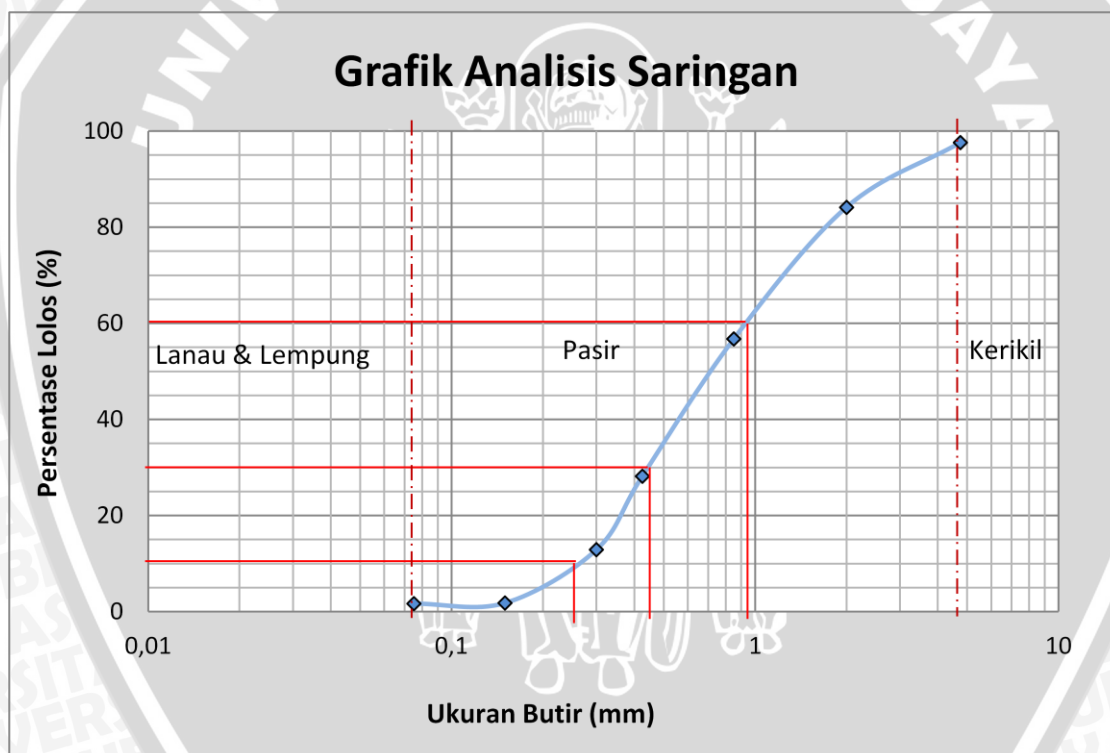


Lampiran 1

Analisa Saringan

Ukuran Butiran	Ukuran Saringan	Berat Tertahan (gram)	Prosen Tertahan (%)	Kumulatif Tertahan (%)	Lolos
4,75	4 (4,75)	23,99	2,40	2,40	97,60
2,00	10 (2,00)	134,46	13,45	15,85	84,15
0,84	20 (0,84)	274,25	27,42	43,27	56,73
0,42	40 (0,42)	285,25	28,52	71,79	28,21
0,30	80 (0,30)	153,07	15,31	87,10	12,90
0,147	100 (0,147)	111,12	11,11	98,21	1,79
0,074	200 (0,074)	1,3	0,13	98,34	1,66
-	-	16,56	1,66	100	0
Total		1000			



$$D_{10} = 0,27$$

$$D_{30} = 0,45$$

$$D_{60} = 0,95$$

$$C_u = \frac{D_{60}}{D_{10}} = 3,518$$

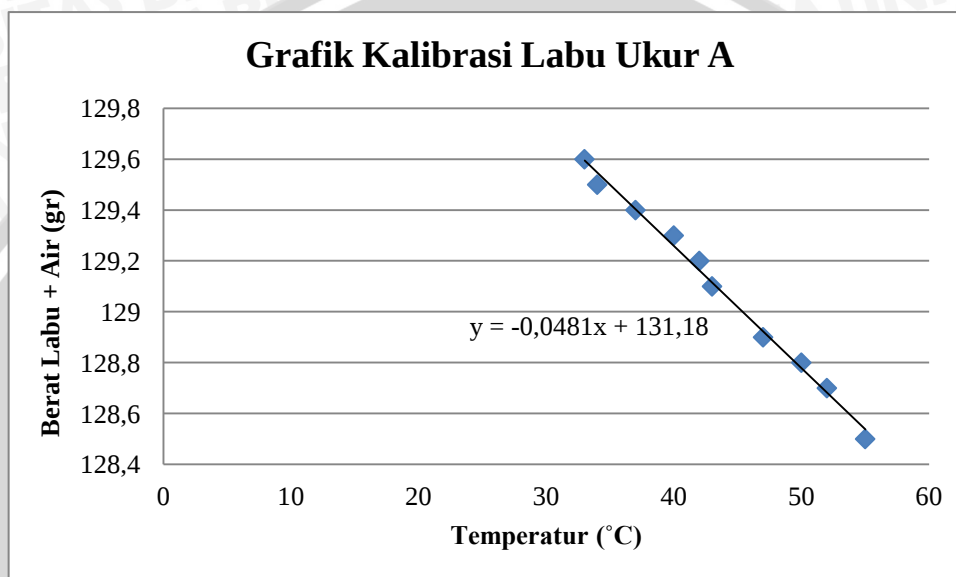
$$C_c = \frac{D_{30}^2}{D_{60} \cdot D_{10}} = 0,789$$

Lampiran 2

Berat Jenis (Specific Gravity)

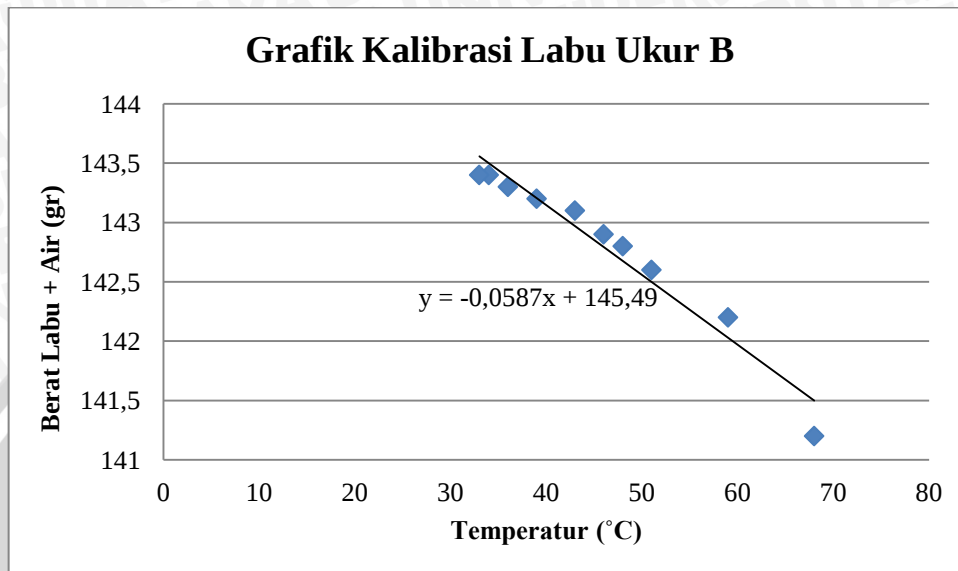
Tabel kalibrasi labu ukur

No.	1	2	3	4	5	6	7	8	9	10
Labu Ukur	A									
Berat Labu Ukur + Air	128,5	128,7	128,8	128,9	129,1	129,2	129,3	129,4	129,5	129,6
Temperatur	55	52	50	47	43	42	40	37	34	33



No.	Labu Ukur		A						
1		Berat Labu Ukur	gram	28,2					
2	W_s	Berat Tanah kering	gram	20					
3	W_1	Berat Labu Ukur + Air + Tanah	gram	140,5	141,5	141,8	142	142	
4		Temperatur TC	$^{\circ}\text{C}$	68	49	43	39	34	
5	W_2	Berat Labu Ukur + Air	gram	127,836	128,748	129,036	129,228	129,468	
6	G_t	Berat Jenis Air pada TC = G_t	gram/cm ³	0,979	0,989	0,991	0,993	0,994	
7	G_s	Berat Jenis Tanah		2,669	2,728	2,739	2,746	2,663	
8		Rata-rata Berat Jenis		2,709					

No.	1	2	3	4	5	6	7	8	9	10
Labu Ukur	B									
Berat Labu Ukur + Air	141,2	142,2	142,6	142,8	142,9	143,1	143,2	143,3	143,4	143,4
Temperatur	68	59	51	48	46	43	39	36	34	33



No.	Labu Ukur		B						
1		Berat Labu Ukur	gram	44,1					
2	W_s	Berat Tanah kering	gram	20					
3	W_1	Berat Labu Ukur + Air + Tanah	gram	154,5	155,1	155,4	155,8	156,2	
4		Temperatur TC	$^{\circ}\text{C}$	66	47	41	38	34	
5	W_2	Berat Labu Ukur + Air	gram	141,572	142,674	143,022	143,196	143,428	
6	G_t	Berat Jenis Air pada TC = G_t	gram/cm^3	0,980	0,989	0,991	0,995	0,994	
7	G_s	Berat Jenis Tanah		2,771	2,612	2,603	2,692	2,752	
8		Rata-rata Berat Jenis		2,669					

$G_s \text{ rata-rata} = \text{—————} = 2,689$

Lampiran 3

Data Hasil Pengujian Kepadatan Standar *Proctor*

Data :

Berat cetakan = 2003,8 gr
 Diameter sampel = 10 cm
 Tinggi sampel = 12 cm

Kadar Air

Penambahan Air	ml	150			300			450			600			750			900		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Berat Cawan	gr	5,6	5,8	5,4	4,4	5,6	6	5,6	6	4,4	6	5,6	5,8	5,8	6	5,6	5,8	6	4,4
Berat Tanah Basah + Cawan	gr	26,2	30,8	27,8	31,8	28,6	27,6	30,6	33,2	27,4	29,4	27,2	36,6	34,4	37,8	34,2	40,2	33,2	37,4
Berat Tanah Kering + Cawan	gr	24,4	29,2	26	29,2	26,4	25	27,2	30,4	24,2	26,2	23,4	33,2	29,8	33,4	29,8	35,4	27,8	32,4
Berat Air	gr	1,8	1,6	1,8	2,6	2,2	2,6	3,4	2,8	3,2	3,2	3,8	3,4	4,6	4,4	4,4	4,8	5,4	5
Berat Tanah Kering	gr	18,8	23,4	20,6	24,8	20,8	19	21,6	24,4	19,8	20,2	17,8	27,4	24	27,4	24,2	29,6	21,8	28
Kadar Air	%	9,57	6,84	8,74	10,48	10,58	13,68	15,74	11,48	16,16	15,84	21,35	12,41	19,17	16,06	18,18	16,22	24,77	17,86
Kadar Air Rata-rata	%	8,38			11,58			14,46			16,53			17,80			19,61		

Density

Penambahan Air	ml	150	300	450	600	750	900
Berat Cetakan	gr	2003,8	2003,8	2003,8	2003,8	2003,8	2003,8
Berat Tanah Basah + Cetakan	gr	3272,8	3405,4	3679,8	3966,2	3953,2	3934,6
Berat Tanah Basah	gr	1269	1401,6	1676	1962,4	1949,4	1930,8
Isi Cetakan	cm ³	942,86	942,86	942,86	942,86	942,86	942,86
Berat Isi Basah	gr/cm ³	1,346	1,487	1,778	2,081	2,068	2,048
Berat Isi Kering	gr/cm ³	1,242	1,332	1,553	1,786	1,755	1,712

Zero Air Void

Penambahan Air	ml	150	300	450	600	750	900
Kadar Air	%	8,38	11,58	14,46	16,53	17,80	19,61
Gs	gr/cm ³	2,69	2,69	2,69	2,69	2,69	2,69
Berat Jenis Air	gr/cm ³	1	1	1	1	1	1
Berat Jenis Air (ZAV)	gr/cm ³	2,195	2,051	1,937	1,862	1,819	1,761

Lampiran 4**Data Kepadatan Tanah**

Lapisan	Berat isi tanah kering (gr/cm ³)							Berat isi tanah kering rata-rata(gr/cm ³)						
	0	50	100	150	200	250	300	0	50	100	150	200	250	300
I	1,2238	1,2238	1,2918	1,3428	1,3938	1,4448	1,5128	1,2012	1,2408	1,2805	1,331	1,3938	1,4391	1,4958
	1,2068	1,2408	1,2748	1,3258	1,4108	1,4448	1,4958							
	1,1728	1,2578	1,2748	1,3258	1,3768	1,4278	1,4788							
II	1,2153	1,2674	1,3021	1,3716	1,3889	1,4584	1,5278	1,2153	1,2674	1,3021	1,365	1,4063	1,4642	1,5162
	1,2327	1,2500	1,3021	1,3542	1,4063	1,4757	1,5105							
	1,1979	1,2847	1,3021	1,3716	1,4236	1,4584	1,5105							
III	1,1944	1,2456	1,2967	1,3309	1,3991	1,4333	1,4844	1,1830	1,2399	1,2854	1,336	1,4048	1,4333	1,49017
	1,2114	1,2285	1,2797	1,3309	1,3991	1,4333	1,4844							
	1,14322	1,24560	1,27973	1,34798	1,41623	1,43330	1,50155							
								1,1998	1,2494	1,2893	1,344	1,4016	1,4455	1,5007

Water content :

Lapisan	1	2	3
Berat Mould	6	5,6	5,8
Berat Tanah Basah	30,6	32,4	28
Berat Tanah Kering	27	29,2	24,8
Kadar Air	13,33333	10,9589	12,90323
Kadar Air rata-rata	12,39848775		

Lampiran 5

Uji Geser Langsung (*Direct Shear*)

Data Hasil Uji Geser Langsung (*direct shear*)

Diameter Sampel : 60 mm

Tinggi Sampel : 21 mm

Luas Sampel : 28,274 cm²

Kalibrasi : 0,358

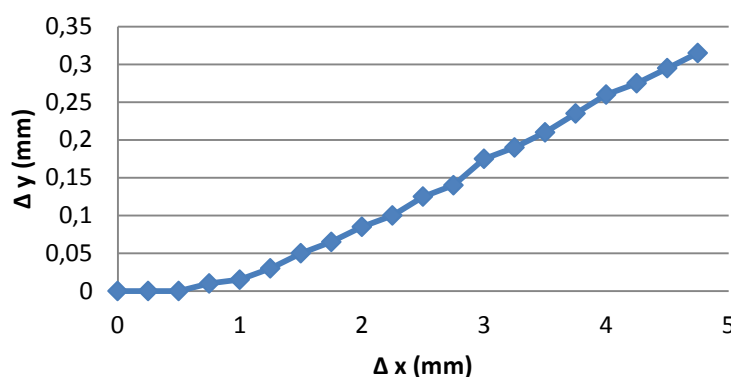
1. Lapisan 3

Gaya Normal		P ₁ = 0,4 kg					Regangan
Tegangan Normal		$\sigma_1 = (P/A) \cdot f = 0,2 \text{ kg/cm}^2$					ϵ
Geseran Horizontal	Geseran Vertikal	Geseran Horizontal (Δx) mm	Geseran Vertikal (Δy) mm	Dial Reading	Gaya Geser (*0,358)	Tegangan Geser τ_1	$\Delta X/X_0$
0	0	0	0	0	0	0	0
25	0	0,25	0,000	5,5	1,969	0,070	0,004
50	0	0,50	0,000	6,0	2,148	0,076	0,008
75	1	0,75	0,010	7,0	2,506	0,089	0,013
100	1,5	1,00	0,015	8,5	3,043	0,108	0,017
125	3	1,25	0,030	9,5	3,401	0,120	0,021
150	5	1,50	0,050	10,0	3,580	0,127	0,025
175	6,5	1,75	0,065	11,0	3,938	0,139	0,029
200	8,5	2,00	0,085	11,0	3,938	0,139	0,033
225	10	2,25	0,100	11,5	4,117	0,146	0,038
250	12,5	2,50	0,125	11,5	4,117	0,146	0,042
275	14	2,75	0,140	12,0	4,296	0,152	0,046
300	17,5	3,00	0,175	12,0	4,296	0,152	0,050
325	19	3,25	0,190	12,5	4,475	0,158	0,054
350	21	3,50	0,210	12,8	4,582	0,162	0,058
375	23,5	3,75	0,235	12,8	4,582	0,162	0,063
400	26	4,00	0,260	12,8	4,582	0,162	0,067
425	27,5	4,25	0,275	12,8	4,582	0,162	0,071
450	29,5	4,50	0,295	12,8	4,582	0,162	0,075
475	31,5	4,75	0,315	12,8	4,582	0,162	0,079

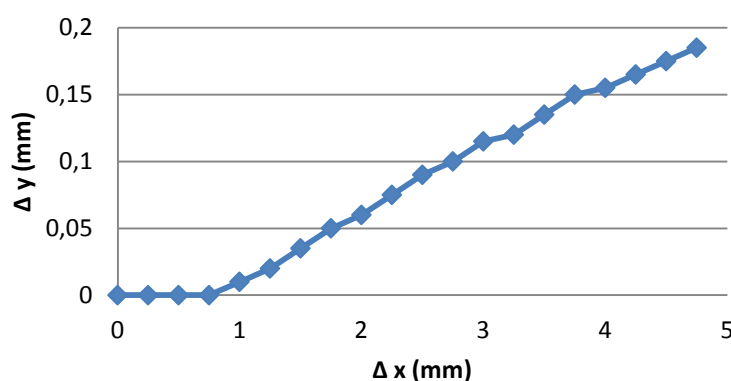
Gaya Normal	$P_1 = 0,8 \text{ kg}$						Regangan
Tegangan Normal	$\sigma_1 = (P/A) \cdot f = 0,4 \text{ kg/cm}^2$						ε
Geseran Horizontal	Geseran Vertikal	Geseran Horizontal (Δx) mm	Geseran Vertikal (Δy) mm	Dial Reading	Gaya Geser (*0,358)	Tegangan Geser τ_1	$\Delta X/X_0$
0	0	0	0	0	0	0	0
25	0	0,25	0,000	10,0	3,580	0,127	0,004
50	0	0,50	0,000	12,0	4,296	0,152	0,008
75	0	0,75	0,000	13,0	4,654	0,165	0,013
100	1	1,00	0,010	13,5	4,833	0,171	0,017
125	2	1,25	0,020	14,0	5,012	0,177	0,021
150	3,5	1,50	0,035	15,0	5,370	0,190	0,025
175	5	1,75	0,050	17,5	6,265	0,222	0,029
200	6	2,00	0,060	19,0	6,802	0,241	0,033
225	7,5	2,25	0,075	20,0	7,160	0,253	0,038
250	9	2,50	0,090	21,5	7,697	0,272	0,042
275	10	2,75	0,100	22,0	7,876	0,279	0,046
300	11,5	3,00	0,115	23,5	8,413	0,298	0,050
325	12	3,25	0,120	25,0	8,950	0,317	0,054
350	13,5	3,50	0,135	25,0	8,950	0,317	0,058
375	15	3,75	0,150	26,0	9,308	0,329	0,063
400	15,5	4,00	0,155	26,0	9,308	0,329	0,067
425	16,5	4,25	0,165	26,0	9,308	0,329	0,071
450	17,5	4,50	0,175	26,0	9,308	0,329	0,075
475	18,5	4,75	0,185	26,0	9,308	0,329	0,079

Gaya Normal	$P_1 = 1,2 \text{ kg}$						Regangan
Tegangan Normal	$\sigma_1 = (P/A) \cdot f = 0,6 \text{ kg/cm}^2$						ε
Geseran Horizontal	Geseran Vertikal	Geseran Horizontal (Δx) mm	Geseran Vertikal (Δy) mm	Dial Reading	Gaya Geser (*0,358)	Tegangan Geser τ_1	$\Delta X/X_0$
0	0	0	0	0	0	0	0
25	-1	0,25	-0,010	15,0	5,370	0,190	0,004
50	-1	0,50	-0,010	16,0	5,728	0,203	0,008
75	-1	0,75	-0,010	17,5	6,265	0,222	0,013
100	-0,5	1,00	-0,005	18,0	6,444	0,228	0,017
125	0,5	1,25	0,005	19,0	6,802	0,241	0,021
150	1,5	1,50	0,015	20,0	7,160	0,253	0,025
175	2,5	1,75	0,025	21,5	7,697	0,272	0,029
200	4	2,00	0,040	23,0	8,234	0,291	0,033
225	4	2,25	0,040	24,5	8,771	0,310	0,038
250	4,5	2,50	0,045	25,0	8,950	0,317	0,042
275	4,5	2,75	0,045	26,0	9,308	0,329	0,046
300	5	3,00	0,050	27,5	9,845	0,348	0,050
325	5,5	3,25	0,055	28,0	10,024	0,355	0,054
350	6	3,50	0,060	29,5	10,561	0,374	0,058
375	6,5	3,75	0,065	30,5	10,919	0,386	0,063
400	7	4,00	0,070	31,0	11,098	0,393	0,067
425	7,5	4,25	0,075	31,0	11,098	0,393	0,071
450	8	4,50	0,080	31,0	11,098	0,393	0,075
475	8	4,75	0,080	31,0	11,098	0,393	0,079

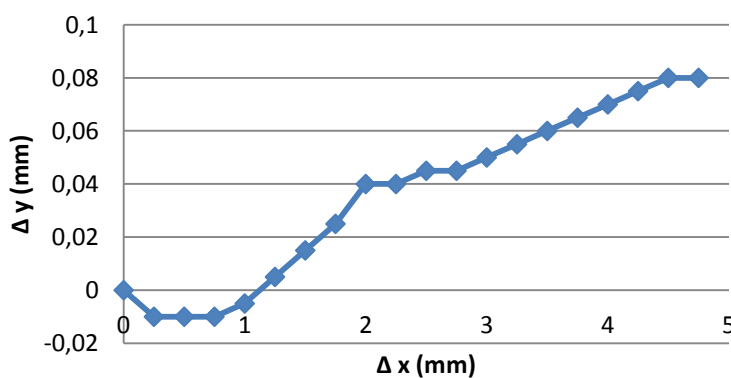
Grafik Hubungan Geseran Vertikal dengan Geseran Horizontal Lapisan 3 (0,4 kg)



