Assignment 3

(3) Prove

$$\gamma_d = \frac{\gamma_{SAT}}{1+w}$$

$$\gamma_d(1+w) = \gamma_{SAT}$$

$$\gamma_d + \gamma_d w = \gamma_{SAT}$$

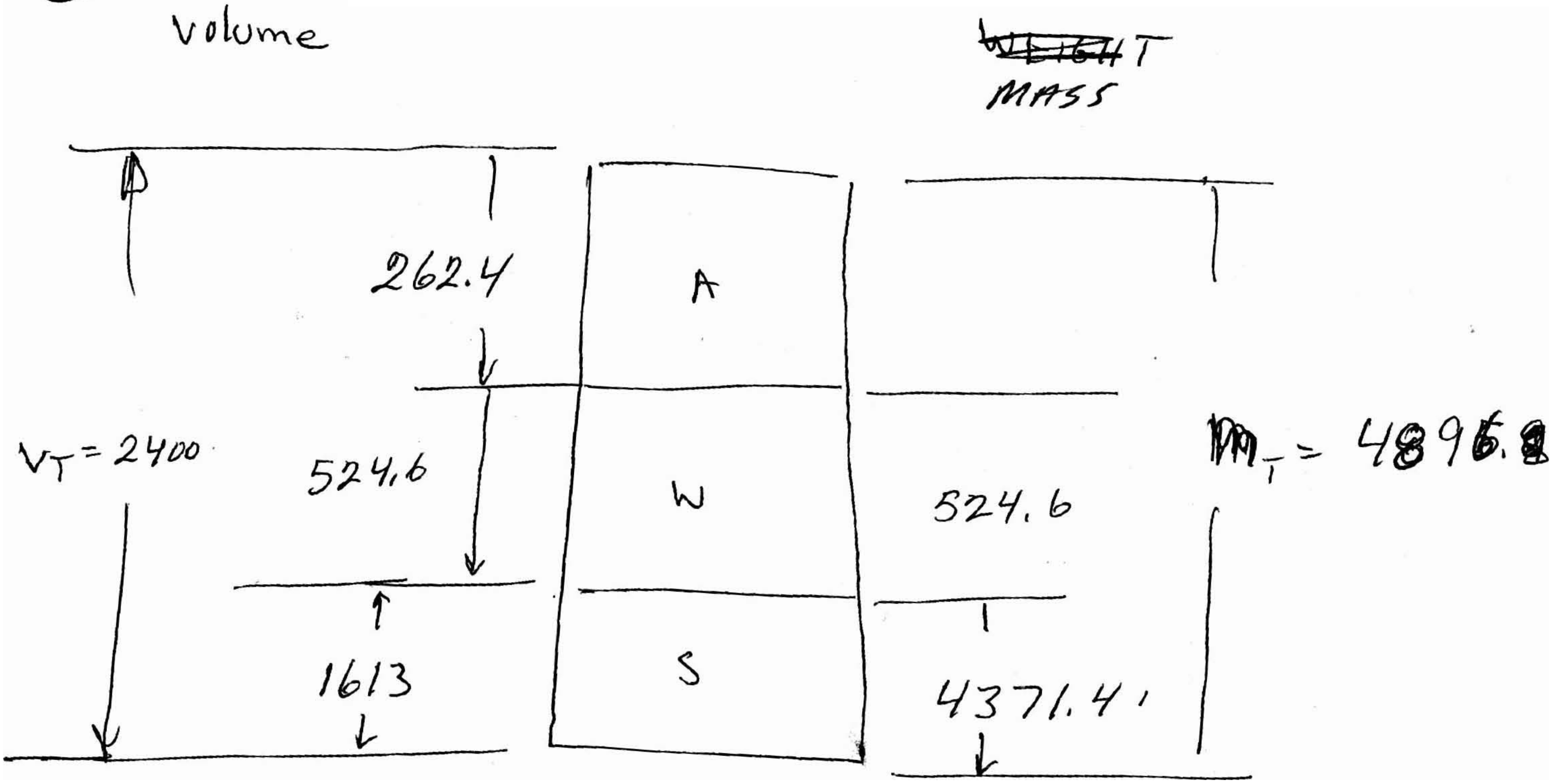
$$\gamma_{SAT} = \frac{W_w + W_s}{V} \qquad \gamma_d = \frac{W_s}{V} \qquad w = \frac{W_w}{W_s}$$

