1. gyakorlat feladatainak megoldása

1.) $\rho_s = 2{,}65\ t/m^3$

Méretek: magasság: 6 cm
átmérő: 4 cm

$m_n = 140{,}3\ g$

$m_d = 120{,}4\ g$

Számítandó: - s; v; l értékek
- ábrázolás s-ben
- e; n; S_r; w; γ_n; γ_d

$$\rho_d = \frac{m_d}{V} = s \cdot \rho_s$$

$$V = r^2 \cdot \pi \cdot m = 2^2 \cdot 3{,}14 \cdot 6 = 75{,}36\ cm^3$$

$$s = \frac{m_d}{V \cdot \rho_s} = \frac{120{,}4}{75{,}36 \cdot 2{,}65} = 0{,}603$$

$s = 60{,}3\ \%$

$$w(\%) = \frac{m_n - m_d}{m_d} \cdot 100 = \frac{140{,}3 - 120{,}4}{120{,}4} = 0{,}1653$$

$w \doteq 16{,}53$

$$w = \frac{v \cdot \rho_v}{s \cdot \rho_s}$$

$$v = \frac{w \cdot s \cdot \rho_s}{\rho_v} = \frac{0{,}1653 \cdot 0{,}603 \cdot 2{,}65}{1} = 0{,}264$$

$v = 26{,}4\ \%$

$$l = 1 - (s + v) = 1 - (0{,}603 + 0{,}264) = 0{,}133$$ **$l = 13{,}3\ \%$**

$$e = \frac{1-s}{s} = \frac{1 - 0{,}603}{0{,}603} = 0{,}658$$ **$e = 0{,}658$**

$$n = (1-s) \cdot 100 = (1 - \underset{\text{nema } e;\ 1=0{,}603}{0{,}658}) \cdot 100 = \underset{39{,}7}{34{,}2}$$ **$n = 34{,}2\ \%$**

$$S_r = \frac{v}{1-s} = \frac{0{,}264}{1 - 0{,}603} = 0{,}664$$

$$\gamma_n = g \cdot \frac{m_n}{V} = \frac{140{,}3}{75{,}36} \cdot 10 = 1{,}86\ g/cm^3 = 1{,}86\ kg/dm^3 =$$

$$= 1{,}86 \cdot 10^{+3}\ kg/m^3 \cdot 10\ \frac{m}{s^2} =$$

$$= 18600\ \frac{N}{m^3} = 18{,}6\ kN/m^3$$

$\gamma_n = 18{,}6\ kN/m^3$

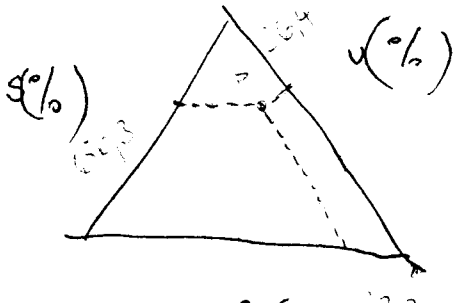
$$\rho_d = \frac{m_d}{V}$$

$$\gamma_d = \rho_d \cdot g = \frac{m_d}{V} \cdot g = \frac{120{,}4}{75{,}36} \cdot g = 1{,}60\ g/cm^3 \cdot g =$$

$$= 1{,}60 \cdot 10^3\ kg/m^3 \cdot 10\ \frac{m}{s^2} = 16000\ \frac{N}{m^3} = 16\ kN/m^3$$

$\gamma_d = 16\ kN/m^3$

Abrahola's:



$$S_r = \frac{V}{1-s} = \frac{0,25}{1-0,625} = 0,66$$

$S_r = 0,66$

$$\gamma_d = g \cdot \rho_d = g \cdot s \cdot \rho_s = 10 \frac{m}{s^2} \cdot 0,625 \cdot 2,8 \ t/m^3$$

$$\gamma_d = 17,5 \ kN$$

2. feladat

Magasság: 10 cm

$s = 50\%$ $\quad v = 20\%$

$\rho_s = 2{,}8\ t/m^3$

a) Számítandó: S_r és γ_d értéke

$$S_r = \frac{v}{1-s} = \frac{0{,}2}{1-0{,}5} = 0{,}4$$

$$\boxed{S_r = 0{,}4}$$

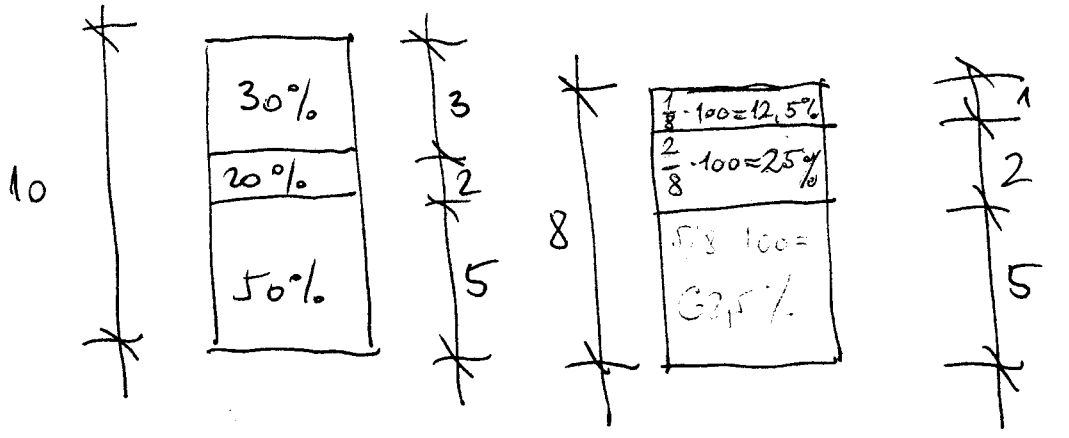
$$\gamma_d = g \cdot \rho_d = g \cdot s \cdot \rho_s = 10\ \frac{m}{s^2} \cdot 0{,}5 \cdot 2{,}8\ t/m^3$$

$$\boxed{\gamma_d = 14\ kN/m^3}$$

b) új magasság: 8 cm

$\rho_s = 2{,}8\ t/m^3$

Levegőtartalom nőtt $0{,}2 \cdot V$ térfogattal.



