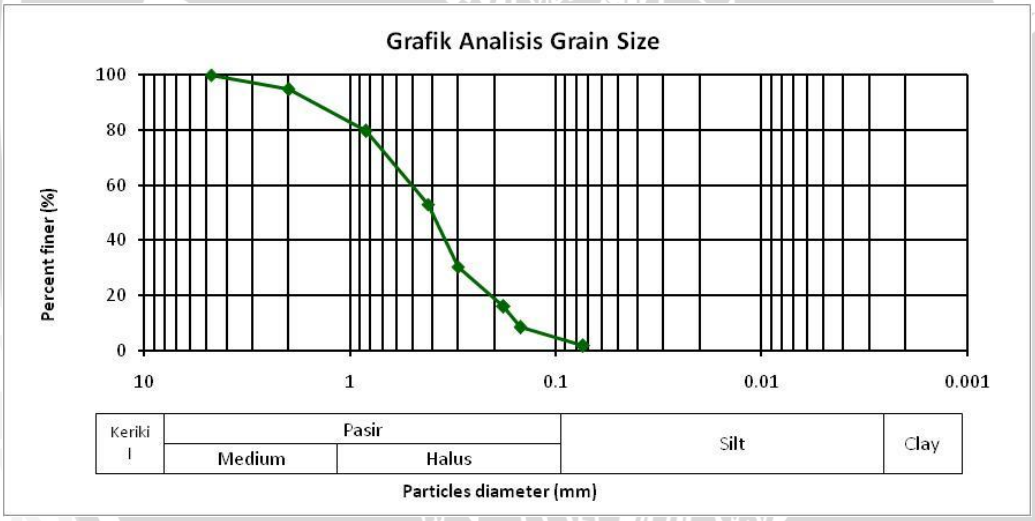
LAMPIRAN

Lampiran 1

Hasil Analisis Gradasi Butiran Tanah

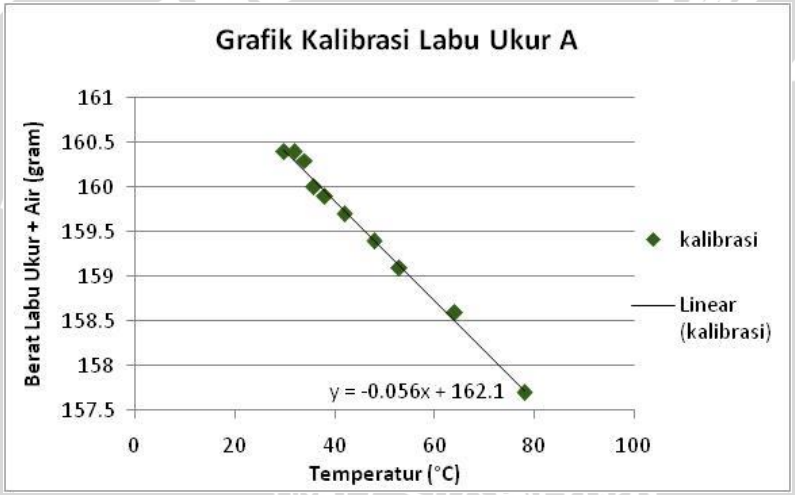
Nomor Ayakan	Diameter Ayakan (mm)	Berat Tertahan (gr)	Berat Kumulatif (gr)	Persen Tertahan (%)	Persen Lolos (%)
No. 4	4.75	0.0	0	0.00	100.00
No. 10	2	26.0	26	5.22	94.78
No. 20	0.84	75.9	101.9	20.44	79.56
No. 40	0.42	132.0	233.9	46.92	53.08
No. 50	0.3	112.2	346.1	69.43	30.57
No. 80	0.18	72.5	418.6	83.97	16.03
No. 100	0.149	37.5	456.1	91.49	8.51
No. 200	0.074	33.3	489.4	98.17	1.83
PAN		9.1	498.5	100.00	0.00



Lampiran 2

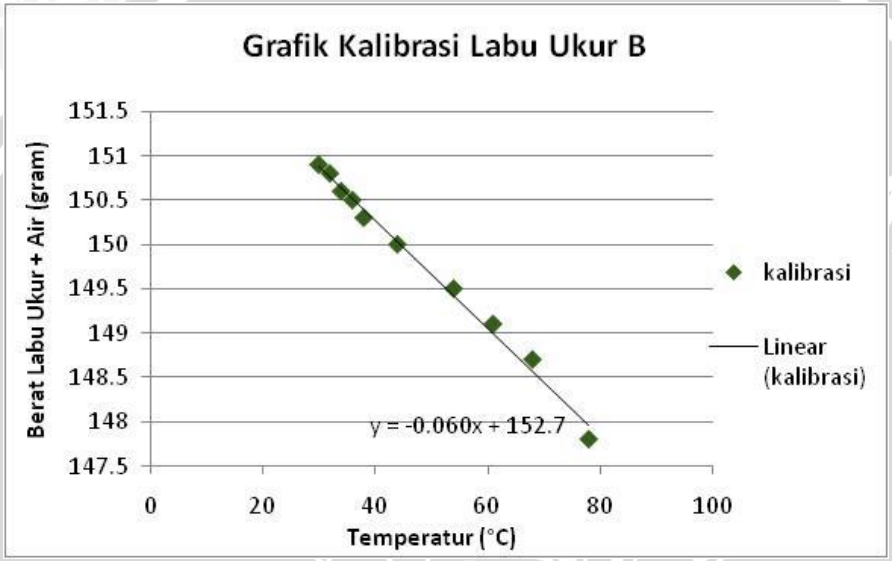
Hasil Analisis Spesifik Gravity Tanah

Labu Ukur	A									
No. Pemeriksaan	1	2	3	4	5	6	7	8	9	10
Temperatur (°C)	78	64	53	48	42	38	36	34	32	30
Berat Labu Ukur + Air (gram)	157.7	158.6	159.1	159.4	159.7	160	160	160.3	160.4	160.4



Labu Ukur		A									
Berat Labu Ukur	gram	52.2									
Berat Tanah Kering (Ws)	gram	20									
Berat Labu Ukur + Air + Tanah (W1)	gram	170.5	170.9	171.2	171.9	172.3	172.6	172.7	173.1	173.4	173.4
Suhu	gram	82	76	70	62	53	45	42	37	34	30
Berat Labu Ukur + Air (W2)	(°C)	157.502	157.839	158.176	158.626	159.131	159.581	159.750	160.031	160.199	160.424
Berat Jenis Air (Gt)	gram/cm³	0.971	0.974	0.978	0.982	0.986	0.99	0.992	0.993	0.994	0.995
Berat Jenis Tanah (Gs)	gram/cm³	2.774	2.807	2.804	2.920	2.887	2.836	2.814	2.866	2.924	2.833
Rata-rata Berat Jenis	gram/cm³	2.846									

Labu Ukur	B									
No. Pemeriksaan	1	2	3	4	5	6	7	8	9	10
Temperatur (°C)	78	68	61	54	44	38	36	34	32	30
Berat Labu Ukur + Air (gram)	147.8	148.7	149.1	149.5	150	150	150.5	150.6	150.8	150.9



Labu Ukur		B									
Berat Labu Ukur	gram	50.1									
Berat Tanah Kering (Ws)	gram	20									
Berat Labu Ukur + Air + Tanah (W1)	gram	160.8	161.3	161.5	162	162.2	162.6	163.1	163.3	163.5	163.7
Suhu	gram	82	75	71	64	61	50	45	40	33	30
Berat Labu Ukur + Air (W2)	(°C)	147.723	148.148	148.390	148.815	148.997	149.665	149.969	150.272	150.697	150.879
Berat Jenis Air (Gt)	gram/cm³	0.971	0.975	0.977	0.981	0.983	0.988	0.99	0.992	0.995	0.995
Berat Jenis Tanah (Gs)	gram/cm³	2.805	2.848	2.836	2.879	2.892	2.797	2.883	2.846	2.765	2.772
Rata-rata Berat Jenis	gram/cm³	2.832									