$$\therefore \frac{W_s}{V} + \frac{\cancel{W_s}}{V}\frac{W_w}{\cancel{W_s}} = \frac{W_w + W_s}{V}$$

$$\frac{W_s + W_w}{V} = \frac{W_w + W_s}{V}$$

Q4 INITIAL

volume



$$V_T = 20 \times 15 \times 8m = 2400\ m^3$$

$$w = \frac{M_w}{M_s}$$

$$\rho_{bulk} = \frac{M_w + M_s}{V_T} = \frac{M_T}{V_T}$$

$$M_w = w\ M_s$$

$$2.04\ Mg/m^3 = \frac{0.12\ M_s + M_s}{2400\ m^3} =$$

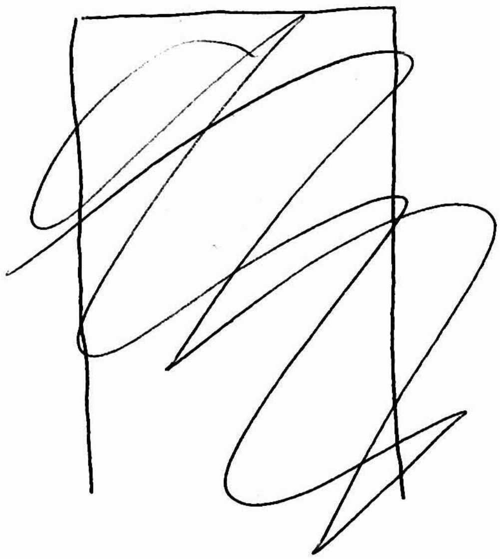
$$1.12\ M_s = 4896\ Mg = M_T$$

$$M_s = 4371.4$$

$$M_w = w\ M_s = 0.12\,(4371.4) = 524.6$$

Q4

$$\cancel{\rho_s =}\ G_s = \frac{\rho_s}{\rho_w}$$



$$\rho_s = 2.71 \cdot 1000\ kg/m^3$$

$$= 2710\ kg/m^3$$

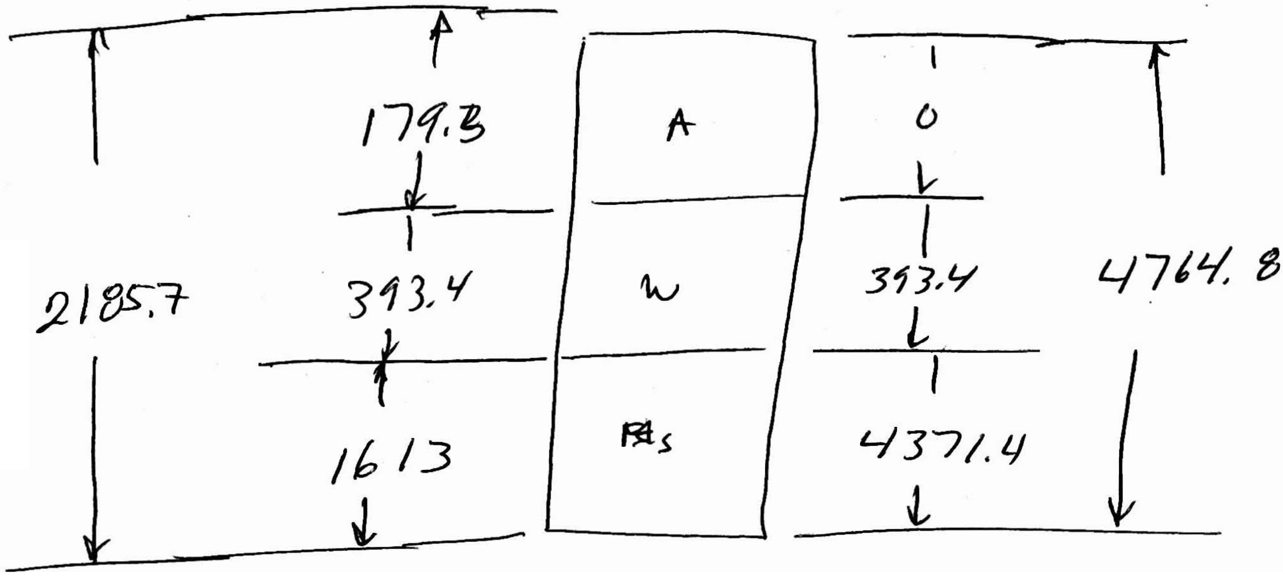
$$= 2.71\ Mg/m^3$$

