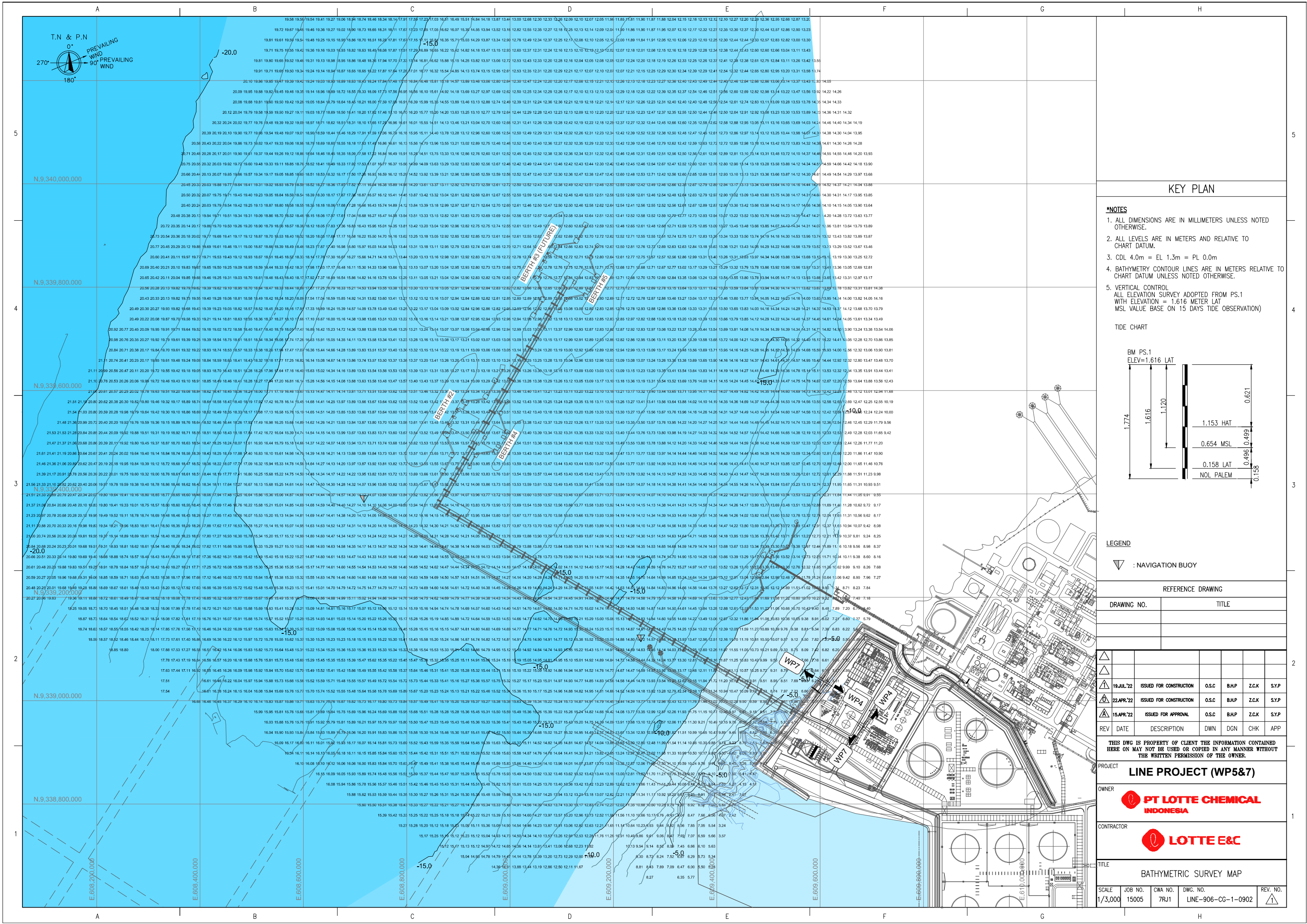


LAMPIRAN



KEY PLAN

NOTES

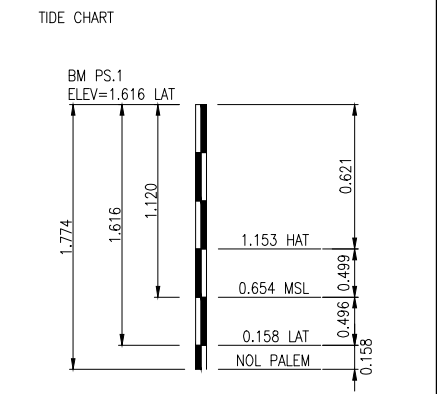
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.

2. ALL LEVELS ARE IN METERS AND RELATIVE TO CHART DATUM.

3. CDL 4.0m = EL 1.3m = PL 0.0m

4. BATHYMETRY CONTROL LINES ARE IN METERS RELATIVE TO CHART DATUM UNLESS NOTED OTHERWISE.

5. VERTICAL CONTROL
ALL ELEVATION SURVEY ADOPTED FROM PS.1
WITH ELEVATION = 1.616 METER LAT
MSL VALUE BASE ON 15 DAYS TIDE OBSERVATION)



LEGEND

: NAVIGATION BUOY

REFERENCE DRAWING				
DRAWING NO.	TITLE			

REV	DATE	DESCRIPTION	DWN	DGN	CHK	APP

THIS DWG IS PROPERTY OF CLIENT THE INFORMATION CONTAINED HEREIN MAY NOT BE USED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF THE OWNER.

PROJECT

OWNER

CONTRACTOR

TITLE

LINE PROJECT (WP5&7)

PT LOTTE CHEMICAL
INDONESIA

LOTTE E&C

SCALE	JOB NO.	CWA NO.	DWG. NO.	REV. NO.
1/3,000	15005	7RJ1	LINE-906-CG-1-0902	

LAMPIRAN

ANALISIS KONSTANTA HARMONIK PASANG SURUT AIR LAUT DENGAN METODE ADMIRALTY



**Disusun oleh:
RIFDA SYAFRIDA
3336210010**

**JURUSAN TEKNIK SIPIL
FAKULTAS TEKNIK
UNIVERSITAS SULTAN AGENG TIRTAYASA
BANTEN
TAHUN 2024**

CONTOH DATA PENGAMATAN PASANG SURUT 30 HARIAN

PENGAMATAN PASANG SURUT PELABUHAN PELINDO REGIONAL II - BANTEN BULAN NOVEMBER 2023

Dalam Satuan Meter

Time Days	Days																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	1,5	1,6	1,6	1,6	1,5	1,3	1,2	1,1	1,1	1,2	1,3	1,4	1,5	1,6	1,5	1,4	1,2	1,0	0,8	0,8	0,8	0,9	1,0	1,2	1,3
2	1,3	1,5	1,6	1,6	1,5	1,4	1,3	1,2	1,1	1,2	1,2	1,3	1,5	1,5	1,5	1,4	1,3	1,1	1,0	0,9	0,8	0,9	1,0	1,1	1,2
3	1,3	1,4	1,5	1,6	1,5	1,4	1,4	1,3	1,2	1,2	1,3	1,3	1,4	1,5	1,5	1,5	1,3	1,2	1,1	1,0	0,9	0,9	1,1	1,1	1,2
4	1,2	1,3	1,4	1,5	1,5	1,4	1,4	1,3	1,3	1,3	1,3	1,3	1,3	1,4	1,5	1,5	1,4	1,3	1,2	1,0	1,0	1,0	1,1	1,1	1,2
5	1,1	1,2	1,4	1,5	1,5	1,5	1,7	1,4	1,3	1,3	1,2	1,2	1,3	1,3	1,3	1,4	1,4	1,3	1,2	1,1	1,1	1,0	1,1	1,1	1,2
6	1,2	1,2	1,3	1,3	1,4	1,4	1,4	1,4	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,2	1,2	1,2	1,1	1,1	1,2	1,2
7	1,2	1,2	1,3	1,3	1,3	1,4	1,4	1,4	1,4	1,4	1,4	1,3	1,3	1,3	1,3	1,3	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
8	1,3	1,2	1,2	1,3	1,3	1,3	1,4	1,4	1,4	1,4	1,4	1,3	1,3	1,3	1,2	1,2	1,1	1,1	1,2	1,2	1,2	1,3	1,3	1,3	1,3
9	1,3	1,2	1,2	1,2	1,2	1,2	1,3	1,4	1,4	1,4	1,4	1,4	1,4	1,3	1,2	1,1	1,1	1,0	1,0	1,1	1,2	1,2	1,3	1,4	1,4
10	1,4	1,3	1,2	1,2	1,2	1,2	1,3	1,4	1,4	1,5	1,5	1,4	1,3	1,2	1,1	1,0	1,0	1,0	1,0	1,1	1,2	1,4	1,4	1,5	1,5
11	1,4	1,4	1,3	1,2	1,2	1,2	1,2	1,3	1,4	1,5	1,5	1,5	1,4	1,2	1,1	1,0	0,9	0,9	1,0	1,1	1,2	1,3	1,5	1,5	1,6
12	1,5	1,5	1,3	1,2	1,1	1,1	1,2	1,2	1,3	1,5	1,6	1,5	1,4	1,3	1,2	1,0	0,9	0,9	0,9	1,0	1,2	1,3	1,5	1,5	1,6
13	1,6	1,5	1,4	1,3	1,2	1,1	1,1	1,1	1,3	1,4	1,5	1,6	1,5	1,4	1,2	1,1	0,9	0,8	0,8	0,9	1,0	1,2	1,4	1,5	1,6
14	1,6	1,6	1,5	1,4	1,2	1,1	1,1	1,1	1,2	1,4	1,5	1,6	1,6	1,5	1,3	1,1	0,9	0,8	0,7	0,8	0,9	1,1	1,3	1,5	1,6
15	1,6	1,6	1,6	1,4	1,3	1,2	1,1	1,1	1,1	1,3	1,4	1,5	1,6	1,5	1,3	1,1	0,9	0,8	0,7	0,7	0,8	1,0	1,1	1,3	1,5
16	1,5	1,6	1,6	1,5	1,4	1,2	1,1	1,0	1,1	1,2	1,3	1,5	1,6	1,5	1,4	1,3	1,1	0,9	0,7	0,7	0,8	0,9	1,1	1,2	1,3
17	1,4	1,6	1,6	1,6	1,4	1,3	1,2	1,1	1,1	1,1	1,2	1,3	1,5	1,5	1,5	1,3	1,2	1,0	0,8	0,7	0,7	0,8	1,0	1,1	1,2
18	1,3	1,5	1,6	1,6	1,5	1,4	1,3	1,2	1,1	1,1	1,2	1,3	1,4	1,5	1,5	1,4	1,3	1,1	1,0	0,8	0,8	0,8	0,9	1,1	1,2
19	1,2	1,3	1,4	1,6	1,5	1,5	1,4	1,3	1,2	1,1	1,2	1,2	1,3	1,4	1,5	1,5	1,4	1,3	1,1	1,0	0,9	0,9	0,9	1,0	1,1
20	1,1	1,2	1,4	1,5	1,5	1,5	1,4	1,4	1,3	1,2	1,2	1,2	1,3	1,3	1,4	1,4	1,4	1,3	1,2	1,1	1,0	1,0	1,0	1,1	1,2
21	1,1	1,2	1,3	1,4	1,5	1,5	1,5	1,5	1,4	1,4	1,3	1,3	1,3	1,3	1,3	1,3	1,4	1,4	1,3	1,3	1,2	1,2	1,2	1,2	1,2
22	1,2	1,2	1,2	1,3	1,4	1,5	1,6	1,6	1,6	1,5	1,4	1,4	1,3	1,2	1,2	1,3	1,3	1,3	1,4	1,4	1,4	1,4	1,3	1,3	1,3
23	1,3	1,3	1,2	1,3	1,4	1,4	1,5	1,6	1,6	1,6	1,5	1,4	1,3	1,2	1,1	1,1	1,1	1,1	1,2	1,3	1,4	1,4	1,4	1,4	1,4
24	1,3	1,3	1,2	1,2	1,2	1,3	1,4	1,5	1,6	1,6	1,6	1,4	1,3	1,2	1,1	1,0	1,0	1,0	1,1	1,2	1,4	1,5	1,6	1,5	1,6
25	1,5	1,5	1,4	1,2	1,3	1,3	1,3	1,4	1,5	1,6	1,6	1,5	1,3	1,1	1,0	0,9	0,8	0,8	0,9	1,1	1,2	1,4	1,5	1,6	1,6
26	1,6	1,5	1,3	1,2	1,1	1,1	1,2	1,3	1,4	1,5	1,5	1,5	1,4	1,3	1,1	0,9	0,8	0,8	0,8	0,9	1,1	1,3	1,5	1,6	1,6
27	1,6	1,6	1,5	1,3	1,2	1,1	1,1	1,1	1,3	1,4	1,5	1,6	1,5	1,3	1,2	1,0	0,8	0,7	0,7	0,8	1,0	1,1	1,4	1,5	1,6
28	1,6	1,6	1,5	1,4	1,2	1,1	1,1	1,1	1,2	1,3	1,5	1,6	1,6	1,4	1,3	1,1	0,9	0,7	0,7	0,7	0,9	1,1	1,3	1,5	1,6
29	1,6	1,6	1,6	1,5	1,4	1,2	1,1	1,1	1,2	1,3	1,4	1,5	1,6	1,5	1,4	1,2	1,0	0,8	0,7	0,7	0,8	1,0	1,2	1,3	1,5
30	1,5	1,6	1,6	1,6	1,4	1,3	1,2	1,1	1,1	1,2	1,3	1,4	1,5	1,5	1,4	1,3	1,1	1,0	0,8	0,8	0,8	0,9	1,0	1,1	1,2

TABEL-TABEL KONSTANTA YANG AKAN DIGUNAKAN

Tabel 1 KONSTANTA PENGALI (SKEMA 2)

Komponen	Waktu (Jam)																							
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
X_1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1
Y_1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	1	1	1	1
X_2	1	1	1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	1	1	1
Y_2	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1
X_4	1	0	-1	-1	0	1	1	0	-1	-1	0	1	1	0	-1	-1	0	1	1	0	-1	-1	0	1
Y_4	1	1	1	-1	-1	-1	1	1	1	-1	-1	-1	1	1	1	-1	-1	-1	1	1	1	-1	-1	-1

Tabel 2 KONSTANTA PENGALI (SKEMA 4)

Index Kedua	0	2	b	3	c	4	d
Konstanta Perkalian Untuk 29 Hari	-29	-1	0	-1	0	-1	0
Konstanta Perkalian Untuk 15 Hari	-15	1	0	5	0	1	0
Konstanta Perkalian Untuk X+B dan Y+B	1	1	0	-1	1	1	0
Untuk 29 Hari	1	1	-1	-1	1	1	-1
	1	1	-1	1	1	-1	-1
	1	1	-1	1	1	-1	-1
	1	-1	-1	1	1	-1	1
	1	-1	-1	1	-1	1	1
	1	-1	-1	1	-1	1	1
Untuk 15 Hari	1	-1	0	-1	-1	1	0
	1	-1	1	-1	-1	1	-1
	1	-1	1	-1	-1	-1	-1
	1	-1	1	-1	1	-1	-1
	1	1	1	-1	1	-1	1
	1	1	1	1	1	-1	1
	1	1	1	1	1	1	1
Hari Tengah-Tengah	1	1	0	1	0	1	0
Untuk 15 Hari	1	1	-1	1	-1	1	-1
	1	1	-1	1	-1	-1	-1
	1	1	-1	-1	-1	-1	-1
	1	-1	-1	-1	-1	-1	1
	1	-1	-1	-1	1	-1	1
	1	-1	-1	-1	1	1	1
	1	-1	0	-1	1	1	0
Untuk 29 Hari	1	-1	1	1	1	1	-1
	1	-1	1	1	1	1	-1
	1	-1	1	1	-1	-1	-1
	1	1	1	1	-1	-1	1
	1	1	1	1	-1	-1	1
	1	1	1	-1	-1	1	1
	1	1	0	-1	-1	1	0

Tabel 3 FAKTOR ANALISA PENGAMATAN 29 HARI (SKEMA 5 DAN SKEMA 6)

Komponen		S₀	M₂	S₂	N₂	K₁	O₁	M₄	MS₄
Skema 5 (PR Cos r)	X ₀₀	1,000							
	X ₁₀					1,000	-0,080		
	X ₁₂ - Y _{1b}		0,070			- 0,020	1,000		0,020
	X ₁₃ - Y _{1c}								
	X ₂₀		-0,030	1,000	-0,030				
	X ₂₂ - Y _{2b}		1,000	0,015	0,038	0,002	-0,058		-0,035
	X ₂₃ - Y _{2c}		-0,060		1,000				
	X ₄₂ - Y _{4b}		0,030						1,000
	X ₄₄ - Y _{4d}							1,000	0,080
Skema 6 (PR Sin r)	Y ₁₀								
	Y ₁₂ + X _{1b}		0,070			1,000	-0,080		
	Y ₁₃ + X _{1c}					- 0,020	1,000		0,030
	Y ₂₀		-0,030	1,000	-0,030				
	Y ₂₂ + X _{2b}		1,000	0,015	0,032		-0,058		-0,035
	Y ₂₃ + X _{2c}		-0,060		1,000				
	Y ₄₂ + X _{4b}		0,030					0,010	1,000
	Y ₄₄ + X _{4d}							1,000	0,080
Untuk Skema 7	Deler P		559	448	566	439	565	507	535
Untuk Skema 7	Konstanta P	696	333	345	327	173	160	307	318

Tabel 4 HUBUNGAN SUDUT ($^{\circ}$), w/fK_2 ($^{\circ}$) dan W/fK_2 ($^{\circ}$)

$S_2, MS_4, 2MS_6$			K_1, MK_2			$N_2, MN_4, 2MN_6$		
Sudut ($^{\circ}$)	w/fK_2 ($^{\circ}$)	W/fK_2 ($^{\circ}$)	Sudut ($^{\circ}$)	w/fK_2 ($^{\circ}$)	W/fK_2 ($^{\circ}$)	Sudut ($^{\circ}$)	w/fK_2 ($^{\circ}$)	W/fK_2 ($^{\circ}$)
0	0,7	-0,214	0	0	0,333	0	0	1,184
10	-6,6	-0,192	10	-2,5	0,316	10	1,6	1,182
20	-12,3	-0,131	20	-4,9	0,297	20	3,1	1,174
30	-15,5	-0,046	30	-7,3	0,271	30	4,6	1,163
40	-16,5	0,047	40	-9,6	0,239	40	5,9	1,147
50	-15,6	0,134	50	-11,8	0,201	50	7,2	1,127
60	-13,4	0,207	60	-13,8	0,157	60	8,3	1,104
70	-10,3	0,258	70	-15,6	0,107	70	9,2	1,077
80	-6,6	0,284	80	-17,1	0,053	80	9,9	1,048
90	-2,6	0,284	90	-18,3	-0,003	90	10,4	1,017
100	1,6	0,256	100	-19,1	-0,06	100	10,6	0,984
110	5,6	0,204	110	-19,3	-0,118	110	10,4	0,953
120	9,2	0,131	120	-19	-0,173	120	10	0,922
130	12	0,041	130	-17,8	-0,224	130	9,1	0,893
140	13,7	-0,058	140	-15,9	-0,268	140	7,8	0,867
150	13,6	-0,157	150	-13,1	-0,302	150	6,2	0,846
160	11,2	-0,245	160	-9,3	-0,323	160	4,3	0,83
170	6	-0,307	170	-4,9	-0,331	170	2,2	0,819
180	-0,9	-0,33	180	0	-0,302	180	0	0,816
190	-7,8	-0,308	190	4,9	-0,323	190	-2,2	0,819
200	-12,6	-0,247	200	9,3	-0,302	200	-4,3	0,83
210	-14,8	-0,163	210	13,1	-0,268	210	-6,2	0,846
220	-14,8	-0,067	220	15,9	-0,224	220	-7,8	0,867
230	-13	0,029	230	17,8	-0,173	230	-9,1	0,893
240	-9,8	0,115	240	19	-0,118	240	10	0,922
250	-6	0,186	250	19,3	-0,06	250	-10,4	0,953
260	-1,8	0,236	260	19,1	-0,003	260	-10,6	0,984
270	2,6	0,263	270	18,3	0,053	270	-10,4	1,017
280	6,9	0,265	280	17,1	0,107	280	-9,9	1,048
290	10,8	0,241	290	15,6	0,157	290	-9,2	1,077
300	14,1	0,192	300	13,8	0,201	300	-8,3	1,104
310	16,5	0,124	310	11,8	0,239	310	-7,2	1,127
320	17,5	0,039	320	9,6	0,271	320	-5,9	1,147
330	16,8	0,051	330	7,3	0,297	330	-4,6	1,163
340	13,7	-0,133	340	4,9	0,316	340	-3,1	1,174
350	8	-0,193	350	2,5	0,327	350	-1,6	1,182
360	0,7	-0,214	360	0	0,331	360	0	1,184
Sudut = $V + u$			Sudut = $2V + u$			Sudut = $3V$		
Untuk K_1			Untuk K_1			Untuk M minus		
$F=fK_1$			$F=fK_1$			2V untuk N		

ANALISIS PASANG SURUT

SKEMA 1: MENGUBAH DATA KE DALAM SATUAN CM. AMBIL SELAMA 29 HARI PENGUKURAN

TABEL HASIL SKEMA 1

Dalam Satuan cm

Jam Tgl	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Jam Tgl
2	134,0	150,0	157,0	157,0	149,0	138,0	125,0	115,0	114,0	117,0	123,0	132,0	145,0	154,0	153,0	143,0	128,0	112,0	97,0	87,0	83,0	89,0	103,0	114,0	2
3	127,0	142,0	152,0	155,0	152,0	144,0	136,0	126,0	119,0	120,0	125,0	131,0	139,0	148,0	152,0	146,0	134,0	119,0	110,0	97,0	91,0	93,0	105,0	113,0	3
4	121,0	132,0	142,0	150,0	149,0	144,0	140,0	130,0	126,0	125,0	125,0	130,0	133,0	142,0	153,0	148,0	135,0	125,0	118,0	103,0	98,0	95,0	107,0	114,0	4
5	114,0	123,0	144,0	153,0	145,0	145,0	174,2	139,0	131,0	128,0	124,0	124,0	129,0	133,0	134,0	136,0	136,0	128,0	119,0	114,0	106,0	104,0	107,0	112,0	5
6	117,0	124,0	127,0	131,0	135,0	139,0	139,0	137,0	133,0	131,0	128,0	129,0	129,0	129,0	129,0	129,0	129,0	126,0	121,0	117,0	113,0	113,0	114,0	116,0	6
7	122,0	124,0	126,0	128,0	132,0	137,0	140,0	140,0	142,0	142,0	137,0	133,0	132,0	129,0	126,0	126,0	124,0	123,0	123,0	122,0	124,0	124,0	124,0	124,0	7
8	126,0	124,0	122,0	125,0	127,0	129,0	136,0	141,0	142,0	142,0	140,0	133,0	128,0	122,0	119,0	115,0	114,0	114,0	118,0	123,0	124,0	129,0	129,0	129,0	8
9	127,0	124,0	119,0	118,0	119,0	124,0	131,0	135,0	142,0	144,0	141,0	135,0	126,0	118,0	110,0	106,0	103,0	104,0	109,0	115,0	124,0	134,0	136,0	137,0	9
10	136,0	128,0	122,0	118,0	117,0	122,0	129,0	135,0	143,0	146,0	148,0	139,0	130,0	119,0	109,0	102,0	97,0	97,0	102,0	113,0	124,0	135,0	142,0	147,0	10
11	143,0	138,0	127,0	121,0	115,0	115,0	123,0	130,0	139,0	146,0	151,0	146,0	135,0	123,0	109,0	97,0	92,0	91,0	97,0	107,0	117,0	134,0	149,0	155,0	11
12	151,0	146,0	134,0	123,0	114,0	113,0	117,0	123,0	133,0	148,0	156,0	154,0	144,0	132,0	116,0	100,0	90,0	87,0	91,0	100,0	115,0	129,0	146,0	150,0	12
13	158,0	153,0	141,0	127,0	117,0	110,0	110,0	114,0	128,0	142,0	153,0	158,0	152,0	138,0	121,0	105,0	88,0	80,0	81,0	89,0	101,0	118,0	139,0	153,0	13
14	160,0	161,0	152,0	136,0	123,0	114,0	108,0	112,0	123,0	137,0	151,0	160,0	157,0	147,0	128,0	108,0	91,0	79,0	73,0	81,0	93,0	107,0	125,0	147,0	14
15	159,0	161,0	155,0	144,0	128,0	115,0	107,0	106,0	113,0	125,0	137,0	150,0	155,0	147,0	131,0	114,0	92,0	76,0	68,0	69,0	77,0	96,0	113,0	132,0	15
16	151,0	160,0	158,0	150,0	136,0	123,0	111,0	104,0	109,0	119,0	131,0	146,0	158,0	154,0	142,0	127,0	107,0	87,0	72,0	68,0	75,0	89,0	105,0	124,0	16
17	142,0	156,0	159,0	155,0	144,0	130,0	117,0	107,0	107,0	113,0	121,0	134,0	148,0	152,0	147,0	134,0	118,0	100,0	81,0	72,0	72,0	82,0	96,0	112,0	17
18	129,0	145,0	156,0	158,0	152,0	140,0	129,0	115,0	111,0	111,0	121,0	129,0	140,0	150,0	153,0	142,0	129,0	114,0	98,0	84,0	78,0	81,0	93,0	108,0	18
19	119,0	133,0	144,0	155,0	151,0	146,0	137,0	126,0	115,0	114,0	117,0	124,0	130,0	140,0	146,0	146,0	138,0	126,0	113,0	100,0	90,0	88,0	94,0	104,0	19
20	114,0	123,0	135,0	146,0	150,0	149,0	144,0	136,0	127,0	121,0	119,0	122,0	125,0	130,0	135,0	139,0	139,0	130,0	121,0	114,0	104,0	98,0	100,0	106,0	20
21	112,0	120,0	128,0	138,0	145,0	150,0	151,0	148,0	142,0	136,0	132,0	129,0	127,0	128,0	131,0	133,0	137,0	137,0	132,0	128,0	121,0	118,0	116,0	117,0	21
22	121,0	122,0	124,0	133,0	141,0	150,0	155,0	158,0	156,0	151,0	139,0	135,0	128,0	124,0	123,0	125,0	129,0	132,0	136,0	137,0	136,0	136,0	133,0	129,0	22
23	128,0	127,0	123,0	128,0	138,0	144,0	149,0	155,0	161,0	157,0	148,0	137,0	126,0	117,0	113,0	111,0	112,0	114,0	123,0	131,0	137,0	139,0	141,0	139,0	23
24	134,0	127,0	120,0	122,0	124,0	133,0	143,0	154,0	160,0	162,0	156,0	144,0	131,0	116,0	106,0	97,0	98,0	101,0	111,0	124,0	138,0	149,0	157,0	153,0	24
25	153,0	148,0	135,0	123,0	125,0	126,0	129,0	141,0	154,0	160,0	157,0	149,0	134,0	113,0	99,0	89,0	83,0	82,0	93,0	107,0	124,0	142,0	152,0	156,0	25
26	156,0	147,0	132,0	121,0	113,0	113,0	118,0	126,0	138,0	150,0	154,0	152,0	140,0	125,0	108,0	88,0	77,0	75,0	80,0	94,0	111,0	131,0	149,0	160,0	26
27	162,0	157,0	146,0	131,0	116,0	108,0	108,0	114,0	128,0	141,0	152,0	156,0	149,0	134,0	117,0	95,0	78,0	70,0	70,0	80,0	96,0	114,0	136,0	154,0	27
28	161,0	159,0	149,0	138,0	121,0	112,0	107,0	112,0	121,0	134,0	147,0	156,0	155,0	142,0	127,0	107,0	89,0	73,0	69,0	72,0	87,0	105,0	125,0	146,0	28
29	159,0	162,0	162,0	153,0	137,0	124,0	113,0	111,0	115,0	125,0	138,0	151,0	158,0	152,0	139,0	121,0	101,0	83,0	72,0	72,0	83,0	97,0	115,0	134,0	29
30	152,0	160,0	161,0	156,0	143,0	129,0	118,0	112,0	111,0	121,0	132,0	143,0	153,0	154,0	143,0	129,0	113,0	95,0	82,0	78,0	80,0	91,0	101,0	117,0	30

SKEMA 2: MENGALIKAN SELURUH NILAI HASIL PADA TABEL SKEMA 1 DENGAN MASING-MASING BARIS (X1, Y1, X2 DST) TABEL 1

TABEL HITUNGAN SKEMA 2 (X1)

Jam Tgl	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Jam Tgl
2	-134,0	-150,0	-157,0	-157,0	-149,0	-138,0	125,0	115,0	114,0	117,0	123,0	132,0	145,0	154,0	153,0	143,0	128,0	112,0	-97,0	-87,0	-83,0	-89,0	-103,0	-114,0	2
3	-127,0	-142,0	-152,0	-155,0	-152,0	-144,0	136,0	126,0	119,0	120,0	125,0	131,0	139,0	148,0	152,0	146,0	134,0	119,0	-110,0	-97,0	-91,0	-93,0	-105,0	-113,0	3
4	-121,0	-132,0	-142,0	-150,0	-149,0	-144,0	140,0	130,0	126,0	125,0	125,0	130,0	133,0	142,0	153,0	148,0	135,0	125,0	-118,0	-103,0	-98,0	-95,0	-107,0	-114,0	4
5	-114,0	-123,0	-144,0	-153,0	-145,0	-145,0	174,2	139,0	131,0	128,0	124,0	124,0	129,0	133,0	134,0	136,0	136,0	128,0	-119,0	-114,0	-106,0	-104,0	-107,0	-112,0	5
6	-117,0	-124,0	-127,0	-131,0	-135,0	-139,0	139,0	137,0	133,0	131,0	128,0	129,0	129,0	129,0	129,0	129,0	129,0	126,0	-121,0	-117,0	-113,0	-113,0	-114,0	-116,0	6
7	-122,0	-124,0	-126,0	-128,0	-132,0	-137,0	140,0	140,0	142,0	142,0	137,0	133,0	132,0	129,0	126,0	126,0	124,0	123,0	-123,0	-122,0	-124,0	-124,0	-124,0	-124,0	7
8	-126,0	-124,0	-122,0	-125,0	-127,0	-129,0	136,0	141,0	142,0	142,0	140,0	133,0	128,0	122,0	119,0	115,0	114,0	114,0	-118,0	-123,0	-124,0	-129,0	-129,0	-129,0	8
9	-127,0	-124,0	-119,0	-118,0	-119,0	-124,0	131,0	135,0	142,0	144,0	141,0	135,0	126,0	118,0	110,0	106,0	103,0	104,0	-109,0	-115,0	-124,0	-134,0	-136,0	-137,0	9
10	-136,0	-128,0	-122,0	-118,0	-117,0	-122,0	129,0	135,0	143,0	146,0	148,0	139,0	130,0	119,0	109,0	102,0	97,0	97,0	-102,0	-113,0	-124,0	-135,0	-142,0	-147,0	10
11	-143,0	-138,0	-127,0	-121,0	-115,0	-115,0	123,0	130,0	139,0	146,0	151,0	146,0	135,0	123,0	109,0	97,0	92,0	91,0	-97,0	-107,0	-117,0	-134,0	-149,0	-155,0	11
12	-151,0	-146,0	-134,0	-123,0	-114,0	-113,0	117,0	123,0	133,0	148,0	156,0	154,0	144,0	132,0	116,0	100,0	90,0	87,0	-91,0	-100,0	-115,0	-129,0	-146,0	-150,0	12
13	-158,0	-153,0	-141,0	-127,0	-117,0	-110,0	110,0	114,0	128,0	142,0	153,0	158,0	152,0	138,0	121,0	105,0	88,0	80,0	-81,0	-89,0	-101,0	-118,0	-139,0	-153,0	13
14	-160,0	-161,0	-152,0	-136,0	-123,0	-114,0	108,0	112,0	123,0	137,0	151,0	160,0	157,0	147,0	128,0	108,0	91,0	79,0	-73,0	-81,0	-93,0	-107,0	-125,0	-147,0	14
15	-159,0	-161,0	-155,0	-144,0	-128,0	-115,0	107,0	106,0	113,0	125,0	137,0	150,0	155,0	147,0	131,0	114,0	92,0	76,0	-68,0	-69,0	-77,0	-96,0	-113,0	-132,0	15
16	-151,0	-160,0	-158,0	-150,0	-136,0	-123,0	111,0	104,0	109,0	119,0	131,0	146,0	158,0	154,0	142,0	127,0	107,0	87,0	-72,0	-68,0	-75,0	-89,0	-105,0	-124,0	16
17	-142,0	-156,0	-159,0	-155,0	-144,0	-130,0	117,0	107,0	107,0	113,0	121,0	134,0	148,0	152,0	147,0	134,0	118,0	100,0	-81,0	-72,0	-72,0	-82,0	-96,0	-112,0	17
18	-129,0	-145,0	-156,0	-158,0	-152,0	-140,0	129,0	115,0	111,0	111,0	121,0	129,0	140,0	150,0	153,0	142,0	129,0	114,0	-98,0	-84,0	-78,0	-81,0	-93,0	-108,0	18
19	-119,0	-133,0	-144,0	-155,0	-151,0	-146,0	137,0	126,0	115,0	114,0	117,0	124,0	130,0	140,0	146,0	146,0	138,0	126,0	-113,0	-100,0	-90,0	-88,0	-94,0	-104,0	19
20	-114,0	-123,0	-135,0	-146,0	-150,0	-149,0	144,0	136,0	127,0	121,0	119,0	122,0	125,0	130,0	135,0	139,0	139,0	130,0	-121,0	-114,0	-104,0	-98,0	-100,0	-106,0	20
21	-112,0	-120,0	-128,0	-138,0	-145,0	-150,0	151,0	148,0	142,0	136,0	132,0	129,0	127,0	128,0	131,0	133,0	137,0	137,0	-132,0	-128,0	-121,0	-118,0	-116,0	-117,0	21
22	-121,0	-122,0	-124,0	-133,0	-141,0	-150,0	155,0	158,0	156,0	151,0	139,0	135,0	128,0	124,0	123,0	125,0	129,0	132,0	-136,0	-137,0	-136,0	-136,0	-133,0	-129,0	22
23	-128,0	-127,0	-123,0	-128,0	-138,0	-144,0	149,0	155,0	161,0	157,0	148,0	137,0	126,0	117,0	113,0	111,0	112,0	114,0	-123,0	-131,0	-137,0	-139,0	-141,0	-139,0	23
24	-134,0	-127,0	-120,0	-122,0	-124,0	-133,0	143,0	154,0	160,0	162,0	156,0	144,0	131,0	116,0	106,0	97,0	98,0	101,0	-111,0	-124,0	-138,0	-149,0	-157,0	-153,0	24
25	-153,0	-148,0	-135,0	-123,0	-125,0	-126,0	129,0	141,0	154,0	160,0	157,0	149,0	134,0	113,0	99,0	89,0	83,0	82,0	-93,0	-107,0	-124,0	-142,0	-152,0	-156,0	25
26	-156,0	-147,0	-132,0	-121,0	-113,0	-113,0	118,0	126,0	138,0	150,0	154,0	152,0	140,0	125,0	108,0	88,0	77,0	75,0	-80,0	-94,0	-111,0	-131,0	-149,0	-160,0	26
27	-162,0	-157,0	-146,0	-131,0	-116,0	-108,0	108,0	114,0	128,0	141,0	152,0	156,0	149,0	134,0	117,0	95,0	78,0	70,0	-70,0	-80,0	-96,0	-114,0	-136,0	-154,0	27
28	-161,0	-159,0	-149,0	-138,0	-121,0	-112,0	107,0	112,0	121,0	134,0	147,0	156,0	155,0	142,0	127,0	107,0	89,0	73,0	-69,0	-72,0	-87,0	-105,0	-125,0	-146,0	28
29	-159,0	-162,0	-162,0	-153,0	-137,0	-124,0	113,0	111,0	115,0	125,0	138,0	151,0	158,0	152,0	139,0	121,0	101,0	83,0	-72,0	-72,0	-83,0	-97,0	-115,0	-134,0	29
30	-152,0	-160,0	-161,0	-156,0	-143,0	-129,0	118,0	112,0	111,0	121,0	132,0	143,0	153,0	154,0	143,0	129,0	113,0	95,0	-82,0	-78,0	-80,0	-91,0	-101,0	-117,0	30