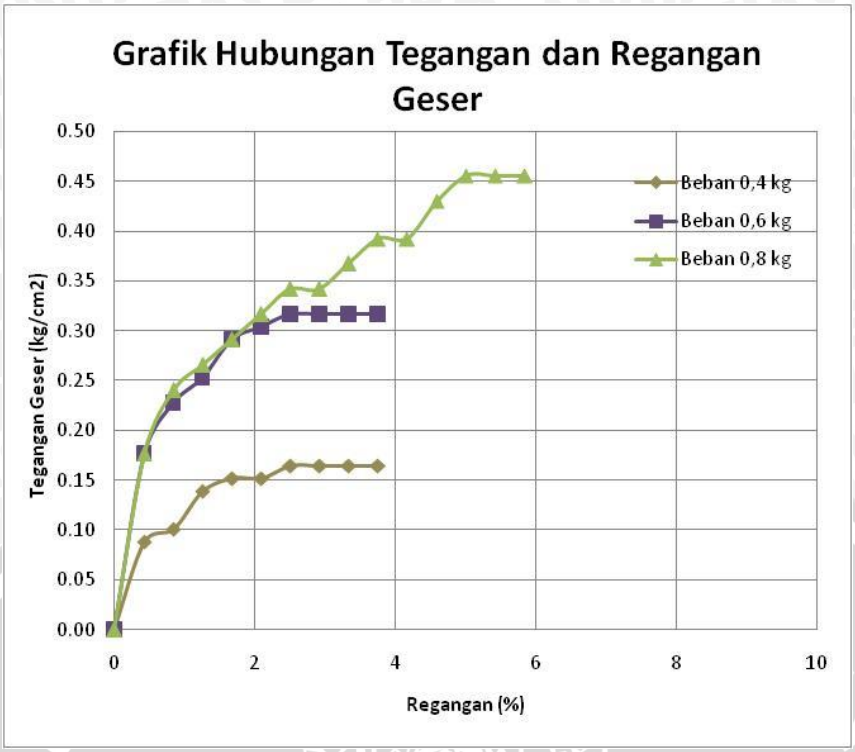
Lampiran 3

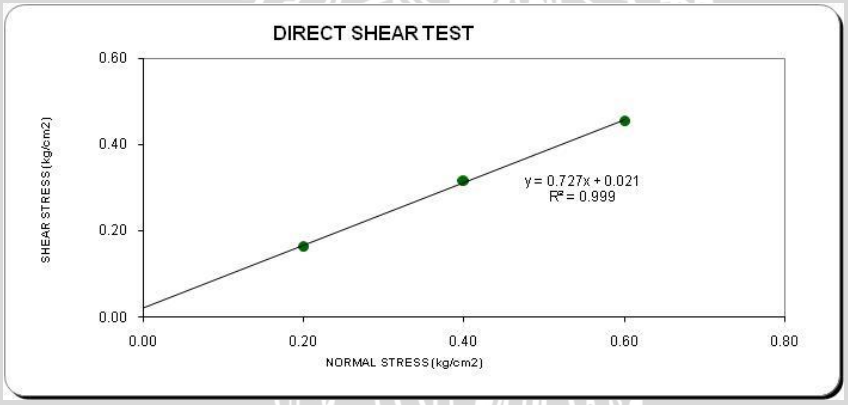
Hasil Analisis Uji Geser Langsung (Direct Shear)

Data :

Kalibrasi alat : 0,358 Tinggi Sampel : 2 cm Diameter Sampel : 6 cm Luas Sampel : 28,274 cm^2

NORMAL FORCE	P1 = 0.4 kg			P2 = 0.8 kg			P3 = 1.2 kg			
NORMAL STRESS	s1 = 0.20 kg/cm^2			s2 = 0.40 kg/cm^2			s3 = 0.60 kg/cm^2			
STRAIN	DIAL READING	SHEAR FORCE	SHEAR STRESS	DIAL READING	SHEAR FORCE	SHEAR STRESS	DIAL READING	SHEAR FORCE	SHEAR STRESS	ΔL / L0
0	0	0	0	0	0	0	0	0	0	0.00
25	7.0	2.506	0.089	14.0	5.012	0.177	14.0	5.012	0.177	0.42
50	8.0	2.864	0.101	18.0	6.444	0.228	19.0	6.802	0.241	0.83
75	11.0	3.938	0.139	20.0	7.160	0.253	21.0	7.518	0.266	1.25
100	12.0	4.296	0.152	23.0	8.234	0.291	23.0	8.234	0.291	1.67
125	12.0	4.296	0.152	24.0	8.592	0.304	25.0	8.950	0.317	2.08
150	13.0	4.654	0.165	25.0	8.950	0.317	27.0	9.666	0.342	2.50
175	13.0	4.654	0.165	25.0	8.950	0.317	27.0	9.666	0.342	2.92
200	13.0	4.654	0.165	25.0	8.950	0.317	29.0	10.382	0.367	3.33
225	13.0	4.654	0.165	25.0	8.950	0.317	31.0	11.098	0.393	3.75
250		0.000	0.000				31.0	11.098	0.393	4.17
275		0.000	0.000				34.0	12.172	0.431	4.58
300		0.000	0.000				36.0	12.888	0.456	5.00
325		0.000	0.000				36.0	12.888	0.456	5.42
350		0.000	0.000				36.0	12.888	0.456	5.83
375		0.000	0.000				36.0	12.888	0.456	6.25
400		0	0		0.0000	0.0000		0.0000	0.0000	
425		0	0		0.0000	0.0000				
450		0	0		0	0				





C	**=**	**0.0000**	kg/cm2
∅	**=**	**33.007**	**°**

Lampiran 4

Hasil Analisis Uji Pemadatan Standar

Berat Mould : 4260 kg

Diameter Mould : 10,16 cm

Tinggi Sampel : 11,63 cm

Kadar Air

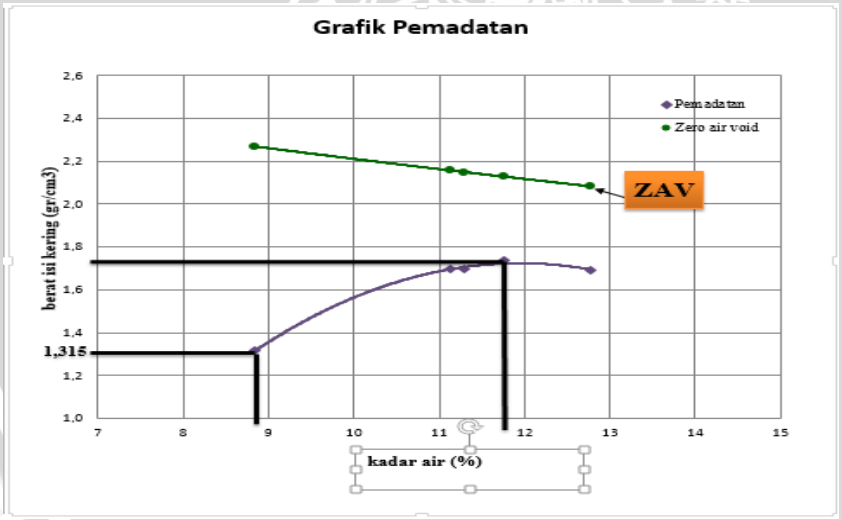
Penambahan air (ml)	264			330			360			390			420		
Lapisan	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah	Atas	Tengah	Bawah
Cawan No.	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Berat cawan + berat tanah basah	25.50	29.90	25.80	23.90	30.70	29.20	22.20	36.70	27.20	25.20	29.10	30.00	37.80	37.40	44.50
Berat cawan + berat tanah kering	24.10	27.90	24.00	22.30	28.30	26.50	20.70	32.80	25.10	23.50	26.30	27.20	34.60	33.70	39.80
Berat air	1.40	2.00	1.8	1.6	2.4	2.7	1.5	3.9	2.1	1.7	2.8	2.8	3.20	3.70	4.7
Berat cawan	5.70	5.70	5.80	5.70	5.60	6.00	4.00	4.30	6.40	5.70	4.20	5.80	5.90	6.10	5.70
Berat tanah kering	18.40	22.20	18.2	16.6	22.7	20.5	16.7	28.5	18.7	17.8	22.1	21.4	28.70	27.60	34.1
Kadar air w%	7.61	9.01	9.89	9.64	10.57	13.17	8.98	13.68	11.23	9.55	12.67	13.08	11.15	13.41	13.78
Rata-rata Kadar Air %	8.8			11.1			11.3			11.8			12.8		

Kepadatan

Penambahan Air		264	330	360	390	420
Berat tanah basah +cetakan	gram	5610	6040	6040	6090	6060
Berat cetakan	gram	4260	4260	4260	4260	4260
Berat tanah basah	gram	1350	1780	1780	1830	1800
Volume cetakan	cm3	943.50	943.50	943.50	943.50	943.50
Berat isi basah (γw)	gr/cm^3	1.431	1.887	1.887	1.940	1.908
Berat isi kering (γd)	gr/cm^3	1.315	1.698	1.695	1.735	1.692