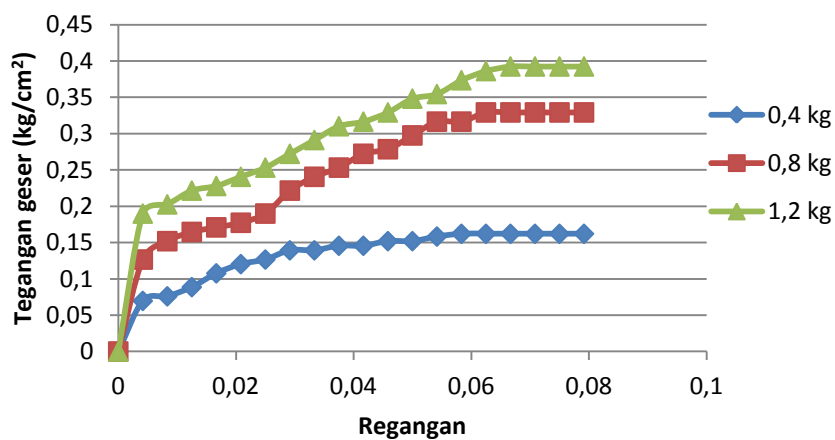
Grafik Hubungan Geseran Vertikal dengan Geseran Horizontal Lapisan 3 (0,8 kg)



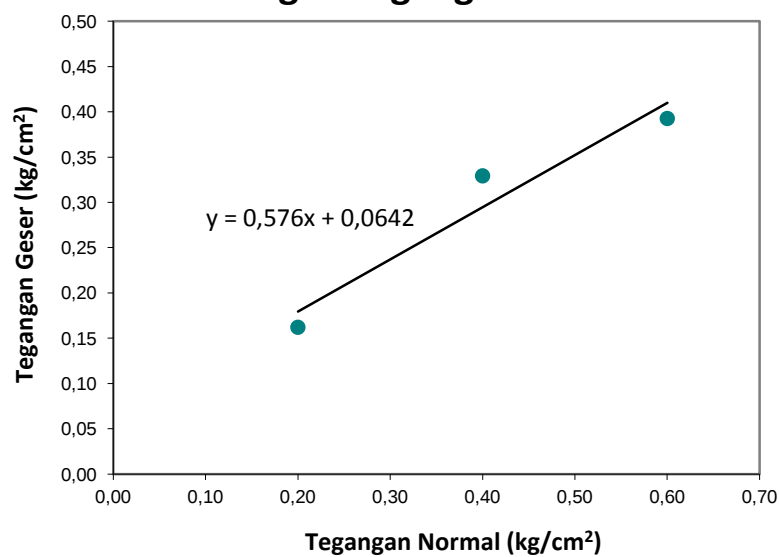
Grafik Hubungan Geseran Vertikal dengan Geseran Horizontal Lapisan 3 (1,2 kg)



Grafik Perbandingan Tegangan Geser dengan Regangan



Grafik Hubungan Tegangan Geser dengan Tegangan Normal



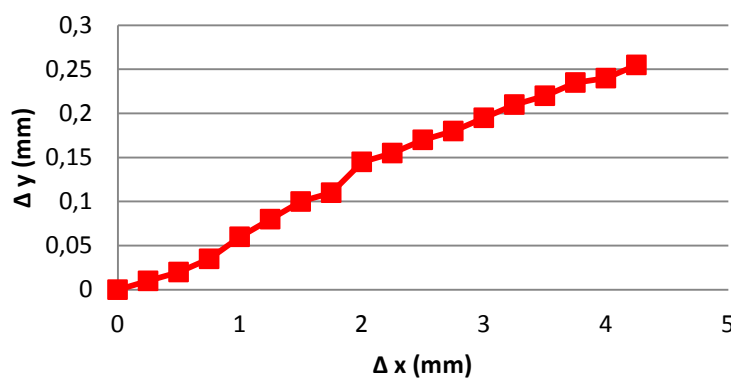
2. Lapisan 5

Gaya Normal	$P_1 = 0,4 \text{ kg}$						Regangan
Tegangan Normal	$\sigma_1 = (P/A) \cdot f = 0,2 \text{ kg/cm}^2$						ε
Geseran Horizontal	Geseran Vertikal	Geseran Horizontal (Δx) mm	Geseran Vertikal (Δy) mm	Dial Reading	Gaya Geser (*0,358)	Tegangan Geser τ_1	$\Delta X/X_0$
0	0	0	0	0	0	0	0
25	1	0,25	0,010	3,5	1,253	0,044	0,004
50	2	0,50	0,020	4,5	1,611	0,057	0,008
75	3,5	0,75	0,035	5,0	1,790	0,063	0,013
100	6	1,00	0,060	5,5	1,969	0,070	0,017
125	8	1,25	0,080	6,0	2,148	0,076	0,021
150	10	1,50	0,100	7,5	2,685	0,095	0,025
175	11	1,75	0,110	7,5	2,685	0,095	0,029
200	14,5	2,00	0,145	8,5	3,043	0,108	0,033
225	15,5	2,25	0,155	8,5	3,043	0,108	0,038
250	17	2,50	0,170	10,0	3,580	0,127	0,042
275	18	2,75	0,180	10,0	3,580	0,127	0,046
300	19,5	3,00	0,195	10,0	3,580	0,127	0,050
325	21	3,25	0,210	10,0	3,580	0,127	0,054
350	22	3,50	0,220	10,0	3,580	0,127	0,058
375	23,5	3,75	0,235	10,0	3,580	0,127	0,063
400	24	4,00	0,240	10,0	3,580	0,127	0,067
425	25,5	4,25	0,255	10,0	3,580	0,127	0,071
450							
475							

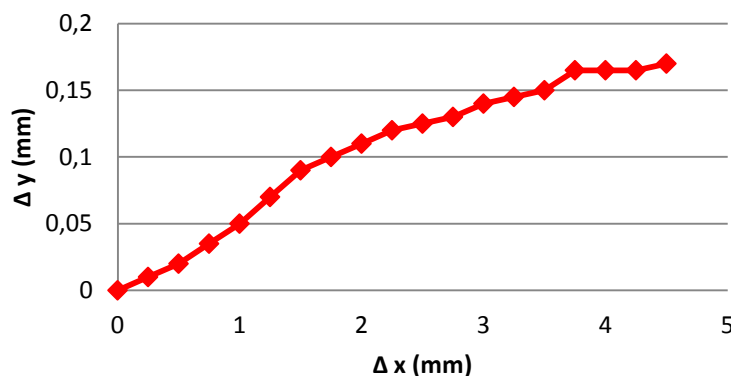
Gaya Normal	$P_1 = 0,8 \text{ kg}$						Regangan
Tegangan Normal	$\sigma_1 = (P/A) \cdot f = 0,4 \text{ kg/cm}^2$						ε
Geseran Horizontal	Geseran Vertikal	Geseran Horizontal (Δx) mm	Geseran Vertikal (Δy) mm	Dial Reading	Gaya Geser (*0,358)	Tegangan Geser τ_1	$\Delta X/X_0$
0	0	0	0	0	0	0	0
25	1	0,25	0,010	7,0	2,506	0,089	0,004
50	2	0,50	0,020	11,0	3,938	0,139	0,008
75	3,5	0,75	0,035	11,0	3,938	0,139	0,013
100	5	1,00	0,050	14,0	5,012	0,177	0,017
125	7	1,25	0,070	15,0	5,370	0,190	0,021
150	9	1,50	0,090	16,5	5,907	0,209	0,025
175	10	1,75	0,100	17,0	6,086	0,215	0,029
200	11	2,00	0,110	17,0	6,086	0,215	0,033
225	12	2,25	0,120	18,5	6,623	0,234	0,038
250	12,5	2,50	0,125	19,0	6,802	0,241	0,042
275	13	2,75	0,130	20,0	7,160	0,253	0,046
300	14	3,00	0,140	20,5	7,339	0,260	0,050
325	14,5	3,25	0,145	22,0	7,876	0,279	0,054
350	15	3,50	0,150	22,0	7,876	0,279	0,058
375	16,5	3,75	0,165	22,0	7,876	0,279	0,063
400	16,5	4,00	0,165	22,0	7,876	0,279	0,067
425	16,5	4,25	0,165	22,0	7,876	0,279	0,071
450	17	4,50	0,170	22,0	7,876	0,279	0,075
475							

Gaya Normal	$P_1 = 1,2 \text{ kg}$						Regangan
Tegangan Normal	$\sigma_1 = (P/A) \cdot f = 0,6 \text{ kg/cm}^2$						ϵ
Geseran Horizontal	Geseran Vertikal	Geseran Horizontal (Δx) mm	Geseran Vertikal (Δy) mm	Dial Reading	Gaya Geser (*0,358)	Tegangan Geser τ_1	$\Delta X/X_0$
0	0	0	0	0	0	0	0
25	-1	0,25	-0,010	16,5	5,907	0,209	0,004
50	-1	0,50	-0,010	18,5	6,623	0,234	0,008
75	-2	0,75	-0,020	19,5	6,981	0,247	0,013
100	-2,5	1,00	-0,025	20,0	7,160	0,253	0,017
125	-3	1,25	-0,030	21,0	7,518	0,266	0,021
150	-3	1,50	-0,030	22,5	8,055	0,285	0,025
175	-3	1,75	-0,030	23,0	8,234	0,291	0,029
200	-2,5	2,00	-0,025	24,5	8,771	0,310	0,033
225	-2	2,25	-0,020	27,0	9,666	0,342	0,038
250	-0,5	2,50	-0,005	29,0	10,382	0,367	0,042
275	0	2,75	0,000	31,5	11,277	0,399	0,046
300	1	3,00	0,010	32,5	11,635	0,412	0,050
325	2	3,25	0,020	32,5	11,635	0,412	0,054
350	3	3,50	0,030	32,5	11,635	0,412	0,058
375	4	3,75	0,040	34,0	12,172	0,431	0,063
400	5	4,00	0,050	34,0	12,172	0,431	0,067
425	6	4,25	0,060	34,0	12,172	0,431	0,071
450	6,5	4,50	0,065	34,0	12,172	0,431	0,075
475	7	4,75	0,070	34,0	12,172	0,431	0,079

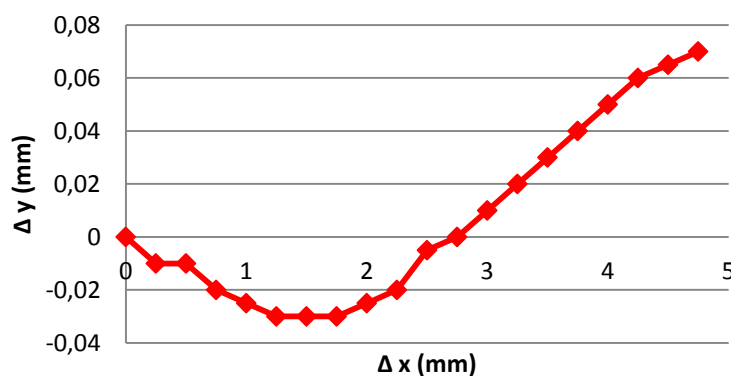
Grafik Hubungan Geseran Vertikal dengan Geseran Horizontal Lapisan 5 (0,4 kg)



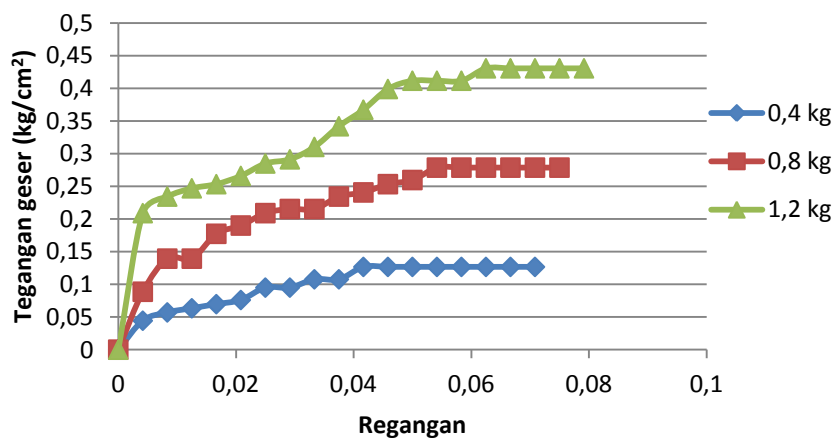
Grafik Hubungan Geseran Vertikal dengan Geseran Horizontal Lapisan 5 (0,8 kg)

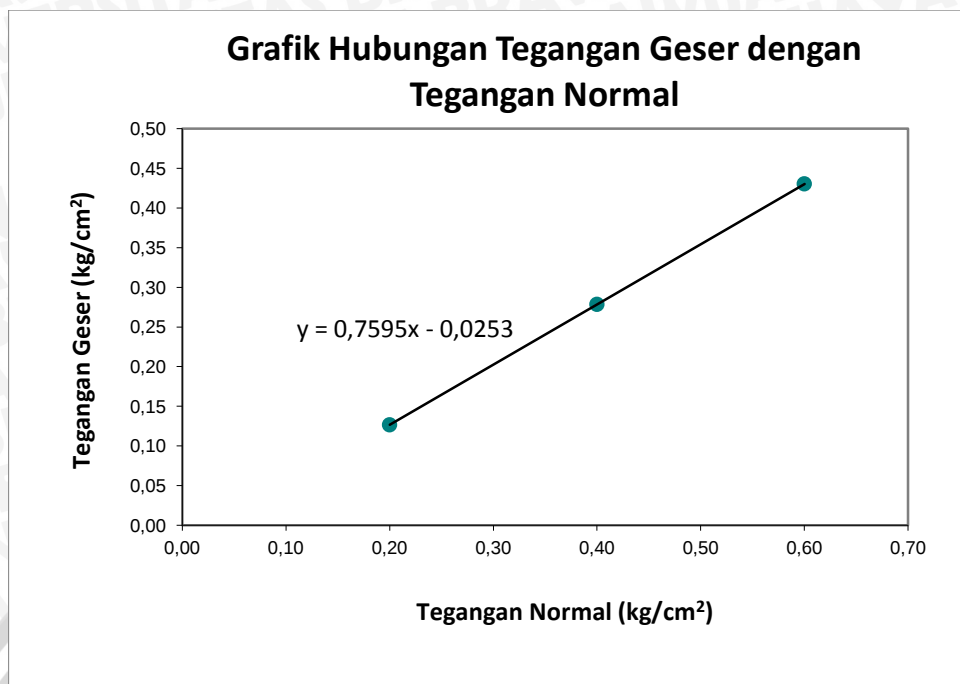


Grafik Hubungan Geseran Vertikal dengan Geseran Horizontal Lapisan 5 (1,2 kg)



Grafik Perbandingan Tegangan Geser dengan Regangan





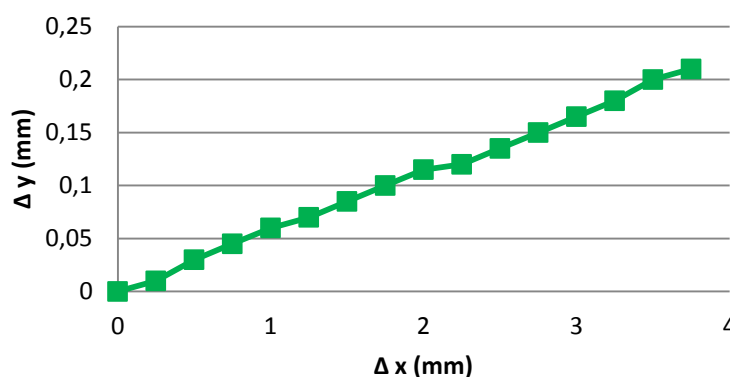
3. Lapis 7

Gaya Normal	$P_1 = 0,4 \text{ kg}$						Regangan
Tegangan Normal	$\sigma_1 = (P/A) \cdot f = 0,2 \text{ kg/cm}^2$						ε
Geseran Horizontal	Geseran Vertikal	Geseran Horizontal (Δx) mm	Geseran Vertikal (Δy) mm	Dial Reading	Gaya Geser (*0,358)	Tegangan Geser τ_1	$\Delta X/X_0$
0	0	0	0	0	0	0	0
25	1	0,25	0,010	6,0	2,148	0,076	0,004
50	3	0,50	0,030	7,0	2,506	0,089	0,008
75	4,5	0,75	0,045	8,0	2,864	0,101	0,013
100	6	1,00	0,060	9,0	3,222	0,114	0,017
125	7	1,25	0,070	11,5	4,117	0,146	0,021
150	8,5	1,50	0,085	13,0	4,654	0,165	0,025
175	10	1,75	0,100	14,5	5,191	0,184	0,029
200	11,5	2,00	0,115	15,5	5,549	0,196	0,033
225	12	2,25	0,120	15,5	5,549	0,196	0,038
250	13,5	2,50	0,135	16,0	5,728	0,203	0,042
275	15	2,75	0,150	16,0	5,728	0,203	0,046
300	16,5	3,00	0,165	16,0	5,728	0,203	0,050
325	18	3,25	0,180	16,0	5,728	0,203	0,054
350	20	3,50	0,200	16,0	5,728	0,203	0,058
375	21	3,75	0,210	16,0	5,728	0,203	0,063
400							
425							
450							
475							

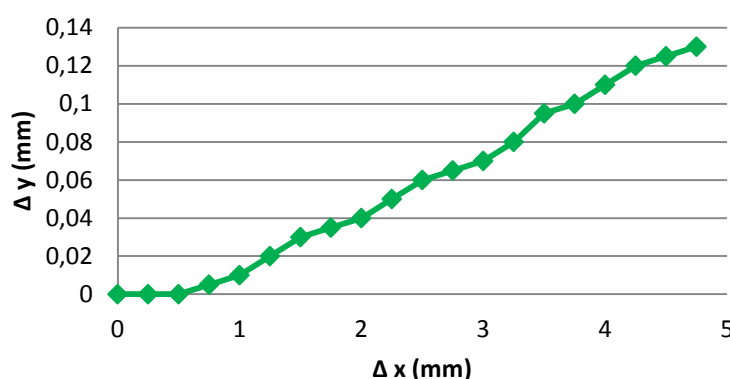
Gaya Normal	$P_1 = 0,8 \text{ kg}$						Regangan
Tegangan Normal	$\sigma_1 = (P/A) \cdot f = 0,4 \text{ kg/cm}^2$						ε
Geseran Horizontal	Geseran Vertikal	Geseran Horizontal (Δx) mm	Geseran Vertikal (Δy) mm	Dial Reading	Gaya Geser (*0,358)	Tegangan Geser τ_1	$\Delta X/X_0$
0	0	0	0	0	0	0	0
25	0	0,25	0,000	12,0	4,296	0,152	0,004
50	0	0,50	0,000	13,0	4,654	0,165	0,008
75	0,5	0,75	0,005	14,5	5,191	0,184	0,013
100	1	1,00	0,010	15,0	5,370	0,190	0,017
125	2	1,25	0,020	17,5	6,265	0,222	0,021
150	3	1,50	0,030	19,0	6,802	0,241	0,025
175	3,5	1,75	0,035	20,0	7,160	0,253	0,029
200	4	2,00	0,040	21,5	7,697	0,272	0,033
225	5	2,25	0,050	23,0	8,234	0,291	0,038
250	6	2,50	0,060	25,0	8,950	0,317	0,042
275	6,5	2,75	0,065	26,0	9,308	0,329	0,046
300	7	3,00	0,070	27,0	9,666	0,342	0,050
325	8	3,25	0,080	28,0	10,024	0,355	0,054
350	9,5	3,50	0,095	28,0	10,024	0,355	0,058
375	10	3,75	0,100	28,0	10,024	0,355	0,063
400	11	4,00	0,110	28,0	10,024	0,355	0,067
425	12	4,25	0,120	28,0	10,024	0,355	0,071
450	12,5	4,50	0,125	28,0	10,024	0,355	0,075
475	13	4,75	0,130	28,0	10,024	0,355	0,079

Gaya Normal	$P_1 = 1,2 \text{ kg}$						Regangan
Tegangan Normal	$\sigma_1 = (P/A) \cdot f = 0,6 \text{ kg/cm}^2$						ε
Geseran Horizontal	Geseran Vertikal	Geseran Horizontal (Δx) mm	Geseran Vertikal (Δy) mm	Dial Reading	Gaya Geser (*0,358)	Tegangan Geser τ_1	$\Delta X/X_0$
0	0	0	0	0	0	0	0
25	0	0,25	0,000	17,0	6,086	0,215	0,004
50	1	0,50	0,010	19,5	6,981	0,247	0,008
75	1,5	0,75	0,015	21,0	7,518	0,266	0,013
100	2	1,00	0,020	22,5	8,055	0,285	0,017
125	2,5	1,25	0,025	24,5	8,771	0,310	0,021
150	3,5	1,50	0,035	27,0	9,666	0,342	0,025
175	4,5	1,75	0,045	28,5	10,203	0,361	0,029
200	5	2,00	0,050	31,0	11,098	0,393	0,033
225	5	2,25	0,050	32,5	11,635	0,412	0,038
250	5	2,50	0,050	34,5	12,351	0,437	0,042
275	5	2,75	0,050	36,0	12,888	0,456	0,046
300	6	3,00	0,060	37,5	13,425	0,475	0,050
325	7	3,25	0,070	39,0	13,962	0,494	0,054
350	7	3,50	0,070	39,0	13,962	0,494	0,058
375	8	3,75	0,080	39,0	13,962	0,494	0,063
400	9	4,00	0,090	39,0	13,962	0,494	0,067
425	9	4,25	0,090	39,0	13,962	0,494	0,071
450	10	4,50	0,100	39,0	13,962	0,494	0,075
475	10	4,75	0,100	39,0	13,962	0,494	0,079

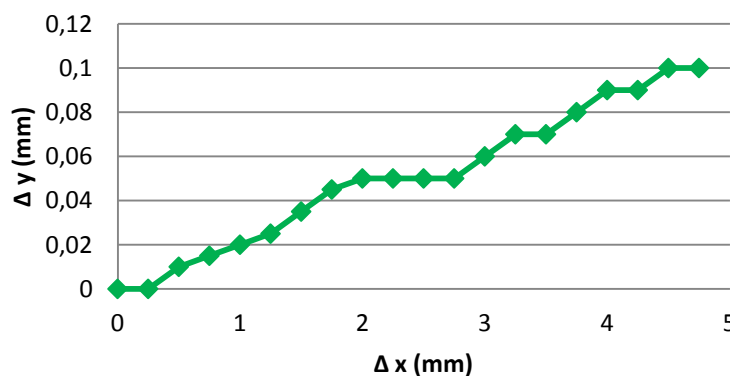
Grafik Hubungan Geseran Vertikal dengan Geseran Horizontal Lapisan 7 (0,4 kg)

