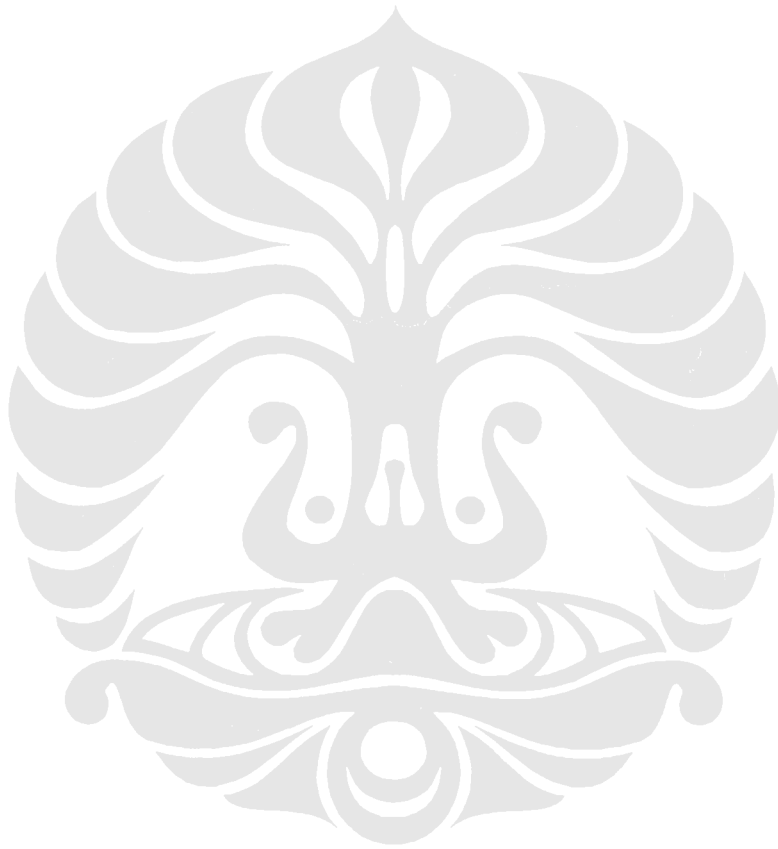


## LAMPIRAN



# Lampiran 1 (Data Tanah)

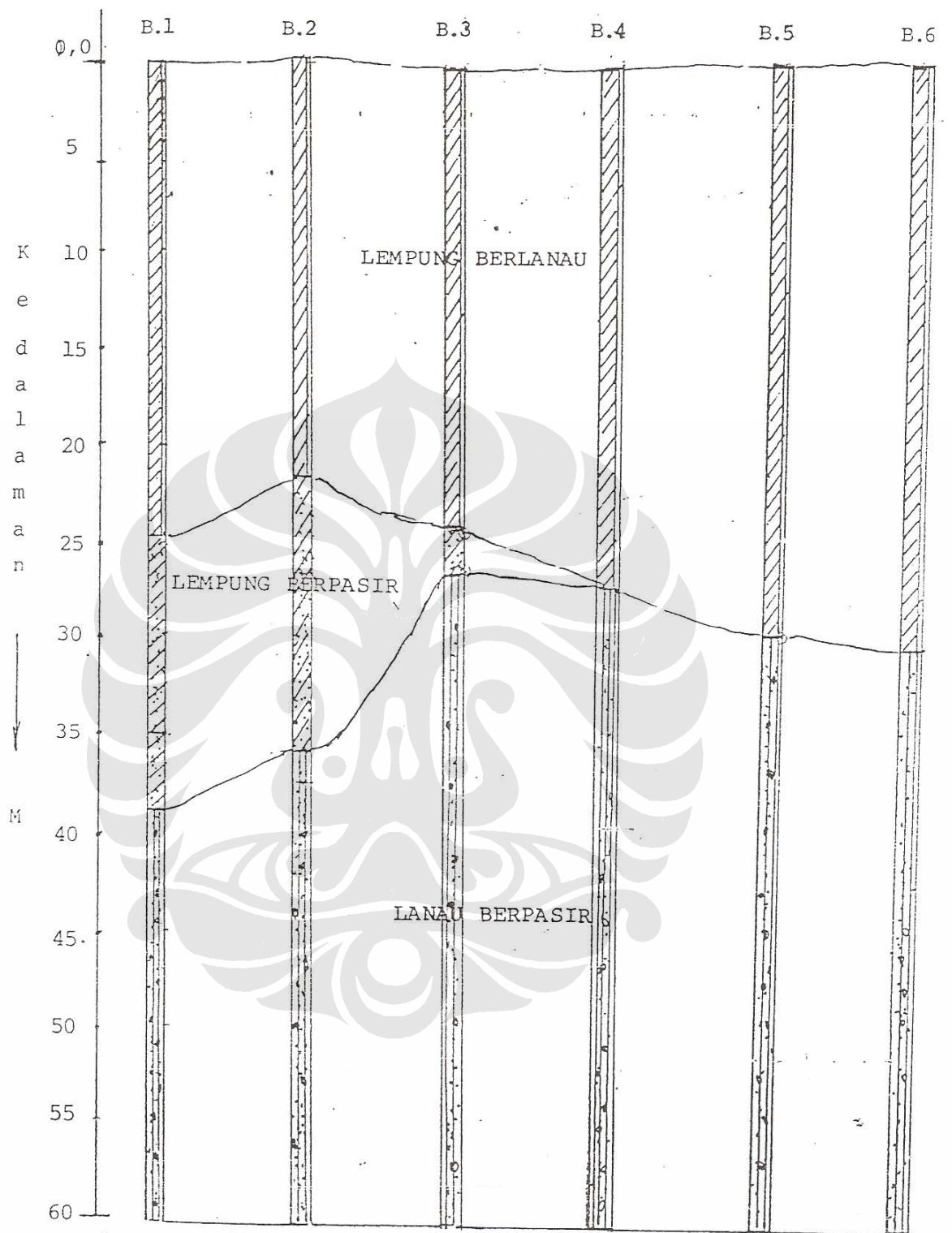
## BORE HOLE LOG

PROJECT : RENCANA PENGEMBANGAN DERMAGA

LOCATION : PELABUHAN TELUK BAYUR

BORING NO : 1 (SATU)