Zero Air Void

Penambahan Air	ml	264	330	360	390	420
Kadar air (wc)	%	8.84	11.13	11.30	11.77	12.78
Gs	gr/cm^3	2.839	2.839	2.839	2.839	2.839
Berat jenis air (gw)	gr/cm^3	1	1	1	1	1
ZAV	gr/cm^3	2.270	2.158	2.150	2.128	2.083



Lampiran 5

Hasil Analisis Pemadatan Model Lereng

γ_d rencana : 1.3828 gr/cm^3 = 1382.8 kg/m^3

Luas kotak : (Panjang kotak *x* Lebar kotak) = 0,98 m *x* 1,15 m = 1,13 m^2

Berat tanah untuk tinggi rencana 10 cm : 1382,8*x* 0,113 = 156,256 kg

Berat tanah untuk tinggi rencana 3,6 cm : 1382,8 *x* 0,041 = 56,695 kg

Berat tanah untuk tinggi rencana 3,2 cm : 1382,8 *x* 0,036 = 50,002 kg

Berat galian (gram)	800
Berat pasir+kerucut (gram)	5900
Berat sisa pasir di kerucut (gram)	5120
Tanah di pelat (gram)	172
Berat isi kering lapangan	1.316
Berat isi kering maksimal di laboratorium	1.735
Rc (%)	75.84

Lampiran 6

Perhitungan Daya Dukung Lereng Tanpa Perkuatan dengan Metode Analitik

A. Metode Shield

γ= 1.315 gr/cm^3

ϕ = sudut geser dalam tanah = 33,007°

D = kedalaman pondasi = 0

L = panjang pondasi = ~

1. Data (B=4 cm ; β=51°)

γ = 1.3828 gr/cm^3

ϕ = sudut geser dalam tanah = 33,007°

β = sudut kemiringan lereng = 51°

B = lebar Pondasi = 4 cm = 1,5748 inchi

D = kedalaman pondasi = 0

L = panjang pondasi = ~

b = Jarak pondasi ke puncak lereng = 4 cm = 1,5748 inchi

$f_\phi = 10^{(0,1159\phi - 2,386)} = 10^{(0,1159.33,007 - 2,386)} = 27,5113$

$f_B = 10^{(0,34 - 0,2 \log B)} = 10^{(0.34 - 0,2 \log 1,5748)} = 1,9978$

$f_{D/B} = 1 + 0,65\ (D/B) = 1 + 0,65\ (0/1,5748) = 1$

$f_{B/L} = 1 - 0,27\ (B/L) = 1 - 0,27\ (1,5748/\sim) = 1$

$f_{D/B,\ B/L} = 1 + 0,39\ (D/L) = 1 + 0,39\ (0/\sim) = 1$

$f_{\beta,\ b/B} = 1 - 0,8\ [1 - (1 - \tan \beta)^2]\{2/[2 + (b/B)^2 \tan \beta]\}$

$= 1 - 0.8\ [1 - (1 - \tan 51°)^2]\{2/[2 + (1,5748/1,5748)^2 \tan 51°]\}$

$= 0,9755$

$f_{\beta,\ b/D,\ D/B} = 1 + 0,6\ (B/L)\ [1 - (1 - \tan 51)^2]\{2/[2 + (b/B)^2 \tan 51]\}$

$= 1 + 0,6\ (1,5478/\sim)\ [1 - (1 - \tan 51°)^2]\{2/[2 + (1,5748/1,5748)^2 \tan 51°]\}$

$= 1$

$f_{\beta,\ b/B,\ B/L} = 1 + 0,33\ (D/B) \tan \beta\ \{2/[2 + (b/B)^2 \tan \beta]\}$

$= 1 + 0,33\ (0/1,5478) \tan 51°\ \{2/[2 + (1,5748/1,5748)^2 \tan 51°]\}$

$= 1$

$N_{\gamma q}$ = 27,5113 x 1,9978 x 1 x 1 x 1 x 0,9779 x 1 x 1 = 53,6172

q_u = 0,5 x γ x B x $N_{\gamma q}$ = 0,5 x 1,315 x 4 x 53,6172 = 141,01 gr/cm^2

q_u = 14,101 kN/m^2

2. Data (B=6 cm ; β=51°)

β = sudut kemiringan lereng = 51°

B = lebar Pondasi = 6 cm = 2,3622 inchi

b = Jarak pondasi ke puncak lereng = 6 cm = 2,3622 inchi

$f_\phi = 10^{(0,1159\phi - 2,386)} = 10^{(0,1159.33,007 - 2,386)} = 27,5113$

$f_B = 10^{(0,34 - 0,2 \log B)} = 10^{(0.34 - 0,2 \log 2,3622)} = 1,8422$

$f_{D/B}$ = 1 + 0,65 (D/B) = 1 + 0,65 (0/2,3622) = 1

$f_{B/L}$ = 1 – 0,27 (B/L) = 1 – 0,27 (2,3622/~) = 1

$f_{D/B,\ B/L}$ = 1 + 0,39 (D/L) = 1 + 0,39 (0/~) = 1

$f_{\beta,\ b/B}$ = 1 – 0,8 [1 – (1 – tan β)^2]{2/[2 + (b/B)^2 tan β]}

= 1 – 0.8 [1 – (1 – tan 51°)^2]{2/[2 + (2,3622/2,3622)^2 tan 51°]}

= 0,9755

$f_{\beta,\ b/D,\ D/B}$ = 1 + 0,6 (B/L) [1 – (1 – tan β)^2]{2/[2 + (b/B)^2 tan β]}

= 1 + 0,6 (1,5478/~) [1 – (1 – tan 51°)^2]{2/[2 + (2,3622/2,3622)^2 tan 51°]}

= 1

$f_{\beta,\ b/B,\ B/L}$ = 1 + 0,33 (D/B) tan β {2/[2 + (b/B)^2 tan β]}

= 1 + 0,33 (0/2,3622) tan 51° {2/[2 + (2,3622/2,3622)^2 tan 51°]}

= 1

$N_{\gamma q}$ = 27,5113 x 1,8422 x 1 x 1 x 1 x 0,9779 x 1 x 1 = 49,4409

q_u = 0,5 x γ x B x $N_{\gamma q}$ = 0,5 x 1,315 x 6 x 49,4409 = 195,04 gr/cm^2

q_u = 19,504 kN/m^2

3. Data (B=8 cm ; β=51°)

β = sudut kemiringan lereng = 51°

B = lebar Pondasi = 8 cm = 3,1492 inchi

b = Jarak pondasi ke puncak lereng = 6 cm = 3,1496 inchi

$f_\phi = 10^{(0,1159\phi - 2,386)} = 10^{(0,1159.33,007 - 2,386)} = 27,5113$

$f_B = 10^{(0,34-0,2 \log B)} = 10^{(0.34-0,2\log 3,1496)} = 1,7392$

$f_{D/B} = 1 + 0,65\ (D/B) = 1 + 0,65\ (0/3,1496) = 1$

$f_{B/L} = 1 - 0,27\ (B/L) = 1 - 0,27\ (3,1496/\sim) = 1$

$f_{D/B,\ B/L} = 1 + 0,39\ (D/L) = 1 + 0,39\ (0/\sim) = 1$

$f_{\beta,\ b/B} = 1 - 0,8\ [1 - (1 - \tan \beta)^2]\{2/[2 + (b/B)^2 \tan \beta]\}$

$= 1 - 0.8\ [1 - (1 - \tan 51°)^2]\{2/[2 + (3,1496/3,1496)^2 \tan 51°]\}$

$= 0,9755$

$f_{\beta,\ b/D,\ D/B} = 1 + 0,6\ (B/L)\ [1 - (1 - \tan \beta)^2]\{2/[2 + (b/B)^2 \tan \beta]\}$

$= 1 + 0,6\ (1,5478/\sim)\ [1 - (1 - \tan 51°)^2]\{2/[2 + (3,1496/3,1496)^2 \tan 51°]\}$

$= 1$

$f_{\beta,\ b/B,\ B/L} = 1 + 0,33\ (D/B) \tan \beta\ \{2/[2 + (b/B)^2 \tan \beta]\}$