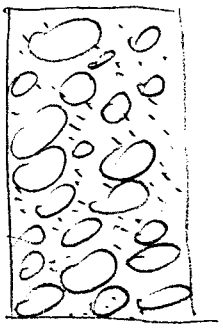
$s = 0{,}625$ $\quad v = 0{,}25$ $\quad l = 0{,}125$

3. feladat

$V = 50\ l = 50\ dm^3$

$m_d = 81\ kg$

$S_r = 1{,}0 \rightarrow m_t = 104\ kg$



$\rho_s = ?$ $\quad c = ?$

$m_{víz} = m_t - m_d = 104 - 81 = 23\ kg.$

$V_{víz} = 23\ dm^3$

$v = \frac{23}{50} = 0{,}46 \quad v(\%) = 46\%$

$s = 1 - (v + l) = 0{,}54 \quad s(\%) = 54\%$

$c = \frac{1-s}{s} = \frac{1-0{,}54}{0{,}54} = 0{,}85$ $\boxed{c = 0{,}85}$

$c = \frac{V \cdot \rho_s}{m_d} - 1$

$\rho_s = \frac{(c+1) \cdot m_d}{V} = \frac{(0{,}85+1) \cdot 81}{50}$

$\boxed{\rho_s = 2{,}997\ t/m^3}$

4. feladat: Ábrázolandó a $\rho_s = 2{,}7\ t/m^3$ térfogatsűrűségű iszap $w = 30\%$, $\rho_n = 1{,}75\ t/m^3$ és $S_r = 0{,}8$ jellemzőihez tartozó egyenesei.

$$W = \frac{v \cdot \rho_v}{s \cdot \rho_s} \cdot 100 \qquad \frac{v \cdot \rho_v}{s \cdot \rho_s} = 0{,}3$$

$$S_r = \frac{v}{1-s} \qquad \frac{v}{1-s} = 0{,}8$$

$$\rho_n = s \cdot \rho_s + v \cdot \rho_v \qquad s \cdot \rho_s + v \cdot \rho_v = 1{,}75$$

egyenletrendszer

$$v = (1-s) \cdot 0{,}8 = 0{,}8 - 0{,}8 \cdot s$$

$$s \cdot \rho_s + 0{,}8 - 0{,}8 \cdot s = 1{,}75$$

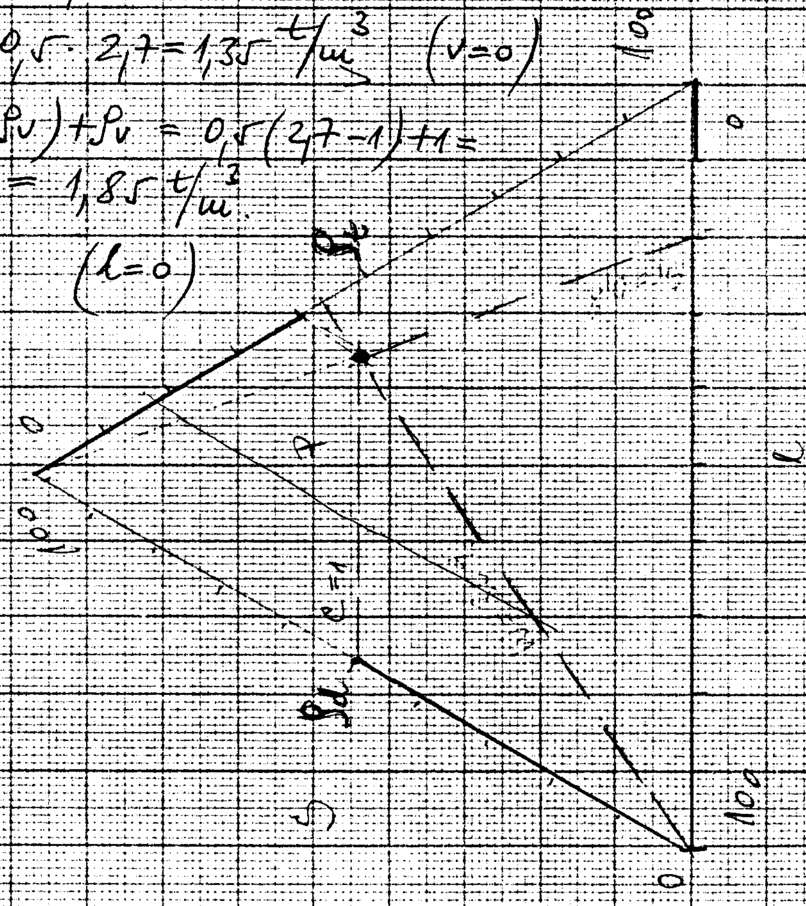
$$1{,}9 \cdot s = 0{,}95$$

$$\boxed{s = 0{,}5} \quad \boxed{v = 0{,}4} \quad \boxed{l = 0{,}1}$$

$$e = \frac{1-s}{s} = \frac{1-0{,}5}{0{,}5} = 1$$

$$\rho_d = s \cdot \rho_s = 0{,}5 \cdot 2{,}7 = 1{,}35\ t/m^3 \quad (v=0)$$

$$\rho_t = s \cdot (\rho_s - \rho_v) + \rho_v = 0{,}5(2{,}7-1)+1 = 1{,}85\ t/m^3 \quad (l=0)$$