DEPTH	STANDARD PENETRATION TEST		GRAPHIC SYMBOL	SAMPLE			DESCRIPTION SOIL
	BLOWS/CM	GRAPH OF N N/ FOOT		Thin Wall	Split Spoon	Wash Out	
							Elevation : 0 M terhadap sea bad (-8,35 M LWS)
0							Lempung berpasir campur kili kerang,abu-abu, sangat lunak.
1							
2							
3							
4	0						
5	30						
6							
7	0						
8	30						
9							Lempung kelanauan campur kulit kerang,abu-abu sangat lunak.
10	1						
11	30						
12							
13	2						
14	30						
15							Lempung kelanauan terdapat kulit kerang,abu-abu,sangat lunak.
16	2						
17	30						
18							
19	4						
20	30						
21							
22	4						
23	30						
24							
25	5						Lempung kelanauan terdapat kili kerang, abu-abu,agak lunak.
26	30						
27							Lempung berpasir campur kerikil karang,abu-abu,agak lunak.
28	5						
29	30						
30							
31	4						
32	30						
33							
34	4						
35	30						
36							Lempung campur kerikil karang, abu-abu, agak lunak.
37	8						
38	30						
39							Lempung kelanauan abu-abu,sangat kenyal
40	18						
41	30						
42							
43	22						
44	30						Lanau abu-abu,sangat kenyal
45							
46	49						
47	30						
48							
49	57						
50	30						Lanau berpasir terdapat kerikil karang,abu-abu, keras.
51							
52	55						
53	30						
54							
55	48						
56	30						Lanau berpasir terdapat kerikil karang,abu-abu,keras
57							
58	38						
59	30						Lanau abu-abu,keras.
60							