$= 1 + 0,33\ (0/2,3622) \tan 51°\ \{2/[2 + (3,1496/3,1496)^2 \tan 51°]\}$

$= 1$

$N_{\gamma q} = 27,5113 \times 1,7392 \times 1 \times 1 \times 1 \times 0,9755 \times 1 \times 1 = 46,6765$

$q_u = 0,5 \times \gamma \times B \times N_{\gamma q} = 0,5 \times 1,315 \times 8 \times 46,6765 = 245,52\ gr/cm^2$

$q_u = 24,552\ kN/m^2$

B. Metode Hansen

$\gamma = 1.315\ gr/cm^3$

ϕ = sudut geser dalam tanah = 33,007°

D = kedalaman pondasi = 0

L = panjang pondasi = ~

1. Data (B=4 cm ; β=51°)

β = sudut kemiringan lereng = 51°

B = lebar Pondasi = 4 cm

b = Jarak pondasi ke puncak lereng = 4 cm

Untuk d = 4B (Tanah Datar) :

$$Nq = e^{\pi \tan\phi} \cdot \tan^2\left(45 + \frac{\phi}{2}\right) = e^{\pi \tan 33{,}007} \cdot \tan^2\left(45 + \frac{33{,}007}{2}\right) = 26{,}114$$

$$Nc = (Nq - 1)\cot\phi = (26{,}114 - 1)\cot 33{,}007 = 38{,}662$$

$$N\gamma = 1{,}5\,(Nq - 1)\tan\phi = 1{,}5\,(26{,}114 - 1)\tan 33{,}007 = 24{,}470$$

Dengan mengasumsikan bahwa nilai c = 0 dan D_f = 0, maka diperoleh nilai daya dukung sebagai berikut;

$$q_u = (c \times Nc) + (D_f \times \gamma \times Nq) + \left(\gamma \times \frac{B}{2} \times N_\gamma\right)$$

$$q_u = (0 \times 38{,}662) + (0 \times 1{,}315 \times 26{,}114) + \left(1{,}315 \times \frac{4}{2} \times 24{,}470\right)$$

$$q_u = 64{,}36 \text{ gr/cm}^2 = 6{,}436 \text{ kN/m}^2$$

<u>Untuk Tanah Lereng :</u>

$$q_u = (c.N_c.s_c.d_c.i_c.g_c.b_c) + (D_f.\gamma.N_q.s_q.d_q.i_q.g_q.b_q) + \left(\gamma.\frac{B}{2}.N_\gamma.s_\gamma.d_\gamma.i_\gamma.g_\gamma.b_\gamma\right)$$

$$Nq = e^{\pi \tan\phi} \cdot \tan^2\left(45 + \frac{\phi}{2}\right) = e^{\pi \tan 33{,}007} \cdot \tan^2\left(45 + \frac{33{,}007}{2}\right) = 26{,}114$$

$$Nc = (Nq - 1)\cot\phi = (26{,}114 - 1)\cot 33{,}007 = 38{,}662$$

$$N\gamma = 1{,}5\,(Nq - 1)\tan\phi = 1{,}5\,(26{,}114 - 1)\tan 33{,}007 = 24{,}470$$

dimana;

$d_c = d_q = d_\gamma = 1$ (faktor kedalaman)

$i_c = i_q = i_\gamma = 1$ (faktor kemiringan beban)

$s_c = s_q = s_\gamma = 1$ (faktor bentuk pondasi)

$b_c = b_q = b_\gamma = 1$ (faktor kemiringan dasar pondasi)

untuk d=0 cm, maka;

$g_q = g_\gamma = (1 - \tan\beta)^2 = (1 - \tan 46^\circ)^2 = 0{,}969$

untuk D_f = 0 cm maka nilai daya dukung :

$$q_u = 1{,}315 \times \frac{4}{2} \times 24{,}470 \times 0{,}969 = 62{,}361 \text{ gr/cm}^2 = 6{,}236 \text{ kN/m}^2$$

Dengan menggunakan interpolasi, dihitung daya dukung pada kondisi d = B (4 cm) :

$d = 0 \rightarrow q_u = 6{,}236 \text{ kN/m}^2$

$d = 4B$ (16 cm) $\rightarrow q_u = 6{,}436 \text{ kN/m}^2$

$\frac{6,436-6,236}{16-0} = \frac{qu-6,236}{4-0}$

$0,8 = 16\ q_u - 99.776$

$q_u = 6,286\ kN/m^2$

2. Data (B=6 cm ; β=51°)

β = sudut kemiringan lereng = 51°

B = lebar Pondasi = 6 cm

b = Jarak pondasi ke puncak lereng = 6 cm

Untuk d = 4B (Tanah Datar) :

$Nq = e^{\pi\ tan\phi} . tan^2 (45 + \frac{\phi}{2}) = e^{\pi \tan 33,007} . tan^2 (45 + \frac{33,007}{2}) = 26,114$

$Nc = (Nq - 1)\ cot\phi = (26,114 - 1)\ cot\ 33,007 = 38,662$

$N\gamma = 1,5\ (Nq - 1)\ tan\ \phi = 1,5\ (26,114 - 1)\ tan\ 33,007 = 24,470$

Dengan mengasumsikan bahwa nilai c = 0 dan D_f = 0, maka diperoleh nilai daya dukung sebagai berikut;

$q_u = (\ c\ x\ Nc\ ) + (\ D_f\ x\ \gamma x\ Nq\ ) + (\ \gamma x\ \frac{B}{2}\ x\ N_\gamma)$

$q_u = (\ 0\ x\ 38,662) + (\ 0\ x\ 1,315\ x\ 26,114\ ) + (\ 1,315\ x\ \frac{6}{2}\ x\ 24,470)$

$q_u = 96.53\ gr/cm^2 = 9,653\ kN/m^2$

Untuk Tanah Lereng :

$q_u = (\ c.N_c.s_c.d_c.i_c.g_c.b_c\ ) + (\ D_f.\gamma.N_q.s_q.d_q.i_q.g_q.b_q\ ) + (\ \gamma.\frac{B}{2}.N_\gamma.s_\gamma.d_\gamma.i_\gamma.g_\gamma.b_\gamma\ )$

$Nq = e^{\pi\ tan\phi} . tan^2 (45 + \frac{\phi}{2}) = e^{\pi \tan 33,007} . tan^2 (45 + \frac{33,007}{2}) = 26,114$

$Nc = (Nq - 1)\ cot\phi = (26,114 - 1)\ cot\ 33,007 = 38,662$

$N\gamma = 1,5\ (Nq - 1)\ tan\ \phi = 1,5\ (26,114 - 1)\ tan\ 33,007 = 24,470$

dimana;

$d_c = d_q = d_\gamma = 1$ (faktor kedalaman)

$i_c = i_q = i_\gamma = 1$ (faktor kemiringan beban)

$s_c = s_q = s_\gamma = 1$ (faktor bentuk pondasi)

$b_c = b_q = b_\gamma = 1$ (faktor kemiringan dasar pondasi)

untuk d=0 cm, maka;

$g_q = g_\gamma = (1 - tan\beta)^2 = (1 - tan\ 51°)^2 = 0{,}969$

untuk D_f = 0 cm maka nilai daya dukung :

$$q_u = 1{,}315\ x\ \frac{6}{2}\ x\ 24{,}470\ x\ 0{,}969 = 93{,}542\ gr/cm^2 = 9{,}354 kN/m^2$$

Dengan menggunakan interpolasi, dihitung daya dukung pada kondisi d = B (6 cm) :

d = 0 $\rightarrow q_u = 9{,}354\ kN/m^2$

d = 4B (24 cm) $\rightarrow q_u = 9{,}653\ kN/m^2$

$$\frac{9{,}653-9{,}354}{24-0} = \frac{qu-9{,}354}{6-0}$$

$1{,}794 = 24\ q_u - 224{,}496$

$q_u = 9{,}428\ kN/m^2$

3. Data (B=8 cm ; β=51°)

β = sudut kemiringan lereng = 51°

B = lebar Pondasi = 8 cm

b = Jarak pondasi ke puncak lereng = 8 cm

<u>Untuk d = 4B (Tanah Datar) :</u>

$$Nq = e^{\pi\ tan\phi}\ .\ tan^2\ (45 + \frac{\phi}{2}) = e^{\pi\ \tan\ 33{,}007}.\ tan^2\ (45 + \frac{33{,}007}{2}) = 26{,}114$$

$Nc = (Nq - 1)\ cot\phi = (26{,}114 - 1)\ cot\ 33{,}007 = 38{,}662$

$N\gamma = 1{,}5\ (Nq - 1)\ tan\ \phi = 1{,}5\ (26{,}114 - 1)\ tan\ 33{,}007 = 24{,}470$