$$\rho_s = \frac{M_s}{V_s}$$

$$V_s = \frac{M_s}{\rho_s} = \frac{4371.4}{2.71} = 1613.$$

$$\rho_w = \frac{M_w}{V_w} = V_w = \frac{M_w}{\rho_w} = \frac{524.6}{1.0\ Mg/m^3}$$

Q4 COMPACTED



$m_s = 4371.4 \text{ Mg}$ assuming no solids <u>lost</u>.

$w = 9\%$

$\therefore \quad w = \frac{M_w}{M_s}$ $\qquad M_w = 0.09 \cdot 4371.4$

$= 393.4$

$\rho_{dry} = \frac{M_s}{V_T}$

$V_T = \frac{M_s}{\rho_{dry}} = \frac{4371.4 \text{ m}^3}{2.0 \text{ Mg/m}^3} = 2185.7 \text{ m}^3$

$\rho_s = \frac{M_s}{V_s}$ $\qquad V_s = \frac{M_s}{\rho_s} = \frac{M_s}{G_s \rho_w} = \frac{4371.4}{2.71 \cdot 1.0}$

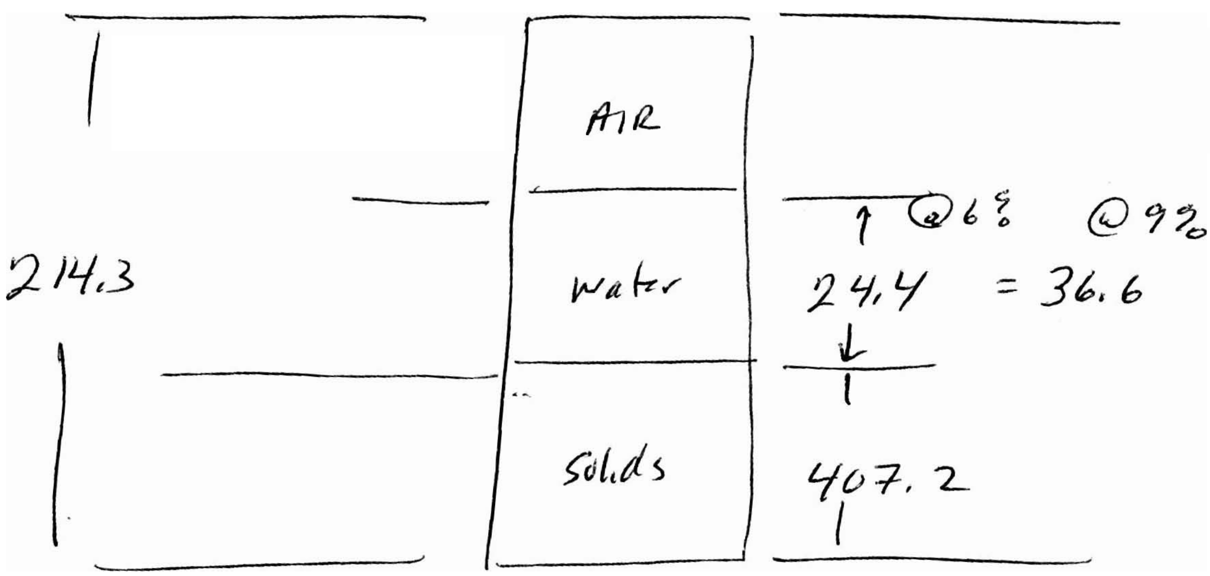
$V_w = \frac{M_w}{\rho_w} =$ $\qquad V_s = 1613.$