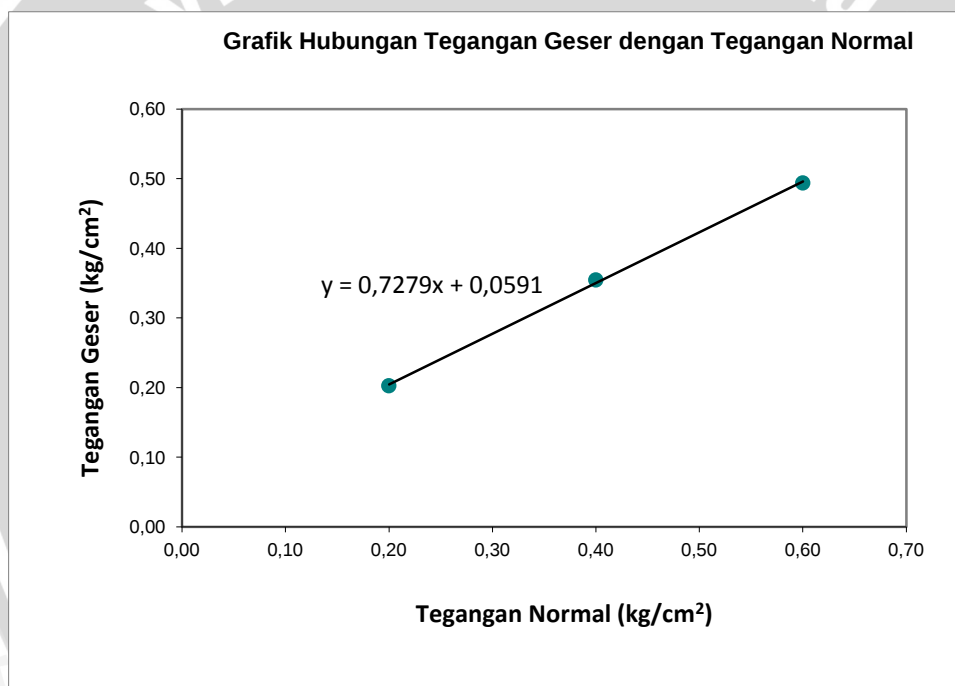
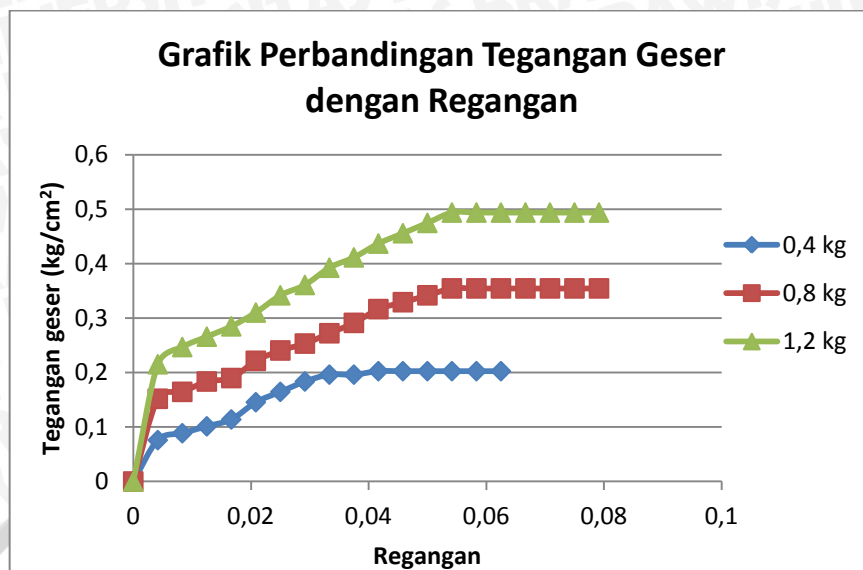


Grafik Hubungan Geseran Vertikal dengan Geseran Horizontal Lapisan 7 (0,8 kg)



Grafik Hubungan Geseran Vertikal dengan Geseran Horizontal Lapisan 7 (1,2 kg)





Rata-rata Nilai Sudut Dilatasi (ψ) dan Sudut Geser Dalam (θ)

		Sudut Dilatasi (ψ)		Sudut Geser Dalam (θ)	
Lapisan 3	0,4	4,56	3,20	29,94	34,40
	0,8	3,43			
	1,2	2,29			
Lapisan 5	0,4	4,95	3,20	37,22	34,40
	0,8	3,43			
	1,2	2,29			
Lapisan 7	0,4	3,81	3,20	36,05	34,40
	0,8	2,29			
	1,2	1,65			

Lampiran 6**Data Pengujian Elastisitas Bahan Pile**

D = 80 mm

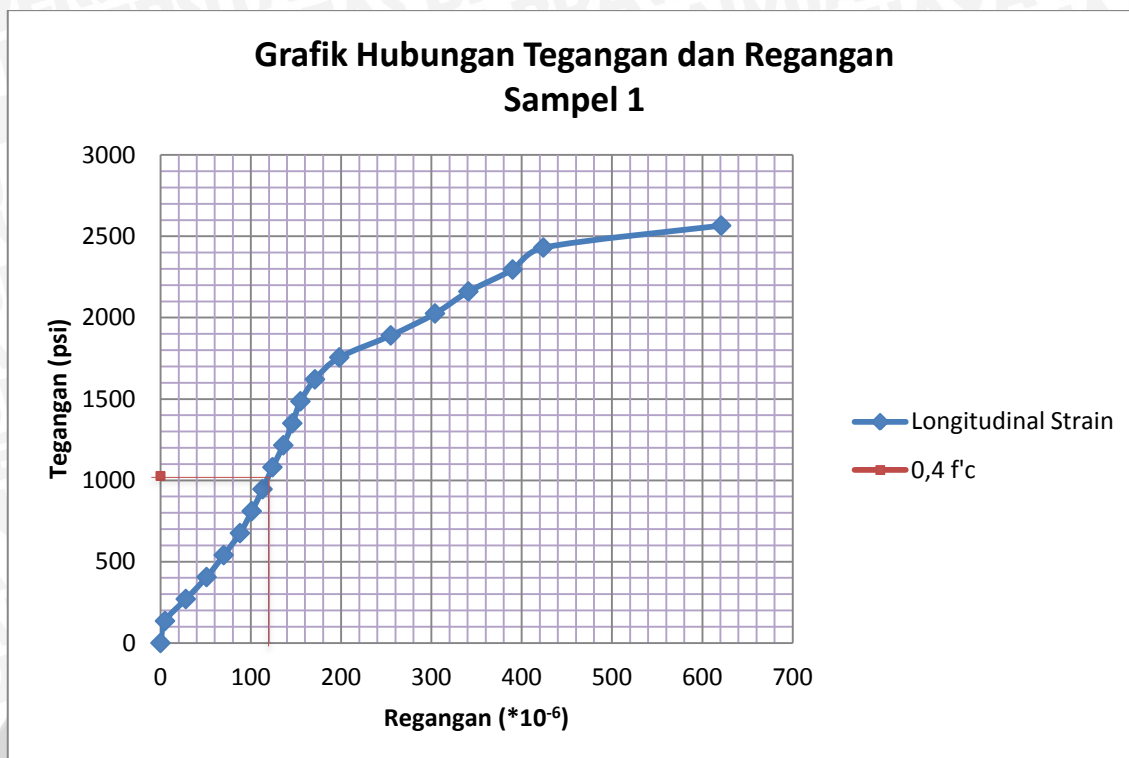
A = 5026,548 cm²

L = 150 mm

Sampel 1

P (kN)	A (mm ²)	Tegangan (psi)	Regangan (*10 ⁻⁶)
0	5026,548	0	0
4	5026,548	135,051	5
8	5026,548	270,102	28
12	5026,548	405,153	51
16	5026,548	540,204	70
20	5026,548	675,255	88
24	5026,548	810,306	101
28	5026,548	945,357	113
32	5026,548	1080,408	124
36	5026,548	1215,460	136
40	5026,548	1350,511	146
44	5026,548	1485,562	155
48	5026,548	1620,613	171
52	5026,548	1755,664	198
56	5026,548	1890,715	255
60	5026,548	2025,766	304
64	5026,548	2160,817	341
68	5026,548	2295,868	390
72	5026,548	2430,919	424
76	5026,548	2565,970	621

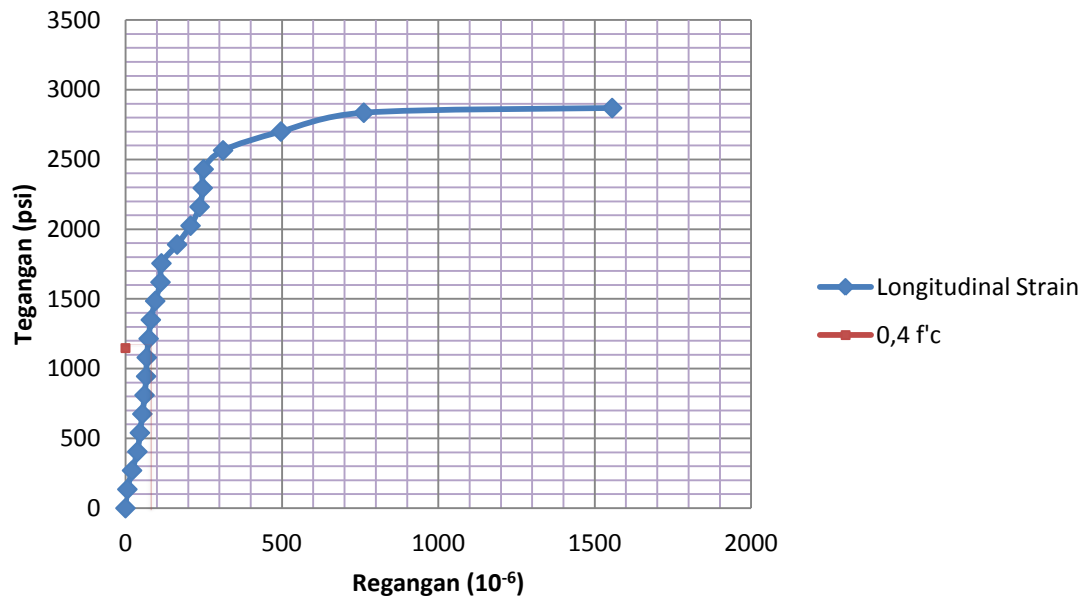
**Grafik Hubungan Tegangan dan Regangan
Sampel 1**



Sampel 2

P (kN)	A (mm ²)	Tegangan (psi)	Regangan ($\times 10^{-6}$)
0	5026,548	0	0
4	5026,548	135,051	6
8	5026,548	270,102	21
12	5026,548	405,153	38
16	5026,548	540,204	46
20	5026,548	675,255	54
24	5026,548	810,306	61
28	5026,548	945,357	66
32	5026,548	1080,408	68
36	5026,548	1215,460	74
40	5026,548	1350,511	81
44	5026,548	1485,562	95
48	5026,548	1620,613	112
52	5026,548	1755,664	115
56	5026,548	1890,715	165
60	5026,548	2025,766	208
64	5026,548	2160,817	237
68	5026,548	2295,868	247
72	5026,548	2430,919	250
76	5026,548	2565,970	312
80	5026,548	2701,021	497
84	5026,548	2836,072	762
85	5026,548	2869,835	1556

**Grafik Hubungan Tegangan dan Regangan
Sampel 2**



Lampiran 7**Data Pembacaan Beban**1. Lereng tanpa *pile*

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
8	184	0,191
8	184	0,191

2. Variasi diameter 1,27 cm dengan jarak antar 7,5 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
11	253	0,262
11,5	264,5	0,274
11,5	264,5	0,274
11,5	264,5	0,274

3. Variasi diameter 1,27 cm dengan jarak antar 10 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
10	230	0,239
10	230	0,239

4. Variasi diameter 1,27 cm dengan jarak antar 12,5 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
9,5	218,5	0,227
9,5	218,5	0,227
9,5	218,5	0,227

5. Variasi diameter 1,27 cm dengan jarak antar 15 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
9	207	0,215
9	207	0,215

6. Variasi diameter 1,905 cm dengan jarak antar 7,5 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
11	253	0,262
12	276	0,286
12	276	0,286
12	276	0,286

7. Variasi diameter 1,905 cm dengan jarak antar 10 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
11	253	0,262
11	253	0,262
11	253	0,262

8. Variasi diameter 1,905 cm dengan jarak antar 12,5 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
10,5	241,5	0,250
10,5	241,5	0,250
10,5	241,5	0,250

9. Variasi diameter 1,905 cm dengan jarak antar 15 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
10	230	0,239
10	230	0,239

10. Variasi diameter 2,54 cm dengan jarak antar 7,5 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
11	253	0,262
12	276	0,286
13	299	0,310
14	322	0,334
15	345	0,358
15	345	0,358
15	345	0,358

11. Variasi diameter 2,54 cm dengan jarak antar 10 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
11	253	0,262
12	276	0,286
13	299	0,310
13	299	0,310
13	299	0,310

12. Variasi diameter 2,54 cm dengan jarak antar 12,5 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
11	253	0,262
11	253	0,262
11	253	0,262

13. Variasi diameter 2,54 cm dengan jarak antar 15 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
10,5	241,5	0,250
10,5	241,5	0,250
10,5	241,5	0,250

14. Variasi diameter 3,175 cm dengan jarak antar 7,5 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
11	253	0,262
12	276	0,286
13	299	0,310
14	322	0,334
15	345	0,358
16	368	0,382
16	368	0,382
16	368	0,382

15. Variasi diameter 3,175 cm dengan jarak antar 10 cm

Strip Beban	Beban P (kg)	Q _u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
11	253	0,262
12	276	0,286
13	299	0,310
14	322	0,334
14	322	0,334
14	322	0,334

16. Variasi diameter 3,175 cm dengan jarak antar 12,5 cm

Strip Beban	Beban P (kg)	Q _u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
11	253	0,262
12	276	0,286
12,5	287,5	0,298
12,5	287,5	0,298
12,5	287,5	0,298

17. Variasi diameter 3,175 cm dengan jarak antar 15 cm

Strip Beban	Beban P (kg)	Q_u (kg/cm ²)
0	0	0
1	23	0,024
2	46	0,048
3	69	0,072
4	92	0,095
5	115	0,119
6	138	0,143
7	161	0,167
8	184	0,191
9	207	0,215
10	230	0,239
11	253	0,262
11	253	0,262
11	253	0,262



Data Pengujian Berat Isi Kering Tanah

SITAS

1,352	1,347	1,355
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1,317

ter 1,905 cm dengan jarak antar 7,5 cm													
1		2		3		4		5		6		7	
a	b	a	b	a	b	a	b	a	b	a	b	a	b
18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
36,2	36,0	35,8	35,6	35,5	35,6	35,2	35,4	35,6	35,2	35,2	35,4	35,4	
17,8	17,6	17,4	17,2	17,1	17,2	16,8	17	17,2	16,8	16,8	17	17	
11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	1
1,575	1,557	1,539	1,522	1,513	1,522	1,486	1,504	1,522	1,486	1,486	1,504	1,504	1
1,398	1,382	1,366	1,351	1,343	1,351	1,319	1,335	1,351	1,319	1,319	1,335	1,335	1
1,390		1,359		1,347		1,327		1,335		1,327		1,343	
1,347													
ter 1,905 cm dengan jarak antar 10 cm													
1		2		3		4		5		6		7	
a	b	a	b	a	b	a	b	a	b	a	b	a	b
18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
36,2	35,8	33,4	34,8	34,4	34,4	33,8	35	34,2	34,8	34,2	35	34,4	
17,8	17,4	15	16,4	16	16	15,4	16,6	15,8	16,4	15,8	16,6	16	
11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	1
1,575	1,539	1,327	1,451	1,415	1,415	1,362	1,469	1,398	1,451	1,398	1,469	1,415	1
1,400	1,368	1,179	1,290	1,258	1,258	1,211	1,305	1,242	1,290	1,242	1,305	1,258	1
1,384		1,235		1,258		1,258		1,266		1,274		1,274	
1,278													

ter 1,905 cm dengan jarak antar 7,5 cm													
1		2		3		4		5		6		7	
a	b	a	b	a	b	a	b	a	b	a	b	a	b
18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
36,2	36,0	35,8	35,6	35,5	35,6	35,2	35,4	35,6	35,2	35,2	35,4	35,4	
17,8	17,6	17,4	17,2	17,1	17,2	16,8	17	17,2	16,8	16,8	17	17	
11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304
1,575	1,557	1,539	1,522	1,513	1,522	1,486	1,504	1,522	1,486	1,486	1,504	1,504	1,504
1,398	1,382	1,366	1,351	1,343	1,351	1,319	1,335	1,351	1,319	1,319	1,335	1,335	1,335
1,390		1,359		1,347		1,327		1,335		1,327		1,343	
1,347													
ter 1,905 cm dengan jarak antar 10 cm													
1		2		3		4		5		6		7	
a	b	a	b	a	b	a	b	a	b	a	b	a	b
18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
36,2	35,8	33,4	34,8	34,4	34,4	33,8	35	34,2	34,8	34,2	35	34,4	
17,8	17,4	15	16,4	16	16	15,4	16,6	15,8	16,4	15,8	16,6	16	
11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304
1,575	1,539	1,327	1,451	1,415	1,415	1,362	1,469	1,398	1,451	1,398	1,469	1,415	1,415
1,400	1,368	1,179	1,290	1,258	1,258	1,211	1,305	1,242	1,290	1,242	1,305	1,258	1,258
1,384		1,235		1,258		1,258		1,266		1,274		1,274	
1,278													

7. Variasi diameter 1,905 cm dengan jarak antar 12,5 cm

Lapisan	1		2		3		4		5		6		7	
Sample	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Berat Ring	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
Berat Ring + Tanah	35,8	37,4	34,0	34,0	36,6	35,0	34,6	35,4	35,4	35,2	34,8	35,4	35,8	35,4
Berat Tanah	17,4	19	15,6	15,6	18,2	16,6	16,2	17	17	16,8	16,4	17	17,4	17
Volume ring	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304
γ	1,539	1,681	1,380	1,380	1,610	1,469	1,433	1,504	1,504	1,486	1,451	1,504	1,539	1,504
γ_d	1,366	1,492	1,225	1,225	1,429	1,303	1,272	1,335	1,335	1,319	1,288	1,335	1,366	1,335
γ_d rata-rata	1,429		1,225		1,366		1,303		1,327		1,311		1,350	
γ_d rata-rata total	1,330													

8. Variasi diameter 1,905 cm dengan jarak antar 15 cm

[illegible]

9. Variasi diameter 2,54 cm dengan jarak antar 7,5 cm

Lapisan	1		2		3		4		5		6		7	
Sample	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Berat Ring	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
Berat Ring + Tanah	35	35	35,8	34,4	34,6	35,2	34,4	34,8	34,6	35	35,2	34,6	35,6	35,8
Berat Tanah	16,6	16,6	17,4	16	16,2	16,8	16	16,4	16,2	16,6	16,8	16,2	17,2	17,4
Volume ring	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304
γ	1,469	1,469	1,539	1,415	1,433	1,486	1,415	1,451	1,433	1,469	1,486	1,433	1,522	1,539
γ_d	1,306	1,306	1,369	1,259	1,275	1,322	1,259	1,290	1,275	1,306	1,322	1,275	1,353	1,369
γ_d rata-rata	1,306		1,314		1,298		1,275		1,290		1,298		1,361	
γ_d rata-rata total	1,306													

10. Variasi diameter 2,54 cm dengan jarak antar 10 cm

[illegible]

11. Variasi diameter 2,54 cm dengan jarak antar 12,5 cm

Lapisan	1		2		3		4		5		6		7	
Sample	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Berat Ring	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
Berat Ring + Tanah	34,8	36	34,2	34,6	35,4	34,2	34,6	34,4	34,8	35,2	35	35,8	35,2	34,6
Berat Tanah	16,4	17,6	15,8	16,2	17	15,8	16,2	16	16,4	16,8	16,6	17,4	16,8	16,2
Volume ring	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304
γ	1,451	1,557	1,398	1,433	1,504	1,398	1,433	1,415	1,451	1,486	1,469	1,539	1,486	1,433
γ_d	1,294	1,389	1,247	1,279	1,342	1,247	1,279	1,263	1,294	1,326	1,310	1,373	1,326	1,279
γ_d rata-rata	1,342		1,263		1,294		1,271		1,310		1,342		1,302	
γ_d rata-rata total	1,303													