5. feladat

$V_1 = 35000\ m^3$ $\quad V_2 = ?$

$n_1 = 46\ \%$ $\quad n_2 = 32\%$

$\rho_s = 2{,}65\ g/cm^3$

$w = 10\ \%$

$$n_1(\%) = \frac{V - \frac{m_d}{\rho_s}}{V} \cdot 100 \Rightarrow 1 - \frac{\frac{m_d}{\rho_s}}{V}$$

$$m_d = (1-n) \cdot V_1 \cdot \rho_s = 0{,}54 \cdot 35000 \cdot 2{,}65\ t/m^3$$

$$m_d = 50085\ t.$$

$$V_2 = \frac{m_d}{\rho_s \cdot (1-n_2)} = \frac{50085}{2{,}65 \cdot (1-0{,}32)} = 27794\ m^3$$

$$\boxed{V_2 = 27794\ m^3}$$

$$(\%)n = (1-s) \cdot 100$$

$s_1 = 1 - n = 0{,}54$ $\quad s_2 = 0{,}68$

$v_1 = \frac{w \cdot s_1 \cdot \rho_s}{\rho_v} = 0{,}14$ $\quad v_2 = 0{,}18$

$l_1 = 0{,}32$ $\quad l_2 = 0{,}14.$

$$V \cdot n = V - \frac{m_d}{\rho_s}$$

$$V \cdot n - V = -\frac{m_d}{\rho_s}$$

$$V \cdot (1-n) = \frac{m_d \rho_s}{\rho_s} \Rightarrow V = \frac{m_d}{\rho_s \cdot (1-n)}$$

felírni

6. feladat

$V_1 = 1000\ cm^3$ $\quad V_2 = 730\ cm^3$

$m_{n_1} = 1{,}55\ kg$ $\quad \rho_s = 2{,}7\ g/cm^3$

$m_d = 1{,}31\ kg$

$s_1 ; \sigma_1 ; l_1$? $\quad s_2 ; \sigma_2 ; l_2$?

halmazsűrűségi diagramm.

$$l_1 = V_1 - V_2 = 1000 - 730 = 0{,}27$$ $\boxed{l_1 = 0{,}27}$

$$s_1 = \frac{m_d}{V_1 \cdot \rho_s} = \frac{1310}{1000 \cdot 2{,}7} = 0{,}49$$ $\boxed{s_1 = 0{,}49}$

$$m_v = m_{n_1} - m_d = 1{,}55\ kg - 1{,}31\ kg = 0{,}24\ kg$$

$\boxed{v_1 = 0{,}24}$

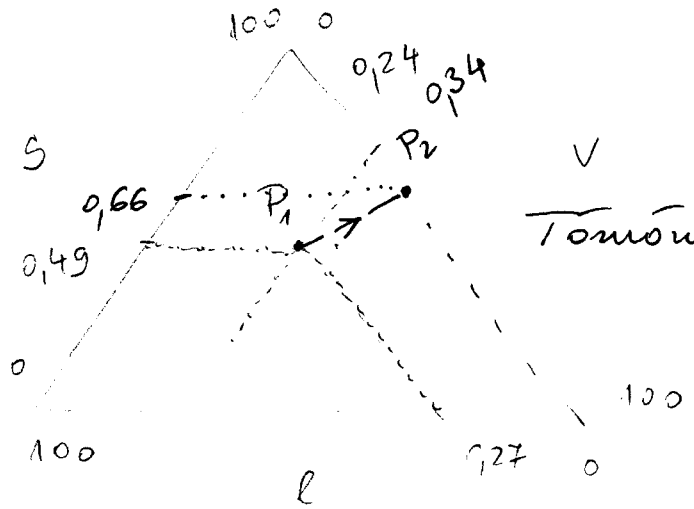
$\boxed{l_2 = 0}$

$$e_2 = \frac{V_2 \cdot \rho_s}{m_d} - 1 = \frac{730 \cdot 2{,}7}{1310} - 1 \qquad e_2 = 0{,}5$$

$$e_2 = \frac{1 - s_2}{s_2} \Rightarrow s_2 = \frac{1}{1 + e_2} = \frac{1}{1 + 0{,}5}$$

$\boxed{s_2 = 0{,}66}$

$\boxed{v_2 = 0{,}34}$



Tovább nincs adat!

7. feladat:

$w = 18\,\%$ $\quad s_1 = 0{,}3\,m$

$Trp = 92\,\%$ $\quad s_2 = 0{,}2\,m$

$\rho_{dmax} = 1{,}88\ g/cm^3$

$\rho_s = 2{,}7\ g/cm^3$

$s_1; v_1; l_1 = ?$ $\qquad s_2; v_2; l_2 = ?$

$$Trp = \frac{\rho_d}{\rho_{dmax}} \cdot 100$$

$$\rho_d = Trp \cdot \rho_{dmax} = 0{,}92 \cdot 1{,}88 = 1{,}72\ g/cm^3$$

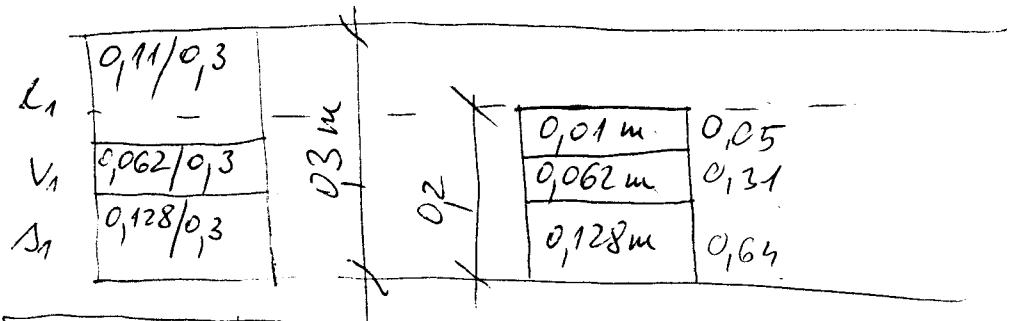
$$\rho_d = s \cdot \rho_s \qquad s = \frac{\rho_d}{\rho_s} = \frac{1{,}72}{2{,}7} = 0{,}64 \qquad \boxed{s_2 = 0{,}64}$$

$$w = \frac{v \cdot \rho_v}{s \cdot \rho_s} \qquad v = \frac{w \cdot s \cdot \rho_s}{\rho_v} = \frac{0{,}18 \cdot 0{,}64 \cdot 2{,}7}{1}$$

$$\boxed{v_2 = 0{,}31}$$

$$l = 1 - (s + v) = 1 - (0{,}64 + 0{,}31)$$

$$\boxed{l_2 = 0{,}05}$$



$s_1 = 0{,}43$	$v_1 = 0{,}21$	$l_1 = 0{,}36$

8.)