Dengan mengasumsikan bahwa nilai c = 0 dan D_f = 0, maka diperoleh nilai daya dukung sebagai berikut;

$$q_u = (\ c\ x\ Nc\ ) + (\ D_f x\ \gamma x\ Nq\ ) + (\ \gamma x\ \frac{B}{2}\ x\ N_\gamma)$$

$$q_u = (\ 0\ x\ 38{,}662) + (\ 0\ x\ 1{,}315\ x\ 26{,}114\ ) + (\ 1{,}315\ x\ \frac{8}{2}\ x\ 24{,}470)$$

$q_u = 128.71\ gr/cm^2 = 12.871\ kN/m^2$

<u>Untuk Tanah Lereng :</u>

$$q_u = (c.N_c.s_c.d_c.i_c.g_c.b_c) + (D_f.\gamma.N_q.s_q.d_q.i_q.g_q.b_q) + (\gamma.\frac{B}{2}.N_\gamma.s_\gamma.d_\gamma.i_\gamma.g_\gamma.b_\gamma)$$

$Nq = e^{\pi \tan\phi} . tan^2 (45 + \frac{\phi}{2}) = e^{\pi \tan 33{,}007} . tan^2 (45 + \frac{33{,}007}{2}) = 26{,}114$

$Nc = (Nq - 1) cot\phi = (26{,}114 - 1) cot\ 33{,}007 = 38{,}662$

$N\gamma = 1{,}5\ (Nq - 1)\ tan\ \phi = 1{,}5\ (26{,}114 - 1)\ tan\ 33{,}007 = 24{,}470$

dimana;

$d_c = d_q = d_\gamma = 1$ (faktor kedalaman)

$i_c = i_q = i_\gamma = 1$ (faktor kemiringan beban)

$s_c = s_q = s_\gamma = 1$ (faktor bentuk pondasi)

$b_c = b_q = b_\gamma = 1$ (faktor kemiringan dasar pondasi)

untuk d=0 cm, maka;

$g_q = g_\gamma = (1 - tan\beta)^2 = (1 - tan\ 51°)^2 = 0{,}969$

untuk D_f = 0 cm maka nilai daya dukung :

$$q_u = 1{,}315\ x\ \frac{8}{2}\ x\ 24{,}470\ x\ 0{,}969 = 124{,}722 gr/cm^2 = 12{,}472\ kN/m^2$$

Dengan menggunakan interpolasi, dihitung daya dukung pada kondisi d = B (8 cm) :

$d = 0 \rightarrow q_u = 12{,}472\ kN/m^2$

$d = 4B\ (32\ cm) \rightarrow q_u = 12{,}871\ kN/m^2$

$$\frac{12{,}871 - 12{,}472}{32 - 0} = \frac{qu - 12{,}472}{8 - 0}$$

$3{,}192 = 32\ q_u - 399{,}104$

$q_u = 12{,}572\ kN/m^2$

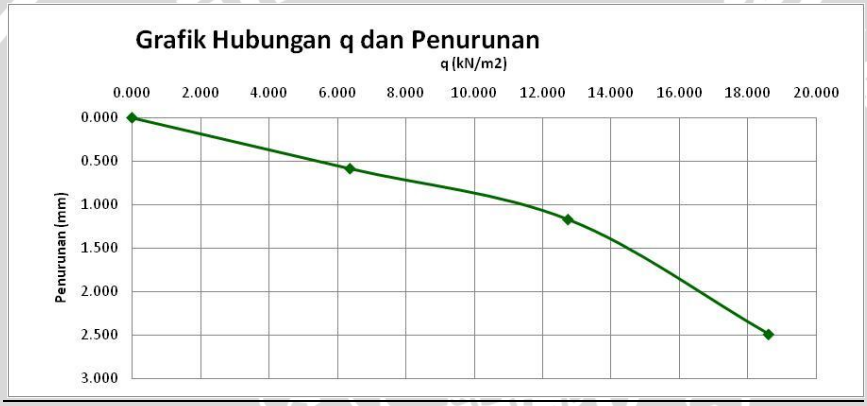
Lampiran 7

Hasil Analisis Daya Dukung Lereng dengan Metode Eksperimen

Lereng Tanpa Perkuatan

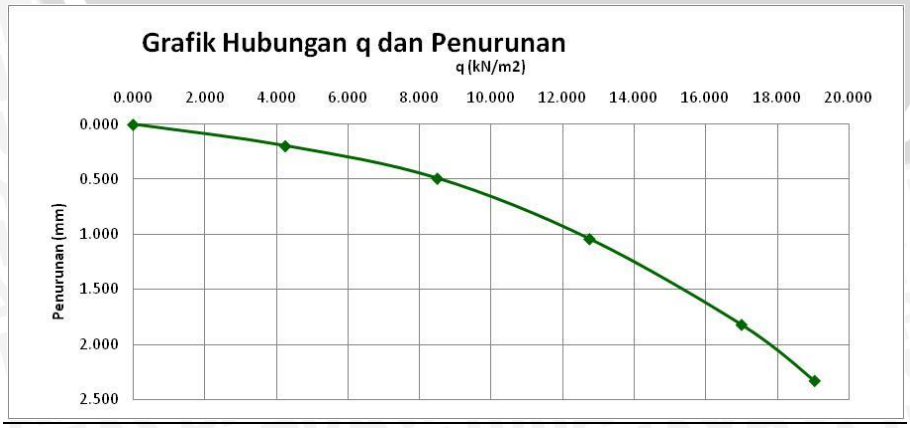
1. α=51°, B=4cm, d/B=1

Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm²)	q (kN/m²)
0	3160	0.000	0.000	0.000	0.000
25	3073	0.435	1.088	0.064	6.378
50	2886	1.370	3.425	0.128	12.755
73	2662	2.690	2.335	0.186	18.622



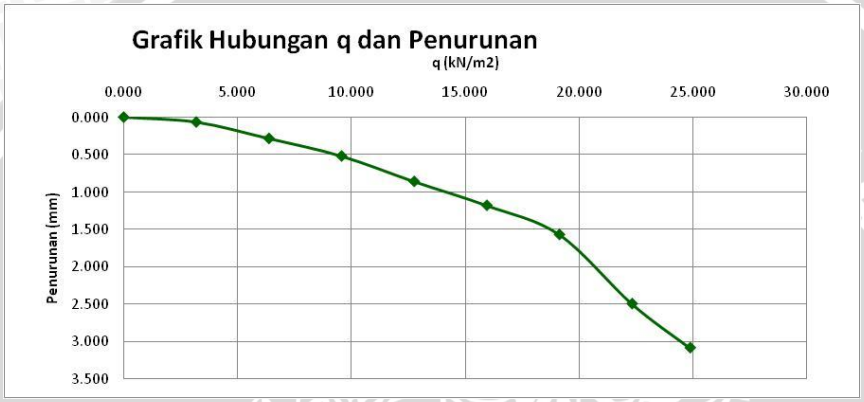
2. α=51°, B=6cm, d/B=1

Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm²)	q (kN/m²)
0	2450	0.000	0.000	0.000	0.000
25	2411	0.195	0.325	0.043	4.252
50	2352	0.490	0.817	0.085	8.503
75	2242	1.040	1.733	0.128	12.755
100	2086	1.820	3.033	0.170	17.007
112	1984	2.330	3.883	0.190	19.048



3. α=51°, B=8cm, d/B=1

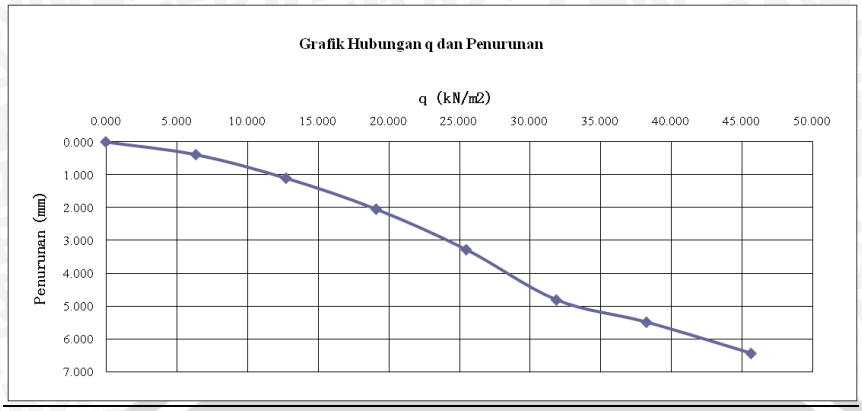
Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm^2)	q (kN/m^2)
0	2645	0.000	0.000	0.000	0.000
25	2632	0.065	0.081	0.032	3.189
50	2588	0.285	0.356	0.064	6.378
75	2541	0.520	0.650	0.096	9.566
100	2473	0.860	1.075	0.128	12.755
125	2409	1.180	1.475	0.159	15.944
150	2331	1.570	1.963	0.191	19.133
175	2146	2.495	3.119	0.223	22.321
195	2028	3.085	3.856	0.249	24.872