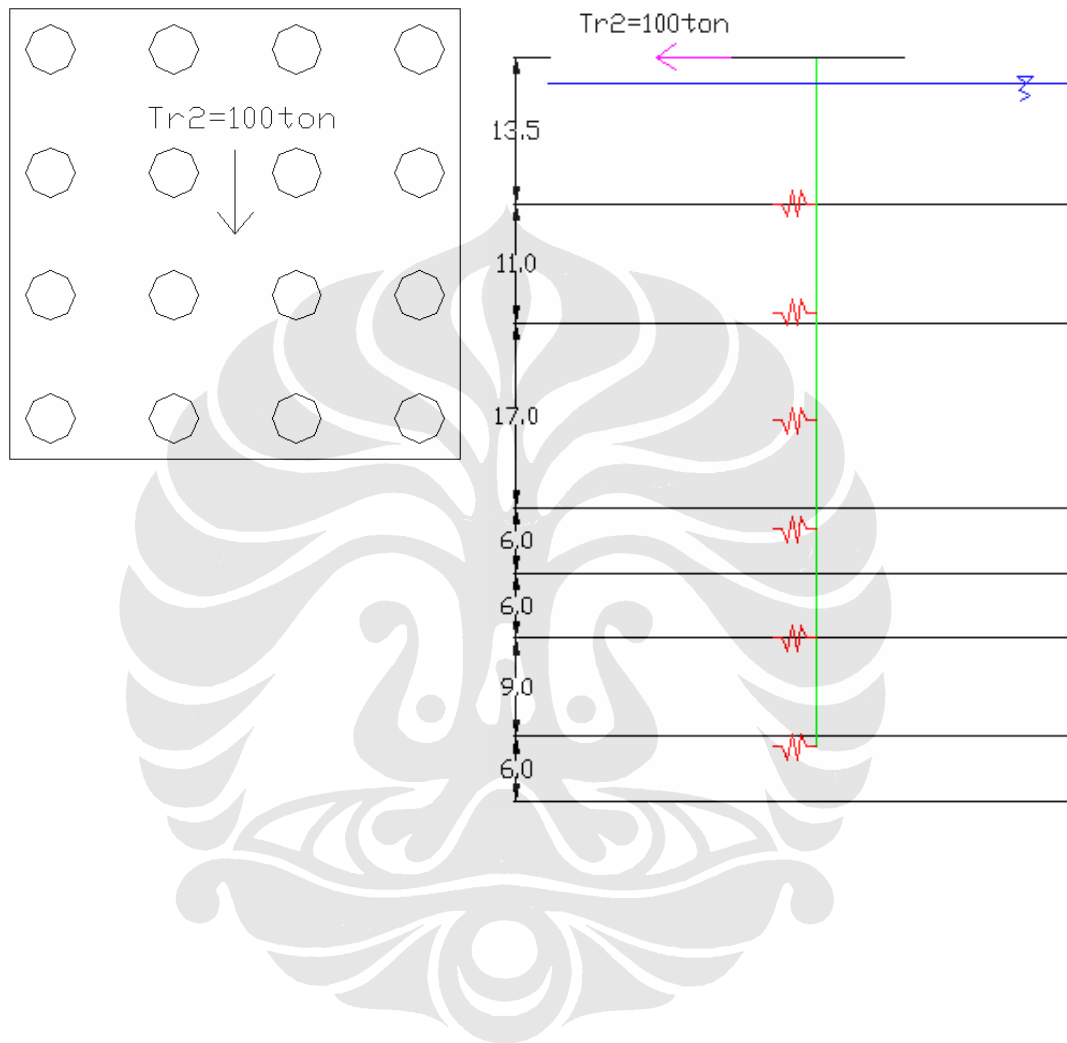
## SUMMARY OF LABORATORY TEST RESULTS

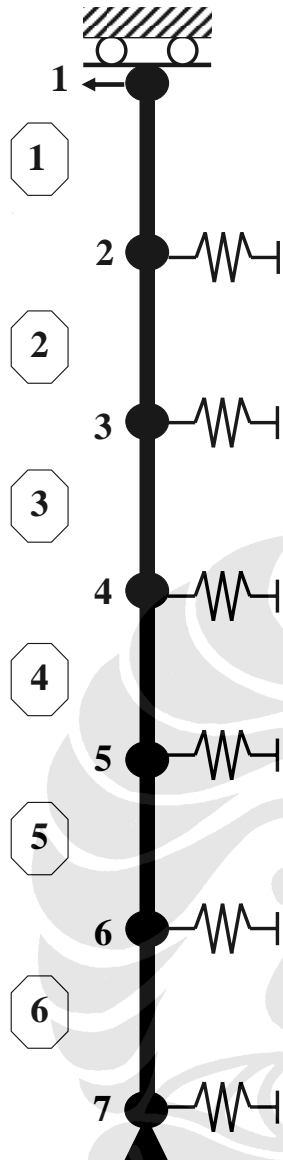
PROJECT : Rencana pembangunan dermaga CPO.  
 LOCATION : Pelabuhan Teluk Bayur.  
 DATE : September 2002  
 BOR : 3 (Tiga)

DEPTH (m)	NATURAL PROPERTIES					ATTERBERG			UNCONFINED			TRIAXIAL		CONSOLIDATION		
	GS	Yn Gr/Cm <sup>3</sup>	Wn %	Yd Gr/Cm <sup>3</sup>	e	Sr %	Wi %	Wp %	Ip %	Qu Kg/Cm <sup>2</sup>	SI	C Kg/Cm <sup>2</sup>	O °	Cc	Cv max Cm <sup>2</sup> /mnt	Cv rata2 Cm <sup>2</sup> /mnt
3.00	2.401	1.387	71.45	0.809	1.968	87.17	-	-	-	0.083	2.128	0.05	00°22'	0.529	0.960	0.568
6.00	2.527	1.430	74.12	0.821	2.077	90.18	-	-	-	0.075	2.143	0.05	00°57'	0.532	0.200	0.122
9.00	2.517	1.543	68.26	0.917	1.745	98.47	67.14	32.71	34.43	0.146	1.947	0.15	00°22'	0.675	0.156	0.109
12.00	2.480	1.564	67.26	0.935	1.652	100	66.19	28.56	37.63	0.289	2.701	0.16	03°26'	0.551	0.165	0.092
15.00	2.617	1.571	66.84	0.942	1.779	98.31	74.21	35.97	38.24	0.291	3.506	0.23	00°27'	0.553	0.046	0.036
18.00	2.560	1.480	65.56	0.894	1.864	90.05	83.26	41.05	42.21	0.385	2.305	0.2	01°31'	0.575	0.084	0.047
21.00	2.476	1.563	67.41	0.934	1.652	100	70.23	35.25	34.89	0.126	1.518	0.08	00°45'	0.959	0.099	0.048
24.00	2.595	1.551	66.11	0.934	1.779	96.42	74.23	29.63	44.60	0.137	2.635	0.14	01°54'	0.876	0.154	0.090
27.00	2.583	1.492	67.45	0.891	1.899	91.75	90.19	39.55	50.64	0.140	2.089	0.08	02°40'	0.681	0.054	0.041
30.00	2.645	1.640	49.41	1.098	1.410	92.71	78.18	36.18	42.00	-	-	-	-	-	-	-
33.00	2.627	1.660	53.86	1.079	1.435	98.61	-	-	-	-	-	-	-	-	-	-
36.00	2.609	1.740	43.70	1.211	1.155	98.74	-	-	-	-	-	-	-	-	-	-
39.00	2.515	1.810	38.74	1.305	0.928	100	-	-	-	-	-	-	-	-	-	-
42.00	2.625	1.370	68.76	0.812	2.234	80.81	-	-	-	-	-	-	-	-	-	-
45.00	2.624	1.490	55.92	0.956	1.746	84.05	-	-	-	-	-	-	-	-	-	-
48.00	2.563	1.720	23.83	1.389	0.845	72.26	-	-	-	-	-	-	-	-	-	-
51.00	2.561	1.600	59.22	1.005	1.549	97.94	-	-	-	-	-	-	-	-	-	-
54.00	2.573	1.600	54.35	1.037	1.482	94.35	-	-	-	-	-	-	-	-	-	-
57.00	2.627	1.620	54.61	1.048	1.507	95.19	-	-	-	-	-	-	-	-	-	-
60.00	2.529	1.650	55.23	1.063	1.379	100	-	-	-	-	-	-	-	-	-	-

## Lampiran 2 (Perhitungan Manual)

Perhitungan manual (contoh untuk tiang vertikal) ini dilakukan untuk memverifikasi ketepatan hasil permodelan pada program SAP2000.