TABEL HITUNGAN SKEMA 2 (Y1)

Jam Tgl	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Jam Tgl
2	-134,0	-150,0	-157,0	-157,0	-149,0	-138,0	-125,0	-115,0	-114,0	-117,0	-123,0	-132,0	145,0	154,0	153,0	143,0	128,0	112,0	97,0	87,0	83,0	89,0	103,0	114,0	2
3	-127,0	-142,0	-152,0	-155,0	-152,0	-144,0	-136,0	-126,0	-119,0	-120,0	-125,0	-131,0	139,0	148,0	152,0	146,0	134,0	119,0	110,0	97,0	91,0	93,0	105,0	113,0	3
4	-121,0	-132,0	-142,0	-150,0	-149,0	-144,0	-140,0	-130,0	-126,0	-125,0	-125,0	-130,0	133,0	142,0	153,0	148,0	135,0	125,0	118,0	103,0	98,0	95,0	107,0	114,0	4
5	-114,0	-123,0	-144,0	-153,0	-145,0	-145,0	-174,2	-139,0	-131,0	-128,0	-124,0	-124,0	129,0	133,0	134,0	136,0	136,0	128,0	119,0	114,0	106,0	104,0	107,0	112,0	5
6	-117,0	-124,0	-127,0	-131,0	-135,0	-139,0	-139,0	-137,0	-133,0	-131,0	-128,0	-129,0	129,0	129,0	129,0	129,0	129,0	126,0	121,0	117,0	113,0	113,0	114,0	116,0	6
7	-122,0	-124,0	-126,0	-128,0	-132,0	-137,0	-140,0	-140,0	-142,0	-142,0	-137,0	-133,0	132,0	129,0	126,0	126,0	124,0	123,0	123,0	122,0	124,0	124,0	124,0	124,0	7
8	-126,0	-124,0	-122,0	-125,0	-127,0	-129,0	-136,0	-141,0	-142,0	-142,0	-140,0	-133,0	128,0	122,0	119,0	115,0	114,0	114,0	118,0	123,0	124,0	129,0	129,0	129,0	8
9	-127,0	-124,0	-119,0	-118,0	-119,0	-124,0	-131,0	-135,0	-142,0	-144,0	-141,0	-135,0	126,0	118,0	110,0	106,0	103,0	104,0	109,0	115,0	124,0	134,0	136,0	137,0	9
10	-136,0	-128,0	-122,0	-118,0	-117,0	-122,0	-129,0	-135,0	-143,0	-146,0	-148,0	-139,0	130,0	119,0	109,0	102,0	97,0	97,0	102,0	113,0	124,0	135,0	142,0	147,0	10
11	-143,0	-138,0	-127,0	-121,0	-115,0	-115,0	-123,0	-130,0	-139,0	-146,0	-151,0	-146,0	135,0	123,0	109,0	97,0	92,0	91,0	97,0	107,0	117,0	134,0	149,0	155,0	11
12	-151,0	-146,0	-134,0	-123,0	-114,0	-113,0	-117,0	-123,0	-133,0	-148,0	-156,0	-154,0	144,0	132,0	116,0	100,0	90,0	87,0	91,0	100,0	115,0	129,0	146,0	150,0	12
13	-158,0	-153,0	-141,0	-127,0	-117,0	-110,0	-110,0	-114,0	-128,0	-142,0	-153,0	-158,0	152,0	138,0	121,0	105,0	88,0	80,0	81,0	89,0	101,0	118,0	139,0	153,0	13
14	-160,0	-161,0	-152,0	-136,0	-123,0	-114,0	-108,0	-112,0	-123,0	-137,0	-151,0	-160,0	157,0	147,0	128,0	108,0	91,0	79,0	73,0	81,0	93,0	107,0	125,0	147,0	14
15	-159,0	-161,0	-155,0	-144,0	-128,0	-115,0	-107,0	-106,0	-113,0	-125,0	-137,0	-150,0	155,0	147,0	131,0	114,0	92,0	76,0	68,0	69,0	77,0	96,0	113,0	132,0	15
16	-151,0	-160,0	-158,0	-150,0	-136,0	-123,0	-111,0	-104,0	-109,0	-119,0	-131,0	-146,0	158,0	154,0	142,0	127,0	107,0	87,0	72,0	68,0	75,0	89,0	105,0	124,0	16
17	-142,0	-156,0	-159,0	-155,0	-144,0	-130,0	-117,0	-107,0	-107,0	-113,0	-121,0	-134,0	148,0	152,0	147,0	134,0	118,0	100,0	81,0	72,0	72,0	82,0	96,0	112,0	17
18	-129,0	-145,0	-156,0	-158,0	-152,0	-140,0	-129,0	-115,0	-111,0	-111,0	-121,0	-129,0	140,0	150,0	153,0	142,0	129,0	114,0	98,0	84,0	78,0	81,0	93,0	108,0	18
19	-119,0	-133,0	-144,0	-155,0	-151,0	-146,0	-137,0	-126,0	-115,0	-114,0	-117,0	-124,0	130,0	140,0	146,0	146,0	138,0	126,0	113,0	100,0	90,0	88,0	94,0	104,0	19
20	-114,0	-123,0	-135,0	-146,0	-150,0	-149,0	-144,0	-136,0	-127,0	-121,0	-119,0	-122,0	125,0	130,0	135,0	139,0	139,0	130,0	121,0	114,0	104,0	98,0	100,0	106,0	20
21	-112,0	-120,0	-128,0	-138,0	-145,0	-150,0	-151,0	-148,0	-142,0	-136,0	-132,0	-129,0	127,0	128,0	131,0	133,0	137,0	137,0	132,0	128,0	121,0	118,0	116,0	117,0	21
22	-121,0	-122,0	-124,0	-133,0	-141,0	-150,0	-155,0	-158,0	-156,0	-151,0	-139,0	-135,0	128,0	124,0	123,0	125,0	129,0	132,0	136,0	137,0	136,0	136,0	133,0	129,0	22
23	-128,0	-127,0	-123,0	-128,0	-138,0	-144,0	-149,0	-155,0	-161,0	-157,0	-148,0	-137,0	126,0	117,0	113,0	111,0	112,0	114,0	123,0	131,0	137,0	139,0	141,0	139,0	23
24	-134,0	-127,0	-120,0	-122,0	-124,0	-133,0	-143,0	-154,0	-160,0	-162,0	-156,0	-144,0	131,0	116,0	106,0	97,0	98,0	101,0	111,0	124,0	138,0	149,0	157,0	153,0	24
25	-153,0	-148,0	-135,0	-123,0	-125,0	-126,0	-129,0	-141,0	-154,0	-160,0	-157,0	-149,0	134,0	113,0	99,0	89,0	83,0	82,0	93,0	107,0	124,0	142,0	152,0	156,0	25
26	-156,0	-147,0	-132,0	-121,0	-113,0	-113,0	-118,0	-126,0	-138,0	-150,0	-154,0	-152,0	140,0	125,0	108,0	88,0	77,0	75,0	80,0	94,0	111,0	131,0	149,0	160,0	26
27	-162,0	-157,0	-146,0	-131,0	-116,0	-108,0	-108,0	-114,0	-128,0	-141,0	-152,0	-156,0	149,0	134,0	117,0	95,0	78,0	70,0	70,0	80,0	96,0	114,0	136,0	154,0	27
28	-161,0	-159,0	-149,0	-138,0	-121,0	-112,0	-107,0	-112,0	-121,0	-134,0	-147,0	-156,0	155,0	142,0	127,0	107,0	89,0	73,0	69,0	72,0	87,0	105,0	125,0	146,0	28
29	-159,0	-162,0	-162,0	-153,0	-137,0	-124,0	-113,0	-111,0	-115,0	-125,0	-138,0	-151,0	158,0	152,0	139,0	121,0	101,0	83,0	72,0	72,0	83,0	97,0	115,0	134,0	29
30	-152,0	-160,0	-161,0	-156,0	-143,0	-129,0	-118,0	-112,0	-111,0	-121,0	-132,0	-143,0	153,0	154,0	143,0	129,0	113,0	95,0	82,0	78,0	80,0	91,0	101,0	117,0	30

TABEL HITUNGAN SKEMA 2 (X4)

Jam Tgl	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Jam Tgl
2	134,0	0,0	-157,0	-157,0	0,0	138,0	125,0	0,0	-114,0	-117,0	0,0	132,0	145,0	0,0	-153,0	-143,0	0,0	112,0	97,0	0,0	-83,0	-89,0	0,0	114,0	2
3	127,0	0,0	-152,0	-155,0	0,0	144,0	136,0	0,0	-119,0	-120,0	0,0	131,0	139,0	0,0	-152,0	-146,0	0,0	119,0	110,0	0,0	-91,0	-93,0	0,0	113,0	3
4	121,0	0,0	-142,0	-150,0	0,0	144,0	140,0	0,0	-126,0	-125,0	0,0	130,0	133,0	0,0	-153,0	-148,0	0,0	125,0	118,0	0,0	-98,0	-95,0	0,0	114,0	4
5	114,0	0,0	-144,0	-153,0	0,0	145,0	174,2	0,0	-131,0	-128,0	0,0	124,0	129,0	0,0	-134,0	-136,0	0,0	128,0	119,0	0,0	-106,0	-104,0	0,0	112,0	5
6	117,0	0,0	-127,0	-131,0	0,0	139,0	139,0	0,0	-133,0	-131,0	0,0	129,0	129,0	0,0	-129,0	-129,0	0,0	126,0	121,0	0,0	-113,0	-113,0	0,0	116,0	6
7	122,0	0,0	-126,0	-128,0	0,0	137,0	140,0	0,0	-142,0	-142,0	0,0	133,0	132,0	0,0	-126,0	-126,0	0,0	123,0	123,0	0,0	-124,0	-124,0	0,0	124,0	7
8	126,0	0,0	-122,0	-125,0	0,0	129,0	136,0	0,0	-142,0	-142,0	0,0	133,0	128,0	0,0	-119,0	-115,0	0,0	114,0	118,0	0,0	-124,0	-129,0	0,0	129,0	8
9	127,0	0,0	-119,0	-118,0	0,0	124,0	131,0	0,0	-142,0	-144,0	0,0	135,0	126,0	0,0	-110,0	-106,0	0,0	104,0	109,0	0,0	-124,0	-134,0	0,0	137,0	9
10	136,0	0,0	-122,0	-118,0	0,0	122,0	129,0	0,0	-143,0	-146,0	0,0	139,0	130,0	0,0	-109,0	-102,0	0,0	97,0	102,0	0,0	-124,0	-135,0	0,0	147,0	10
11	143,0	0,0	-127,0	-121,0	0,0	115,0	123,0	0,0	-139,0	-146,0	0,0	146,0	135,0	0,0	-109,0	-97,0	0,0	91,0	97,0	0,0	-117,0	-134,0	0,0	155,0	11
12	151,0	0,0	-134,0	-123,0	0,0	113,0	117,0	0,0	-133,0	-148,0	0,0	154,0	144,0	0,0	-116,0	-100,0	0,0	87,0	91,0	0,0	-115,0	-129,0	0,0	150,0	12
13	158,0	0,0	-141,0	-127,0	0,0	110,0	110,0	0,0	-128,0	-142,0	0,0	158,0	152,0	0,0	-121,0	-105,0	0,0	80,0	81,0	0,0	-101,0	-118,0	0,0	153,0	13
14	160,0	0,0	-152,0	-136,0	0,0	114,0	108,0	0,0	-123,0	-137,0	0,0	160,0	157,0	0,0	-128,0	-108,0	0,0	79,0	73,0	0,0	-93,0	-107,0	0,0	147,0	14
15	159,0	0,0	-155,0	-144,0	0,0	115,0	107,0	0,0	-113,0	-125,0	0,0	150,0	155,0	0,0	-131,0	-114,0	0,0	76,0	68,0	0,0	-77,0	-96,0	0,0	132,0	15
16	151,0	0,0	-158,0	-150,0	0,0	123,0	111,0	0,0	-109,0	-119,0	0,0	146,0	158,0	0,0	-142,0	-127,0	0,0	87,0	72,0	0,0	-75,0	-89,0	0,0	124,0	16
17	142,0	0,0	-159,0	-155,0	0,0	130,0	117,0	0,0	-107,0	-113,0	0,0	134,0	148,0	0,0	-147,0	-134,0	0,0	100,0	81,0	0,0	-72,0	-82,0	0,0	112,0	17
18	129,0	0,0	-156,0	-158,0	0,0	140,0	129,0	0,0	-111,0	-111,0	0,0	129,0	140,0	0,0	-153,0	-142,0	0,0	114,0	98,0	0,0	-78,0	-81,0	0,0	108,0	18
19	119,0	0,0	-144,0	-155,0	0,0	146,0	137,0	0,0	-115,0	-114,0	0,0	124,0	130,0	0,0	-146,0	-146,0	0,0	126,0	113,0	0,0	-90,0	-88,0	0,0	104,0	19
20	114,0	0,0	-135,0	-146,0	0,0	149,0	144,0	0,0	-127,0	-121,0	0,0	122,0	125,0	0,0	-135,0	-139,0	0,0	130,0	121,0	0,0	-104,0	-98,0	0,0	106,0	20
21	112,0	0,0	-128,0	-138,0	0,0	150,0	151,0	0,0	-142,0	-136,0	0,0	129,0	127,0	0,0	-131,0	-133,0	0,0	137,0	132,0	0,0	-121,0	-118,0	0,0	117,0	21
22	121,0	0,0	-124,0	-133,0	0,0	150,0	155,0	0,0	-156,0	-151,0	0,0	135,0	128,0	0,0	-123,0	-125,0	0,0	132,0	136,0	0,0	-136,0	-136,0	0,0	129,0	22
23	128,0	0,0	-123,0	-128,0	0,0	144,0	149,0	0,0	-161,0	-157,0	0,0	137,0	126,0	0,0	-113,0	111,0	0,0	114,0	123,0	0,0	-137,0	-139,0	0,0	139,0	23
24	134,0	0,0	-120,0	-122,0	0,0	133,0	143,0	0,0	-160,0	-162,0	0,0	144,0	131,0	0,0	-106,0	-97,0	0,0	101,0	111,0	0,0	-138,0	-149,0	0,0	153,0	24
25	153,0	0,0	-135,0	-123,0	0,0	126,0	129,0	0,0	-154,0	-160,0	0,0	149,0	134,0	0,0	-99,0	-89,0	0,0	82,0	93,0	0,0	-124,0	-142,0	0,0	156,0	25
26	156,0	0,0	-132,0	-121,0	0,0	113,0	118,0	0,0	-138,0	-150,0	0,0	152,0	140,0	0,0	-108,0	-88,0	0,0	75,0	80,0	0,0	-111,0	-131,0	0,0	160,0	26
27	162,0	0,0	-146,0	-131,0	0,0	108,0	108,0	0,0	-128,0	-141,0	0,0	156,0	149,0	0,0	-117,0	-95,0	0,0	70,0	70,0	0,0	-96,0	-114,0	0,0	154,0	27
28	161,0	0,0	-149,0	-138,0	0,0	112,0	107,0	0,0	-121,0	-134,0	0,0	156,0	155,0	0,0	-127,0	-107,0	0,0	73,0	69,0	0,0	-87,0	-105,0	0,0	146,0	28
29	159,0	0,0	-162,0	-153,0	0,0	124,0	113,0	0,0	-115,0	-125,0	0,0	151,0	158,0	0,0	-139,0	-121,0	0,0	83,0	72,0	0,0	-83,0	-97,0	0,0	134,0	29
30	152,0	0,0	-161,0	-156,0	0,0	129,0	118,0	0,0	-111,0	-121,0	0,0	143,0	153,0	0,0	-143,0	-129,0	0,0	95,0	82,0	0,0	-80,0	-91,0	0,0	117,0	30

TABEL HITUNGAN SKEMA 2 (Y4)

Jam Tgl	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Jam Tgl
2	134,0	150,0	157,0	-157,0	-149,0	-138,0	125,0	115,0	114,0	-117,0	-123,0	-132,0	145,0	154,0	153,0	-143,0	-128,0	-112,0	97,0	87,0	83,0	-89,0	-103,0	-114,0	2
3	127,0	142,0	152,0	-155,0	-152,0	-144,0	136,0	126,0	119,0	-120,0	-125,0	-131,0	139,0	148,0	152,0	-146,0	-134,0	-119,0	110,0	97,0	91,0	-93,0	-105,0	-113,0	3
4	121,0	132,0	142,0	-150,0	-149,0	-144,0	140,0	130,0	126,0	-125,0	-125,0	-130,0	133,0	142,0	153,0	-148,0	-135,0	-125,0	118,0	103,0	98,0	-95,0	-107,0	-114,0	4
5	114,0	123,0	144,0	-153,0	-145,0	-145,0	174,2	139,0	131,0	-128,0	-124,0	-124,0	129,0	133,0	134,0	-136,0	-136,0	-128,0	119,0	114,0	106,0	-104,0	-107,0	-112,0	5
6	117,0	124,0	127,0	-131,0	-135,0	-139,0	139,0	137,0	133,0	-131,0	-128,0	-129,0	129,0	129,0	129,0	-129,0	-129,0	-126,0	121,0	117,0	113,0	-113,0	-114,0	-116,0	6
7	122,0	124,0	126,0	-128,0	-132,0	-137,0	140,0	140,0	142,0	-142,0	-137,0	-133,0	132,0	129,0	126,0	-126,0	-124,0	-123,0	123,0	122,0	124,0	-124,0	-124,0	-124,0	7
8	126,0	124,0	122,0	-125,0	-127,0	-129,0	136,0	141,0	142,0	-142,0	-140,0	-133,0	128,0	122,0	119,0	-115,0	-114,0	-114,0	118,0	123,0	124,0	-129,0	-129,0	-129,0	8
9	127,0	124,0	119,0	-118,0	-119,0	-124,0	131,0	135,0	142,0	-144,0	-141,0	-135,0	126,0	118,0	110,0	-106,0	-103,0	-104,0	109,0	115,0	124,0	-134,0	-136,0	-137,0	9
10	136,0	128,0	122,0	-118,0	-117,0	-122,0	129,0	135,0	143,0	-146,0	-148,0	-139,0	130,0	119,0	109,0	-102,0	-97,0	-97,0	102,0	113,0	124,0	-135,0	-142,0	-147,0	10
11	143,0	138,0	127,0	-121,0	-115,0	-115,0	123,0	130,0	139,0	-146,0	-151,0	-146,0	135,0	123,0	109,0	-97,0	-92,0	-91,0	97,0	107,0	117,0	-134,0	-149,0	-155,0	11
12	151,0	146,0	134,0	-123,0	-114,0	-113,0	117,0	123,0	133,0	-148,0	-156,0	-154,0	144,0	132,0	116,0	-100,0	-90,0	-87,0	91,0	100,0	115,0	-129,0	-146,0	-150,0	12
13	158,0	153,0	141,0	-127,0	-117,0	-110,0	110,0	114,0	128,0	-142,0	-153,0	-158,0	152,0	138,0	121,0	-105,0	-88,0	-80,0	81,0	89,0	101,0	-118,0	-139,0	-153,0	13
14	160,0	161,0	152,0	-136,0	-123,0	-114,0	108,0	112,0	123,0	-137,0	-151,0	-160,0	157,0	147,0	128,0	-108,0	-91,0	-79,0	73,0	81,0	93,0	-107,0	-125,0	-147,0	14
15	159,0	161,0	155,0	-144,0	-128,0	-115,0	107,0	106,0	113,0	-125,0	-137,0	-150,0	155,0	147,0	131,0	-114,0	-92,0	-76,0	68,0	69,0	77,0	-96,0	-113,0	-132,0	15
16	151,0	160,0	158,0	-150,0	-136,0	-123,0	111,0	104,0	109,0	-119,0	-131,0	-146,0	158,0	154,0	142,0	-127,0	-107,0	-87,0	72,0	68,0	75,0	-89,0	-105,0	-124,0	16
17	142,0	156,0	159,0	-155,0	-144,0	-130,0	117,0	107,0	107,0	-113,0	-121,0	-134,0	148,0	152,0	147,0	-134,0	-118,0	-100,0	81,0	72,0	72,0	-82,0	-96,0	-112,0	17
18	129,0	145,0	156,0	-158,0	-152,0	-140,0	129,0	115,0	111,0	-111,0	-121,0	-129,0	140,0	150,0	153,0	-142,0	-129,0	-114,0	98,0	84,0	78,0	-81,0	-93,0	-108,0	18
19	119,0	133,0	144,0	-155,0	-151,0	-146,0	137,0	126,0	115,0	-114,0	-117,0	-124,0	130,0	140,0	146,0	-146,0	-138,0	-126,0	113,0	100,0	90,0	-88,0	-94,0	-104,0	19
20	114,0	123,0	135,0	-146,0	-150,0	-149,0	144,0	136,0	127,0	-121,0	-119,0	-122,0	125,0	130,0	135,0	-139,0	-139,0	-130,0	121,0	114,0	104,0	-98,0	-100,0	-106,0	20
21	112,0	120,0	128,0	-138,0	-145,0	-150,0	151,0	148,0	142,0	-136,0	-132,0	-129,0	127,0	128,0	131,0	-133,0	-137,0	-137,0	132,0	128,0	121,0	-118,0	-116,0	-117,0	21
22	121,0	122,0	124,0	-133,0	-141,0	-150,0	155,0	158,0	156,0	-151,0	-139,0	-135,0	128,0	124,0	123,0	-125,0	-129,0	-132,0	136,0	137,0	136,0	-136,0	-133,0	-129,0	22
23	128,0	127,0	123,0	-128,0	-138,0	-144,0	149,0	155,0	161,0	-157,0	-148,0	-137,0	126,0	117,0	113,0	-111,0	-112,0	-114,0	123,0	131,0	137,0	-139,0	-141,0	-139,0	23
24	134,0	127,0	120,0	-122,0	-124,0	-133,0	143,0	154,0	160,0	-162,0	-156,0	-144,0	131,0	116,0	106,0	-97,0	-98,0	-101,0	111,0	124,0	138,0	-149,0	-157,0	-153,0	24
25	153,0	148,0	135,0	-123,0	-125,0	-126,0	129,0	141,0	154,0	-160,0	-157,0	-149,0	134,0	113,0	99,0	-89,0	-83,0	-82,0	93,0	107,0	124,0	-142,0	-152,0	-156,0	25
26	156,0	147,0	132,0	-121,0	-113,0	-113,0	118,0	126,0	138,0	-150,0	-154,0	-152,0	140,0	125,0	108,0	-88,0	-77,0	-75,0	80,0	94,0	111,0	-131,0	-149,0	-160,0	26
27	162,0	157,0	146,0	-131,0	-116,0	-108,0	108,0	114,0	128,0	-141,0	-152,0	-156,0	149,0	134,0	117,0	-95,0	-78,0	-70,0	70,0	80,0	96,0	-114,0	-136,0	-154,0	27
28	161,0	159,0	149,0	-138,0	-121,0	-112,0	107,0	112,0	121,0	-134,0	-147,0	-156,0	155,0	142,0	127,0	-107,0	-89,0	-73,0	69,0	72,0	87,0	-105,0	-125,0	-146,0	28
29	159,0	162,0	162,0	-153,0	-137,0	-124,0	113,0	111,0	115,0	-125,0	-138,0	-151,0	158,0	152,0	139,0	-121,0	-101,0	-83,0	72,0	72,0	83,0	-97,0	-115,0	-134,0	29
30	152,0	160,0	161,0	-156,0	-143,0	-129,0	118,0	112,0	111,0	-121,0	-132,0	-143,0	153,0	154,0	143,0	-129,0	-113,0	-95,0	82,0	78,0	80,0	-91,0	-101,0	-117,0	30

SELURUH NILAI DALAM BARIS PADA MASING-MASING TABEL HASIL DI ATAS, DIJUMLAH BERDASARKAN BILANGAN POSITIF DAN NEGATIF (JUMLAHKAN SELURUH BILANGAN POSITIF DAN JUMLAHKAN SELURUH BILANGAN NEGATIF PADA MASING-MASING BARIS/TANGGAL DAN TABEL)

HASIL ANALISA SKEMA 2

Tanggal	X ₁		Y ₁		X ₂		Y ₂		X ₄		Y ₄	
	+	-	+	-	+	-	+	-	+	-	+	-
02-Nov-23	1561	1458	1408	1611	1571	1448	1720	1299	997	1013	1514	1505
03-Nov-23	1595	1481	1447	1629	1547	1529	1710	1366	1019	1028	1539	1537
04-Nov-23	1612	1473	1471	1614	1519	1566	1674	1411	1025	1037	1538	1547
05-Nov-23	1616,2	1486	1458	1644,2	1476	1626,2	1620	1482,2	1045,2	1036	1560,2	1542
06-Nov-23	1568	1467	1465	1570	1486	1549	1544	1491	1016	1006	1515	1520
07-Nov-23	1594	1510	1501	1603	1543	1561	1529	1575	1034	1038	1550	1554
08-Nov-23	1546	1505	1464	1587	1543	1508	1465	1586	1013	1018	1525	1526
09-Nov-23	1495	1486	1422	1559	1551	1430	1398	1583	993	997	1480	1501
10-Nov-23	1494	1506	1417	1583	1601	1399	1397	1603	1002	999	1490	1510
11-Nov-23	1482	1518	1406	1594	1656	1344	1406	1594	1005	990	1488	1512
12-Nov-23	1500	1512	1400	1612	1706	1306	1450	1562	1007	998	1502	1510
13-Nov-23	1489	1487	1365	1611	1726	1250	1490	1486	1002	983	1486	1490
14-Nov-23	1501	1472	1336	1637	1732	1241	1556	1417	998	984	1495	1478
15-Nov-23	1453	1417	1270	1600	1661	1209	1577	1293	962	955	1448	1422
16-Nov-23	1495	1411	1308	1598	1637	1269	1653	1253	972	969	1462	1444
17-Nov-23	1498	1401	1314	1585	1562	1337	1685	1214	964	969	1460	1439
18-Nov-23	1544	1422	1370	1596	1516	1450	1708	1258	987	990	1488	1478
19-Nov-23	1559	1437	1415	1581	1453	1543	1674	1322	999	998	1493	1503
20-Nov-23	1567	1460	1441	1586	1428	1599	1615	1412	1011	1005	1508	1519
21-Nov-23	1631	1525	1525	1631	1494	1662	1586	1570	1055	1047	1568	1588
22-Nov-23	1655	1598	1568	1685	1565	1688	1552	1701	1086	1084	1620	1633
23-Nov-23	1600	1598	1503	1695	1595	1603	1481	1717	1060	1069	1590	1608
24-Nov-23	1568	1592	1481	1679	1655	1505	1409	1751	1050	1054	1564	1596
25-Nov-23	1490	1584	1374	1700	1698	1376	1410	1664	1022	1026	1530	1544
26-Nov-23	1451	1507	1338	1620	1704	1254	1395	1563	994	979	1475	1483
27-Nov-23	1442	1470	1293	1619	1718	1194	1463	1449	977	968	1461	1451
28-Nov-23	1470	1444	1297	1617	1706	1208	1533	1381	979	968	1461	1453
29-Nov-23	1507	1470	1327	1650	1692	1285	1651	1326	994	995	1498	1479
30-Nov-23	1524	1450	1336	1638	1628	1346	1688	1286	989	992	1504	1470

SKEMA 3: PADA TIAP KELOMPOK KOLOM HASIL ANALISA SKEMA 2 (X1, Y1, X2, Y2 DST), MASING-MASING NILAI (+ DAN -) DICARI SELISIHNYA DAN DITAMBAH DENGAN ANGKA FAKTORNYA.

HASIL ANALISA SKEMA 3

Tanggal	X ₀	X ₁₊	Y ₁₊	X ₂₊	Y ₂₊	X ₄₊	Y ₄₊
	+	2000	2000	2000	2000	500	500
02-Nov-23	3019	2103	1797	2123	2421	484	509
03-Nov-23	3076	2114	1818	2018	2344	491	502
04-Nov-23	3085	2139	1857	1953	2263	488	491
05-Nov-23	3102,2	2130,2	1813,8	1849,8	2137,8	509,2	518,2
06-Nov-23	3035	2101	1895	1937	2053	510	495
07-Nov-23	3104	2084	1898	1982	1954	496	496
08-Nov-23	3051	2041	1877	2035	1879	495	499
09-Nov-23	2981	2009	1863	2121	1815	496	479
10-Nov-23	3000	1988	1834	2202	1794	503	480
11-Nov-23	3000	1964	1812	2312	1812	515	476
12-Nov-23	3012	1988	1788	2400	1888	509	492
13-Nov-23	2976	2002	1754	2476	2004	519	496
14-Nov-23	2973	2029	1699	2491	2139	514	517
15-Nov-23	2870	2036	1670	2452	2284	507	526
16-Nov-23	2906	2084	1710	2368	2400	503	518
17-Nov-23	2899	2097	1729	2225	2471	495	521
18-Nov-23	2966	2122	1774	2066	2450	497	510
19-Nov-23	2996	2122	1834	1910	2352	501	490
20-Nov-23	3027	2107	1855	1829	2203	506	489
21-Nov-23	3156	2106	1894	1832	2016	508	480
22-Nov-23	3253	2057	1883	1877	1851	502	487
23-Nov-23	3198	2002	1808	1992	1764	491	482
24-Nov-23	3160	1976	1802	2150	1658	496	468
25-Nov-23	3074	1906	1674	2322	1746	496	486
26-Nov-23	2958	1944	1718	2450	1832	515	492
27-Nov-23	2912	1972	1674	2524	2014	509	510
28-Nov-23	2914	2026	1680	2498	2152	511	508
29-Nov-23	2977	2037	1677	2407	2325	499	519
30-Nov-23	2974	2074	1698	2282	2402	497	534

SKEMA 4: TERDAPAT 15 INDEKS $\rightarrow$ 0.0, 1.0, 1.2, 1.b, 1.3, 1.c, 2.0, 2.2, 2.b, 2.3, 2.c, 4.2, 4.b, 4.4, 4.d. ANGKA PERTAMA INDEKS MENUNJUKKAN JENIS KOMPONENNYA. MISAL INDEKS 1.b ARTINYA JENIS KOMPONENNYA ADALAH X1 DAN Y1, MISAL INDEKS 4.d ARTINYA JENIS KOMPONENNYA ADALAH X4 DAN Y4. SEDANGKAN ANGKA KEDUA INDEKS MENENTUKAN KOEFISIEN PADA TABEL 2 (PERHATIKAN TULISAN “INDEKS KEDUA” PADA TABEL 2 TERSEBUT). DENGAN DEMIKIAN MISALNYA INDEKS 1.b ADALAH KOMPONEN X1 DAN Y1 DENGAN KOEFISIEN PADA TABEL 2 DI KOLOM KEEMPAT (INDEKS KEDUA ADALAH “b”).

