



## Perhitungan Index Properties

Tabel perhitungan *water content* tanah dengan akar rumput kikuyu (kadar air)

water content ( kadar air )			
Beban	Ring (gram) (a)	Ring + tanah basah (gram) (b)	Ring + tanah kering (gram) (c)
5 Kg	79,4	175,7	147,2
10 Kg	79,4	178,5	156,2
15 Kg	79,4	172,9	144,3

### A. Tanah Dengan Akar Rumput Kikuyu

Perhitungan :

$$\text{water content ( w )} = \frac{b-c}{c-a} \times 100 \%$$

$$w \text{ 5 Kg} = \frac{175,7-147,2}{147,2-79,4} \times 100 \% = \frac{28,5}{67,8} \times 100 \% = 42,035 \%$$

$$w \text{ 10 Kg} = \frac{178,5-156,2}{156,2-79,4} \times 100 \% = \frac{22,3}{76,8} \times 100 \% = 41,068 \%$$

$$w \text{ 15 Kg} = \frac{172,9-144,3}{144,3-79,4} \times 100 \% = \frac{28,6}{64,9} \times 100 \% = 44,067 \%$$

$$\begin{aligned} w \text{ rata - rata} &= \frac{w \text{ 5 Kg} + w \text{ 10 kg} + w \text{ 15 kg}}{3} = \frac{42,035 + 41,068 + 44,067}{3} \\ &= 42,39 \% \end{aligned}$$





$$c : 83,7 \text{ gram}$$

$$d : 175,2 \text{ gram}$$

$$\begin{aligned} W_1 &= (b - a) \times t_1 \\ &= (162,090 - 62) \times 1,00428 \\ &= 100,09 \times 1,00428 \\ &= 100,518 \text{ gram} \end{aligned}$$

$$\begin{aligned} Gs_1 &= \frac{(c-a)}{W-(d-c) \times t1} \\ &= \frac{(83,7-62)}{100,518-(175,2-83,7) \times 1,00428} \end{aligned}$$

$$Gs_1 = 2,515$$

Data II :

$$a : 62 \text{ gram} \qquad t_1 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$b : 162,090 \text{ gram} \qquad t_2 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$c : 83,7 \text{ gram} \qquad t_3 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$d : 174,8 \text{ gram}$$

$$\begin{aligned} W_2 &= (b - a) \times t_2 \\ &= (162,090 - 62) \times 1,00428 \\ &= 100,09 \times 1,00428 \\ &= 100,518 \text{ gram} \end{aligned}$$

$$\begin{aligned} Gs_2 &= \frac{(c-a)}{W-(d-c) \times t1} \\ &= \frac{(83,7-62)}{100,518-(174,8-83,7) \times 1,00428} \end{aligned}$$

$$Gs_2 = 2,403$$



Data III :

$$a : 62 \text{ gram} \qquad t_1 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$b : 162,090 \text{ gram} \qquad t_2 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$c : 83,7 \text{ gram} \qquad t_3 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$d : 175,2 \text{ gram}$$

$$\begin{aligned} W_3 &= (b - a) \times t_2 \\ &= (162,090 - 62) \times 1,00428 \\ &= 100,09 \times 1,00428 \\ &= 100,518 \text{ gram} \end{aligned}$$

$$\begin{aligned} Gs_3 &= \frac{(c - a)}{W - (d - c) \times t_1} \\ &= \frac{(83,7 - 62)}{100,518 - (175,2 - 83,7) \times 1,00428} \end{aligned}$$

$$Gs_3 = 2,515$$

$$Gs \text{ Rata - rata} = \frac{Gs_1 + Gs_2 + Gs_3}{3} = \frac{2,515 + 2,403 + 2,515}{3} = 2,478$$

### 1. Perhitungan *moist unit weight* ( $\gamma$ )

Perhitungan :

Diameter ring = 6,12 cm, tinggi ring = 2 cm

$$\begin{aligned} \text{Volume} &= \pi r^2 \times t \\ &= 3,14 \times (3,06)^2 \times 2 \\ &= 58,803 \text{ cm}^3 \end{aligned}$$



Perhitungan :

$$\begin{aligned}\gamma &= \frac{W}{V} \\ &= \frac{96,3}{58,803} \\ &= 1,637 \text{ gr/cm}^3\end{aligned}$$

## 2. Perhitungan *dry unit weight* ( $\gamma_d$ )

Perhitungan :

$$\begin{aligned}\gamma_d &= \frac{\gamma}{1 + w} \\ &= \frac{1,637}{1 + 0,42035} \\ &= 1,152 \text{ gr/cm}^3\end{aligned}$$

## 3. Perhitungan *porosity* ( $n$ )

Data :  $G_s = 2,478$

$\gamma_d = 1,152 \text{ gram / cm}^3$

Perhitungan :

$$\begin{aligned}n &= 1 - \frac{\gamma_d}{G_s} \times 100\% \\ &= 1 - \frac{1,152}{2,478} \times 100\% \\ &= 53,51 \%\end{aligned}$$



#### 4. Perhitungan void ratio ( e )

Data : kadar pori ( n ) = 0,5351

$$e = \frac{V_v}{V_s} = \frac{V_v}{V - V_v} = \frac{V_v/V}{1 - V_v/V} = \frac{n}{1 - n}$$

$$e = \frac{0,5351}{1 - 0,5351} = 1,151$$

Percobaan 10 kg

Data I : a : 62 gram  $t_1 : 30^\circ\text{C} \longrightarrow 1,00428$

b : 162,090 gram  $t_2 : 30^\circ\text{C} \longrightarrow 1,00428$

c : 83,6 gram  $t_3 : 30^\circ\text{C} \longrightarrow 1,00428$

d : 175 gram

$$\begin{aligned} W_1 &= (b - a) \times t_1 \\ &= (162,090 - 62) \times 1,00428 \\ &= 100,09 \times 1,00428 \\ &= 100,518 \text{ gram} \end{aligned}$$

$$\begin{aligned} Gs_1 &= \frac{(c - a)}{W - (d - c) \times t_1} \\ &= \frac{(83,6 - 62)}{100,518 - (175 - 83,6) \times 1,00428} \end{aligned}$$

$$Gs_1 = 2,475$$

Data II :

a : 62 gram  $t_1 : 30^\circ\text{C} \longrightarrow 1,00428$

b : 162,090 gram  $t_2 : 30^\circ\text{C} \longrightarrow 1,00428$



$$c : 83,6 \text{ gram} \qquad t_3 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$d : 174,7 \text{ gram}$$

$$\begin{aligned} W_2 &= (b - a) \times t_2 \\ &= (162,090 - 62) \times 1,00428 \\ &= 100,09 \times 1,00428 \\ &= 100,518 \text{ gram} \end{aligned}$$

$$\begin{aligned} Gs_2 &= \frac{(c-a)}{W-(d-c) \times t_1} \\ &= \frac{(83,6-62)}{100,518-(174,7-83,6) \times 1,00428} \\ Gs_2 &= 2,392 \end{aligned}$$

Data III :

$$a : 62 \text{ gram} \qquad t_1 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$b : 162,090 \text{ gram} \qquad t_2 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$c : 83,6 \text{ gram} \qquad t_3 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$d : 174,6 \text{ gram}$$

$$\begin{aligned} W_3 &= (b - a) \times t_2 \\ &= (162,090 - 62) \times 1,00428 \\ &= 100,09 \times 1,00428 \\ &= 100,518 \text{ gram} \end{aligned}$$

$$\begin{aligned} Gs_3 &= \frac{(c-a)}{W-(d-c) \times t_1} \\ &= \frac{(83,6-62)}{100,518-(174,6-83,6) \times 1,00428} \\ Gs_3 &= 2,366 \end{aligned}$$



$$G_s \text{ Rata - rata} = \frac{G_{s1} + G_{s2} + G_{s3}}{3} = \frac{2,475 + 2,392 + 2,366}{3} = 2,411$$

### 1. Perhitungan *moist unit weight* ( $\gamma$ )

Perhitungan :

Diameter ring = 6,12 cm, tinggi ring = 2 cm

$$\begin{aligned} \text{Volume} &= \pi r^2 \times t \\ &= 3,14 \times (3,06)^2 \times 2 \\ &= 58,803 \text{ cm}^3 \end{aligned}$$

Perhitungan :

$$\begin{aligned} \gamma &= \frac{W}{V} \\ &= \frac{99,1}{58,803} \\ &= 1,685 \text{ gr/cm}^3 \end{aligned}$$

### 2. Perhitungan *dry unit weight* ( $\gamma_d$ )

Perhitungan :

$$\begin{aligned} \gamma_d &= \frac{\gamma}{1 + w} \\ &= \frac{1,685}{1 + 0,41068} \\ &= 1,194 \text{ gr/cm}^3 \end{aligned}$$





### 3. Perhitungan *porosity* ( *n* )

Data :  $G_s = 2,411$

$\gamma_d = 1,194 \text{ gram / cm}^3$

Perhitungan :

$$\begin{aligned}n &= 1 - \frac{\gamma_d}{G_s} \times 100\% \\&= 1 - \frac{1,194}{2,411} \times 100\% \\&= 50,47 \%\end{aligned}$$

### 4. Perhitungan *void ratio* ( *e* )

Data : kadar pori ( *n* ) = 0,5047

$$e = \frac{V_v}{V_s} = \frac{V_v}{V - V_v} = \frac{V_v/V}{1 - V_v/V} = \frac{n}{1 - n}$$

$$e = \frac{0,5047}{1 - 0,5047} = 1,019$$

Percobaan 15 kg

Data I : a : 62 gram  $t_1 : 30^\circ\text{C} \longrightarrow 1,00428$

b : 162,090 gram  $t_2 : 30^\circ\text{C} \longrightarrow 1,00428$

c : 80,1 gram  $t_3 : 30^\circ\text{C} \longrightarrow 1,00428$

d : 172,4 gram

$$\begin{aligned}W_1 &= (b - a) \times t_1 \\&= (162,090 - 62) \times 1,00428 \\&= 100,09 \times 1,00428\end{aligned}$$



$$= 100,518 \text{ gram}$$

$$G_{s1} = \frac{(c-a)}{W-(d-c) \times t1}$$

$$= \frac{(80,1-62)}{100,518-(172,4-80,1) \times 1,00428}$$

$$G_{s1} = 2,313$$

Data II : a : 62 gram t<sub>1</sub> : 30°C → 1,00428

b : 162,090 gram t<sub>2</sub> : 30°C → 1,00428

c : 80,1 gram t<sub>3</sub> : 30°C → 1,00428

d : 173 gram

$$W_2 = (b - a) \times t_2$$

$$= (162,090 - 62) \times 1,00428$$

$$= 100,09 \times 1,00428$$

$$= 100,518 \text{ gram}$$

$$G_{s2} = \frac{(c-a)}{W-(d-c) \times t1}$$

$$= \frac{(80,1-62)}{100,518-(173-80,1) \times 1,00428}$$

$$G_{s2} = 2,506$$

Data III : a : 62 gram t<sub>1</sub> : 30°C → 1,00428

b : 162,090 gram t<sub>2</sub> : 30°C → 1,00428

c : 80,1 gram t<sub>3</sub> : 30°C → 1,00428

d : 172,5 gram



$$\begin{aligned}W_3 &= (b - a) \times t_2 \\ &= (162,090 - 62) \times 1,00428 \\ &= 100,09 \times 1,00428 \\ &= 100,518 \text{ gram}\end{aligned}$$

$$\begin{aligned}Gs_3 &= \frac{(c-a)}{W-(d-c) \times t_1} \\ &= \frac{(80,1-62)}{100,518-(172,5-80,1) \times 1,00428}\end{aligned}$$

$$Gs_3 = 2,343$$

$$Gs \text{ Rata - rata} = \frac{Gs_1 + Gs_2 + Gs_3}{3} = \frac{2,313 + 2,506 + 2,343}{3} = 2,388$$

