



L – 01

UJI KLASIFIKASI



L - 01 - 1

UJI INDEX PROPERTIES

BERAT JENIS TANAH

No. Uji	1	2
Picnometer	Kecil	Kecil
Berat pic kosong (gr) (A)	37,5	39,3
berat pic + aquades (gr) (B)	138,6	139,7
Temperatur, T ₁ (°)	28	28
Berat pic + tanah kering (gr) (C)	75,5	79,7
Berat tanah kering (gr)	38	40,4
Berat pic + aquades + sample tanah (gr) (D)	163,2	165,4
Temperatur, T ₂ (°)	29	29
Berat aquades (gr)	101,1	100,4
G _s (spesific gravity)	2,841	2,754
G _s (spesific gravity) rata-rata	2,798	

Contoh Perhitungan Picnometer 1





- Berat tanah kering (a) = 38 gr
- Berat pic + aquades (b) = 138,6 gr
- Berat pic + tanah kering (c) = 75,5 gr
- Berat pic kosong (d) = 37,5 gr
- Berat pic + aquades – berat pic (e) = 101,1 gr
- Berat pic + aquades + sample tanah (f) = 163,2 gr
- T₁ (28°), faktor koreksi (g) = 0,9963
- T₂ (29°), faktor koreksi (h) = 0,9959


- Spesific Grafity (G_s)

$$G_s = \frac{c - d}{(e \cdot g) - \{(f - c)\} \cdot h}$$

$$G_s = \frac{75,5 - 37,5}{(101,1 \cdot 0,9963) - \{(163,2 - 75,5) \cdot 0,9959\}}$$

$$G_s = 2,798$$

No	Gambar	Keterangan
1		<p>Proses memasukan air aquades kedalam picnometer (Sumber: Dokumentasi Pribadi, 2016)</p>
2		<p>Ukur suhu air aquades dengan termometer (Sumber: Dokumentasi Pribadi, 2016)</p>
3		<p>Proses memasukan tanah sampel kedalam picnometer (Sumber: Dokumentasi Pribadi, 2016)</p>
4		<p>Proses mencampur aquades dengan tanah (Sumber: Dokumentasi Pribadi, 2016)</p>

No	Gambar	Keterangan
5		Ukur suhu air aquades + tanah dengan termometer (Sumber: Dokumentasi Pribadi, 2016)



KADAR AIR ALAMI

No. Uji	1	2
No. Ring	1	2
Tinggi Ring (cm)	1,70	1,50
Diameter Ring (cm)	3,50	3,50
Volume Ring (cm ³)	16,36	14,43
Berat Ring (gr)	17,30	16,70
Berat Ring + tanah bsh (gr)	45,80	41,10
Berat Ring + tanah krg (gr)	37,70	34,10
Berat Tanah basah (gr)	28,50	24,40
Berat Tanah kering (gr)	20,40	17,40
Berat Air (gr)	8,10	7,00
Kadar Air (%)	39,71	40,23
Kadar Air Rata-Rata (%)	39,97	

Contoh Perhitungan Kadar Air Alami

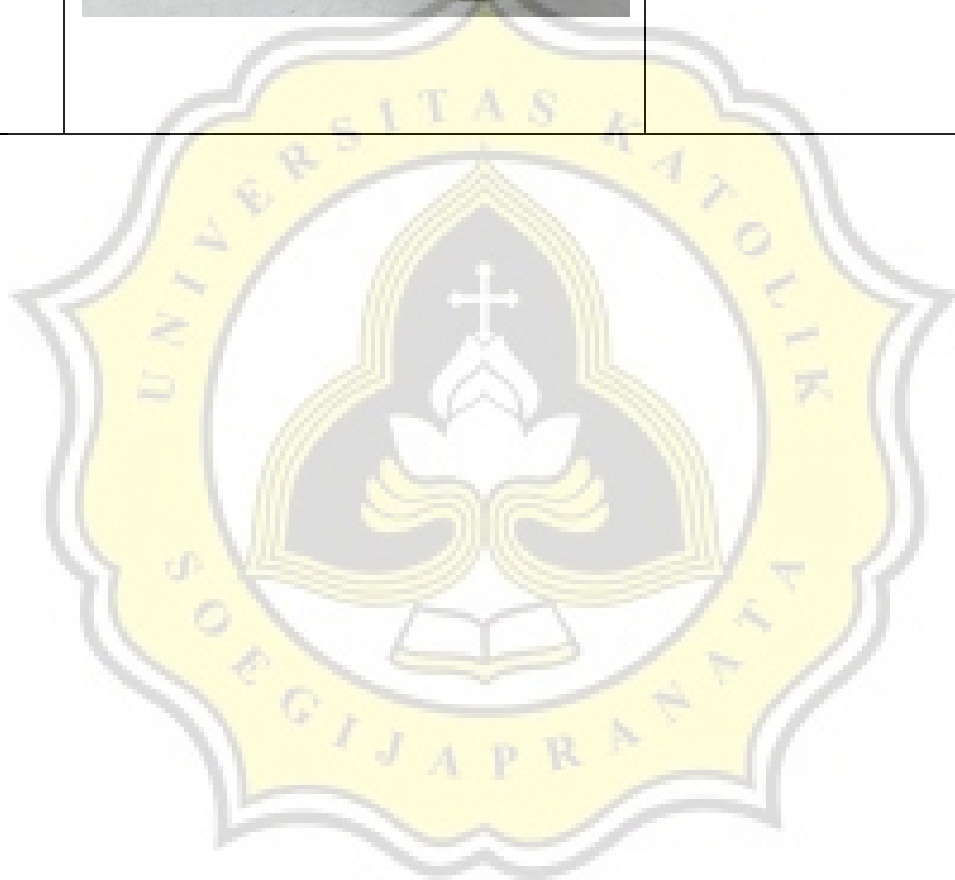
No. Uji		=1
No. Ring		=1
Berat Ring ,	W_1	= 17,30 gr
Berat Tanah Basah+ Ring,	W_2	= 45,80 gr
Berat Tanah Kering + Ring ,	W_3	= 37,70 gr
Berat Tanah Basah,	W	= $W_2 - W_1$
		= 45,80 – 17,30
		= 28,50 gr
 Berat Tanah Kering,	 W_s	 = $W_3 - W_1$
		= 37,70 – 17,30
		= 20,40 gr
 Berat air,	 W_w	 = $W - W_s$
		= 28,50 – 20,40
		= 8,10 gr

Kadar air, $w_1 = \frac{W_w}{W_s} \times 100\%$
 $= \frac{8,10}{20,40} \times 100\%$
 $= 39,71 \%$

Kadar air rata-rata $w_{rata-rata} = \frac{w_1 + w_2}{2}$
 $= \frac{39,71 + 40,23}{2}$
 $= 39,97 \%$



No	Gambar	Keterangan
1		<p>Ring + tanah yang telah di oven</p> <p>(Sumber: Dokumentasi Pribadi, 2016)</p>