PERKALIAN INDEKS 0.0

Tanggal	Indeks 00						
	X ₀	Y ₀	Konst	Perkalian			
				+X ₀₀	-X ₀₀	+Y ₀₀	-Y ₀₀
02-Nov-23	3019		1	3019	0	0	0
03-Nov-23	3076		1	3076	0	0	0
04-Nov-23	3085		1	3085	0	0	0
05-Nov-23	3102,2		1	3102,2	0	0	0
06-Nov-23	3035		1	3035	0	0	0
07-Nov-23	3104		1	3104	0	0	0
08-Nov-23	3051		1	3051	0	0	0
09-Nov-23	2981		1	2981	0	0	0
10-Nov-23	3000		1	3000	0	0	0
11-Nov-23	3000		1	3000	0	0	0
12-Nov-23	3012		1	3012	0	0	0
13-Nov-23	2976		1	2976	0	0	0
14-Nov-23	2973		1	2973	0	0	0
15-Nov-23	2870		1	2870	0	0	0
16-Nov-23	2906		1	2906	0	0	0
17-Nov-23	2899		1	2899	0	0	0
18-Nov-23	2966		1	2966	0	0	0
19-Nov-23	2996		1	2996	0	0	0
20-Nov-23	3027		1	3027	0	0	0
21-Nov-23	3156		1	3156	0	0	0
22-Nov-23	3253		1	3253	0	0	0
23-Nov-23	3198		1	3198	0	0	0
24-Nov-23	3160		1	3160	0	0	0
25-Nov-23	3074		1	3074	0	0	0
26-Nov-23	2958		1	2958	0	0	0
27-Nov-23	2912		1	2912	0	0	0
28-Nov-23	2914		1	2914	0	0	0
29-Nov-23	2977		1	2977	0	0	0
30-Nov-23	2974		1	2974	0	0	0
JUMLAH				87654,2	0	0	0

PERKALIAN INDEKS 1.0

Tanggal	Indeks 1.0						
	X ₁	Y ₁	Konst	Perkalian			
				+X ₁₀	-X ₁₀	+Y ₁₀	-Y ₁₀
02-Nov-23	2103	1797	1	2103	0	1797	0
03-Nov-23	2114	1818	1	2114	0	1818	0
04-Nov-23	2139	1857	1	2139	0	1857	0
05-Nov-23	2130,2	1813,8	1	2130,2	0	1813,8	0
06-Nov-23	2101	1895	1	2101	0	1895	0
07-Nov-23	2084	1898	1	2084	0	1898	0
08-Nov-23	2041	1877	1	2041	0	1877	0
09-Nov-23	2009	1863	1	2009	0	1863	0
10-Nov-23	1988	1834	1	1988	0	1834	0
11-Nov-23	1964	1812	1	1964	0	1812	0
12-Nov-23	1988	1788	1	1988	0	1788	0
13-Nov-23	2002	1754	1	2002	0	1754	0
14-Nov-23	2029	1699	1	2029	0	1699	0
15-Nov-23	2036	1670	1	2036	0	1670	0
16-Nov-23	2084	1710	1	2084	0	1710	0
17-Nov-23	2097	1729	1	2097	0	1729	0
18-Nov-23	2122	1774	1	2122	0	1774	0
19-Nov-23	2122	1834	1	2122	0	1834	0
20-Nov-23	2107	1855	1	2107	0	1855	0
21-Nov-23	2106	1894	1	2106	0	1894	0
22-Nov-23	2057	1883	1	2057	0	1883	0
23-Nov-23	2002	1808	1	2002	0	1808	0
24-Nov-23	1976	1802	1	1976	0	1802	0
25-Nov-23	1906	1674	1	1906	0	1674	0
26-Nov-23	1944	1718	1	1944	0	1718	0
27-Nov-23	1972	1674	1	1972	0	1674	0
28-Nov-23	2026	1680	1	2026	0	1680	0
29-Nov-23	2037	1677	1	2037	0	1677	0
30-Nov-23	2074	1698	1	2074	0	1698	0
JUMLAH				59360,2	0	51785,8	0

PERKALIAN INDEKS 1.2

Tanggal	Indeks 1.2						
	X ₁	Y ₁	Konst	Perkalian			
				+X ₁₂	-X ₁₂	+X ₁₂	-X ₁₂
02-Nov-23	2103	1797	1	2103	0	1797	0
03-Nov-23	2114	1818	1	2114	0	1818	0
04-Nov-23	2139	1857	1	2139	0	1857	0
05-Nov-23	2130,2	1813,8	1	2130,2	0	1813,8	0
06-Nov-23	2101	1895	-1	0	2101	0	1895
07-Nov-23	2084	1898	-1	0	2084	0	1898
08-Nov-23	2041	1877	-1	0	2041	0	1877
09-Nov-23	2009	1863	-1	0	2009	0	1863
10-Nov-23	1988	1834	-1	0	1988	0	1834
11-Nov-23	1964	1812	-1	0	1964	0	1812
12-Nov-23	1988	1788	-1	0	1988	0	1788
13-Nov-23	2002	1754	1	2002	0	1754	0
14-Nov-23	2029	1699	1	2029	0	1699	0
15-Nov-23	2036	1670	1	2036	0	1670	0
16-Nov-23	2084	1710	1	2084	0	1710	0
17-Nov-23	2097	1729	1	2097	0	1729	0
18-Nov-23	2122	1774	1	2122	0	1774	0
19-Nov-23	2122	1834	1	2122	0	1834	0
20-Nov-23	2107	1855	-1	0	2107	0	1855
21-Nov-23	2106	1894	-1	0	2106	0	1894
22-Nov-23	2057	1883	-1	0	2057	0	1883
23-Nov-23	2002	1808	-1	0	2002	0	1808
24-Nov-23	1976	1802	-1	0	1976	0	1802
25-Nov-23	1906	1674	-1	0	1906	0	1674
26-Nov-23	1944	1718	-1	0	1944	0	1718
27-Nov-23	1972	1674	1	1972	0	1674	0
28-Nov-23	2026	1680	1	2026	0	1680	0
29-Nov-23	2037	1677	1	2037	0	1677	0
30-Nov-23	2074	1698	1	2074	0	1698	0
JUMLAH				31087,2	28273	26184,8	25601

PERKALIAN INDEKS 1.b

Tanggal	Indeks 1.b						
	X ₁	Y ₁	Konst	Perkalian			
				+X _{1b}	-X _{1b}	+Y _{1b}	-Y _{1b}
02-Nov-23	2103	1797	0	0	0	0	0
03-Nov-23	2114	1818	-1	0	2114	0	1818
04-Nov-23	2139	1857	-1	0	2139	0	1857
05-Nov-23	2130,2	1813,8	-1	0	2130,2	0	1813,8
06-Nov-23	2101	1895	-1	0	2101	0	1895
07-Nov-23	2084	1898	-1	0	2084	0	1898
08-Nov-23	2041	1877	-1	0	2041	0	1877
09-Nov-23	2009	1863	0	0	0	0	0
10-Nov-23	1988	1834	1	1988	0	1834	0
11-Nov-23	1964	1812	1	1964	0	1812	0
12-Nov-23	1988	1788	1	1988	0	1788	0
13-Nov-23	2002	1754	1	2002	0	1754	0
14-Nov-23	2029	1699	1	2029	0	1699	0
15-Nov-23	2036	1670	1	2036	0	1670	0
16-Nov-23	2084	1710	0	0	0	0	0
17-Nov-23	2097	1729	-1	0	2097	0	1729
18-Nov-23	2122	1774	-1	0	2122	0	1774
19-Nov-23	2122	1834	-1	0	2122	0	1834
20-Nov-23	2107	1855	-1	0	2107	0	1855
21-Nov-23	2106	1894	-1	0	2106	0	1894
22-Nov-23	2057	1883	-1	0	2057	0	1883
23-Nov-23	2002	1808	0	0	0	0	0
24-Nov-23	1976	1802	1	1976	0	1802	0
25-Nov-23	1906	1674	1	1906	0	1674	0
26-Nov-23	1944	1718	1	1944	0	1718	0
27-Nov-23	1972	1674	1	1972	0	1674	0
28-Nov-23	2026	1680	1	2026	0	1680	0
29-Nov-23	2037	1677	1	2037	0	1677	0
30-Nov-23	2074	1698	0	0	0	0	0
JUMLAH				23868	25220,2	20782	22127,8

PERKALIAN INDEKS 1.3

Tanggal	Indeks 1.3						
	X ₁	Y ₁	Konst	Perkalian			
				+X ₁₃	-X ₁₃	+Y ₁₃	-Y ₁₃
02-Nov-23	2103	1797	-1	0	2103	0	1797
03-Nov-23	2114	1818	-1	0	2114	0	1818
04-Nov-23	2139	1857	1	2139	0	1857	0
05-Nov-23	2130,2	1813,8	1	2130,2	0	1813,8	0
06-Nov-23	2101	1895	1	2101	0	1895	0
07-Nov-23	2084	1898	1	2084	0	1898	0
08-Nov-23	2041	1877	1	2041	0	1877	0
09-Nov-23	2009	1863	-1	0	2009	0	1863
10-Nov-23	1988	1834	-1	0	1988	0	1834
11-Nov-23	1964	1812	-1	0	1964	0	1812
12-Nov-23	1988	1788	-1	0	1988	0	1788
13-Nov-23	2002	1754	-1	0	2002	0	1754
14-Nov-23	2029	1699	1	2029	0	1699	0
15-Nov-23	2036	1670	1	2036	0	1670	0
16-Nov-23	2084	1710	1	2084	0	1710	0
17-Nov-23	2097	1729	1	2097	0	1729	0
18-Nov-23	2122	1774	1	2122	0	1774	0
19-Nov-23	2122	1834	-1	0	2122	0	1834
20-Nov-23	2107	1855	-1	0	2107	0	1855
21-Nov-23	2106	1894	-1	0	2106	0	1894
22-Nov-23	2057	1883	-1	0	2057	0	1883
23-Nov-23	2002	1808	-1	0	2002	0	1808
24-Nov-23	1976	1802	1	1976	0	1802	0
25-Nov-23	1906	1674	1	1906	0	1674	0
26-Nov-23	1944	1718	1	1944	0	1718	0
27-Nov-23	1972	1674	1	1972	0	1674	0
28-Nov-23	2026	1680	1	2026	0	1680	0
29-Nov-23	2037	1677	-1	0	2037	0	1677
30-Nov-23	2074	1698	-1	0	2074	0	1698
JUMLAH				30687,2	28673	26470,8	25315

PERKALIAN INDEKS 1.c

Tanggal	Indeks 1.c						
	X ₁	Y ₁	Konst	Perkalian			
				+X _{1c}	-X _{1c}	+Y _{1c}	-Y _{1c}
02-Nov-23	2103	1797	1	2103	0	1797	0
03-Nov-23	2114	1818	1	2114	0	1818	0
04-Nov-23	2139	1857	1	2139	0	1857	0
05-Nov-23	2130,2	1813,8	1	2130,2	0	1813,8	0
06-Nov-23	2101	1895	1	2101	0	1895	0
07-Nov-23	2084	1898	-1	0	2084	0	1898
08-Nov-23	2041	1877	-1	0	2041	0	1877
09-Nov-23	2009	1863	-1	0	2009	0	1863
10-Nov-23	1988	1834	-1	0	1988	0	1834
11-Nov-23	1964	1812	-1	0	1964	0	1812
12-Nov-23	1988	1788	1	1988	0	1788	0
13-Nov-23	2002	1754	1	2002	0	1754	0
14-Nov-23	2029	1699	1	2029	0	1699	0
15-Nov-23	2036	1670	1	2036	0	1670	0
16-Nov-23	2084	1710	0	0	0	0	0
17-Nov-23	2097	1729	-1	0	2097	0	1729
18-Nov-23	2122	1774	-1	0	2122	0	1774
19-Nov-23	2122	1834	-1	0	2122	0	1834
20-Nov-23	2107	1855	-1	0	2107	0	1855
21-Nov-23	2106	1894	1	2106	0	1894	0
22-Nov-23	2057	1883	1	2057	0	1883	0
23-Nov-23	2002	1808	1	2002	0	1808	0
24-Nov-23	1976	1802	1	1976	0	1802	0
25-Nov-23	1906	1674	1	1906	0	1674	0
26-Nov-23	1944	1718	-1	0	1944	0	1718
27-Nov-23	1972	1674	-1	0	1972	0	1674
28-Nov-23	2026	1680	-1	0	2026	0	1680
29-Nov-23	2037	1677	-1	0	2037	0	1677
30-Nov-23	2074	1698	-1	0	2074	0	1698
JUMLAH				28689,2	28587	25152,8	24923

PERKALIAN INDEKS 2.0

Tanggal	Indeks 2.0						
	X ₂	Y ₂	Konst	Perkalian			
				+X ₂₀	-X ₂₀	+Y ₂₀	-Y ₂₀
02-Nov-23	2123	2421	1	2123	0	2421	0
03-Nov-23	2018	2344	1	2018	0	2344	0
04-Nov-23	1953	2263	1	1953	0	2263	0
05-Nov-23	1849,8	2137,8	1	1849,8	0	2137,8	0
06-Nov-23	1937	2053	1	1937	0	2053	0
07-Nov-23	1982	1954	1	1982	0	1954	0
08-Nov-23	2035	1879	1	2035	0	1879	0
09-Nov-23	2121	1815	1	2121	0	1815	0
10-Nov-23	2202	1794	1	2202	0	1794	0
11-Nov-23	2312	1812	1	2312	0	1812	0
12-Nov-23	2400	1888	1	2400	0	1888	0
13-Nov-23	2476	2004	1	2476	0	2004	0
14-Nov-23	2491	2139	1	2491	0	2139	0
15-Nov-23	2452	2284	1	2452	0	2284	0
16-Nov-23	2368	2400	1	2368	0	2400	0
17-Nov-23	2225	2471	1	2225	0	2471	0
18-Nov-23	2066	2450	1	2066	0	2450	0
19-Nov-23	1910	2352	1	1910	0	2352	0
20-Nov-23	1829	2203	1	1829	0	2203	0
21-Nov-23	1832	2016	1	1832	0	2016	0
22-Nov-23	1877	1851	1	1877	0	1851	0
23-Nov-23	1992	1764	1	1992	0	1764	0
24-Nov-23	2150	1658	1	2150	0	1658	0
25-Nov-23	2322	1746	1	2322	0	1746	0
26-Nov-23	2450	1832	1	2450	0	1832	0
27-Nov-23	2524	2014	1	2524	0	2014	0
28-Nov-23	2498	2152	1	2498	0	2152	0
29-Nov-23	2407	2325	1	2407	0	2325	0
30-Nov-23	2282	2402	1	2282	0	2402	0
JUMLAH				63083,8	0	60423,8	0

PERKALIAN INDEKS 2.2

Tanggal	Indeks 2.2						
	X ₂	Y ₂	Konst	Perkalian			
				+X ₂₂	-X ₂₂	+Y ₂₂	-Y ₂₂
02-Nov-23	2123	2421	1	2123	0	2421	0
03-Nov-23	2018	2344	1	2018	0	2344	0
04-Nov-23	1953	2263	1	1953	0	2263	0
05-Nov-23	1849,8	2137,8	1	1849,8	0	2137,8	0
06-Nov-23	1937	2053	-1	0	1937	0	2053
07-Nov-23	1982	1954	-1	0	1982	0	1954
08-Nov-23	2035	1879	-1	0	2035	0	1879
09-Nov-23	2121	1815	-1	0	2121	0	1815
10-Nov-23	2202	1794	-1	0	2202	0	1794
11-Nov-23	2312	1812	-1	0	2312	0	1812
12-Nov-23	2400	1888	-1	0	2400	0	1888
13-Nov-23	2476	2004	1	2476	0	2004	0
14-Nov-23	2491	2139	1	2491	0	2139	0
15-Nov-23	2452	2284	1	2452	0	2284	0
16-Nov-23	2368	2400	1	2368	0	2400	0
17-Nov-23	2225	2471	1	2225	0	2471	0
18-Nov-23	2066	2450	1	2066	0	2450	0
19-Nov-23	1910	2352	1	1910	0	2352	0
20-Nov-23	1829	2203	-1	0	1829	0	2203
21-Nov-23	1832	2016	-1	0	1832	0	2016
22-Nov-23	1877	1851	-1	0	1877	0	1851
23-Nov-23	1992	1764	-1	0	1992	0	1764
24-Nov-23	2150	1658	-1	0	2150	0	1658
25-Nov-23	2322	1746	-1	0	2322	0	1746
26-Nov-23	2450	1832	-1	0	2450	0	1832
27-Nov-23	2524	2014	1	2524	0	2014	0
28-Nov-23	2498	2152	1	2498	0	2152	0
29-Nov-23	2407	2325	1	2407	0	2325	0
30-Nov-23	2282	2402	1	2282	0	2402	0
JUMLAH				33642,8	29441	34158,8	26265

PERKALIAN INDEKS 2.b

Tanggal	Indeks 2.b						
	X ₂	Y ₂	Konst	Perkalian			
				+X _{2b}	-X _{2b}	+Y _{2b}	-Y _{2b}
02-Nov-23	2123	2421	0	0	0	0	0
03-Nov-23	2018	2344	-1	0	2018	0	2344
04-Nov-23	1953	2263	-1	0	1953	0	2263
05-Nov-23	1849,8	2137,8	-1	0	1849,8	0	2137,8
06-Nov-23	1937	2053	-1	0	1937	0	2053
07-Nov-23	1982	1954	-1	0	1982	0	1954
08-Nov-23	2035	1879	-1	0	2035	0	1879
09-Nov-23	2121	1815	0	0	0	0	0
10-Nov-23	2202	1794	1	2202	0	1794	0
11-Nov-23	2312	1812	1	2312	0	1812	0
12-Nov-23	2400	1888	1	2400	0	1888	0
13-Nov-23	2476	2004	1	2476	0	2004	0
14-Nov-23	2491	2139	1	2491	0	2139	0
15-Nov-23	2452	2284	1	2452	0	2284	0
16-Nov-23	2368	2400	0	0	0	0	0
17-Nov-23	2225	2471	-1	0	2225	0	2471
18-Nov-23	2066	2450	-1	0	2066	0	2450
19-Nov-23	1910	2352	-1	0	1910	0	2352
20-Nov-23	1829	2203	-1	0	1829	0	2203
21-Nov-23	1832	2016	-1	0	1832	0	2016
22-Nov-23	1877	1851	-1	0	1877	0	1851
23-Nov-23	1992	1764	0	0	0	0	0
24-Nov-23	2150	1658	1	2150	0	1658	0
25-Nov-23	2322	1746	1	2322	0	1746	0
26-Nov-23	2450	1832	1	2450	0	1832	0
27-Nov-23	2524	2014	1	2524	0	2014	0
28-Nov-23	2498	2152	1	2498	0	2152	0
29-Nov-23	2407	2325	1	2407	0	2325	0
30-Nov-23	2282	2402	0	0	0	0	0
JUMLAH				28684	23513,8	23648	25973,8

PERKALIAN INDEKS 2.3

Tanggal	Indeks 2.3						
	X ₂	Y ₂	Konst	Perkalian			
				+X ₂₃	-X ₂₃	+Y ₂₃	-Y ₂₃
02-Nov-23	2123	2421	-1	0	2123	0	2421
03-Nov-23	2018	2344	-1	0	2018	0	2344
04-Nov-23	1953	2263	1	1953	0	2263	0
05-Nov-23	1849,8	2137,8	1	1849,8	0	2137,8	0
06-Nov-23	1937	2053	1	1937	0	2053	0
07-Nov-23	1982	1954	1	1982	0	1954	0
08-Nov-23	2035	1879	1	2035	0	1879	0
09-Nov-23	2121	1815	-1	0	2121	0	1815
10-Nov-23	2202	1794	-1	0	2202	0	1794
11-Nov-23	2312	1812	-1	0	2312	0	1812
12-Nov-23	2400	1888	-1	0	2400	0	1888
13-Nov-23	2476	2004	-1	0	2476	0	2004
14-Nov-23	2491	2139	1	2491	0	2139	0
15-Nov-23	2452	2284	1	2452	0	2284	0
16-Nov-23	2368	2400	1	2368	0	2400	0
17-Nov-23	2225	2471	1	2225	0	2471	0
18-Nov-23	2066	2450	1	2066	0	2450	0
19-Nov-23	1910	2352	-1	0	1910	0	2352
20-Nov-23	1829	2203	-1	0	1829	0	2203
21-Nov-23	1832	2016	-1	0	1832	0	2016
22-Nov-23	1877	1851	-1	0	1877	0	1851
23-Nov-23	1992	1764	-1	0	1992	0	1764
24-Nov-23	2150	1658	1	2150	0	1658	0
25-Nov-23	2322	1746	1	2322	0	1746	0
26-Nov-23	2450	1832	1	2450	0	1832	0
27-Nov-23	2524	2014	1	2524	0	2014	0
28-Nov-23	2498	2152	1	2498	0	2152	0
29-Nov-23	2407	2325	-1	0	2407	0	2325
30-Nov-23	2282	2402	-1	0	2282	0	2402
JUMLAH				33302,8	29781	31432,8	28991

PERKALIAN INDEKS 2.c

Tanggal	Indeks 2.c						
	X ₂	Y ₂	Konst	Perkalian			
				+X _{2c}	-X _{2c}	+Y _{2c}	-Y _{2c}
02-Nov-23	2123	2421	1	2123	0	2421	0
03-Nov-23	2018	2344	1	2018	0	2344	0
04-Nov-23	1953	2263	1	1953	0	2263	0
05-Nov-23	1849,8	2137,8	1	1849,8	0	2137,8	0
06-Nov-23	1937	2053	1	1937	0	2053	0
07-Nov-23	1982	1954	-1	0	1982	0	1954
08-Nov-23	2035	1879	-1	0	2035	0	1879
09-Nov-23	2121	1815	-1	0	2121	0	1815
10-Nov-23	2202	1794	-1	0	2202	0	1794
11-Nov-23	2312	1812	-1	0	2312	0	1812
12-Nov-23	2400	1888	1	2400	0	1888	0
13-Nov-23	2476	2004	1	2476	0	2004	0
14-Nov-23	2491	2139	1	2491	0	2139	0
15-Nov-23	2452	2284	1	2452	0	2284	0
16-Nov-23	2368	2400	0	0	0	0	0
17-Nov-23	2225	2471	-1	0	2225	0	2471
18-Nov-23	2066	2450	-1	0	2066	0	2450
19-Nov-23	1910	2352	-1	0	1910	0	2352
20-Nov-23	1829	2203	-1	0	1829	0	2203
21-Nov-23	1832	2016	1	1832	0	2016	0
22-Nov-23	1877	1851	1	1877	0	1851	0
23-Nov-23	1992	1764	1	1992	0	1764	0
24-Nov-23	2150	1658	1	2150	0	1658	0
25-Nov-23	2322	1746	1	2322	0	1746	0
26-Nov-23	2450	1832	-1	0	2450	0	1832
27-Nov-23	2524	2014	-1	0	2524	0	2014
28-Nov-23	2498	2152	-1	0	2498	0	2152
29-Nov-23	2407	2325	-1	0	2407	0	2325
30-Nov-23	2282	2402	-1	0	2282	0	2402
JUMLAH				29872,8	30843	28568,8	29455

PERKALIAN INDEKS 4.2

Tanggal	Indeks 4.2						
	X ₄	Y ₄	Konst	Perkalian			
				+X ₄₂	-X ₄₂	+Y ₄₂	-Y ₄₂
02-Nov-23	484	509	1	484	0	509	0
03-May-10	491	502	1	491	0	502	0
04-May-10	488	491	1	488	0	491	0
05-May-10	509,2	518,2	1	509,2	0	518,2	0
06-May-10	510	495	-1	0	510	0	495
07-May-10	496	496	-1	0	496	0	496
08-May-10	495	499	-1	0	495	0	499
09-May-10	496	479	-1	0	496	0	479
10-May-10	503	480	-1	0	503	0	480
11-May-10	515	476	-1	0	515	0	476
12-May-10	509	492	-1	0	509	0	492
13-May-10	519	496	1	519	0	496	0
14-May-10	514	517	1	514	0	517	0
15-May-10	507	526	1	507	0	526	0
16-May-10	503	518	1	503	0	518	0
17-May-10	495	521	1	495	0	521	0
18-May-10	497	510	1	497	0	510	0
19-May-10	501	490	1	501	0	490	0
20-May-10	506	489	-1	0	506	0	489
21-May-10	508	480	-1	0	508	0	480
22-May-10	502	487	-1	0	502	0	487
23-May-10	491	482	-1	0	491	0	482
24-May-10	496	468	-1	0	496	0	468
25-May-10	496	486	-1	0	496	0	486
26-May-10	515	492	-1	0	515	0	492
27-May-10	509	510	1	509	0	510	0
28-May-10	511	508	1	511	0	508	0
29-May-10	499	519	1	499	0	519	0
30-May-10	497	534	1	497	0	534	0
JUMLAH				7524,2	7038	7669,2	6801

PERKALIAN INDEKS 4.b

Tanggal	Indeks 4.b						
	X ₄	Y ₄	Konst	Perkalian			
				+X _{4b}	-X _{4b}	+Y _{4b}	-Y _{4b}
02-Nov-23	484	509	0	0	0	0	0
03-Nov-23	491	502	-1	0	491	0	502
04-Nov-23	488	491	-1	0	488	0	491
05-Nov-23	509,2	518,2	-1	0	509,2	0	518,2
06-Nov-23	510	495	-1	0	510	0	495
07-Nov-23	496	496	-1	0	496	0	496
08-Nov-23	495	499	-1	0	495	0	499
09-Nov-23	496	479	0	0	0	0	0
10-Nov-23	503	480	1	503	0	480	0
11-Nov-23	515	476	1	515	0	476	0
12-Nov-23	509	492	1	509	0	492	0
13-Nov-23	519	496	1	519	0	496	0
14-Nov-23	514	517	1	514	0	517	0
15-Nov-23	507	526	1	507	0	526	0
16-Nov-23	503	518	0	0	0	0	0
17-Nov-23	495	521	-1	0	495	0	521
18-Nov-23	497	510	-1	0	497	0	510
19-Nov-23	501	490	-1	0	501	0	490
20-Nov-23	506	489	-1	0	506	0	489
21-Nov-23	508	480	-1	0	508	0	480
22-Nov-23	502	487	-1	0	502	0	487
23-Nov-23	491	482	0	0	0	0	0
24-Nov-23	496	468	1	496	0	468	0
25-Nov-23	496	486	1	496	0	486	0
26-Nov-23	515	492	1	515	0	492	0
27-Nov-23	509	510	1	509	0	510	0
28-Nov-23	511	508	1	511	0	508	0
29-Nov-23	499	519	1	499	0	519	0
30-Nov-23	497	534	0	0	0	0	0
JUMLAH				6093	5998,2	5970	5978,2

PERKALIAN INDEKS 4.4

Tanggal	Indeks 4.4						
	X ₄	Y ₄	Konst	Perkalian			
				+X ₄₄	-X ₄₄	+Y ₄₄	-Y ₄₄
02-Nov-23	484	509	1	484	0	509	0
03-Nov-23	491	502	1	491	0	502	0
04-Nov-23	488	491	-1	0	488	0	491
05-Nov-23	509,2	518,2	-1	0	509,2	0	518,2
06-Nov-23	510	495	-1	0	510	0	495
07-Nov-23	496	496	1	496	0	496	0
08-Nov-23	495	499	1	495	0	499	0
09-Nov-23	496	479	1	496	0	479	0
10-Nov-23	503	480	1	503	0	480	0
11-Nov-23	515	476	-1	0	515	0	476
12-Nov-23	509	492	-1	0	509	0	492
13-Nov-23	519	496	-1	0	519	0	496
14-Nov-23	514	517	-1	0	514	0	517
15-Nov-23	507	526	1	507	0	526	0
16-Nov-23	503	518	1	503	0	518	0
17-Nov-23	495	521	1	495	0	521	0
18-Nov-23	497	510	-1	0	497	0	510
19-Nov-23	501	490	-1	0	501	0	490
20-Nov-23	506	489	-1	0	506	0	489
21-Nov-23	508	480	-1	0	508	0	480
22-Nov-23	502	487	1	502	0	487	0
23-Nov-23	491	482	1	491	0	482	0
24-Nov-23	496	468	1	496	0	468	0
25-Nov-23	496	486	1	496	0	486	0
26-Nov-23	515	492	-1	0	515	0	492
27-Nov-23	509	510	-1	0	509	0	510
28-Nov-23	511	508	-1	0	511	0	508
29-Nov-23	499	519	1	499	0	519	0
30-Nov-23	497	534	1	497	0	534	0
JUMLAH				7451	7111,2	7506	6964,2

PERKALIAN INDEKS 4.d

Tanggal	Indeks 4.d						
	X ₄	Y ₄	Konst	Perkalian			
				+X _{4d}	-X _{4d}	+Y _{4d}	-Y _{4d}
02-Nov-23	484	509	0	0	0	0	0
03-Nov-23	491	502	-1	0	491	0	502
04-Nov-23	488	491	-1	0	488	0	491
05-Nov-23	509,2	518,2	-1	0	509,2	0	518,2
06-Nov-23	510	495	1	510	0	495	0
07-Nov-23	496	496	1	496	0	496	0
08-Nov-23	495	499	1	495	0	499	0
09-Nov-23	496	479	0	0	0	0	0
10-Nov-23	503	480	-1	0	503	0	480
11-Nov-23	515	476	-1	0	515	0	476
12-Nov-23	509	492	-1	0	509	0	492
13-Nov-23	519	496	1	519	0	496	0
14-Nov-23	514	517	1	514	0	517	0
15-Nov-23	507	526	1	507	0	526	0
16-Nov-23	503	518	0	0	0	0	0
17-Nov-23	495	521	-1	0	495	0	521
18-Nov-23	497	510	-1	0	497	0	510
19-Nov-23	501	490	-1	0	501	0	490
20-Nov-23	506	489	1	506	0	489	0
21-Nov-23	508	480	1	508	0	480	0
22-Nov-23	502	487	1	502	0	487	0
23-Nov-23	491	482	0	0	0	0	0
24-Nov-23	496	468	-1	0	496	0	468
25-Nov-23	496	486	-1	0	496	0	486
26-Nov-23	515	492	-1	0	515	0	492
27-Nov-23	509	510	1	509	0	510	0
28-Nov-23	511	508	1	511	0	508	0
29-Nov-23	499	519	1	499	0	519	0
30-Nov-23	497	534	0	0	0	0	0
JUMLAH				6076	6015,2	6022	5926,2

HASIL ANALISA SKEMA 4

Indeks	Tanda	X	Y	$\bar{X}$	$\bar{Y}$
0.0	+	87654,2	0		
	-	0	0	87654,2	0
1.0	+	59360,2	51785,8		
	-	0	0		
	-29	-58000	-58000	1360,2	-6214,2
1.2	+	31087,2	26184,8		
	-	28273	25601		
	-1	-2000	-2000	814,2	-1416,2
1.b	+	23868	20782		
	-	25220,2	22127,8		
	0	0	0	-1352,2	-1345,8
1.3	+	30687,2	26470,8		
	-	28673	25315		
	-1	-2000	-2000	14,2	-844,2
1.c	+	28689,2	25152,8		
	-	28587	24923		
	0	0	0	102,2	229,8
2.0	+	63083,8	60423,8		
	-	0	0		
	-29	-58000	-58000	5083,8	2423,8
2.2	+	33642,8	34158,8		
	-	29441	26265		
	-1	-2000	-2000	2201,8	5893,8
2.b	+	28684	23648		
	-	23513,8	25973,8		
	0	0	0	5170,2	-2325,8
2.3	+	33302,8	31432,8		
	-	29781	28991		
	-1	-2000	-2000	1521,8	441,8
2.c	+	29872,8	28568,8		
	-	30843	29455		
	0	0	0	-970,2	-886,2
4.2	+	7524,2	7669,2		
	-	7038	6801		
	-1	-500	-500	-13,8	368,2
4.b	+	6093	5970		
	-	5998,2	5978,2		
	0	0	0	94,8	-8,2
4.4	+	7451	7506		
	-	7111,2	6964,2		
	-1	-500	-500	-160,2	41,8
4.d	+	6076	6022		
	-	6015,2	5926,2		
	0	0	0	60,8	95,8

SKEMA 5: SKEMA 5 MELIBATKAN TABEL KOEFISIEN PADA TABEL 3. APLIKASINYA DAPAT DILIHAT PADA HASIL BERIKUT INI.

HASIL ANALISA SKEMA 5

Skema 5 (PR cos r)	Analisa	Hasil	Hasil Perkalian Dengan Koefisien Untuk Komponen Pasut							
			S_0	M_2	S_2	N_2	K_1	O_1	M_4	MS_4
	X_{00}	87654,2	87654,2	0	0	0	0	0	0	0
	X_{10}	1360,2	0	0	0	0	1360,2	-108,82	0	0
	$X_{12} - Y_{1b}$	2160	0	151,2	0	0	-43,2	2160	0	43,2
	$X_{13} - Y_{1c}$	-244	0	0	0	0	0	0	0	0
	X_{20}	5083,8	0	-152,51	5083,8	-152,51	0	0	0	0
	$X_{22} - Y_{2b}$	4527,6	0	4527,6	67,914	172,049	9,0552	-262,6	0	-158,47
	$X_{23} - Y_{2c}$	2408	0	-144,48	0	2408	0	0	0	0
	$X_{42} - Y_{4b}$	-5,6	0	-0,168	0	0	0	0	0	-5,6
	$X_{44} - Y_{4d}$	-256	0	0	0	0	0	0	-256	-20,48
	JUMLAH		87654,2	4381,64	5151,71	2427,53	1326,06	1788,58	-256	-141,35

SKEMA 6: PADA SKEMA 6 DILAKUKAN SAMA DENGAN SEPERTI SKEMA 5, NAMUN YANG DIGUNAKAN ADALAH TABEL 3 UNTUK SKEMA 6

HASIL ANALISA SKEMA 6

Skema 6 (PR sin r)	Analisa	Hasil	Hasil Perkalian Dengan Koefisien							
			S_0	M_2	S_2	N_2	K_1	O_1	M_4	MS_4
	Y_{10}	-6214,2	0	0	0	0	0	0	0	0
	$Y_{12} + X_{1b}$	-2768,4	0	-193,79	0	0	-2768,4	221,472	0	0
	$Y_{13} + X_{1c}$	-742	0	0	0	0	14,84	-742	0	-22,26
	Y_{20}	2423,8	0	-72,714	2423,8	-72,714	0	0	0	0
	$Y_{22} + X_{2b}$	11064	0	11064	165,96	354,048	0	-641,71	0	-387,24
	$Y_{23} + X_{2c}$	-528,4	0	31,704	0	-528,4	0	0	0	0
	$Y_{42} + X_{4b}$	463	0	13,89	0	0	0	0	4,63	463
	$Y_{44} + X_{4d}$	102,6	0	0	0	0	0	0	102,6	8,208
	JUMLAH		0	10843,1	2589,76	-247,07	-2753,6	-1162,2	107,23	61,708

SKEMA 7: SKEMA 7 DILAKUKAN DENGAN MENGIKUTI PERSAMAAN-PERSAMAAN SESUAI DENGAN KOMPONEN YANG ADA DI SKEMA

HASIL ANALISA SKEMA 7

	Analisa	Komponen Pasang Surut									
		S ₀	M ₂	S ₂	N ₂	K ₁	O ₁	M ₄	MS ₄	K ₂	P ₁
Skema 7	PR cos r	87654,2	4381,64	5151,71	2427,53	1326,06	1788,58	-256	-141,35		
	PR sin r	0	10843,1	2589,76	-247,07	-2753,6	-1162,2	107,23	61,708		
	PR	87654,2	11694,9	5766,02	2440,08	3056,23	2133,03	277,55	154,229		
	P	696	559	448	566	439	565	507	535		
	<i>Analisa f</i>										
	Y	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010
	D	136	136	136	136	136	136	136	136	136	136
	l	27,25	27,25	27,25	27,25	27,25	27,25	27,25	27,25	27,25	27,25
	s	16660,4	16660,4	16660,4	16660,4	16660,4	16660,4	16660,4	16660,4	16660,4	16660,4
	h	414,838	414,838	414,838	414,838	414,838	414,838	414,838	414,838	414,838	414,838
	p	4825,44	4825,44	4825,44	4825,44	4825,44	4825,44	4825,44	4825,44	4825,44	4825,44
	N	-1875,6	-1875,6	-1875,6	-1875,6	-1875,6	-1875,6	-1875,6	-1875,6	-1875,6	-1875,6
	f	1	0,99	1	0,99	1,04	1,18	0,98	0,99	1,09	1
	l+W (Skema 8)	1	1	0,79966	2,1075	1,1998	1	1	0,79966		
	V		-32491	0	-44326	504,838	-32636	-64982	-32491	829,676	-144,84
	m		91	0	124	1	91	181	91	2	1
	m x 360°		32760	0	44640	360	32760	65160	32760	720	360
	V (Normalized)		268,824	0	313,842	144,838	123,985	177,647	268,824	109,676	215,162
	u		2,07	0	2,07	8,22	-9,68	4,15	2,07	16,49	0
	w (Skema 8)	0	0	14,0116	-11,328	14,7723	0	0	14,0116		
	p		333	345	327	173	160	307	318		
	r	0	68,00	26,69	-5,81	-64,29	-33,02	-22,73	-23,58		
	r (Normalized)	0	68,00	26,69	354,19	295,71	326,98	337,27	336,42		
	g°	0,00	671,89	385,70	985,78	636,55	601,29	826,07	939,32	385,70	636,55
	A	125,94	21,11	16,10	2,06	5,57	3,19	0,56	0,36	4,35	1,84
	n	0	1	1	1	0	1	1	2	1	0
	n x 360°	0	360	360	360	0	360	360	720	360	0
	g° (Normalized)	0	311,893	25,7002	625,776	636,549	241,294	466,065	219,323	25,7002	636,549

SKEMA 8: SKEMA INI MERUPAKAN SKEMA TERAKHIR, MENGGUNAKAN TABEL 4 UNTUK ANALISA SKEMA 8 INI. HASIL-HASIL DARI SKEMA 7 MENJADI INPUT PADA ANALISA SKEMA 8. HASIL SKEMA 8 1+W DIKEMBALIKAN KE TABEL PADA SKEMA 7.