Lereng Dengan Perkuatan

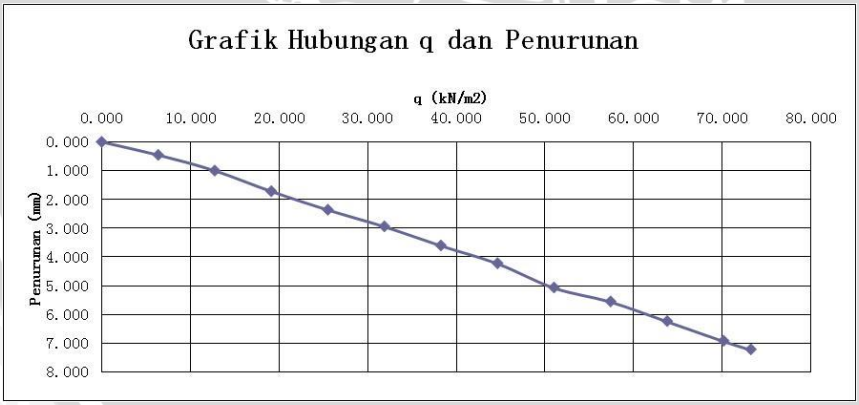
1. α=51°, B=4cm, d/B=1, n=1

Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm^2)	q (kN/m^2)
0	2715	0.000	0.000	0.000	0.000
25	2638	0.385	0.963	0.064	6.378
50	2494	1.105	2.763	0.128	12.755
75	2305	2.050	5.125	0.191	19.133
100	2058	3.285	8.213	0.255	25.510
125	1752	4.815	12.038	0.319	31.888
150	1616	5.495	13.738	0.383	38.265
179	1426	6.445	16.113	0.457	45.663



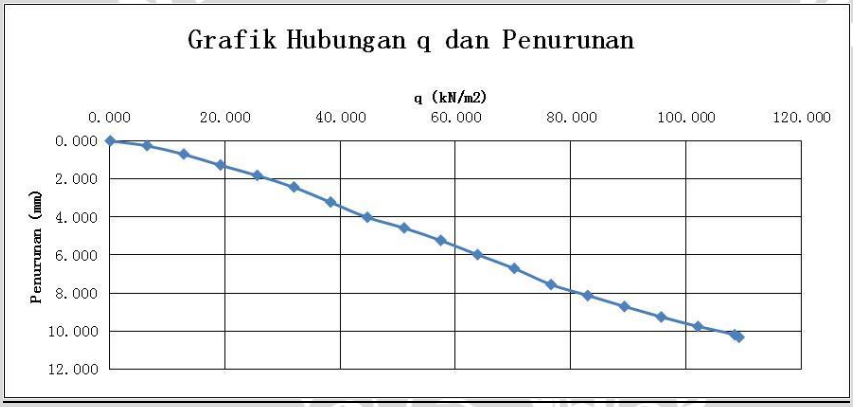
2. α=51°, B=4cm, d/B=1, n=2

Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm^2)	q (kN/m^2)
0	3507	0.000	0.000	0.000	0.000
25	3416	0.455	1.138	0.064	6.378
50	3307	1.000	2.500	0.128	12.755
75	3163	1.720	4.300	0.191	19.133
100	3034	2.365	5.913	0.255	25.510
125	2918	2.945	7.363	0.319	31.888
150	2785	3.610	9.025	0.383	38.265
175	2661	4.230	10.575	0.446	44.643
200	2492	5.075	12.688	0.510	51.020
225	2395	5.560	13.900	0.574	57.398
250	2258	6.245	15.613	0.638	63.776
275	2121	6.930	17.325	0.702	70.153
287	2061	7.230	18.075	0.732	73.214



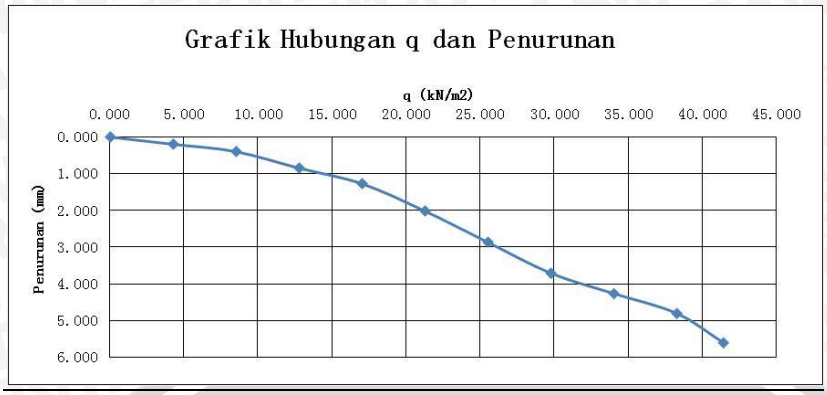
3. α=51°, B=4cm, d/B=1, n=3

Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm^2)	q (kN/m^2)
0	3023	0.000	0.000	0.000	0.000
25	2973	0.250	0.625	0.064	6.378
50	2884	0.695	1.738	0.128	12.755
75	2769	1.270	3.175	0.191	19.133
100	2660	1.815	4.538	0.255	25.510
125	2537	2.430	6.075	0.319	31.888
150	2379	3.220	8.050	0.383	38.265
175	2219	4.020	10.050	0.446	44.643
200	2107	4.580	11.450	0.510	51.020
225	1976	5.235	13.088	0.574	57.398
250	1826	5.985	14.963	0.638	63.776
275	1681	6.710	16.775	0.702	70.153
300	1511	7.560	18.900	0.765	76.531
325	1396	8.135	20.338	0.829	82.908
350	1280	8.715	21.788	0.893	89.286
375	1170	9.265	23.163	0.957	95.663
400	1070	9.765	24.413	1.020	102.041
425	984	10.195	25.488	1.084	108.418
428	957	10.330	25.825	1.092	109.184



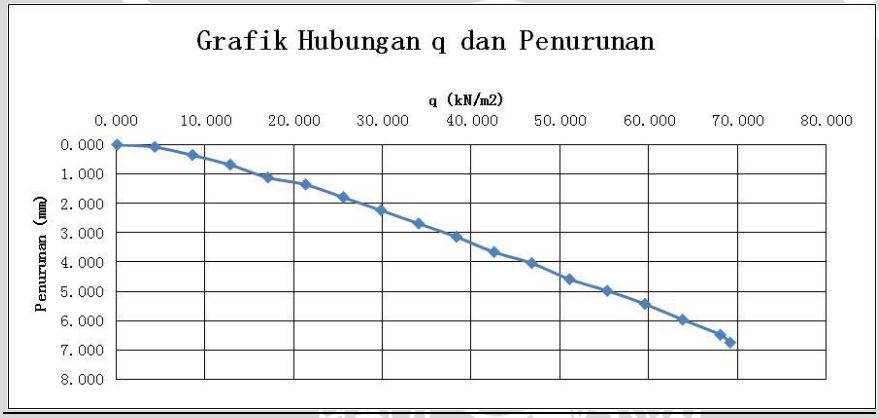
4. α=51°, B=6cm, d/B=1, n=1

Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm^2)	q (kN/m^2)
0	2729	0.000	0.000	0.000	0.000
25	2690	0.195	0.325	0.043	4.252
50	2650	0.395	0.658	0.085	8.503
75	2560	0.845	1.408	0.128	12.755
100	2475	1.270	2.117	0.170	17.007
125	2326	2.015	3.358	0.213	21.259
150	2156	2.865	4.775	0.255	25.510
175	1987	3.710	6.183	0.298	29.762
200	1876	4.265	7.108	0.340	34.014
225	1768	4.805	8.008	0.383	38.265
243.5	1608	5.605	9.342	0.414	41.412