12. Variasi diameter 2,54 cm dengan jarak antar 15 cm

Lapisan	1		2		3		4		5		6		7	
Sample	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Berat Ring	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
Berat Ring + Tanah	35	35,6	35,8	33,8	33,6	35,4	34	34,8	35,2	35	35,8	35,2	33,8	34,4
Berat Tanah	16,6	17,2	17,4	15,4	15,2	17	15,6	16,4	16,8	16,6	17,4	16,8	15,4	16
Volume ring	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304
γ	1,469	1,522	1,539	1,362	1,345	1,504	1,380	1,451	1,486	1,469	1,539	1,486	1,362	1,415
γ_d	1,311	1,358	1,374	1,216	1,200	1,342	1,232	1,295	1,327	1,311	1,374	1,327	1,216	1,263
γ_d rata-rata	1,334		1,295		1,271		1,263		1,319		1,350		1,240	
γ_d rata-rata total	1,296													

ter 3,175 cm dengan jarak antar 7,5 cm

1		2		3		4		5		6		7	
a	b	a	b	a	b	a	b	a	b	a	b	a	b
18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
36,4	36,4	34,8	34,8	35,8	35,4	35,4	35,2	35,8	36,0	35,6	35,2	35,6	35,6
18	18	16,4	16,4	17,4	17	17	16,8	17,4	17,6	17,2	16,8	17,2	17,2
11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304
1,592	1,592	1,451	1,451	1,539	1,504	1,504	1,486	1,539	1,557	1,522	1,486	1,522	1,522
1,410	1,410	1,285	1,285	1,363	1,332	1,332	1,316	1,363	1,379	1,347	1,316	1,347	1,347
1,410		1,285		1,347		1,324		1,371		1,332		1,355	
1,346													

ter 3,175 cm dengan jarak antar 10 cm

1		2		3		4		5		6		7	
a	b	a	b	a	b	a	b	a	b	a	b	a	b
18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
39,8	38,8	34,6	33,6	33,6	34,4	35,4	34,8	34,8	35,6	35,8	34,6	34,6	34,6
21,4	20,4	16,2	15,2	15,2	16	17	16,4	16,4	17,2	17,4	16,2	16,2	16,2
11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304
1,893	1,805	1,433	1,345	1,345	1,415	1,504	1,451	1,451	1,522	1,539	1,433	1,433	1,433
1,677	1,599	1,270	1,191	1,191	1,254	1,332	1,285	1,285	1,348	1,364	1,270	1,270	1,270
1,638		1,231		1,223		1,309		1,317		1,317		1,278	
1,330													

ter 3,175 cm dengan jarak antar 7,5 cm

1		2		3		4		5		6		7	
a	b	a	b	a	b	a	b	a	b	a	b	a	b
18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
36,4	36,4	34,8	34,8	35,8	35,4	35,4	35,2	35,8	36,0	35,6	35,2	35,6	35,6
18	18	16,4	16,4	17,4	17	17	16,8	17,4	17,6	17,2	16,8	17,2	17,2
11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304
1,592	1,592	1,451	1,451	1,539	1,504	1,504	1,486	1,539	1,557	1,522	1,486	1,522	1,522
1,410	1,410	1,285	1,285	1,363	1,332	1,332	1,316	1,363	1,379	1,347	1,316	1,347	1,347
1,410		1,285		1,347		1,324		1,371		1,332		1,355	
1,346													

ter 3,175 cm dengan jarak antar 10 cm

1		2		3		4		5		6		7	
a	b	a	b	a	b	a	b	a	b	a	b	a	b
18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
39,8	38,8	34,6	33,6	33,6	34,4	35,4	34,8	34,8	35,6	35,8	34,6	34,6	34,6
21,4	20,4	16,2	15,2	15,2	16	17	16,4	16,4	17,2	17,4	16,2	16,2	16,2
11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304
1,893	1,805	1,433	1,345	1,345	1,415	1,504	1,451	1,451	1,522	1,539	1,433	1,433	1,433
1,677	1,599	1,270	1,191	1,191	1,254	1,332	1,285	1,285	1,348	1,364	1,270	1,270	1,270
1,638		1,231		1,223		1,309		1,317		1,317		1,278	
1,330													

16. Variasi diameter 3,175 cm dengan jarak antar 15 cm

Lapisan	1		2		3		4		5		6		7	
Sample	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Berat Ring	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4	18,4
Berat Ring + Tanah	35,6	36,0	35,6	36,2	35,0	35,4	34,4	36,2	35,8	36,0	35,2	35,5	35,6	35,8
Berat Tanah	17,2	17,6	17,2	17,8	16,6	17	16	17,8	17,4	17,6	16,8	17,1	17,2	17,4
Volume ring	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304	11,304
γ	1,522	1,557	1,522	1,575	1,469	1,504	1,415	1,575	1,539	1,557	1,486	1,513	1,522	1,539
γ_d	1,348	1,380	1,348	1,395	1,301	1,333	1,254	1,395	1,364	1,380	1,317	1,340	1,348	1,364
γ_d rata-rata	1,364		1,372		1,317		1,325		1,372		1,329		1,356	
γ_d rata-rata total	1,348													

12. Variasi diameter 2,54 cm dengan jarak antar 15 cm

Lapisan	1	2	3	4	5	6	7
Berat Cawan	5,8	5,6	5,6	5,8	6,0	6,0	5,8
Berat Cawan + Tanah Basah	38,6	37,6	37,0	38,6	37,6	39,8	36,6
Berat Cawan + Tanah Kering	34,8	34,4	33,8	34,8	34,6	36,0	33,2
Kadar Air (%)	13,103	11,111	11,348	13,103	10,490	12,667	12,409
Kadar Air rata-rata (%)	12,033						

13. Variasi diameter 3,175 cm dengan jarak antar 7,5 cm

Lapisan	1	2	3	4	5	6	7
Berat Cawan	5,6	5,6	5,8	5,8	5,6	5,6	5,8
Berat Cawan + Tanah Basah	43,4	38,2	41,4	39,8	41,8	40,2	40,4
Berat Cawan + Tanah Kering	37,6	35,4	37,6	36,0	37,2	36,4	36,8
Kadar Air (%)	18,125	9,396	11,950	12,583	14,557	12,338	11,613
Kadar Air rata-rata (%)	12,937						

14. Variasi diameter 3,175 cm dengan jarak antar 10 cm

Lapisan	1	2	3	4	5	6	7
Berat Cawan	6,0	6,0	6,0	4,4	5,8	5,6	6,0
Berat Cawan + Tanah Basah	46,6	36,4	36,6	37,2	38,6	38,0	37,8
Berat Cawan + Tanah Kering	39,0	33,8	34,2	33,8	35,0	34,0	34,6
Kadar Air (%)	23,030	9,353	8,511	11,565	12,329	14,085	11,189
Kadar Air rata-rata (%)	12,866						

15. Variasi diameter 3,175 cm dengan jarak antar 12,5 cm

Lapisan	1	2	3	4	5	6	7
Berat Cawan	6,2	4,2	5,8	5,6	5,8	4,4	5,6
Berat Cawan + Tanah Basah	42,2	38,0	42,0	39,8	38,8	40,4	42,6
Berat Cawan + Tanah Kering	37,6	33,8	37,8	35,8	35,4	36,6	37,8
Kadar Air (%)	14,650	14,189	13,125	13,245	11,486	11,801	14,907
Kadar Air rata-rata (%)	13,343						

16. Variasi diameter 3,175 cm dengan jarak antar 15 cm

Lapisan	1	2	3	4	5	6	7
Berat Cawan	4,4	5,6	6,0	1,4	5,6	6,0	5,6
Berat Cawan + Tanah Basah	38,8	40,6	40,4	35,6	40,6	39,8	41,2
Berat Cawan + Tanah Kering	34,6	36,8	36,6	31,8	36,6	36,0	37,0
Kadar Air (%)	13,907	12,179	12,418	12,500	12,903	12,667	13,376
Kadar Air rata-rata (%)	12,850						

Lampiran 10

Data Penurunan Tanah

1. Lereng tanpa *pile*

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	74	82	72	80
2	169	180	164	175
3	285	294	272	281
4	381	389	372	380
5	493	501	485	493
6	607	618	586	597
7	685	694	679	688
8	851	859	839	847
8	981	989	953	961
8	1040	1051	1031	1042

2. Variasi diameter 1,27 cm dengan jarak antar 7,5 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	41	45	32	37
2	76	81	65	69
3	132	138	119	123
4	179	184	174	177
5	219	224	205	208
6	288	294	272,5	278
7	418,5	421	396	403
8	526	530	512,5	519
9	679,5	684	667	671
10	784	788	769	773
11	894,5	898	880	884
11,5	996	998	975,5	980
11,5	1085	1088	1072	1076
11,5	1153	1156	1137	1139

3. Variasi diameter 1,27 cm dengan jarak antar 10 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	37	45	33	41
2	76	87	71	82
3	134	143	129	138
4	219	227	204	212
5	323	331	318	326
6	409	420	404	415
7	506	515	502	511
8	642	650	636	644
9	769	777	758	766
10	905	916	882	893
10	972	981	957	966
10	1086	1095	1064	1073

4. Variasi diameter 1,27 cm dengan jarak antar 12,5 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	44	48	57	60
2	96	101	111	114
3	181,5	185	195	197,5
4	242	248	257	261
5	384	387	408	411,5
6	485	488	508,5	511
7	580	585	502	606
8	681,5	687	705	707
9	808	812	825	831
9,5	887	891	904	910
9,5	942	947,5	857	962
9,5	985	989	1001	1005

5. Variasi diameter 1,27 cm dengan jarak antar 15 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	59	61	72,5	75
2	132	135	145	149
3	245	248,5	259	262
4	305,5	309	324	328
5	437	439	451	456
6	533	536	546	550
7	614	617	629,5	633
8	742	746	756	760
9	855,5	859	872	876,5
9	907	911	926	930
9	949	952	971	975

6. Variasi diameter 1,905 cm dengan jarak antar 7,5 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	21	24	27	29
2	49	53	64	67
3	99	102	113	116
4	128	132	142	148
5	156	159	165	170,5
6	234,5	237	250	254
7	370	374	385	389
8	477	481	496	500
9	575	578	592,5	596
10	694	697	705	712
11	835,5	840	849	853
12	917	919	930	935
12	1008	1011	1027	1032
12	1090,5	1094	1109	1113

7. Variasi diameter 1,905 cm dengan jarak antar 10 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	29	37	24	32
2	79	87	73	81
3	138	146	123	131
4	207	215	188	196
5	298	306	282	290
6	383	391	366	374
7	479	487	461	469
8	608	616	589	597
9	723	731	698	706
10	838	846	822	830
11	1037	1045	1022	1030
11	1101	1109	1090	1098
11	1195	1203	1181	1189

8. Variasi diameter 1,905 cm dengan jarak antar 12,5 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	28	32	42	45
2	83	85	98	102
3	133	137	146	149
4	204	209	217	221
5	289	293	304	307
6	404,5	408	419	421,5
7	498	501	511	515
8	654	656	663,5	668
9	776	779,5	795	798
10	897	901	916	920,5
10,5	1025	1027	1048	1051
10,5	1135	1139	1150	1154
10,5	1148	1153	1162	1165

9. Variasi diameter 1,905 cm dengan jarak antar 15 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	28	34	48	50
2	105	117	126	131
3	164	168	193	197
4	251	255	278	286
5	348	352	375	379
6	448	457	464	474
7	567	573	575	579
8	701	705	716	720
9	832	837	841	850
10	1033	1036	1014	1020
10	1066	1072	1050	1056
10	1248	1253	1227	1236

10. Variasi diameter 2,54 cm dengan jarak antar 7,5 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	4	6	10	12
2	19	23	35	41
3	35	39	58	63
4	79	85	96	101
5	123	129	133	137
6	185	190	190,5	196
7	280	286	280	288
8	335	339	338	343
9	462,5	470	476	480
10	584	589	595	605
11	689	696	700	706
12	829	834	949	855
13	992	996	997	1004
14	1096	1104	1104	1108
15	1171	1177	1186	1196
15	1225	1230	1236	1241
15	1444	1453	1447	1454

11. Variasi diameter 2,54 cm dengan jarak antar 10 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	15,5	23,5	15	23
2	55	61	54	60
3	91	100	88	97
4	145,5	153,5	140	148
5	206	214	190	198
6	273,5	282,5	259	270
7	389	397	372	381
8	442,5	448,5	426	434
9	562	568	548	556
10	681,5	689,5	662	670
11	797	805	781	789
12	963,5	969,5	949	958
13	1179	1187	1167	1175
13	1260,5	1271,5	1250	1258
13	1379	1388	1366	1377

12. Variasi diameter 2,54 cm dengan jarak antar 12,5 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	23	31	31	36
2	82	87	85	95
3	130	135	142	146
4	189	196	207	215
5	269	278	289	296
6	358	367	376	381
7	462	467	482	487
8	557	564	581	586
9	697	705	723	726
10	827,5	831	839	840,5
11	1032	1037	1039	1043
11	1081	1088	1093	1098
11	1185	1189	1193	1200

13. Variasi diameter 2,54 cm dengan jarak antar 15 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	47	49	34	37
2	105	110	90	95
3	173	176	158	164
4	232	236	207	212
5	322	327	305	311
6	437	443	425	428
7	549	555	532,5	537
8	685	690	671	676
9	826	830	813	817
10	973	977	981	987
10,5	1009	1013	1015	1024
10,5	1107	1116	1131	1137
10,5	1157	1163	1157	1165

14. Variasi diameter 3,175 cm dengan jarak antar 7,5 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	0,5	1	0	1
2	12	13	3,5	6
3	35	37	17	24
4	56	59	33	44
5	84	87	57	63
6	105,5	109	81	88
7	130	134	113	115
8	163	168	141	144
9	200	201	173	180
10	278	280	225	232
11	372	376	355	360
12	508	514	485	490
13	646	649	629	639
14	786	794	762	774
15	856	861	827	836
16	961	969	940,5	947
16	988	997	962	967
16	1065	1088	1060	1070

15. Variasi diameter 3,175 cm dengan jarak antar 10 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	9	13	2,5	7
2	32	37	19	24
3	41	50	31	41
4	68	78	62	65,5
5	205,5	115	89	91
6	141	148	120	129
7	190	195	158	168
8	235	237	213	216
9	283	292,5	276	282
10	374	384	352	359
11	515	517	482	488
12	679	686	661,5	667
13	783	786	747	750
14	943	954	926	940
14	1033	1038	1007	1016
14	997	1093	1061	1068

16. Variasi diameter 3,175 cm dengan jarak antar 12,5 cm

Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	2	4,5	8	8
2	14	19,5	25	25
3	37	40	54	56
4	83	86	90	94,5
5	111,5	117	145	149,5
6	173	180	199	208
7	239	249	271,5	281
8	338	342	368	374
9	449	451	462	470
10	571	578	590	596
11	711	719,5	732	735
12	928,5	936,5	966	968
12,5	1039	1046	1065	1072
12,5	1148	1157	1162	1179
12,5	1272	1279	1300	1306

17. Variasi diameter 3,175 cm dengan jarak antar 15 cm

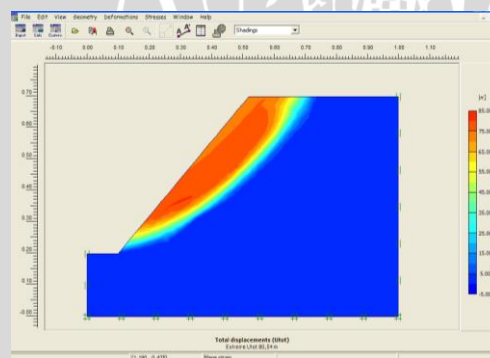
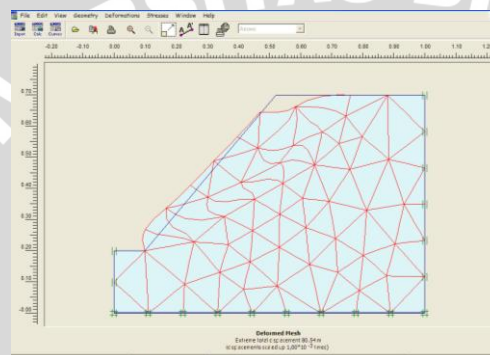
Beban	Kanan		Kiri	
	Pembacaan Awal	Pembacaan Akhir	Pembacaan Awal	Pembacaan Akhir
0	0	0	0	0
1	15	20,5	22	27
2	57,5	67	71,5	78
3	101	108	115	123
4	139	148	162	169
5	203	207	223	225
6	301	309	318	326
7	401	408,5	411	419
8	502	504	518	526
9	610,5	616	625	632
10	716	723	743	748
11	864	871	876,5	884
11	986	994	1005	1013
11	1290	1298	1315	1320



Lampiran 11

Hasil Analisis PLAXIS 8.2 untuk Kondisi (1) Lereng tanpa *Pile* dan Beban luar

Calculation information			
Multipliers Additional Info Step Info			
Step Info			
Step	110 of 110	Extrapolation factor	2,000
PLASTIC STEP		Relative stiffness	0,000
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0,000	Σ -Mdisp:	1,000
Load system A	MloadA: 0,000	Σ -MloadA:	1,000
Load system B	MloadB: 0,000	Σ -MloadB:	1,000
Soil weight	Mweight: 0,000	Σ -Mweight:	1,000
Acceleration	Maccel: 0,000	Σ -Maccel:	0,000
Strength reduction factor	Msfr: -0,001	Σ -Msfr:	1,217
Time	Increment: 0,000	End time:	0,000
Dynamic Time	Increment: 0,000	End time:	0,000

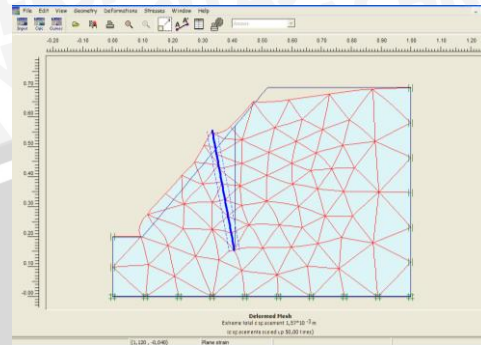


Lampiran 12

Hasil Analisis PLAXIS 8.2 untuk Kondisi (2) Lereng dengan *Pile* tanpa Beban luar

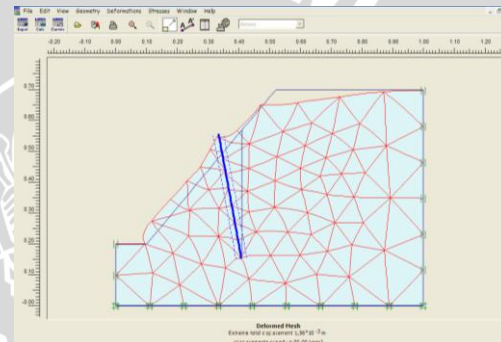
1. Variasi diameter 1,27 cm jarak antar 7,5 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info	Step	125 of 125	Extrapolation factor
PLASTIC STEP			0.500
			Relative stiffness
			0.002
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0.000	Σ -Mdisp: 1.000	
Load system A	MloadA: 0.000	Σ -MloadA: 1.000	
Load system B	MloadB: 0.000	Σ -MloadB: 1.000	
Soil weight	Mweight: 0.000	Σ -Mweight: 1.000	
Acceleration	Maccel: 0.000	Σ -Maccel: 0.000	
Streight reduction factor	Msf: 0.000	Σ -Msf: 1.454	
Time	Increment: 0.000	End time: 0.000	
Dynamic Time	Increment: 0.000	End time: 0.000	



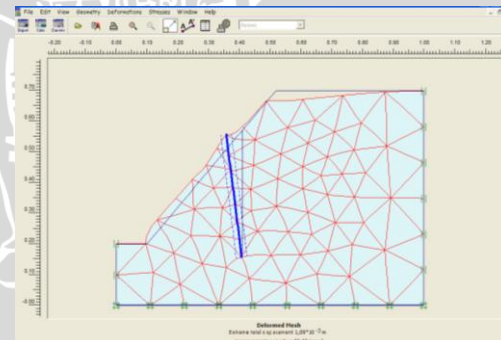
2. Variasi diameter 1,27 cm jarak antar 10 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info	Step	123 of 123	Extrapolation factor
PLASTIC STEP			1.000
			Relative stiffness
			0.002
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0.000	Σ -Mdisp: 1.000	
Load system A	MloadA: 0.000	Σ -MloadA: 1.000	
Load system B	MloadB: 0.000	Σ -MloadB: 1.000	
Soil weight	Mweight: 0.000	Σ -Mweight: 1.000	
Acceleration	Maccel: 0.000	Σ -Maccel: 0.000	
Streight reduction factor	Msf: 0.000	Σ -Msf: 1.453	
Time	Increment: 0.000	End time: 0.000	
Dynamic Time	Increment: 0.000	End time: 0.000	



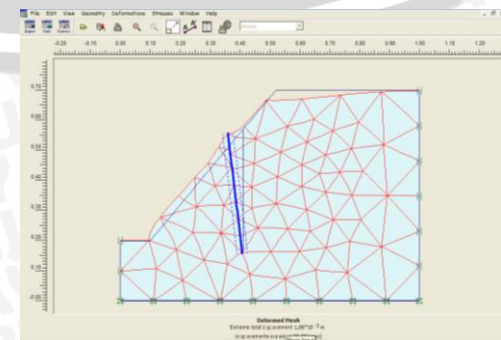
3. Variasi diameter 1,27 cm jarak antar 12,5 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info	Step	119 of 119	Extrapolation factor
PLASTIC STEP			0.500
			Relative stiffness
			0.003
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0.000	Σ -Mdisp: 1.000	
Load system A	MloadA: 0.000	Σ -MloadA: 1.000	
Load system B	MloadB: 0.000	Σ -MloadB: 1.000	
Soil weight	Mweight: 0.000	Σ -Mweight: 1.000	
Acceleration	Maccel: 0.000	Σ -Maccel: 0.000	
Streight reduction factor	Msf: 0.000	Σ -Msf: 1.442	
Time	Increment: 0.000	End time: 0.000	
Dynamic Time	Increment: 0.000	End time: 0.000	



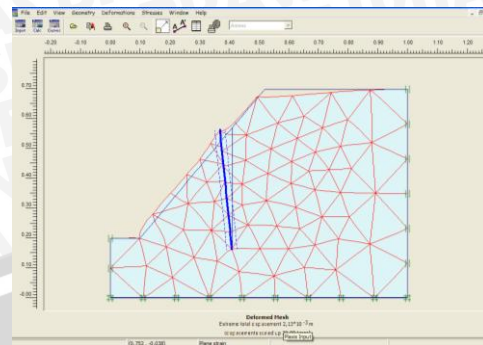
4. Variasi diameter 1,27 cm jarak antar 15 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info	Step	103 of 103	Extrapolation factor
PLASTIC STEP			0.500
			Relative stiffness
			0.003
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0.000	Σ -Mdisp: 1.000	
Load system A	MloadA: 0.000	Σ -MloadA: 1.000	
Load system B	MloadB: 0.000	Σ -MloadB: 1.000	
Soil weight	Mweight: 0.000	Σ -Mweight: 1.000	
Acceleration	Maccel: 0.000	Σ -Maccel: 0.000	
Streight reduction factor	Msf: 0.000	Σ -Msf: 1.441	
Time	Increment: 0.000	End time: 0.000	
Dynamic Time	Increment: 0.000	End time: 0.000	



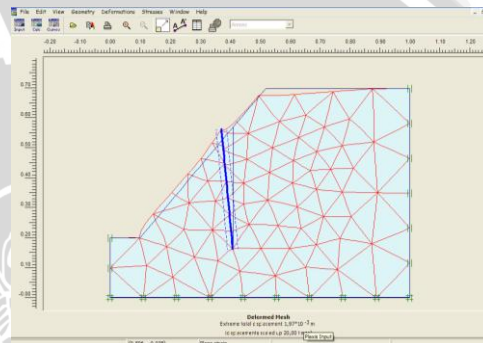
5. Variasi diameter 1,905 cm jarak antar 7,5 cm