L - 01 - 2

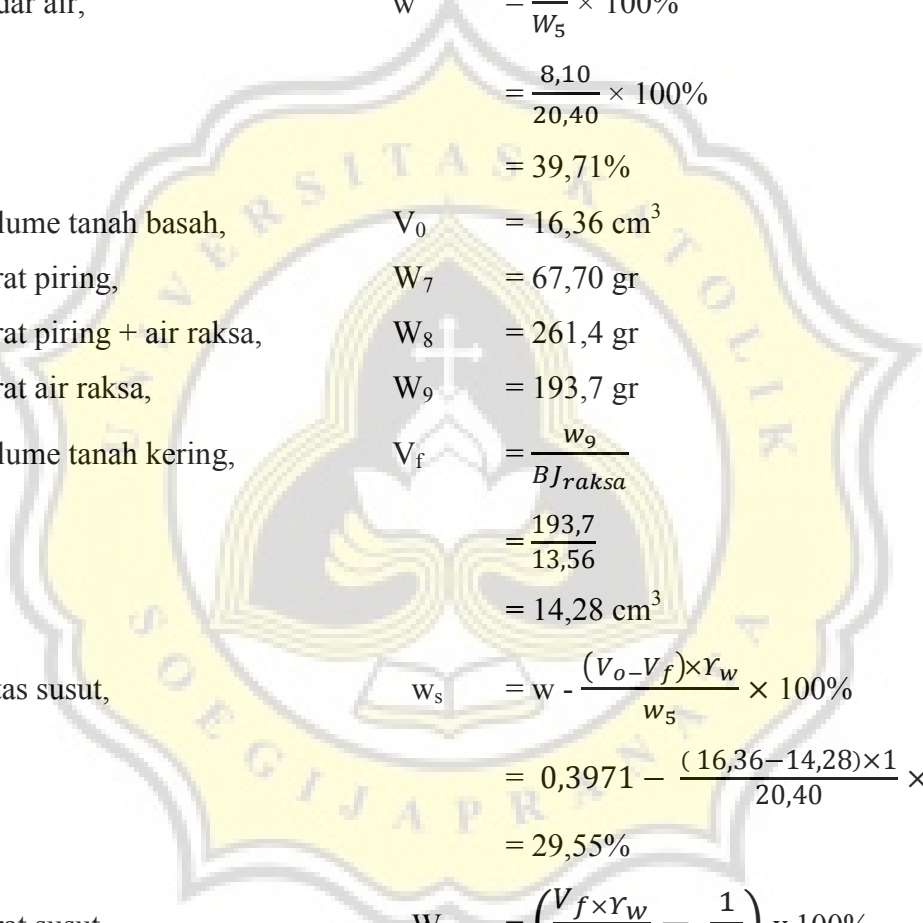
UJI ATTERBERG LIMIT

BATAS SUSUT

No. Uji	1	2
No. Ring	1	2
Tinggi Ring (cm)	1,70	1,50
Diameter Ring (cm)	3,50	3,50
Volume Ring (cm ³)	16,36	14,43
Berat Ring (gr)	17,30	16,70
Berat Ring + tanah bsh (gr)	45,80	41,10
Berat Ring + tanah krg (gr)	37,70	34,10
Berat Tanah basah (gr)	28,50	24,40
Berat Tanah kering (gr)	20,40	17,40
Berat Air (gr)	8,10	7,00
Kadar Air (%)	39,71	40,23
Volume tanah basah (cm ³)	16,36	14,43
Berat Piring (gr)	67,70	67,70
Berat Piring + Air Raksa (gr)	261,40	231,00
Berat Air Raksa Tumpah (gr)	193,70	163,30
γ Air Raksa (gr/cm ³)	13,56	13,56
Volume Tanah kering (cm ³)	14,28	12,04
Batas Susut, ws (%)	29,55	26,50
Rerata Batas Susut, ws (%)	28,03	
Berat Susut, Ws (%)	34,28	33,47
Shrinkage Ratio, SR	1,43	1,44
Gs	2,798	

Contoh Perhitungan Batas Susut

No. Uji	=	1
No. Ring	=	1
Berat ring,	W_1	= 17,30 gr
Berat tanah basah+ ring,	W_2	= 45,80 gr
Berat tanah kering+ ring,	W_3	= 37,70 gr
Volume ring	V	= 16,36 cm ³
Berat tanah basah,	W_4	= $W_2 - W_1$ = 45,80 – 17,30 = 28,50 gr



Berat tanah kering, $W_5 = W_3 - W_1$
 $= 37,70 - 17,30$
 $= 20,40 \text{ gr}$

Berat air, $W_6 = W_4 - W_5$
 $= 28,50 - 20,40$
 $= 8,10 \text{ gr}$

Kadar air, $w = \frac{W_6}{W_5} \times 100\%$
 $= \frac{8,10}{20,40} \times 100\%$
 $= 39,71\%$

Volume tanah basah, $V_0 = 16,36 \text{ cm}^3$

Berat piring, $W_7 = 67,70 \text{ gr}$

Berat piring + air raksa, $W_8 = 261,4 \text{ gr}$

Berat air raksa, $W_9 = 193,7 \text{ gr}$



Volume tanah kering, $V_f = \frac{W_9}{BJ_{raksa}}$
 $= \frac{193,7}{13,56}$
 $= 14,28 \text{ cm}^3$

Batas susut, $w_s = w - \frac{(V_0 - V_f) \times \gamma_w}{W_5} \times 100\%$
 $= 0,3971 - \frac{(16,36 - 14,28) \times 1}{20,40} \times 100\%$
 $= 29,55\%$

Berat susut, $W_s = \left(\frac{V_f \times \gamma_w}{W_5} - \frac{1}{G_s} \right) \times 100\%$
 $= \left(\frac{14,28 \times 1}{20,40} - \frac{1}{2,798} \right) \times 100\%$
 $= 34,28\%$

$$\text{Shrinkage ratio, SR} = \frac{W_5}{V_f}$$

$$= \frac{20,40}{14,28} = 1,43$$

No	Gambar	Keterangan
1		<p>Ring + tanah yang telah di oven (Sumber: Dokumentasi Pribadi, 2016)</p>
2		<p>Mengukur volume kering sampel (Sumber: Dokumentasi Pribadi, 2016)</p>

BATAS CAIR

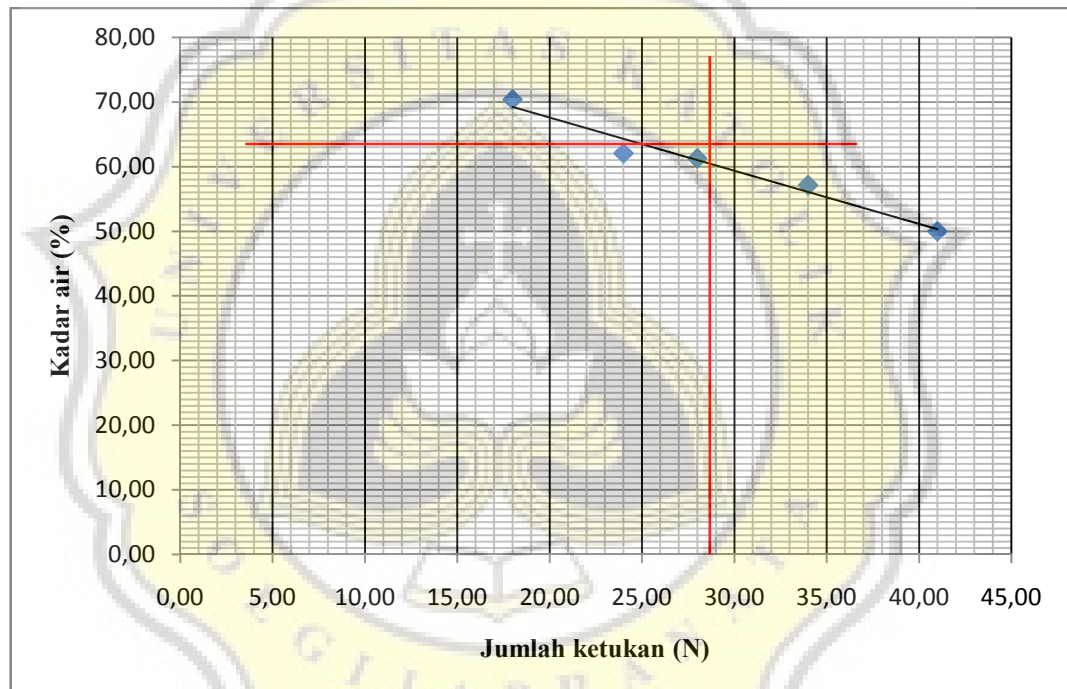
No. Uji	1	2	3	4	5
No. Container	1	2	3	4	5
Berat Container, W1 (gr)	4,90	5,00	5,00	4,90	4,70
Berat tanah basah + Container, W2 (gr)	9,70	10,50	10,00	9,60	9,30
Berat tanah kering + Container, W3 (gr)	8,10	8,50	8,10	7,80	7,40
Berat tanah basah, W4 = W2 - W1 (gr)	4,80	5,50	5,00	4,70	4,60
Berat tanah kering, W5 = W3 - W1 (gr)	3,20	3,50	3,10	2,90	2,70
Berat air, W6 = W4 - W5 (gr)	1,60	2,00	1,90	1,80	1,90
Kadar air, w = (W6/W5) X 100% (%)	50,00	57,14	61,29	62,07	70,37
Banyak ketukan, N	41,00	34,00	28,00	24,00	18,00
Batas cair, LL (%)	63,50				