Grafik Hubungan q dan Penurunan
q (kN/m2)
0.000
5.000
10.000
15.000
20.000
25.000
30.000
35.000
40.000
45.000
Penurunan (mm)
0.000
1.000
2.000
3.000
4.000
5.000
6.000

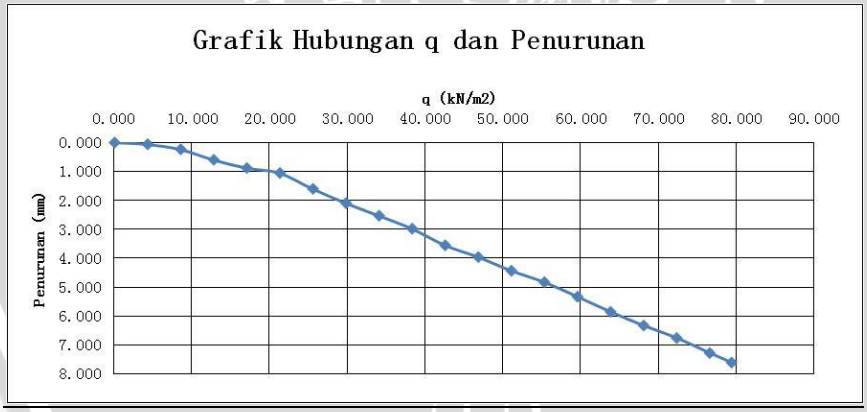
5. α=51°, B=6cm, d/B=1, n=2

Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm^2)	q (kN/m^2)
0	3495	0.000	0.000	0.000	0.000
25	3480	0.075	0.125	0.043	4.252
50	3425	0.350	0.583	0.085	8.503
75	3359	0.680	1.133	0.128	12.755
100	3272	1.115	1.858	0.170	17.007
125	3224	1.355	2.258	0.213	21.259
150	3137	1.790	2.983	0.255	25.510
175	3049	2.230	3.717	0.298	29.762
200	2958	2.685	4.475	0.340	34.014
225	2868	3.135	5.225	0.383	38.265
250	2764	3.655	6.092	0.425	42.517
275	2688	4.035	6.725	0.468	46.769
300	2579	4.580	7.633	0.510	51.020
325	2500	4.975	8.292	0.553	55.272
350	2410	5.425	9.042	0.595	59.524
375	2303	5.960	9.933	0.638	63.776
400	2200	6.475	10.792	0.680	68.027
406.5	2147	6.740	11.233	0.691	69.133



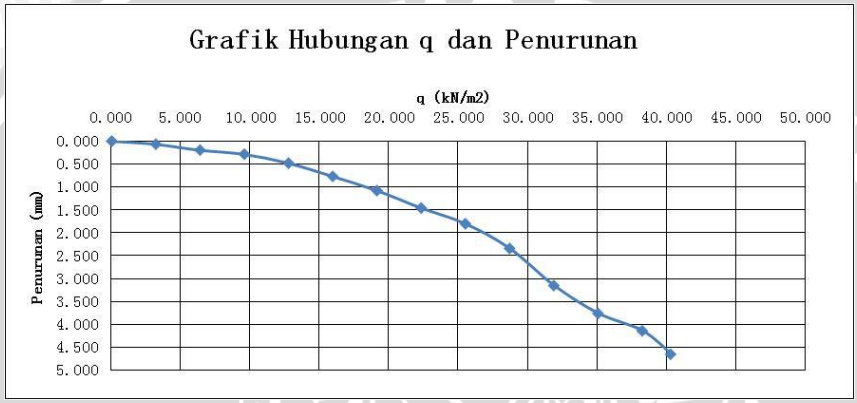
6. α=51°, B=6cm, d/B=1, n=3

Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm^2)	q (kN/m^2)
0	3306	0.000	0.000	0.000	0.000
25	3294	0.060	0.100	0.043	4.252
50	3259	0.235	0.392	0.085	8.503
75	3187	0.595	0.992	0.128	12.755
100	3130	0.880	1.467	0.170	17.007
125	3095	1.055	1.758	0.213	21.259
150	2986	1.600	2.667	0.255	25.510
175	2887	2.095	3.492	0.298	29.762
200	2800	2.530	4.217	0.340	34.014
225	2710	2.980	4.967	0.383	38.265
250	2595	3.555	5.925	0.425	42.517
275	2514	3.960	6.600	0.468	46.769
300	2419	4.435	7.392	0.510	51.020
325	2340	4.830	8.050	0.553	55.272
350	2240	5.330	8.883	0.595	59.524
375	2135	5.855	9.758	0.638	63.776
400	2040	6.330	10.550	0.680	68.027
425	1954	6.760	11.267	0.723	72.279
450	1850	7.280	12.133	0.765	76.531
466.5	1784	7.610	12.683	0.793	79.337



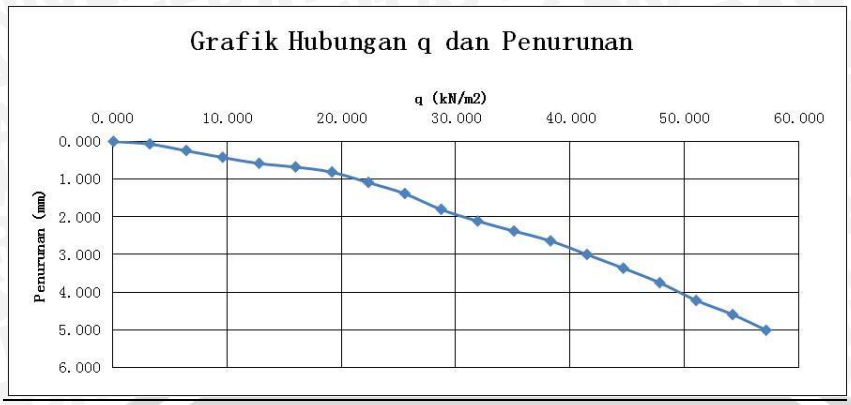
7. α=51°, B=8 cm, d/B=1, n=1

Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm^2)	q (kN/m^2)
0	2644	0.000	0.000	0.000	0.000
25	2631	0.065	0.081	0.032	3.189
50	2605	0.195	0.244	0.064	6.378
75	2587	0.285	0.356	0.096	9.566
100	2548	0.480	0.600	0.128	12.755
125	2490	0.770	0.963	0.159	15.944
150	2428	1.080	1.350	0.191	19.133
175	2352	1.460	1.825	0.223	22.321
200	2283	1.805	2.256	0.255	25.510
225	2175	2.345	2.931	0.287	28.699
250	2013	3.155	3.944	0.319	31.888
275	1891	3.765	4.706	0.351	35.077
300	1815	4.145	5.181	0.383	38.265
316	1713	4.655	5.819	0.403	40.306



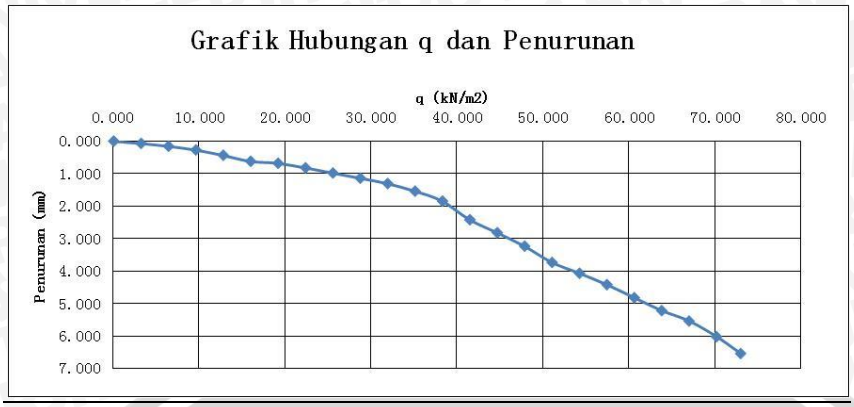
8. α=51°, B=8 cm, d/B=1, n=2

Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm^2)	q (kN/m^2)
0	4527	0.000	0.000	0.000	0.000
25	4514	0.065	0.081	0.032	3.189
50	4479	0.240	0.300	0.064	6.378
75	4443	0.420	0.525	0.096	9.566
100	4411	0.580	0.725	0.128	12.755
125	4392	0.675	0.844	0.159	15.944
150	4365	0.810	1.013	0.191	19.133
175	4310	1.085	1.356	0.223	22.321
200	4251	1.380	1.725	0.255	25.510
225	4167	1.800	2.250	0.287	28.699
250	4105	2.110	2.638	0.319	31.888
275	4052	2.375	2.969	0.351	35.077
300	4000	2.635	3.294	0.383	38.265
325	3928	2.995	3.744	0.415	41.454
350	3855	3.360	4.200	0.446	44.643
375	3778	3.745	4.681	0.478	47.832
400	3684	4.215	5.269	0.510	51.020
425	3609	4.590	5.738	0.542	54.209
448	3526	5.005	6.256	0.571	57.143