$V_1 = 10^6\ m^3$

$I_p = 15\ \%$

$\rho_m = 1{,}82\ t/m^3$

$w = 13{,}5\ \%$

$\rho_d^{max} = 1{,}88\ t/m^3$

$T_{rp} = 95\ \%$

Megoldás:

$$T_{rp} = \frac{\rho_d}{\rho_d^{max}} \Rightarrow \rho_{d_2} = 0{,}95 \cdot 1{,}88 = 1{,}786\ t/m^3$$

$I_p = 15\ \% \rightarrow$ iszap: $\rho_s = 2{,}7\ g/cm^3$

$$\rho_{h_1} = \frac{m_{n_1}}{V_1} \Rightarrow m_{n_1} = 10^6 \cdot 1{,}82 = 1\,820\,000\ t.$$

$$w = \frac{m_n - m_d}{m_d} \Rightarrow m_d = \frac{m_n}{1+w} = \frac{1\,820\,000}{1 + 0{,}135}$$

$$m_d = 1\,603\,524{,}23\ t$$

$$V_2 = \frac{m_d}{\rho_{d_2}} = \frac{1\,603\,524{,}23}{1{,}786} = \underline{\underline{897\,829{,}9\ m^3}}$$

9.

$w_p = 25\ \%$
$w_L = 55\ \%$
$I_c = 0{,}85$
$\rho_n = 1{,}83\ t/m^3$

fázisdiagram:

w, n, S_r, s, v, l

$$I_c = \frac{w_L - w}{w_L - w_p} = \frac{w_L - w}{I_p}$$

$$I_p = w_L - w_p = 55 - 25 = 30\ \%$$

$$I_c \cdot I_p = w_L - w$$

$$w = w_L - I_c \cdot I_p = 0{,}55 - 0{,}85 \cdot 0{,}3 = \underline{0{,}295 = w}$$

szemcse sűrűség: $\rho_s = 2{,}8\ g/cm^3$

$1\ m^3$-re: $\rho_n = \frac{m_n}{V} \Rightarrow m_n = 1{,}83 \cdot t$

$$m_d = \frac{m_n}{1+w} = \frac{1{,}83}{1+0{,}295} = 1{,}41\ t$$

$$\rho_d = \frac{m_d}{V} = s \cdot \rho_s \qquad s = \frac{m_d}{V \cdot \rho_s} = \frac{1{,}41}{1 \cdot 2{,}8} = \underline{0{,}50}$$

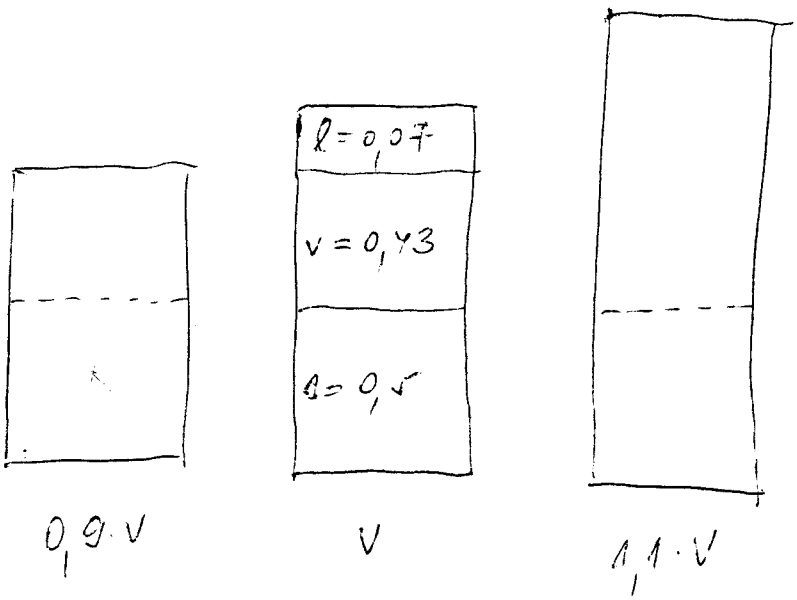
$$\rho_n = s \cdot \rho_s + v \cdot \rho_v$$

$$v = \frac{\rho_n - s \cdot \rho_s}{\rho_v} = \frac{1{,}83 - 0{,}5 \cdot 2{,}8}{1} = \underline{0{,}43}$$

$$l = 1 - (0{,}5 + 0{,}43) = \underline{0{,}07}$$

$$n_l = (1 - s) \cdot 100 = \underline{50\ \%}$$

$$S_r = \frac{v}{1-s} = \frac{0{,}43}{0{,}5} = \underline{0{,}86}$$



0,9 · V V 1,1 · V

V = 0

$s = \frac{0,5}{0,9} = 0,56$

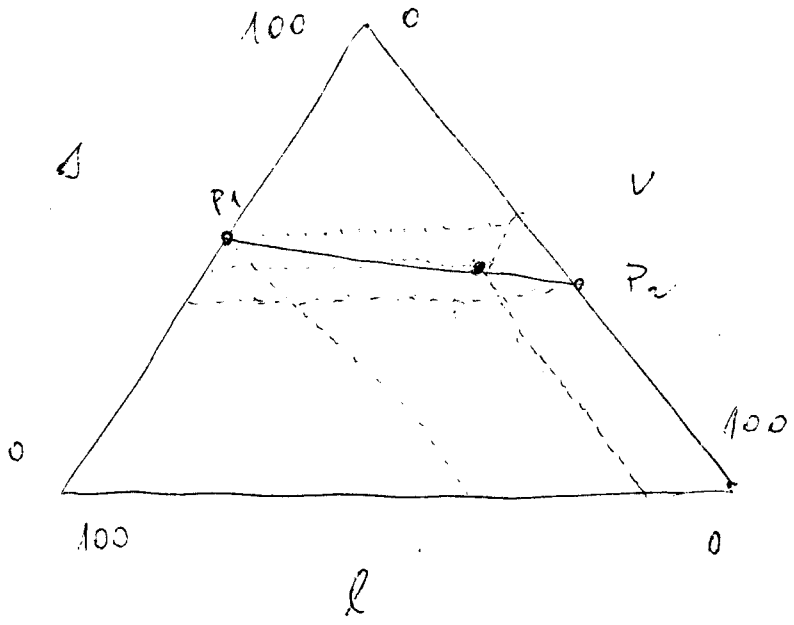
$l = \frac{0,43}{0,9} = 0,47$

$1 - 0,56 = 0,44$

l = 0

s = 0,45

v = 0,55



c) 2 azonatlan minta:

$d = 7{,}5$ cm

$h = 20$ cm

térfogat: $w = 12\%$ $\quad S_r = 0{,}98$

$$w = 12\% = \frac{V \cdot S_r}{s \cdot 2{,}7} \Rightarrow \quad V = 0{,}324 \cdot s$$

$$S_r = 0{,}98 = \frac{0{,}324 \cdot s}{1 - s}$$

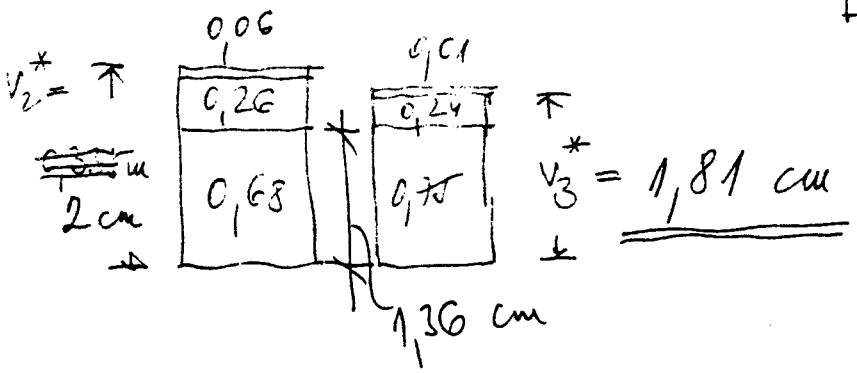
$$0{,}98 - 0{,}98 \cdot s = 0{,}324 \cdot s$$

$$0{,}98 = 1{,}304 \cdot s$$

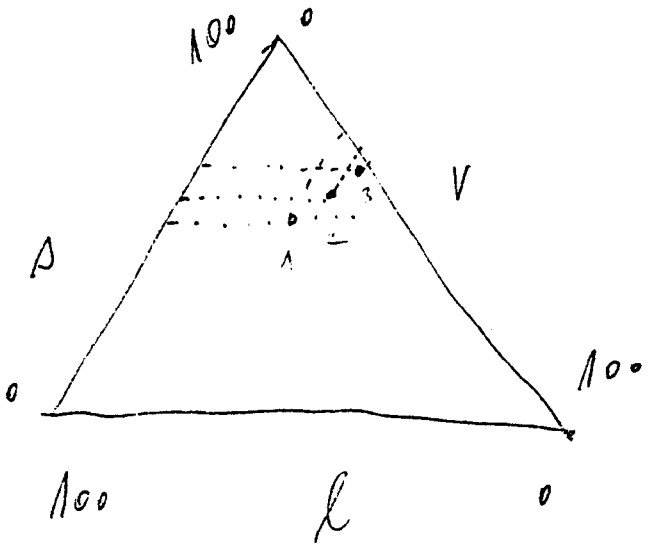
$s = 0{,}75$

$V = 0{,}24$

$l = 0{,}01$



$V_3^* = 1{,}81$ cm



$\rho_d \to \rho_t$ vonal ábrázolása:

$1{,}93 = s \cdot \rho_s + v \cdot \rho_v$ $\quad v=0 \to s = \frac{1{,}93}{2{,}75} = 0{,}7$

$\left[s=0 \to v = \frac{1{,}93}{1} = 1{,}93 \right]$

Egyenletek:

$$w = \frac{v \cdot \rho_v}{s \cdot \rho_s} \cdot 100$$

$$s_r = \frac{v}{1-s} \cdot 100$$

$$\rho_n = s \cdot \rho_s + v \cdot \rho_v$$

10.

$I_p = 14\%$ $\qquad S_r = 0{,}5$

$w = 14\%$.

$V^* = 0{,}4\ m$ laza tenték vastagság.

a.) $\boxed{I_p = 14\% \rightarrow \text{iszap}: \rho_s = 2{,}7\ g/cm^3}$

$$S_r = \frac{v}{1-s}$$

$$w = \frac{v \cdot \rho_v}{s \cdot \rho_s} = 0{,}14 = \frac{v \cdot 1}{s \cdot 2{,}7} \Rightarrow \cancel{v = 0{,}14 \cdot s + 0{,}378}$$

$$v = 0{,}378 \cdot s$$

$$S_r = \frac{0{,}378 \cdot s}{1-s} = 0{,}5$$

$$0{,}378 \cdot s = (1-s) \cdot 0{,}5 = 0{,}5 - 0{,}5 \cdot s$$

$$0{,}878 \cdot s = 0{,}5$$

$$\boxed{\begin{aligned} s &= 0{,}57 \\ v &= 0{,}21 \\ l &= 0{,}22 \end{aligned}}$$

$$V_1^* = 0{,}4\ m$$

b.) 5 hengerjárat után $S_r = 0{,}8$

$$v = 0{,}378 \cdot s$$

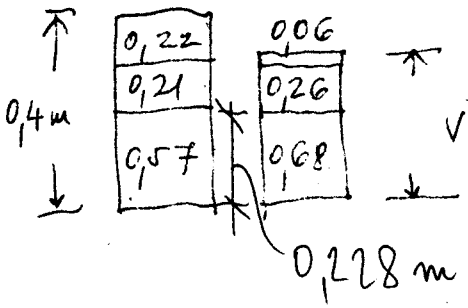
$$S_r = 0{,}8 = \frac{0{,}378 \cdot s}{1-s}$$

$$w = \frac{v \cdot \rho_v}{s \cdot \rho_s} \rightarrow v \qquad (w = 0{,}14;\ \rho_s = 2{,}7)$$

$$0{,}8 - 0{,}8 \cdot s = 0{,}378 \cdot s$$

$$0{,}8 = 1{,}178 \cdot s$$

$$\boxed{\begin{aligned} s &= 0{,}68 \\ v &= 0{,}26 \\ l &= 0{,}06 \end{aligned}}$$



$$V_2^* = 0{,}335\ m$$

11.