(Q4) Sr compacted SAND

$$S_{rv} = \frac{V_w}{V_v} = \frac{179.3}{179.3 + 393.4} = \frac{179.3}{572.7} = \underline{\underline{31.3\%}}$$

Volume short $= 2400 - 2185.7 = 214.3\ m^3$

$\boxed{w = 6.0\%}$



$\rho_d = 1.90\ Mg/m^3$

$$\rho_d = \frac{M_s}{V_T} \qquad M_s = \rho_d . V_T$$
$$= 1.9 \times 214.3$$
$$= 407.2$$

$$W = \frac{M_w}{M_s} \qquad M_w = 0.06(407.2) = 24.4$$
$$M_w = 0.09(407.2) = 36.6$$

Q4 ~~M~~ Mass to be brought in @ 6% water content.

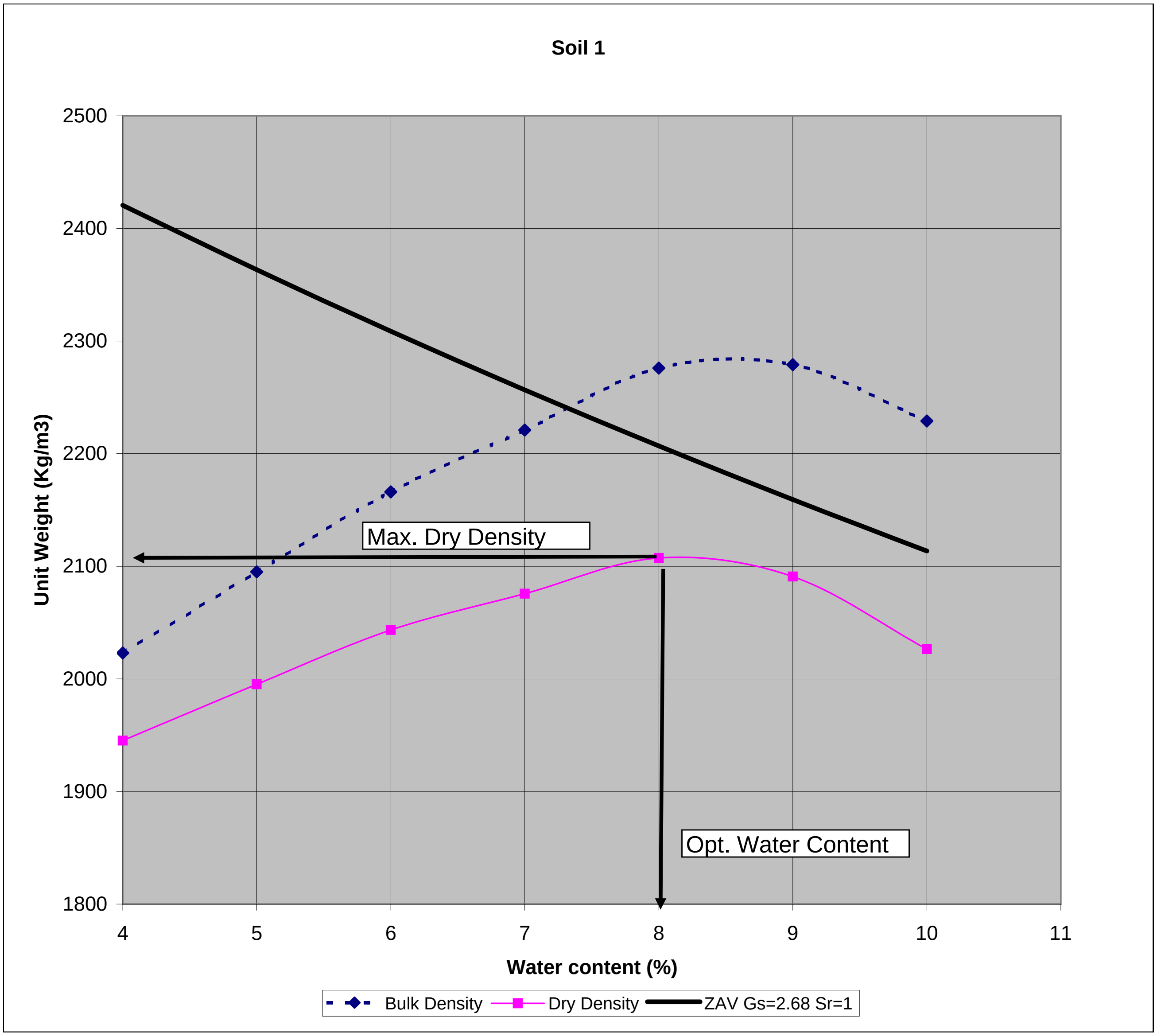
$$M_T = 24.4 + 407.2 = \underline{\underline{431.6 \text{ Mg}}}.$$