Calculation information			
Multipliers		Step Info	
Step Info		Step	213 of 213
		PLASTIC STEP	
		Extrapolation factor	0.500
		Relative stiffness	0.002
Multipliers		Incremental Multipliers	Total Multipliers
Prescribed displacements	Mdisp:	0.000	Σ -Mdisp: 1.000
Load system A	MloadA:	0.000	Σ -MloadA: 1.000
Load system B	MloadB:	0.000	Σ -MloadB: 1.000
Soil weight	Mweight:	0.000	Σ -Mweight: 1.000
Acceleration	Maccel:	0.000	Σ -Maccel: 0.000
Streight reduction factor	Msf:	0.000	Σ -Msf: 1.463
Time	Increment:	0.000	End time: 0.000
Dynamic Time	Increment:	0.000	End time: 0.000



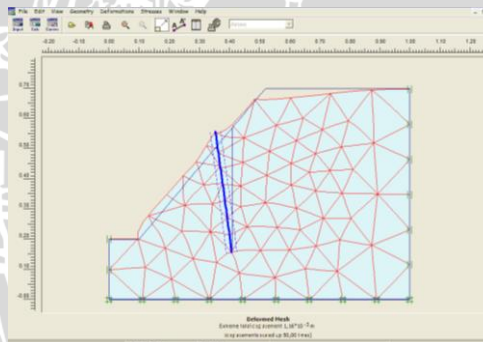
6. Variasi diameter 1,905 cm jarak antar 10 cm

Calculation information			
Multipliers		Step Info	
Step Info		Step	221 of 221
		PLASTIC STEP	
		Extrapolation factor	1.000
		Relative stiffness	0.000
Multipliers		Incremental Multipliers	Total Multipliers
Prescribed displacements	Mdisp:	0.000	Σ -Mdisp: 1.000
Load system A	MloadA:	0.000	Σ -MloadA: 1.000
Load system B	MloadB:	0.000	Σ -MloadB: 1.000
Soil weight	Mweight:	0.000	Σ -Mweight: 1.000
Acceleration	Maccel:	0.000	Σ -Maccel: 0.000
Streight reduction factor	Msf:	-0.001	Σ -Msf: 1.457
Time	Increment:	0.000	End time: 0.000
Dynamic Time	Increment:	0.000	End time: 0.000



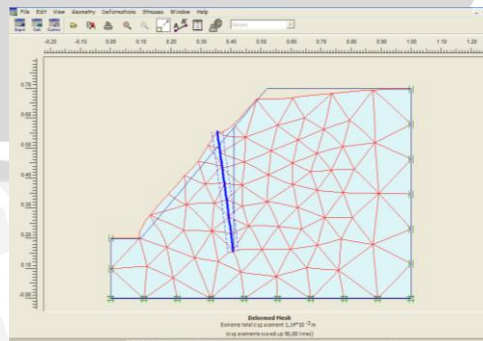
7. Variasi diameter 1,905 cm jarak antar 12,5 cm

Calculation information			
Multipliers		Step Info	
Step Info		Step	121 of 121
		PLASTIC STEP	
		Extrapolation factor	0.500
		Relative stiffness	0.003
Multipliers		Incremental Multipliers	Total Multipliers
Prescribed displacements	Mdisp:	0.000	Σ -Mdisp: 1.000
Load system A	MloadA:	0.000	Σ -MloadA: 1.000
Load system B	MloadB:	0.000	Σ -MloadB: 1.000
Soil weight	Mweight:	0.000	Σ -Mweight: 1.000
Acceleration	Maccel:	0.000	Σ -Maccel: 0.000
Streight reduction factor	Msf:	0.000	Σ -Msf: 1.444
Time	Increment:	0.000	End time: 0.000
Dynamic Time	Increment:	0.000	End time: 0.000



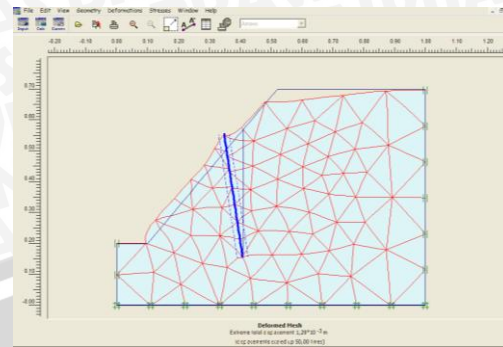
8. Variasi diameter 1,905 cm jarak antar 15 cm

Calculation information			
Multipliers		Step Info	
Step Info		Step	129 of 129
		PLASTIC STEP	
		Extrapolation factor	0.500
		Relative stiffness	0.002
Multipliers		Incremental Multipliers	Total Multipliers
Prescribed displacements	Mdisp:	0.000	Σ -Mdisp: 1.000
Load system A	MloadA:	0.000	Σ -MloadA: 1.000
Load system B	MloadB:	0.000	Σ -MloadB: 1.000
Soil weight	Mweight:	0.000	Σ -Mweight: 1.000
Acceleration	Maccel:	0.000	Σ -Maccel: 0.000
Streight reduction factor	Msf:	0.000	Σ -Msf: 1.443
Time	Increment:	0.000	End time: 0.000
Dynamic Time	Increment:	0.000	End time: 0.000



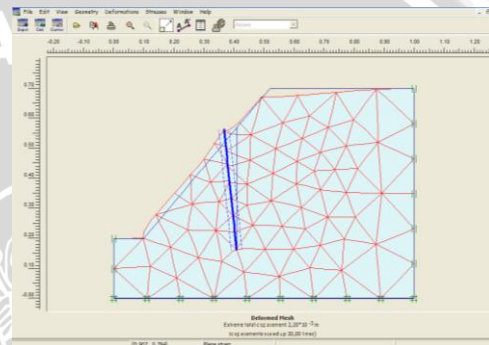
9. Variasi diameter 2,54 cm jarak antar 7,5 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info		Step	123 of 123
PLASTIC STEP		Extrapolation factor	0,500
		Relative stiffness	0,004
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdispl: 0,000	Σ -Mdispl:	1,000
Load system A	MloadA: 0,000	Σ -MloadA:	1,000
Load system B	MloadB: 0,000	Σ -MloadB:	1,000
Soil weight	Mweight: 0,000	Σ -Mweight:	1,000
Acceleration	Maccel: 0,000	Σ -Maccel:	0,000
Streight reduction factor	Msf: 0,000	Σ -Msf:	1,450
Time	Increment: 0,000	End time:	0,000
Dynamic Time	Increment: 0,000	End time:	0,000



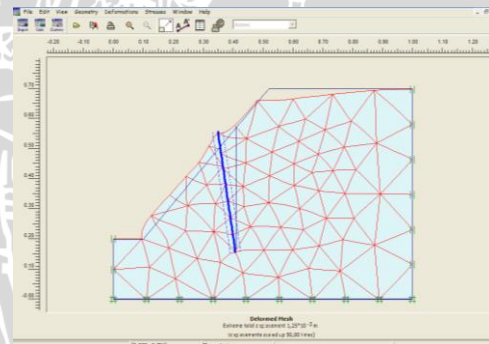
10. Variasi diameter 2,54 cm jarak antar 10 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info		Step	256 of 256
PLASTIC STEP		Extrapolation factor	1,000
		Relative stiffness	0,000
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdispl: 0,000	Σ -Mdispl:	1,000
Load system A	MloadA: 0,000	Σ -MloadA:	1,000
Load system B	MloadB: 0,000	Σ -MloadB:	1,000
Soil weight	Mweight: 0,000	Σ -Mweight:	1,000
Acceleration	Maccel: 0,000	Σ -Maccel:	0,000
Streight reduction factor	Msf: -0,001	Σ -Msf:	1,462
Time	Increment: 0,000	End time:	0,000
Dynamic Time	Increment: 0,000	End time:	0,000



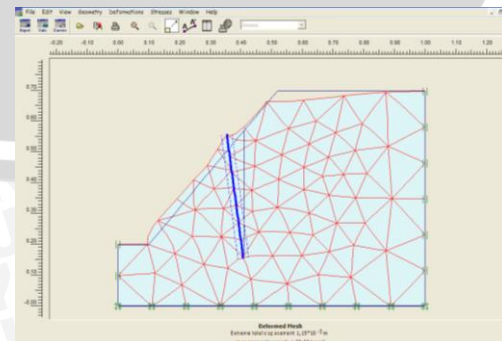
11. Variasi diameter 2,54 cm jarak antar 12,5 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info		Step	129 of 129
PLASTIC STEP		Extrapolation factor	2,000
		Relative stiffness	0,001
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdispl: 0,000	Σ -Mdispl:	1,000
Load system A	MloadA: 0,000	Σ -MloadA:	1,000
Load system B	MloadB: 0,000	Σ -MloadB:	1,000
Soil weight	Mweight: 0,000	Σ -Mweight:	1,000
Acceleration	Maccel: 0,000	Σ -Maccel:	0,000
Streight reduction factor	Msf: -0,001	Σ -Msf:	1,446
Time	Increment: 0,000	End time:	0,000
Dynamic Time	Increment: 0,000	End time:	0,000



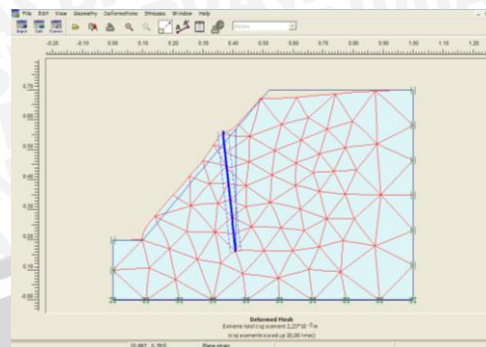
12. Variasi diameter 2,54 cm jarak antar 15 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info		Step	129 of 129
PLASTIC STEP		Extrapolation factor	1,000
		Relative stiffness	0,003
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdispl: 0,000	Σ -Mdispl:	1,000
Load system A	MloadA: 0,000	Σ -MloadA:	1,000
Load system B	MloadB: 0,000	Σ -MloadB:	1,000
Soil weight	Mweight: 0,000	Σ -Mweight:	1,000
Acceleration	Maccel: 0,000	Σ -Maccel:	0,000
Streight reduction factor	Msf: 0,000	Σ -Msf:	1,444
Time	Increment: 0,000	End time:	0,000
Dynamic Time	Increment: 0,000	End time:	0,000



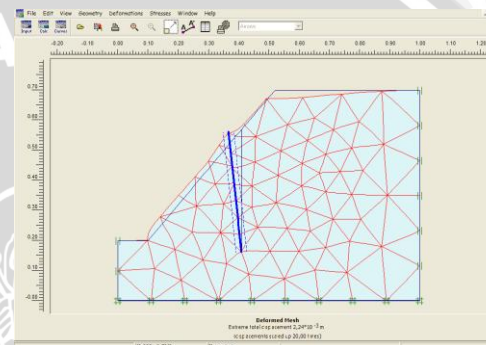
13. Variasi diameter 3,175 cm jarak antar 7,5 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info		Step	269 of 269
PLASTIC STEP		Extrapolation factor	2.000
		Relative stiffness	0.001
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0.000	Σ -Mdisp:	1.000
Load system A	MloadA: 0.000	Σ -MloadA:	1.000
Load system B	MloadB: 0.000	Σ -MloadB:	1.000
Soil weight	Mweight: 0.000	Σ -Mweight:	1.000
Acceleration	Maccel: 0.000	Σ -Maccel:	0.000
Streight reduction factor	Msf: 0.000	Σ -Msf:	1.465
Time	Increment: 0.000	End time:	0.000
Dynamic Time	Increment: 0.000	End time:	0.000



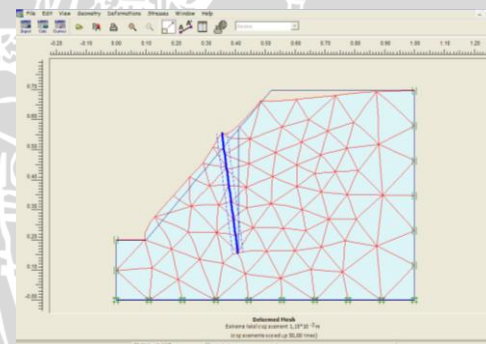
14. Variasi diameter 3,175 cm jarak antar 10 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info		Step	270 of 270
PLASTIC STEP		Extrapolation factor	2.000
		Relative stiffness	0.002
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0.000	Σ -Mdisp:	1.000
Load system A	MloadA: 0.000	Σ -MloadA:	1.000
Load system B	MloadB: 0.000	Σ -MloadB:	1.000
Soil weight	Mweight: 0.000	Σ -Mweight:	1.000
Acceleration	Maccel: 0.000	Σ -Maccel:	0.000
Streight reduction factor	Msf: 0.001	Σ -Msf:	1.464
Time	Increment: 0.000	End time:	0.000
Dynamic Time	Increment: 0.000	End time:	0.000



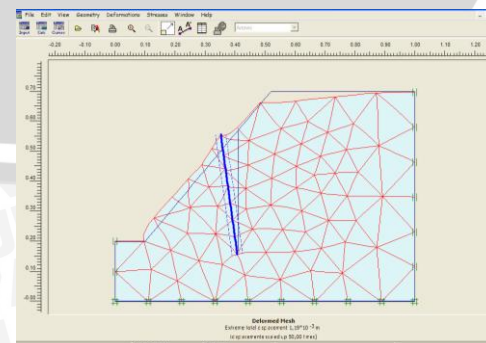
15. Variasi diameter 3,175 cm jarak antar 12,5 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info		Step	123 of 123
PLASTIC STEP		Extrapolation factor	0.500
		Relative stiffness	0.003
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0.000	Σ -Mdisp:	1.000
Load system A	MloadA: 0.000	Σ -MloadA:	1.000
Load system B	MloadB: 0.000	Σ -MloadB:	1.000
Soil weight	Mweight: 0.000	Σ -Mweight:	1.000
Acceleration	Maccel: 0.000	Σ -Maccel:	0.000
Streight reduction factor	Msf: 0.000	Σ -Msf:	1.448
Time	Increment: 0.000	End time:	0.000
Dynamic Time	Increment: 0.000	End time:	0.000



16. Variasi diameter 3,175 cm jarak antar 15 cm

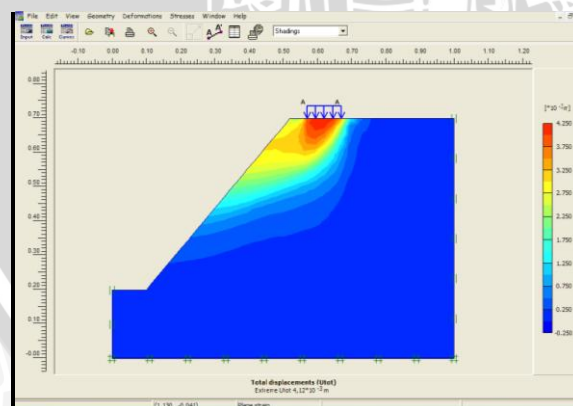
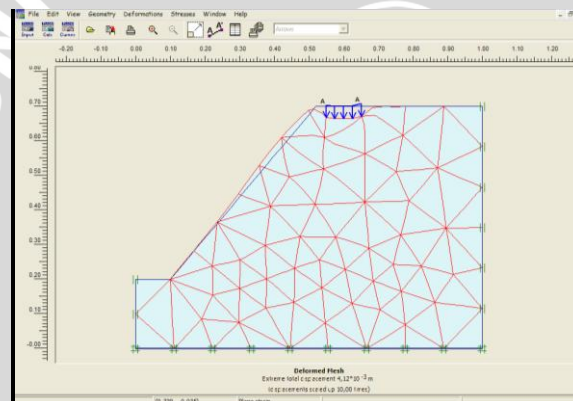
Calculation information			
Multipliers Additional Info Step Info			
Step Info		Step	123 of 123
PLASTIC STEP		Extrapolation factor	2.000
		Relative stiffness	0.001
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0.000	Σ -Mdisp:	1.000
Load system A	MloadA: 0.000	Σ -MloadA:	1.000
Load system B	MloadB: 0.000	Σ -MloadB:	1.000
Soil weight	Mweight: 0.000	Σ -Mweight:	1.000
Acceleration	Maccel: 0.000	Σ -Maccel:	0.000
Streight reduction factor	Msf: 0.000	Σ -Msf:	1.449
Time	Increment: 0.000	End time:	0.000
Dynamic Time	Increment: 0.000	End time:	0.000



Lampiran 13

Hasil Analisis PLAXIS 8.2 untuk Kondisi (3) Lereng tanpa Pile dengan Beban luar

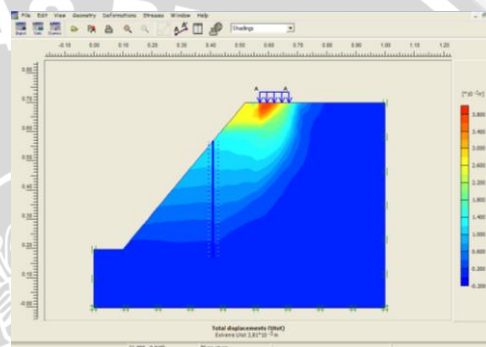
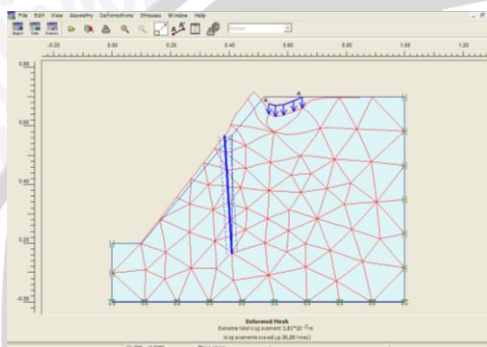
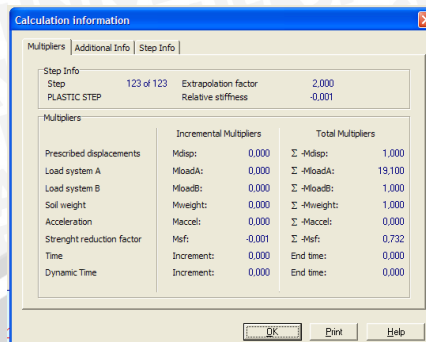
Calculation information			
Multipliers Additional Info Step Info			
Step Info			
Step	105 of 105	Extrapolation factor	1,000
PLASTIC STEP		Relative stiffness	0,002
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0,000	Σ -Mdisp:	1,000
Load system A	MloadA: 0,000	Σ -MloadA:	19,100
Load system B	MloadB: 0,000	Σ -MloadB:	1,000
Soil weight	Mweight: 0,000	Σ -Mweight:	1,000
Acceleration	Maccel: 0,000	Σ -Maccel:	0,000
Strenght reduction factor	Msf: 0,001	Σ -Msf:	0,645
Time	Increment: 0,000	End time:	0,000
Dynamic Time	Increment: 0,000	End time:	0,000



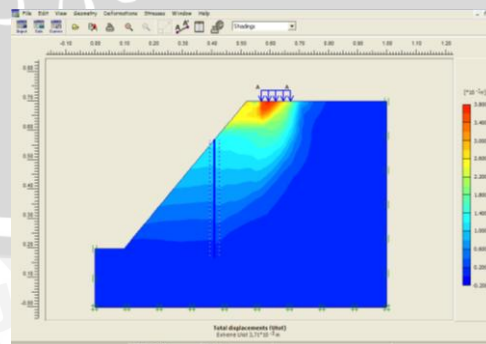
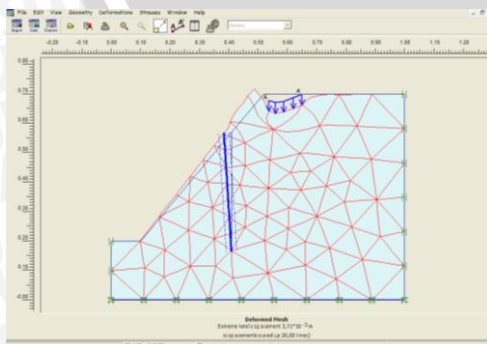
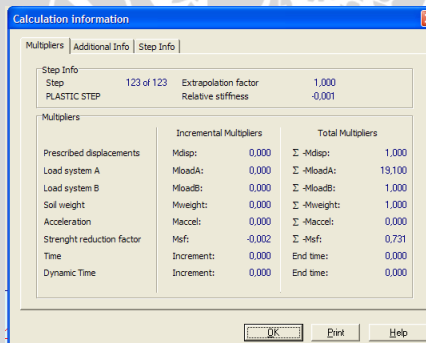
Lampiran 14

Hasil Analisis PLAXIS 8.2 untuk Kondisi (4) Lereng dengan *Pile* dan Beban luar

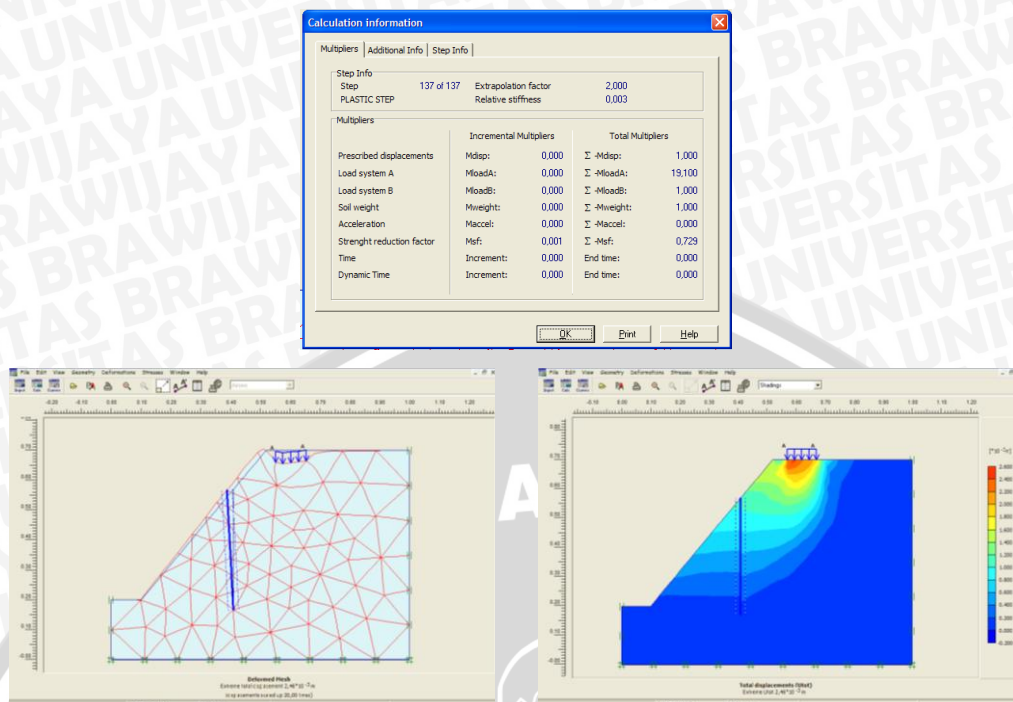
1. Variasi diameter 1,27 cm jarak antar 7,5 cm