Contoh Perhitungan Batas Cair




No uji		= 1
No.Container		= 1
Berat Container ,	W ₁	= 4,90 gr
Berat Tanah Basah+ Container,	W ₂	= 9,70 gr
Berat Tanah Kering + Container,	W ₃	= 8,10 gr
Berat Tanah Basah,	W ₄	= W ₂ - W ₁
		= 9,70 - 4,90
		= 4,80 gr
Berat Tanah Kering,	W ₅	= W ₃ - W ₁
		= 8,10 - 4,90
		= 3,20 gr
Berat air,	W ₆	= W ₄ -W ₅
		= 4,80 - 3,20
		= 1,60 gr

Kadar air, $w = \frac{W_6}{W_5} \times 100\%$
 $= \frac{1,60}{3,20} \times 100\%$
 $= 50\%$

Banyak ketukan, $N = 25$
 Batas Cair $W_L = 63,50\%$ (lihat grafik)



Batas air standar pada ketukan ke-25, sehingga diperoleh kadar air sebesar 63.5%

No	Gambar	Keterangan
1		<p>Alat dan bahan uji batas cair</p> <p>(Sumber: Dokumentasi Pribadi, 2016)</p>
2		<p>Pengambilan sampel tanah pada saat uji batas cair untuk diuji kadar airnya</p> <p>(Sumber: Dokumentasi Pribadi, 2016)</p>
3		<p>Sampel tanah hasil uji batas cair</p> <p>(Sumber: Dokumentasi Pribadi, 2016)</p>

BATAS PLASTIS

No. Uji	1	2	3
No. Container	Tepat	Tepat	Tepat
Berat Container (gr)	4,80	4,90	4,7
Berat Container + Tanah Basah (gr)	6,30	6,60	6,7
Berat Container + Tanah Kering (gr)	5,90	6,20	6,2
Berat Tanah Basah (gr)	1,50	1,70	2,00
Berat Tanah Kering (gr)	1,10	1,30	1,50
Berat Air (gr)	0,40	0,40	0,50
Kadar Air (%)	36,36	30,77	33,33
Plastis Limit (PL)	33,49		

Contoh Perhitungan Batas Plastis

No uji		= 1
No.Container		= 1
Berat Container ,	W_1	= 4,80 gr
Berat Tanah Basah+ Container,	W_2	= 6,30 gr
Berat Tanah Kering + Container,	W_3	= 5,90 gr
Berat Tanah Basah,	W_4	= $W_2 - W_1$ = 6,30 – 4,80 = 1,50 gr
Berat Tanah Kering,	W_5	= $W_3 - W_1$ = 5,90 – 4,80 = 1,10 gr
Berat air,	W_6	= $W_4 - W_5$ = 1,50 – 1,10 = 0,40 gr
Kadar air,	w	= $\frac{W_6}{W_5} \times 100\%$ = $\frac{0,40}{1,10} \times 100\%$ = 36,36 %

Batas Plastis



W_p

$$= \frac{Wp_1 + Wp_2 + Wp_3}{3}$$

$$= \frac{36,36 + 30,77 + 33,33}{3}$$

$$= 33,49 \%$$



No	Gambar	Keterangan
1		<p>Proses penggulungan sampel tanah mencapai 3 mm (Sumber: Dokumentasi Pribadi, 2016)</p>
2		<p>Sampel tanah yang telah digulung 3 mm (Sumber: Dokumentasi Pribadi, 2016)</p>

Plasticity Index (I_p) Dan Liquidity Index (I_L)

Dari perhitungan di atas diperoleh hasil :

- Batas Susut / *Shrinkage Limit* (W_s) = 33,88%
- Batas Plastis / *Plastic Limit* (W_p) = 33,49%
- Batas Cair / *Liquid Limit* (W_L) = 63,50%

- Plasticity Index (I_p) :

$$I_p = W_L - W_p$$

$$I_p = 63,50\% - 33,49\%$$

$$I_p = 30,01\%$$

- Liquidity Index (I_L)

$$I_L = \frac{W - W_p}{W_L - W_p}$$

$$I_L = \frac{39,71\% - 33,49\%}{63,50\% - 33,49\%}$$

$$I_L = \frac{6,22\%}{30,01\%} = 0,207$$

L - 01 - 3

ANALISIS BUTIRAN TANAH



DATA HASIL UJI SARINGAN

No. Saringan	Diameter Saringan (mm)	Berat Saringan (gram)	Berat Tanah dan Saringan (gram)	Berat Tertahan (gram)	% Tertahan	% Lolos
4	4,750	441,0	441,0	0,0	0,00	100,00
10	2,000	317,4	317,4	0,0	0,00	100,00
20	0,850	315,0	315,4	0,4	0,40	99,60
30	0,590	419,4	419,6	0,2	0,20	99,40
40	0,425	304,2	304,4	0,2	0,20	99,20
50	0,297	406,8	407,2	0,4	0,40	98,80
80	0,180	289,2	289,4	0,2	0,20	98,60
100	0,150	400,8	401,4	0,6	0,60	98,00
200	0,074	283,6	284,4	0,8	0,80	97,20
Pan	~	471,2	568,4	97,2	97,20	0,00
Jumlah				100,0	100,00	

CONTOH PERHITUNGAN UJI SARINGAN

No. Saringan = 20
 Diameter saringan = 0,850
 Berat saringan = 315,0 gr
 Berat tanah + saringan = 315,4 gr
 Berat tertahan = (Berat tanah + Saringan) - Berat saringan
 = 315,4 - 315,0
 = 0,4 gr

Persentase tertahan = $\frac{\text{Berat tertahan}}{\text{Jumlah sampel tanah}} \times 100\%$

$$\begin{aligned}
 &= \frac{0,4}{100} \times 100\% \\
 &= 0,4\%
 \end{aligned}$$

Persentase lolos

$$\begin{aligned}
 &= (\text{Total persentase tertahan} - \text{Persentase tertahan saringan no.4}) \\
 &= 100\% - 0,4\% = 99,6\%
 \end{aligned}$$

DATA HASIL UJI HIDROMETER

Elapsed Time t (minute)	I		II		III		Average	
	Temp	Actual Hyd. Reading	Temp	Actual Hyd. Reading	Temp	Actual Hyd. Reading	Temp	Actual Hyd. Reading
	(°C)	Ra	(°C)	Ra	(°C)	Ra	(°C)	Ra
0	29	60	29	60	29	60	29	60,00
1	29	60	28	60	29	60	28,66667	60,00
2	28	60	28	60	29	60	28,33333	60,00
3	28	60	29	60	29	60	28,66667	60,00
							Σ	60,00

Elapsed Time t (minute)	Temp. (°C)	Actual Hyd. Reading Ra	Corr. Hyd. Reading Rc	% Finer	Hyd. Corr. Only for Meniscus R	L cm	L/t cm/mnt	K	Diameter D (mm)
0	29	60	56,95	56,77	60,1	6,5	-	0,01178	-
1	29	60	56,95	56,77	60,1	6,5	6,5	0,01178	0,0300
2	29	60	56,95	56,77	60,1	6,5	3,25	0,01178	0,0212
4	29	60	56,95	56,77	60,1	6,5	1,625	0,01178	0,0150
8	29	60	56,95	56,77	60,1	6,5	0,8125	0,01178	0,0106
16	29	59	55,95	55,77	59,1	6,6	0,413	0,01178	0,0076
30	29	57	53,95	53,78	57,1	7	0,233333	0,01178	0,0057
45	30	56	52,20	52,04	56,1	7,1	0,15778	0,01166	0,0046
90	30	52	48,20	48,05	52,1	7,8	0,08667	0,01166	0,0034
210	30	49	45,20	45,06	49,1	8,3	0,03952	0,01166	0,0023
1290	29	47	43,95	43,81	47,1	8,6	0,00667	0,01178	0,0010
1440	29	46	42,95	42,81	46,1	8,8	0,00611	0,01178	0,0009