Data:

- $H (Tr2) = 100 \text{ ton} \rightarrow H (Tr2)$  untuk setiap tiang = 6,25 ton
- Panjang tiang = 63,5 m
- Kedalaman tiang dalam tanah = 50 m
- Jarak antar pegas = 10 m
- Diameter tiang = 600 mm
- Tebal tiang = 100 mm
- Jumlah elemen = 6
- $E \text{ beton} = 25 \text{ GPa}$
- Luas penampang =

$$\frac{\pi}{4} (0,6^2 - 0,4^2) = 0,1571 \text{ m}^2$$

$$\bullet \quad I = \frac{\pi}{64} \times (0,6^4 - (0,6 - 0,2)^4) = 0,0051$$

- Panjang elemen:

- Elemen 1 = 13,5 m

- Elemen 2 - 6 = 10 m

$$\frac{EI}{L^3} = \frac{(2,5 \times 10^6) \times 0,0051}{13,5^3} = 5.187$$

$$\frac{EI}{L^3} = \frac{(2,5 \times 10^6) \times 0,0051}{10^3} = 12.763$$

### Perhitungan Kekakuan Pegas

Elevasi	N-SPT	no spring	kh (N/cm3)	kh (ton/m3)	L elemen (m)	A (m2)	ks (ton/m)
2 - 13	1	1	4	400	5	3	1200
		2	4	400	6	3.6	3360
13 - 30	4	2	8	800	4	2.4	
		3	8	800	10	6	4800
		4	8	800	3	1.8	21960
30 - 36	24	4	47	4700	6	3.6	
36 - 42	35	4	60	6000	1	0.6	
		5	60	6000	5	3	45000
42 - 51	48	5	90	9000	5	3	
		6	90	9000	4	2.4	27600
51 - 57	58	6	100	10000	1	0.6	



## Matriks sistem tiang dan tanah

Kondisi batas:  $\theta_1 = 0, v_7 = 0$

$$[K] = \begin{pmatrix} 62.2 & 420.2 & -62.2 & 420.2 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 420.2 & 3781.5 & 420.2 & 1890.8 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ -62.2 & 420.2 & 1415.4 & 345.6 & -153.2 & 765.8 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 420.2 & 1890.8 & 345.6 & 8886.6 & -765.8 & 2552.5 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & -153.2 & -765.8 & 3666.3 & 0.0 & -153.2 & 765.8 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 765.8 & 2552.5 & 0.0 & 10210.2 & -765.8 & 2552.5 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & -153.2 & -765.8 & 5106.3 & 0.0 & -153.2 & 765.8 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 765.8 & 2552.5 & 0.0 & 10210.2 & -765.8 & 2552.5 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & -153.2 & -765.8 & 22266.3 & 0.0 & -153.2 & 765.8 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 765.8 & 2552.5 & 0.0 & 10210.2 & -765.8 & 2552.5 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & -153.2 & -765.8 & 45306.3 & 0.0 & -153.2 & 765.8 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 765.8 & 2552.5 & 0.0 & 10210.2 & -765.8 & 2552.5 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 153.2 & 765.8 & 27753.2 & 765.8 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 765.8 & 2552.5 & -765.8 & 5105.1 \end{pmatrix}$$

$$[K] = \begin{pmatrix} 62.2 & -62.2 & 420.2 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ -62.2 & 1415.4 & 345.6 & -153.2 & 765.8 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 420.2 & 345.6 & 8886.6 & -765.8 & 2552.5 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & -153.2 & -765.8 & 3666.3 & 0.0 & -153.2 & 765.8 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 765.8 & 2552.5 & 0.0 & 10210.2 & -765.8 & 2552.5 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & -153.2 & -765.8 & 5106.3 & 0.0 & -153.2 & 765.8 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 765.8 & 2552.5 & 0.0 & 10210.2 & -765.8 & 2552.5 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & -153.2 & -765.8 & 22266.3 & 0.0 & -153.2 & 765.8 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 765.8 & 2552.5 & 0.0 & 10210.2 & -765.8 & 2552.5 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & -153.2 & -765.8 & 45306.3 & 0.0 & 0.0 & 765.8 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 765.8 & 2552.5 & 0.0 & 10210.2 & -765.8 & 2552.5 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 765.8 & 2552.5 & 5105.1 & 0.0 \end{pmatrix}$$