HASIL ANALISA SKEMA 8

w dan (1+W) Untuk S_2, MS_4			w dan (1+W) Untuk K_1			w dan (1+W) Untuk N_2		
	V untuk K_1	144,838		2V untuk K_1	289,676		3V untuk M_2	537,64705
	u untuk K_1	8,22		u untuk K_1	8,22		2V untuk N_2	627,68
	V + u	153,062		2V + u	297,9		3V - 2V	-90,04
	n			n			n	1
	n x 360°	0		n x 360°	0		n x 360°	360
	V + u (Normalized)	153,062		2V + u (Normalized)	297,9		3V + 2V (Normalized)	269,9629
150	w/f	13,6	290	w/f	15,6	260	w/f	-10,6
160	w/f	11,2	300	w/f	13,8	270	w/f	-10,4
V+u	w/f	12,865	2V+u	w/f	14,178	3V+2V	w/f	-10,401
150	W/f	-0,157	290	W/f	0,157	260	W/f	0,984
160	W/f	-0,245	300	W/f	0,201	270	W/f	1,017
V+u	W/f	-0,184	2V+u	W/f	0,192	3V+2V	W/f	1,017
	f untuk K_2	1,09		f untuk K_1	1,04		f untuk K_2	1,09
	w	14,0116		w	14,7723		w	-11,32765
	W	-0,2003		W	0,1998		W	1,1075011
	1+W	0,79966		1+W	1,1998		1+W	2,1075011

HASIL AKHIR: DIAMBIL DARI SKEMA 7 YANG SUDAH FINAL (SUDAH DILENGKAPI DENGAN SKEMA 8). HASIL AKHIR BERUPA BESARNYA KONSTANTA HARMONIK DAN PERHITUNGAN MSL DSB BERDASARKAN RUMUS YANG ADA DI BAWAH.

Water Level Componen	Tides Components									
	S ₀	M ₂	S ₂	N ₂	K ₁	O ₁	M ₄	MS ₄	K ₂	P ₁
A (cm)	70,00	26,11	18,40	3,04	10,61	4,89	0,56	0,36	4,35	1,84
g ^o	0	311,893	25,7002	625,776	636,549	241,294	466,065	219,323	25,7002	636,549
MSL	70 cm		0,70 m		Mean Sea Level					
HAT	140 cm		1,40 m		Highest Astronomical Tide					
MHWL	130 cm		1,30 m		Mean High Water Level					
MLWL	9 cm		0,09 m		Mean Low Water Level					
LAT	0 cm		0,00 m		Lowest Astronomical Tide					

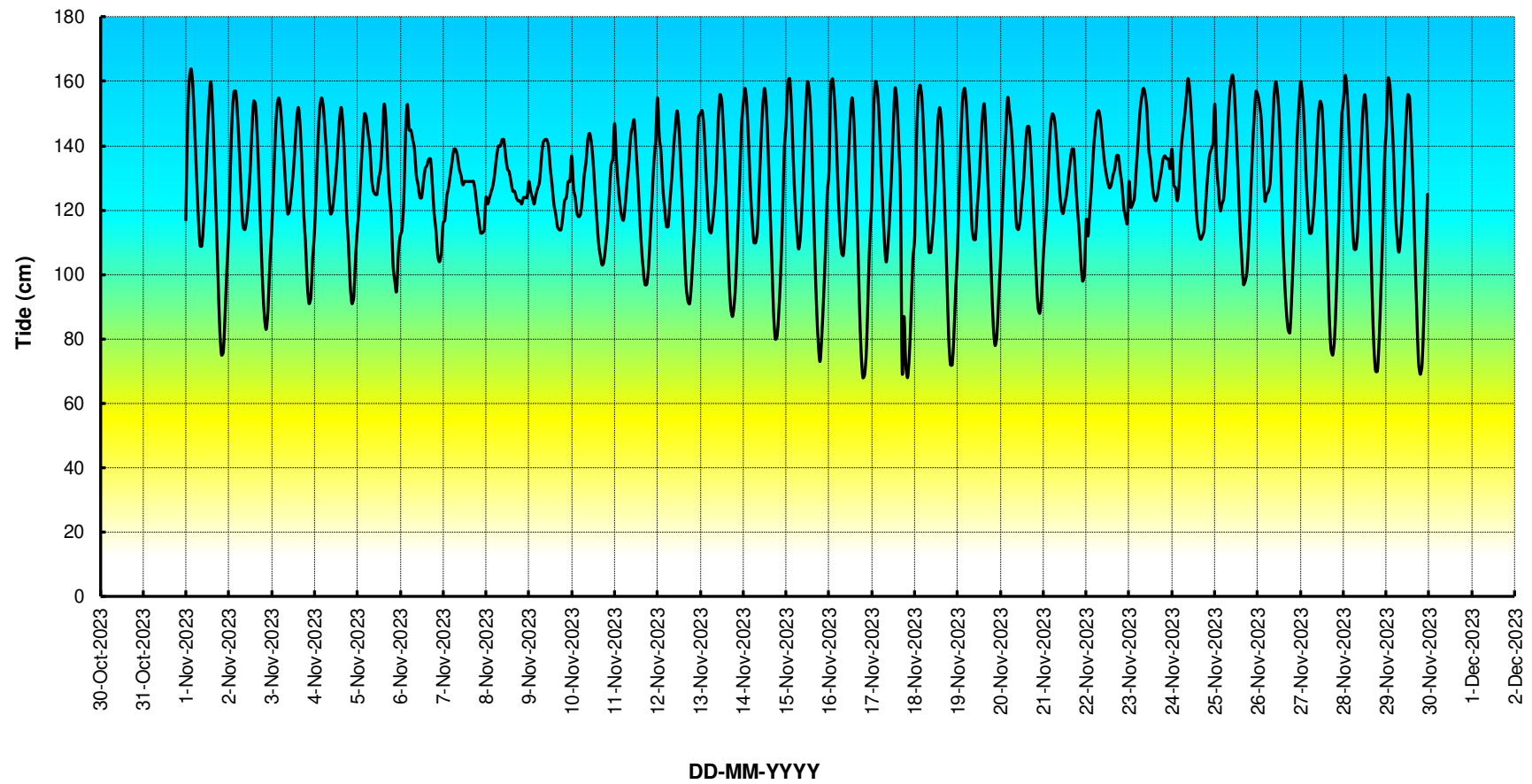
$$MSL = S_o$$

$$HHWL = S_o + M_2 + S_2 + K_1 + O_1$$

$$MHWL = S_o + M_2 + K_1 + O_1$$

$$MLWL = S_o - M_2 - K_1 - O_1$$

$$LLWL = S_o - M_2 - S_2 - O_1$$



Gambar Grafik Analisis Pasang Surut Metode Admiralty 29 Piantan

LAMPIRAN



BADAN METEOROLOGI, KLIMATOLOGI, DAN GEOFISIKA
STASIUN METEOROLOGI MARITIM KELAS I MERAK

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e-mail: stamet_serang@bmkg.go.id/stamet_serang@yahoo.co.id

Nomor : e.T/ME.01.02/095/KSRB/V/2024 Serang, 31 Mei 2024
Lampiran : 1 (satu) berkas.
Perihal : **Informasi Tinggi gelombang wilayah Merak**

Yth. Dekan Fakultas Teknik
Universitas Tirtayasa
di
Tempat

Menindaklanjuti Surat dari Universitas Tirtayasa nomor Surat B/011/UN43.3.6/PT.01.4/2024 tanggal 12 Februari 2024 perihal permohonan data perihal permohonan tarif nol rupiah atas nama:

Nama : Rifda Syafida
NRP : 3336210010
Program Studi : Teknik Sipil

Dengan ini kami sampaikan data Tinggi Gelombang tahun 2019 - 2023 untuk Wilayah Merak Banten, Sesuai surat pernyataan yang dibuat oleh mahasiswa tersebut diatas, diharapkan dapat menyerahkan hasil Tugas akhir kepada kami tertanggal **27 desember 2024**

Demikianlah kami sampaikan , harap dipergunakan sebagaimana mestinya

Demikian untuk dipergunakan sebagaimana mestinya, atas perhatiannya kami ucapkan terima kasih.



Kepala Sub Bagian Tata Usaha
Stasiun Meteorologi Maritim Merak

Deny, S.IKom



**BADAN METEOROLOGI KLIMATOLOGI DAN GEOFISIKA
STASIUN METEOROLOGI MARITIM KELAS I MERAK**

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e-mail: , stamet.serang@bmkg.go.id stamet_serang@yahoo.co

A. DATA TINGGI GELOMBANG TAHUN 2019 - 2023

GARIS LINTANG :05°58' 018" LS

GARIS Bujur :105°59' 099" BT

LOKASI : CILEGON

1. DATA TAHUN 2019

Bulan	Katagori	Tinggi Gelombang		Arah Angin (Knot)	Arah Angin dari
		Hsig (m)	Hmax (m)		
Januari	Rata rata	0.14	0.24	36.32	SSW
	Max	0.50	0.84		
Februari	Rata rata	0.09	0.09	19.82	SSW
	Max	0.20	0.33		
Maret	Rata rata	0.09	0.14	33.15	SSW
	Max	0.40	0.67		
April	Rata rata	0.08	0.13	28.06	SSW
	Max	0.33	0.56		
Mei	Rata rata	0.09	0.14	24.29	SSW
	Max	0.50	0.81		
Juni	Rata rata	0.09	0.15	18.57	SW
	Max	0.19	0.31		
Juli	Rata rata	0.10	0.17	25.95	NNE
	Max	0.32	0.53		
Agustus	Rata rata	0.10	0.17	24.18	NNE
	Max	0.20	0.34		
September	Rata rata	0.09	0.15	23.05	NE
	Max	0.24	0.40		
Oktober	Rata rata	0.10	0.16	22.11	SW
	Max	0.24	0.40		
November	Rata rata	0.11	0.18	30.46	N
	Max	0.33	0.55		
Desember	Rata rata	0.11	0.16	28.79	SSW
	Max	0.67	0.98		

2. TAHUN 2020

Bulan	Katagori	Tinggi Gelombang		Arah Angin (Knot)	Arah Angin dari
		Hsig (m)	Hmax (m)		
Januari	Rata rata	0.09	0.14	30.46	SSW
	Max	0.42	0.70		
Februari	Rata rata	0.13	0.22	28.31	ESE
	Max	0.45	0.76		
Maret	Rata rata	0.08	0.13	41.32	SSW
	Max	0.60	1.00		
April	Rata rata	0.07	0.12	31.22	SSW
	Max	0.34	0.57		
Mei	Rata rata	0.09	0.16	26.74	SSW
	Max	0.25	0.42		
Juni	Rata rata	0.10	0.16	25.21	NNE
	Max	0.24	0.41		
Juli	Rata rata	0.14	0.23	28.17	NNE
	Max	0.27	0.45		
Agustus	Rata rata	0.11	0.18	25.60	NNE
	Max	0.26	0.43		
September	Rata rata	0.10	0.16	31.09	NNE
	Max	0.32	0.54		
Oktober	Rata rata	0.10	0.17	31.47	SSW
	Max	0.32	0.53		
November	Rata rata	0.12	0.20	37.23	SSW
	Max	0.49	0.81		
Desember	Rata rata	0.23	0.39	33.82	SSW
	Max	0.54	0.89		

3. TAHUN 2021

Bulan	Katagori	Tinggi Gelombang		Arah Angin (Knot)	Arah Angin dari
		Hsig (m)	Hmax (m)		
Januari	Rata rata	0.22	0.29	13.00	N
	Max	0.64	0.85		
Februari	Rata rata	0.29	0.39	14.00	NNW
	Max	0.81	1.06		
Maret	Rata rata	0.08	0.10	9.00	WSW
	Max	0.28	0.37		
April	Rata rata	0.10	0.10	13.00	WSW
	Max	0.43	0.57		
Mei	Rata rata	0.06	0.08	10.00	E
	Max	0.26	0.26		
Juni	Rata rata	0.06	0.08	10.00	SW
	Max	0.20	0.27		
Juli	Rata rata	0.08	0.10	10.00	E
	Max	0.21	0.27		
Agustus	Rata rata	0.07	0.09	9.00	ESE
	Max	0.16	0.21		
September	Rata rata	0.06	0.08	8.00	ESE
	Max	0.16	0.20		
Oktober	Rata rata	0.07	0.09	12.00	SW
	Max	0.33	0.44		
November	Rata rata	0.13	0.17	16.00	SW
	Max	0.39	0.51		
Desember	Rata rata	0.11	0.14	12.00	WSW
	Max	0.28	0.37		

4. TAHUN 2022

Bulan	Katagori	Tinggi Gelombang		Arah Angin (Knot)	Arah Angin dari
		Hsig (m)	Hmax (m)		
Januari	Rata rata	0.11	0.15	12.00	WSW
	Max	0.35	0.47		
Februari	Rata rata	0.13	0.17	17.00	WSW
	Max	0.37	0.48		
Maret	Rata rata	0.17	0.22	15.00	WSW
	Max	0.41	0.54		
April	Rata rata	0.09	0.12	14.00	SW
	Max	0.27	0.35		
Mei	Rata rata	0.08	0.11	10.00	WSW
	Max	0.23	10.00		
Juni	Rata rata	0.07	0.09	10.00	SW
	Max	0.25	0.32		
Juli	Rata rata	0.07	0.09	12.00	SW
	Max	0.12	0.16		
Agustus	Rata rata	0.06	0.08	7.00	ESE
	Max	0.12	0.16		
September	Rata rata	0.07	0.09	14.00	SW
	Max	0.34	0.44		
Oktober	Rata rata	0.11	0.14	17.00	WSW
	Max	0.49	0.64		
November	Rata rata	0.18	0.24	17.00	WSW
	Max	0.47	0.62		
Desember	Rata rata	0.18	0.24	17.00	W
	Max	0.53	0.69		



BADAN METEOROLOGI KLIMATOLOGI DAN GEOFISIKA
STASIUN METEOROLOGI MARITIM KELAS I MERAK

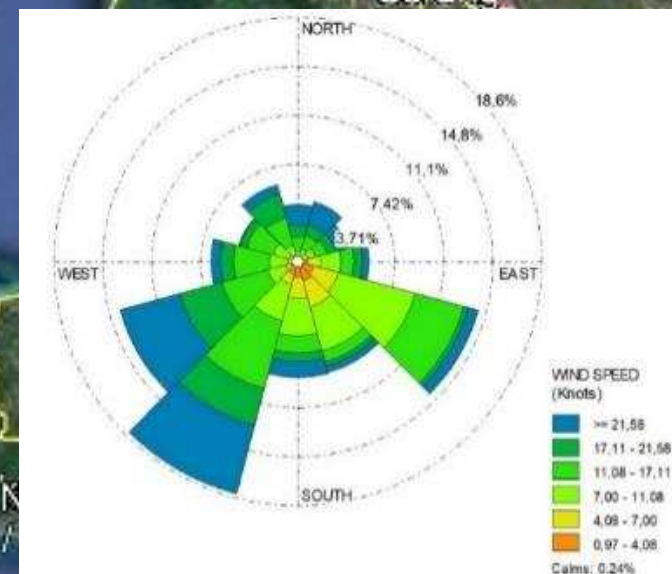
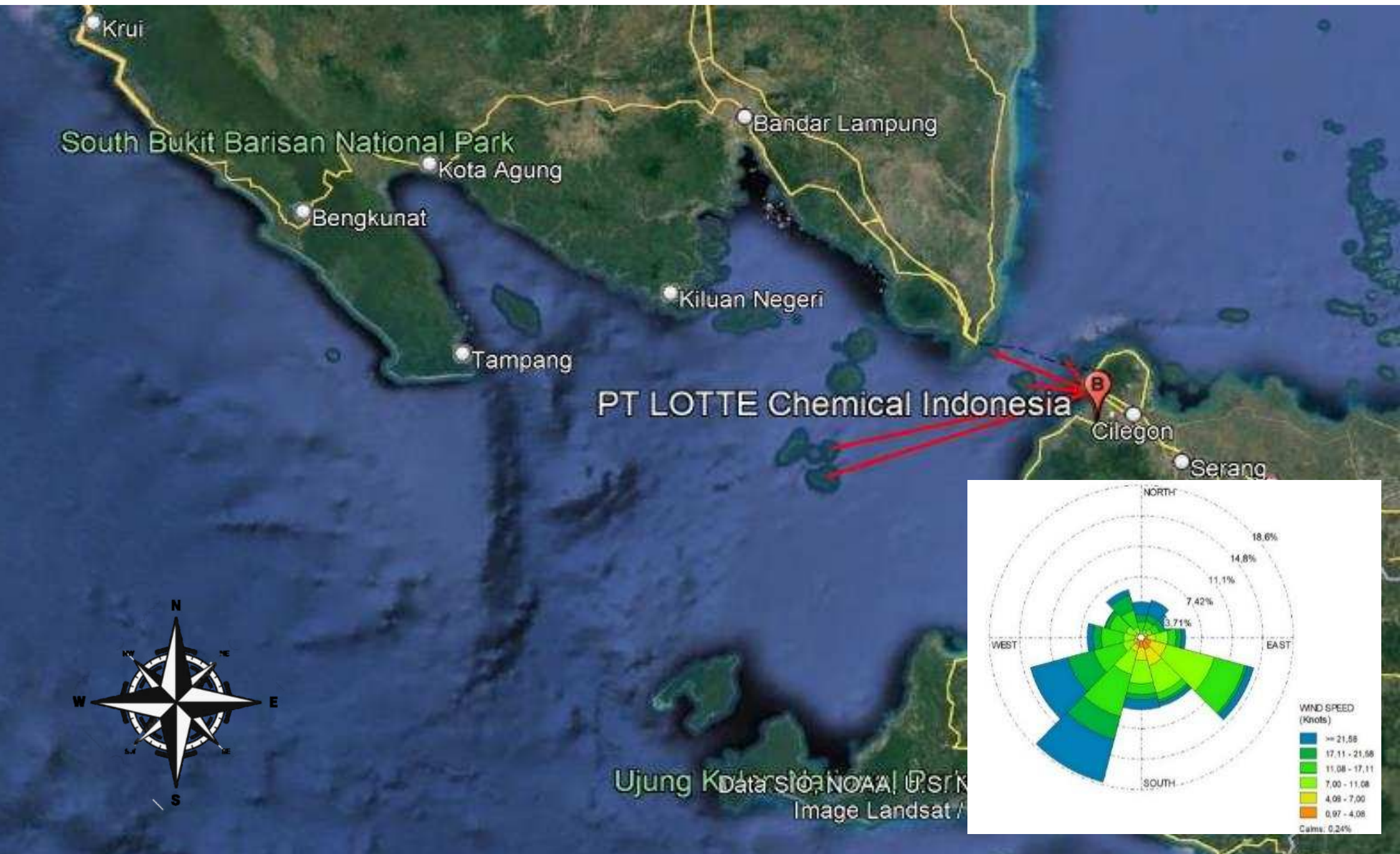
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e-mail: , stamet.serang@bmkg.go.id stamet_serang@yahoo.co

5. TAHUN 2023

Bulan	Katagori	Tinggi Gelombang		Arah Angin (Knot)	Arah Angin dari
		Hsig (m)	Hmax (m)		
Januari	Rata rata	0.16	0.21	14.00	WSW
	Max	0.38	0.50		
Februari	Rata rata	0.18	0.24	14.00	WSW
	Max	0.48	0.63		
Maret	Rata rata	0.08	0.11	10.00	SW
	Max	0.26	0.34		
April	Rata rata	0.12	0.15	13.00	WSW
	Max	0.27	0.36		
Mei	Rata rata	0.05	0.07	11.00	SW
	Max	0.17	0.22		
Juni	Rata rata	0.04	0.11	6.00	E
	Max	0.07	1.10		
Juli	Rata rata	0.06	0.08	8.00	SE
	Max	0.12	0.16		
Agustus	Rata rata	0.05	0.08	7.00	ESE
	Max	0.13	0.20		
September	Rata rata	0.05	0.08	7.00	ESE
	Max	0.11	0.17		
Oktober	Rata rata	0.05	0.07	6.00	ESE
	Max	0.22	0.34		
November	Rata rata	0.04	0.06	7.00	WSW
	Max	0.14	0.21		
Desember	Rata rata	0.08	0.12	11.00	SW
	Max	0.20	0.30		



Serang, 31 Mei 2024
Pelayanan Jasa
Stasiun Meteorologi Maritim Kelas I Mrak
Dian Herdianingsih, SP



LAMPIRAN

 PT. LOTTE CHEMICAL INDONESIA	REPORT	 LOTTE E&C
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Project Name :
Line Project

Site Location :
Cilegon, Indonesia

Document Title :
GEOTECHNICAL INVESTIGATION REPORT

Document No.
LINE-906-CC-4-0101

Client's Contract No. : Later
LEC's Job No. : 15005

A	21-Apr-2022	Issued For Approval	B.H.PARK	Z.C.KIM	S.Y.PARK
Rev	Date	Description	Prepared	Reviewed	Approved

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2	SCOPE OF WORKS.....	5
3	FIELD INVESTIGATION.....	15
4	DESIGN PARAMETER.....	32

APPENDICES**APPENDIX 1. BORING LOCATION PLAN****APPENDIX 2. SOIL PROFILE****APPENDIX 3. BORING LOG.**

1 INTRODUCTION

1.1 General

In order to estimate physical & engineering properties of Geotechnical condition of the Project location, 20 number of boring and in-situ / laboratory testing were carried out in Addition to 30 number of boring information done during Feed & Bid stage

Result of :

- Drilling of 16 points(Feed Design), 14 points(Bid Design) and 20 points(Detail Design)
- PMT(Pressure Meter Test) of 6 points(Bid Design) and 6 points(Detail Design)
- UDS(Undisturbed Sample) and SPT(Standard Penetration Test) sampling
- Laboratory testing

1.2 Project Location

The project is located at located on Cilegon, Banten Province, Indonesia.

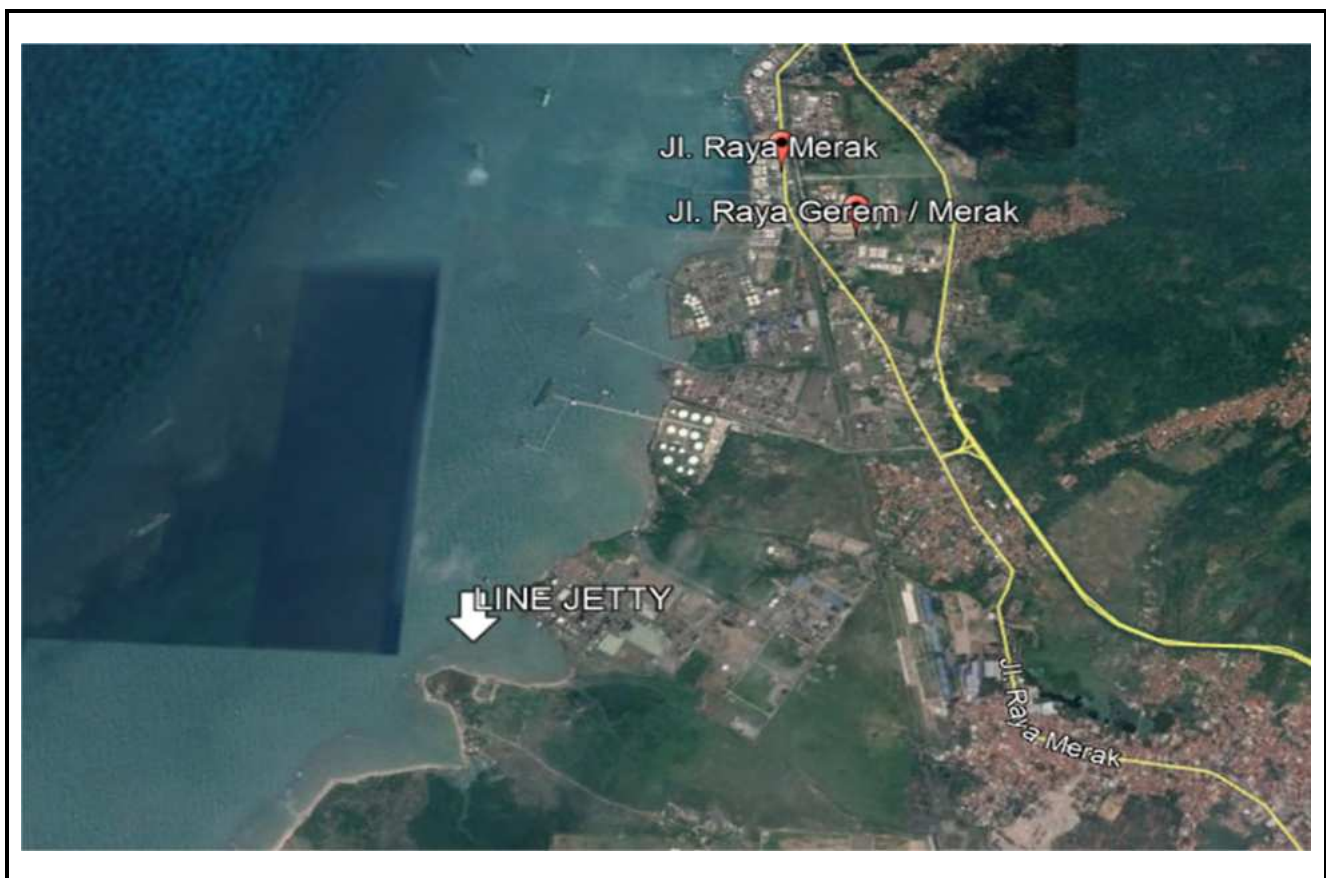


Figure 1-1 Project Location

1.3 Objectives

The general purpose of this investigation is to study the sub surface soil condition beneath the project location and to determine the geotechnical parameters to perform analysis for geotechnical structures and issues beneath the project site.

2 SCOPE OF WORKS

2.1 Scope

Table – 2.1 Geotechnical Investigation Scope

Work item	Unit	Bid Design	Detail Design	Total
1) Field test for new jetty area				
a. Boring	ea	14	20	34
b. Standard Penetration Test (SPT)	ea	229	360	589
d. Pressuremeter Test (PMT)	ea	6	6	12
e. Picking Undisturbed Sample	ea	12	20	32
2) LAB test for New Jetty				
Particle Analysis	ea	25	40	65
Liquid Limit Test	ea	25	40	65
Plastic Limit Test	ea	25	40	65
Water Content Test	ea	25	40	65
Specific Gravity Test	ea	25	40	65
Uniaxial Compression Test	ea	12	10	22
Triaxial Compression Test (UU,CU)	ea	12	20	22
Rock Index Properties	ea	8	14	22
Rock Point Load Test	ea	13	10	23
Rock Uniaxial Compression	ea	8	7	15

Consolidation Test

ea

-

10

10

2.2 Performance

2.2.1 Soil Investigation Works

2.2.1.1 Platform Establishment

Platforms are required to house drilling and testing equipment over the water level. The platform must be strong enough to withstand weather and natural elements. The platform is made using bamboo beams of 3-4" diameter and wooden plate as base. The connectors are nail and hemp rope. The platform cover uses wooden plates of 2 cm thick and plywood. The pipes are connected and drilled onland. The material is then transported to the location of the boreholes. Bamboo beams are sunk to act as starter piles around the borehole. The platform is then completed on these starter bamboo beams. After the frame is complete, wooden plate and plywood is put into the platforms and safety railing is added.

The platform will be 6x6 m area to provide enough space for drilling. This platform is only designed to be used for water depth 10m ~ 20m.

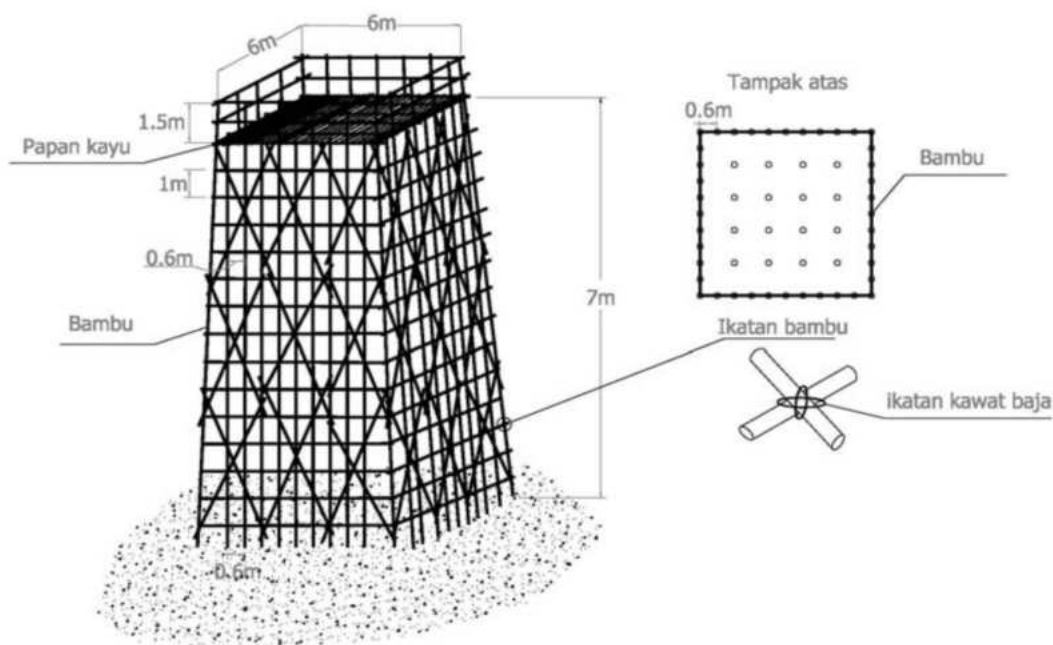


Figure 2-1 Bamboo Platform Design

Before moving the equipment to the platform, the drilling machines are dismantled into manageable pieces and then transported by boat to the platform. After reaching the platform the rigs were then reassembled. The hoisting tools are traditional and chain blocks attached to special portals on the platform.



Figure 2-2 Moving Rig to Platform

2.2.1.2 Exploratory Drilling

Access borehole will be sunk for exploratory purpose with insitu tests and undisturbed soil sampling. The borehole diameter will be sufficiently large to allow the insertion of insitu test apparatus and undisturbed soil sampler with minimum diameter of 75 mm (NX Size). The drilling will be carried out by continuous coring. The boring will use pressurized water to loosen the soil for boring. Lithology will be logged by a competent Geotechnical engineer for the description of soil type, consistency or compactness, plasticity, colour, degree of cementation if any, and other features that are important for foundation design. Borehole will be stable from collapsing. When the borehole reach soil layer with high collapsing potential, casing pipe will be provided to protect the borehole wall. In any case, the casing pipe should not be deeper than the borehole and will be at 0.5m above the bottom of the borehole (except during rock coring)

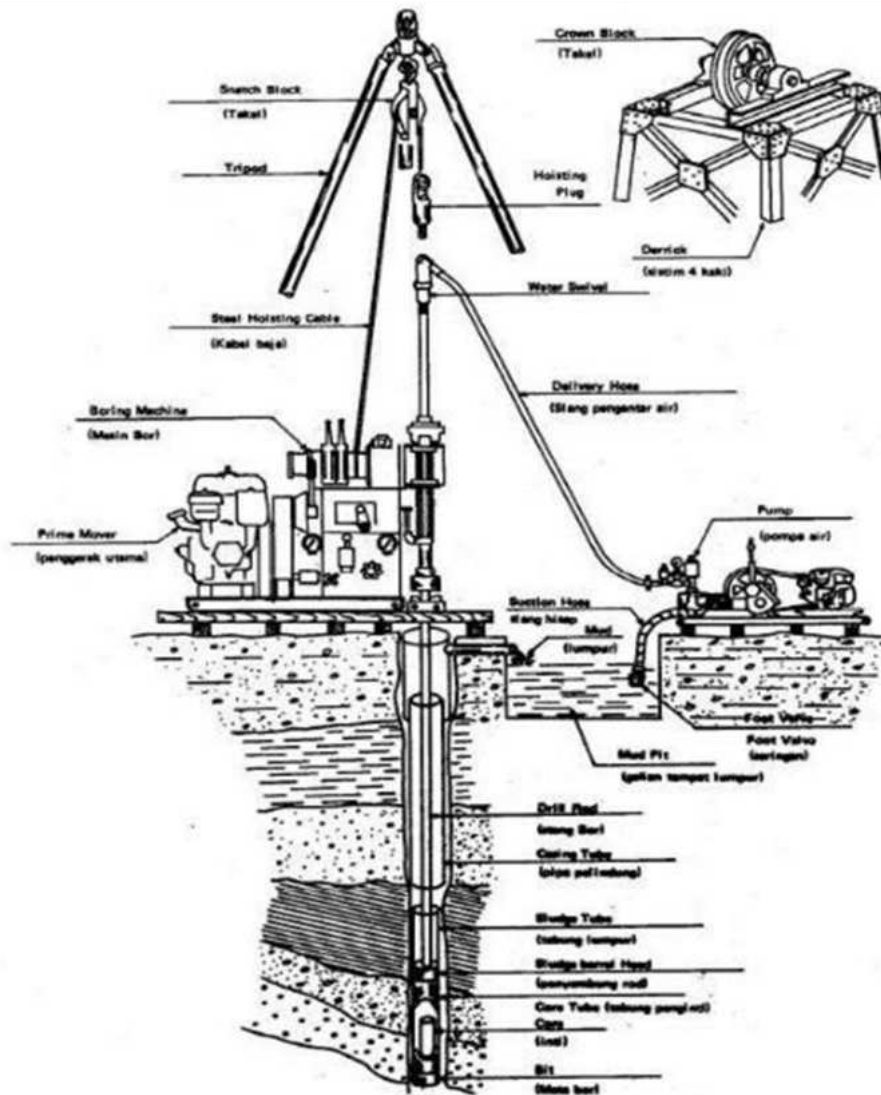


Figure 2-3 Geotechnical Drilling With Rotary Drilling Rig

2.2.1.3 Standard Penetration Test (SPT)

Standards used : ASTM D 1586-97

Equipment used : free fall manual hammer

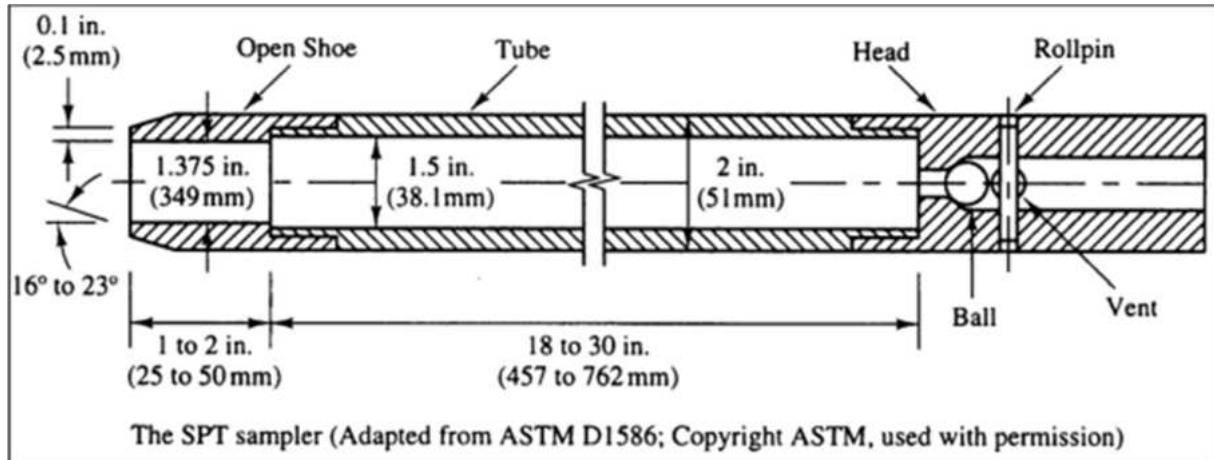


Figure 2-4 ASTM SPT Sampler

Standard penetration tests have been done following ASTM D 1586-97.