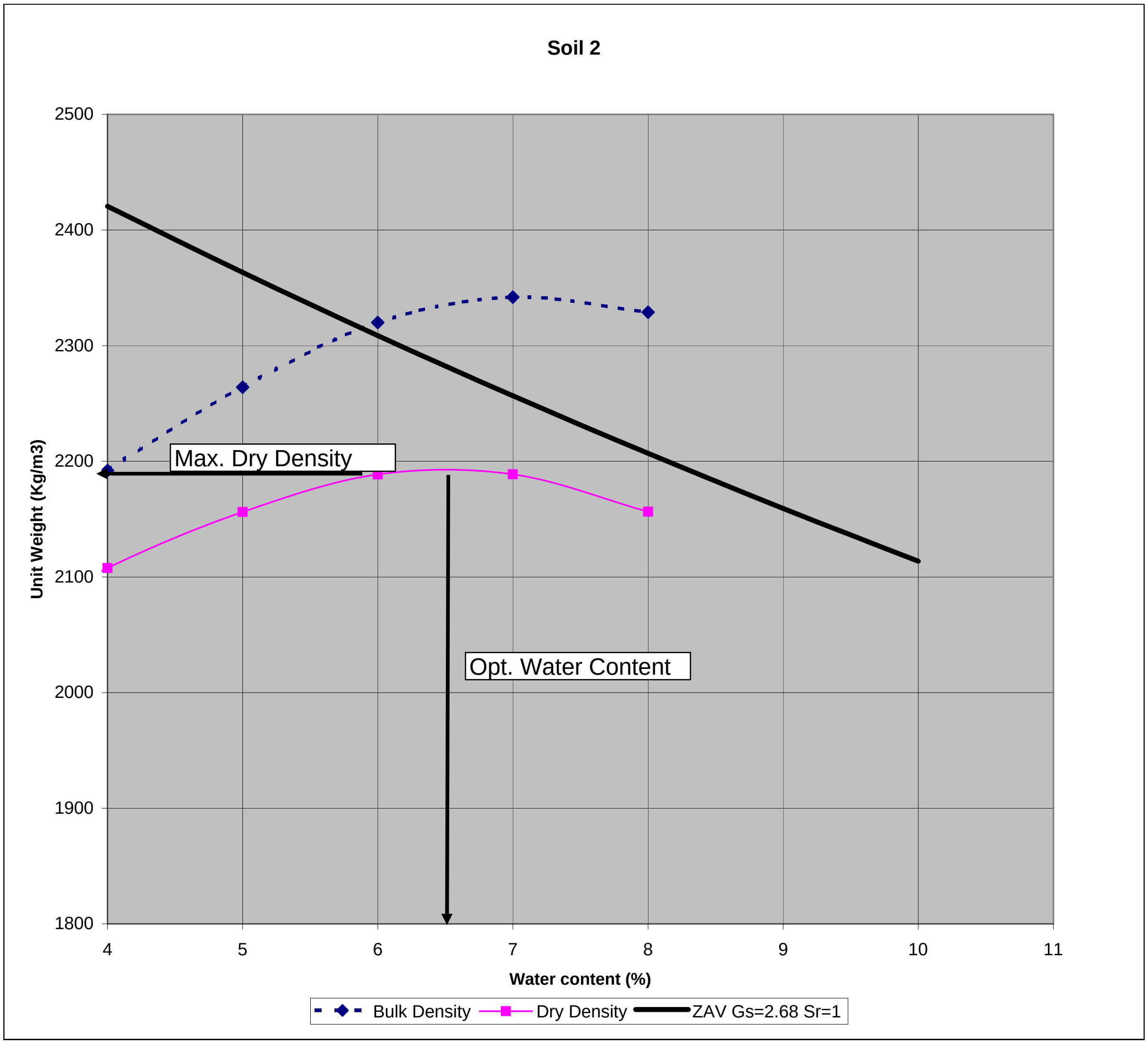
Amount of water $36.6 - 24.4 = \underline{\underline{12.2 \text{ Mg}}}$