9. α=51°, B=8 cm, d/B=1, n=3

Beban (kg)	LVDT	Penurunan (mm)	s/B (%)	q (kg/cm^2)	q (kN/m^2)
0	4134	0.000	0.000	0.000	0.000
25	4120	0.070	0.088	0.032	3.189
50	4103	0.155	0.194	0.064	6.378
75	4080	0.270	0.338	0.096	9.566
100	4047	0.435	0.544	0.128	12.755
125	4010	0.620	0.775	0.159	15.944
150	3998	0.680	0.850	0.191	19.133
175	3970	0.820	1.025	0.223	22.321
200	3938	0.980	1.225	0.255	25.510
225	3906	1.140	1.425	0.287	28.699
250	3873	1.305	1.631	0.319	31.888
275	3826	1.540	1.925	0.351	35.077
300	3765	1.845	2.306	0.383	38.265
325	3650	2.420	3.025	0.415	41.454
350	3570	2.820	3.525	0.446	44.643
375	3487	3.235	4.044	0.478	47.832
400	3387	3.735	4.669	0.510	51.020
425	3320	4.070	5.088	0.542	54.209
450	3250	4.420	5.525	0.574	57.398
475	3170	4.820	6.025	0.606	60.587
500	3090	5.220	6.525	0.638	63.776
525	3026	5.540	6.925	0.670	66.964
550	2930	6.020	7.525	0.702	70.153
572	2826	6.540	8.175	0.730	72.959


Grafik Hubungan q dan Penurunan
q (kN/m2)
0.000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
Penurunan (mm)
0.000
1.000
2.000
3.000
4.000
5.000
6.000
7.000

Lampiran 8

Perhitungan Daya Dukung pada Penurunan s/B : 2% Daya Dukung (q) diperoleh dengan interpolasi orde dua dengan rumus:

$F(x_0) = b_o + b_1 (x_o - x_0) + b_2 (x_0 - x_0) (x_0 - x_1)$

$b_o = f(x_0)$

$b_1 = \frac{f(x_1) - f(x_0)}{x_1 - x_0}$

$b_2 = \frac{\frac{f(x_2) - f(x_1)}{x_2 - x_1} - \frac{f(x_1) - f(x_0)}{x_1 - x_0}}{x_2 - x_0}$

Lereng Tanpa Perkuatan

1. α=51°, B=4cm, d/B=1

s/B(%)	s/B (%)		q (kN/m^2)		B_1	B_2	q (kN/m^2)
(x)	(x_0,x_1,x_2)		[f(x_0),f(x_1),f(x_2)]				f(x)
2	x_0	1.088	f(x_0)	6.378	2.728	-0.123	9.027
	x_1	3.425	f(x_1)	12.755			
	x_2	6.225	f(x_2)	18.622			

2. α=51°, B=6cm, d/B=1

s/B(%)	s/B (%)		q (kN/m^2)		B_1	B_2	q (kN/m^2)
(x)	(x_0,x_1,x_2)		[f(x_0),f(x_1),f(x_2)]				f(x)
2	x_0	1.733	f(x_0)	12.755	3.271	-0.404	13.739
	x_1	3.033	f(x_1)	17.007			
	x_2	3.883	f(x_2)	19.048			

3. α=51°, B=8cm, d/B=1

s/B(%)	s/B (%)		q (kN/m^2)		B_1	B_2	q (kN/m^2)
(x)	(x_0,x_1,x_2)		[f(x_0),f(x_1),f(x_2)]				f(x)
2	x_0	1.963	f(x_0)	19.133	2.758	0.370	19.221
	x_1	3.119	f(x_1)	22.321			
	x_2	3.856	f(x_2)	24.872			

Lereng Dengan Perkuatan Variasi Lebar Pondasi

n	B	s/B(%)	s/B (%)		q (kN/m^2)		B_1	B_2	q (kN/m^2)
		(x)	(x_0,x_1,x_2)		[$f(x_0)$,$f(x_1)$,$f(x_2)$]				f(x)
1	4	2	x_0	0.963	$f(x_0)$	6.378	3.543	-0.203	10.214
			x_1	2.763	$f(x_1)$	12.755			
			x_2	5.125	$f(x_2)$	19.133			
	6		x_0	1.408	$f(x_0)$	12.755	6.002	-1.322	16.398
			x_1	2.117	$f(x_1)$	17.007			
			x_2	3.358	$f(x_2)$	21.259			
	8		x_0	1.350	$f(x_0)$	19.133	6.713	0.752	23.582
			x_1	1.825	$f(x_1)$	22.321			
			x_2	2.256	$f(x_2)$	25.510			
2	4		x_0	1.138	$f(x_0)$	6.378	4.681	-0.360	10.570
			x_1	2.500	$f(x_1)$	12.755			
			x_2	4.300	$f(x_2)$	19.133			
	6		x_0	1.858	$f(x_0)$	17.007	10.629	-4.235	18.668
			x_1	2.258	$f(x_1)$	21.259			
			x_2	2.983	$f(x_2)$	25.510			
	8		x_0	1.725	$f(x_0)$	25.510	6.074	2.362	27.018
			x_1	2.250	$f(x_1)$	28.699			
			x_2	2.638	$f(x_2)$	31.888			
3	4		x_0	1.738	$f(x_0)$	12.755	4.437	0.087	13.893
			x_1	3.175	$f(x_1)$	19.133			
			x_2	4.538	$f(x_2)$	25.510			
	6		x_0	1.467	$f(x_0)$	17.007	14.577	-8.247	23.718
			x_1	1.758	$f(x_1)$	21.259			
			x_2	2.667	$f(x_2)$	25.510			
	8		x_0	1.425	$f(x_0)$	28.699	15.461	-9.211	35.636
			x_1	1.631	$f(x_1)$	31.888			
			x_2	1.925	$f(x_2)$	35.077			

Lereng Dengan Perkuatan Variasi Jumlah Lapis Perkuatan

B	n	s/B(%)	s/B (%)		q (kN/m^2)		B_1	B_2	q (kN/m^2)
		(x)	(x_0,x_1,x_2)		[$f(x_0)$,$f(x_1)$,$f(x_2)$]				f(x)
4	1	2	x_0	0.963	$f(x_0)$	6.378	3.543	-0.203	10.214
			x_1	2.763	$f(x_1)$	12.755			
			x_2	5.125	$f(x_2)$	19.133			
	2		x_0	1.138	$f(x_0)$	6.378	4.681	-0.360	10.570
			x_1	2.500	$f(x_1)$	12.755			
			x_2	4.300	$f(x_2)$	19.133			
	3		x_0	1.738	$f(x_0)$	12.755	4.437	0.087	13.893
			x_1	3.175	$f(x_1)$	19.133			
			x_2	4.538	$f(x_2)$	25.510			
6	1		x_0	1.408	$f(x_0)$	12.755	6.002	-1.322	16.398
			x_1	2.117	$f(x_1)$	17.007			
			x_2	3.358	$f(x_2)$	21.259			
	2		x_0	1.858	$f(x_0)$	17.007	10.629	-4.235	18.668
			x_1	2.258	$f(x_1)$	21.259			
			x_2	2.983	$f(x_2)$	25.510			
	3		x_0	1.467	$f(x_0)$	17.007	14.577	-8.247	23.718
			x_1	1.758	$f(x_1)$	21.259			
			x_2	2.667	$f(x_2)$	25.510			
8	1		x_0	1.350	$f(x_0)$	19.133	6.713	0.752	23.582
			x_1	1.825	$f(x_1)$	22.321			
			x_2	2.256	$f(x_2)$	25.510			
	2		x_0	1.725	$f(x_0)$	25.510	6.074	2.362	27.018
			x_1	2.250	$f(x_1)$	28.699			
			x_2	2.638	$f(x_2)$	31.888			
	3		x_0	1.425	$f(x_0)$	28.699	15.461	-9.211	35.636
			x_1	1.631	$f(x_1)$	31.888			
			x_2	1.925	$f(x_2)$	35.077			