Test was carried out in each boring hole to obtain a measured of soil resistance to penetration of the sampler. The purpose of performing this test is to determine relative density of coarse grain soil or the consistency of fine grain, which reflect the soil supporting capacity. In the test process, a split barrel sampler is lowered into the bottom of bore hole by drilled rods. The sampler then drives 45 cm into a soil by 140 lbs free falling hammers over a height of 30 in. The automatic drop hammer device is used to maintain free falling and constant height. For the test result, the first 15 cm penetration is not taken in the analysis and considered to be a seating drive. Hence the number of blows to achieve this 15 cm penetration is not including in the N SPT value. The total cumulative numbers of blow count required to drive the sampler to the last 30 cm penetration is recorded as the N value. Soil samples taken from SPT are stored in plastic bag for identification.

The hammer used for SPT testing and sampling is the automatic trip hammer with N70 energy ratio.

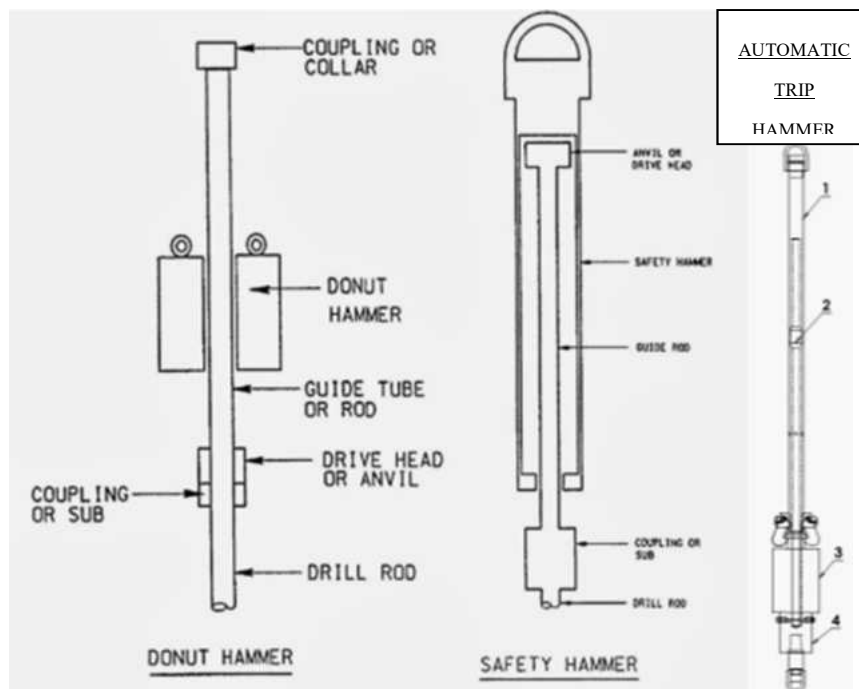


Figure 2-5 SPT Hammer Types

2.2.1.4 Undisturbed Sampling

Standards used : ASTM D 1587-97.

Sampling interval : according to request

Equipment used : thin wall sampler

In order to obtain undisturbed samples, a clean bore hole has been drilled to the desired sampling depth. A set of sampler consist of a stainless steel tube attached to the sampler head lowered to the bottom of the bore hole. The sampler is then pushed into the soil without rotation. After penetrating into the soil for approximately 95 % of samples length, the thin wall tube is withdrawn from the borehole. Both end of the tube are then sealed with paraffinwax immediately after the tube is separated from the sampler head. Samples are then brought to the laboratory for testing.

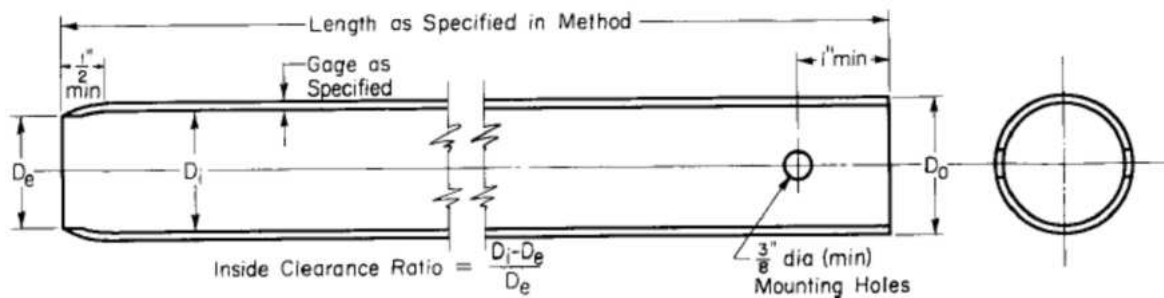


Figure 2-6 UDS Sampler Size

Outside diameter (Do) = 2"/50.8 mm

Tube Length = 0.5 m

2.2.1.5 Pressuremeter Testing

The test is commonly termed as Pressuremeter Test/PMT /Lateral Loading Test/LLT/ Elastmeter. The difference between LLT/Elastmeter is only the capacity of the pressure. LLT is used for soft soil and Elastmeter is used for sand or stiff soil.

The test is done on a borehole slightly larger than the cylindrical rubber balloon. The pressure is gradually increased as the rubber cylinder compresses the surrounding soil. The water pressure, soil deformation and rubber creep is measured and is corrected by groundwater effects and rubber strength. The test is stopped if maximum pressure has been obtained or the pressure recorded is steady (indicating that the soil has yielded). The pressuremeter used will be of Menard production. The test will be performed in accordance to ASTM D4719.

The pressuremeter consists of two main elements : a radially expandable cylindrical probe which is placed inside a borehole at the desired test elevation and a monitoring unit which remains on the ground surface. The probe is made up of three independent cells and consequently exerts at the central cell level a strictly uniform pressure against the borehole walls. The pressure is increased in equal increments of time and pressure and the resulting borehole expansions recorded.

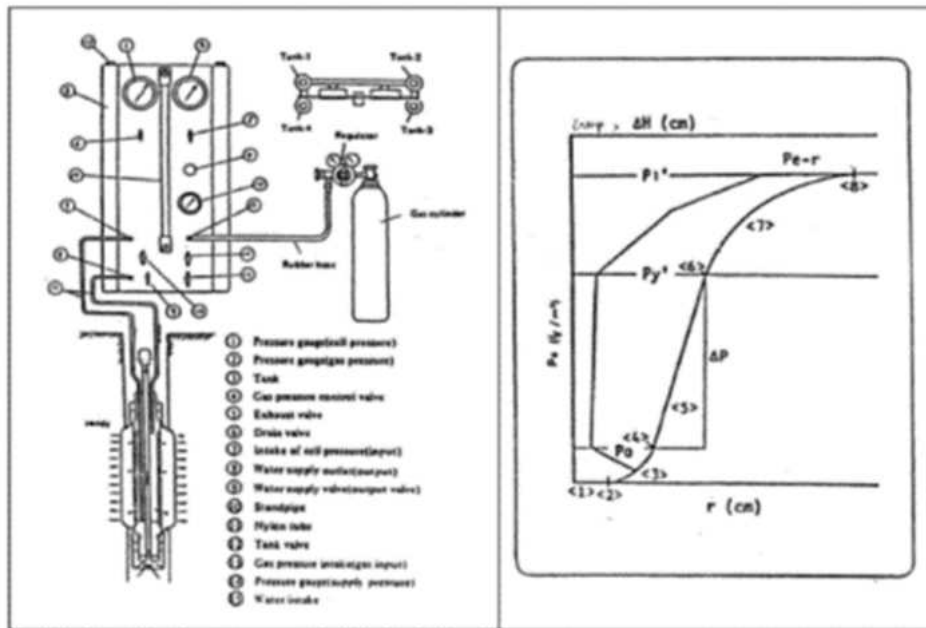


Figure 2-7 Pressuremeter Testing Schematics

2.2.2 Laboratory Works

The laboratory soil test will be carried out on selected undisturbed sampling following the ASTM standard, as below:

2.2.2.1 Unit weight ASTM D2937

Unit weight is measured by driving a hollow cylinder ring into the undisturbed sample. The volume of the ring is known, therefore by weighing the hollow cylinder ring, the unit weight of the soil may be determined. Standard used is ASTM D2937

2.2.2.2 Natural moisture content ASTM D2216

Natural moisture content is determined by drying soil sample in an oven for minimum 12 hours and by reduction of weight we can determine the natural moisture content. Standard used is ASTM D2216

2.2.2.3 Atterberg limits ASTM D4318

Atterberg limits that are determined are:

1. Liquid limit using the Casagrande Method
2. Plastic limit using the Hand Rolling Method

By knowing the liquid limit and plastic limit we can determine the Index Properties of the soil.

Standard used is ASTM D4318

2.2.2.4 Grain size analysis (sieve + hydrometer) ASTM D422

Grain Size analysis uses the wet sieving method where all of the appropriate soil samples are soaked into a hydrometer that will calculate the coefficients for grain size <200 sieve no. After that the soil is dried and sieved with the following sieve sizes: Standard used is ASTM D422

No.	Opening mm	No.	Opening mm	No.	Opening mm
3"	101.600	3/8"	9.525	100	0.149
2"	75.000	4	4.760	200	0.074
1 1/2"	38.100	8	2.380		
1"	25.400	20	0.840		
3/4"	19.050	40	0.420		
1/2"	12.700	80	0.177		

2.2.2.5 Specific gravity ASTM D854

Specific gravity of soil is determined with the water pycnometer method. By replacing the the water with soil, we can determine the specific gravity of soil. Standard used is ASTM D854.

2.2.2.6 Unconfined Compression Test ASTM D2166

Unconfined compression uses the same triaxial machine but without the confining pressure. This test is only applicable to cohesive soil. Undrained shear strength may directly be found using this test.

The specimen used is:

Specimen Diameter	cm	3.800
Specimen Height	cm	7.600
Specimen Area	cm ²	11.341

2.2.2.7 One Dimensional Consolidation test ASTM D2435

The odometer test or one dimensional consolidation test is done to determine consolidation parameters such as preconsolidation pressure, coefficient of volumetric change and coefficient of consolidation. The test is done by compressing a sample with sepcific weights with daily increments. The time and change in sample size is measured daily and plotted. After 7 days, the weights are remove incrementally and the sample rebound is measured. The results are plotted and calculated to find consolidation coefficients. Standard used is ASTM D2435

Sample Size used is:

Sample Height	2.000 cm
Sample Diameter	5.000 cm
Sample Area (A)	19.635 cm ²

2.2.2.8 Triaxial Compression Tests (UU) ASTM D2850

UU Triaxial Compression is a compression tests which the soil sample is subjected to a confining pressure. Confining pressure is generated by pressurized water. The sample is then stressed by using constant strain. This test method covers determination of the strength and stress-strain relationships of a cylindrical specimen of either undisturbed or remoulded cohesive soil. No drainage is allowed for the sample. The results give stress-strain relationship in total stress, which is not corrected for pore water pressure. The tests is done three times using the same soil or remoulded soil to find the undrained shear strength.

Standard used is ASTM D2850

Specimen Diameter	cm	3.800
Specimen Height	cm	7.600
Specimen Area	cm ²	11.341



Figure 2-8 Triaxial Machine

3 FIELD INVESTIGATION

3.1 Boring

Drilling was done using continuous coring method. The following table shows the coordinates and elevation of points. Elevation is taken from staking out topographic survey.

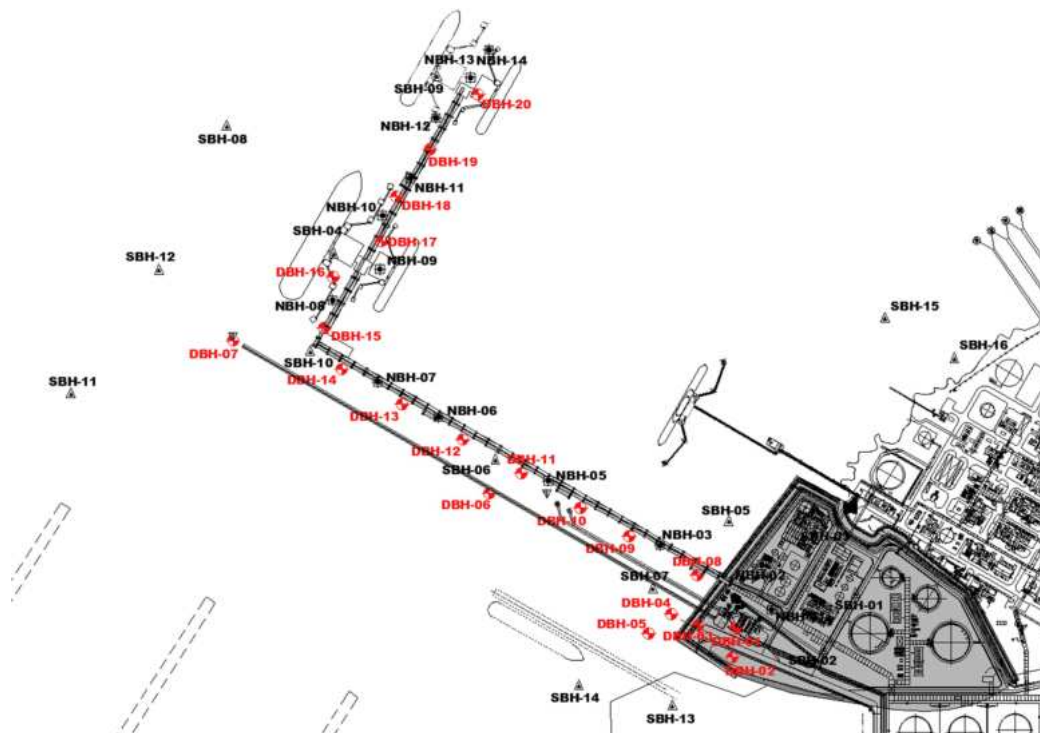


Figure 3-1 Boring location

Table – 3.1 Borehole Coordinates and Elevation

Boring No.		Easting (X)	Northing (Y)	Elevation	Depth
Detail Design	DBH-01	609,574	9,338,891	+6.0	30
	DBH-02	609,569	9,338,842	+3.0	30
	DBH-03	609,511	9,338,896	+3.1	40
	DBH-04	609,465	9,338,916	-2.5	30
	DBH-05	609,426	9,338,883	-3.0	30
	DBH-06	609,154	9,339,122	-15.0	30
	DBH-07	608,717	9,339,383	-14.3	30
	DBH-08	609,510	9,338,983	-4.0	30
	DBH-09	609,393	9,339,049	-10.3	33
	DBH-10	609,310	9,339,097	-12.5	30
	DBH-11	609,209	9,339,156	-15.0	30

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Boring No.		Easting (X)	Northing (Y)	Elevation	Depth
Detail Design	DBH-12	609,109	9,339,214	-15.0	30
	DBH-13	609,006	9,339,274	-14.5	30
	DBH-14	608,903	9,339,334	-14.2	30
	DBH-15	608,873	9,339,405	-14.3	30
	DBH-16	608,888	9,339,492	-13.7	30
	DBH-17	608,970	9,339,552	-13.5	30
	DBH-18	608,996	9,339,628	-13.3	30
	DBH-19	609,053	9,339,709	-13.3	30
	DBH-20	609,135	9,339,803	-12.5	30
Bid Design	NBH-01	609,636	9338923	-0.25	25
	NBH-02	609,612	9338997	-3.25	25
	NBH-03	609,446	9339036	-8.75	25
	NBH-05	609,278	9339135	-14.25	30
	NBH-06	609,066	9339262	-15.00	25
	NBH-07	608,965	9339316	-14.00	25
	NBH-08	608,887	9339451	-14.00	25
	NBH-09	609,002	9339502	-13.50	30
	NBH-10	608,972	9339571	-13.50	30
	NBH-11	609,026	9339644	-13.50	30
	NBH-12	609,063	9339762	-13.00	30
	NBH-13	609,122	9339831	-12.50	30
	NBH-14	609,149	9339871	-12.50	30
Feed Design	SBH-01	609,780	9,338,952	-1.50	16
	SBH-02	609,724	9,338,856	-0.25	15
	SBH-03	609,747	9,339,074	-1.75	15
	SBH-04	608,889	9,339,531	-13.5	15
	SBH-05	609,563	9,339,075	-5.75	15
	SBH-06	609,165	9,339,180	-15.0	15
	SBH-07	609,433	9,338,960	-7.0	15
	SBH-08	608,706	9,339,749	-13.5	15
	SBH-09	609,065	9,339,834	-13.0	15
	SBH-10	608,849	9,339,365	-14.5	15
	SBH-11	608,441	9,339,292	-15.0	15

Boring No.		Easting (X)	Northing (Y)	Elevation	Depth
Feed Design	SBH-12	608,591	9,339,504	-14.0	15
	SBH-13	609,467	9,338,760	-	18
	SBH-14	609,307	9,338,795	-	15
	SBH-15	609,829	9,339,421	-	15
	SBH-16	609,497	9,339,353	-	16.45

3.2 Pressuremeter Testing

Pressuremeter testing were performed at 6 points on selected boreholes. The results are interpreted and summarized here:

Table – 3.2 Pressuremeter Coordinates

No.	Borehole	Easting (X)	Northing (Y)
Detail Design	DBH-03	609,510	9,338,896
	DBH-04	609,465	9,338,916
	DBH-08	609,509	9,338,982
	DBH-11	609,208	9,339,156
	DBH-14	608,902	9,339,334
	DBH-19	609,053	9,339,709
Bid Design	NBH-05	609,278	9,339,262
	NBH-07	608,965	9,339,316
	NBH-08	608,887	9,339,451
	NBH-10	608,972	9,339,571
	NBH-12	609,063	9,339,762
	NBH-13	609,122	9,339,831

Table – 3.3 Pressuremeter Test Results

No.	PMT	Depth	Nspt	Limit Pressure	Menard Modulus	Shear Modulus
				PI	Em	Gm
	Borehole			kg/cm2	kg/cm2	kg/cm2
Detail Design	DBH-03	11.0	7	1.96	11.85	4.56
	DBH-04	9.5	20	6.33	162.9	65.2
	DBH-08	7.0	7	1.90	48.9	19.6
	DBH-11	3.0	2	1.72	10.37	3.99
	DBH-14	5.0	2	1.58	40.7	16.3
	DBH-19	7.5	2	2.03	52.1	20.9
Bid Design	NBH-05	3.0	1	4.9	19.13	7.36
	NBH-07	4.5	2	4.5	14.42	5.55
	NBH-08	6.5	16	12.5	99.05	38.10
	NBH-10	3.0	1	4.0	17.60	6.77
	NBH-12	5.0	7	4.75	23.6	9.08
	NBH-13	3.0	5	4.3	19.95	7.67

3.3 Subsurface Soil Stratigraphy

3.4.1 Specific Boreholes

1) Detail Design

Table – 3.4 Soil Type at DBH-1

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 -10.55	SAND	Very loose, loose brown	1-9
2	10.55-14.0	GRAVEL	Very dense brown	77-100
3	14.0-18.0	CORAL, SAND	Very loose, grey	2-6
4	18.0-26	SAND	Very dense grey, brown	39-88
5	25.0 - 30.0	WEATHERED ROCK	Very dense, brown	>100

Table – 3.5 Soil Type at DBH-2

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0-6.0	SAND	Loose brown, Very loose, grey	1-8
2	6.0-15.0	SILT	Very soft, Grey sandy	1-5
3	15.0-19.55	SAND	Very dense	52-70
4	19.55-30	WEATHERED ROCK	Very dense, light brown	>100

Table – 3.6 Soil Type at DBH-3

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0-9.8	SAND	Very loose, loose brown, grey	1-8
2	9.8-15.0	SAND	Loose grey, Medium dense, grey	5-26
3	15.0-16..45	GRAVEL	Very dense	28-67
4	16.45-23.0	SAND	Very dense, light brown	73-86
5	23.0-30.0	WEATHERED ROCK	Very dense	>100

Table – 3.7 Soil Type at DBH-4

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.00-2.55	SANDY SILT	Soft grey sandy	1-4
2	2.55-7.45	CORAL	Very loose, grey	1-2
3	7.45-12.5	SAND	Very dense, grey	53-100
4	12.5-30.0	WEATHERED ROCK	Very dense, brown	>100

Table – 3.8 Soil Type at DBH-5

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	1.0-6.0	CORAL	Very loose, grey	2
2	6.0-9.5	GRAVEL	Loose Medium dense, grey	8-13
3	9.5-13.45	SAND	Dense to very dense, brown	45-90
4	13.45-30.0	WEATHERED ROCK	Very dense, brown	>100

Table – 3.9 Soil Type at DBH-6

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 -3.5	CLAY	Very soft, dark grey, moist	1-2
2	3.5-7.0	SILT	Soft, dark grey, moist	12-19
3	7.0-13.0	SAND	Vety dense, light brown	25-60
4	23.8 - 25.0	WEATHERED ROCK	Vety dense, light brown	>100

Table – 3.10 Soil Type at DBH-7

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0-5.0	CLAY	Very soft, dark grey, wet	1-4
2	5.0-13.5	SAND	grey, low plasticity, moist	32-74
3	4.5 - 23.8	WEATHERED ROCK	very dense, brown to dark grey	>100

Table – 3.11 Soil Type at DBH-8

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 -5.15	SILT	Very soft, grey	1-2
2	5.15-10.0	CLAY	Medium stiff, yellowish grey	7-9
3	10.0-12.0	SILT	Stiff, yellowish grey	9
4	12.0-30.0	WEATHERED ROCK	Very dense, brownish grey	>100

Table – 3.12 Soil Type at DBH-9

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0-6.2	SILT	Very soft, grey	1
2	6.2-9.0	CLAY	Medium stiff, grey	6-13
3	9.0-30.0	WEATHERED ROCK	Very dense, grey	>100

Table – 3.13 Soil Type at DBH-10

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 -1.45	SILT	Very soft, grey	1
2	1.45-5.0	SAND	Medium dense, brownish grey	15-43
3	5.0 – 30.0	WEATHERED ROCK	Very dense, brown	>100

Table – 3.14 Soil Type at DBH-11

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 -3.75	CLAY	Very soft , dark grey, moist	1-2
2	3.75 – 30.0	WEATHERED ROCK	Very dense, non plastic, light brown	>100

Table – 3.15 Soil Type at DBH-12

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 6.0	CLAY	Very soft, medium plasticity, moist	1-2
2	6.0 – 10.5	SILT	soft, high plasticity, moist	20-69
3	10.5 - 14.0	SAND	Very dense, dark brown	78-85
4	14.0 – 30.0	WEATHERED ROCK	Very dense, brown, strong cemented	>100

Table – 3.16 Soil Type at DBH-13

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 – 4.5	CLAY	Very soft, low plasticity, wet	1-2
2	4.5 – 10.0	SILT	Soft to very stiff, low plasticity, moist	3-22
3	10.0 – 13.8	SAND	Very dense	55-59
4	13.8 – 30.0	WEATHERED ROCK	Very dense, brown, strong cemented	>100

Table – 3.17 Soil Type at DBH-14

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 3.5	CLAY	Very soft, dark grey, low plasticity, moist	1
2	3.5 – 6.5	SILT	grey, very soft, low plasticity, moist	2
3	6.5 – 9.2	SAND	Grey, stiff, low plasticity, moist	65-92
4	9.2 – 30.0	WEATHERED ROCK	very dense, dark grey	>100

Table – 3.18 Soil Type at DBH-15

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 – 5.5	SILT	Very stiff, non plastic, moist	1-2
2	5.5 – 11.5	SAND	Very dense, brown	18-69
3	11.5 – 30.0	WEATHERED ROCK	Very dense, brown, strong cemented	>100

Table – 3.19 Soil Type at DBH-16

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 – 5.5	CLAY	Soft to very stiff, low plasticity, moist	3-18
2	5.5 – 10.0	SAND	Very dense, brown	49-85
3	10.0 - 13.0	SILT	Soft to very stiff, low plasticity, moist	25-29
4	13.0 – 30.0	WEATHERED ROCK	brown, very dense, strong cemented, dry	>100

Table – 3.20 Soil Type at DBH-17

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 – 2.0	CLAY	Soft to very stiff, low plasticity, moist	1
2	2.0 - 5.5	SILT	Soft to very stiff, low plasticity, moist	3-23
3	5.5 – 13.0	SAND	Very dense, dark grey,	34-85
4	13.0 - 30.0	WEATHERED ROCK	Very dense, moist	>100

Table – 3.21 Soil Type at DBH-18

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 – 2.0	CLAY	Very soft, medium to low plasticity, moist	1
2	2.0 – 9.0	SILT	grey, soft to very soft, low plasticity, moist	15-38
3	4.5 - 23.8	WEATHERED ROCK	Very dense, dark grey, moist	>100

Table – 3.22 Soil Type at DBH-19

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 – 3.5	CLAY	Very soft, medium plasticity, moist	1
2	3.5 – 12.0	SILT	Very stiff to hard, low plasticity, moist	2-25
3	12.0 – 20.0	SAND	Very dense, grey	64-94
4	20.0 - 30.0	WEATHERED ROCK	Very dense, dark grey, moist	>100

Table – 3.23 Soil Type at DBH-20

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 – 3.0	CLAY	Very soft, medium plasticity, moist	1
2	3.0 – 5.0	SILT	very stiff, high plasticity, moist	2-10
3	5.0 – 30.0	WEATHERED ROCK	Very dense, brown, moist	>100

2) Bid Design

Table – 3.24 Soil Type at NBH-01

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 2.0	CORAL	very loose, dry	1
2	2.0 - 5.0	Clayey SILT with CORAL	dark green, very soft, wet	1
3	5.0 - 11.0	SILT with CORAL	dark grey, very soft to soft, moist	1-4
4	11.0 - 19.6	Silty SAND	dark grey to dark brown, dense, low to non plastic, moist to dry	44->50
5	19.6 - 25.0	WEATHERED ROCK	light grey to dark grey, very dense, strong cemented, dry	>50

Table – 3.25 Soil Type at NBH-02

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 9.0	CLAY with a few GRAVEL	grey, very soft to firm, medium plasticity, moist	1-6
2	9.0 - 12.0	Silty CLAY	dark grey, stiff, high plasticity, moist	14-16
3	12.0 - 14.0	SANDSTONE	dark brown, subrounded, moderate, very dense, dry	>50
4	14.0 - 25.0	WEATHERED ROCK	Dark brown to dark grey, rounded, strong cementation, very dense, dry	>50

Table – 3.26 Soil Type at NBH-03

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 3.5	CLAY, CORAL REEF	dark grey, very soft, low plasticity, wet	1
2	3.5 - 11.0	SILT, CORAL REEF	dark grey and white, stiff to very stiff, medium plasticity, moist	8-16
3	11.0 - 12.0	Sandy CLAY	dark grey, stiff, medium plasticity, moist	-
4	12.0 - 25.0	WEATHERED ROCK	grey to dark grey, very dense, moderate to strong cemented, dry	>50

Table – 3.27 Soil Type at NBH-05

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 3.0	CLAY	dark grey, very soft, medium plasticity, moist	1
2	3.0 - 4.0	SILT	grey, very stiff, high plasticity, moist	30
3	4.0 - 25.5	WEATHERED ROCK	light brown, very dense, non plastic, moist	>50
4	25.5 - 29.0	SAND	light brown, very dense, non plastic, dry	>50
5	29.0 - 30.0	Sandy CLAY	dark grey, hard, low plasticity, moist	>50

Table – 3.28 Soil Type at NBH-06

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 3.5	Sandy CLAY	grey to dark grey, very soft, medium to high plasticity, moist	1
2	3.5 - 5.5	SILT	grey to dark grey, soft, high plasticity, moist	1
3	5.5 - 11.0	SILT	grey to dark grey, very stiff to hard, high plasticity, moist	18-33
4	11.0 - 13.0	SANDSTONE	dark brown, subrounded, moderate cemented, very dense, dry	>50
5	13.0 - 25.0	WEATHERED ROCK	dark grey to grey, rounded, strong cemented, very dense, dry	>50

Table – 3.29 Soil Type at NBH-07

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 7.0	CLAY, CORAL REEFS to Silty CLAY	grey to dark grey, very soft to very stiff, low plasticity, wet to dry	1-23
2	7.0 - 13.0	SILT	grey, hard, low plasticity, moist	48->50
3	13.0 - 25.0	WEATHERED ROCK	dark grey to dark brown, very dense, strong cemented, dry	>50

Table – 3.30 Soil Type at NBH-08

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 6.8	Sandy SILT	grey, firm to very stiff, non plastic, moist	6-23
2	6.8 - 8.0	Sandy CLAY	grey, stiff, low plasticity, moist	14
3	8.0 - 10.0	SILT	grey, stiff, low plasticity, moist	25
4	10.0 - 25.0	WEATHERED ROCK	brown to dark grey, very dense, dry	>50

Table – 3.31 Soil Type at NBH-09

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 2.5	Sandy CLAY	dark grey, very soft, medium to low plasticity, moist	1
2	2.5 - 5.0	Sandy SILT	grey, very stiff, medium plasticity, moist	23-26
3	5.0 - 9.0	SAND	dark grey, dense to very dense, non plastic, dry	46->50
4	9.0 - 12.0	SANDSTONE	dark grey, moderate cemented, very dense, dry	>50
5	12.0 - 30.0	WEATHERED ROCK	dark brown, strong cemented, very dense, dry	>50

Table – 3.32 Soil Type at NBH-10

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 5.0	Sandy CLAY	dark grey, very soft, medium to low plasticity, moist	1-6
2	5.0 - 9.0	Sandy SILT	dark grey, hard, low plasticity, moist	34-46
3	9.0 - 30.0	WEATHERED ROCK	brown, strong cemented, very dense, moist	>50

Table – 3.33 Soil Type at NBH-11

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 4.0	Sandy CLAY	grey, very soft to soft, low plasticity, moist	2-3
2	4.0 - 5.0	Sandy SILT	grey, very stiff to hard, low plasticity, moist	30
3	5.0 - 9.0	WEATHERED ROCK	dark grey, very dense, strong cemented, moist	>50

Layer No	Depth	Layer Name	Soil Type	N-SPT
4	9.0 - 12.0	SILT	grey, hard, low plasticity, moist	45->54
5	12.0 - 30.0	WEATHERED ROCK	dark grey, very dense, strong cemented, moist	>50

Table – 3.34 Soil Type at NBH-12

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 3.0	CLAY	dark grey, very soft, medium plasticity, moist	1
2	3.0 - 7.0	Sandy CLAY	dark grey, firm to stiff, medium to low plasticity, moist	4-10
3	7.0 - 15.0	Sandy SILT	grey to brown, stiff to very hard, low plasticity, moist	34->50
4	15.0 - 16.0	SANDSTONE	light brown, rounded, strong cemented, very dense, dry	>50
5	16.0 - 22.2	SAND	brown, rounded, weak cemented, very dense, dry	>50
6	22.2 - 30.0	WEATHERED ROCK	dark brown to brown, rounded, strong cemented, very dense, dry	>50

Table – 3.35 Soil Type at NBH-13

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 3.5	CLAY	dark grey, very soft, medium plasticity	1-5
2	3.5 - 6.5	SILT	dark brown, very stiff, high plasticity	21-31
3	6.5 - 30.0	WEATHERED ROCK	brown-dark grey, very dense, strong cemented, moist	>50

Table – 3.36 Soil Type at NBH-14

Layer No	Depth	Layer Name	Soil Type	N-SPT
1	0.0 - 3.0	CLAY	dark grey, very soft, medium plasticity	1
2	3.0 - 4.5	SILT	grey, very soft, high plasticity, moist	2
3	4.5 - 23.8	WEATHERED ROCK	light brown, very dense, dry	>50
4	23.8 - 25.0	SAND	brown, very dense, non plastic, moist	>50
5	25.0 - 30.0	WEATHERED ROCK	dark brown, very dense, dry	>50

3.4 Laboratory Testing

3.5.1 Soil Test

UDS(Undisturbed Sample), and DS (Disturbed Sample) were taken for testing at Jakarta lab..

The following table shows the tests done on the samples.

There are 2 samples that are tested, undisturbed (UDS) and triple core sample (DS). DS samples were taken from triple core sampling in stiff soil or cemented soil. They are taken to be tested as the soil is already stiff therefore not able to be penetrated using thin wall sampler (UDS). The triple core samples can still be tested for index, engineering and strength properties.