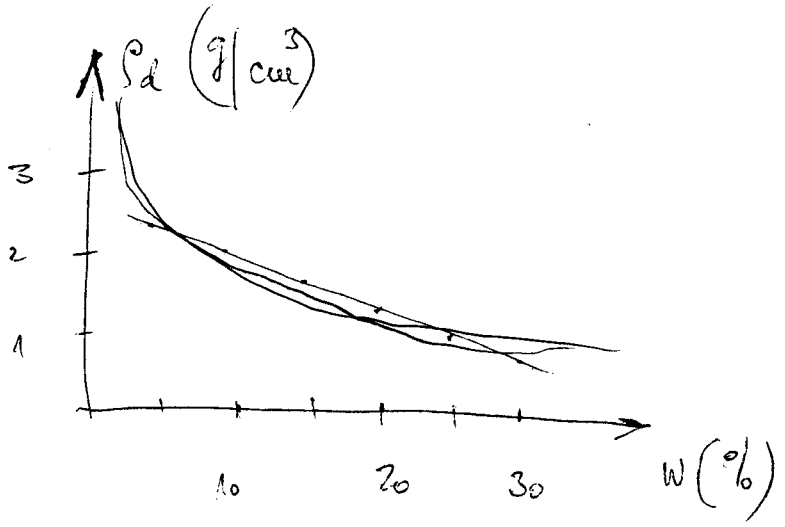
Jovaíny agyag: ρ_d ; w összefüggése
$S_r = 0,8$ és $w = 0,1 - 30\ \%$ között
5 %-onként.

$\rho_s = 2,75\ g/cm^3$ (kiszárított talaj)

$$\rho_d = \frac{S_r \cdot \rho_v}{S_r \cdot \rho_v + w \cdot \rho_s} \cdot \rho_s = \frac{0,8 \cdot 1}{0,8 + w \cdot 2,75} \cdot 2,75$$

~~($\rho_d =$)~~

w : (%)	ρ_d : $[g/cm^3]$	
5	~~0,85~~ 2,35	
10	~~0,74~~ 2,04	-0,062
15		-0,046
20	1,81 / 1,63	-0,036
25	1,48	
30	1,35	



12.

$V_1 = ?$ $\quad V_2 = 10^5\ m^3$

$J_p = 15\ \%$

$\rho_n = 1{,}78\ t/m^3$

$w = 14\ \%$

$\rho_d^{max} = 1{,}82\ t/m^3$

$T_{rp} = 95\ \%$

$T_{rp} = \dfrac{\rho_d}{\rho_{dmax}}$

$\rho_d = \rho_d^{max} \cdot T_{rp} = 1{,}729\ g/cm^3$

$\rho_d = \dfrac{m_d}{V} \Rightarrow m_d = V_2 \cdot \rho_d = 10^5 \cdot 1{,}729 =$

$172\,900\ t$

$w = \dfrac{m_n - m_d}{m_d} \Rightarrow w \cdot m_d = m_n - m_d$

$m_n = w \cdot m_d + m_d = m_d \cdot (w+1) =$

$= 172900 \cdot (0{,}14+1) = 197106\ t$

$\rho_n = \dfrac{m_n}{V_1} \Rightarrow V_1 = \dfrac{m_n}{\rho_n} = \dfrac{197106}{1{,}78} = 110733\ m^3$

13.

$J_p = 25\ \%$

$w_L = 37\ \%$

$J_c = 0{,}8$

$\rho_n = 1{,}78\ t/m^3$

$J_p = w_L - w_p$

$J_c = \dfrac{w_L - w}{I_p}$

$J_c \cdot I_p = w_L - w$

a) $w = w_L - I_c \cdot I_p = 37 - 0{,}8 \cdot 25 = 17\ \%$

Legyen $V = 1\ (m^3)$

$\rho_n = \dfrac{m_n}{V} \Rightarrow m_n = V \cdot \rho_n = 1\,m^3 \cdot 1{,}78\ t/m^3 = 1{,}78\ t$

$m_d = m_n - m_d \cdot w =$ ~~$1{,}78\ t$~~

$m_d + m_d \cdot w = m_n$

$m_d \cdot (1+w) = m_n \qquad m_d = \dfrac{m_n}{1+w}$

$$m_d = \frac{m_n}{1+w} = \frac{1{,}78\ t}{1+0{,}17} = 1{,}52\ t$$

$\rho_s = 2{,}75\ t/m^3$ sorsány agyag.

$$\rho_d = \frac{m_d}{V} = s \cdot \rho_s \qquad s = \frac{m_d}{V \cdot \rho_s} = \frac{1{,}52}{1 \cdot 2{,}75} = 0{,}55$$

$$\rho_n = s \cdot \rho_s + v \cdot \rho_v$$

$$v = \frac{\rho_n - s \cdot \rho_s}{\rho_v} = \frac{1{,}78 - 0{,}55 \cdot 2{,}75}{1}$$

$$v = 0{,}2675$$

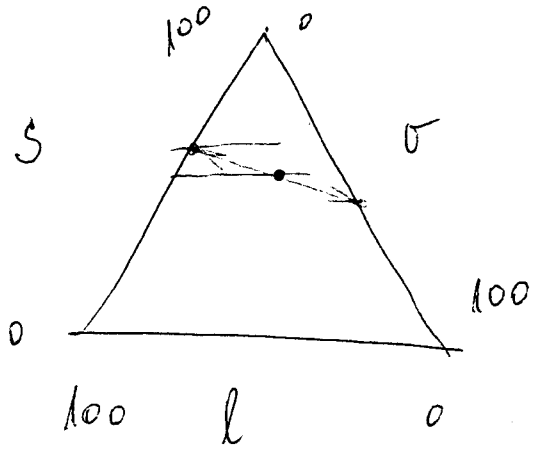
$$l = 1 - (s+v) = 0{,}1825$$

$$\rho_d = s \cdot \rho_s = 0{,}55 \cdot 2{,}75 = 1{,}5125\ t/m^3$$

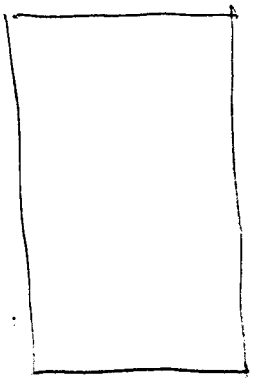
$$e = \frac{1-s}{s} = \frac{1-0{,}55}{0{,}55} = 0{,}82$$