CONTOH PERHITUNGAN UJI HIDROMETER

G_s (specific gravity) = 2,798

Faktor Koreksi (a)

$$\begin{aligned} a &= \frac{165 \times G_s}{265 \times (G_s - 1)} \\ &= \frac{165 \times 2798}{265 \times (2798 - 1)} \\ &= 0,969 \end{aligned}$$

Correction Hydrometer Reading

$$\begin{aligned} R_a &= 60 \\ \text{Zero Correction, } C_o &= 0 \\ \text{Temp.} &= 29^\circ \\ C_t &= 3,05 \\ R_c &= R_a - (\text{Zero Correction} + C_t) \\ &= 60 - (0 + 3,05) \\ &= 56,95 \end{aligned}$$

Berat Tanah Kering

$$W_s = 97,2 \text{ gr}$$

Persen Finer

$$\begin{aligned} \% \text{ finer} &= \frac{R_c \times a}{W_s} \times 100\% \\ &= \frac{56,95 \times 0,969}{97,2} \times 100\% \\ &= 56,77 \% \end{aligned}$$

Harga R

$$\begin{aligned} R_a &= 60 \\ R &= R_a + \text{Mensius Correction} \\ &= 60 + 0,1 \\ &= 60,1 \end{aligned}$$

Harga L

$$\begin{aligned} R &= 60 \\ L &= 6,5 \text{ cm} \end{aligned}$$

L / t

$$L = 6,5 \text{ cm}$$

$$t = 1 \text{ menit}$$

$$L/t = \frac{6,5}{1}$$

$$= 6,5 \text{ cm/menit}$$

Harga K

$$\text{Temp.} = 29^\circ$$

$$G_w = 0,99598$$

$$\eta = 0,00818$$

$$g = 981 \text{ cm/s}$$

$$K^2 = \frac{30 \times \eta}{g \times (G_s - G_w)}$$

$$= \frac{30 \times 0,00818}{981 \times (2798 - 0,99598)}$$

$$= 0,000139$$

$$K = 0,01178$$

Diameter, D

$$D = K \times \sqrt{\frac{L}{t}}$$

$$= 0,01178 \times \sqrt{\frac{6,5}{1}}$$

$$= 0,03 \text{ mm}$$

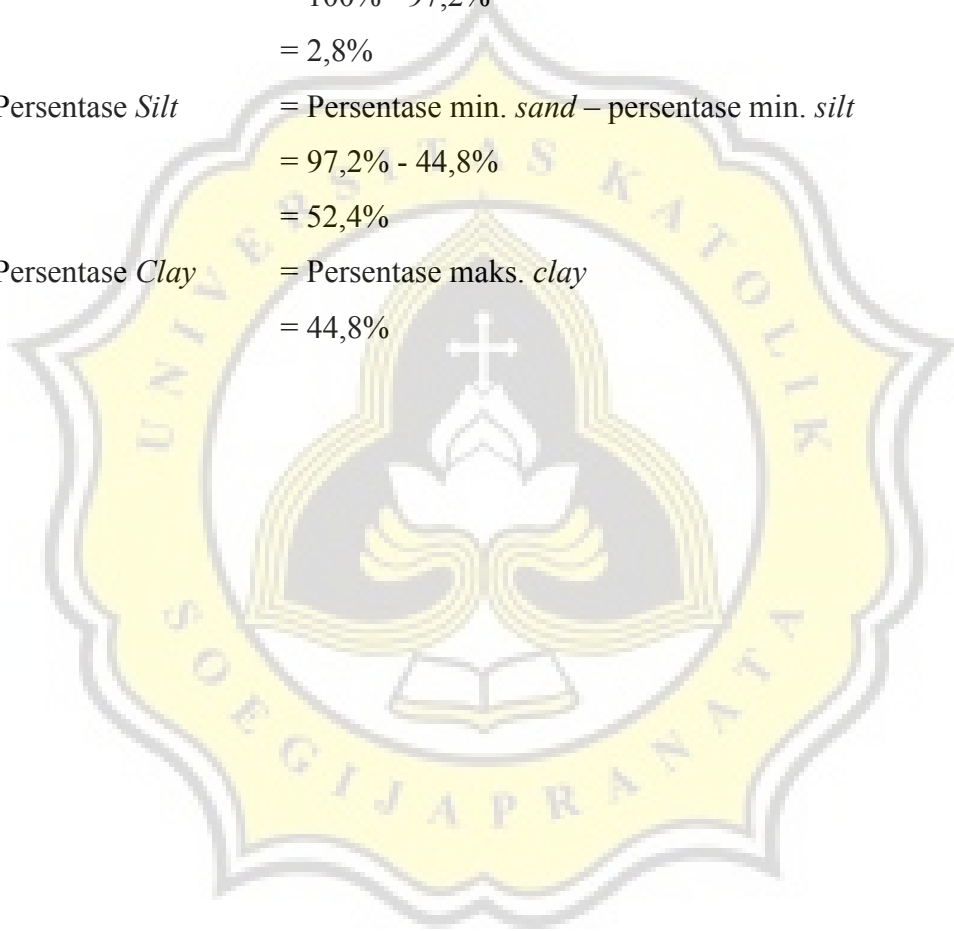
Contoh Perhitungan Analisis Butiran Tanah


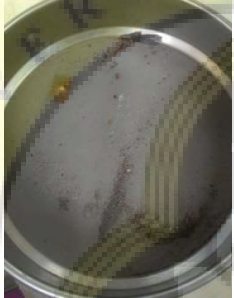


$$\begin{aligned}\text{Persentase Gravel} &= \text{Persentase lolos No.4} - \text{Persentase min. gravel} \\ &= 100\% - 100\% \\ &= 0\%\end{aligned}$$

$$\begin{aligned}\text{Persentase Sand} &= \text{Persentase min. gravel} - \text{Persentase min. sand} \\ &= 100\% - 97,2\% \\ &= 2,8\%\end{aligned}$$

$$\begin{aligned}\text{Persentase Silt} &= \text{Persentase min. sand} - \text{persentase min. silt} \\ &= 97,2\% - 44,8\% \\ &= 52,4\%\end{aligned}$$

$$\begin{aligned}\text{Persentase Clay} &= \text{Persentase maks. clay} \\ &= 44,8\%\end{aligned}$$



No	Gambar	Keterangan
1		<p>Proses pencucian tanah menggunakan saringan No.200 (Sumber: Dokumentasi Pribadi, 2016)</p>
2		<p>Tanah yang tertahan pada saringan No.200 setelah dilakukan pencucian (Sumber: Dokumentasi Pribadi, 2016)</p>
3		<p>Proses <i>mixer</i> tanah untuk persiapan uji hidrometer (Sumber: Dokumentasi Pribadi, 2016)</p>
4		<p>Proses uji hidrometer (Sumber: Dokumentasi Pribadi, 2016)</p>