1) Detail Design (to be updated)

Table – 3.37 Laboratory Test Results

Boring No.	Depth	Sample Type	USCS SOIL CLASS	Specific Gravity	Liquid & Plastic Limit			Grain size Analysis				
					WL (%)	WP (%)	IP (%)	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	#200 sieve
DBH-1	4.0~4.3	SPT	GP	2.74	NP	NP	NP	61.8	33.69	4.32	0.18	4.50
DBH-1	8.5~8.8	SPT	SP-SM	2.67	NP	NP	NP	0.00	93.40	6.54	0.06	6.60
DBH-1	16.0~16.3	SPT	SC	2.74	34.13	21.62	12.51	42.16	44.99	10.86	2.00	12.86
DBH-2	3.7~4.0	SPT	SP-SM	2.67	NP	NP	NP	0.00	89.34	10.42	0.24	10.66
DBH-2	8.0~8.3	SPT	SC	2.68	40.37	24.14	16.23	23.56	42.81	25.27	8.35	33.62
DBH-2	17.0~17.3	SPT	SM	2.45	NP	NP	NP	0.00	54.30	41.58	4.12	45.70
DBH-2	25.0~25.3	SPT	SM	2.45	NP	NP	NP	0.00	58.88	39.26	1.86	41.12
DBH-3	2.0~2.3	SPT	SM	2.69	NP	NP	NP	0.00	75.10	22.43	2.47	24.90
DBH-3	6.0~6.3	SPT	SP-SM	2.65	NP	NP	NP	24.86	65.33	9.28	0.34	9.62
DBH-3	21.0~21.3	SPT	SM	2.42	NP	NP	NP	12.23	58.21	28.21	1.35	29.55
DBH-3	36.7~37.0	SPT	SM	2.47	NP	NP	NP	23.18	44.40	30.20	2.23	32.42

2) Bid Design

Table – 3.38 Laboratory Test Results

Boring No.	Depth	Sample Type	USCS SOIL CLASS	Specific Gravity	Liquid & Plastic Limit			Grain size Analysis				
					WL (%)	WP (%)	IP (%)	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	#20 sieve
NBH-1	1.50~1.95	SPT	CL	2.766	30.49	18.74	11.76	10.61	58.43	5.10	25.86	30.96
NBH-2	7.5~7.95	SPT	CL	2.695	48.59	24.93	23.67	0.00	25.74	26.34	47.92	74.26
NBH-3	10.5~10.9	SPT	CL	2.513	34.69	11.56	23.14	0.00	47.74	21.78	30.48	52.26
NBH-5	1.50~1.95	SPT	CH	2.611	65.29	20.21	45.08	0.00	8.19	25.28	66.53	91.81
NBH-6	1.50~1.95	SPT	CL	2.676	45.19	22.93	22.26	2.31	54.70	8.33	34.66	42.99
NBH-7	3.00~3.45	SPT	CL	2.725	40.79	21.37	19.42	5.04	58.26	5.18	31.52	36.70
NBH-8	7.50~7.95	SPT	CH	2.647	80.19	33.11	47.10	0.00	35.42	16.77	47.81	64.58
NBH-9	1.50~1.95	SPT	CH	2.613	57.49	29.02	28.48	0.00	15.47	14.71	69.82	84.53
NBH-10	3.00~3.45	SPT	CL	2.692	37.09	19.58	17.51	0.00	76.27	3.16	20.57	23.73
NBH-11	1.50~1.95	SPT	CL	2.674	27.19	19.28	7.91	0.00	76.27	3.16	20.57	23.73
NBH-12	1.50~1.95	SPT	CL	2.698	43.49	23.79	19.71	0.69	50.91	10.15	38.26	48.41
NBH-13	3.00~3.45	SPT	CH	2.612	57.59	29.28	28.13	0.00	17.49	24.36	58.15	82.51
NBH-14	1.50~1.95	SPT	CL	2.653	49.39	27.41	21.99	0.00	47.41	8.21	44.38	52.59

Table – 3.39 Laboratory Test Results

Boring No.	Depth	Sample Type	USCS SOIL CLASS	Specific Gravity	Water Content Wn(%)	Bulk Densit Yn (gr/cm ³)	Dry Densit Yd (gr/cm ³)	Void Ratio	Liquid & Plastic Limit			Grain size Analysis				
									WL (%)	WP (%)	IP (%)	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	#200 sieve
NBH-1	1.50~1.95	UDS	ML	2.661	44.457	1.813	1.255	1.125	46.40	28.78	17.62	13.19	48.83	8.83	29.12	37.98
NBH-2	3.50~4.50	UDS	CL	2.709	46.280	1.771	1.211	1.239	37.69	19.73	17.96	4.0	41.45	18.24	36.31	54.56
NBH-3	3.50~4.50	UDS	CH	2.677	52.598	1.707	1.119	1.389	73.09	32.75	40.34	0.66	27.16	23.11	49.06	72.18
NBH-5	2.00~3.00	UDS	CH	2.539	96.456	1.682	0.856	1.974	69.79	22.34	47.45	0.00	7.33	26.91	65.75	92.67
NBH-6	3.50~4.50	UDS	CL	2.666	87.411	1.652	0.882	2.019	47.49	25.61	21.88	0.41	28.14	16.85	54.60	71.45
NBH-7	3.50~4.50	UDS	CL	2.685	39.120	1.953	1.404	0.917	37.79	21.62	16.17	0.00	80.87	8.33	10.79	19.13
NBH-9	0.50~1.50	UDS	CH	2.603	66.743	1.584	0.950	1.741	58.29	28.12	30.17	0.00	15.81	37.21	46.98	84.19
NBH-10	2.00~3.00	UDS	CH	2.561	137.06	1.585	0.669	2.823	58.59	29.31	29.29	0.00	43.03	6.63	50.34	56.97
NBH-11	2.00~3.00	UDS	CH	2.605	110.95	1.660	0.787	2.307	56.99	17.08	39.91	0.00	20.04	33.77	46.19	79.96
NBH-12	2.00~3.00	UDS	CL	2.653	39.102	1.801	1.295	1.052	35.19	11.17	24.02	0.74	69.27	10.62	19.36	29.99
NBH-13	2.00~3.00	UDS	CH	2.613	110.08	1.530	0.728	2.579	67.49	28.61	38.88	0.00	21.11	18.58	60.31	78.89
NBH-14	2.00~3.00	UDS	CL	2.656	45.059	1.530	1.055	1.518	36.19	19.87	16.32	4.69	55.75	7.03	32.52	39.56

Table – 3.40 Laboratory Test Results

Boring No.	Depth	Sample Type	USCS SOIL CLASS	Triaxial UU		Unconfined Compression		
				Friction Angle	Undrained Shear Strength (kg/cm ²)	Unconfined Compression Strength (undisturbed, kg/cm ²)	Unconfined Compression Strength (remolded, kg/cm ²)	Sensitivity
NBH-1	1.50~1.95	UDS	ML	2.12	0.152	0.007	0.004	1.995
NBH-2	3.50~4.50	UDS	CL	2.18	0.055	0.036	0.018	1.979
NBH-3	3.50~4.50	UDS	CH	4.59	0.168	0.370	0.203	1.818
NBH-5	2.00~3.00	UDS	CH	1.72	0.032	0.194	0.172	1.128
NBH-6	3.50~4.50	UDS	CL	0.46	0.040	0.018	0.007	2.487
NBH-7	3.50~4.50	UDS	CL	2.98	0.250	0.340	0.197	1.726
NBH-9	0.50~1.50	UDS	CH	0.86	0.135	0.322	0.175	1.837
NBH-10	2.00~3.00	UDS	CH	0.86	0.020	0.290	0.175	1.655
NBH-11	2.00~3.00	UDS	CH	1.20	0.035	0.194	0.137	1.413
NBH-12	2.00~3.00	UDS	CL	3.04	0.067	0.194	0.137	1.413
NBH-13	2.00~3.00	UDS	CH	0.52	0.040	0.290	0.172	1.685
NBH-14	2.00~3.00	UDS	CL	1.38	0.045	0.287	0.172	1.669

3.5.2 Rock Test

1) Bid Design

Table – 3.41 Laboratory Test Results

Boring No.	Depth	Natural Water Content (%)	Absorption (%)	Porosity (%)	Void Ratio	Compression Strength (kg/cm ²)	Sigma Compression (kg/cm ²)
NBH-1	24.54 ~ 25.0	5.370	7.850	18.220	0.15	30.50	18.74
NBH-2	24.0 ~ 24.12	8.530	11.390	28.370	0.22	48.60	24.93
NBH-3	24.26 ~24.82	12.300	14.970	38.360	0.28	31.80	39.66
NBH-6	24.05 ~24.23	9.620	13.940	29.900	0.230	23.92	26.83
NBH-7	24.48 ~24.65	10.120	17.810	41.120	0.290	42.65	39.67
NBH-8	24.05 ~24.40	8.830	13.430	26.950	0.210	41.20	50.9
NBH-11	23.51 ~23.91	9.340	15.060	30.300	0.230	77.53	83.92
NBH-12	25.55 ~25.91	7.560	17.180	34.720	0.260	61.050	72.620

4 DESIGN PARAMETER

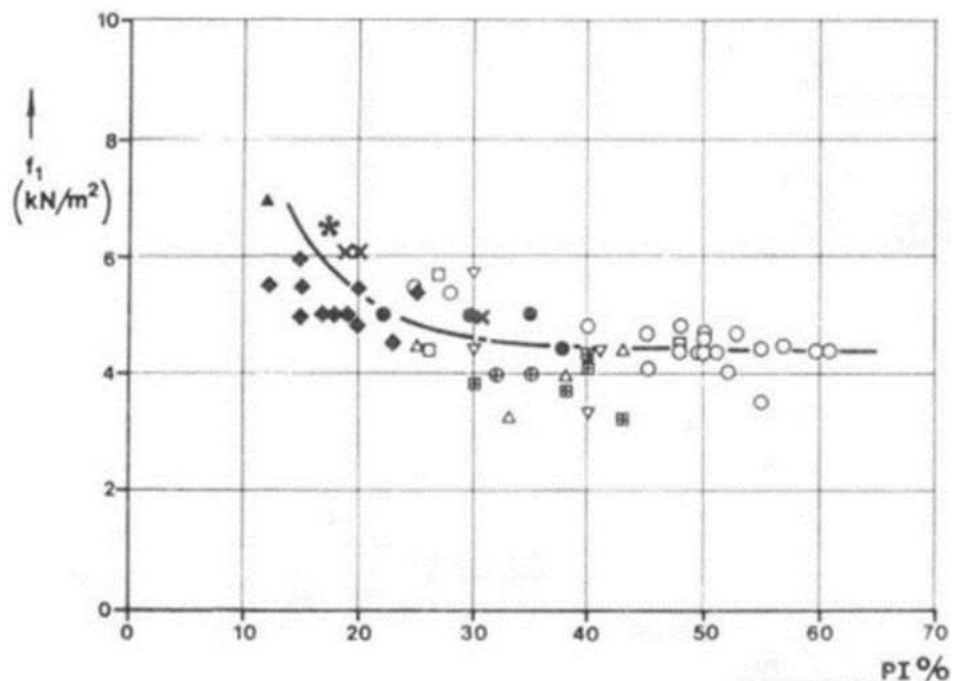
4.1 Corelation Used for Design Parameter

This section recommends the parameter to be used for design. The input data is borehole log, field tests, lab tests and judgement.

The parameters will be recommended by each borehole and a general one which is a summary of the individual boreholes. These parameters were derived from experience and judgment of the geotech engineer assigned to this project and a list of equation and correlation used is shown below. Fristly we check lab tests results and compare the values

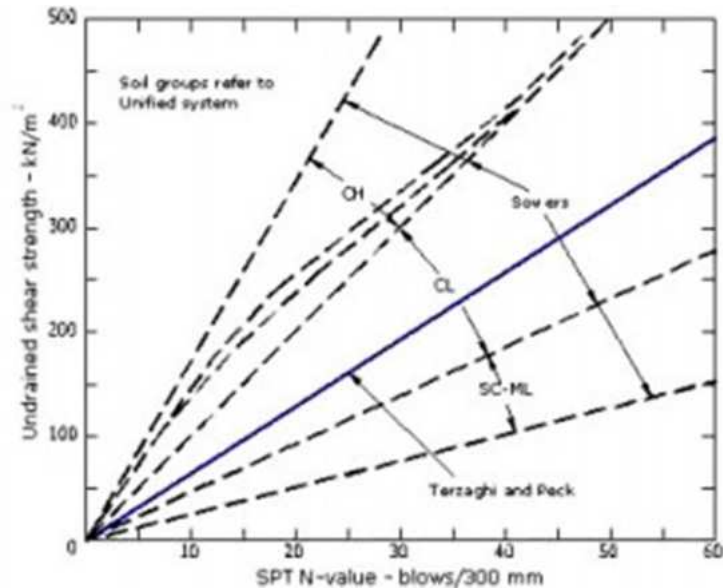
4.1.1 SPT to Su Correlation,

- a. For soft clay below NSPT <10 we used corelation by (Stroud & Butler, 1974)



Where $f_1 = S_u/N$, generally soft soil in Indonesia has above 20% Plasticity Index, therefore we used the number $S_u = 4.5 \times N$ value. In our experience this number is adequate.

- b. For stiff clay over NSPT >10 we use the Sowers (1979) recommendation



We used the average value of $S_u = 8 \times N$ value and by our experience the number is adequate.

- 4.1.2 For rock shear strength (c_u) we use the Cole and Stroud (1977) recommendation. We also check the results of unconfined compression and point load tests.

Shear Strength kN/m^2	Approx. N Value	Strength / Consistency	Grade	Breakability	Penetration	Strength
40000		Strong	A	Difficult to break against solid object with hammer		Can not be scratched with knife
20000						
10000	600	Moderately Strong	B	Broken against solid object with hammer		Can just be scratched with knife
8000						
6000	400					
4000		Moderately Weak	C	Broken in hand by hitting with hammer		Scratched with knife. Can just be scratched with thumb-nail
2000	200		D	Broken by leaning on sample with hammer	No penetration with knife	Scratched with thumb-nail
1000		Weak	E	Broken by hand	Penetration to about 2 mm with knife	
800	100					
600	80	Hard or Very Weak	F	Easily Broken by hand	Penetration to about 5 mm with knife	
400	60					
200	40	Very Stiff			Penetrated by thumb-nail and to about 1.5 mm with knife	
100	20	Stiff			Indented by thumb	
80						
60	10	Firm			Penetrated by thumb with effort	
40	8					
20	4	Soft			Easily Penetrated by thumb	
10	2	Very Soft				

4.1.3 SPT to ϕ Correlation

For ϕ calculations we use the formula from Bowles (Foundation Analysis and Design), taken from Shioi and Fukui (1982) which is: $\phi = \sqrt{18N} + 15$

And properties of sandy soil and weathered rock are recommended by Roy E.

Hunt(Geotechnical Engineering Investigation Manual) and Tomlinson(Pile Design and Construction Practice)

a. Roy E. Hunt recommendation:

Material	Compactness	D_R (%)	N^a	γ_{dry} (g/cm ³) ^b	γ_{dry} (pcf) ^b	Void ratio e	Strength ^c ϕ
GW: well-graded gravels, gravel-sand mixtures	Dense	75	90	2.21	138	0.22	40
	Medium dense	50	55	2.08	130	0.28	36
	Loose	25	<28	1.97	123	0.36	32
GP: poorly graded gravels, gravel-sand mixtures	Dense	75	70	2.04	127	0.33	38
	Medium dense	50	50	1.92	120	0.39	35
	Loose	25	<20	1.83	114	0.47	32
SW: well-graded sands, gravelly sands	Dense	75	65	1.89	118	0.43	37
	Medium dense	50	35	1.79	112	0.49	34
	Loose	25	<15	1.70	106	0.57	30
SP: poorly graded sands, gravelly sands	Dense	75	50	1.76	110	0.52	36
	Medium dense	50	30	1.67	104	0.60	33
	Loose	25	<10	1.59	99	0.65	29
SM: silty sands	Dense	75	45	1.65	103	0.62	35
	Medium dense	50	25	1.55	97	0.74	32
	Loose	25	<8	1.49	93	0.80	29
ML: inorganic silts, very fine sands	Dense	75	35	1.49	93	0.80	33
	Medium dense	50	20	1.41	88	0.90	31
	Loose	25	<4	1.35	84	1.0	27

^a N is blows per foot of penetration in the SPT. Adjustments for gradation are after Burmister (1962). See Table 2.23 for general relationships of D_R vs. N .

^b Density given is for $G_s = 2.65$ (quartz grains).

^c Friction angle ϕ depends on mineral type, normal stress, and grain angularity as well as D_R and gradation (see Figure 2.93).

b. Tomlinson recommendation:

	Density when drained above groundwater level γ (Mg/m ³)	Density when submerged below groundwater level γ_{sat} (Mg/m ³)	Angle of shearing resistance ϕ (degrees)
Loose gravel with low sand content	1.6–1.9	0.9	28–30
Medium dense gravel with low sand content	1.8–2.0	1.0	30–36
Dense to very dense gravel with low sand content	1.9–2.1	1.1	36–45
Loose well-graded sandy gravel	1.8–2.0	1.0	28–30
Medium-dense well-graded sandy gravel	1.9–2.1	1.1	30–36
Dense well-graded sandy gravel	2.0–2.2	1.2	36–45
Loose clayey sandy gravel	1.8–2.0	1.0	28–30
Medium-dense clayey sandy gravel	1.9–2.1	1.1	30–35
Dense to very dense clayey sandy gravel	2.1–2.2	1.2	35–40
Loose coarse to fine sand	1.7–2.0	1.0	28–30
Medium-dense coarse to fine sand	2.0–2.1	1.1	30–35
Dense to very dense coarse to fine sand	2.1–2.2	1.2	35–40
Loose fine and silty sand	1.5–1.7	0.7	28–30
Medium-dense fine and silty sand	1.7–1.9	0.9	30–35
Dense to very dense fine and silty sand	1.9–2.1	1.1	35–40

4.1.4 For unit weight of soil if unknown, we will use the following method of determination:

- Use the same unit weight as other lab tested soil layer with similar consistency (SPT value)
- Use Bowles, 1997 recommendation:

Description	Very loose	Loose	Medium	Dense	Very dense
Relative density D_r	0	0.15	0.35	0.65	0.85
SPT N'_{70} : fine	1-2	3-6	7-15	16-30	?
medium	2-3	4-7	8-20	21-40	> 40
coarse	3-6	5-9	10-25	26-45	> 45
ϕ : fine	26-28	28-30	30-34	33-38	
medium	27-28	30-32	32-36	36-42	< 50
coarse	28-30	30-34	33-40	40-50	
γ_{wet} , kN/m ³	11-16*	14-18	17-20	17-22	20-23

4.1.5 Modulus of Elasticity from SPT, CPT, S_u , (Bowles, 97)

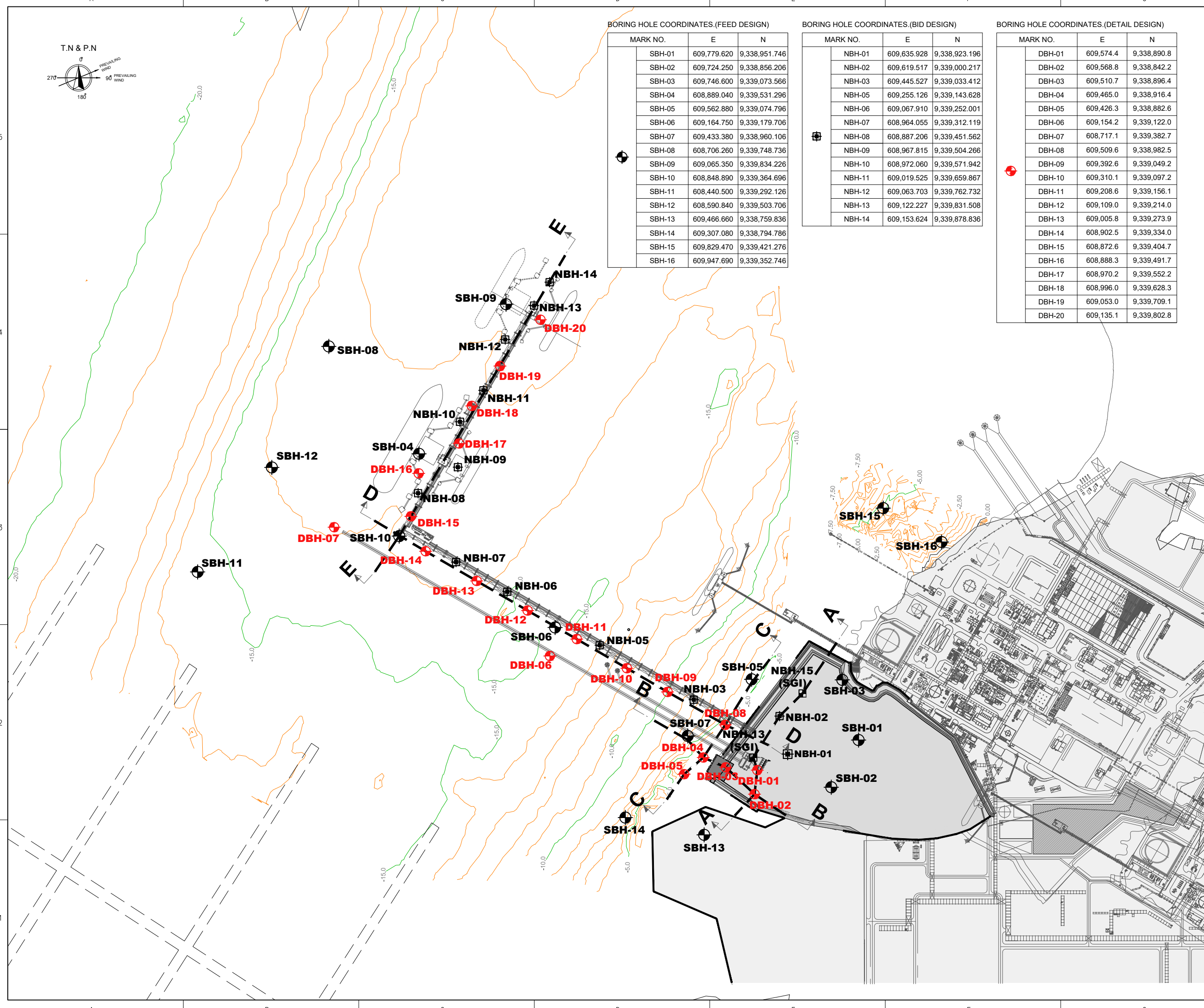
- $E_s = 7000\sqrt{N}$; N in blows, E_s in kPa for sands
- $E_s = 100S_u$; S_u in kg/cm², E_s in kg/cm² for clays

4.2 Result of Design Parameter(to be updated)

Table – 4.1 Result of Design Parameter

Layer No.	UCSC	Unit Weight (kN/m ³)	Friction Angle (deg)	Cohesion (kPa)	Remark
1	CL, ML	17.0	-	9.0	-
1a	CL, ML	19.0	-	37.5	-
1b	CL, ML	19.0	-	71.9	-
1c	CL, ML	19.0	-	109.4	-
1d	CL, ML	19.0	-	156.3	-
1e	CL, ML	19.0	-	250.0	-
2	SP	17.0	25.0	-	-
2a	SP	18.0	31.0	-	-
2b	SP	18.0	36.0	-	-
2c	SP	18.0	39.0	-	-
3	Coral	18.0	33.0	-	-
4a, 4b	SP Tuff Breccia	20.0	39.0	30.0	-

APPENDIX 1. BORING LOCATION PLAN



MARK NO.		E	N
	SBH-01	609,779.620	9,338,951.746
	SBH-02	609,724.250	9,338,856.206
	SBH-03	609,746.600	9,339,073.566
	SBH-04	608,889.040	9,339,531.296
	SBH-05	609,562.880	9,339,074.796
	SBH-06	609,164.750	9,339,179.706
	SBH-07	609,433.380	9,338,960.106
	SBH-08	608,706.260	9,339,748.736
	SBH-09	609,065.350	9,339,834.226
	SBH-10	608,848.890	9,339,364.696
	SBH-11	608,440.500	9,339,292.126
	SBH-12	608,590.840	9,339,503.706
	SBH-13	609,466.660	9,338,759.836
	SBH-14	609,307.080	9,338,794.786
	SBH-15	609,829.470	9,339,421.276
	SBH-16	609,947.690	9,339,352.746

MARK NO.		E	N
	NBH-01	609,635.928	9,338,923.196
	NBH-02	609,619.517	9,339,000.217
	NBH-03	609,445.527	9,339,033.412
	NBH-05	609,255.126	9,339,143.628
	NBH-06	609,067.910	9,339,252.001
	NBH-07	608,964.055	9,339,312.119
	NBH-08	608,887.206	9,339,451.562
	NBH-09	608,967.815	9,339,504.266
	NBH-10	608,972.060	9,339,571.942
	NBH-11	609,019.525	9,339,659.867
	NBH-12	609,063.703	9,339,762.732
	NBH-13	609,122.227	9,339,831.508
	NBH-14	609,153.624	9,339,878.836

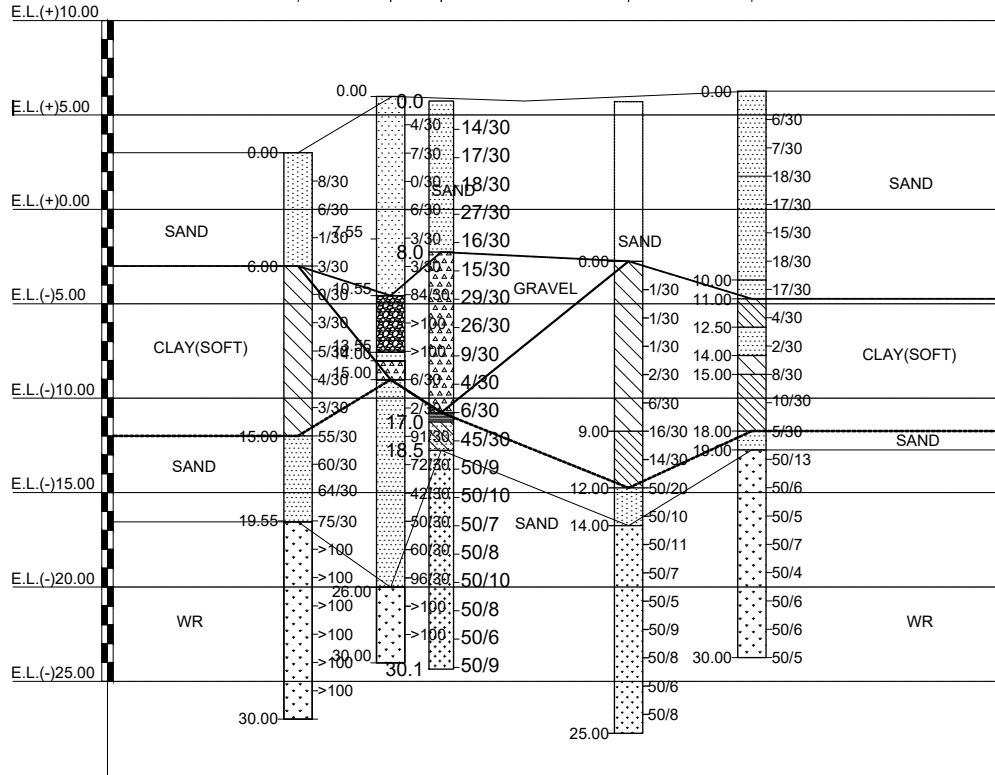
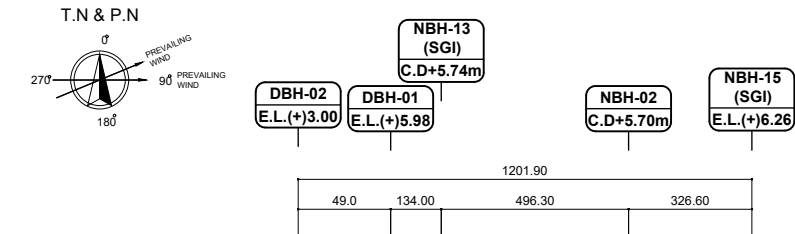
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	DBH-03	609,510.7	9,338,896.4
	DBH-04	609,465.0	9,338,916.4
	DBH-05	609,426.3	9,338,882.6
	DBH-06	609,154.2	9,339,122.0
	DBH-07	608,717.1	9,339,382.7
	DBH-08	609,509.6	9,338,982.5
	DBH-09	609,392.6	9,339,049.2
	DBH-10	609,310.1	9,339,097.2
	DBH-11	609,208.6	9,339,156.1
	DBH-12	609,109.0	9,339,214.0
	DBH-13	609,005.8	9,339,273.9
	DBH-14	608,902.5	9,339,334.0
	DBH-15	608,872.6	9,339,404.7
	DBH-16	608,888.3	9,339,491.7
	DBH-17	608,970.2	9,339,552.2
	DBH-18	608,996.0	9,339,628.3
	DBH-19	609,053.0	9,339,709.1
	DBH-20	609,135.1	9,339,802.8

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.

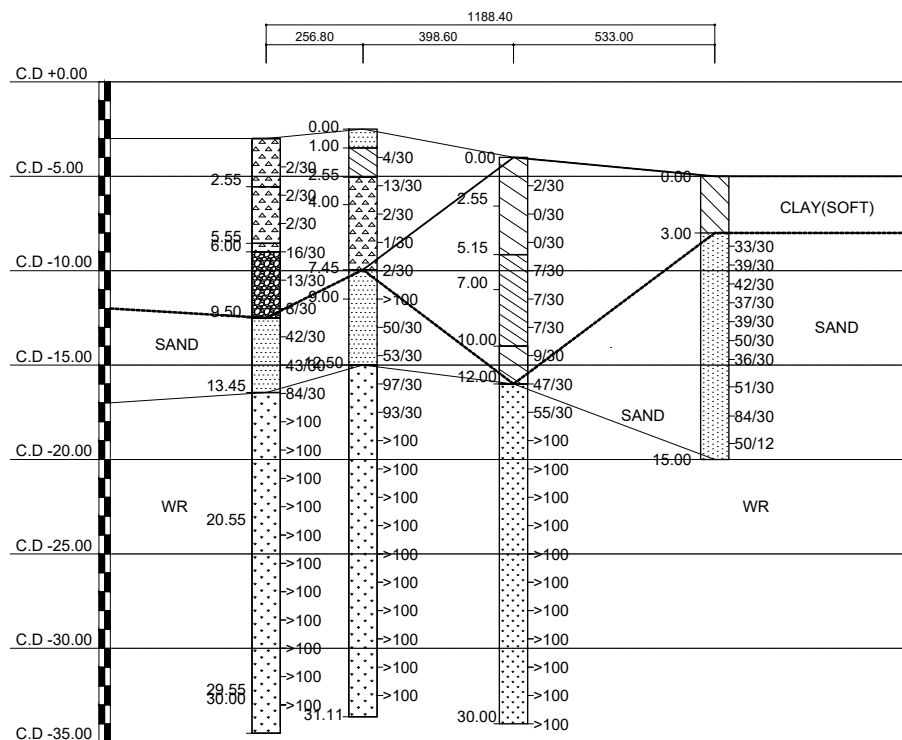
2. CDL 4.0m = EL 1.3m = PL 0.0m

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THIS DWG IS PROPERTY OF CLIENT THE INFORMATION CONTAINED HERE ON MAY NOT BE USED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF THE OWNER.							
PROJECT LINE PROJECT							
OWNER PT. LOTTE CHEMICAL INDONESIA							
CONTRACTOR LOTTE E&C							
TITLE BORING LOCATION PLAN							
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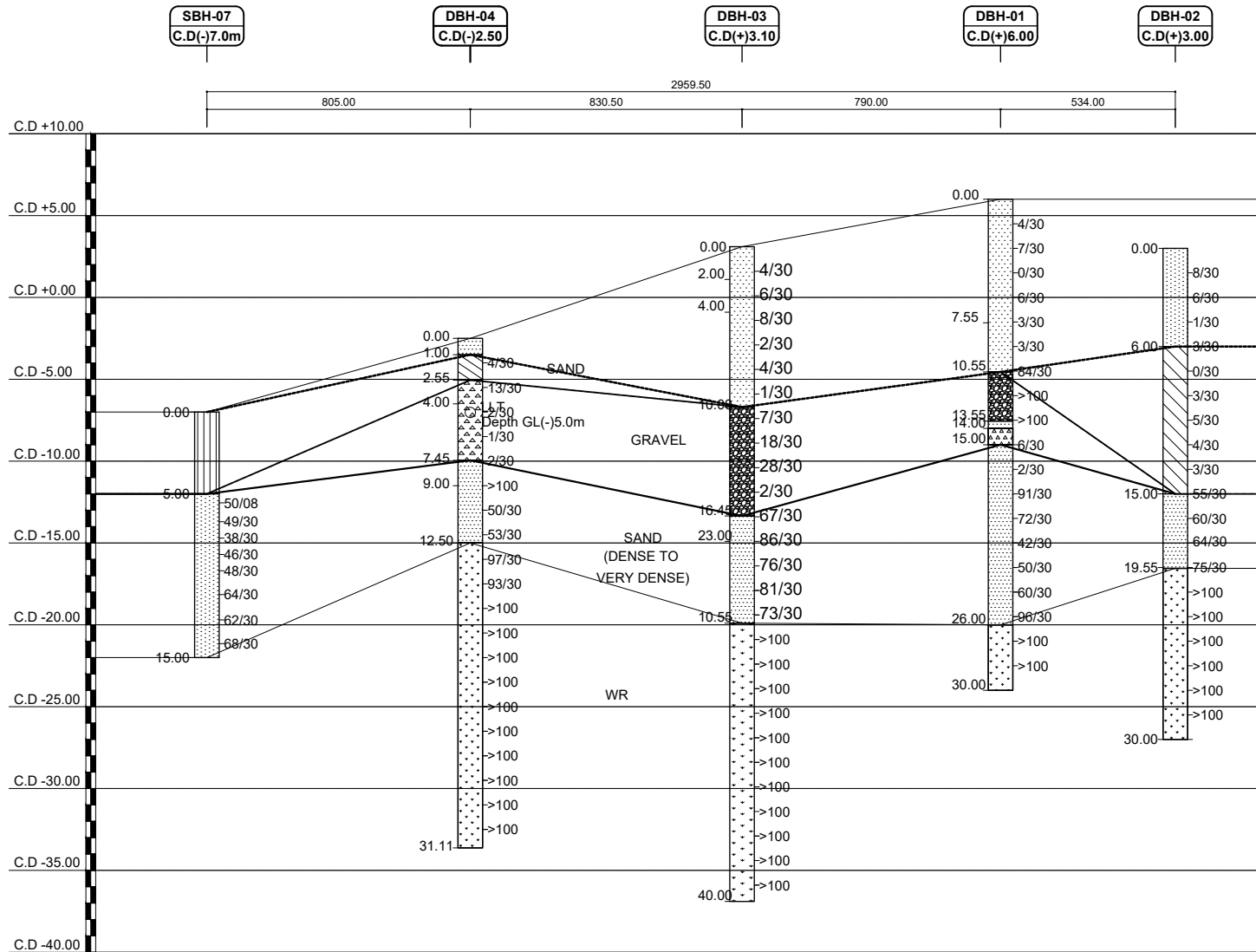
APPENDIX 2. SOIL PROFILE



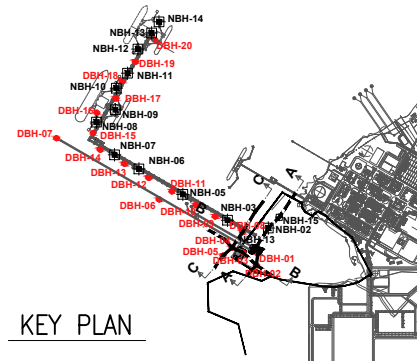
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SCALE H=1:10
SCALE V=1:1



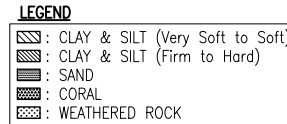
B SECTION
G-004
SCALE H=1:10
SCALE V=1:1



C SECTION
G-004
SCALE H=1:10
SCALE V=1:1



- *NOTES**
- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
 - CDL 4.0m = EL 1.3m = PL 0.0m



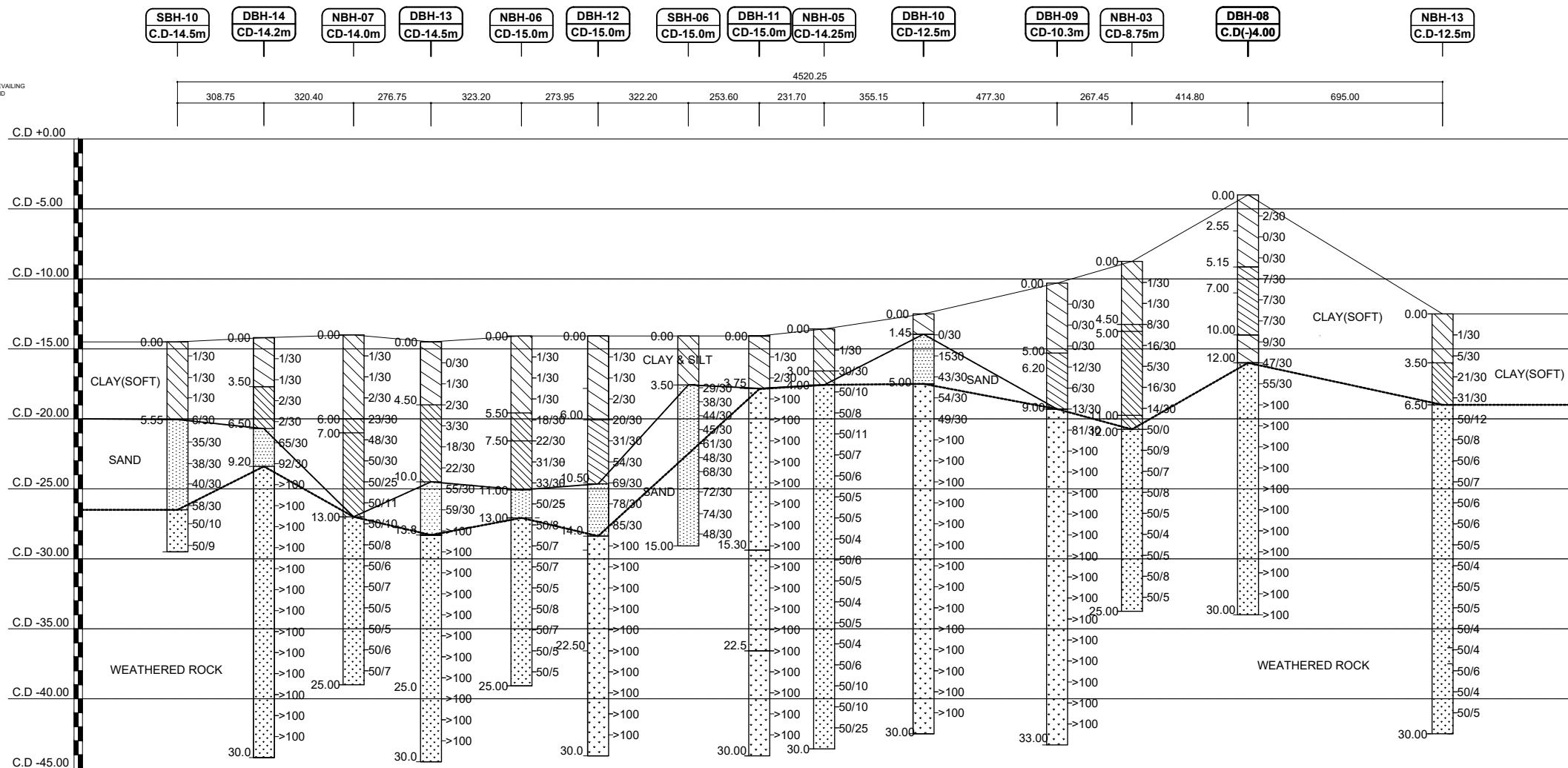
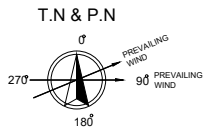
REFERENCE DRAWING