Gs = 2.68

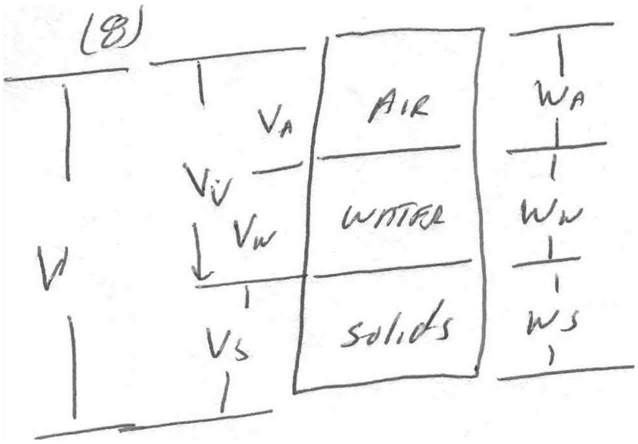
γw= 1000 kg/m3

Soil 1 Bulk Density kg/m3	Water Content (%)	Dry Density kg/m3	ZAV Dry Density Content (%)	Soil 2 Bulk Density kg/m3	Water Content (%)	Dry Density kg/m3
2023	4	1945.2	2420.5	2105	3	2043.7
2095	5	1995.2	2363.3	2192	4	2107.7
2166	6	2043.4	2308.8	2264	5	2156.2
2221	7	2075.7	2256.7	2320	6	2188.7
2276	8	2107.4	2206.9	2342	7	2188.8
2279	9	2090.8	2159.2	2329	8	2156.5
2229	10	2026.4	2113.6			




Soil 2
Unit Weight (Kg/m3)
2500
2400
2300
2200
2100
2000
1900
1800
4
5
6
7
8
9
10
11
Water content (%)
Max. Dry Density
Opt. Water Content
Bulk Density
Dry Density
ZAV Gs=2.68 Sr=1

(8)



$$\gamma_d = \frac{W_s}{V} \qquad \gamma_t = \frac{W_w + W_s}{V}$$

γ for constant V

γ_d ~~↑ W_s ↑ γ_d~~

If $\gamma_d \uparrow$ $W_s \uparrow$

if $W_s \uparrow$ $V_s \uparrow$ and $V_v \downarrow$ + $e \downarrow$

$\therefore$ $\gamma_d \uparrow$ $e \downarrow$ thus $\gamma_d \approx \frac{1}{e}$