L – 02

UJI PEMADATAN TANAH



**TABEL HASIL UJI PEMADATAN TANAH ASLI (*PORTLAND CEMENT*
0%)**

Percobaan Ke-	1			2			3			4			5			6		
Berat tanah asli (gr)	5000			5000			5000			5000			5000			5000		
Banyak air yang disemprot (cc)	600			800			1000			1200			1400			1600		
Berat mold (gr)	5350			5350			5350			5350			5350			5350		
Berat mold + tanah basah (gr)	8640			8860			8990			9280			8880			8810		
Berat tanah basah (gr)	3290			3510			3640			3930			3530			3460		
Diameter mold (cm)	15,24			15,24			15,24			15,24			15,24			15,24		
Tinggi mold (cm)	11,46			11,46			11,46			11,46			11,46			11,46		
Volume (mold)	2091,31			2091,31			2091,31			2091,31			2091,31			2091,31		
Berat jenis isi tanah (gr/cm ³)	1,573			1,678			1,741			1,879			1,688			1,654		
Berat jenis isi kering (gr/cm ³)	1,354			1,414			1,360			1,355			1,174			1,141		
No. Container	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah
Berat container (gr)	4,90	4,80	4,90	4,80	4,80	4,70	4,80	4,80	6,70	4,90	4,80	5,10	4,90	6,80	4,40	10,50	9,50	11,50
Berat container + tanah basah (gr)	13,70	13,30	12,00	14,20	14,90	13,80	14,20	16,10	16,10	26,60	24,50	32,30	17,80	17,50	20,60	25,80	36,40	33,90
Berat container + tanah kering (gr)	12,40	12,20	11,00	12,70	13,30	12,40	12,20	13,50	14,10	20,10	19,30	24,90	13,70	14,00	16,30	20,60	28,50	27,30
Berat tanah basah (gr)	8,80	8,50	7,10	9,40	10,10	9,10	9,40	11,30	9,40	21,70	19,70	27,20	12,90	10,70	16,20	15,30	26,90	22,40
Berat tanah kering (gr)	7,50	7,40	6,10	7,90	8,50	7,70	7,40	8,70	7,40	15,20	14,50	19,80	8,80	7,20	11,90	10,10	19,00	15,80
Kadar air (%)	17,33	14,86	16,39	18,99	18,82	18,18	27,03	29,89	27,03	42,76	35,86	37,37	46,59	48,61	36,13	51,49	41,58	41,77
Kadar air rata-rata (%)	16,20			18,66			27,98			38,67			43,78			44,95		

TABEL HASIL UJI PROKTOR TANAH + *PORTLAND CEMENT* 10%

Percobaan Ke-	1			2			3			4			5			6		
Berat tanah asli (gr)	5000			5000			5000			5000			5000			5000		
Banyak air yang disemprot (cc)	600			800			1000			1200			1400			1600		
Berat mold (gr)	5350			5350			5350			5350			5350			5350		
Berat mold + tanah basah (gr)	8770			8945			9000			9285			9240			8990		
Berat tanah basah (gr)	3420			3595			3650			3935			3890			3640		
Diameter mold (cm)	15,24			15,24			15,24			15,24			15,24			15,24		
Tinggi mold (cm)	11,46			11,46			11,46			11,46			11,46			11,46		
Volume (mold)	2091,31			2091,31			2091,31			2091,31			2091,31			2091,31		
Berat jenis isi tanah (gr/cm ³)	1,635			1,719			1,745			1,882			1,860			1,741		
Berat jenis isi kering (gr/cm ³)	1,400			1,430			1,429			1,476			1,423			1,273		
No. Container	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah
Berat container (gr)	6,90	6,90	7,00	4,90	4,70	4,70	6,80	7,20	7,00	6,90	7,10	7,00	6,90	7,00	7,00	9,70	6,50	9,80
Berat container + tanah basah (gr)	28,70	23,90	23,60	15,00	18,20	14,10	21,70	21,70	19,40	19,10	22,90	24,00	29,40	23,40	20,30	26,30	28,40	22,50
Berat container + tanah kering (gr)	26,70	21,50	20,40	13,50	15,70	12,50	19,10	18,80	17,30	16,50	19,40	20,40	24,00	19,60	17,20	21,70	22,50	19,20
Berat tanah basah (gr)	21,80	17,00	16,60	10,10	13,50	9,40	14,90	14,50	12,40	12,20	15,80	17,00	22,50	16,40	13,30	16,60	21,90	12,70
Berat tanah kering (gr)	19,80	14,60	13,40	8,60	11,00	7,80	12,30	11,60	10,30	9,60	12,30	13,40	17,10	12,60	10,20	12,00	16,00	9,40
Kadar air (%)	10,10	16,44	23,88	17,44	22,73	20,51	21,14	25,00	20,39	27,08	28,46	26,87	31,58	30,16	30,39	38,33	36,88	35,11
Kadar air rata-rata (%)	16,81			20,23			22,18			27,47			30,71			36,77		

TABEL HASIL UJI PROKTOR TANAH + *PORTLAND CEMENT* 20%

Percobaan Ke-	1			2			3			4			5			6		
Berat tanah asli (gr)	5000			5000			5000			5000			5000			5000		
Banyak air yang disemprot (cc)	600			800			1000			1200			1400			1600		
Berat mold (gr)	5350			5350			5350			5350			5350			5350		
Berat mold + tanah basah (gr)	8860			8940			9180			9365			9350			9045		
Berat tanah basah (gr)	3510			3590			3830			4015			4000			3695		
Diameter mold (cm)	15,24			15,24			15,24			15,24			15,24			15,24		
Tinggi mold (cm)	11,46			11,46			11,46			11,46			11,46			11,46		
Volume (mold)	2091,31			2091,31			2091,31			2091,31			2091,31			2091,31		
Berat jenis isi tanah (gr/cm ³)	1,678			1,717			1,831			1,920			1,913			1,767		
Berat jenis isi kering (gr/cm ³)	1,435			1,459			1,499			1,506			1,479			1,304		
No. Container	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah
Berat container (gr)	10,60	6,50	4,60	6,90	6,90	7,10	4,80	4,90	4,70	6,40	7,00	6,90	12,80	12,70	12,10	6,70	7,00	10,50
Berat container + tanah basah (gr)	27,80	23,20	15,20	23,60	20,90	22,90	12,80	11,80	12,00	22,50	18,10	20,30	26,50	37,50	24,60	27,60	33,80	33,40
Berat container + tanah kering (gr)	25,30	20,90	13,60	21,10	18,90	20,40	11,50	10,40	10,70	18,90	15,80	17,40	23,40	31,80	21,80	22,10	26,70	27,50
Berat tanah basah (gr)	17,20	16,70	10,60	16,70	14,00	15,80	8,00	6,90	7,30	16,10	11,10	13,40	13,70	24,80	12,50	20,90	26,80	22,90
Berat tanah kering (gr)	14,70	14,40	9,00	14,20	12,00	13,30	6,70	5,50	6,00	12,50	8,80	10,50	10,60	19,10	9,70	15,40	19,70	17,00
Kadar air (%)	17,01	15,97	17,78	17,61	16,67	18,80	19,40	25,45	21,67	28,80	26,14	27,62	29,25	29,84	28,87	35,71	36,04	34,71
Kadar air rata-rata (%)	16,92			17,69			22,17			27,52			29,32			35,49		

CONTOH PERHITUNGAN UJI PEMADATAN TANAH ASLI

Percobaan ke	= 1
Berat tanah asli	= 5000 gr
Berat mold	= 5350 gr
Berat mold + tanah basah	= 8640 gr
Berat tanah basah	= (berat mold + tanah basah) – berat mold = 8640 - 5350 = 3290 gr
Diameter mold	= 15,24 cm
Tinggi mold	= 11,46 cm
Volume mold	= $\frac{1}{4} \times \pi \times d^2 \times t$ = 2091,31 cm ³
No. container	= atas
Berat container	= 4,9 gr
Berat container+tanah basah	= 13,7 gr
Berat container+tanah kering	= 12,4 gr
Berat tanah basah	= (berat container + tanah basah) – berat container = 13,7 – 4,9 = 8,8 gr
Berat tanah kering	= (berat container + tanah kering) – berat container = 12,4 – 4,9 = 7,5 gr

$$\begin{aligned}
 \text{Kadar Air (w)} &= \frac{tb - tk}{tk} \times 100 \% \\
 &= \frac{8,8 - 7,5}{7,5} \times 100 \% \\
 &= 17,33 \%
 \end{aligned}$$

No. container = tengah

Berat container = 4,8 gr

Berat container + tanah basah = 13,3 gr

Berat container + tanah kering = 12,2 gr

Berat tanah basah = (berat container + tanah basah) – berat container
 = 13,3 – 4,8
 = 8,5 gr