$$[K^{-1}] = \begin{pmatrix} 2.71E-02 & 1.37E-03 & -1.43E-03 & -2.29E-04 & 2.71E-04 & 3.20E-05 & -5.37E-05 & -1.51E-06 & 1.18E-05 & 1.68E-07 & -3.25E-06 & 1.60E-06 & -1.60E-06 & -1.60E-06 \\ 1.37E-03 & 8.12E-04 & -8.27E-05 & 1.42E-05 & -4.32E-05 & -5.70E-06 & 1.03E-05 & 2.94E-07 & -2.32E-06 & -3.29E-08 & 6.36E-07 & -3.13E-07 & -3.13E-07 & -3.13E-07 \\ -1.43E-03 & -8.27E-05 & 2.00E-04 & 3.61E-05 & -4.66E-05 & -5.58E-06 & 9.48E-06 & 2.68E-07 & -2.10E-06 & -2.98E-08 & 5.75E-07 & -2.83E-07 & -2.83E-07 & -2.83E-07 \\ -2.29E-04 & 1.42E-05 & 3.61E-05 & 2.86E-04 & -4.11E-06 & 7.14E-06 & -2.18E-05 & -6.49E-07 & 5.27E-06 & 7.49E-08 & -1.45E-06 & 7.13E-07 & 7.13E-07 & 7.13E-07 \\ 2.71E-04 & -4.32E-05 & -4.66E-05 & -4.11E-06 & 1.22E-04 & 1.71E-05 & -3.21E-05 & -9.18E-07 & 7.25E-06 & 1.03E-07 & -1.99E-06 & 9.79E-07 & 9.79E-07 & 9.79E-07 \\ 3.20E-05 & -5.70E-06 & -5.58E-06 & 7.14E-06 & 1.71E-05 & 2.01E-04 & -7.06E-07 & 1.20E-06 & -1.60E-05 & -2.30E-07 & 4.47E-06 & -2.20E-06 & -2.20E-06 & -2.20E-06 \\ -5.37E-05 & 1.03E-05 & 9.48E-06 & -2.18E-05 & -3.21E-05 & -7.06E-07 & 1.16E-04 & 3.68E-06 & -3.10E-05 & -4.41E-07 & 8.53E-06 & -4.20E-06 & -4.20E-06 & -4.20E-06 \\ -1.51E-06 & 2.94E-07 & 2.68E-07 & -6.49E-07 & -9.18E-07 & 1.20E-06 & 3.68E-06 & 4.52E-05 & -3.59E-08 & 1.20E-07 & -3.86E-06 & 1.91E-06 & 1.91E-06 & 1.91E-06 \\ 1.18E-05 & -2.32E-06 & -2.10E-06 & 5.27E-06 & 7.25E-06 & -1.60E-05 & -3.10E-05 & -3.59E-08 & 1.15E-04 & 1.67E-06 & -3.29E-05 & 1.62E-05 & 1.62E-05 & 1.62E-05 \\ 1.68E-07 & -3.29E-08 & -2.98E-08 & 7.49E-08 & 1.03E-07 & -2.30E-07 & -4.41E-07 & 1.20E-07 & 1.67E-06 & 2.22E-05 & 4.61E-07 & -3.55E-06 & -3.55E-06 & -3.55E-06 \\ -3.25E-06 & 6.36E-07 & 5.75E-07 & -1.45E-06 & -1.99E-06 & 4.47E-06 & 8.53E-06 & -3.86E-06 & -3.29E-05 & 4.61E-07 & 1.22E-04 & -6.09E-05 & -6.09E-05 & -6.09E-05 \\ 1.60E-06 & -3.13E-07 & -2.83E-07 & 7.13E-07 & 9.79E-07 & -2.20E-06 & -4.20E-06 & 1.91E-06 & 1.62E-05 & -3.55E-06 & -6.09E-05 & 2.27E-04 & 2.27E-04 & 2.27E-04 \end{pmatrix}$$

## Gaya sistem

$$\{F\} = \begin{pmatrix} 6.25 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$



### Peralihan sistem

$$\{U\} = \begin{Bmatrix} 1.69E-01 \\ 8.56E-03 \\ -8.95E-03 \\ -1.43E-03 \\ 1.69E-03 \\ 2.00E-04 \\ -3.35E-04 \\ -9.45E-06 \\ 7.40E-05 \\ 1.05E-06 \\ -2.03E-05 \\ 9.99E-06 \end{Bmatrix}$$

### Gaya dalam elemen

elemen 1

$$[K \ 1-2] = \begin{Bmatrix} 62.25 & 420.17 & -62.25 & 420.17 \\ 420.17 & 3781.55 & -420.17 & 1890.77 \\ -62.25 & -420.17 & 62.25 & -420.17 \\ 420.17 & 1890.77 & -420.17 & 3781.55 \end{Bmatrix}$$

$$[U^{BNE} \ 1-2] = \begin{Bmatrix} 0.17 \\ 0.00 \\ 0.01 \\ -0.01 \end{Bmatrix}$$

$$[F^{BNE} \ 1-2] = \begin{Bmatrix} 6.25 \\ 50.65 \\ -6.25 \\ 33.72 \end{Bmatrix}$$

$$[F^{GDE} \ 1-2] = \begin{Bmatrix} 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \end{Bmatrix}$$

$$[F \ 1-2] = \begin{Bmatrix} 6.25 \\ 50.65 \\ -6.25 \\ 33.72 \end{Bmatrix}$$

elemen 2

$$[K \ 2-3] = \begin{Bmatrix} 153.15 & 765.76 & -153.15 & 765.76 \\ 765.76 & 5105.09 & -765.76 & 2552.54 \\ -153.15 & -765.76 & 153.15 & -765.76 \\ 765.76 & 2552.54 & -765.76 & 5105.09 \end{Bmatrix}$$

$$[U^{BNE} \ 2-3] = \begin{Bmatrix} 0.01 \\ -0.01 \\ 0.00 \\ 0.00 \end{Bmatrix}$$

$$[F^{BNE} \ 2-3] = \begin{Bmatrix} -4.03 \\ -33.72 \\ 4.03 \\ -6.54 \end{Bmatrix}$$

$$[F^{GDE} \ 2-3] = \begin{Bmatrix} 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \end{Bmatrix}$$

$$[F \ 2-3] = \begin{Bmatrix} -4.03 \\ -33.72 \\ 4.03 \\ -6.54 \end{Bmatrix}$$

elemen 3

$$[K \ 3-4] = \begin{pmatrix} 153.15 & 765.76 & -153.15 & 765.76 \\ 765.76 & 5105.09 & -765.76 & 2552.54 \\ -153.15 & -765.76 & 153.15 & -765.76 \\ 765.76 & 2552.54 & -765.76 & 5105.09 \end{pmatrix}$$

$$[U^{BNE} \ 3-4] = \begin{pmatrix} 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \end{pmatrix}$$