### 1. Perhitungan *moist unit weight* ( $\gamma$ )

Perhitungan :

Diameter ring = 6,12 cm, tinggi ring = 2 cm

$$\begin{aligned}\text{Volume} &= \pi r^2 \times t \\ &= 3,14 \times (3,06)^2 \times 2 \\ &= 58,803 \text{ cm}^3\end{aligned}$$

Perhitungan :

$$\begin{aligned}\gamma &= \frac{W}{V} \\ &= \frac{93,5}{58,803} \\ &= 1,590 \text{ gr/cm}^3\end{aligned}$$



## 2. Perhitungan *dry unit weight* ( $\gamma_d$ )

Perhitungan :

$$\begin{aligned}\gamma_d &= \frac{\gamma}{1+w} \\ &= \frac{1,590}{1+0,44067} \\ &= 1,103 \text{ gr/cm}^3\end{aligned}$$

## 3. Perhitungan *porosity* ( $n$ )

Data :  $G_s = 2,388$

$\gamma_d = 1,103 \text{ gram / cm}^3$

Perhitungan :

$$\begin{aligned}n &= 1 - \frac{\gamma_d}{G_s} \times 100\% \\ &= 1 - \frac{1,103}{2,388} \times 100\% \\ &= 53,81 \%\end{aligned}$$

## 4. Perhitungan *void ratio* ( $e$ )

Data : kadar pori ( $n$ ) = 0,5381

$$e = \frac{V_v}{V_s} = \frac{V_v}{V - V_v} = \frac{V_v/V}{1 - V_v/V} = \frac{n}{1 - n}$$

$$e = \frac{0,5381}{1 - 0,5381} = 1,165$$



**B. Tanah Tanpa Akar Rumput Kikuyu**

Tabel Perhitungan *water content* tanah tanpa akar rumput kikuyu (kadar air)

water content ( kadar air )			
Beban	Cawan (gram) (a)	Cawan + tanah basah (gram) (b)	Cawan + tanah kering (gram) (c)
5 Kg	79,4	182,2	150,6
10 Kg	79,4	180	152,9
15 Kg	79,4	187,9	158,5

Perhitungan :

$$\text{water content ( w )} = \frac{b-c}{c-a} \times 100 \%$$

$$w \text{ 5 Kg} = \frac{182,2-150,6}{150,6-79,4} \times 100 \% = \frac{31,6}{71,2} \times 100 \% = 44,382 \%$$

$$w \text{ 10 Kg} = \frac{180-152,9}{152,9-79,4} \times 100 \% = \frac{27,1}{73,5} \times 100 \% = 36,870 \%$$

$$w \text{ 15 Kg} = \frac{187,9-158,5}{158,5-79,4} \times 100 \% = \frac{29,4}{79,1} \times 100 \% = 37,168 \%$$

$$w \text{ rata - rata} = \frac{w \text{ 5 Kg} + w \text{ 10 kg} + w \text{ 15 kg}}{3} = \frac{44,382 + 36,870 + 37,168}{3} = 39,473 \%$$



Tabel Perhitungan specific gravity tanah tanpa akar rumput kikuyu (Gs)

Beban	Berat Picnometer (a)	Picnometer + aquades (b)	Picnometer + sampel kering (c)	Picnometer + sampel + aquades (d)
5 kg	62,6	162,492	88	a. 177,2
				b. 176,8
				c. 177
10 kg	62	161,889	87,9	a. 176,5
				b. 176,7
				c. 176,5
15 kg	62	162,090	88,8	a. 177
				b. 176,4
				c. 177,1

Perhitungan:

Percobaan 5 kg

Data I : a : 62,6 gram  $t_1 : 30^\circ\text{C} \longrightarrow 1,00428$   
 b : 162,492 gram  $t_2 : 30^\circ\text{C} \longrightarrow 1,00428$   
 c : 88 gram  $t_3 : 30^\circ\text{C} \longrightarrow 1,00428$   
 d : 177,2 gram

$$\begin{aligned}
 W_1 &= (b - a) \times t_1 \\
 &= (162,492 - 62,6) \times 1,00428 \\
 &= 99,892 \times 1,00428 \\
 &= 100,319 \text{ gram}
 \end{aligned}$$



$$Gs_1 = \frac{(c-a)}{W-(d-c) \times t_1}$$

$$= \frac{(88-62,6)}{100,319-(177,2-88) \times 1,00428}$$

$$Gs_1 = 2,365$$

Data II : a : 62,6 gram  $t_1 : 30^\circ\text{C} \longrightarrow 1,00428$

b : 162,492 gram  $t_2 : 30^\circ\text{C} \longrightarrow 1,00428$

c : 88 gram  $t_3 : 30^\circ\text{C} \longrightarrow 1,00428$

d : 176,8 gram

$$W_2 = (b - a) \times t_2$$

$$= (162,492 - 62,6) \times 1,00428$$

$$= 99,892 \times 1,00428$$

$$= 100,319 \text{ gram}$$

$$Gs_2 = \frac{(c-a)}{W-(d-c) \times t_2}$$

$$= \frac{(88-62,6)}{100,319-(176,8-88) \times 1,00428}$$

$$Gs_2 = 2,280$$

Data III : a : 62 gram  $t_1 : 30^\circ\text{C} \longrightarrow 1,00428$

b : 162,492 gram  $t_2 : 30^\circ\text{C} \longrightarrow 1,00428$

c : 88 gram  $t_3 : 30^\circ\text{C} \longrightarrow 1,00428$

d : 177 gram

$$W_3 = (b - a) \times t_3$$

$$= (162,492 - 62,6) \times 1,00428$$



$$\begin{aligned} &= 99,892 \times 1,00428 \\ &= 100,319 \text{ gram} \\ Gs_3 &= \frac{(c-a)}{W-(d-c) \times t_3} \\ &= \frac{(88-62,6)}{100,319-(177-88) \times 1,00428} \\ Gs_3 &= 2,322 \end{aligned}$$

$$Gs \text{ Rata - rata} = \frac{Gs_1 + Gs_2 + Gs_3}{3} = \frac{2,365 + 2,280 + 2,322}{3} = 2,322$$

### 1. Perhitungan moist unit weight ( $\gamma$ )

Perhitungan :

Diameter ring = 6,12 cm, tinggi ring = 2 cm

$$\begin{aligned} \text{Volume} &= \pi r^2 \times t \\ &= 3,14 \times (3,06)^2 \times 2 \\ &= 58,803 \text{ cm}^3 \end{aligned}$$

Perhitungan :

$$\begin{aligned} \gamma &= \frac{W}{V} \\ &= \frac{102,8}{58,803} \\ &= 1,748 \text{ gr/cm}^3 \end{aligned}$$





## 2. Perhitungan *dry unit weight* ( $\gamma_d$ )

Perhitungan :

$$\begin{aligned}\gamma_d &= \frac{\gamma}{1+w} \\ &= \frac{1,748}{1+0,44382} \\ &= 1,210 \text{ gr/cm}^3\end{aligned}$$

## 3. Perhitungan *porosity* ( $n$ )

Data :  $G_s = 2,322$

$\gamma_d = 1,210 \text{ gram / cm}^3$

Perhitungan :

$$\begin{aligned}n &= 1 - \frac{\gamma_d}{G_s} \times 100\% \\ &= 1 - \frac{1,210}{2,322} \times 100\% \\ &= 47,88 \%\end{aligned}$$

## 4. Perhitungan *void ratio* ( $e$ )

Data : kadar pori ( $n$ ) = 0,4788

$$e = \frac{V_v}{V_s} = \frac{V_v}{V - V_v} = \frac{V_v/V}{1 - V_v/V} = \frac{n}{1 - n}$$

$$e = \frac{0,4788}{1 - 0,4788} = 0,9186$$



Percobaan 10 kg

Data I : a : 62 gram  $t_1 : 30^\circ\text{C} \longrightarrow 1,00428$

b : 161,889 gram  $t_2 : 30^\circ\text{C} \longrightarrow 1,00428$

c : 87,9 gram  $t_3 : 30^\circ\text{C} \longrightarrow 1,00428$

d : 176,5 gram

$$\begin{aligned}W_1 &= (b - a) \times t_1 \\ &= (161,889 - 62) \times 1,00428 \\ &= 99,889 \times 1,00428 \\ &= 100,316 \text{ gram}\end{aligned}$$

$$\begin{aligned}Gs_1 &= \frac{(c - a)}{W - (d - c) \times t_1} \\ &= \frac{(87,9 - 62)}{100,316 - (176,5 - 87,9) \times 1,00428} \\ Gs_1 &= 2,284\end{aligned}$$

Data II : a : 62 gram  $t_1 : 30^\circ\text{C} \longrightarrow 1,00428$

b : 161,889 gram  $t_2 : 30^\circ\text{C} \longrightarrow 1,00428$

c : 87,9 gram  $t_3 : 30^\circ\text{C} \longrightarrow 1,00428$

d : 176,7 gram

$$\begin{aligned}W_2 &= (b - a) \times t_2 \\ &= (161,889 - 62) \times 1,00428 \\ &= 99,889 \times 1,00428 \\ &= 100,316 \text{ gram}\end{aligned}$$



$$Gs_2 = \frac{(c-a)}{W-(d-c) \times t_2}$$

$$= \frac{(87,9-62)}{100,316-(176,7-87,9) \times 1,00428}$$

$$Gs_2 = 2,325$$

Data III : a : 62 gram t<sub>1</sub> : 30°C → 1,00428

b : 161,889 gram t<sub>2</sub> : 30°C → 1,00428

c : 87,9 gram t<sub>3</sub> : 30°C → 1,00428

d : 176,6 gram

$$W_3 = (b - a) \times t_3$$

$$= (161,889 - 62) \times 1,00428$$

$$= 99,889 \times 1,00428$$

$$= 100,316 \text{ gram}$$

$$Gs_3 = \frac{(c-a)}{W-(d-c) \times t_3}$$

$$= \frac{(87,9-62)}{100,316-(176,6-87,9) \times 1,00428}$$

$$Gs_3 = 2,305$$

$$Gs \text{ Rata - rata} = \frac{Gs_1 + Gs_2 + Gs_3}{3} = \frac{2,284 + 2,325 + 2,305}{3} = 2,305$$