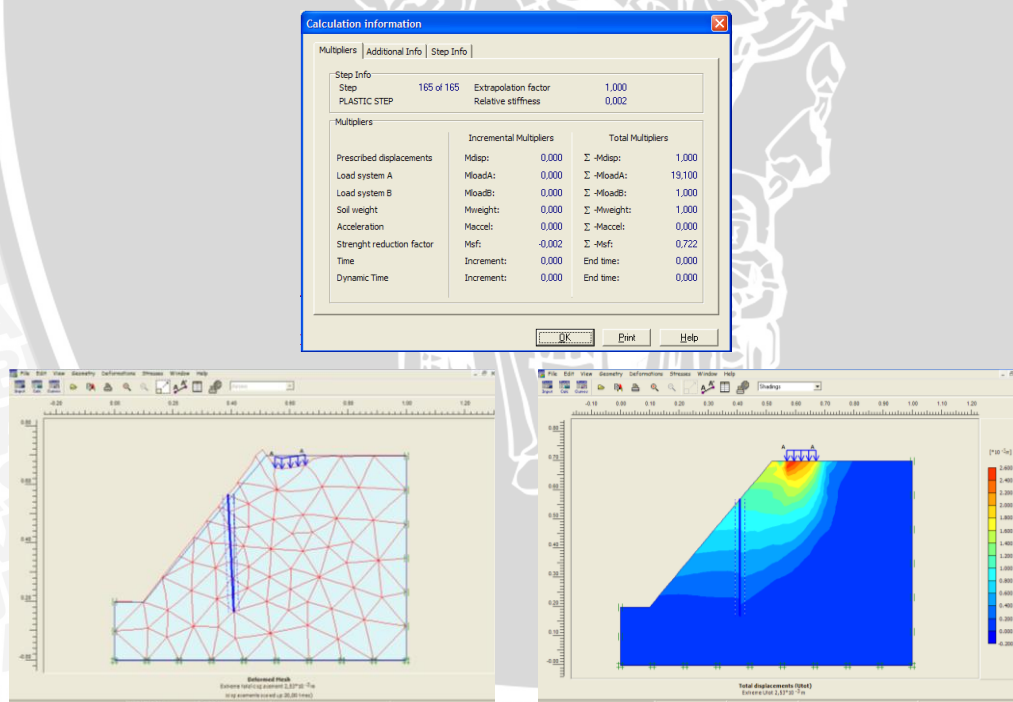
2. Variasi diameter 1,27 cm jarak antar 10 cm



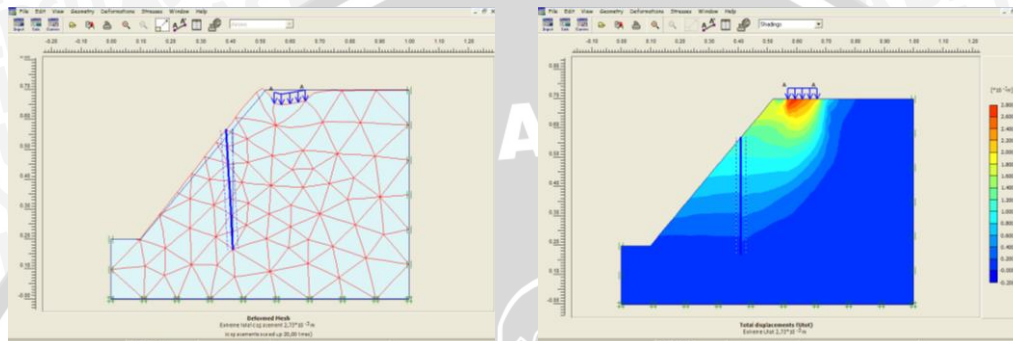
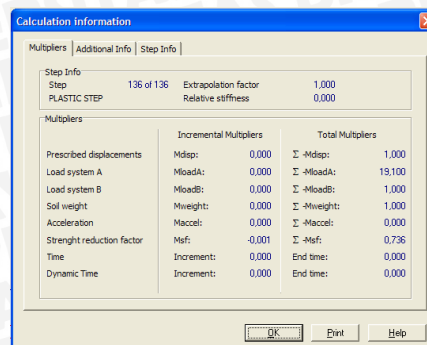
3. Variasi diameter 1,27 cm jarak antar 12,5 cm



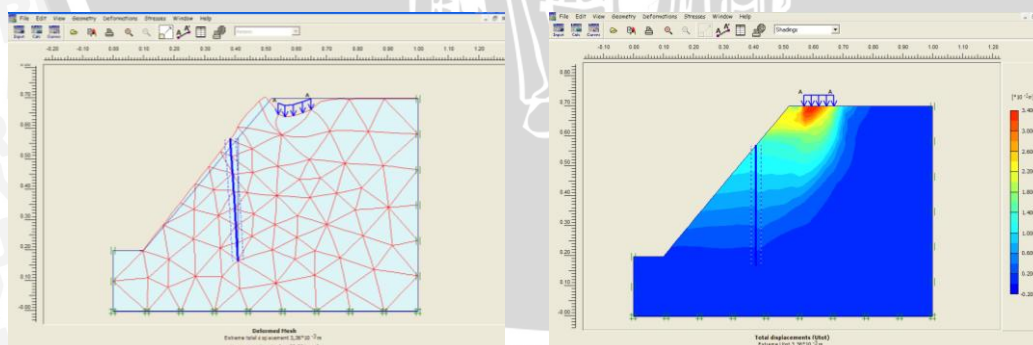
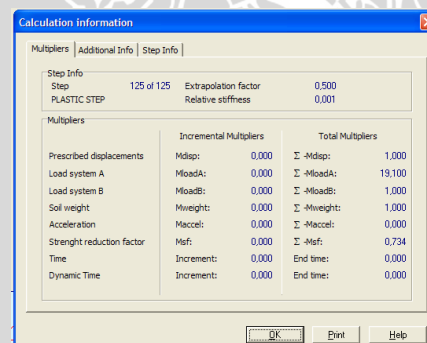
4. Variasi diameter 1,27 cm jarak antar 15 cm



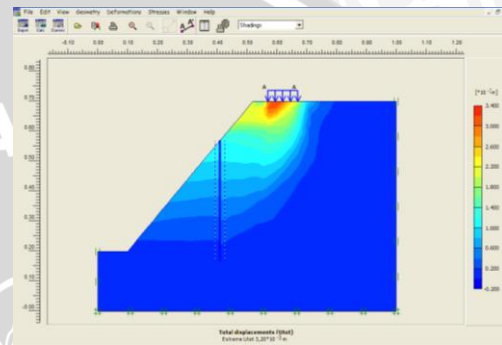
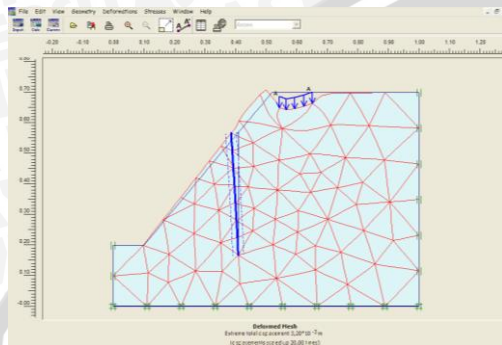
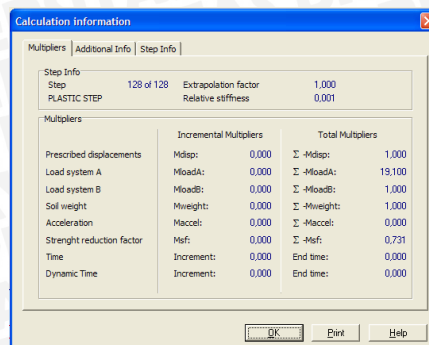
5. Variasi diameter 1,905 cm jarak antar 7,5 cm



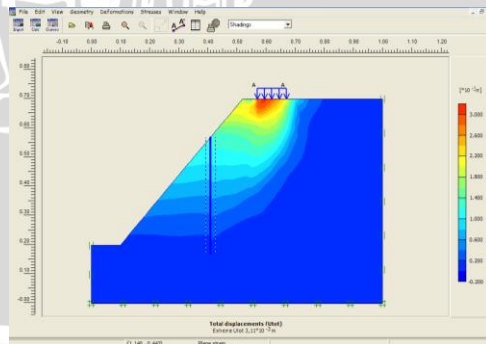
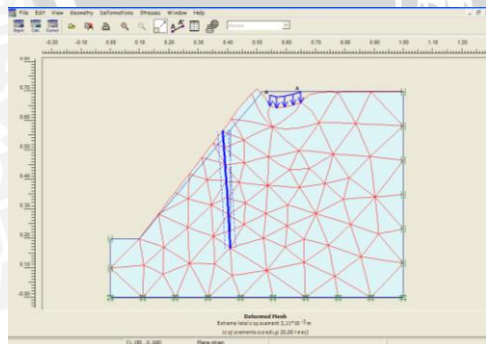
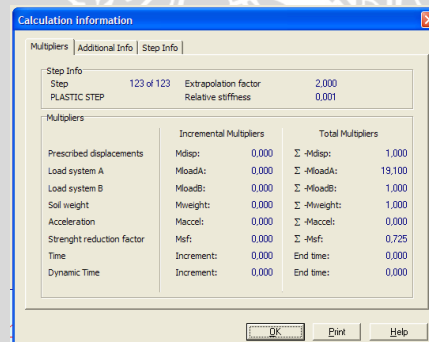
6. Variasi diameter 1,905 cm jarak antar 10 cm



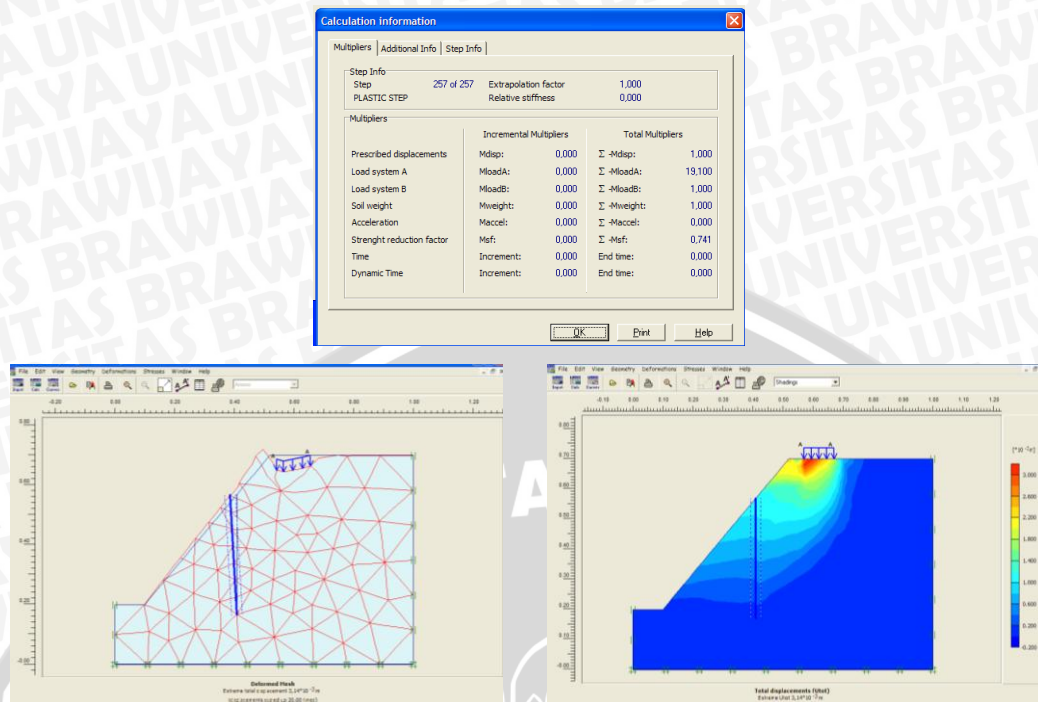
7. Variasi diameter 1,905 cm jarak antar 12,5 cm



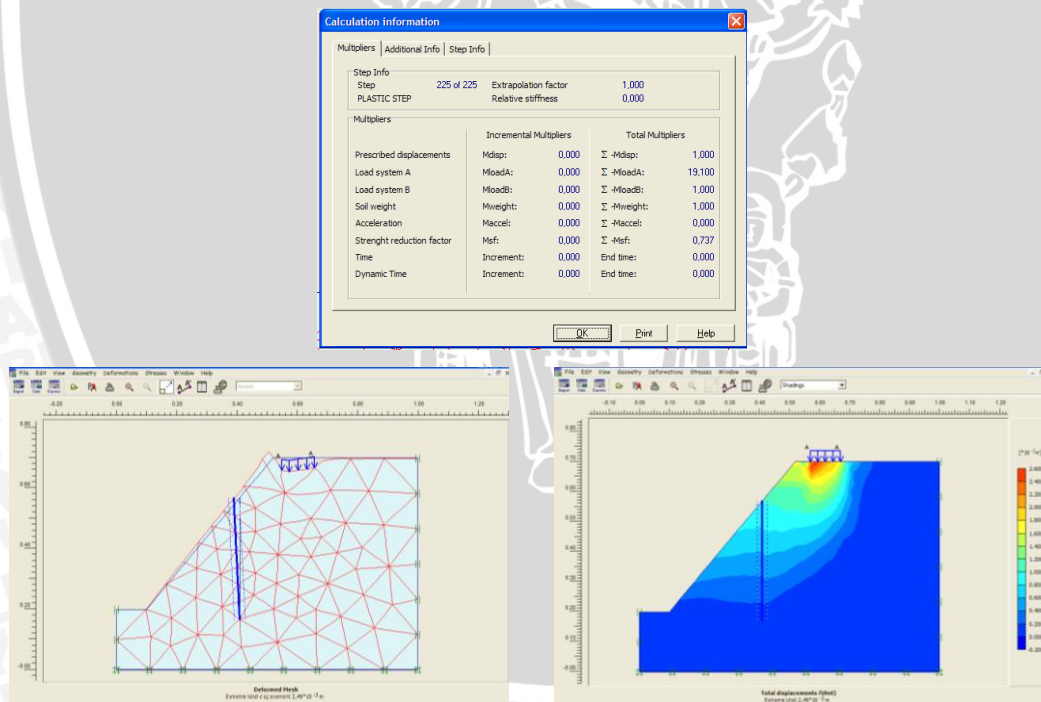
8. Variasi diameter 1,905 cm jarak antar 15 cm



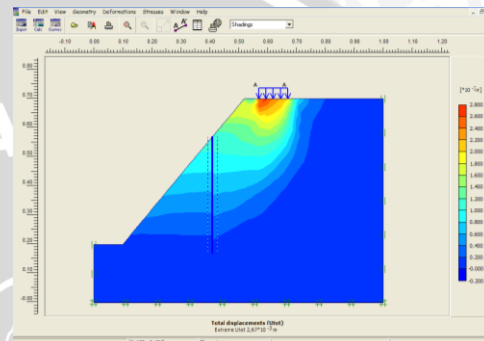
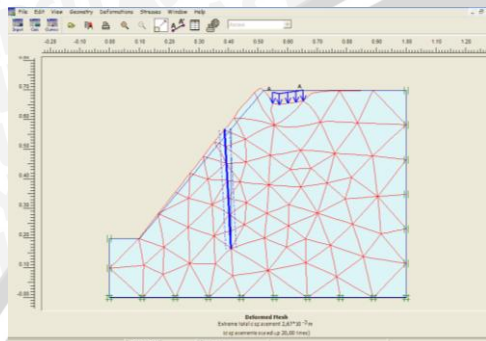
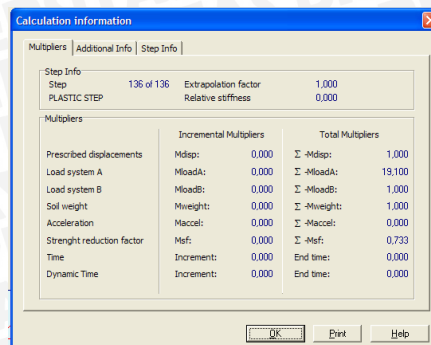
9. Variasi diameter 2,54 cm jarak antar 7,5 cm



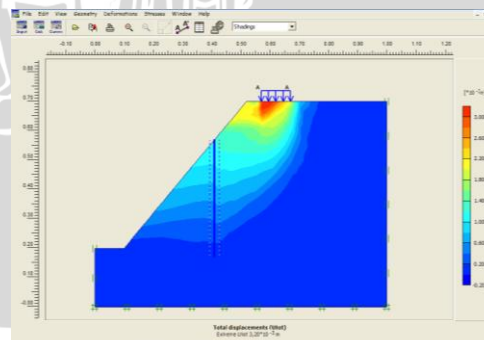
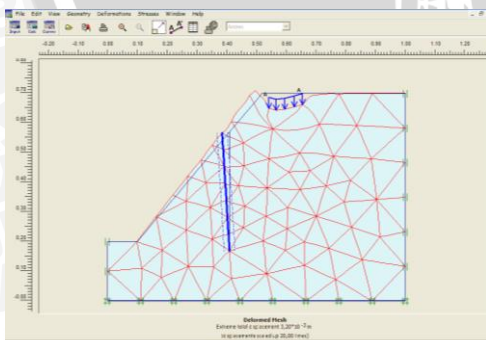
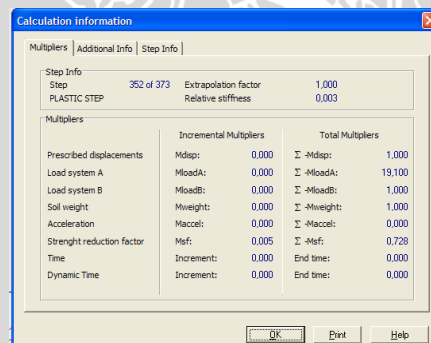
10. Variasi diameter 2,54 cm jarak antar 10 cm



11. Variasi diameter 2,54 cm jarak antar 12,5 cm

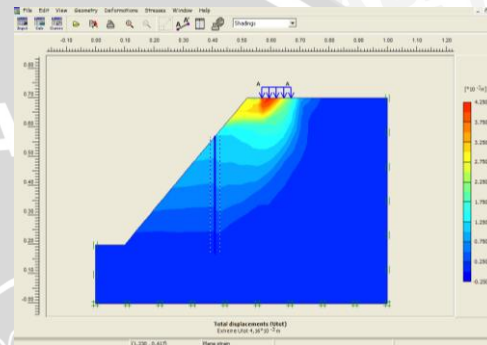
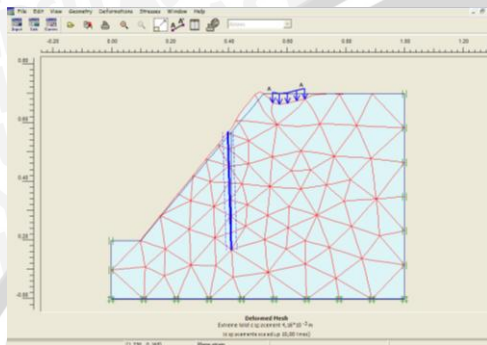


12. Variasi diameter 2,54 cm jarak antar 15 cm



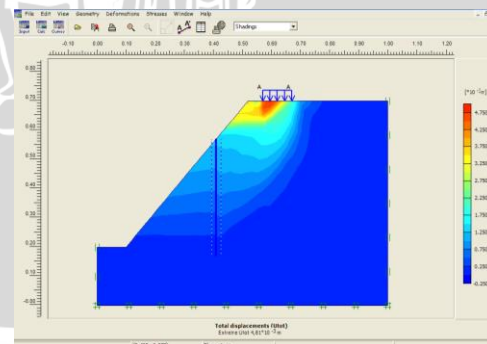
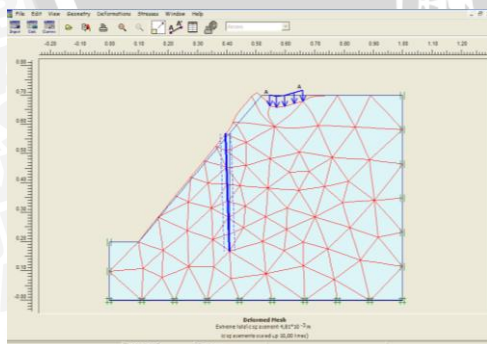
13. Variasi diameter 3,175 cm jarak antar 7,5 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info			
Step	123 of 123	Extrapolation factor	1,000
PLASTIC STEP		Relative stiffness	0,000
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdispl: 0,000	Σ -Mdispl:	1,000
Load system A	MloadA: 0,000	Σ -MloadA:	19,100
Load system B	MloadB: 0,000	Σ -MloadB:	1,000
Soil weight	Mweight: 0,000	Σ -Mweight:	1,000
Acceleration	Maccel: 0,000	Σ -Maccel:	0,000
Strength reduction factor	Msf: -0,001	Σ -Msf:	0,744
Time	Increment: 0,000	End time:	0,000
Dynamic Time	Increment: 0,000	End time:	0,000