$$[F^{BNE} \ 3-4] = \begin{pmatrix} 0.79 \\ 6.54 \\ -0.79 \\ 1.36 \end{pmatrix}$$

$$[F^{GDE} \ 3-4] = \begin{pmatrix} 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \end{pmatrix}$$

$$[F \ 3-4] = \begin{pmatrix} 0.79 \\ 6.54 \\ -0.79 \\ 1.36 \end{pmatrix}$$

elemen 4

$$[K \ 4-5] = \begin{pmatrix} 153.15 & 765.76 & -153.15 & 765.76 \\ 765.76 & 5105.09 & -765.76 & 2552.54 \\ -153.15 & -765.76 & 153.15 & -765.76 \\ 765.76 & 2552.54 & -765.76 & 5105.09 \end{pmatrix}$$

$$[U^{BNE} \ 4-5] = \begin{pmatrix} 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \end{pmatrix}$$

$$[F^{BNE} \ 4-5] = \begin{pmatrix} -0.17 \\ -1.36 \\ 0.17 \\ -0.32 \end{pmatrix}$$

$$[F^{GDE} \ 4-5] = \begin{pmatrix} 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \end{pmatrix}$$

$$[F \ 4-5] = \begin{pmatrix} -0.17 \\ -1.36 \\ 0.17 \\ -0.32 \end{pmatrix}$$

elemen 5

$$[K \ 5-6] = \begin{pmatrix} 153.15 & 765.76 & -153.15 & 765.76 \\ 765.76 & 5105.09 & -765.76 & 2552.54 \\ -153.15 & -765.76 & 153.15 & -765.76 \\ 765.76 & 2552.54 & -765.76 & 5105.09 \end{pmatrix}$$

$$[U^{BNE} \ 5-6] = \begin{pmatrix} 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \end{pmatrix}$$

$$[F^{BNE} \ 5-6] = \begin{pmatrix} 0.06 \\ 0.37 \\ -0.06 \\ 0.19 \end{pmatrix}$$

$$[F^{GDE} \ 5-6] = \begin{pmatrix} 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \end{pmatrix}$$

$$[F \ 5-6] = \begin{pmatrix} 0.06 \\ 0.37 \\ -0.06 \\ 0.19 \end{pmatrix}$$

elemen 6

$$[K \ 6-7] = \begin{pmatrix} 153.15 & 765.76 & -153.15 & 765.76 \\ 765.76 & 5105.09 & -765.76 & 2552.54 \\ -153.15 & -765.76 & 153.15 & -765.76 \\ 765.76 & 2552.54 & -765.76 & 5105.09 \end{pmatrix}$$

$$[U^{BNE} \ 6-7] = \begin{pmatrix} 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \end{pmatrix}$$

$$[F^{BNE} \ 6-7] = \begin{pmatrix} -0.01 \\ -0.08 \\ 0.01 \\ 0.00 \end{pmatrix}$$

$$[F^{GDE} \ 6-7] = \begin{pmatrix} 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \end{pmatrix}$$

$$[F \ 6-7] = \begin{pmatrix} -0.01 \\ -0.08 \\ 0.01 \\ 0.00 \end{pmatrix}$$

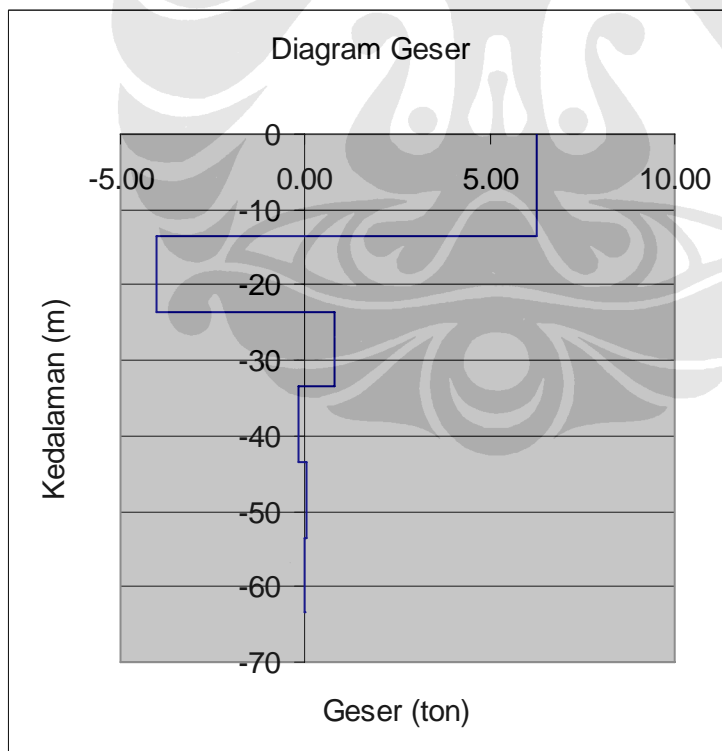
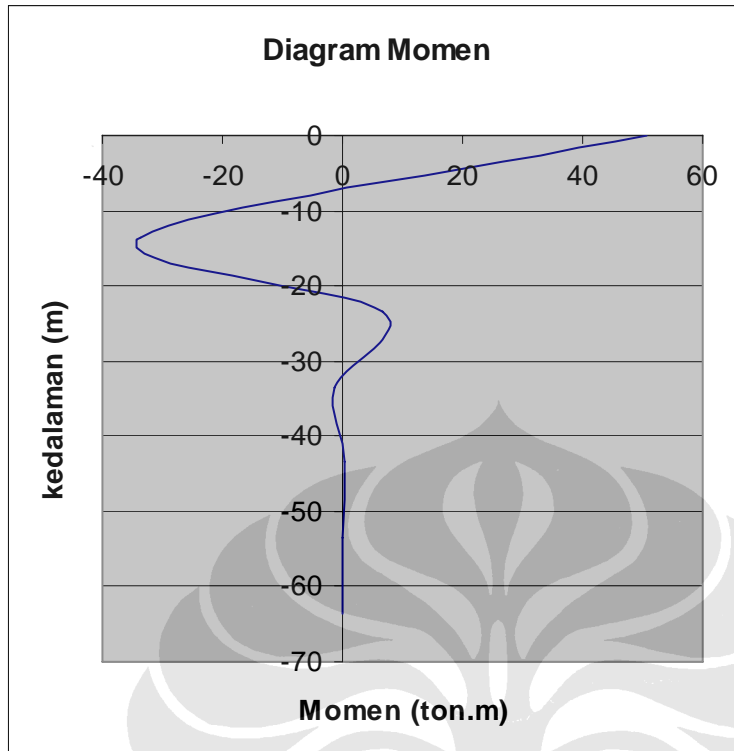
### Perbandingan Hasil Hitungan Manual dengan SAP