### 1. Perhitungan *moist unit weight* ( $\gamma$ )

Perhitungan :

Diameter ring = 6,12 cm, tinggi ring = 2 cm

$$\begin{aligned}\text{Volume} &= \pi r^2 \times t \\ &= 3,14 \times (3,06)^2 \times 2 \\ &= 58,803 \text{ cm}^3\end{aligned}$$

Perhitungan :

$$\begin{aligned}\gamma &= \frac{W}{V} \\ &= \frac{100,6}{58,803} \\ &= 1,710 \text{ gr/cm}^3\end{aligned}$$

### 2. Perhitungan *dry unit weight* ( $\gamma_d$ )

Perhitungan :

$$\begin{aligned}\gamma_d &= \frac{\gamma}{1 + w} \\ &= \frac{1,710}{1 + 0,3687} \\ &= 1,250 \text{ gr/cm}^3\end{aligned}$$

### 3. Perhitungan *porosity* ( $n$ )

Data :  $G_s = 2,305$

$\gamma_d = 1,250 \text{ gram / cm}^3$

Perhitungan :



$$\begin{aligned}
 n &= 1 - \frac{\gamma_d}{G_s} \times 100\% \\
 &= 1 - \frac{1,250}{2,305} \times 100\% \\
 &= 45,77 \ %
 \end{aligned}$$

#### 4. Perhitungan void ratio ( e )

Data : kadar pori ( n ) = 0.4577

$$e = \frac{V_v}{V_s} = \frac{V_v}{V - V_v} = \frac{V_v/V}{1 - V_v/V} = \frac{n}{1 - n}$$

$$e = \frac{0,4577}{1 - 0,4577} = 0,8440$$

Percobaan 15 kg

Data I : a : 62 gram  $t_1 : 30^\circ\text{C} \longrightarrow 1,00428$

b : 161,889 gram  $t_2 : 30^\circ\text{C} \longrightarrow 1,00428$

c : 88,8 gram  $t_3 : 30^\circ\text{C} \longrightarrow 1,00428$

d : 177 gram

$$\begin{aligned}
 W_1 &= (b - a) \times t_1 \\
 &= (161,889 - 62) \times 1,00428 \\
 &= 99,889 \times 1,00428 \\
 &= 100,316 \text{ gram}
 \end{aligned}$$

$$\begin{aligned}
 G_{s1} &= \frac{(c - a)}{W - (d - c) \times t_1} \\
 &= \frac{(88,8 - 62)}{100,316 - (177 - 88,8) \times 1,00428}
 \end{aligned}$$



$$Gs_1 = 2,283$$

$$\text{Data II : } a : 62 \text{ gram} \qquad t_1 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$b : 161,889 \text{ gram} \qquad t_2 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$c : 88,8 \text{ gram} \qquad t_3 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$d : 177,4 \text{ gram}$$

$$\begin{aligned} W_2 &= (b - a) \times t_2 \\ &= (161,889 - 62) \times 1,00428 \\ &= 99,889 \times 1,00428 \\ &= 100,316 \text{ gram} \end{aligned}$$

$$\begin{aligned} Gs_2 &= \frac{(c - a)}{W - (d - c) \times t_2} \\ &= \frac{(88,8 - 62)}{100,316 - (177,4 - 88,8) \times 1,00428} \end{aligned}$$

$$Gs_2 = 2,364$$

$$\text{Data III : } a : 62 \text{ gram} \qquad t_1 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$b : 161,889 \text{ gram} \qquad t_2 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$c : 88,8 \text{ gram} \qquad t_3 : 30^\circ\text{C} \longrightarrow 1,00428$$

$$d : 177,1 \text{ gram}$$

$$\begin{aligned} W_3 &= (b - a) \times t_3 \\ &= (161,889 - 62) \times 1,00428 \\ &= 99,889 \times 1,00428 \\ &= 100,316 \text{ gram} \end{aligned}$$

$$Gs_3 = \frac{(c - a)}{W - (d - c) \times t_3}$$



$$= \frac{(88,8-62)}{100,316-(177,1-88,8) \times 1,00428}$$
$$Gs_3 = 2,302$$

$$Gs \text{ Rata - rata} = \frac{Gs_1 + Gs_2 + Gs_3}{3} = \frac{2,283 + 2,364 + 2,302}{3} = 2,316$$

### 1. Perhitungan *moist unit weight* ( $\gamma$ )

Perhitungan :

Diameter ring = 6,12 cm, tinggi ring = 2 cm

$$\begin{aligned} \text{Volume} &= \pi r^2 \times t \\ &= 3,14 \times (3,06)^2 \times 2 \\ &= 58,803 \text{ cm}^3 \end{aligned}$$

Perhitungan :

$$\begin{aligned} \gamma &= \frac{W}{V} \\ &= \frac{108,5}{58,803} \\ &= 1,845 \text{ gr/cm}^3 \end{aligned}$$

### 2. Perhitungan *dry unit weight* ( $\gamma_d$ )

Perhitungan :

$$\begin{aligned} \gamma_d &= \frac{\gamma}{1+w} \\ &= \frac{1,845}{1+0,37168} \\ &= 1,345 \text{ gr/cm}^3 \end{aligned}$$



### 3. Perhitungan *porosity* ( $n$ )

Data :  $G_s = 2,316$

$\gamma_d = 1,345 \text{ gram / cm}^3$

Perhitungan :

$$\begin{aligned}n &= 1 - \frac{\gamma_d}{G_s} \times 100\% \\&= 1 - \frac{1,345}{2,316} \times 100\% \\&= 41,92 \%\end{aligned}$$

### 4. Perhitungan *void ratio* ( $e$ )

Data : kadar pori (  $n$  ) = 0,4192

$$\begin{aligned}e &= \frac{V_v}{V_s} = \frac{V_v}{V - V_v} = \frac{V_v/V}{1 - V_v/V} = \frac{n}{1 - n} \\e &= \frac{0,4192}{1 - 0,4192} = 0,7217\end{aligned}$$





## Uji Saringan

Percobaan ini mencakup penentuan dari distribusi ukuran butir tanah yang lebih besar dari  $75\mu\text{m}$  (tertahan oleh saringan no.200). Tujuan dari percobaan ini adalah untuk mengetahui distribusi ukuran butir tanah, sehingga tanah dapat mudah diklasifikasikan tanah butir kasar dengan mendapatkan koefesien keseragaman ( $C_u$ ) dari kurva distribusi ukuran butir (gradasi) tanah. Berikut tabel Uji saringan yang dilakukan di laboratorium:

Tabel Sieve analisis tanah dengan akar rumput kikuyu

SIEVE ANALISIS TANAH + AKAR						
Percobaan	No	Diameter	Berat Saringan	Berat Saringan + Tanah	wt.of Retained	% Retained
1	4	4,75	532,4	532,4	0	0
	20	0,85	315,7	328,7	13	13
	30	0,6	422	428	6	6
	40	0,425	304,7	308,6	3,9	3,9
	60	0,25	405,4	413,4	8	8
	80	0,18	277,7	282,5	4,8	4,8
	100	0,125	280,8	286,2	5,4	5,4
	200	0,075	280,4	285,8	5,4	5,4
	Pan	-	270,6	271,5	0,9	0,9



SIEVE ANALISIS TANAH + AKAR						
Percobaan	No	Diameter	Berat Saringan	Berat Saringan + Tanah	wt.of Retained	% Retained
<b>2</b>	4	4,75	532,4	532,4	0	0
	20	0,85	315,7	327,8	12,1	12,1
	30	0,6	422	427,5	5,5	5,5
	40	0,425	304,7	308,3	3,6	3,6
	60	0,25	405,4	412,5	7,1	7,1
	80	0,18	277,7	282,2	4,5	4,5
	100	0,125	280,8	285,9	5,1	5,1
	200	0,075	280,4	283,5	3,1	3,1
	Pan	-	270,6	273,9	3,3	3,3

SIEVE ANALISIS TANAH + AKAR						
Percobaan	No	Diameter	Berat Saringan	Berat Saringan + Tanah	wt.of Retained	% Retained
<b>3</b>	4	4,75	532,4	532,7	0,3	0,3
	20	0,85	315,7	328,8	13,1	13,1
	30	0,6	422	427	5	5
	40	0,425	304,7	307,6	2,9	2,9
	60	0,25	405,4	411,8	6,4	6,4
	80	0,18	277,7	281,7	4	4
	100	0,125	280,8	285,4	4,6	4,6
	200	0,075	280,4	285	4,6	4,6
	Pan	-	270,6	271,6	1	1

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Tabel Hidrometer tanah dengan akar rumput kikuyu Percobaan I

Time of reading	Elapsed time, t (menit)	Temp (°C)	Actual Hyd Reading, Ra	Corr. Hyd Reading, Rc	% Finer	Hyd Corr. Only for Meniscus, R	L	L/t	K	Diameter, D (mm)	% Finer terhadap total sampel
11.42.50"	0	27	46	51	49,93	47	9,6		0,011858		46,33
11.43.50"	1	27	40	45	44,06	41	11,1	11,1	0,011858	3,95E-02	40,88
11.44.50"	2	27	34	39	38,18	35	11,9	5,95	0,011858	2,89E-02	35,43
11.46.50"	4	27	28	33	32,31	29	12,5	3,1250	0,011858	2,10E-02	29,98
11.50.50"	8	27	23	28	27,41	24	13,3	1,6625	0,011858	1,53E-02	25,44
11.58.50"	16	27	17	22	21,54	18	14,2	0,8875	0,011858	1,12E-02	19,99
12.12.50"	30	27	13	18	17,62	14	14,7	0,4900	0,011858	8,30E-03	16,35
12.27.50"	45	27	8	13	12,73	9	15	0,3333	0,011858	6,85E-03	11,81
13.12.50"	90	27	6	11	10,77	7	15,2	0,1689	0,011858	4,87E-03	9,99
15.12.50"	210	27	3	8	7,83	4	15,6	0,0743	0,011858	3,23E-03	7,27