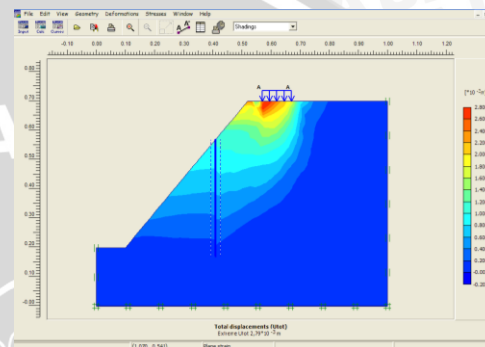
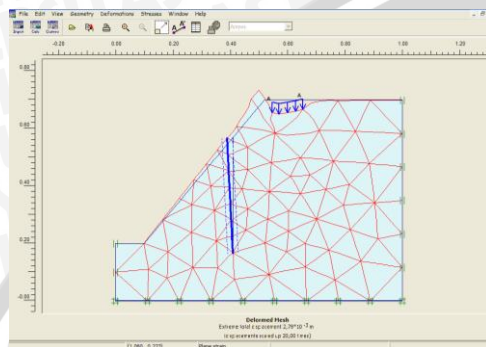
14. Variasi diameter 3,175 cm jarak antar 10 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info			
Step	121 of 121	Extrapolation factor	1,000
PLASTIC STEP		Relative stiffness	0,000
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdispl: 0,000	Σ -Mdispl:	1,000
Load system A	MloadA: 0,000	Σ -MloadA:	19,100
Load system B	MloadB: 0,000	Σ -MloadB:	1,000
Soil weight	Mweight: 0,000	Σ -Mweight:	1,000
Acceleration	Maccel: 0,000	Σ -Maccel:	0,000
Strength reduction factor	Msf: 0,000	Σ -Msf:	0,742
Time	Increment: 0,000	End time:	0,000
Dynamic Time	Increment: 0,000	End time:	0,000



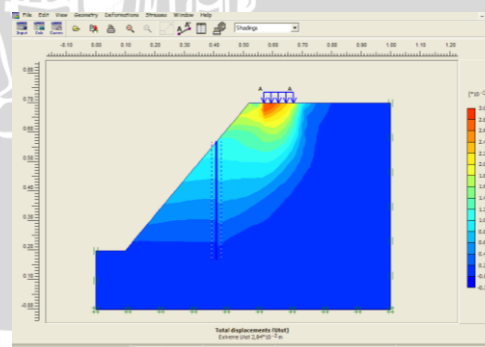
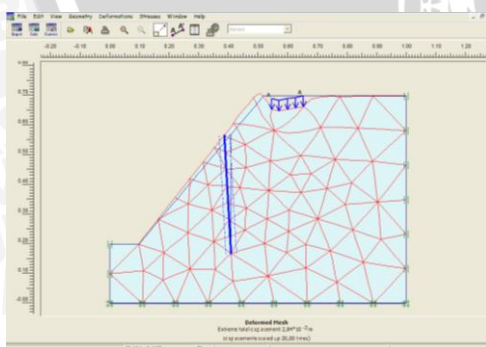
15. Variasi diameter 3,175 cm jarak antar 12,5 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info			
Step	166 of 166	Extrapolation factor	1.000
PLASTIC STEP		Relative stiffness	0.000
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0.000	Σ -Mdisp:	1.000
Load system A	MloadA: 0.000	Σ -MloadA:	19.100
Load system B	MloadB: 0.000	Σ -MloadB:	1.000
Soil weight	Mweight: 0.000	Σ -Mweight:	1.000
Acceleration	Maccel: 0.000	Σ -Maccel:	0.000
Streight reduction factor	Msf: 0.000	Σ -Msf:	0.735
Time	Increment: 0.000	End time:	0.000
Dynamic Time	Increment: 0.000	End time:	0.000



16. Variasi diameter 3,175 cm jarak antar 15 cm

Calculation information			
Multipliers Additional Info Step Info			
Step Info			
Step	133 of 133	Extrapolation factor	2.000
PLASTIC STEP		Relative stiffness	-0.001
Multipliers			
	Incremental Multipliers	Total Multipliers	
Prescribed displacements	Mdisp: 0.000	Σ -Mdisp:	1.000
Load system A	MloadA: 0.000	Σ -MloadA:	19.100
Load system B	MloadB: 0.000	Σ -MloadB:	1.000
Soil weight	Mweight: 0.000	Σ -Mweight:	1.000
Acceleration	Maccel: 0.000	Σ -Maccel:	0.000
Streight reduction factor	Msf: -0.002	Σ -Msf:	0.732
Time	Increment: 0.000	End time:	0.000
Dynamic Time	Increment: 0.000	End time:	0.000



Lampiran 15

Data dan Contoh Perhitungan Gaya Lateral Tanah p(z)

Data nilai z (kedalaman pile) dan nilai p (z) :

D / B	D ₁ / B	z (m)	p(z) (kg/m)	
			Ito & Matsui	De Beer & Carpentier
0,127	0,75	0,360	19,403	8,710
	1	0,360	16,302	8,399
	1,25	0,365	15,024	8,343
	1,5	0,370	14,340	8,348
0,1905	0,75	0,355	43,459	13,989
	1	0,355	31,554	13,134
	1,25	0,360	27,082	12,871
	1,5	0,360	24,453	12,599
0,254	0,75	0,350	96,865	20,298
	1	0,355	57,945	18,652
	1,25	0,360	45,284	17,972
	1,5	0,365	39,344	17,661
0,3175	0,75	0,340	232,451	27,818
	1	0,350	104,787	24,709
	1,25	0,360	73,451	23,643
	1,5	0,370	60,606	23,278

Contoh perhitungan p(z) :

- Metode Ito & Matsui :

Ito & Matsui untuk pasir dg pile diameter 1,27 cm jarak 10 cm

$$p(z) = \frac{\gamma z}{N_0} \left\{ D_1 \left(\frac{D_1}{D_2} \right)^{N_0 \tan^2(\pi/4 + \phi/2)} \exp \left(\frac{D_1 - D_2}{D_2} N_0 \tan \left(\frac{\pi}{4} + \frac{\phi}{2} \right) \right) - D_2 \right\}$$

γ =	13,2	kN/m ³
z =	0,36	m
d =	0,0127	m
D ₁ =	0,1	m
D ₂ =	0,0873	m
c =	0,064	
φ =	34,4	°
N ₀ =	0,600393 radian	
	tan ² (π/4 + φ/2)	
	= 3,597352	
	exp \left(\frac{D_1 - D_2}{D_2} N_0 \tan \left(\frac{\pi}{4} + \frac{\phi}{2} \right) \right) = 1,241298	
	\left(\frac{D_1}{D_2} \right)^{N_0 \tan^2(\pi/4 + \phi/2)} = 3,896029	
	D_1 \left(\frac{D_1}{D_2} \right)^{N_0 \tan^2(\pi/4 + \phi/2)} = 0,16975	
p (z) =	0,163022 kN/m =	16,30219 kg/m

- Metode De Beer & Carpentier :

De Beer untuk pasir dg pile diameter 1,27 cm jarak 10 cm

$$p(z) = \frac{\gamma z}{N_0} \left(1 + \frac{\sin \theta}{2} N_0 \right) \cdot \left[D_1 \left(\frac{D_1}{D_2} \right)^{F_1(\theta)} e^{\frac{D_1 - D_2}{D_2} F_2(\theta)} - D_2 \right]$$

$$F_1(\theta) = \frac{N_0}{\tan \left(\frac{\pi}{4} + \frac{\theta}{2} \right)} (1 - \sin \theta) \tan \theta + N_0 (1 - \sin \theta) - 1$$

$$F_2(\theta) = \frac{1 - \sin^2 \theta}{1 + \sin^2 \theta} \tan \theta \tan \theta \left(\frac{\pi}{8} + \frac{\theta}{4} \right)$$

$$\gamma = 13,2 \text{ kN/m}^3$$

$$z = 0,36 \text{ m}$$

$$d = 0,0127 \text{ m}$$

$$D_1 = 0,1 \text{ m}$$

$$D_2 = 0,0873 \text{ m}$$

$$c = 0,064$$

$$\theta = 34,4^\circ = 0,600393 \text{ radian}$$

$$N_0 = \tan^2 \left(\frac{\pi}{4} + \frac{\theta}{2} \right) = 3,597352$$

$$\frac{N_0}{\tan \left(\frac{\pi}{4} + \frac{\theta}{2} \right)} = 1,896669$$

$$(1 - \sin \theta) \tan \theta = 0,297873$$

$$N_0 (1 - \sin \theta) = 1,564967$$

$$F_1(\theta) = \frac{N_0}{\tan \left(\frac{\pi}{4} + \frac{\theta}{2} \right)} (1 - \sin \theta) \tan \theta + N_0 (1 - \sin \theta) - 1$$

$$= 1,129934$$

$$\frac{\sin^2 \theta}{1 - \sin^2 \theta} = 0,319188$$

$$\frac{1 - \sin^2 \theta}{1 + \sin^2 \theta} = 0,516084$$

$$\left(\frac{\pi}{8} + \frac{\theta}{4} \right) = 0,542797$$

$$F_2(\theta) = \frac{1 - \sin^2 \theta}{1 + \sin^2 \theta} \tan \theta \tan \theta \left(\frac{\pi}{8} + \frac{\theta}{4} \right)$$

$$= 0,131334$$

$$\left(1 + \frac{\sin \theta}{2} N_0 \right) = 2,016193$$

$$\left[D_1 \left(\frac{D_1}{D_2} \right)^{F_1(\theta)} \right] = 0,116587$$

$$\frac{D_1 - D_2}{D_2} F_2(\theta) = 1,01929$$

$$p(z) = \frac{\gamma z}{N_0} \left(1 + \frac{\sin \theta}{2} N_0 \right) \cdot \left[D_1 \left(\frac{D_1}{D_2} \right)^{F_1(\theta)} e^{\frac{D_1 - D_2}{D_2} F_2(\theta)} - D_2 \right]$$

$$p(z) = 0,083991 \text{ kN/m} = 8,399055 \text{ kg/m}$$

Lampiran 16

Data Perpindahan Horizontal Kepala *Pile* :

1. Variasi diameter 1,27 cm jarak antar 7,5 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	34,500	34,500	0	0
1	34,530	34,530	0,030	0,0239
2	34,544	34,544	0,044	0,0479
3	34,566	34,566	0,066	0,0718
4	34,637	34,637	0,137	0,0958
5	34,796	34,796	0,296	0,1197
6	34,896	34,896	0,396	0,1437
7	35,048	35,048	0,548	0,1676
8	35,218	35,218	0,718	0,1916
9	35,387	35,387	0,887	0,2155
10	35,671	35,671	1,171	0,2395
11	36,016	36,016	1,516	0,2634
11,5	36,135	36,135	1,635	0,2754
11,5	36,359	36,359	1,859	0,2754
11,5	36,523	36,523	2,023	0,2754

2. Variasi diameter 1,27 cm jarak antar 10 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	10,830	10,830	0	0
1	10,860	10,860	0,030	0,0239
2	10,880	10,880	0,050	0,0479
3	10,950	10,950	0,120	0,0718
4	11,040	11,040	0,210	0,0958
5	11,170	11,170	0,340	0,1197
6	11,260	11,260	0,430	0,1437
7	11,410	11,410	0,580	0,1676
8	11,610	11,610	0,780	0,1916
9	11,800	11,800	0,970	0,2155
10	12,140	12,140	1,310	0,2395
10	12,360	12,360	1,530	0,2395
10	12,620	12,620	1,790	0,2395

3. Variasi diameter 1,27 cm jarak antar 12,5 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	51,845	51,845	0	0
1	51,904	51,904	0,059	0,0239
2	51,925	51,925	0,08	0,0479
3	51,972	51,972	0,127	0,0718
4	52,059	52,059	0,214	0,0958
5	52,206	52,206	0,361	0,1197
6	52,317	52,317	0,472	0,1437
7	52,456	52,456	0,611	0,1676
8	52,667	52,667	0,822	0,1916
9	52,848	52,848	1,003	0,2155
9,5	53,224	53,224	1,379	0,2275
9,5	53,465	53,465	1,62	0,2275
9,5	53,705	53,705	1,86	0,2275

4. Variasi diameter 1,27 cm jarak antar 15 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	21,725	21,725	0	0
1	21,799	21,799	0,074	0,0239
2	21,818	21,818	0,093	0,0479
3	21,879	21,879	0,154	0,0718
4	21,978	21,978	0,253	0,0958
5	22,114	22,114	0,389	0,1197
6	22,248	22,248	0,523	0,1437
7	22,418	22,418	0,693	0,1676
8	22,599	22,599	0,874	0,1916
9	22,76	22,76	1,035	0,2155
9	22,928	22,928	1,203	0,2155
9	23,132	23,132	1,407	0,2155

5. Variasi diameter 1,905 cm jarak antar 7,5 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	41,279	41,279	0	0
1	41,304	41,304	0,025	0,0239
2	41,309	41,309	0,030	0,0479
3	41,340	41,340	0,061	0,0718
4	41,408	41,408	0,129	0,0958
5	41,516	41,516	0,237	0,1197
6	41,563	41,563	0,284	0,1437
7	41,641	41,641	0,362	0,1676
8	41,840	41,840	0,561	0,1916
9	42,061	42,061	0,782	0,2155
10	42,248	42,248	0,969	0,2395
11	42,582	42,582	1,303	0,2634
12	42,865	42,865	1,586	0,2874
12	42,971	42,971	1,692	0,2874
12	43,547	43,547	2,268	0,2874

6. Variasi diameter 1,905 cm jarak antar 10 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	12,1	12,100	0	0
1	12,130	12,130	0,030	0,0239
2	12,140	12,140	0,040	0,0479
3	12,180	12,180	0,080	0,0718
4	12,290	12,290	0,190	0,0958
5	12,350	12,350	0,250	0,1197
6	12,410	12,410	0,310	0,1437
7	12,520	12,520	0,420	0,1676
8	12,760	12,760	0,660	0,1916
9	12,950	12,950	0,850	0,2155
10	13,230	13,230	1,130	0,2395
11	13,620	13,620	1,520	0,2634
11	14,080	14,080	1,980	0,2634
11	14,410	14,410	2,310	0,2634

7. Variasi diameter 1,905 cm jarak antar 12,5 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	24,016	24,016	0	0
1	24,06	24,06	0,044	0,0239
2	24,086	24,086	0,07	0,0479
3	24,114	24,114	0,098	0,0718
4	24,21	24,21	0,194	0,0958
5	24,285	24,285	0,269	0,1197
6	24,363	24,363	0,347	0,1437
7	24,518	24,518	0,502	0,1676
8	24,687	24,687	0,671	0,1916
9	24,919	24,919	0,903	0,2155
10	25,298	25,298	1,282	0,2395
10,5	25,647	25,647	1,631	0,2515
10,5	25,785	25,785	1,769	0,2515
10,5	26,088	26,088	2,072	0,2515

8. Variasi diameter 1,905 cm jarak antar 15 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	32,657	32,657	0	0
1	32,721	32,721	0,064	0,0239
2	32,746	32,746	0,089	0,0479
3	32,791	32,791	0,134	0,0718
4	32,863	32,863	0,206	0,0958
5	32,937	32,937	0,28	0,1197
6	33,038	33,038	0,381	0,1437
7	33,186	33,186	0,529	0,1676
8	33,369	33,369	0,712	0,1916
9	33,57	33,57	0,913	0,2155
10	34,036	34,036	1,379	0,2395
10	34,55	34,55	1,893	0,2395
10	34,416	34,416	1,759	0,2395

9. Variasi diameter 2,54 cm jarak antar 7,5 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	2,09	2,090	0	0
1	2,100	2,100	0,010	0,0239
2	2,110	2,110	0,020	0,0479
3	2,120	2,120	0,030	0,0718
4	2,150	2,150	0,060	0,0958
5	2,170	2,170	0,080	0,1197
6	2,230	2,230	0,140	0,1437
7	2,320	2,320	0,230	0,1676
8	2,510	2,510	0,420	0,1916
9	2,750	2,750	0,660	0,2155
10	2,850	2,850	0,760	0,2395
11	3,110	3,110	1,020	0,2634
12	3,440	3,440	1,350	0,2874
13	3,760	3,760	1,670	0,3113
14	4,200	4,200	2,110	0,3353
15	4,420	4,420	2,330	0,3592
15	4,870	4,870	2,780	0,3592
15	4,970	4,970	2,880	0,3592

10. Variasi diameter 2,54 cm jarak antar 10 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	32,89	32,890	0	0
1	32,900	32,900	0,010	0,0239
2	32,930	32,930	0,040	0,0479
3	32,950	32,950	0,060	0,0718
4	33,010	33,010	0,120	0,0958
5	33,050	33,050	0,160	0,1197
6	33,070	33,070	0,180	0,1437
7	33,210	33,210	0,320	0,1676
8	33,430	33,430	0,540	0,1916
9	33,610	33,610	0,720	0,2155
10	33,820	33,820	0,930	0,2395
11	34,220	34,220	1,330	0,2634
12	34,620	34,620	1,730	0,2874
13	35,040	35,040	2,150	0,3113
13	35,130	35,130	2,240	0,3113
13	35,320	35,320	2,430	0,3113

11. Variasi diameter 2,54 cm jarak antar 12,5 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	15,03	15,03	0	0
1	15,07	15,07	0,04	0,0239
2	15,09	15,09	0,06	0,0479
3	15,11	15,11	0,08	0,0718
4	15,15	15,15	0,12	0,0958
5	15,16	15,16	0,13	0,1197
6	15,2	15,2	0,17	0,1437
7	15,34	15,34	0,31	0,1676
8	15,61	15,61	0,58	0,1916
9	15,78	15,78	0,75	0,2155
10	15,95	15,95	0,92	0,2395
11	16,45	16,45	1,42	0,2634
11	16,78	16,78	1,75	0,2634
11	17,24	17,24	2,21	0,2634

12. Variasi diameter 2,54 cm jarak antar 15 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	1,56	1,56	0	0
1	1,62	1,62	0,060	0,0239
2	1,64	1,64	0,080	0,0479
3	1,68	1,68	0,120	0,0718
4	1,73	1,73	0,170	0,0958
5	1,74	1,74	0,180	0,1197
6	1,81	1,81	0,250	0,1437
7	1,94	1,94	0,380	0,1676
8	2,2	2,2	0,640	0,1916
9	2,33	2,33	0,770	0,2155
10	2,55	2,55	0,990	0,2395
10,5	2,93	2,93	1,370	0,2515
10,5	3,54	3,54	1,980	0,2515
10,5	3,71	3,71	2,150	0,2515

13. Variasi diameter 3,175 cm jarak antar 7,5 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	35,926	35,926	0	0
1	35,935	35,935	0,009	0,0239
2	35,940	35,940	0,014	0,0479
3	35,944	35,944	0,018	0,0718
4	35,980	35,980	0,054	0,0958
5	36,000	36,000	0,074	0,1197
6	36,065	36,065	0,139	0,1437
7	36,144	36,144	0,218	0,1676
8	36,334	36,334	0,408	0,1916
9	36,469	36,469	0,543	0,2155
10	36,657	36,657	0,731	0,2395
11	36,848	36,848	0,922	0,2634
12	37,175	37,175	1,249	0,2874
13	37,394	37,394	1,468	0,3113
14	37,988	37,988	2,062	0,3353
15	38,170	38,170	2,244	0,3592
16	38,618	38,618	2,692	0,3832
16	38,908	38,908	2,982	0,3832
16	39,554	39,554	3,628	0,3832

14. Variasi diameter 3,175 cm jarak antar 10 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	17,94	17,940	0	0
1	17,950	17,950	0,010	0,0239
2	17,970	17,970	0,030	0,0479
3	17,980	17,980	0,040	0,0718
4	18,020	18,020	0,080	0,0958
5	18,050	18,050	0,110	0,1197
6	18,090	18,090	0,150	0,1437
7	18,230	18,230	0,290	0,1676
8	18,440	18,440	0,500	0,1916
9	18,620	18,620	0,680	0,2155
10	18,820	18,820	0,880	0,2395
11	19,000	19,000	1,060	0,2634
12	19,490	19,490	1,550	0,2874
13	19,990	19,990	2,050	0,3113
14	20,290	20,290	2,350	0,3353
14	20,590	20,590	2,650	0,3353
14	20,980	20,980	3,040	0,3353

15. Variasi diameter 3,175 cm jarak antar 12,5 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	27,891	27,891	0	0
1	27,902	27,902	0,011	0,0239
2	27,949	27,949	0,058	0,0479
3	27,964	27,964	0,073	0,0718
4	27,996	27,996	0,105	0,0958
5	28,008	28,008	0,117	0,1197
6	28,045	28,045	0,154	0,1437
7	28,187	28,187	0,296	0,1676
8	28,468	28,468	0,577	0,1916
9	28,64	28,64	0,749	0,2155
10	28,786	28,786	0,895	0,2395
11	29,253	29,253	1,362	0,2634
12	29,649	29,649	1,758	0,2874
12,5	29,993	29,993	2,102	0,2994
12,5	30,109	30,109	2,218	0,2994
12,5	30,38	30,38	2,489	0,2994

16. Variasi diameter 3,175 cm jarak antar 15 cm

Beban	Pembacaan	l (mm)	Δl (mm)	Q_u (kg/cm ²)
0	63,991	63,991	0	0
1	64,004	64,004	0,013	0,0239
2	64,06	64,06	0,069	0,0479
3	64,097	64,097	0,106	0,0718
4	64,16	64,16	0,169	0,0958
5	64,168	64,168	0,177	0,1197
6	64,238	64,238	0,247	0,1437
7	64,303	64,303	0,312	0,1676
8	64,58	64,58	0,589	0,1916
9	64,742	64,742	0,751	0,2155
10	64,929	64,929	0,938	0,2395
11	65,373	65,373	1,382	0,2634
11	65,683	65,683	1,692	0,2634
11	65,843	65,843	1,852	0,2634

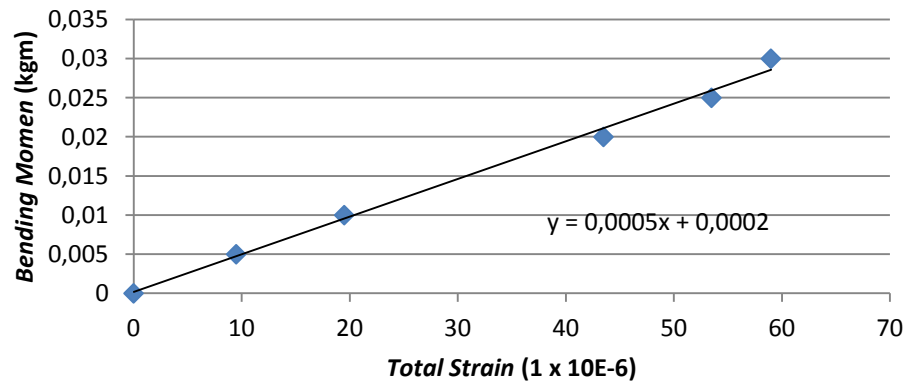
Lampiran 17

Kalibrasi Strain Gauge :