$$n = (1-s) \cdot 100 = (1-0{,}55) \cdot 100 = 45\ \%$$

$$S_r = \frac{v}{1-s} = \frac{0{,}2675}{1-0{,}55} = 0{,}594$$

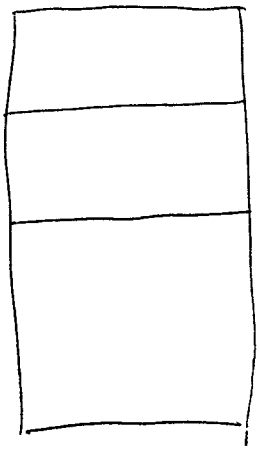


b.) $s = 0,61$
$v = 0$
$l = 0,39$



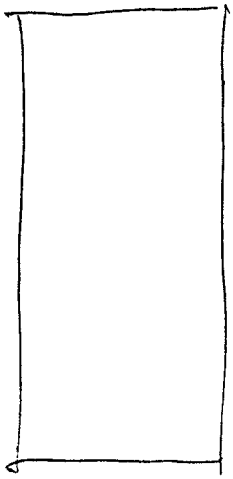
$0,9 \cdot V$

$s = 0,\sqrt{\ }$
$v = 0,26$
$l = 0,19$



V

$s = 0,\sqrt{\ }$
$v = 0,\sqrt{\ }$
$l = 0$



$1,1 \cdot V$

$\frac{0,\sqrt{\ }}{0,9}$

14.

$m_n = 250\ g$

$m_n + m_p = 265\ g$

$\Sigma V = 145\ cm^3$

$w = 18\ \%$

$\rho_p = 0{,}95\ g/cm^3$

$m_p = 265 - 250 = 15\ g$

$\rho_p = \frac{m_p}{V_p} \Rightarrow V_p = \frac{m_p}{\rho_p} = \frac{15\ g}{0{,}95\ g/cm^3} = 15{,}79\ cm^3$

$V = 145 - 15{,}79 = 129{,}21\ cm^3$

$w = \frac{m_n - m_d}{m_d} \Rightarrow w \cdot m_d = m_n - m_d \Rightarrow$

$w \cdot m_d + m_d = m_n \Rightarrow m_d(w+1) = m_n$

$m_d = \frac{m_n}{w+1} = \frac{250}{0{,}18+1} = 211{,}86\ g$

$m_v = m_n - m_d = 250 - 211{,}86 = 38{,}14\ g$

$V = \frac{V_v}{V} = \frac{38{,}14\ cm^3}{129{,}21\ cm^3} = 0{,}3$

$V = 0{,}3$

ρ_s (sovány aggag) $= 2{,}75\ g/cm^3$

$$s = \frac{m_d}{V \cdot \rho_s} = \frac{211,86}{129,21 \cdot 2,75} = 0,6$$

$s = 0,6$

$$l = 1 - (s + v) = 0,1$$

$l = 0,1$

$$e = \frac{1-s}{s} = \frac{1-0,6}{0,6} = 0,67$$

$e = 0,67$

$$n = 100 - s = 40$$

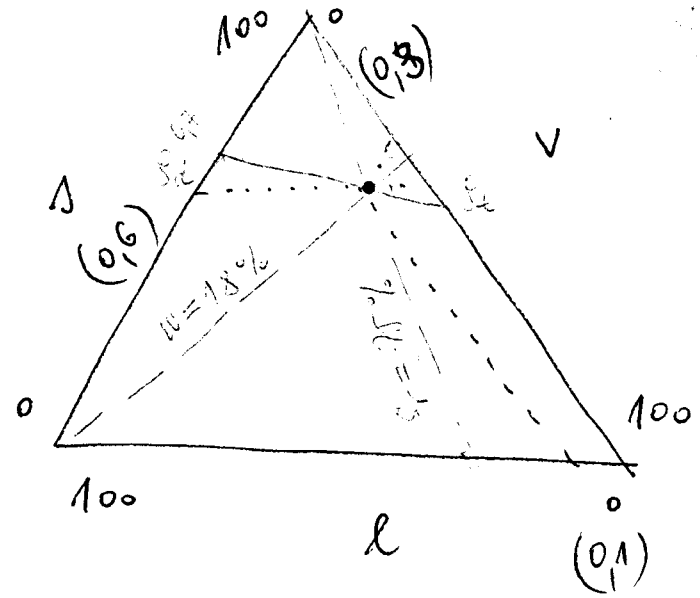
$n = 40\ \%$

$$\rho_d = \frac{m_d}{V} = \frac{211,86}{129,21} = 1,64\ g/cm^3$$

$$\rho_n = \frac{m_u}{V} = \frac{250}{129,21} = 1,93\ g/cm^3$$

$$\rho_t = s \cdot \rho_s + (1-s) \cdot \rho_v =$$

$$= 0,6 \cdot 2,75 + (1-0,6) \cdot 1 = 2,05\ g/cm^3$$



15.) $\rho_n = 1{,}8\ t/m^3$ V legyen $1\ m^3$

$w = 14\ \%$

kiszámítandó: ρ_d, ρ_t, e, n, S_r

$$m_n = V \cdot \rho_n = \underline{1{,}8\ t}$$

$$w = \frac{V \cdot \rho_v}{s \cdot \rho_s} = \frac{m_n - m_d}{m_d}$$

$$m_d = \frac{m_n}{w+1} = \frac{1{,}8\ t}{0{,}14+1} = \underline{1{,}58\ t}$$

$$\rho_d = \frac{m_d}{V} = \frac{m_n}{(w+1)V} = \frac{V \cdot \rho_n}{V(w+1)}$$

$$\rho_d = \frac{m_d}{V} = \frac{1{,}58\ t}{1\ m^3} = \underline{\boxed{1{,}58\ t/m^3}}$$