Tabel Hidrometer tanah dengan akar rumput kikuyu Percobaan II

Time of reading	Elapsed time, t (menit)	Temp (°C)	Actual Hyd Reading, Ra	Corr. Hyd Reading, Rc	% Finer	Hyd Corr. Only for Meniscus, R	L	L/t	K	Diameter, D (mm)	% Finer terhadap total sampel
11.42.50"	0	27	43	48	46,99	44	9,6		0,011858		43,61
11.43.50"	1	27	37	42	41,12	38	11,1	11,1	0,011858	3,95E-02	38,16
11.44.50"	2	27	32	37	36,22	33	11,9	5,95	0,011858	2,89E-02	33,61
11.46.50"	4	27	27	32	31,33	28	12,5	3,1250	0,011858	2,10E-02	29,07
11.50.50"	8	27	22	27	26,43	23	13,3	1,6625	0,011858	1,53E-02	24,53
11.58.50"	16	27	18	23	22,52	19	14,2	0,8875	0,011858	1,12E-02	20,90
12.12.50"	30	27	13	18	17,62	14	14,7	0,4900	0,011858	8,30E-03	16,35
12.27.50"	45	27	9	14	13,71	10	15	0,3333	0,011858	6,85E-03	12,72
13.12.50"	90	27	4	9	8,81	5	15,2	0,1689	0,011858	4,87E-03	8,18
15.12.50"	210	27	2	7	6,85	3	15,6	0,0743	0,011858	3,23E-03	6,36



Tabel Hidrometer tanah dengan akar rumput kikuyu Percobaan III

Time of reading	Elapsed time, t (menit)	Temp (°C)	Actual Hyd Reading, Ra	Corr. Hyd Reading, Rc	% Finer	Hyd Corr. Only for Meniscus, R	L	L/t	K	Diameter, D (mm)	% Finer terhadap total sampel
11.42.50"	0	27	45	50	48,95	46	9,6		0,011858		45,42
11.43.50"	1	27	40	45	44,06	41	11,1	11,1	0,011858	3,95E-02	40,88
11.44.50"	2	27	35	40	39,16	36	11,9	5,95	0,011858	2,89E-02	36,34
11.46.50"	4	27	31	36	35,24	32	12,5	3,1250	0,011858	2,10E-02	32,71
11.50.50"	8	27	23	28	27,41	24	13,3	1,6625	0,011858	1,53E-02	25,44
11.58.50"	16	27	17	22	21,54	18	14,2	0,8875	0,011858	1,12E-02	19,99
12.12.50"	30	27	12	17	16,64	13	14,7	0,4900	0,011858	8,30E-03	15,44
12.27.50"	45	27	8	13	12,73	9	15	0,3333	0,011858	6,85E-03	11,81
13.12.50"	90	27	5	10	9,79	6	15,2	0,1689	0,011858	4,87E-03	9,08
15.12.50"	210	27	3	8	7,83	4	15,6	0,0743	0,011858	3,23E-03	7,27



Tabel Sieve analisis tanah tanpa akar rumput kikuyu

SIEVE ANALISIS TANAH ASLI						
Percobaan	No	Diameter	Berat Saringan	Berat Saringan + Tanah	wt.of Retained	% Retained
1	4	4,75	532,4	532,4	0	0
	20	0,85	315,7	330,1	14,4	14,4
	30	0,6	422	429,3	7,3	7,3
	40	0,425	304,7	309	4,3	4,3
	60	0,25	405,4	412,3	6,9	6,9
	80	0,18	277,7	280,9	3,2	3,2
	100	0,125	280,8	283,8	3	3
	200	0,075	280,4	282,9	2,5	2,5
	Pan	-	-	270,6	271,0	0,4

SIEVE ANALISIS TANAH ASLI						
Percobaan	No	Diameter	Berat Saringan	Berat Saringan + Tanah	wt.of Retained	% Retained
2	4	4,75	532,4	532,4	0	0
	20	0,85	315,7	328,2	12,5	12,5
	30	0,6	422	430,6	8,6	8,6
	40	0,425	304,7	309,2	4,5	4,5
	60	0,25	405,4	411,9	6,5	6,5
	80	0,18	277,7	280,5	2,8	2,8
	100	0,125	280,8	283,3	2,5	2,5
	200	0,075	280,4	280,7	0,3	0,3
	Pan	-	-	270,6	272,7	2,1

SIEVE ANALISIS TANAH ASLI						
Percobaan	No	Diameter	Berat Saringan	Berat Saringan + Tanah	wt.of Retained	% Retained
3	4	4,75	532,4	532,4	0	0
	20	0,85	315,7	332,1	16,4	16,4
	30	0,6	422	429,2	7,2	7,2
	40	0,425	304,7	308,8	4,1	4,1
	60	0,25	405,4	412,2	6,8	6,8
	80	0,18	277,7	281,1	3,4	3,4
	100	0,125	280,8	284,3	3,5	3,5
	200	0,075	280,4	283,3	2,9	2,9
	Pan	-	-	270,6	271,2	0,6

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Tabel Hidrometer tanah tanpa akar rumput kikuyu Percobaan I

Time of reading	Elapsed time, t (menit)	Temp (°C)	Actual Hyd Reading, Ra	Corr. Hyd Reading, Rc	% Finer	Hyd Corr. Only for Meniscus, R	L	L/t	K	Diameter, D (mm)	% Finer terhadap total sampel
11.42.50"	0	27	49	54	52,87	50	9,6		0,011858		49,06
11.43.50"	1	27	43	48	46,99	44	11,1	11,1	0,011858	3,95E-02	43,61
11.44.50"	2	27	36	41	40,14	37	11,9	5,95	0,011858	2,89E-02	37,25
11.46.50"	4	27	30	35	34,27	31	12,5	3,1250	0,011858	2,10E-02	31,80
11.50.50"	8	27	24	29	28,39	25	13,3	1,6625	0,011858	1,53E-02	26,35
11.58.50"	16	27	19	24	23,50	20	14,2	0,8875	0,011858	1,12E-02	21,80
12.12.50"	30	27	13	18	17,62	14	14,7	0,4900	0,011858	8,30E-03	16,35
12.27.50"	45	27	9	14	13,71	10	15	0,3333	0,011858	6,85E-03	12,72
13.12.50"	90	27	6	11	10,77	7	15,2	0,1689	0,011858	4,87E-03	9,99
15.12.50"	210	27	4	9	8,81	5	15,6	0,0743	0,011858	3,23E-03	8,18

Tabel Hidrometer tanah tanpa akar rumput kikuyu Percobaan II

Time of reading	Elapsed time, t (menit)	Temp (°C)	Actual Hyd Reading, Ra	Corr. Hyd Reading, Rc	% Finer	Hyd Corr. Only for Meniscus, R	L	L/t	K	Diameter, D (mm)	% Finer terhadap total sampel
11.42.50"	0	27	48	53	51,89	49	9,6		0,011858		48,15
11.43.50"	1	27	42	47	46,01	43	11,1	11,1	0,011858	3,95E-02	42,70
11.44.50"	2	27	35	40	39,16	36	11,9	5,95	0,011858	2,89E-02	36,34
11.46.50"	4	27	30	35	34,27	31	12,5	3,1250	0,011858	2,10E-02	31,80
11.50.50"	8	27	23	28	27,41	24	13,3	1,6625	0,011858	1,53E-02	25,44
11.58.50"	16	27	19	24	23,50	20	14,2	0,8875	0,011858	1,12E-02	21,80
12.12.50"	30	27	14	19	18,60	15	14,7	0,4900	0,011858	8,30E-03	17,26
12.27.50"	45	27	9	14	13,71	10	15	0,3333	0,011858	6,85E-03	12,72
13.12.50"	90	27	5	10	9,79	6	15,2	0,1689	0,011858	4,87E-03	9,08
15.12.50"	210	27	3	8	7,83	4	15,6	0,0743	0,011858	3,23E-03	7,27



Tabel Hidrometer tanah tanpa akar rumput kikuyu Percobaan III

Time of reading	Elapsed time, t (menit)	Temp (°C)	Actual Hyd Reading, Ra	Corr. Hyd Reading, Rc	% Finer	Hyd Corr. Only for Meniscus, R	L	L/t	K	Diameter, D (mm)	% Finer terhadap total sampel
11.42.50"	0	27	45	50	48,95	46	9,6		0,011858		45,42
11.43.50"	1	27	39	44	43,08	40	11,1	11,1	0,011858	3,95E-02	39,97
11.44.50"	2	27	33	38	37,20	34	11,9	5,95	0,011858	2,89E-02	34,52
11.46.50"	4	27	27	32	31,33	28	12,5	3,1250	0,011858	2,10E-02	29,07
11.50.50"	8	27	21	26	25,45	22	13,3	1,6625	0,011858	1,53E-02	23,62
11.58.50"	16	27	17	22	21,54	18	14,2	0,8875	0,011858	1,12E-02	19,99
12.12.50"	30	27	13	18	17,62	14	14,7	0,4900	0,011858	8,30E-03	16,35
12.27.50"	45	27	9	14	13,71	10	15	0,3333	0,011858	6,85E-03	12,72
13.12.50"	90	27	4	9	8,81	5	15,2	0,1689	0,011858	4,87E-03	8,18
15.12.50"	210	27	2	7	6,85	3	15,6	0,0743	0,011858	3,23E-03	6,36



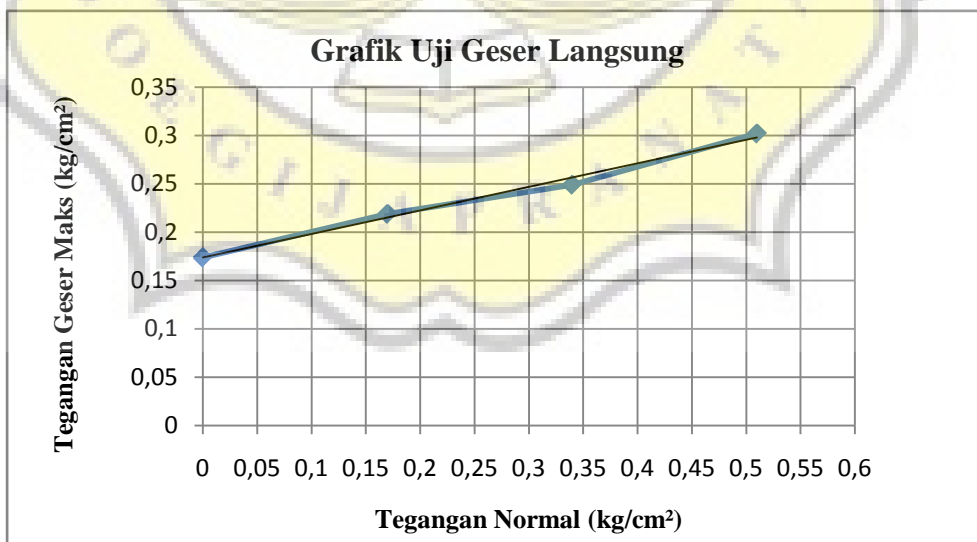
### *Direct Shear*

Uji geser / *direct shear* adalah untuk memperoleh besarnya tahanan geser tanah pada tegangan normal tertentu pada kondisi drainase tertentu. Hasil Uji geser langsung dapat digunakan untuk mendapatkan nilai  $c$  dan  $\phi$ , sehingga dapat diketahui jenis tanah. Berikut adalah data yang diperoleh pada saat pengujian di laboratorium :