Berat tanah kering = (berat container + tanah kering) – berat container
 = 12,2 – 4,8
 = 7,4 gr

$$\begin{aligned}
 \text{Kadar air (w)} &= \frac{tb - tk}{tk} \times 100 \% \\
 &= \frac{8,5 - 7,4}{7,4} \times 100 \% \\
 &= 14,86 \%
 \end{aligned}$$

No. container = bawah

Berat container = 4,9 gr

Berat container + tanah basah = 12 gr

Berat container + tanah kering = 11 gr

Berat tanah basah = (berat container + tanah basah) – berat container
 = 12 – 4,9
 = 7,1 gr

$$\begin{aligned} \text{Berat tanah kering} &= (\text{berat container} + \text{tanah kering}) - \text{berat container} \\ &= 11 - 4,9 \\ &= 6,1 \text{ gr} \end{aligned}$$

$$\begin{aligned} \text{Kadar Air (w)} &= \frac{tb - tk}{tk} \times 100 \% \\ &= \frac{7,1 - 6,1}{6,1} \times 100\% \\ &= 16,39 \% \end{aligned}$$

$$\begin{aligned} \text{Kadar air rata - rata} &= \frac{\text{Kadar air atas} + \text{Kadar air tengah} + \text{Kadar air bawah}}{3} \\ &= \frac{17,33 + 14,86 + 16,39}{3} \\ &= 16,2 \% \end{aligned}$$

$$\begin{aligned} \text{Berat isi tanah basah} &= \frac{\text{berat tanah basah}}{\text{volume mold}} \\ &= \frac{3290}{2091,31} \\ &= 1,573 \text{ gr/cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Berat isi tanah kering} &= \frac{\text{berat isi tanah basah}}{1 + \left(\frac{\text{kadar air rata - rata}}{100}\right)} \\ &= \frac{1,573}{1 + \left(\frac{16,2}{100}\right)} \\ &= 1,354 \text{ gr/cm}^3 \end{aligned}$$

Keterangan :

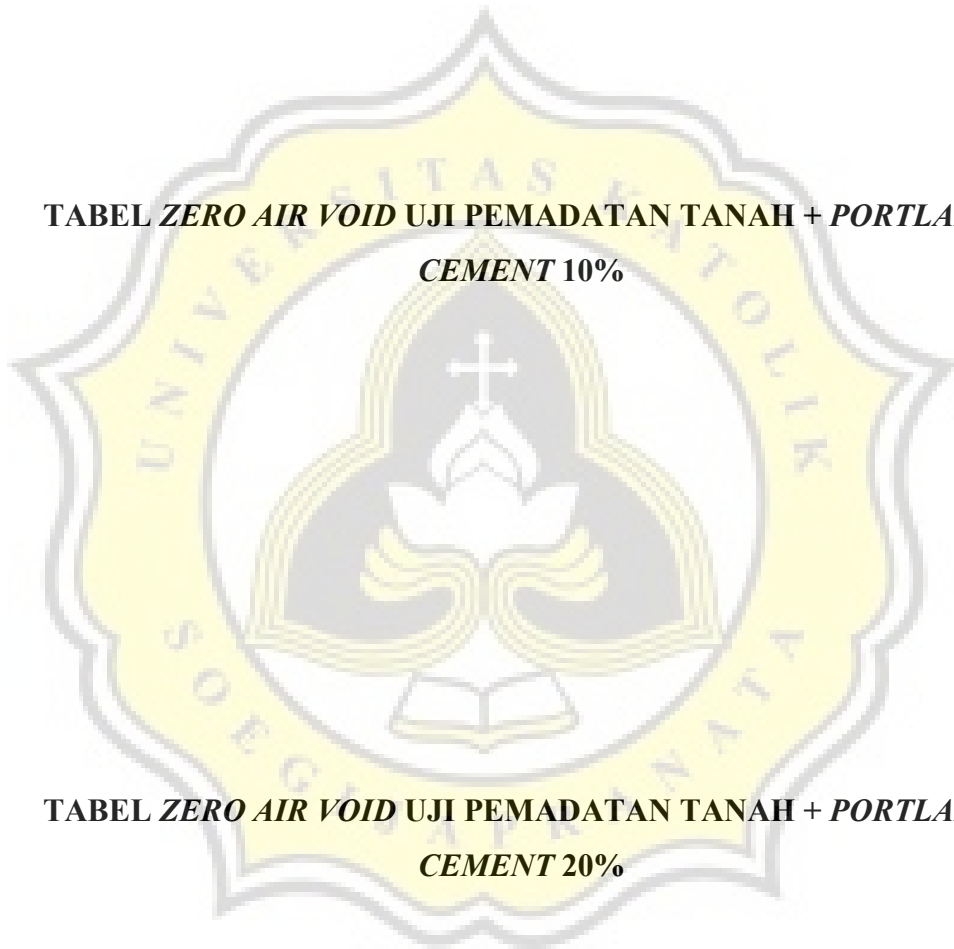
BC = berat container

Tb = berat tanah basah

Tk = berat tanah kering

TABEL *ZERO AIR VOID* UJI PEMADATAN TANAH ASLI

**TABEL *ZERO AIR VOID* UJI PEMADATAN TANAH + *PORTLAND*
*CEMENT 10%***



**TABEL *ZERO AIR VOID* UJI PEMADATAN TANAH + *PORTLAND*
*CEMENT 20%***



CONTOH PERHITUNGAN *ZERO AIR VOID*
UJI PEMADATAN TANAH ASLI

Kadar air, $w = 16,20 \%$
 $G_s = 2,798$
 $\gamma_w = 1 \text{ ton/m}^3$
 $= 1 \text{ gr/cm}^3$

Berat Isi Kering (γ_{dry})

$$\begin{aligned} S_r &= 100 \% \\ \gamma_{\text{dry}} &= \frac{G_s \times \gamma_w}{1 + \frac{w \times G_s}{S_r}} \\ &= \frac{2,798 \times 1}{1 + \frac{16,20 \times 2,798}{100}} \\ &= 1,925 \text{ gr/cm}^2 \end{aligned}$$

$$\begin{aligned} S_r &= 80 \% \\ \gamma_{\text{dry}} &= \frac{G_s \times \gamma_w}{1 + \frac{w \times G_s}{S_r}} \\ &= \frac{2,798 \times 1}{1 + \frac{16,20 \times 2,798}{80}} \\ &= 1,786 \text{ gr/cm}^2 \end{aligned}$$

No	Gambar	Keterangan
1		<p>Tanah dicampur <i>Portland Cement</i></p> <p>(Sumber: Dokumentasi Pribadi, 2016)</p>
2		<p>Mencampur sampel dengan air</p> <p>(Sumber: Dokumentasi Pribadi, 2016)</p>
3		<p>Memadatkan tanah dengan penumbuk</p> <p>(Sumber: Dokumentasi Pribadi, 2016)</p>
4		<p>Hasil sampel yang telah dipadatkan</p> <p>(Sumber: Dokumentasi Pribadi, 2016)</p>