$$m_v = m_n - m_d = 1{,}8 - 1{,}58 = \underline{0{,}22\ t.}$$

irap: $\rho_s = 2{,}7\ t/m^3$

$$s = \frac{m_d}{V \cdot \rho_s} = \frac{1{,}58}{2{,}7} = \underline{0{,}58}$$

$$v = \underline{0{,}22}$$

$$l = \underline{0{,}2}$$

$$\rho_t = s \cdot \rho_s + (1-s) \cdot \rho_v = 0{,}58 \cdot 2{,}7 + (1 - 0{,}58) \cdot 1$$

$$\rho_t = \underline{\boxed{1{,}986\ t/m^3}}$$

$$e = \frac{1-s}{s} = \frac{1-0{,}58}{0{,}58} = \boxed{0{,}72}$$

$$n = (100-s)\cdot 100 = \boxed{42\ \%}$$

$$S_r = \frac{v}{1-s} = \frac{0{,}22}{1-0{,}58} = \boxed{0{,}52}$$

$V_l = 0{,}2\ m^3$
$V_v = 0{,}22\ m^3$
$V_s = 0{,}58\ m^3$

$V = 1\ m^3$

$m_l = 0$

$m_v = 0{,}22\ t$

$m_s = 2{,}7 \cdot 0{,}58 = 1{,}566\ t$

16.

$h_1 = 0,5$ m

$h_2 = 0,35$ m

$T_{rg} = 0,95$

$\rho_{d2} = 1,76$ t/m^3

$\rho_d^{max} = 1,85$ t/m^3

$w_{opt} = 14\%$

$\rho_s = 2,7$ t/m^3 homogen i izotr

$T_{rg} = \frac{\rho_d}{\rho_{d\,max}} \Rightarrow \rho_{d2} = 0,95 \cdot 1,85 = 1,76$ t/m^3.

$\rho_{d2} = s_2 \cdot \rho_s \quad s_2 = \frac{\rho_{d2}}{\rho_s} = \frac{1,76}{2,7} = 0,65 = s_2$

$w = \frac{V \cdot \rho_v}{s \cdot \rho_s} \Rightarrow V_2 = \frac{w \cdot s \rho_s}{\rho_v} = \frac{0,14 \cdot 0,65 \cdot 2,7}{1}$

$V_2 = 0,25$

$l_2 = 0,1$

$\rho_{d2} = \frac{m_d}{V_2} \quad m_d = 1,76$ t/m$^3 \cdot 0,35 \cdot 1 = 0,62$ t

$\rho_{d1} = \frac{m_d}{V_1} = \frac{0,62\ t}{0,5 \cdot 1} = 1,24$ t/m^3

$s_1 = \frac{\rho_{d1}}{\rho_s} = \frac{1,24}{2,7} = 0,46$

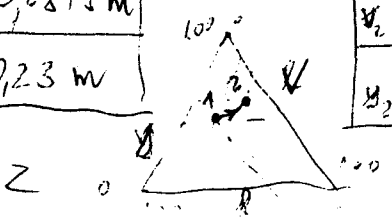
$s_1 = 0,46$

$V_1 = 0,175$

$l_1 = 0,365$

0,5 m
$z_1 = 0,1825$ m
$V_1 = 0,0875$ m
$y_1 = 0,23$ m

0,35 m
$z_2 = 0,0375$ m
$V_2 = 0,0875$ m
$y_2 = 0,23$ m



17.

$e = 0,68$

$w = 12\% = 0,12$

$J_p = 3\% \rightarrow$ Homoklast $\rightarrow \rho_s = 2,67$

a) $e = \frac{1-S}{S} \rightarrow e \cdot S = 1 - S \rightarrow e \cdot S + S = 1 \rightarrow$

$\rightarrow S(1+e) = 1 \rightarrow S = \frac{1}{1+e} = \frac{1}{1+0,68} = 0,6$

$w = \frac{V \cdot \rho_v}{S \cdot \rho_s} \rightarrow V = \frac{w \cdot S \cdot \rho_s}{\rho_v} = \frac{0,12 \cdot 0,6 \cdot 2,67}{1} = 0,2$

$l = 0,2$

$\rho_d = S \rho_s = 0,6 \cdot 2,67 = 1,602 \ g/cm^3$

$\rho_n = S \cdot \rho_s + V \cdot \rho_v = 1,602 + 0,2 \cdot 1 = 1,802 \ g/cm^3 = \rho_n$

$S_r = \frac{V}{1-S} = \frac{0,2}{1-0,6} = 0,5 = S_r$

$n = 100 - S = 40\% = n$

$\rho_t = S \rho_s + (1-S) \cdot \rho_v = 1,602 + (1-0,6) \cdot 1$

$\rho_t = 2,002 \ g/cm^3$

b) $V_s = 1 \ m^3 \ (60\%$

$V = 1,67 \ m^3$

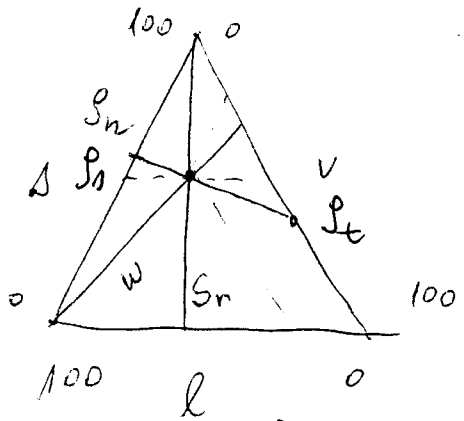
$V_v = 1,67 \cdot 0,2 = 0,334 \ m^3$

$V_l = 1,67 \cdot 0,2 = 0,334 \ m^3$

$m_S = V_S \cdot \rho_S = 2{,}67\ t$

$m_V = 0{,}334\ m^3 \cdot \rho_V = 0{,}334\ t$

$m_n = m_S + m_V = 3\ t$



ρ_d grafikus meghatározása:

$\rho_n = s \cdot \rho_s + v \cdot \rho_v \quad v = 0$

$1{,}802 = s \cdot 2{,}67 \qquad s = \frac{\rho_n}{\rho_s} = \frac{1{,}802}{2{,}67} = \underline{\underline{0{,}67}}$

$v = 0$

$l = 1 - 0{,}67 = \underline{\underline{0{,}33}}$