#### 1. Tanah Dengan Akar Rumput Kikuyu

Tabel 1	5 Kg	10 Kg	15 Kg
Tegangan Normal (kg/cm <sup>2</sup> )	0,17	0,34	0,51
Tegangan Geser (kg/cm <sup>2</sup> )	0,2190	0,2492	0,3020
$c = 0,174$ (kg/cm <sup>2</sup> )	$\phi = 10^\circ$		

Berikut adalah Grafik hubungan antara Geser maks dan Tegangan normal dari hasil uji diatas:

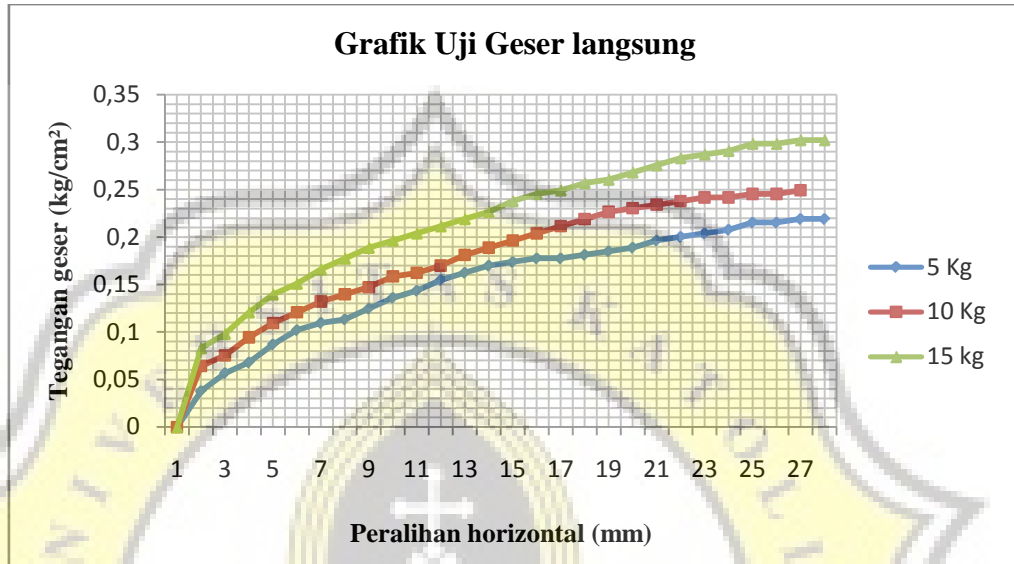


**Grafik 1.1** Hubungan antara tegangan geser maks dengan tegangan normal





Berikut adalah grafik hubungan antara tegangan geser dengan peralihan horizontal:

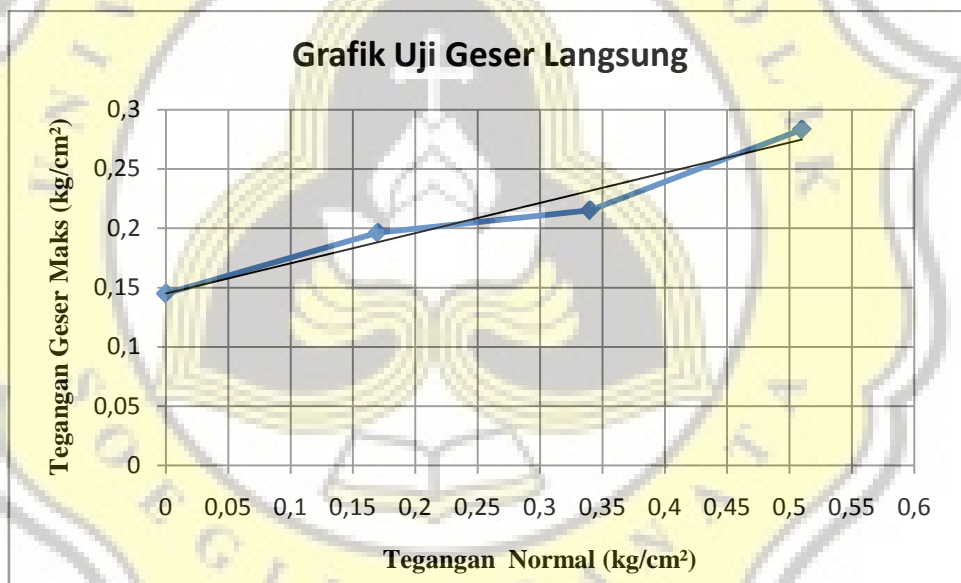


**Grafik 1.1** Hubungan antara tegangan geser dengan peralihan horizontal



<b>Tabel 2</b>	<b>5 Kg</b>	<b>10 Kg</b>	<b>15 Kg</b>
Tegangan Normal (kg/cm <sup>2</sup> )	0,17	0,34	0,51
Tegangan Geser (kg/cm <sup>2</sup> )	0,1963	0,2151	0,2831
$c = 0,145 \text{ (kg/cm}^2\text{)}$		$\phi = 11^\circ$	

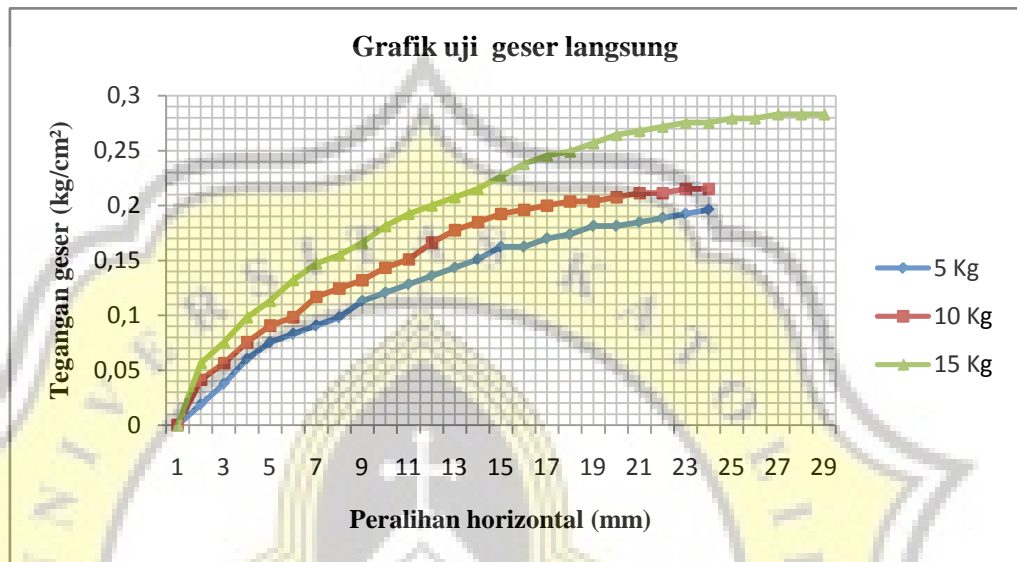
Berikut adalah Grafik hubungan antara Geser maks dan Tegangan normal dari hasil uji diatas:



**Grafik 1.2** Hubungan antara tegangan geser maks dengan tegangan normal



Berikut adalah grafik hubungan antara tegangan geser dengan peralihan horizontal:

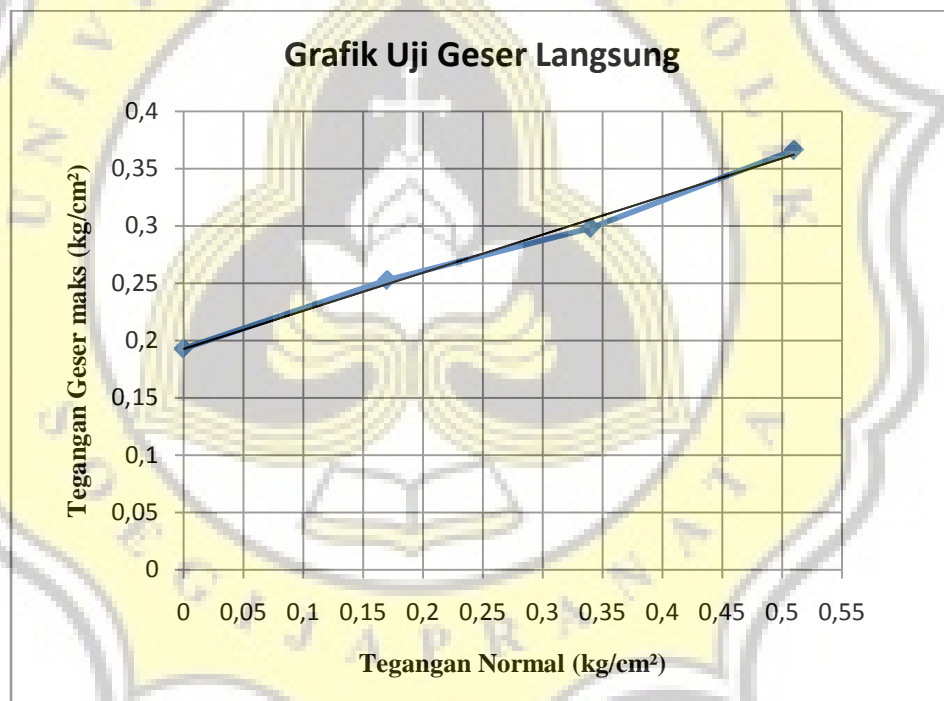


Grafik 1.2 Hubungan antara tegangan geser dengan peralihan horizontal



<b>Tabel 3</b>	<b>5 Kg</b>	<b>10 Kg</b>	<b>15 Kg</b>
Tegangan Normal (kg/cm <sup>2</sup> )	0,17	0,34	0,51
Tegangan Geser (kg/cm <sup>2</sup> )	0,2529	0,2982	0,3661
$c = 0,193 \text{ (kg/cm}^2\text{)}$		$\phi = 11^\circ$	