L – 03

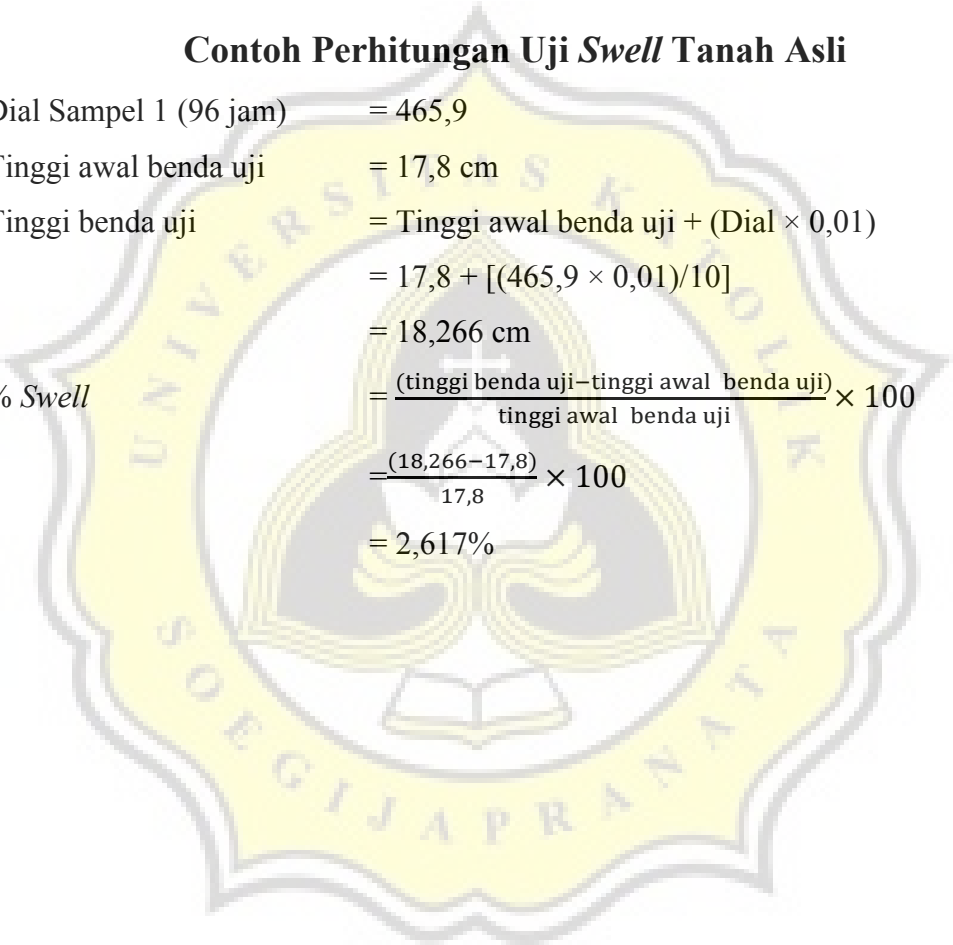
**UJI PENGEMBANGAN
(*SWELL*)**





Tabel Hasil Persentase Uji Pengembangan (*Swelling Test*)

Contoh Perhitungan Uji *Swell* Tanah Asli



Dial Sampel 1 (96 jam) = 465,9

Tinggi awal benda uji = 17,8 cm

Tinggi benda uji = Tinggi awal benda uji + (Dial × 0,01)

$$= 17,8 + [(465,9 \times 0,01)/10]$$
$$= 18,266 \text{ cm}$$

% *Swell* = $\frac{(\text{tinggi benda uji} - \text{tinggi awal benda uji})}{\text{tinggi awal benda uji}} \times 100$

$$= \frac{(18,266 - 17,8)}{17,8} \times 100$$
$$= 2,617\%$$

No	Gambar	Keterangan
1		<p>Proses perendaman benda uji di dalam air selama 4 hari (Sumber: Dokumentasi Pribadi, 2016)</p>
2		<p>Proses meniriskan benda uji dan didiamkan selama ± 15 menit (Sumber: Dokumentasi Pribadi, 2016)</p>

The logo of Universitas Katolik Soegijapranata is a yellow shield with a scalloped border. Inside the shield, there is a central emblem featuring a book and a lamp. The text "UNIVERSITAS KATOLIK" is written along the top inner edge, and "SOEGIJAPRANATA" is written along the bottom inner edge.

L – 04

***UJI CALIFORNIA BEARING
RATIO
(CBR)***

TABEL UJI CBR TANAH ASLI (1)

Penurunan (inch)	Bacaan Dial	Standar Beban (lb)	Beban (lb)	Koreksi Beban (lb)
0,0125	3		17,982	
0,0250	6		35,963	
0,0500	10		59,939	
0,0750	12		71,926	
0,1000	15	3000	89,908	89,908
0,1500	18		107,890	
0,2000	20	4500	119,877	119,877
0,3000	25		149,847	
0,4000	32		191,804	
0,5000	37		221,773	

TABEL UJI CBR TANAH ASLI (2)

Penurunan (inch)	Bacaan Dial	Standar Beban (lb)	Beban (lb)	Koreksi Beban (lb)
0,0125	2		11,988	
0,0250	5		29,969	
0,0500	7		41,957	
0,0750	10		59,939	
0,1000	14	3000	83,914	94
0,1500	19		113,884	
0,2000	22	4500	131,865	135
0,3000	26		155,841	
0,4000	30		179,816	
0,5000	32		191,804	

**TABEL UJI CBR TANAH + *PORTLAND CEMENT* 10% (1) – 14
HARI**

Penurunan (inch)	Bacaan Dial	Standar Beban (lb)	Beban (lb)	Koreksi Beban (lb)
0,0125	8		47,951	
0,0250	19		113,884	
0,0500	40		239,755	
0,0750	61		365,626	
0,1000	91	3000	545,442	580
0,1500	166		994,982	
0,2000	208	4500	1246,725	1260
0,3000	220		1318,651	
0,4000	229		1372,596	
0,5000	232		1390,578	

**TABEL UJI CBR TANAH + *PORTLAND CEMENT* 10% (2) – 14
HARI**

Penurunan (inch)	Bacaan Dial	Standar Beban (lb)	Beban (lb)	Koreksi Beban (lb)
0,0125	14		83,914	
0,0250	27		161,834	
0,0500	35		209,785	
0,0750	56		335,657	
0,1000	87	3000	521,467	750
0,1500	148		887,093	
0,2000	194	4500	1162,811	1245
0,3000	228		1366,602	
0,4000	240		1438,529	
0,5000	253		1516,449	

**TABEL UJI CBR TANAH + *PORTLAND CEMENT* 20% (1) – 14
HARI**

Penurunan (inch)	Bacaan Dial	Standar Beban (lb)	Beban (lb)	Koreksi Beban (lb)
0,0125	30		179,816	
0,0250	62		371,620	
0,0500	182		1090,884	
0,0750	270		1618,345	
0,1000	345	3000	2067,885	2225
0,1500	477		2859,076	
0,2000	672	4500	4027,881	4275
0,3000	1068		6401,453	
0,4000	1174		7036,803	
0,5000	1238		7420,411	

**TABEL UJI CBR TANAH + *PORTLAND CEMENT* 20% (2) – 14
HARI**

Penurunan (inch)	Bacaan Dial	Standar Beban (lb)	Beban (lb)	Koreksi Beban (lb)
0,0125	28		167,828	
0,0250	82		491,497	
0,0500	157		941,038	
0,0750	264		1582,382	
0,1000	339	3000	2031,922	2140
0,1500	482		2889,045	
0,2000	701	4500	4201,703	4330
0,3000	1102		6605,245	
0,4000	1252		7504,325	
0,5000	1287		7714,111	

TABEL UJI CBR TANAH + *PORTLAND CEMENT* 10% (1) – 28**HARI**

Penurunan (inch)	Bacaan Dial	Standar Beban (lb)	Beban (lb)	Koreksi Beban (lb)
0,0125	20		119,877	
0,0250	45		269,724	
0,0500	150		899,081	
0,0750	248		1486,480	
0,1000	345	3000	2067,885	2380
0,1500	504		3020,910	
0,2000	575	4500	3446,475	3520
0,3000	638		3824,089	
0,4000	697		4177,727	
0,5000	737		4417,482	

TABEL UJI CBR TANAH + *PORTLAND CEMENT* 10% (2) – 28**HARI**

Penurunan (inch)	Bacaan Dial	Standar Beban (lb)	Beban (lb)	Koreksi Beban (lb)
0,0125	14		83,914	
0,0250	31		185,810	
0,0500	157		941,038	
0,0750	234		1402,566	
0,1000	306	3000	1834,124	2220
0,1500	467		2799,137	
0,2000	550	4500	3296,629	3390
0,3000	602		3608,310	
0,4000	634		3800,114	
0,5000	659		3949,960	