DRAWING NO.	TITLE

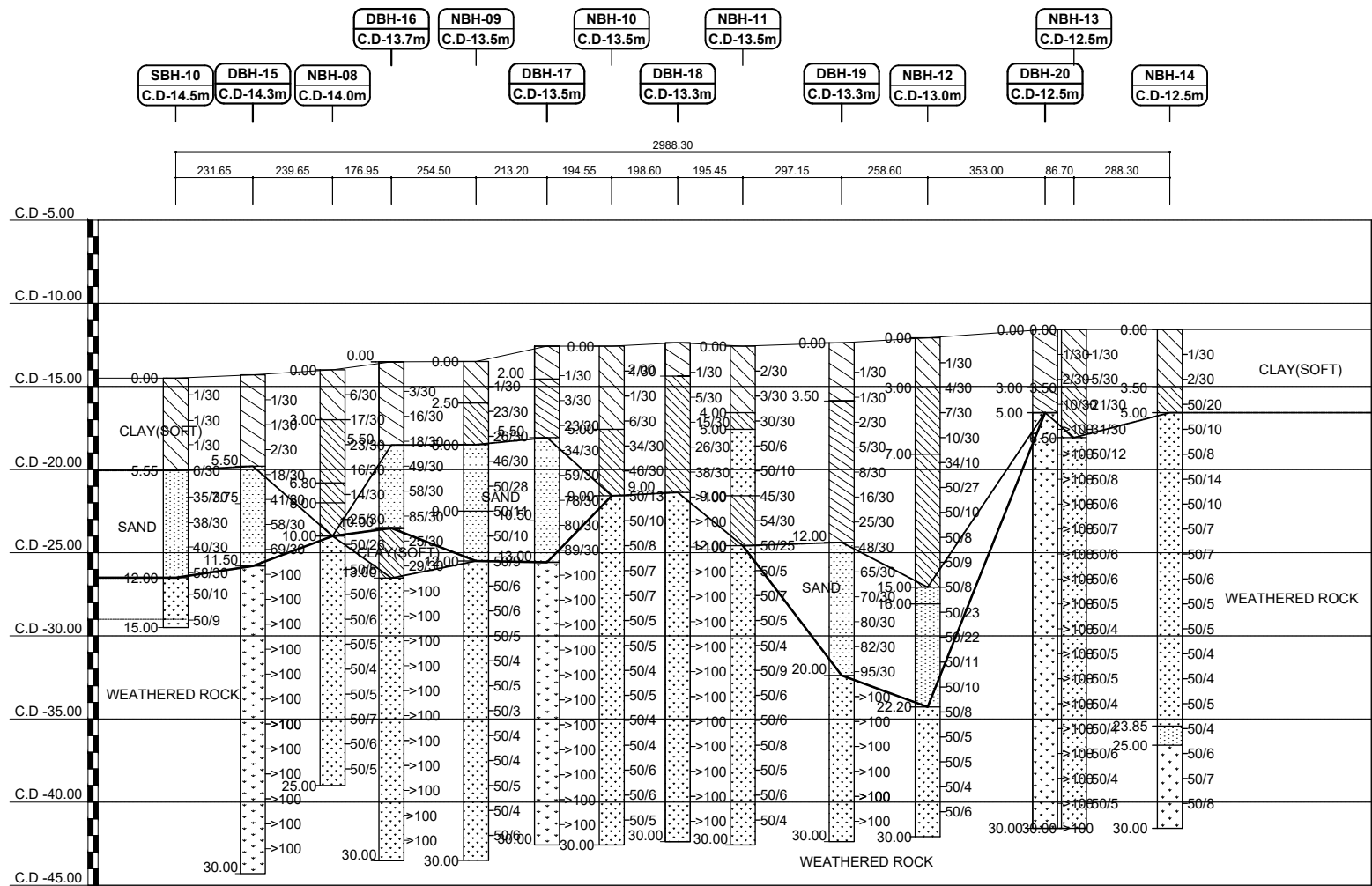
△						
△						
△						
△						
△	21.APR.22	ISSUED FOR APPROVAL	C.H.K.	B.H.P.	Z.C.K.	S.Y.P.
REV	DATE	DESCRIPTION	DWN	DGN	CHK	APP

THIS DWG IS PROPERTY OF CLIENT THE INFORMATION CONTAINED HERE ON MAY NOT BE USED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF THE OWNER.

PROJECT					LINE PROJECT				
OWNER					 PT. LOTTE CHEMICAL INDONESIA				
CONTRACTOR					 LOTTE E&C				
TITLE					SOIL PROFILE(1)				
SCALE H=1/20 V=1/200		JOB NO. 15005		CWA NO. 7RJ1		DWG. NO. LINE-906-CG-1-0904		REV. NO. 	



D SECTION
SCALE H=1:10
SCALE V=1:1



E SECTION
SCALE H=1:10
SCALE V=1:1

KEY PLAN

*NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. CDL 4.0m = EL 1.3m = PL 0.0m

LEGEND

- CLAY & SILT (Very Soft to Soft)
- CLAY & SILT (Firm to Hard)
- SAND
- CORAL
- WEATHERED ROCK

REFERENCE DRAWING

DRAWING NO.	TITLE

△					
△					
△					
△					
△					
△	21.APR.22	ISSUED FOR APPROVAL	C.H.K.	B.H.P.	Z.C.K.
REV	DATE	DESCRIPTION	DWN	DGN	CHK
					APP

THIS DWG IS PROPERTY OF CLIENT THE INFORMATION CONTAINED HERE ON MAY NOT BE USED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF THE OWNER.

PROJECT					LINE PROJECT	
OWNER						
		PT. LOTTE CHEMICAL INDONESIA				
CONTRACTOR						
		LOTTE E&C				
TITLE						
OVERALL PLOT PLAN						
SCALE	JOB NO.	CWA NO.	DWG. NO.			REV. NO.
H=1/20 V=1/200	15005	7RJ1	LINE-906-CG-1-0904			

APPENDIX 3. BORING LOG

PROJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 24-12-2021 DRILLING DATE COMPLETED: 28-12-2021 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman												ETR (%): 65.50 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosadi												BORING LOG: DBH-01 NORTHING: 9338890.8m EASTING: 609574.4m ELEVATION: 6.0m GWL: -4.40m dated 29-12-2021											
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80				SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL ○ 40 80 120 160 WC △ 40 80 120 160 LL ● 40 80 120 160 Bulk Density ■ kN/m ³ 8 12 16 20																			
1						Very loose to loose brown coarse SAND with boulder and gravel					5	4	3																						
2																																			
3											9	7	4																						
4											0	0	6																						
5	5.00																																		
6						Very loose to loose brown silty SAND, found few gravel at 05.00 - 06.00 m					6	6	7.5																						
7																																			
8	7.55										3	3	8.5																						
9						Very loose brown coarse SAND with gravel, found few gravel at 10.00 - 10.55 m					3	3	9.1																						
10																																			
11	10.55					Very dense brown to brownish white GRAVEL with sand and boulder					77	84	10.6																						
12	12.00																																		
13	13.00					Very dense brownish white SAND with gravel and boulder					100	100	12.6																						
14	13.55					BOULDER																													
15	14.00					Very dense white SAND with boulder					98	100	15.1																						
16						CORAL																													
17	15.00										6	6	16.6																						
18						Very loose to loose grey coarse SAND with silt and gravel, found shell fragments at 17.00 - 18.00 m																													
19	18.00										2	2	18.1																						
20																																			
21	19.00					Very dense grey silty SAND with gravel					84	91	17.1																						
22																																			
23						Dense to very dense brown to greyish brown silty SAND					66	72	21.1																						
24											39	42	22.6																						
25											46	50	24.1																						
26	26.00										55	60	25.6																						
27											88	96	27.1																						
28						Very dense brown SAND with silt, found few gravel at 29.00 - 30.00 m					100	100	29.6																						
29																																			
30	30.00					Hole Terminated at 30.00 m					100	100	30.1																						

</

- Sample



- Pressuremeter Test (PRM)



- Vane Shear Test (VST)



- SPT N Value



- Attempt TW/P/MZ/U



P - Piston Sample



TW - Thin Wall Push



U - Thick Wall Open Drive



C - Core Run

REMARKS:

DATA QUALITY RATING

PROJECT: Soil Investigation at LINE Project (PKG#7)
 CLIENT: Yedham Engineering
 PROJECT NO:
 LOCATION: Cilengon
 DRILLING DATE STARTED: 24-12-2021
 DRILLING DATE COMPLETED: 30-12-2021
 LOGGED BY: Antonius Adnan Kusuma
 CHECKED BY: Dede Budiman

ETR (%): 64.30
 SPT TYPE: Automatic Hammer
 DRILLING RIG: XY-1B
 BOREHOLE DIA: 89mm
 DRILLED METHOD: ROTARY
 DRILLED BY: Deny Yusuf

BORING LOG: DBH-02

NORTHING: 9338842.1m
 EASTING: 609568.8m
 ELEVATION: 3.0m
 GWL: -1.30m dated 20-12-2021

Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80	SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL G 40 80 120 160 WC △ 40 80 120 160 LL ● 40 80 120 160 Bulk Density kN/m ³ 8 12 16 20
1						Loose brown SAND with gravel and boulder							
2	2.50							10	8	3			
3	3.00					BOULDER		8	6	17.1			
4						Very loose brownish grey to grey coarse SAND with gravel and boulder		2	1	17.1			
5								3	3	17.1			
6	6.00					Very soft to soft grey sandy SILT with gravel, found a layer of grey medium stiff sandy silt with gravel at 10.55 - 11.00 m and silty sand with gravel at 06.45 - 07.55 m		0	0	17.1			
7								3	3	17.1			
8								5	5	17.1			
9								4	4	17.1			
10								3	3	15			
11								52	55	16.5			
12	15.00					Very dense grey silty SAND		60	59	18.5			
13								60	64	19.5			
14								70	75	21			
15	19.55					Very dense light brown to brown silty SAND, found few gravel at 23.00 - 24.00 m and coarse silty sand at 26.00 - 27.00 m		100	100	22.5			
16								100	100	24			
17								100	100	25			
18								100	100	27			
19								100	100	28.5			
20	27.70					Very dense greyish brown silty SAND		100	100	29.5			
21								100	100	30.5			
22						Hole Terminated at 30.00 m							
23	30.00												



- Sample



- Pressuremeter Test (PRM)



- Vane Shear Test (VST)



- SPT N Value



- Attempt TW/P/MZ/U

P

- Piston Sample

TW

- Thin Wall Push

U - Thick Wall Open Drive

C - Core Run

REMARKS:

DATA QUALITY RATING

PROJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 31-12-2021 DRILLING DATE COMPLETED: 07-01-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman												ETR (%): 65.50 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosady												BORING LOG: DBH-03											
												NORTHING: 9338896.6m EASTING: 609510.6m ELEVATION: 3.1m GWL: -2.45m dated 07-01-2022																							
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80				SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL 40 80 120 160 WC 40 80 120 160 LL 40 80 120 160 ■ Bulk Density kN/m ³ 8 12 16 20																			
1						Loose brown light brown SAND with silt					6	4	2.1																						
2	2.00																																		
3						Loose light brown to brownish light grey silty SAND					7	6	4.1																						
4	4.00																																		
5						Very loose to loose grey silty SAND with gravel, found shell fragments at 6.00-7.00 m, few boulder at 7.45-8.55m					9	8	5.6																						
6											2	2	7.31																						
7											4	4	8.1																						
8																																			
9											1	1	10.1																						
10	9.80 10.00 10.45					BOULDER Loose grey GRAVEL with sand					7	7	11.1																						
11						Medium dense white to whitish grey BOULDER with sand																													
12											17	18	13.1																						
13											26	28	17																						
14																																			
15	14.45 15.00					Very loose grey GRAVEL with sand					5	2	15.1																						
16						Very dense grey silty GRAVEL with sand																													
17	16.45										62	67	17.6																						
18						Very dense grey silty SAND																													
19	18.00										79	86	19.1																						
20						Very dense light brown brown silty SAND, found sandstone at 18.00-19.00 m, few gravel at 27.00-28.00 m																													
21											70	76	20.6																						
22																																			
23											75	81	22.1																						
24																																			
25											67	73	23.6																						
26																																			
27											100	100	25.6																						
28																																			
29											100	100	26.6																						
30	30.00																																		
												⊗ - Sample ■ - Pressuremeter Test (PRM) ⊕ - Vane Shear Test (VST) ● - SPT N Value □ - Attempt TW/P/MZ/U P - Piston Sample TW - Thin Wall Push U - Thick Wall Open Drive C - Core Run												REMARKS:											
												DATA QUALITY RATING																							

PRJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 31-12-2021 DRILLING DATE COMPLETED: 07-01-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman ETR (%): 65.50 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosady											BORING LOG: DBH-03 NORTHING: 9338896.6m EASTING: 609510.6m ELEVATION: 3.1m GWL: -2.45m dated 07-01-2022						
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80		○ SPT N60 blows / 30 cm 20 40 60 80	SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL ⊕ 40 80 120 160	WC △ 40 80 120 160	LL ● 40 80 120 160
31	31.45		⬇			LooseVery dense ligh grey silty SAND, few gravel at 30.00-31.00 m	—	—	—	—	● 100	100	32.1				
32						Very dense light grey to grey silty SAND with boulder	—	—	—	—	● 100	100	33.6				
33							—	—	—	—	● 100	100	35.1				
34	35.00		⬇			SANDSTONE, grey	—	—	—	—	● 100	100	36.6				
35							—	—	—	—	● 100	100	38.1				
36							—	—	—	—	● 100	100	40.1				
37							—	—	—	—	● 100	100					
38	40.00		⬇			Hole Terminated at 40.00 m	—	—	—	—							
39							—	—	—	—							
40							—	—	—	—							
41							—	—	—	—							
42							—	—	—	—							
43							—	—	—	—							
44							—	—	—	—							
45							—	—	—	—							
46							—	—	—	—							
47							—	—	—	—							
48							—	—	—	—							
49							—	—	—	—							
50							—	—	—	—							
51							—	—	—	—							
52							—	—	—	—							
53							—	—	—	—							
54							—	—	—	—							
55							—	—	—	—							
56							—	—	—	—							
57							—	—	—	—							
58							—	—	—	—							
59							—	—	—	—							
60							—	—	—	—							

⊗

- Sample

■

- Pressuremeter Test (PRM)

⊕

- Vane Shear Test (VST)

●

- SPT N Value

□

- Attempt TW/P/MZ/U

P

- Piston Sample

TW

- Thin Wall Push

U

- Thick Wall Open Drive

C

- Core Run

REMARKS:

DATA QUALITY RATING

PROJECT: Soil Investigation at LINE Project (PKG#7)
 CLIENT: Yedham Engineering
 PROJECT NO:
 LOCATION: Cilengon
 DRILLING DATE STARTED: 28-01-2022
 DRILLING DATE COMPLETED: 31-01-2022
 LOGGED BY: Antonius Adnan Kusuma
 CHECKED BY: Dede Budiman

ETR (%): 65.50
 SPT TYPE: Automatic Hammer
 DRILLING RIG: XY-1B
 BOREHOLE DIA: 89mm
 DRILLED METHOD: ROTARY
 DRILLED BY: A. Rosadi

BORING LOG: DBH-04

NORTHING: 9338916.4m
 EASTING: 609465.0m
 ELEVATION: -2.50m
 GWL: m dated

Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm				SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL WC LL			
							○ SPT N60 blows / 30 cm									■ Bulk Density kN/m ³			
							20	40	60	80						8	12	16	20
1	1.00					Grey Silty SAND													
2	2.55					Soft grey sandy SILT with coral fragments	●				4	4	9.6						
3						Medium dense grey with CORAL with sand	●				12	13	11.1						
4	4.00					Very loose grey CORAL with sand	●				2	2	12.6						
5							●				1	1	13.6						
6							●				2	2	14.6						
7	7.45					Very dense grey silty SAND with gravel					100	100	16.1						
8	9.00					Dense to very dense brownish grey to grey silty SAND					46	50	17.6						
9											49	53	19.1						
10	12.50					Very dense brown to light brown silty SAND; found sandstone at 25.00~26.00m					89	97	20.6						
11											86	93	22.1						
12											100	100	23.1						
13											100	100	24.6						
14											100	100	26.6						
15											100	100	28.1						
16											100	100	29.6						
17											100	100	30.6						
18											100	100	32.1						
19	26.00					Grey SANDSTONE					100	100	34.1						
20											100	100	35.1						
21											100	100	37.1						
22	29.55										100	100							
23																			
24																			
25																			
26																			
27																			
28																			
29																			
30																			

- Sample

- Pressuremeter Test (PRM)

- Vane Shear Test (VST)

●

○

P

TW

- SPT N Value

- Attempt TW/P/MZ/U

- Piston Sample

- Thin Wall Push

U

C

- Thick Wall Open Drive

- Core Run

REMARKS:

DATA QUALITY RATING



- Sample



- Pressuremeter Test (PRM)



- Vane Shear Test (VST)



- SPT N Value



- Attempt TW/P/MZ/U



P - Piston Sample



TW - Thin Wall Push

U - Thick Wall Open Drive

C - Core Run

REMARKS:

DATA QUALITY RATING

PRJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 28-01-2022 DRILLING DATE COMPLETED: 31-01-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman ETR (%): 65.50 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosadi											BORING LOG: DBH-04 NORTHING: 9338916.4m EASTING: 609465.0m ELEVATION: -2.50m GWL: m dated					
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80				SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL ⊕ 40 80 120 160 WC △ 40 80 120 160 LL ● 40 80 120 160 ■ Bulk Density kN/m³ 8 12 16 20
31	31.11		← ← ←			Very dense greyish brown to brown silty SAND with sandstone (continued)					● 100	100	38.6			
32						Hole Terminated at 31.11m										
33																
34																
35																
36																
37																
38																
39																
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41																
42																
43																
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- Sample

- Pressuremeter Test (PRM)

- Vane Shear Test (VST)

●

□

P

TW

- SPT N Value

- Attempt TW/P/MZ/U

- Piston Sample

- Thin Wall Push

U

C

- Thick Wall Open Drive

- Core Run

REMARKS:

DATA QUALITY RATING

PRJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 29-01-2022 DRILLING DATE COMPLETED: 02-02-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman ETR (%): 64.30 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: Deny Yusuf											BORING LOG: DBH-05 NORTHING: 9338882.6m EASTING: 609426.3m ELEVATION: -3.0m GWL: m dated					
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80				SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL ⊕ 40 80 120 160 WC △ 40 80 120 160 LL ● 40 80 120 160 ■ Bulk Density kN/m³ 8 12 16 20
31	31.50		↓ ↓ ↓ ↓			sandstone Grey SANDSTONE					● 100	100	38.5			
32																
33						Hole Terminated at 31.50m										
34																
35																
36																
37																
38																
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60																

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⊕

- Sample

- Pressuremeter Test (PRM)

- Vane Shear Test (VST)

●

□

P

TW

- SPT N Value

- Attempt TW/P/MZ/U

- Piston Sample

- Thin Wall Push

U

C

- Thick Wall Open Drive

- Core Run

REMARKS:

DATA QUALITY RATING

PROJECT: Soil Investigation at LINE Project (PKG#7)
 CLIENT: Yedham Engineering
 PROJECT NO:
 LOCATION: Cilengon
 DRILLING DATE STARTED: 28-01-2022
 DRILLING DATE COMPLETED: 29-03-2022
 LOGGED BY: Antonius Adnan Kusuma
 CHECKED BY: Dede Budiman

ETR (%): 60.00
 SPT TYPE: Automatic Hammer
 DRILLING RIG: XY-1B
 BOREHOLE DIA: 89mm
 DRILLED METHOD: ROTARY
 DRILLED BY: A. Rosadi

BORING LOG: DBH-06

NORTHING: 9339122.0m
 EASTING: 609154.2m
 ELEVATION: -15.0m
 GWL: m dated

Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80	SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL ⊕ 40 80 120 160 WC △ 40 80 120 160 LL ● 40 80 120 160 Bulk Density ■ kN/m³ 8 12 16 20
1	3.50					CLAY, homogeneous, dark grey, very soft, medium plasticity, moist	●	1	1	9.6			
2							●	2	1	11.1			
3							●	12	10	12.6			
4						SILT, homogeneous, grey to dark grey, soft, high plasticity, moist	●	19	15	13.6			
5							●	25	24	14.6			
6							●	34	30	16.1			
7	7.00					SAND, homogeneous, light brown, very dense, non plastic	●	58	55	17.6			
8							●	62	60	19.1			
9							●	100	97	20.6			
10						Weathered ROCK, homogeneous, light brown, very dense, non plastic, moist	●	100	98	22.1			
11							●	100	100	23.1			
12							●	100	100	24.6			
13							●	100	100	26.6			
14							●	100	100	28.1			
15							●	100	100	29.6			
16							●	100	100	30.6			
17							●	100	100	32.1			
18							●	100	100	34.1			
19							●	100	100	35.1			
20							●	100	100	37.1			
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													



- Sample



- Pressuremeter
Test (PRM)



- Vane Shear
Test (VST)



- SPT N Value

- Attempt
TW/P/MZ/U

P - Piston Sample

TW - Thin Wall Push

U - Thick Wall
Open Drive

C - Core Run

REMARKS:

DATA QUALITY RATING

PROJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 31-03-2022 DRILLING DATE COMPLETED: 02-04-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman ETR (%): 60.00 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosadi											BORING LOG: DBH-07 NORTHING: 9339382.7m EASTING: 608717.1m ELEVATION: -14.30m GWL: m dated						
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80		SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL ⊖ 40 80 120 160	WC △ 40 80 120 160	LL ● 40 80 120 160	■ Bulk Density kN/m³ 8 12 16 20
1						CLAY, CORAL REEFS, homogeneous, dark grey, very soft, low plasticity, wet		1	1								
2								2	1								
3																	
4								4	3								
5	5.00																
6						SAND, homogeneous, grey, stiff, low plasticity, moist		32	31								
7								50	48								
8																	
9								62	60								
10								70	70								
11																	
12								74	71								
13	13.50							100	98								
14						WEATHERED ROCK, homogeneous, brown to dark grey, very dense		100	100								
15								100	100								
16								100	100								
17								100	100								
18								100	100								
19								100	100								
20								100	100								
21								100	100								
22								100	100								
23								100	100								
24								100	100								
25								100	100								
26								100	100								
27								100	100								
28								100	100								
29								100	100								
30	30.00							100	100								
⊗ - Sample ■ - Pressuremeter Test (PRM) ⊕ - Vane Shear Test (VST) ● - SPT N Value □ - Attempt TW/P/MZ/U P - Piston Sample TW - Thin Wall Push U - Thick Wall Open Drive C - Core Run													REMARKS:				
													DATA QUALITY RATING				

PROJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 10-03-2022 DRILLING DATE COMPLETED: 13-03-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman													
ETR (%): 57.60 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: Dedi S													
BORING LOG: DBH-09													
NORTHING: 9339049.2m EASTING: 609392.6m ELEVATION: -10.3m GWL: m dated													
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80	SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL ⊕ 40 80 120 160 WC △ 40 80 120 160 LL ● 40 80 120 160 Bulk Density ■ kN/m ³ 8 12 16 20
1						Very soft grey sandy SILT		0	0	14.6			
2								0	0	16.1			
3					3.00 DS			0	0	17.6			
4					3.30								
5	5.00				5.00 DS	Stiff grey sandy SILT with gravel		12	11	18.1			
6	6.20				5.30								
7						Medium stiff to stiff grey to yellowish grey sandy CLAY		6	5	19.1			
8					7.55 UDS								
9	9.00				8.55 DS			13	12	20.6			
10					9.00 DS	Very dense grey silty SAND							
11					9.30			81	77	22.1			
12								100	96	23.6			
13								100	96	25.1			
14								100	96	28.1			
15								100	96	29.6			
16								100	96	30.1			
17					17.00 DS								
18					17.30			100	96	31.6			
19								100	96	33.1			
20								100	96	34.6			
21								100	96	36.1			
22								100	96	37.6			
23								100	96	38.1			
24					24.00 DS								
25					24.30			100	96	39.6			
26								100	96	41.1			
27													
28													
29													
30	30.00												



- Sample



- Pressuremeter Test (PRM)



- Vane Shear Test (VST)



- SPT N Value



- Attempt TW/P/MZ/U

P

- Piston Sample

TW

- Thin Wall Push

U - Thick Wall Open Drive

C - Core Run

REMARKS:

DATA QUALITY RATING

PROJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 10-03-2022 DRILLING DATE COMPLETED: 14-03-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman							ETR (%): 57.60 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: Dedi S				BORING LOG: DBH-09 NORTHING: 9339049.2m EASTING: 609392.6m ELEVATION: -10.3m GWL: m dated						
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20406080		SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL ○ 4080120160	WC △ 4080120160	LL ● 4080120160	
							○ SPT N60 blows / 30 cm 20406080							■ Bulk Density kN/m' 8121620			
31	33.00		⬇	⊗	DS 30.30	Very dense grey silty SAND with gravel			⊕● 100	96	42.6						
32								⊕● 100	96	44.1							
33						Hole Terminated at 33.00m											
34																	
35																	
36																	
37																	
38																	
39																	
40																	
41																	
42																	
43																	
44																	
45																	
46																	
47																	
48																	
49																	
50																	
51																	
52																	
53																	
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55																	
56																	
57																	
58																	
59																	
60																	

⊗

- Sample

■

- Pressuremeter Test (PRM)

⊕

- Vane Shear Test (VST)

●

- SPT N Value

□

- Attempt TW/P/MZ/U

P

- Piston Sample

TW

- Thin Wall Push

U

- Thick Wall Open Drive

C

- Core Run

REMARKS:

DATA QUALITY RATING

PROJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PRJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 15-03-2022 DRILLING DATE COMPLETED: 18-03-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman												ETR (%): 60.00 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: Aceng B												BORING LOG: DBH-10			
																								NORTHING: 9339097.2m EASTING: 609310.1m ELEVATION: -12.5m GWL: m dated			
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80				SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL WC LL 40 80 120 160 ■ Bulk Density kN/m³ 8 12 16 20											
							○ SPT N60 blows / 30 cm 20 40 60 80																				
					DS	Very soft grey SILT																					
1	1.45										0	0	17.1														
2						Medium dense to dense brownish grey silty SAND					15	15	18.6														
3					DS						43	43	20.1														
4											54	54	21.6														
5	5.00				DS	Dense to very dense brown to greyish brown silty SAND					49	49	22.1														
6											100	100	24.6														
7											100	100	26.1														
8											100	100	27.6														
9											100	100	29.1														
10					DS						100	100	30.6														
11											100	100	32.1														
12											100	100	33.6														
13											100	100	35.1														
14					DS						100	100	36.6														
15											100	100	38.1														
16											100	100	39.6														
17											100	100	41.1														
18					DS						100	100	42.6														
19											100	100	44.1														
20											82	82	45.6														
21						Hole Terminated at 30.00m																					
22																											
23																											
24																											
25																											
26																											
27																											
28																											
29																											
30	30.00																										
																REMARKS:											
																DATA QUALITY RATING											

PRJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 31-03-2022 DRILLING DATE COMPLETED: 05-04-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman ETR (%): 60.00 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosadi														BORING LOG: DBH-11 NORTHING: 9339156.1m EASTING: 609208.6m ELEVATION: -15.0m GWL: m dated								
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80		SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL ⊖ 40 80 120 160	WC △ 40 80 120 160	LL ● 40 80 120 160	■ Bulk Density kN/m³ 8 12 16 20					
1	3.75					CLAY, homogeneous, dark grey, very soft, medium plasticity, moist	●	1	1	16.5												
2																						
3																						
4																						
5	15.30					Weathered ROCK, homogeneous, light brown, very dense, non plastic, moist		100	100	19.5												
6																						
7																						
8																						
9																						
10																						
11																						
12																						
13																						
14																						
15																						
16											Weathered ROCK, homogeneous, light brown, very dense, non plastic, moist		100	100	31.5							
17																						
18																						
19																						
20																						
21	22.5																					
22																						
23																						
24																						
25																						
26																						
27																						
28																						
29																						
30	30.00																					

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- Sample

- Pressuremeter Test (PRM)

- Vane Shear Test (VST)

●

□

P

TW

- SPT N Value

- Attempt TW/P/MZ/U

- Piston Sample

- Thin Wall Push

U

C

- Thick Wall Open Drive

- Core Run

REMARKS:

DATA QUALITY RATING

PROJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 03-04-2022 DRILLING DATE COMPLETED: 05-04-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman ETR (%): 60.00 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosadi												BORING LOG: DBH-12									
												NORTHING: 9339214.0m EASTING: 609109.0m ELEVATION: -15.0m GWL: m dated									
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm				SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL WC LL ○ △ ● 40 80 120 160					
							○ SPT N60 blows / 30 cm									■ Bulk Density kN/m ³					
							20	40	60	80						8	12	16	20		
1						Silty CLAY, homogeneous, grey, very soft, medium plasticity, moist					1	1	16.5								
2											1	1	18								
3																					
4											2	1	19.5								
5																					
6	6.00										20	18	21								
7						SILT, homogeneous, grey to dark grey, soft, high plasticity, moist					31	30	22.5								
8																					
9											54	53	24								
10	10.50										69	65	25.5								
11																					
12						SANDSTONE (medium fine SAND), homogeneous, dark brown, subrounded, moderate cemented, very dense					78	74	27								
13																					
14	14.0										85	80	28.5								
15																					
16						WEATHERED ROCK, homogeneous, brown, very dense, strong cemented, dry					100	100	30								
17											100	100	31.5								
18											100	100	33								
19											100	100	34.5								
20											100	100	36								
21											100	100	37.5								
22											100	100	39								
23											100	100	40.5								
24											100	100	42								
25											100	100	43.5								
26											100	100	45								
27																					
28																					
29																					
30	30.00																				

☒ - Sample

■ - Pressuremeter Test (PRM)

⊕ - Vane Shear Test (VST)

● - SPT N Value

□ - Attempt TW/P/MZ/U

P - Piston Sample

TW - Thin Wall Push

U - Thick Wall Open Drive

C - Core Run

REMARKS:

DATA QUALITY RATING

PRJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 04-04-2022 DRILLING DATE COMPLETED: 06-04-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman ETR (%): 60.00 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosadi											BORING LOG: DBH-16 NORTHING: 9339491.7m EASTING: 608888.3m ELEVATION: -13.7m GWL: m dated					
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80	SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL 40 80 120 160	WC 40 80 120 160	LL 40 80 120 160	■ Bulk Density kN/m³ 8 12 16 20
1						Silty CLAY, homogeneous, grey, soft to very stiff, low plasticity, moist		3	3	15.2						
2								16	15	16.7						
3								18	16	18.2						
4																
5	5.50															
6						Very dense greyish brown silty SAND		49	45	19.7						
7								58	55	21.2						
8								85	84	22.7						
9																
10	10.00							25	22	24.2						
11						SILT, homogeneous, grey, soft to very stiff, low plasticity, moist		29	25	25.7						
12																
13	13.00							100	100	27.2						
14						WEATHERED ROCK, homogeneous, brown, very dense, strong cemented, dry		100	100	28.7						
15								100	100	30.2						
16								100	100	31.7						
17								100	100	33.2						
18								100	100	34.7						
19								100	100	36.2						
20								100	100	37.7						
21								100	100	39.2						
22								100	100	40.7						
23								100	100	42.2						
24																
25																
26																
27																
28																
29																
30	30.00															

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- Sample

- Pressuremeter Test (PRM)

- Vane Shear Test (VST)

●

□

P

TW

- SPT N Value

- Attempt TW/P/MZ/U

- Piston Sample

- Thin Wall Push

U

C

- Thick Wall Open Drive

- Core Run

REMARKS:

DATA QUALITY RATING

PROJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 06-04-2022 DRILLING DATE COMPLETED: 09-04-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman ETR (%): 60.00 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosadi											BORING LOG: DBH-17						
											NORTHING: 9339552.2m EASTING: 608970.2m ELEVATION: -13.5m GWL: m dated						
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm		SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL	WC	LL	
							○ SPT N60 blows / 30 cm							40	80	120	160
														8	12	16	20
1						Silty CLAY, homogeneous, grey, soft to very stiff, low plasticity, moist											
2	2.00								1	1	15.0						
3						SILT, homogeneous, grey, soft to very stiff, low plasticity, moist			3	2	16.5						
4																	
5	5.50								23	22	18.0						
6						homogeneous, dark grey, moderate cemented, very dense silty SAND			34	30	19.5						
7																	
8									59	55	21.0						
9																	
10									78	76	22.5						
11									80	80	24						
12									89	85	25.5						
13	13.00																
14						WEATHERED ROCK, homogeneous, brown, very dense, strong cemented, moist			100	95	27.0						
15									100	100	28.5						
16									100	100	30.0						
17									100	100	31.5						
18									100	100	33.0						
19									100	100	34.5						
20									100	100	36.0						
21									100	100	37.5						
22									100	100	39.0						
23									100	100	40.5						
24									100	100	42.0						
25																	
26																	
27																	
28																	
29																	
30	30.00																

⊗ - Sample

■ - Pressuremeter Test (PRM)

⊕ - Vane Shear Test (VST)

● - SPT N Value

□ - Attempt TW/P/MZ/U

P - Piston Sample

TW - Thin Wall Push

U - Thick Wall Open Drive

C - Core Run

REMARKS:

DATA QUALITY RATING

PROJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 30-03-2022 DRILLING DATE COMPLETED: 01-04-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman											ETR (%): 60.00 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosadi					BORING LOG: DBH-18				
											NORTHING: 9339628.3m EASTING: 608996.01 ELEVATION: -13.30m GWL: m dated									
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80	SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL 40 80 120 160 WC 40 80 120 160 LL 40 80 120 160 Bulk Density kN/m ³							
1	2.00					Sandy CLAY, homogeneous, dark grey, very soft, medium to low plasticity, moist		0	0	14.8										
2						SILT, homogeneous, grey, soft to very stiff, low plasticity, moist		1	1	16.3										
3								15	1	17.8										
4								12	9	19.3										
5	9.00							38	25	20.8										
6						Weathered ROCK, homogeneous, dark grey, very dense, strong cemented, moist		100	100	22.3										
7								100	100	23.8										
8								100	100	25.3										
9								100	100	26.8										
10								100	100	28.3										
11								100	100	29.8										
12								100	100	31.3										
13								100	100	32.8										
14								100	100	34.3										
15								100	100	35.8										
16								100	100	37.3										
17								100	100	38.8										
18								100	100	40.3										
19								100	100	41.8										
20	30.00																			

- Sample
 - Pressuremeter Test (PRM)
 - Vane Shear Test (VST)

- SPT N Value
 - Attempt TW/P/MZ/U
 P - Piston Sample
 TW - Thin Wall Push

U - Thick Wall Open Drive
 C - Core Run

REMARKS:

DATA QUALITY RATING

PROJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 06-04-2022 DRILLING DATE COMPLETED: 09-04-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman												ETR (%): 60.00 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosadi												BORING LOG: DBH-19			
																								NORTHING: 9339709.1m EASTING: 609053.0m ELEVATION: -13.3m GWL: m dated			
Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm 20 40 60 80 ○ SPT N60 blows / 30 cm 20 40 60 80				SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL G	WC △	LL ●	Bulk Density kN/m³								
							20	40	60	80						40	80	120	160	8 12 16 20							
1						CLAY, homogeneous, dark grey, very soft, medium plasticity, moist					1	1	14.8														
2											1	1	16.3														
3	3.50																										
4						Sandy SILT, homogeneous, grey, very stiff to hard, low plasticity, moist					2	1	17.8														
5											5	3	19.3														
6											8	5	20.8														
7											16	15	22.3														
8											25	24	23.8														
9											48	45	25.3														
10	12.00					Very dense grey silty SAND with gravel					65	64	26.8														
11											70	70	28.3														
12											80	78	29.8														
13											82	80	31.3														
14											95	94	32.8														
15	20.00					Weathered ROCK, homogeneous, dark grey, very dense, strong cemented, moist					100	100	34.3														
16											100	100	35.8														
17											100	100	37.3														
18											100	100	38.8														
19											100	100	40.3														
20											100	100	41.8														
21	30.00																										
												⊗ ■ ⊕ - Sample - Pressuremeter Test (PRM) - Vane Shear Test (VST) ● □ P TW - SPT N Value - Attempt TW/P/MZ/U - Piston Sample - Thin Wall Push U C - Thick Wall Open Drive - Core Run												REMARKS:			
												DATA QUALITY RATING															

PROJECT: Soil Investigation at LINE Project (PKG#7) CLIENT: Yedham Engineering PROJECT NO: LOCATION: Cilengon DRILLING DATE STARTED: 31-03-2022 DRILLING DATE COMPLETED: 02-04-2022 LOGGED BY: Antonius Adnan Kusuma CHECKED BY: Dede Budiman	ETR (%): 60.00 SPT TYPE: Automatic Hammer DRILLING RIG: XY-1B BOREHOLE DIA: 89mm DRILLED METHOD: ROTARY DRILLED BY: A. Rosadi	BORING LOG: DBH-20
		NORTHING: 9339802.8m EASTING: 609135.1m ELEVATION: -12.5m GWL: m dated

Scale	Depth(m)	CLASSIFICATION SYMBOL	Graphic Log	Legend	Type & No.	Description	● SPT N blows / 30 cm ○ SPT N60 blows / 30 cm 20 40 60 80	SPT N blows/30 cm	SPT N60 blows/30 cm	Rod Length (m)	Casing Depth (m)	Grain Size Analysis G/SA/S/C	PL WC LL 40 80 120 160 ■ Bulk Density kN/m³ 8 12 16 20
1						CLAY, homogeneous, dark grey, very soft, medium plasticity, moist							
2								1	1	14.0			
3	3.00					SILT, homogeneous, dark brown, very stiff, high plasticity, moist		2	1	15.5			
4								10	8	17.0			
5	5.00					Weathered ROCK, homogeneous, brown, very dense, strong cemented, moist		100	94	18.5			
6								100	94	20.0			
7								100	97	21.5			
8								100	98	23.0			
9								100	100	24.5			
10								100	100	26			
11								100	100	27.5			
12								100	100	29.0			
13								100	100	30.5			
14								100	100	32.0			
15								100	100	33.5			
16								100	100	35.0			
17								100	100	36.5			
18								100	100	38.0			
19								100	100	39.5			
20								100	100	41.0			
21													
22													
23													
24													
25													
26													
27													
28													
29													
30	30.00												

⊗ - Sample ● - SPT N Value U - Thick Wall Open Drive ■ - Pressuremeter Test (PRM) □ - Attempt TW/P/MZ/U C - Core Run ⊕ - Vane Shear Test (VST) P - Piston Sample TW - Thin Wall Push	REMARKS: DATA QUALITY RATING
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LAMPIRAN

1. GENERAL

- 1.1 ALL DRAWING DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
1.2 EASTINGS AND NORTHINGS OF SET OUT COORDINATES ARE GIVEN IN METRES, REFERRED TO UTM WGS 84.
1.3 THE SI METRIC SYSTEM IS USED FOR ALL DOCUMENTS & DRAWINGS EXCEPT FOR SOME UNITS LIKE: °C, BAR, H (HOUR), MIN (MINUTES), KG/H AND M3/H.
1.4 ALL DIMENSIONS SHOULD BE ADJUSTED AND OPTIMISED IN ORDER TO ACCOMMODATE ACTUAL EQUIPMENT DIMENSIONS BY VENDOR.