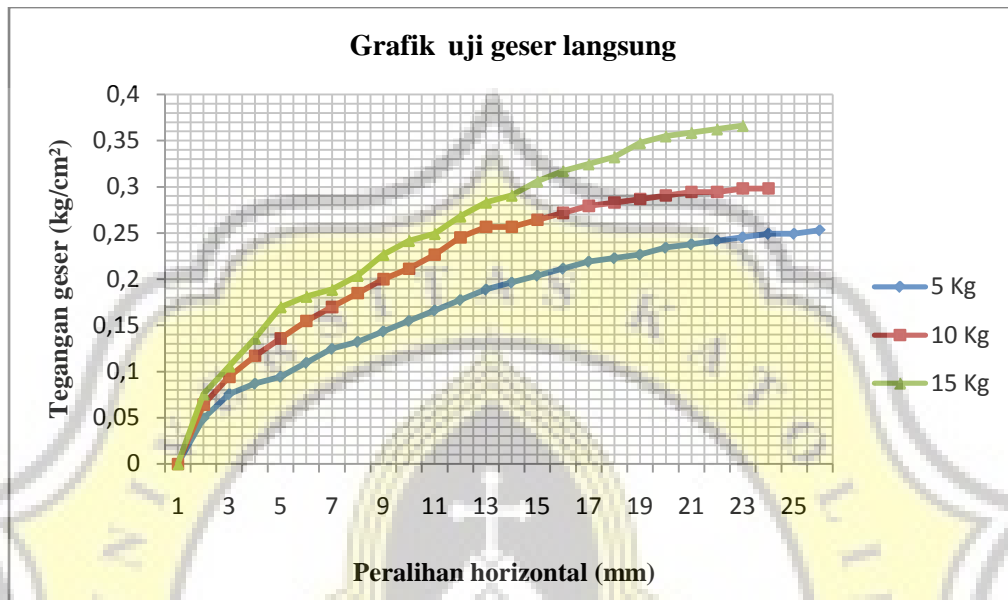
Berikut adalah Grafik hubungan antara Geser maks dan Tegangan normal dari hasil uji diatas:



**Grafik 1.3** Hubungan antara tegangan geser maks dengan tegangan normal



Berikut adalah grafik hubungan antara tegangan geser dengan peralihan horizontal:

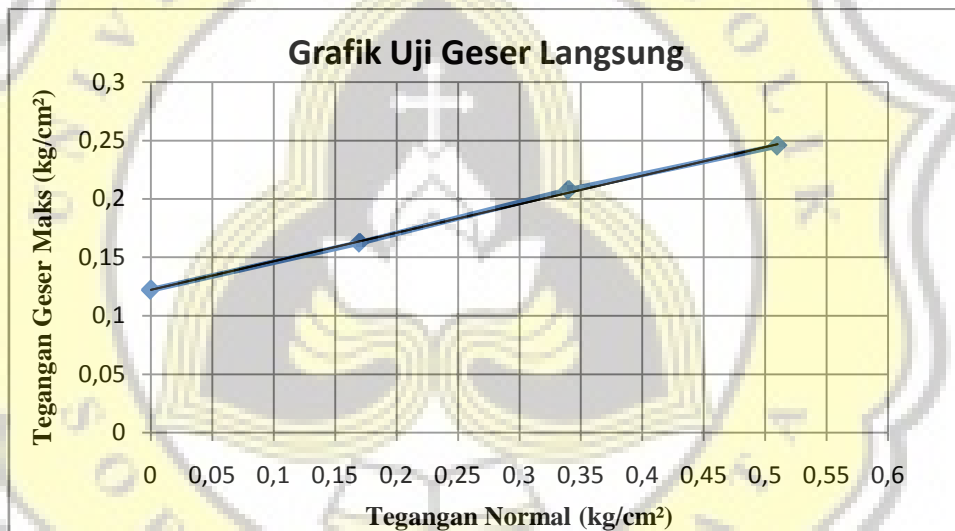


Grafik 1.3 Hubungan antara tegangan geser dengan peralihan horizontal



<b>Tabel 4</b>	<b>5 Kg</b>	<b>10 Kg</b>	<b>15 Kg</b>
Tegangan Normal (kg/cm <sup>2</sup> )	0,17	0,34	0,51
Tegangan Geser (kg/cm <sup>2</sup> )	0,1623	0,2076	0,2454
$c = 0,122 \text{ (kg/cm}^2\text{)}$		$\phi = 13^\circ$	

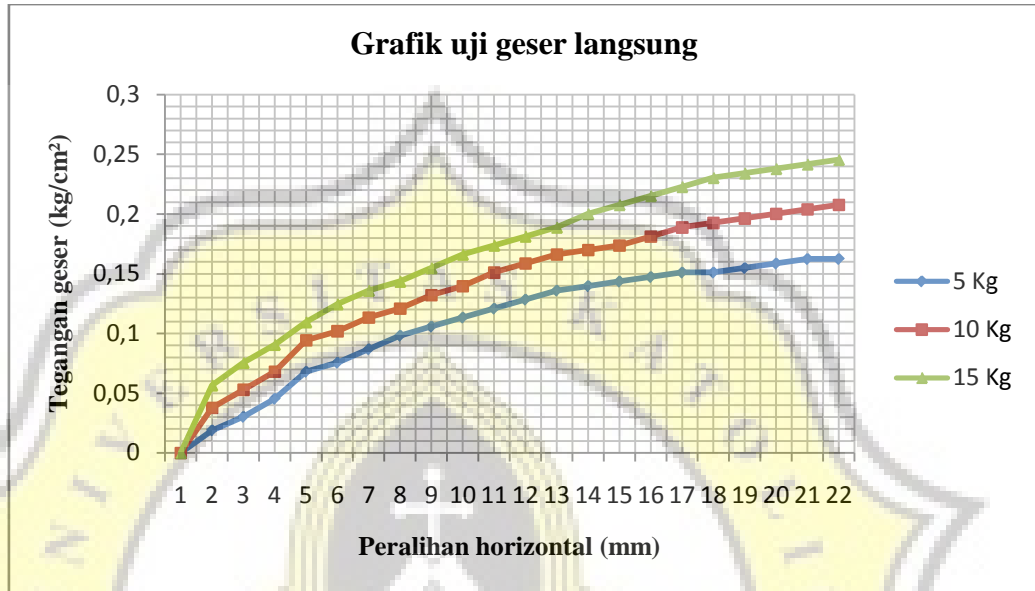
Berikut adalah Grafik hubungan antara Geser maks dan Tegangan normal dari hasil uji diatas:



**Grafik 1.4** Hubungan antara tegangan geser maks dengan tegangan normal



Berikut adalah grafik hubungan antara tegangan geser dengan peralihan horizontal:

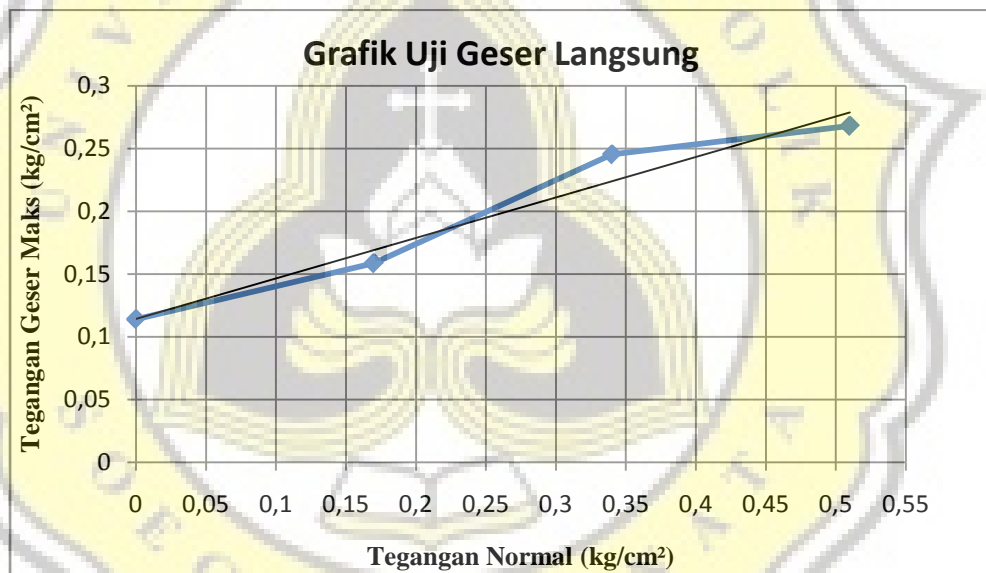


**Grafik 1.4** hubungan antara tegangan geser dengan peralihan horizontal



<b>Tabel 5</b>	<b>5 Kg</b>	<b>10 Kg</b>	<b>15 Kg</b>
Tegangan Normal (kg/cm <sup>2</sup> )	0,17	0,34	0,51
Tegangan Geser (kg/cm <sup>2</sup> )	0,1585	0,2453	0,2680
c = 0,114 (kg/cm <sup>2</sup> )		Ø = 15°	

Berikut adalah Grafik hubungan antara Geser maks dan Tegangan normal dari hasil uji diatas:

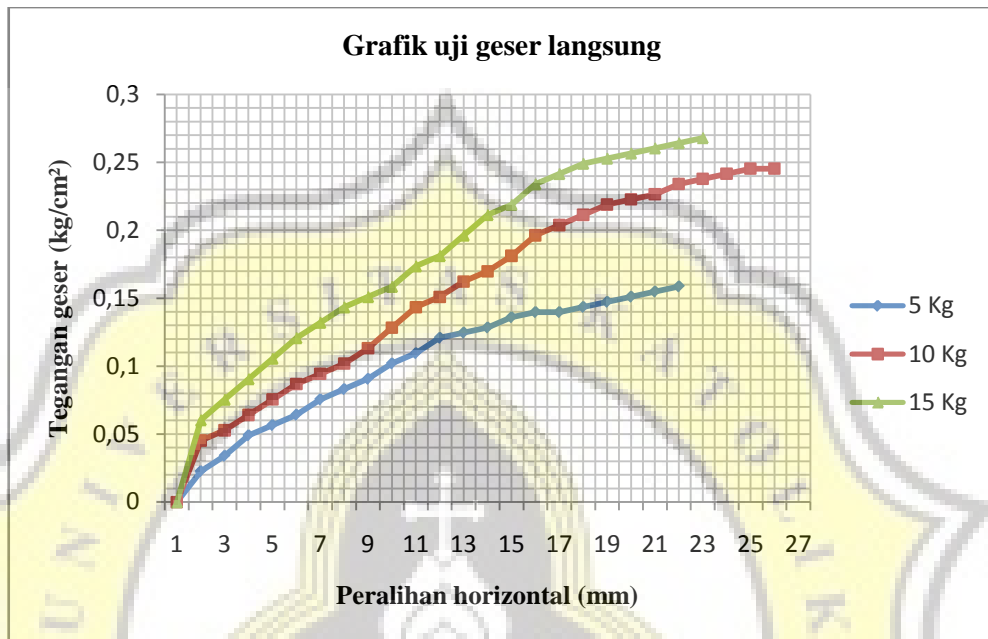


**Grafik 1.5** Hubungan antara tegangan geser maks dengan tegangan normal





Berikut adalah grafik hubungan antara tegangan geser dengan peralihan horizontal:



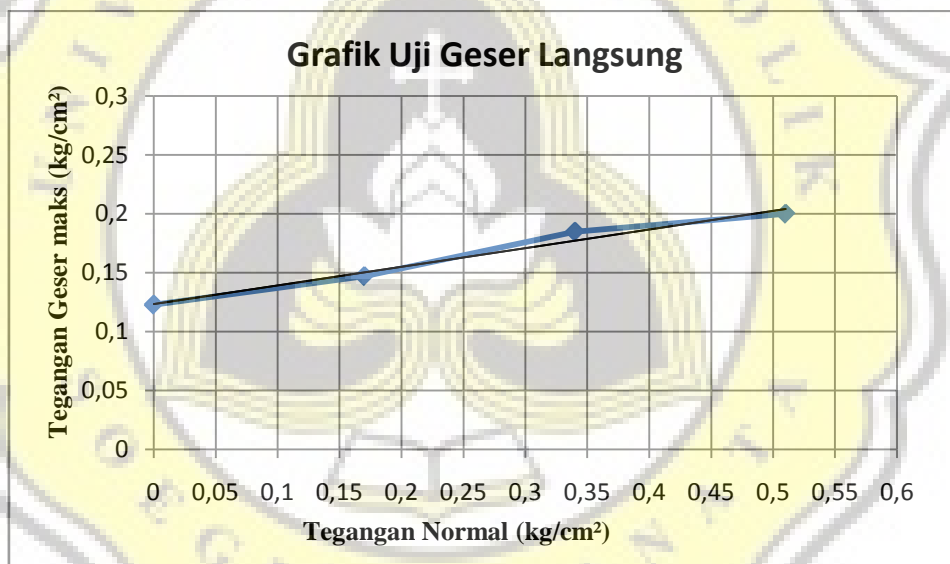
Grafik 1.5 Hubungan antara tegangan geser dengan peralihan horizontal



## 2. Tanah Tanpa Akar Rumput Kikuyu

Tabel 1	5 Kg	10 Kg	15 Kg
Tegangan Normal (kg/cm <sup>2</sup> )	0,17	0,34	0,51
Tegangan Geser (kg/cm <sup>2</sup> )	0,1472	0,1850	0,2001
c = 0,125 (kg/cm <sup>2</sup> )		Ø = 10°	

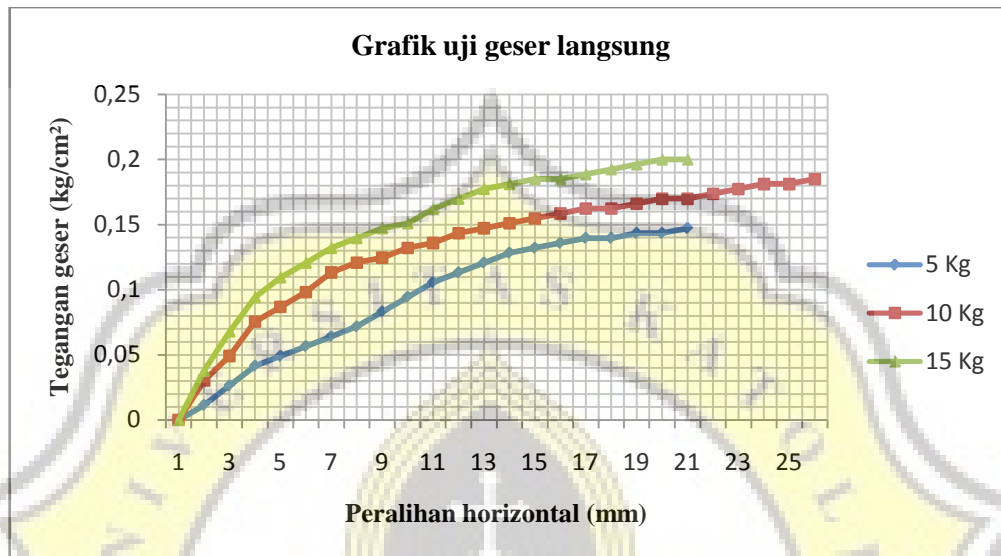
Berikut adalah Grafik hubungan antara Geser maks dan Tegangan normal dari hasil uji diatas:



Grafik 2.1 Hubungan antara tegangan geser maks dengan tegangan normal



Berikut adalah grafik hubungan antara tegangan geser dengan peralihan horizontal:

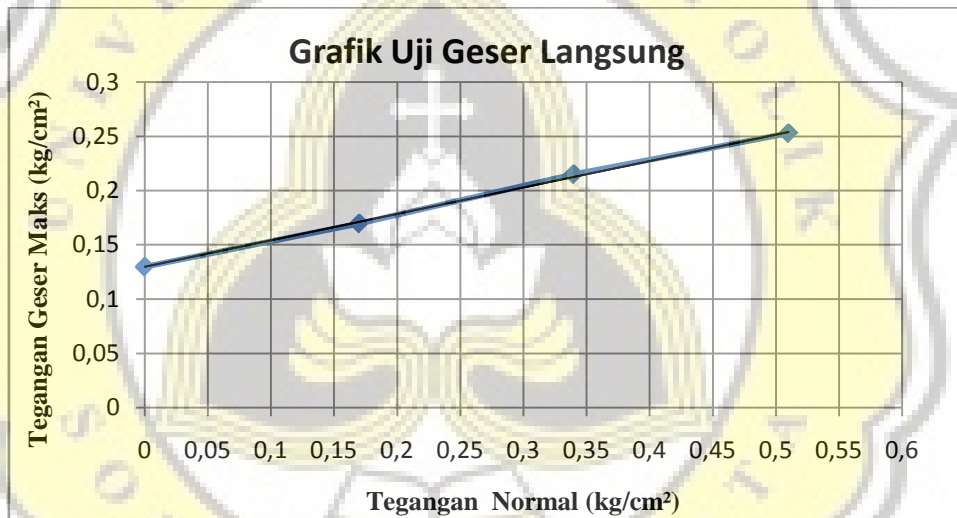


Grafik 2.1 Hubungan antara tegangan geser dengan peralihan horizontal



<b>Tabel 2</b>	<b>5 Kg</b>	<b>10 Kg</b>	<b>15 Kg</b>
Tegangan Normal (kg/cm <sup>2</sup> )	0,17	0,34	0,51
Tegangan Geser (kg/cm <sup>2</sup> )	0,1699	0,2152	0,2529
$c = 0,130$ (kg/cm <sup>2</sup> )		$\phi = 10^\circ$	

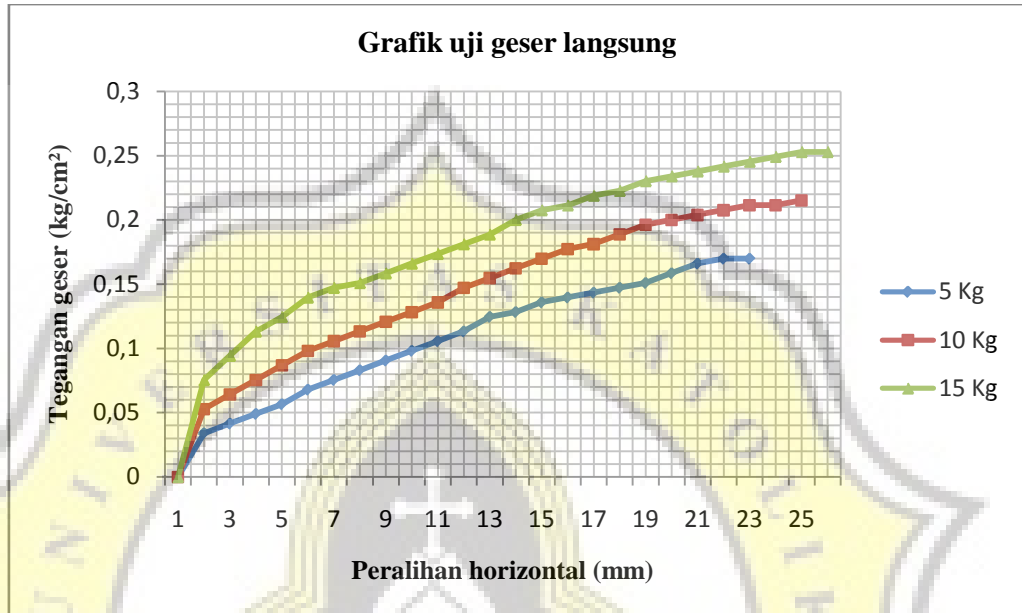
Berikut adalah Grafik hubungan antara Geser maks dan Tegangan normal dari hasil uji diatas:



**Grafik 2.2** Hubungan antara tegangan geser maks dengan tegangan normal



Berikut adalah grafik hubungan antara tegangan geser dengan peralihan horizontal:

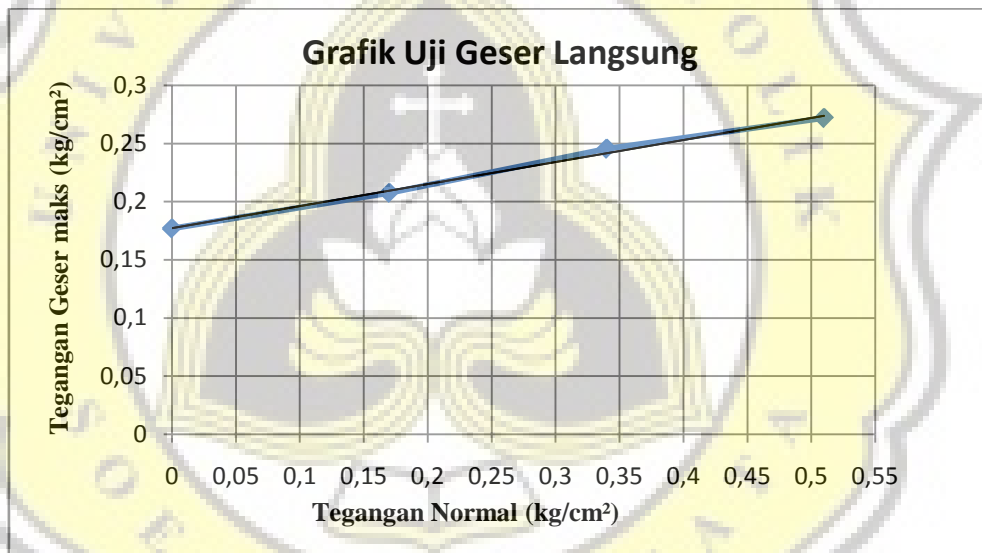


**Grafik 2.2** Hubungan antara tegangan geser dengan peralihan horizontal



<b>Tabel 3</b>	<b>5 Kg</b>	<b>10 Kg</b>	<b>15 Kg</b>
Tegangan Normal (kg/cm <sup>2</sup> )	0,17	0,34	0,51
Tegangan Geser (kg/cm <sup>2</sup> )	0,2076	0,2454	0,2718
$c = 0,177$ (kg/cm <sup>2</sup> )		$\phi = 9^\circ$	