1. Pile diameter 1,27 cm

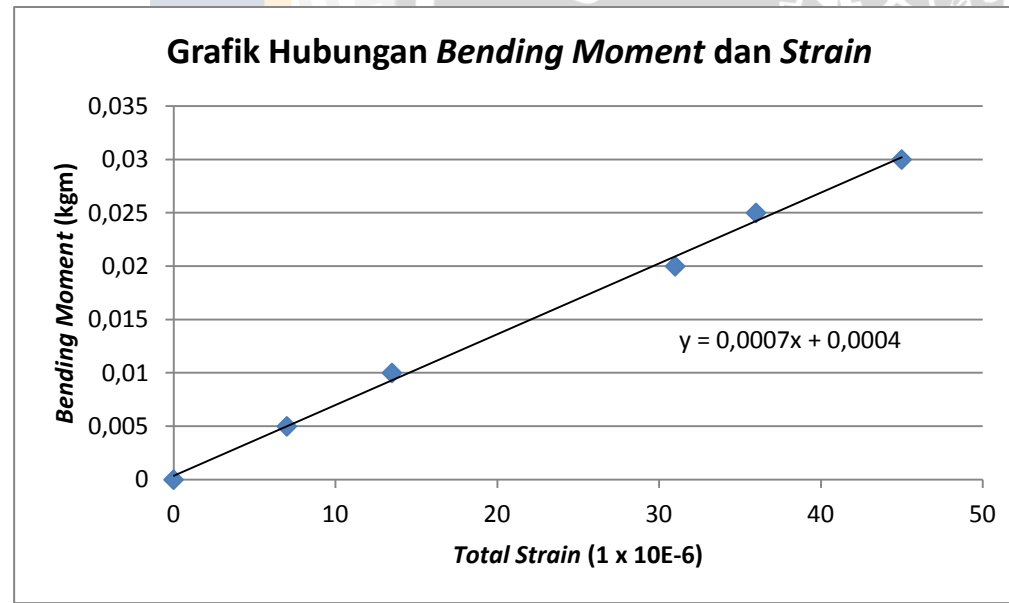
Variasi beban (kg)	Pembacaan strain								Regangan kalibrasi				Bending Moment (kg.cm)	Bending Moment (kg.m)	Strain total
	Awal				Akhir				ε ₀	ε ₁	ε ₂	ε ₃			
	0	1	2	3	0	1	2	3							
0	108	450	1064	1534	108	450	1064	1534	0	0	0	0	0	0	0
0,05	108	450	1064	1534	116	444	1075	1527	8	-6	11	-7	0,5	0,005	9,5
0,1	108	450	1064	1534	124	435	1087	1518	16	-15	23	-16	1	0,01	19,5
0,2	108	450	1064	1534	146	409	1113	1490	38	-41	49	-44	2	0,02	43,5
0,25	108	450	1064	1534	155	400	1124	1481	47	-50	60	-53	2,5	0,025	53,5
0,3	108	450	1064	1534	157	394	1133	1476	49	-56	69	-58	3	0,03	59

Grafik Hubungan Bending Moment dan Strain



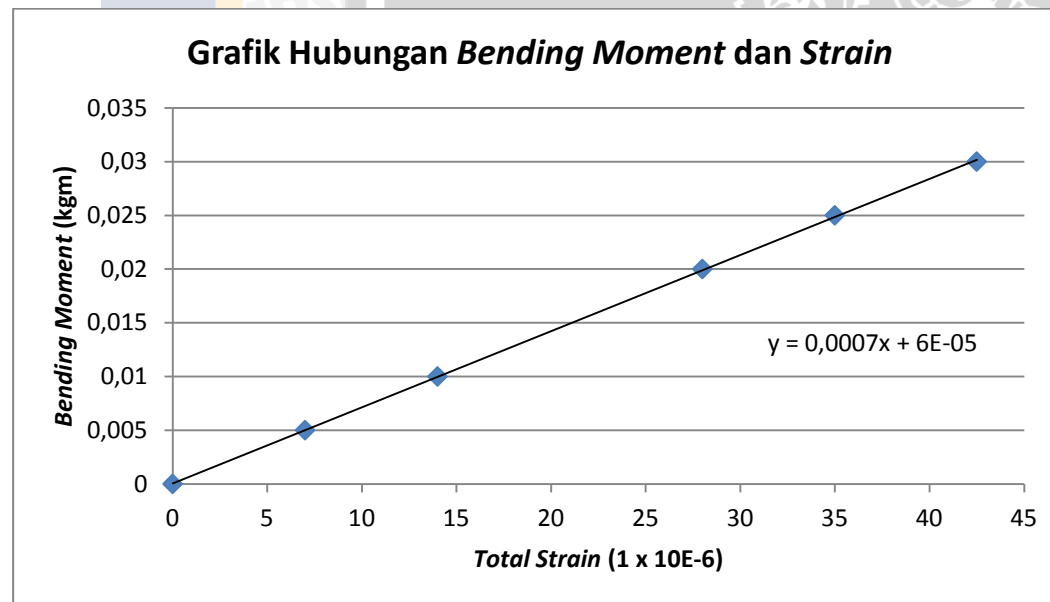
2. Pile diameter 1,905 cm

Variasi beban (kg)	Pembacaan strain								Regangan kalibrasi				Bending Moment (kg.cm)	Bending Moment (kg.m)	Strain tota
	Awal				Akhir				ϵ_0	ϵ_1	ϵ_2	ϵ_3			
	0	1	2	3	0	1	2	3							
0	108	455	600	-79	108	455	600	-79	0	0	0	0	0	0	0
0,05	108	455	600	-79	114	451	608	-82	6	-4	8	-3	0,5	0,005	7
0,1	108	455	600	-79	119	446	616	-86	11	-9	16	-7	1	0,01	13,5
0,2	108	455	600	-79	135	434	635	-98	27	-21	35	-19	2	0,02	31
0,25	108	455	600	-79	140	427	640	-105	32	-28	40	-26	2,5	0,025	36
0,3	108	455	600	-79	148	424	650	-112	40	-31	50	-33	3	0,03	45



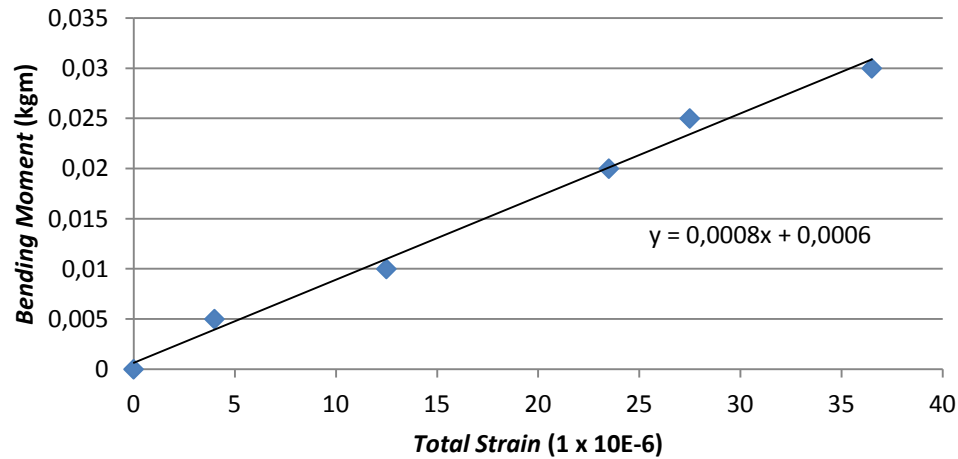
3. *Pile* diameter 2,54 cm

Variasi beban (kg)	Pembacaan <i>strain</i>								Regangan kalibrasi				<i>Bending Moment</i> (kg.cm)	<i>Bending Moment</i> (kg.m)	<i>Strain</i> total
	Awal				Akhir				ε ₀	ε ₁	ε ₂	ε ₃			
	0	1	2	3	0	1	2	3							
0	3687	5192	5871	2107	3687	5192	5871	2107	0	0	0	0	0	0	0
0,05	3687	5192	5871	2107	3693	5200	5881	2111	6	8	10	4	0,5	0,005	7
0,1	3687	5192	5871	2107	3700	5207	5888	2118	13	15	17	11	1	0,01	14
0,2	3687	5192	5871	2107	3714	5221	5902	2132	27	29	31	25	2	0,02	28
0,25	3687	5192	5871	2107	3721	5228	5909	2139	34	36	38	32	2,5	0,025	35
0,3	3687	5192	5871	2107	3728,5	5235,5	5916,5	2146,5	42	44	46	40	3	0,03	43



4. Pile diameter 3,175 cm

Variasi beban (kg)	Pembacaan strain								Regangan kalibrasi				Bending Moment (kg.cm)	Bending Moment (kg.m)	Strain total
	Awal				Akhir				ε ₀	ε ₁	ε ₂	ε ₃			
	0	1	2	3	0	1	2	3							
0	-160	133	6108	1342	-160	133	6108	1342	0	0	0	0	0	0	0
0,05	-160	133	6108	1342	-164	136	6113	1339	-4	3	5	-3	0,5	0,005	4
0,1	-160	133	6108	1342	-170	141	6125	1335	-10	8	17	-7	1	0,01	12,5
0,2	-160	133	6108	1342	-183	154	6134	1324	-23	21	26	-18	2	0,02	23,5
0,25	-160	133	6108	1342	-186	157	6139	1321	-26	24	31	-21	2,5	0,025	27,5
0,3	-160	133	6108	1342	-195	164	6150	1313	-35	31	42	-29	3	0,03	36,5

Grafik Hubungan *Bending Moment* dan *Strain*

Lampiran 18**Data Pembacaan Regangan :****1. Variasi diameter 1,27 cm jarak antar 7,5 cm**

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	0	0	0	1	0	0,0007
2	-2	3	0	1	0,0017	0,0007
3	-2	3	-2	3	0,0017	0,0017
4	-7	8	-2	3	0,0042	0,0017
5	-7	8	-3	4	0,0042	0,0022
6	-10	12	-3	4	0,0062	0,0022
7	-10	12	-4	6	0,0062	0,0032
8	-14	15	-4	6	0,0077	0,0032
9	-14	15	-6	8	0,0077	0,0042
10	-17	19	-6	8	0,0097	0,0042
11	-17	19	-8	10	0,0097	0,0052
11,5	-22	24	-10	11	0,0122	0,0057
11,5	-22	24	-10	11	0,0122	0,0057
11,5	-25	28	-11	13	0,0142	0,0067

2. Variasi diameter 1,27 cm jarak antar 10 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	-2	2	0	0	0,0012	0
2	-2	2	0	2	0,0012	0,0012
3	-2	2	0	2	0,0012	0,0012
4	-4	5	-1	2	0,0027	0,0012
5	-4	5	-1	3	0,0027	0,0017
6	-4	5	-1	3	0,0027	0,0017
7	-8	9	-2	4	0,0047	0,0022
8	-8	9	-2	4	0,0047	0,0022
9	-8	9	-2	4	0,0047	0,0022
10	-10	12	-4	7	0,0062	0,0037
10	-10	12	-4	7	0,0062	0,0037
10	-10	12	-6	8	0,0062	0,0042

3. Variasi diameter 1,27 cm jarak antar 12,5 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	-1	2	0	1	0,0012	0,0007
3	-1	2	0	1	0,0012	0,0007
4	-1	2	-1	2	0,0012	0,0012
5	-1	3	-1	2	0,0017	0,0012
6	-2	3	-3	4	0,0017	0,0022
7	-4	5	-3	4	0,0027	0,0022
8	-4	5	-4	5	0,0027	0,0027
9	-4	5	-4	5	0,0027	0,0027
9,5	-5	7	-5	6	0,0037	0,0032
9,5	-5	7	-5	6	0,0037	0,0032
9,5	-7	10	-6	8	0,0052	0,0042

4. Variasi diameter 1,27 cm jarak antar 15 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	1	0	0	0,0007	0
3	-1	1	-1	1	0,0007	0,0007
4	-1	1	-1	1	0,0007	0,0007
5	-2	3	-1	1	0,0017	0,0007
6	-2	3	-2	2	0,0017	0,0012
7	-4	5	-2	2	0,0027	0,0012
8	-4	5	-2	2	0,0027	0,0012
9	-5	6	-3	4	0,0032	0,0022
9	-5	6	-3	4	0,0032	0,0022
9	-7	8	-4	5	0,0042	0,0027

5. Variasi diameter 1,905 cm jarak antar 7,5 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	0	1	0	1	0,0011	0,0011
2	0	1	-2	3	0,0011	0,0025
3	-1	2	-2	4	0,0018	0,0032
4	-1	3	-3	4	0,0025	0,0032
5	-2	3	-5	6	0,0025	0,0046
6	-6	6	-6	6	0,0046	0,0046
7	-8	9	-6	7	0,0067	0,0053
8	-10	11	-7	7	0,0081	0,0053
9	-13	13	-8	9	0,0095	0,0067
10	-16	17	-9	9	0,0123	0,0067
11	-17	19	-13	14	0,0137	0,0102
12	-22	24	-13	14	0,0172	0,0102
12	-23	25	-14	15	0,0179	0,0109
12	-27	28	-15	17	0,0200	0,0123

6. Variasi diameter 1,905 cm jarak antar 10 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	4	-4	1	0,0032	0,0011
3	-4	8	-4	1	0,0060	0,0011
4	-4	8	-4	1	0,0060	0,0011
5	-4	8	-4	5	0,0060	0,0039
6	-4	10	-4	5	0,0074	0,0039
7	-8	10	-8	5	0,0074	0,0039
8	-8	10	-8	5	0,0074	0,0039
9	-8	16	-8	5	0,0116	0,0039
10	-12	16	-8	12	0,0116	0,0088
11	-12	20	-8	12	0,0144	0,0088
11	-12	20	-12	12	0,0144	0,0088
11	-12	20	-12	12	0,0144	0,0088

7. Variasi diameter 1,905 cm jarak antar 12,5 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	-1	3	-1	2	0,0025	0,0018
3	-2	3	-1	2	0,0025	0,0018
4	-2	3	-4	5	0,0025	0,0039
5	-5	7	-4	5	0,0053	0,0039
6	-5	7	-6	7	0,0053	0,0053
7	-9	10	-6	7	0,0074	0,0053
8	-9	10	-6	8	0,0074	0,0060
9	-12	14	-8	9	0,0102	0,0067
10	-12	14	-8	9	0,0102	0,0067
10,5	-15	17	-9	10	0,0123	0,0074
10,5	-15	17	-9	10	0,0123	0,0074
10,5	-17	20	-11	13	0,0144	0,0095

8. Variasi diameter 1,905 cm jarak antar 15 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	0	1	0	0	0,0011	0
2	-2	3	-1	2	0,0025	0,0018
3	-2	3	-1	2	0,0025	0,0018
4	-6	7	-3	4	0,0053	0,0032
5	-6	7	-3	4	0,0053	0,0032
6	-8	10	-4	5	0,0074	0,0039
7	-8	10	-4	5	0,0074	0,0039
8	-9	11	-5	6	0,0081	0,0046
9	-9	11	-5	6	0,0081	0,0046
10	-11	12	-5	7	0,0088	0,0053
10	-11	12	-6	7	0,0088	0,0053
10	-12	14	-6	8	0,0102	0,0060

9. Variasi diameter 2,54 cm jarak antar 7,5 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	0	4	0	2	0,0029	0,0015
2	-1	4	-1	3	0,0029	0,0022
3	-2	6	-2	4	0,0043	0,0029
4	-2	8	-2	4	0,0057	0,0029
5	-5	10	-4	6	0,0071	0,0043
6	-7	12	-6	8	0,0085	0,0057
7	-12	14	-11	8	0,0099	0,0057
8	-12	17	-14	9	0,0120	0,0064
9	-15	19	-16	10	0,0134	0,0071
10	-19	19	-16	14	0,0134	0,0099
11	-19	24	-17	14	0,0169	0,0099
12	-19	24	-17	18	0,0169	0,0127
13	-21	26	-19	19	0,0183	0,0134
14	-22	27	-20	20	0,0190	0,0141
15	-26	32	-22	24	0,0225	0,0169
15	-27	32	-23	24	0,0225	0,0169
15	-33	32	-23	24	0,0225	0,0169

10. Variasi diameter 2,54 cm jarak antar 10 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	-5	3	-5	-2	0,0022	-0,0013
2	-8	6	-7	1	0,0043	0,0008
3	-8	8	-8	3	0,0057	0,0022
4	-10	11	-10	4	0,0078	0,0029
5	-14	13	-14	6	0,0092	0,0043
6	-14	14	-15	6	0,0099	0,0043
7	-14	16	-17	12	0,0113	0,0085
8	-22	20	-18	16	0,0141	0,0113
9	-22	20	-18	16	0,0141	0,0113
10	-22	24	-20	17	0,0169	0,0120
11	-24	26	-22	18	0,0183	0,0127
12	-24	26	-22	19	0,0183	0,0134
13	-24	30	-26	21	0,0211	0,0148
13	-28	30	-26	21	0,0211	0,0148
13	-28	30	-28	21	0,0211	0,0148

11. Variasi diameter 2,54 cm jarak antar 12,5 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	0	2	0	0	0,0015	0
2	0	2	-4	4	0,0015	0,0029
3	-4	4	-4	4	0,0029	0,0029
4	-4	4	-4	4	0,0029	0,0029
5	-4	6	-4	6	0,0043	0,0043
6	-4	8	-4	7	0,0057	0,0050
7	-8	9	-8	8	0,0064	0,0057
8	-8	11	-8	8	0,0078	0,0057
9	-8	11	-8	9	0,0078	0,0064
10	-12	13	-8	12	0,0092	0,0085
11	-16	23	-12	14	0,0162	0,0099
11	-17	24	-12	14	0,0169	0,0099
11	-18	24	-14	15	0,0169	0,0106

12. Variasi diameter 2,54 cm jarak antar 15 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	-1	0	0	0	0	0
2	-4	2	-1	0	0,0015	0,0001
3	-6	2	-3	2	0,0015	0,0015
4	-6	4	-4	2	0,0029	0,0015
5	-6	6	-6	5	0,0043	0,0036
6	-8	8	-6	4	0,0057	0,0029
7	-8	8	-7	6	0,0057	0,0043
8	-8	9	-8	7	0,0064	0,0050
9	-10	10	-10	8	0,0071	0,0057
10	-10	11	-9	9	0,0078	0,0064
10,5	-15	15	-10	9	0,0106	0,0064
10,5	-15	15	-11	9	0,0106	0,0064
10,5	-15	16	-12	10	0,0113	0,0071

13. Variasi diameter 3,175 cm jarak antar 7,5 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	0	1	-1	2	0,0014	0,0022
2	-1	1	-2	2	0,0014	0,0022
3	-2	3	-3	4	0,0030	0,0038
4	-2	3	-3	5	0,0030	0,0046
5	-5	6	-4	5	0,0054	0,0046
6	-5	6	-7	8	0,0054	0,0070
7	-6	7	-7	8	0,0062	0,0070
8	-9	10	-7	8	0,0086	0,0070
9	-10	10	-9	10	0,0086	0,0086
10	-13	14	-11	13	0,0118	0,0110
11	-15	16	-11	13	0,0134	0,0110
12	-17	19	-15	17	0,0158	0,0142
13	-20	22	-15	17	0,0182	0,0142
14	-23	25	-18	19	0,0206	0,0158
15	-26	29	-18	19	0,0238	0,0158
16	-30	33	-19	22	0,0270	0,0182
16	-32	35	-19	22	0,0286	0,0182
16	-35	38	-22	25	0,0310	0,0206

14. Variasi diameter 3,175 cm jarak antar 10 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	-1	0	-2	4	0	0,0038
2	-4	4	-2	4	0,0038	0,0038
3	-6	4	-3	4	0,0038	0,0038
4	-6	4	-3	4	0,0038	0,0038
5	-6	4	-3	4	0,0038	0,0038
6	-8	4	-6	8	0,0038	0,0070
7	-8	8	-6	8	0,0070	0,0070
8	-8	8	-7	8	0,0070	0,0070
9	-10	11	-7	8	0,0094	0,0070
10	-10	11	-7	8	0,0094	0,0070
11	-19	21	-12	13	0,0174	0,0110
12	-19	21	-12	13	0,0174	0,0110
13	-25	28	-16	18	0,0230	0,0150
14	-25	28	-17	19	0,0230	0,0158
14	-26	28	-18	19	0,0230	0,0158
14	-26	28	-19	20	0,0230	0,0166

15. Variasi diameter 3,175 cm jarak antar 12,5 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	-1	2	0	0	0,0022	0
2	-1	2	0	0	0,0022	0
3	-4	5	-1	3	0,0046	0,0030
4	-5	7	-2	3	0,0062	0,0030
5	-6	7	-2	3	0,0062	0,0030
6	-10	11	-4	5	0,0094	0,0046
7	-10	11	-4	5	0,0094	0,0046
8	-12	13	-7	8	0,0110	0,0070
9	-15	16	-7	8	0,0134	0,0070
10	-17	19	-9	11	0,0158	0,0094
11	-18	19	-9	11	0,0158	0,0094
12	-20	22	-10	12	0,0182	0,0102
12,5	-22	24	-12	14	0,0198	0,0118
12,5	-22	24	-12	15	0,0198	0,0126
12,5	-24	28	-15	19	0,0230	0,0158

16. Variasi diameter 3,175 cm jarak antar 15 cm

Beban	ϵ Atas	ϵ Atas	ϵ Bawah	ϵ Bawah	Momen Atas	Momen Bawah
0	0	0	0	0	0	0
1	-2	3	0	1	0,0030	0,0014
2	-6	7	-1	1	0,0062	0,0014
3	-6	7	-1	3	0,0062	0,0030
4	-8	9	-2	3	0,0078	0,0030
5	-8	10	-2	3	0,0086	0,0030
6	-9	10	-6	7	0,0086	0,0062
7	-11	12	-6	7	0,0102	0,0062
8	-11	12	-6	7	0,0102	0,0062
9	-13	15	-8	9	0,0126	0,0078
10	-14	16	-8	9	0,0134	0,0078
11	-20	22	-9	10	0,0182	0,0086
11	-24	27	-9	10	0,0222	0,0086
11	-25	30	-11	13	0,0246	0,0110