} \quad \text{---------- (2)}$$

Equating (1) and (2) $\Rightarrow$ $\dfrac{\delta h}{h} = \dfrac{\delta e}{1+e} = \dfrac{\delta e}{1+e_1}$

$\delta h = ?$

$h = 3\ m$

$$\delta h = h \cdot \frac{\delta e}{1 + e_1} = 3 \cdot \frac{-0.13}{1 + 0.762} = -0.221$$

$\delta h = -221\ mm$

SETTLEMENT IN SAND LAYER = 221 mm

A.3.

b) 98 % is coarse ⟹ either S or G

% 67 SAND

% 31 GRAVEL

% 2 FINES

Now $\frac{67}{98} \times 100 = 68.4\ \%$

68.4 % > 50 % ⟹ coarse fraction is sand. This lies sandy. S

fines = 2 % ⟹ 0 < fine < 5 % from table SW

or SP

$D_{60} = 1.40$ } obtained from the grain size distribution cu

$D_{30} = 0.52$

$D_{10} = 0.18$

$C_u = \frac{D_{60}}{D_{10}} = \frac{1.40}{0.18} = 7.77 \cong \underline{\underline{7.8}}$

$C_c = \frac{D_{30}^2}{D_{60} \cdot D_{10}} = \frac{0.52^2}{0.18 \cdot 1.40} = 1.07 \cong \underline{\underline{1.1}}$

C. } SW

3

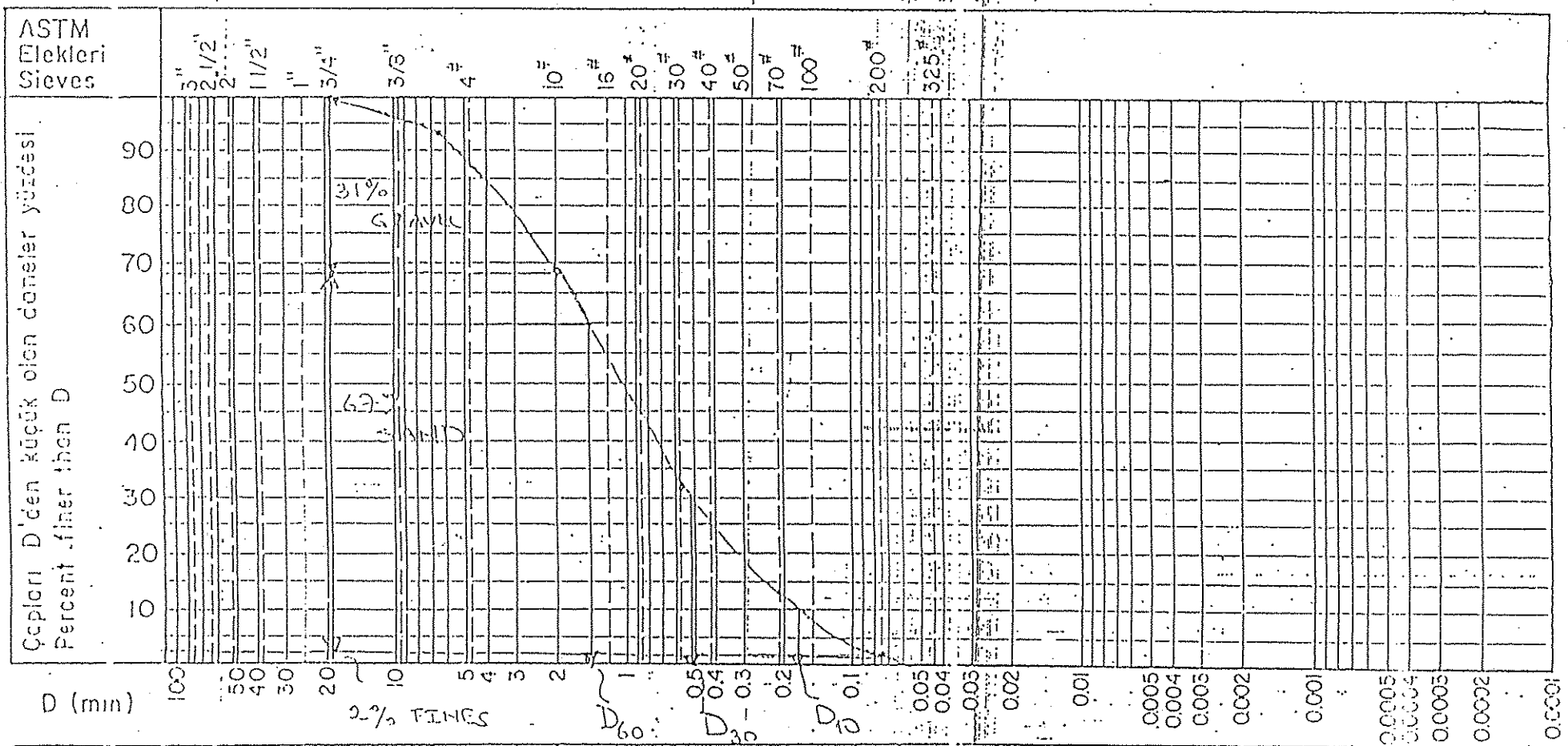
O.D.T.Ü./M.E.T.U.