TABEL UJI CBR TANAH + *PORTLAND CEMENT* 20% (1) – 28**HARI**

Penurunan (inch)	Bacaan Dial	Standar Beban (lb)	Beban (lb)	Koreksi Beban (lb)
0,0125	25		149,847	
0,0250	47		281,712	
0,0500	162		971,007	
0,0750	320		1918,038	
0,1000	443	3000	2655,284	3310
0,1500	686		4111,795	
0,2000	867	4500	5196,685	5445
0,3000	1015		6083,778	
0,4000	1176		7048,791	
0,5000	1289		7726,098	

TABEL UJI CBR TANAH + *PORTLAND CEMENT* 20% (2) – 28**HARI**

Penurunan (inch)	Bacaan Dial	Standar Beban (lb)	Beban (lb)	Koreksi Beban (lb)
0,0125	21		125,871	
0,0250	38		227,767	
0,0500	184		1102,872	
0,0750	319		1912,045	
0,1000	497	3000	2978,953	3490
0,1500	698		4183,721	
0,2000	860	4500	5154,728	5380
0,3000	1012		6065,796	
0,4000	1156		6928,914	
0,5000	1247		7474,356	




CONTOH PERHITUNGAN UJI CBR TANAH ASLI

$$\text{Kalibrasi} = 5,99387 \text{ lb/div}$$

$$\begin{aligned}\text{Beban} &= \text{Kalibrasi} \times \text{bacaan dial} \\ &= 5,99387 \times 15 \\ &= 89,908 \text{ lb}\end{aligned}$$

$$\begin{aligned}\text{CBR } 0,1'' &= \frac{\text{koreksi beban } 0,1''}{\text{standar beban } 0,1''} \times 100 \\ &= \frac{89,908}{3000} \times 100 \\ &= 2,997\%\end{aligned}$$

$$\begin{aligned}\text{CBR } 0,2'' &= \frac{\text{koreksi beban } 0,2''}{\text{standar beban } 0,2''} \times 100 \\ &= \frac{119,877}{4500} \times 100 \\ &= 2,664\%\end{aligned}$$

No	Gambar	Keterangan
1		<p>Sampel hasil uji pengembangan (<i>swell</i>) (Sumber: Dokumentasi Pribadi, 2016)</p>
2		<p>Uji penetrasi CBR (Sumber: Dokumentasi Pribadi, 2016)</p>
3		<p>Sampel setelah uji penetrasi CBR (Sumber: Dokumentasi Pribadi, 2016)</p>

L – 05

PORTLAND CEMENT



Portland Cement

Semen adalah bahan yang memiliki sifat hidrolis, yaitu jika dicampur air maka akan berubah menjadi bahan yang bersifat perekat. Pada umumnya semen memiliki beberapa tipe dan jenis yang dijual di pasaran. Jenis dan tipe semen tersebut diatur dalam SNI 15-2049-2004, bahwa semen portland (OPC = *Ordinary Portland Cement*) dibedakan menjadi 5 macam, yaitu:

1. Semen Portland tipe I, untuk yang tidak memerlukan persyaratan khusus seperti yang disyaratkan pada jenis lainnya.
2. Semen Portland tipe II, untuk penggunaan yang memerlukan ketahanan terhadap kalor hidrasi sedang dan sulfat.
3. Semen Portland tipe III, untuk penggunaan yang memerlukan kekuatan tinggi pada tahap permulaan setelah pengikatan terjadi.
4. Semen Portland tipe IV, untuk penggunaan yang memerlukan kalor hidrasi rendah.
5. Semen Portland tipe V, untuk penggunaan yang memerlukan ketahanan tinggi sulfat.

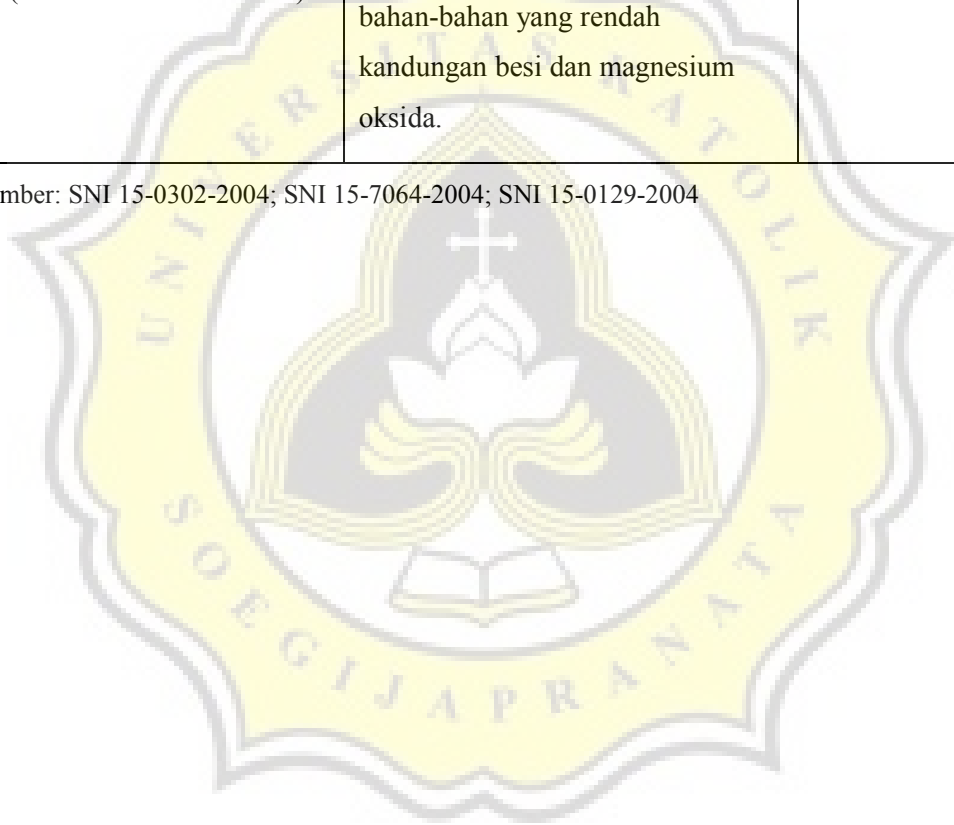
Selain 5 (lima) tipe semen di atas, berikut merupakan beberapa jenis semen yang digunakan juga untuk pekerjaan konstruksi.

Tabel 1 Jenis-Jenis Semen yang Digunakan Juga Untuk Pekerjaan Konstruksi

Jenis Semen	Pengertian	Penggunaan
<i>Portland Pozzolan Cement</i> (PPC)	Semen yang terbuat dari campuran homogen antara semen portland dengan pozolan halus. Kadar pozolan sebesar 6% - 40% dari massa <i>Portland Pozzolan Cement</i> .	- Bangunan umum - Jembatan - Jalan - Perumahan - Pondasi plat penuh
<i>Portland Composite Cement</i> (PCC)	Semen yang terbuat dari penggilingan terak semen Portland, gipsum, dan satu atau lebih bahan anorganik. Bahan organik tersebut	- Pasangan batu bata - Selokan - Pagar dinding

Jenis Semen	Pengertian	Penggunaan
	<p>antara lain: terak tanur tinggi, senyawa silikat, batu kapur. Kadar bahan organik tersebut sebesar 6% - 35% dari massa <i>Portland Composite Cement</i> .</p>	<ul style="list-style-type: none"> - Beton <i>prestress</i> - <i>Paving block</i> - Beton <i>precast</i>
<p>Semen Putih (<i>White Portland Cement</i>)</p>	<p>Semen putih merupakan jenis semen bermutu tinggi. Semen putih digunakan untuk pekerjaan arsitektur. Semen ini dibuat dari bahan-bahan yang rendah kandungan besi dan magnesium oksida.</p>	<ul style="list-style-type: none"> - Dekorasi interior - Dekorasi eksterior - Sambungan keramik

Sumber: SNI 15-0302-2004; SNI 15-7064-2004; SNI 15-0129-2004



L – 06

HASIL SCAN PLAGIASI



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