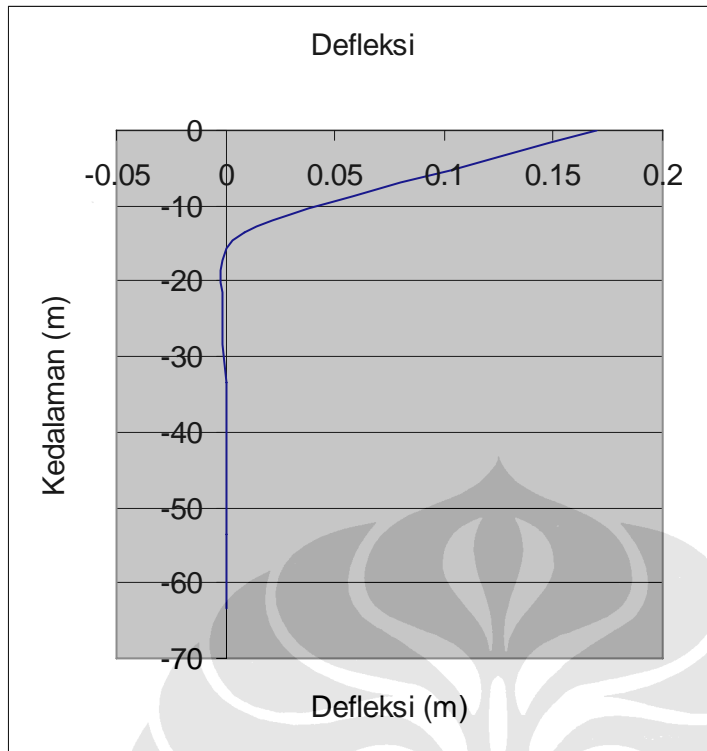
Kedalaman	manual			SAP2000 (spring 6)		
	M	V	U	M	V	U
0	50.6515	6.25	0.1694	50.7	6.25	0.171
-13.5	-33.724	-4.03	0.00856	-33.68	-4.01	0.0085
-23.5	6.54488	0.79	-0.0014	6.419	0.77	-0.0014
-33.5	-1.3629	-0.17	0.0002	-1.31	-0.161	0.0002
-43.5	0.37327	0.06	-9E-06	0.299	0.037	0
-53.5	-0.0773	-0.01	1.1E-06	-0.072	-0.01	0
-63.5	6.9E-18	-0.08	0	1.39E-17	-0.01	0

Kedalaman	SAP2000 (spring 16)		
	M	V	U
0.0	52.134	6.25	0.19647
-13.5	-32.241	-3.366	0.02404
-16.8	-21.021	-4.574	0.00151
-20.2	-5.7739	-1.969	-0.0033
-23.5	0.79015	-0.213	-0.0018
-26.8	1.49871	0.315	-0.0003
-30.2	0.44744	0.141	0.00011
-33.5	-0.0241	0.0125	8.1E-05
-36.8	-0.0656	-0.136	1.6E-05
-40.1	-0.0204	-0.0078	-3E-06
-43.5	0.00521	0.0013	-1E-06
-46.8	0.00078	0.0003	1E-07
-50.1	-0.0002	0	3.1E-08
-53.5	-1E-05	0	-4E-09
-56.8	7.7E-06	0	-5E-10
-60.1	-4E-07	0	1.4E-10
-63.5	0	0	0