Zemin Mek. Lab./Soil Mech. Lab.

GRANÜLOMETRİ EĞRİSİ
GRAIN SIZE CURVE

Sondaj No / Boring No: 1

Numune No / Sample No:

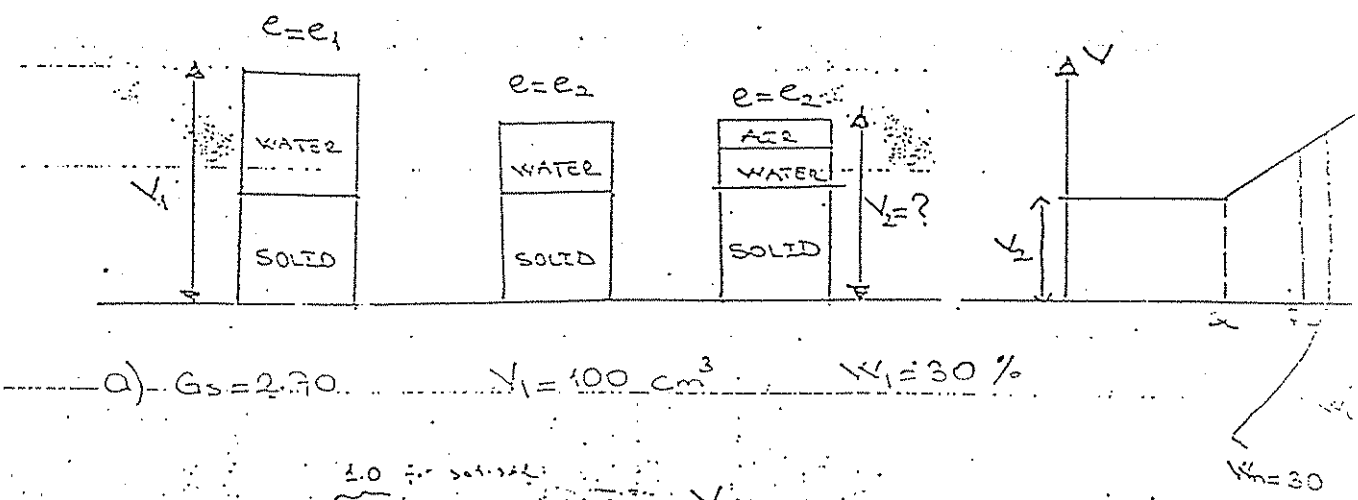


Zemin Soil	Taş Stone	Çakıl – Gravel			Kum – Sand			Silt – Silt			Kil – Clay
		Kaba Coarse	Orta Medium	İnce Fine	Kaba Coarse	Orta Medium	İnce Fine	Kaba Coarse	Orta Medium	İnce Fine	

A4.

LL = 55 % PL = 27 % SL = 20 %

$w_1 = 30\%$ $w_2 = SL = 20\%$ $w_3 = 15\%$



a) $G_s = 2.70$ $V_1 = 100\ cm^3$ $w_1 = 30\ \%$

$w \cdot G_s = e \cdot S_r$ (1.0 for saturated) $e = \frac{V_v}{V_s}$

$e_1 = w_1 \cdot G_s = 0.30 \cdot 2.70 = 0.81$ $V_s = \frac{V_{v_1}}{e_1} = \frac{100 - V_s}{0.81}$

$V_s = 55.25\ cm^3$

$e_2 = 0.20 \cdot 2.70 = 0.54$ $e_2 = \frac{V_{v_2}}{V_s} \rightarrow V_{v_2} = e_2 \cdot V_s$

$V_{v_2} = 0.54 \cdot 55.25$

$V_{v_2} = 29.84\ cm$

$V_I = V_s + V_{v_2} = 55.25 + 29.84 = 85.09\ cm^3$

b) $w_n = 30$ $PL < w_n < LL$ so PLASTIC

c) $PI = LL - PL = 55 - 27 = 28\ \%$

d) $LI = \frac{w_n - PL}{PI} = \frac{30 - 27}{28} = 0.107$