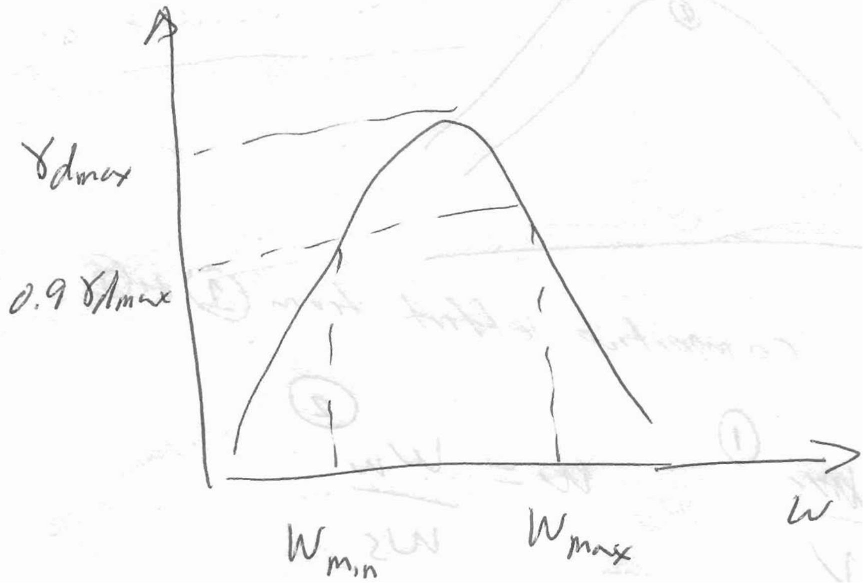
a increase in γ_d must ~~decre~~ result in decrease in the soil ~~voi~~ void ratio

$$\gamma = \frac{W_w + W_s}{V}$$

if $\gamma \uparrow$ not sure if due to increase in W_w or W_s $\therefore$ no direct relationship to void ratio.

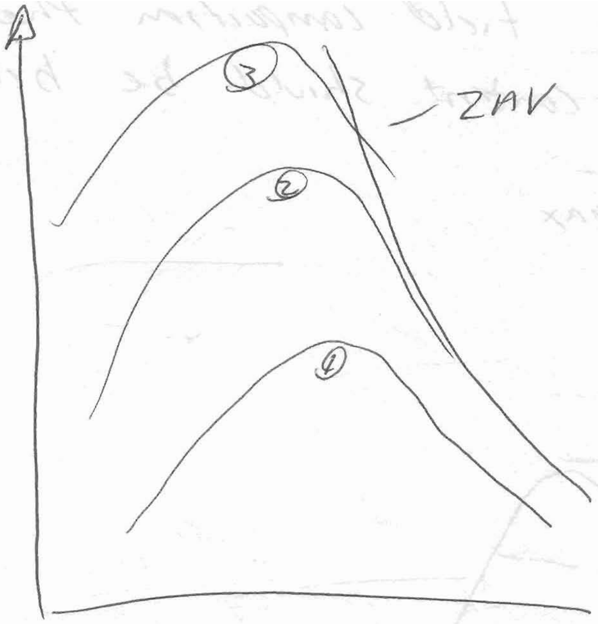
(9) To obtain field compaction the soil water content should be between

W_{min} + W_{max}



If soil to wet or dry then you will not be able obtain the desired field ~~dry~~ γ_{dry} or @ minimum void ratio desired.

10)



Increasing compactive effort from 1 to 3

$$\gamma_d = \frac{W_s}{V} \quad (1) \qquad w = \frac{W_w}{W_s} \quad (2)$$

$\gamma_d \uparrow$ with compactive effort

$w \downarrow$ with compactive ~~effort~~.

for constant V

$\gamma_d \uparrow$ ~~with~~ $M_s \uparrow$

if $M_s \uparrow$ $w \downarrow$ ⇐ less space for water