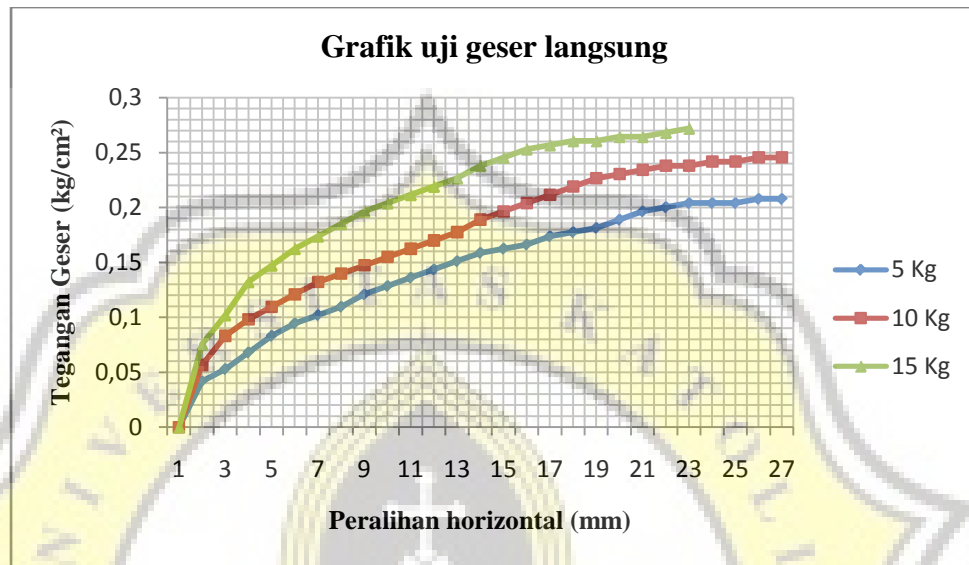
Berikut adalah Grafik hubungan antara Geser maks dan Tegangan normal dari hasil uji diatas:



**Grafik 2.3** Hubungan antara tegangan geser maks dengan tegangan normal



Berikut adalah grafik hubungan antara tegangan geser dengan peralihan horizontal:

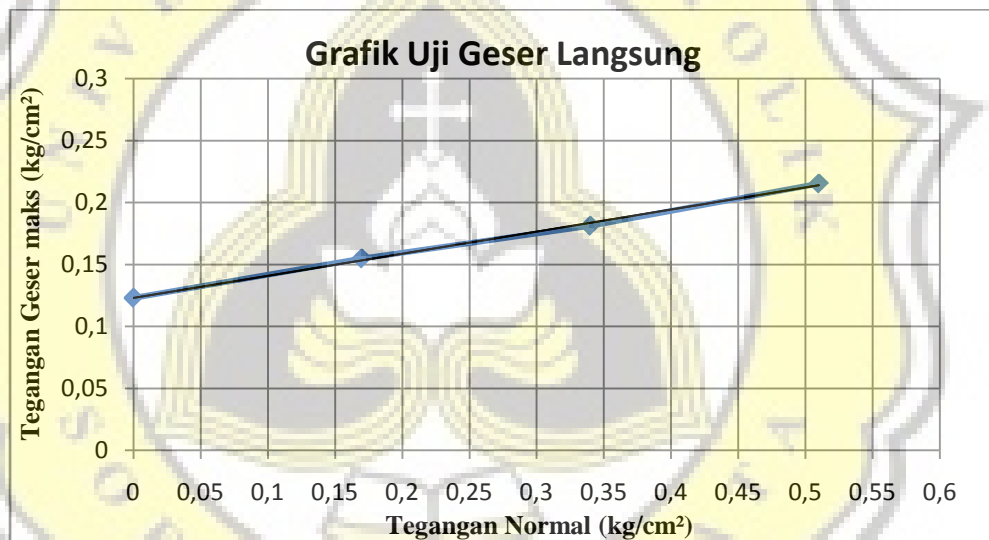


Grafik 2.3 Hubungan antara tegangan geser dengan peralihan horizontal



<b>Tabel 4</b>	<b>5 Kg</b>	<b>10 Kg</b>	<b>15 Kg</b>
Tegangan Normal (kg/cm <sup>2</sup> )	0,17	0,34	0,51
Tegangan Geser (kg/cm <sup>2</sup> )	0,1548	0,1812	0,2152
$c = 0,123$ (kg/cm <sup>2</sup> )		$\phi = 10^\circ$	

Berikut adalah Grafik hubungan antara Geser maks dan Tegangan normal dari hasil uji diatas:

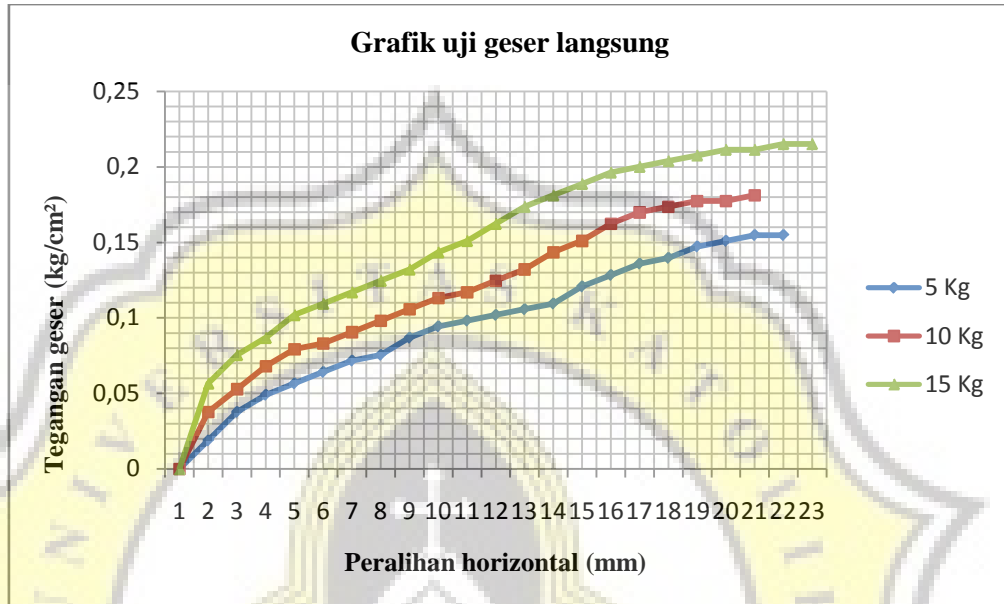


**Grafik 2.4** Hubungan antara tegangan geser maks dengan tegangan normal





Berikut adalah grafik hubungan antara tegangan geser dengan peralihan horizontal:

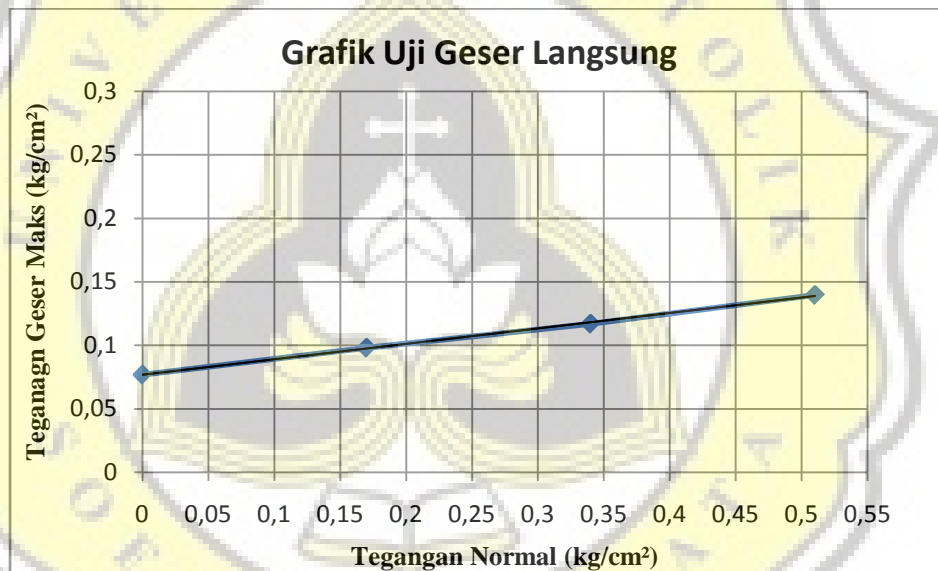


Grafik 2.4 Hubungan antara tegangan geser dengan peralihan horizontal



<b>Tabel 5</b>	<b>5 Kg</b>	<b>10 Kg</b>	<b>15 Kg</b>
Tegangan Normal (kg/cm <sup>2</sup> )	0,17	0,34	0,51
Tegangan Geser (kg/cm <sup>2</sup> )	0,0982	0,1170	0,1397
$c = 0,077$ (kg/cm <sup>2</sup> )		$\phi = 11^\circ$	

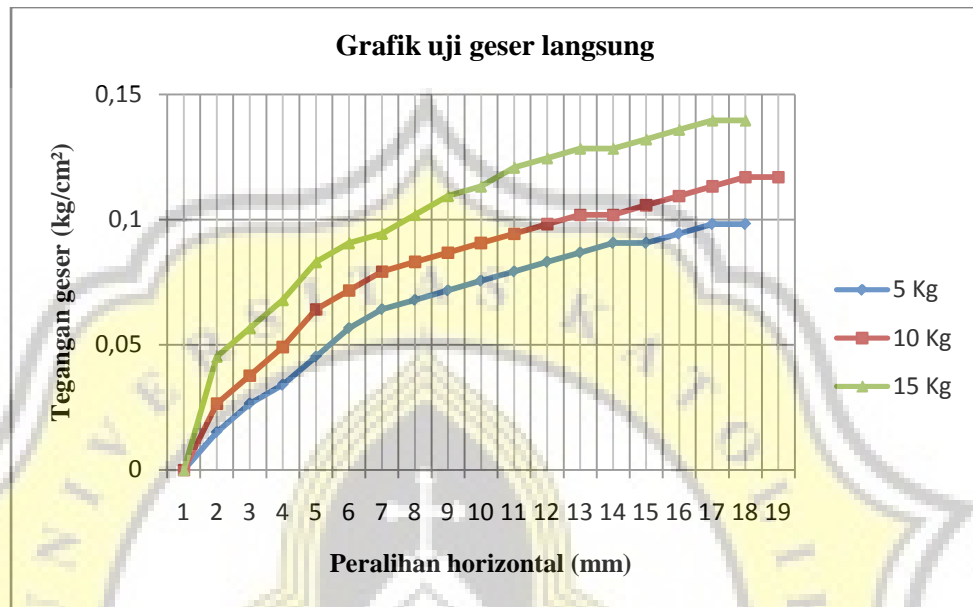
Berikut adalah Grafik hubungan antara Geser maks dan Tegangan normal dari hasil uji diatas:



**Grafik 2.5** Hubungan antara tegangan geser maks dengan tegangan normal



Berikut adalah grafik hubungan antara tegangan geser dengan peralihan horizontal:



Grafik 2.5 Hubungan antara tegangan geser dengan peralihan horizontal