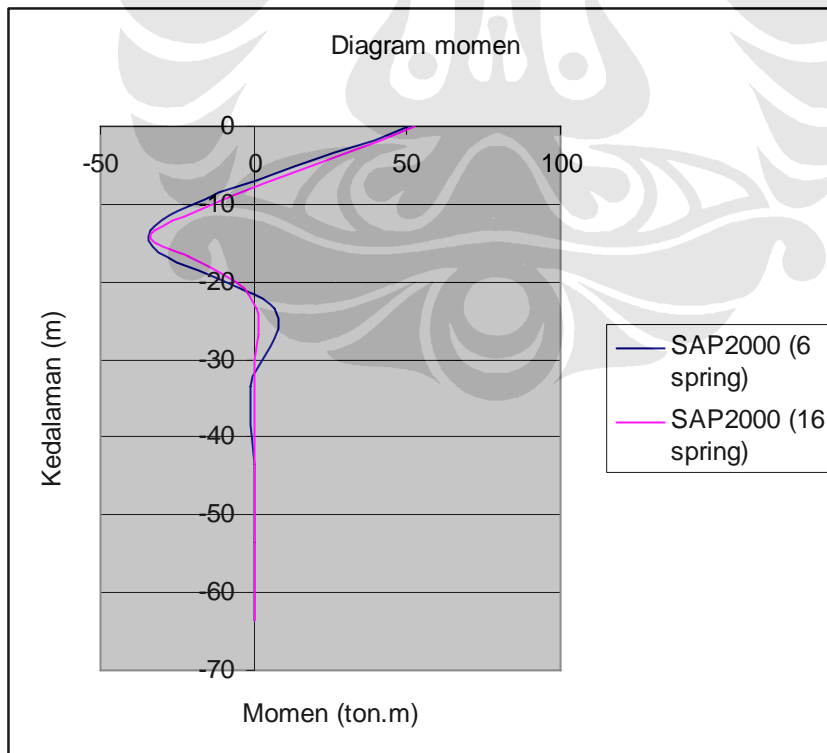
ket: M = momen, V = geser, U = defleksi

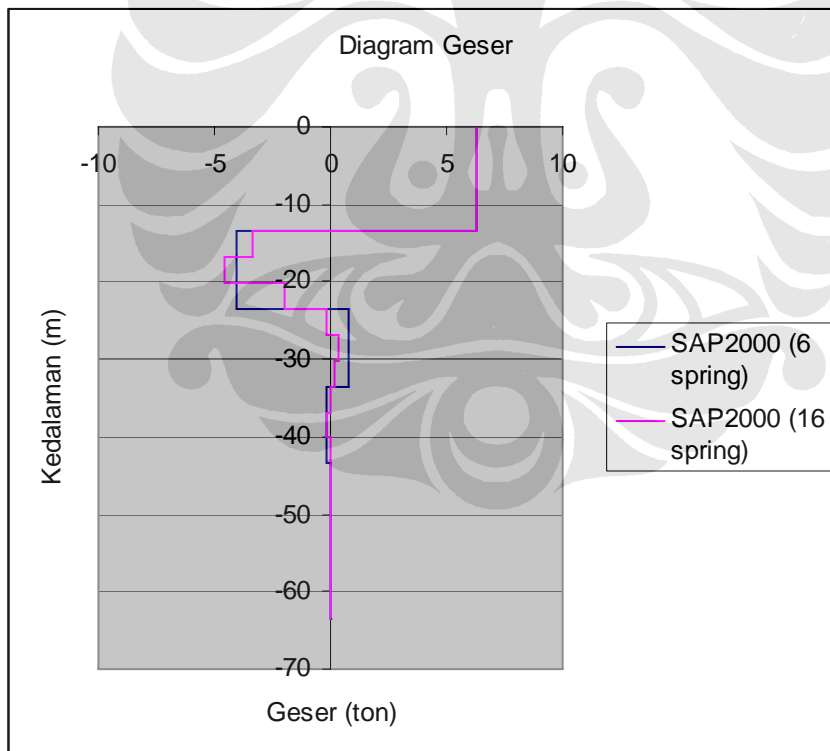
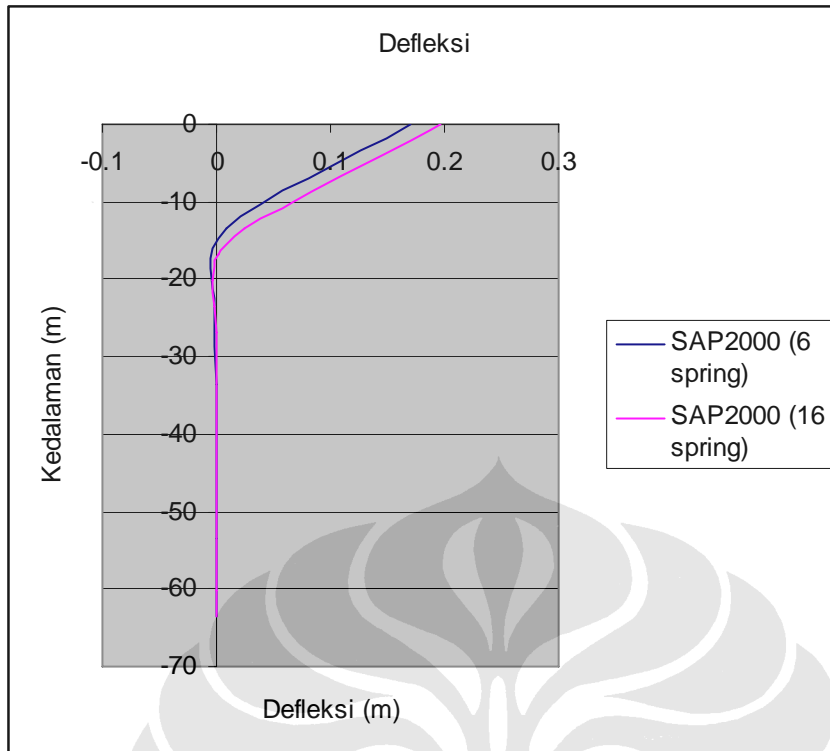
Hasil hitungan manual:





Hasil SAP2000 dengan 6 spring dan 16 spring:





Dari hasil yang diperoleh, dapat disimpulkan bahwa:

- Hasil perhitungan manual dengan program SAP2000 hampir sama, hanya berbeda 0,01.
- Jika dibandingkan hasil antara tiang yang menggunakan 6 spring dengan yang 16 spring, output dari tiang dengan 16 spring akan lebih detail dibandingkan dengan yang hanya menggunakan 6 spring.