2. CODES & STANDARDS

THE FOLLOWING LIST OF CODES, STANDARDS AND REFERENCE DOCUMENTS ARE INDICATIVE OF THOSE THAT WILL FORM THE BASIS FOR THE DETAILED DESIGN OF THE OFFSHORE PLANTS.

ACI 318M-14	BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE
ACI 350-06	CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES
ACI 201.2R	GUIDE TO DURABLE CONCRETE
ACI 224R-01	CONTROL OF CRACKING IN CONCRETE STRUCTURES
ACI 224.3R-95	JOINTS IN CONCRETE CONSTRUCTION
ACI301-99	SPECIFICATIONS FOR STRUCTURAL CONCRETE
ACI SP66-04	ACI DETAILING MANUAL
AISC-335-89	SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, ALLOWABLE STRESS DESIGN AND PLASTIC DESIGN
ASCE 7-10	MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES
ASCE61-14	SEISMIC DESIGN OF PIERS AND WHARVES
ASTM A572-15	STANDARD SPECIFICATION FOR HIGH-STRENGTH LOW-ALLOY COLUMBIAN-VANADIUM STRUCTURAL STEEL
AASHTO	STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES
API RP 2A-WSD	RECOMMENDED PRACTICE FOR PLANNING, DESIGNING, AND CONSTRUCTION FIXED OFFSHORE PLATFORMS - WSD
AWWA-M55	PE PIPE-DESIGN AND INSTALLATION
BS 5328-1:1997	GUIDE TO SPECIFYING CONCRETE
BS 6349-1-1:2013	MARITIME WORKS - GENERAL. CODE OF PRACTICE FOR PLANNING AND DESIGN FOR OPERATIONS
BS 6349-1-2:2016	MARITIME WORKS - GENERAL. CODE OF PRACTICE FOR ASSESSMENT OF ACTIONS
BS 6349-1-4:2013	MARITIME WORKS - GENERAL. CODE OF PRACTICE FOR MATERIALS
BS 6349-2:2010	MARITIME WORKS - DESIGN OF QUAY WALLS, JETTIES, AND DOLPHINS
BS 6349-4:2014	MARITIME WORKS - CODE OF PRACTICE FOR DESIGN OF FENDERING AND MOORING SYSTEMS
BS 6349-5:2016	MARITIME WORKS: CODE OF PRACTICE FOR DREDGING AND LAND RECLAMATION
BS EN 12473:2014	GENERAL PRINCIPLES OF CATHODIC PROTECTION IN SEA WATER
BS EN 12944-5:2007	PAINTS AND VARNISHES-CORROSION PROTECTION OF STEEL STRUCTURES BY PROTECTIVE PAINT SYSTEMS
BS EN ISO 13174:2012	CATHODIC PROTECTION FOR HARBOUR INSTALLATIONS
BS EN 1992-3:2006	DESIGN OF CONCRETE STRUCTURES, LIQUID RETAINING, AND CONTAINING STRUCTURES
BS EN 1997-1:2004	GEOTECHNICAL DESIGN - PART1:GENERAL RULES
DNV RP B401	CATHODIC PROTECTION DESIGN
DNV RP E305	ON-BOTTOM STABILITY DESIGN OF SUBMARINE PIPELINES, 1988
DNV RP F109	ON-BOTTOM STABILITY DESIGN OF SUBMARINE PIPELINES, 2010
ENV-2	DESIGN OF CONCRETE STRUCTURES - CONCRETE BRIDGES
FHWA	DESIGN AND CONSTRUCTION OF DRIVEN PILE FOUNDATIONS, 2006
IBC 2012	INTERNATIONAL BUILDING CODE
NAVFAC DM-7	NAVAL FACILITIES ENGINEERING COMMAND DESIGN MANUAL 7, U.S DEPARTMENT OF THE NAVY
NFPA 307:2016	CONSTRUCTION AND FIRE PROTECTION OF MARINE TERMINALS, PIERS, AND WHARVES
SNI 1726:2012	EARTHQUAKE RESISTANCE PLANNING METHOD FOR BUILDING AND NON-BUILDING STRUCTURES
UFC 4-152:2017	UNIFIED FACILITIES CRITERIA, DESIGN: PIERS AND WHARVES
ANSI/HI 9.8-2012	PUMP INTAKE DESIGN
EPA 40 CFR	NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM REGULATIONS ADDRESSING COOLING WATER INTAKE STRUCTURES FOR NEW FACILITIES

3. DESIGN LIFE

- THE PROJECT DESIGN LIFE OF THE DEVELOPMENT IS 30 YEARS.
FOR ITEMS SUSCEPTIBLE TO NORMAL WEAR AND TEARS SUCH AS ROPES, LADDERS, TIMBERS, AND FENDERS, AND SIMILAR, FOR WHICH A DESIGN LIFE OF 30 YEARS CANNOT REASONABLY BE MET, THE DESIGNS AND CONSTRUCTION SHALL PERMIT EASY REPLACEMENT.

4. MATERIAL

- 4.1 CONCRETE
THE CONCRETE MATERIAL PROPERTY CONFORM TO ASTM C33 AND ACI 318M-14. NORMAL WEIGHT CONCRETE IS TYPICALLY TAKEN AS 2320 TO 2400 kg/m³.
- REINFORCED CONCRETE DENSITY= 24 kN/m³
- SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE (f_{ck}) = 35MPa
- MODULUS OF ELASTICITY (E_c) = 27,806MPa
- POISSON'S RATIO (μ) = 0.2
- COEFFICIENT OF THERMAL EXPANSION (α) = 10E-6/°C
- MAXIMUM AGGREGATE SIZE= 25mm
- MINIMUM SLUMP= 120mm
- AIR CONTENT= 7%
- 4.2 REINFORCEMENT
DESIGN AND SPECIFICATION OF MATERIALS FOR REINFORCING STEEL CONFORM TO ASTM A615M, GRADE 420, AND ALL REINFORCING STEEL SHALL BE DEFORMED BILLET STEEL BARS.
- MINIMUM YIELD STRENGTH FOR REINFORCEMENT (f_y) = 420 MPa
- MINIMUM TENSILE STRENGTH FOR REINFORCEMENT (f_t) = 550 MPa
- BAR NOMINAL DIMENSION D10, D13, D16, D19, D22, D25, D29, D32, D36, D40
- 4.3 STRUCTURAL STEEL
THE CHARACTERISTIC OF STEEL MATERIAL IN DESIGN IS BASICALLY BASED ON THE HOT ROLLED CARBON STEEL EXCEPT AS OTHERWISE INDICATED IN THE REQUIREMENT. THE MINIMUM YIELD STRENGTH OF STRUCTURAL STEEL IS 245MPA. ALL STRUCTURAL STEEL FABRICATION WILL BE IN ACCORDANCE WITH AISC STEELWORK SPECIFICATION.
- 4.4 STEEL PILE
THE STEEL PILE MATERIAL PROPERTY CONFORMS TO ASTM A-572 GRADE 50 OR EQUIVALENT.
- STEEL PILE DENSITY= 77 kN/m³
- YIELD STRENGTH OF STEEL PIPE PILE (f_y) = 345 MPa
- TENSILE STRENGTH OF STEEL PIPE PILE (f_t) = 450 MPa
- POISSON'S RATIO (μ) = 0.3
- MODULUS OF ELASTICITY FOR REINFORCEMENT (E_s) = 2.0E+5 MPa
- COEFFICIENT OF THERMAL EXPANSION (α) = 12E-6/°C
- 4.5 PC PILING
THE PRECAST PRESTRESSED CONCRETE PILE MATERIAL PROPERTY CONFORM TO ACI 543R-12 OR EQUIVALENT.
- TRICALCIUM ALUMINATE (C3A) CONTENTS 5% TO 8%
- RANGE OF AIR-ENTRAINING ADMXTURE OF CONCRETE 3% TO 7%
- SEVEN (7) WIRE-STRAND CONFORM TO ASTM A416 (GRADE 250 OR GRADE 270)
- WIRE REINFORCEMENT CONFORM TO ASTM A421

5. OCEANOGRAPHIC DATA

- 5.1 DATUM AND COORDINATE SYSTEM
ALL LEVELS REFER TO CHART DATUM (CD). CHART DATUM CORRESPONDS TO LAT. UNLESS OTHERWISE STATED. THE TIDAL LEVEL IS PRESENTED RELATIVE TO MEAN SEA LEVEL (MSL) AND LAT. THE DIFFERENCE BETWEEN MSL AND LAT IS 0.70m (LAT= -0.70m MSL)
- 5.2 SEA LEVEL RISE
FROM THE INFORMATION OF THE MET OCEAN STUDY REPORT, THE MAXIMUM ESTIMATE SEA LEVEL RISE RATE IS SELECTED AS 8 mm/YEAR. TOTAL SEA-LEVEL RISE OVER THE DESIGN LIFE OF 30 YEARS IS TAKEN AS 0.24 METERS.
- 5.3 DESIGN TIDAL WATER LEVEL
THE DESIGN TIDAL WATER LEVEL ELEVATIONS AT THE SITE TO BE USED IN THE DESIGN ARE TABULATED BELOW.

LEVEL	ELEVATION (mCD)
HIGHEST ASTRONOMICAL TIDE (HAT)	+1.40
MEAN HIGHER HIGH WATER (MHHW)	+1.30
MEAN SEA LEVEL (MSL)	+0.70
MEAN LOWER LOW WATER (MLLW)	+0.09
LOWEST ASTRONOMICAL TIDE (LAT)	+0.00

6. WAVES

- THE DESIGN OF OPERATION AND EXTREME WAVES AT THE OFFSHORE AND NEARSHORE SITE ARE AS BELOW.

CONDITION		OPERATION	EXTREME
JETTY & SEAWATER SYSTEM	SIGNIFICANT WAVE HEIGHT (H _s)	0.98 meter	2.8 meter
	SIGNIFICANT WAVE PERIOD (T _s)	16.4 second	8.0 second

7. CURRENT

- THE DESIGN OF OPERATION AND EXTREME CURRENT VELOCITIES AT THE OFFSHORE SITE ARE AS BELOW.

CONDITION	OPERATION	EXTREME
JETTY & SEAWATER SYSTEM	0.50 m/sec	1.20 m/sec

8. WINDS

- THE DESIGN OF OPERATION AND EXTREME WIND SPEEDS AT THE OFFSHORE SITE ARE AS BELOW.

CONDITION	OPERATION	EXTREME
JETTY, SEAWATER SYSTEM & LIGHTER'S WHARF	12.2 m/sec	45.0 m/sec

9. VESSEL DATA

9.1 THE CHARACTERISTICS OF DESIGN VESSEL ARE DETAILED IN THE BELOW TABLE RESPECTIVELY.

NO.	DWT (t)	DISPLACEMENT (m)	LOA (m)	LBP (m)	BEAM (m)	DEPTH (m)	DRAFT (m)
1	120,000	137,520	250.00	239.00	44.00	21.00	15.23
2	80,000	90,305	228.00	219.00	32.30	20.69	14.52
3	50,000	60,553	183.21	174.00	32.20	18.80	13.03
4	10,000	12,185	114.40	106.40	18.20	10.00	7.98
5	8,000	11,347	113.00	105.40	18.20	9.60	7.62
6	5,000	5,774	89.96	85.00	14.60	7.55	6.24
7	3,000	4,070	84.35	78.50	13.00	6.20	5.45
8	1,000	1,788	64.52	61.00	10.30	4.50	4.03

9.2 THE CHARACTERISTIC OF BARGE VESSEL IS DETAILED IN THE BELOW TABLE RESPECTIVELY.

NO.	DWT (t)	DISPLACEMENT (m)	LOA (m)	BEAM (m)	DEPTH (m)	DRAFT (m)
1	19,400	18,800	166.00	40.00	9.50	6.00

10. ABBREVIATIONS

AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AWLC	ACCELERATED LOW WATER CORROSION
API	AMERICAN PETROLEUM INSTITUTE
ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS
BD	BREASTING DOLPHIN, BERTHING DOLPHIN
BS	BRITISH STANDARDS
CD	CHART DATUM
CP	CATHODIC PROTECTION OR CORNER PLATFORM
C.T.C	CENTER TO CENTER
DIR	DIRECTION
DNV	DET NORSKE VERITAS
DWT	DEADWEIGHT TONNAGE
EPC	ENGINEERING, PROCUREMENT AND CONSTRUCTION
F	FIXED
FEED	FRONT END ENGINEERING DESIGN
HAT	HIGHEST ASTRONOMICAL TIDE
HOR.	HORIZONTAL
IALA	INTERNATIONAL ASSOCIATION OF LIGHTHOUSE AUTHORITIES
IBC	INTERNATIONAL BUILDING CODE
IBD	INNER BREASTING DOLPHIN, INNER BERTHING DOLPHIN
IPCC	INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE
ISGOTT	INTERNATIONAL SAFETY GUIDE FOR OIL TANKERS & TERMINALS
JP	JUNCTION PLATFORM
KN	KILO-NEWTON
LAT	LOWEST ASTRONOMICAL TIDE
LINE	LOTTE CHEMICAL INDONESIA NEW ETHYLENE COMPLEX
LOA	LENGTH OVERALL OF A VESSEL
LRFD	LOAD RESISTANCE FACTORED DESIGN
MAX.	MAXIMUM
MBL	MINIMUM BREAKING LOAD
MD	MOORING DOLPHIN
MHWS	MEAN HIGH WATER SPRING TIDES
MIN.	MINIMUM
MLWN	MEAN LOW WATER NEAP TIDES
MLWS	MEAN LOW WATER SPRING TIDES
MSL	MEAN SEA LEVEL
OB	OUTER BREASTING DOLPHIN, OUTER BERTHING DOLPHIN
OCIMF	OIL COMPANIES INTERNATIONAL MARINE FORUM
OPP.	OPPOSITE
PC	PRECAST CONCRETE
PGA	PEAK GROUND ACCELERATION
PIANC	PERMANENT INTERNATIONAL ASSOCIATION OF NAVIGATION CONGRESSES
POVF	POINT OF VIRTUAL FIXITY OF A PILE EMBEDDED IN THE GROUND
QRH	QUICK-RELEASE HOOK
S	SLIDING
SI	SITE INVESTIGATION
S.I.	SYSTEM INTERNATIONAL
SOP	SETTING OUT POINT
TBA	TO BE ANNOUNCED
TBC	TO BE CONFIRMED
THK.	THICKNESS
TYP.	TYPICAL
UDL	UNIFORMLY DISTRIBUTED LOAD
UKC	UNDER KEEL CLEARANCE
UTM	UNIVERSAL TRANSVERSE MERCATOR
VERT.	VERTICAL
LP	LOADING PLATFORM
WSD	WORKING STRESS DESIGN

REFERENCE DRAWING						
DRAWING NO.		TITLE				
						
						
	19.JUL'22	ISSUED FOR CONSTRUCTION	O.S.C	B.H.P	Z.C.K	S.Y.P
	22.APR.'22	ISSUED FOR CONSTRUCTION	O.S.C	B.H.P	Z.C.K	S.Y.P
	15.APR.'22	ISSUED FOR APPROVAL	O.S.C	B.H.P	Z.C.K	S.Y.P
REV	DATE	DESCRIPTION	DWN	DGN	CHK	APP
THIS DWG IS PROPERTY OF CLIENT THE INFORMATION CONTAINED HERE ON MAY NOT BE USED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF THE OWNER.						
PROJECT LINE PROJECT (WP5&7)						
OWNER 						
CONTRACTOR 						
TITLE GENERAL NOTE FOR JETTY						
SCALE NONE	JOB NO. 15005	CWA NO. 7RJ1	DWG. NO. LINE-906-CG-1-0900	REV. NO. 		



SETTING OUT COORDINATES.

MARK NO.	E	N
SOP-01	609,917.898	9,338,760.037
SOP-02	608,851.410	9,339,374.437
SOP-03	608,880.403	9,339,530.023
SOP-04	609,055.770	9,339,831.476
SOP-05	609,142.966	9,339,798.968
SOP-06	608,963.714	9,339,489.308

KEY PLAN

- *NOTES**
- 1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
 - 2. ALL LEVELS ARE IN METERS AND RELATIVE TO CHART DATUM.
 - 3. CDL 4.0m = EL 1.3m = PL 0.0m
 - 4. BATHYMETRY CONTOUR LINES ARE IN METERS RELATIVE TO CHART DATUM UNLESS NOTED OTHERWISE.
 - 5. THE CORRELATION BETWEEN MEAN SEA LEVEL AND LAT IS 0.7m (LAT=-0.7m MSL)

LEGEND

▽ : NAVIGATION BUOY

REFERENCE DRAWING

DRAWING NO.	TITLE

REV	DATE	DESCRIPTION	DWN	DGN	CHK	APP
△	19.JUL'22	ISSUED FOR CONSTRUCTION	O.S.C	B.H.P	Z.C.K	S.Y.P
△	22.APR'22	ISSUED FOR CONSTRUCTION	O.S.C	B.H.P	Z.C.K	S.Y.P
△	15.APR'22	ISSUED FOR APPROVAL	O.S.C	B.H.P	Z.C.K	S.Y.P

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PROJECT
LINE PROJECT (WP5&7)

OWNER

CONTRACTOR

TITLE OVERALL PLOT PLAN FOR JETTY					
SCALE 1/3,000	JOB NO. 15005	CWA NO. 7RJ1	DWG. NO. LINE-906-CG-1-0901	REV. NO. △	



Jurusan Teknik Sipil
Fakultas Teknik
Universitas Sultan Ageng Tirtayasa

TUGAS AKHIR
SEMESTER GANJIL 2024/2025

ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT

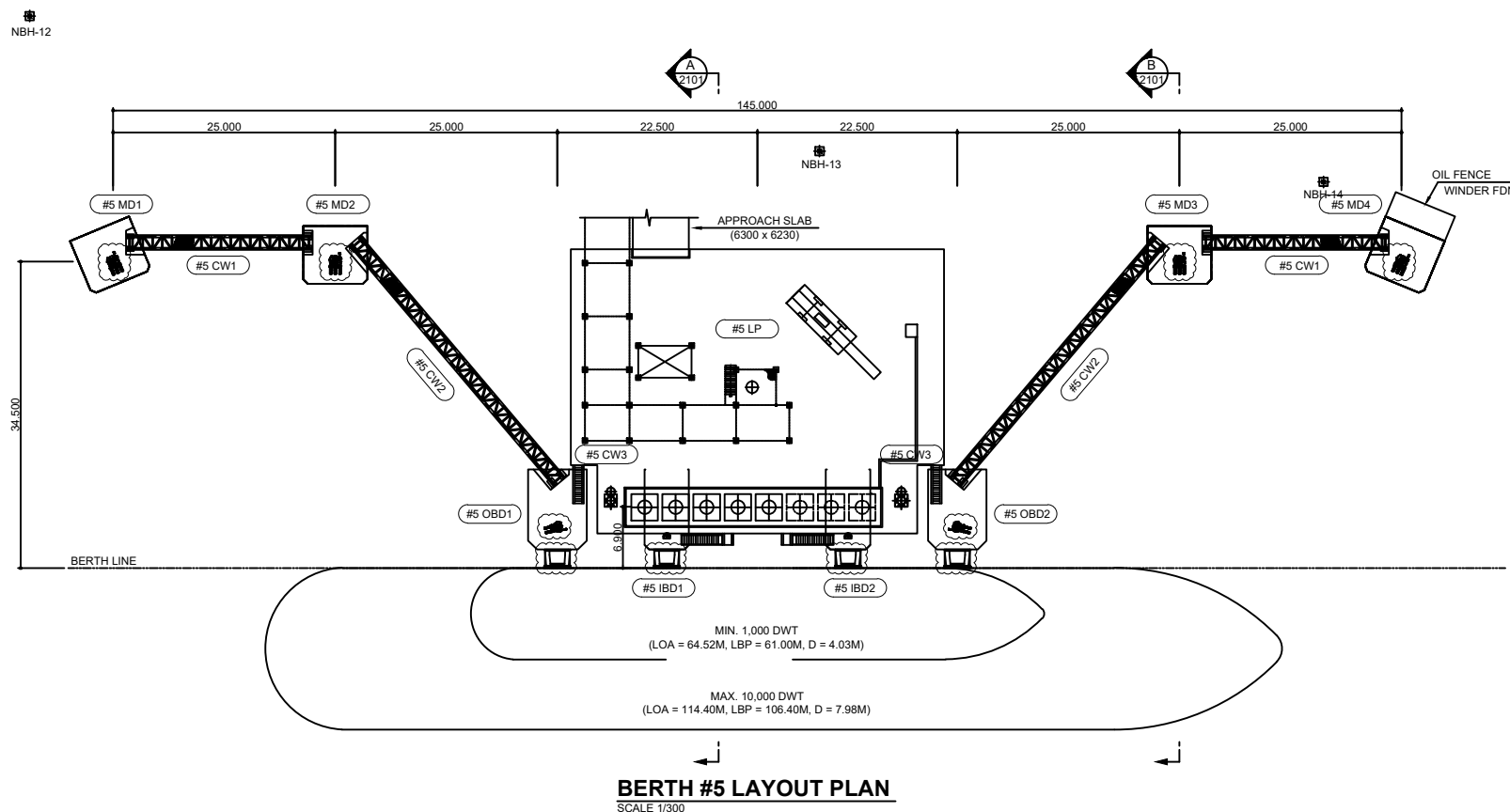
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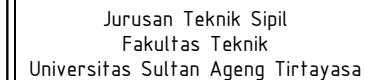
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DOSEN PEMBIMBING 2 : BAEHAHI, S.T., M. Eng NIP. 198705082015041001	

GAMBAR	SKALA
B#5 LAYOUT PLAN	1:300

DIGAMBAR	PARAF
RIFDA SYAFRIDA 3336210010	

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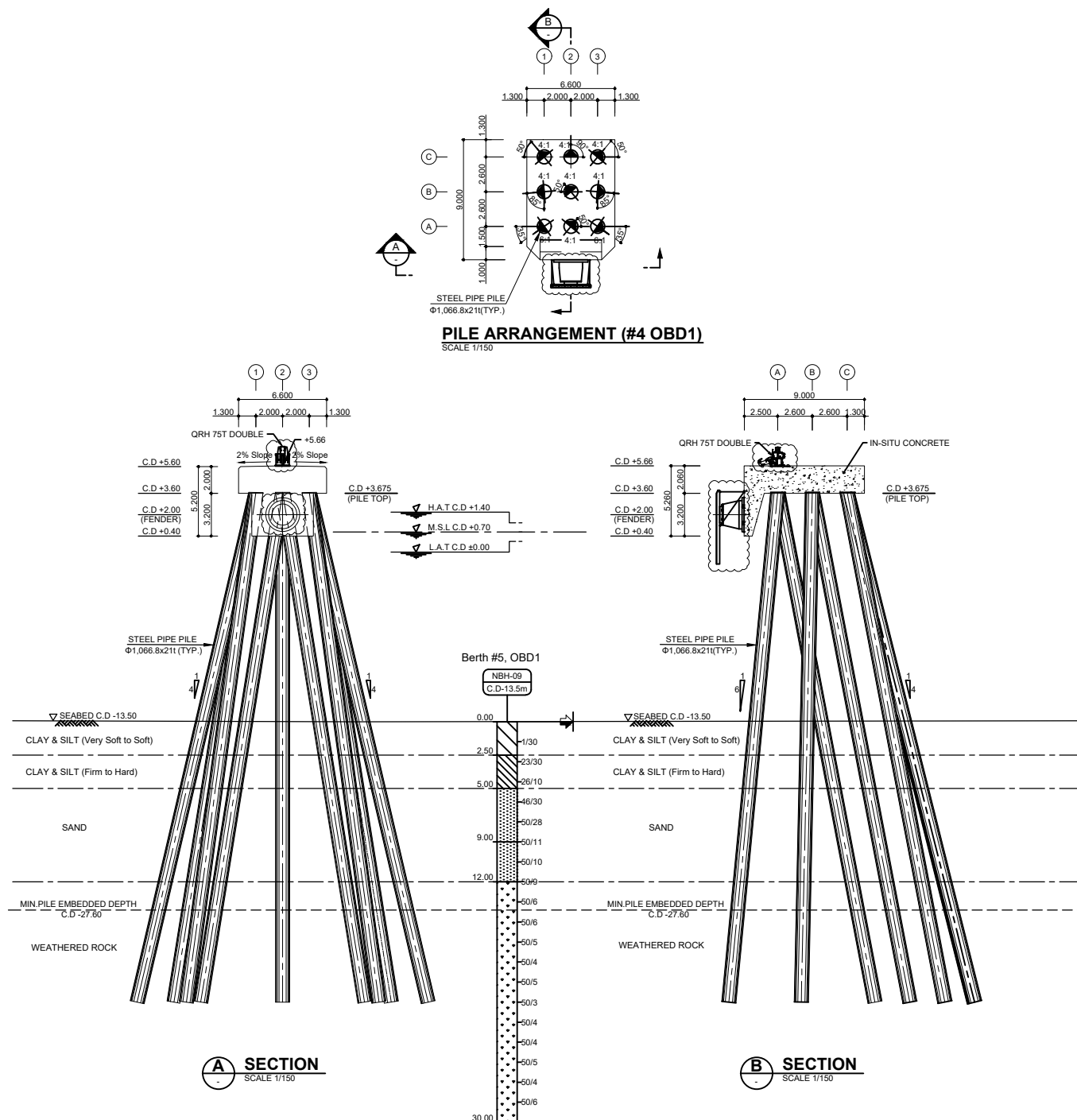




TUGAS AKHIR
SEMESTER GANJIL 2024/2025

ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT

DIPERIKSA	PARAF	
DOSEN PENGUJI 1 : BAMBANG ADHI PRIYAMBODHO S.T., M.T NIP. 197704042009121001		
DOSEN PENGUJI 2 : ZULMAHDI DARWIS, S.T., M. Eng NIP. 197706182008011005		
DISETUJUI	PARAF	
DOSEN PEMBIMBING 1 : Dr. SUBEKTI, S.T., M.T NIP. 197506122008011020		
DOSEN PEMBIMBING 2 : BAEHAKI, S.T., M. Eng NIP. 198705082015041001		
GAMBAR	SKALA	
B#5 Breastling Dolphin Pile Arrangement	1:150	
DIGAMBAR	PARAF	
RIFDA SYAFRIDA 3336210010		
UKURAN KERTAS	KODE	HAL
A4		02





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TUGAS AKHIR
SEMESTER GANJIL 2024/2025

ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT

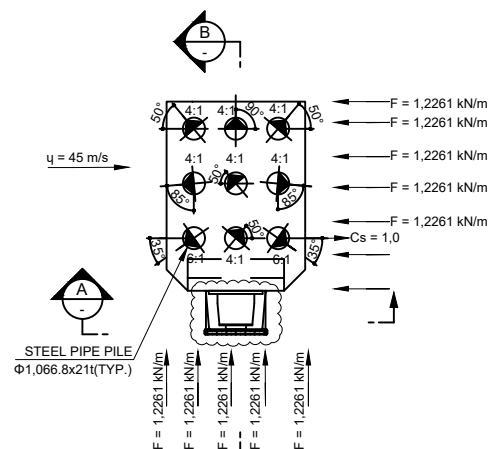
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DOSEN PENGUJI 2 : ZULMAHDI DARWIS, S.T., M. Eng NIP. 197705182008011005	

DISETUJUI	PARAF
DOSEN PEMBIMBING 1 : Dr. SUBEKTI, S.T., M.T NIP. 197506122008011020	
DOSEN PEMBIMBING 2 : BAEHAQI, S.T., M. Eng NIP. 198705082015041001	

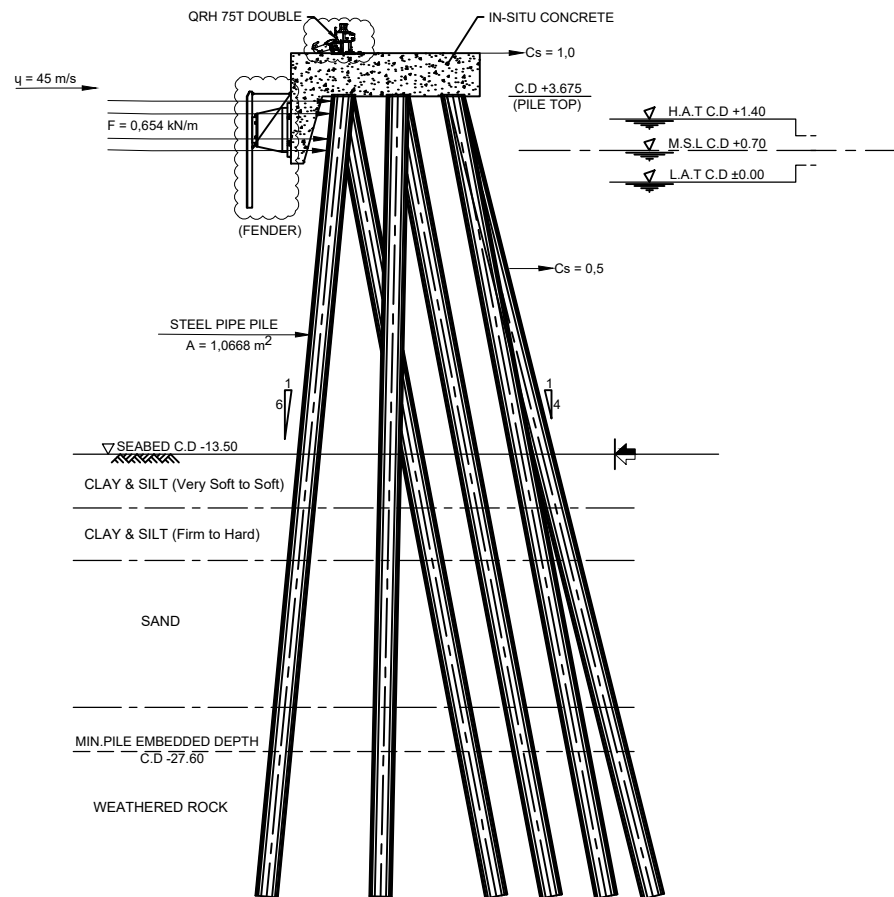
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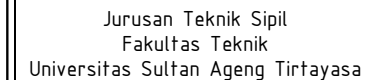
UKURAN KERTAS	KODE	HAL
A4		03



TAMPAK ATAS (#5 OBD1)
SCALE 1/150



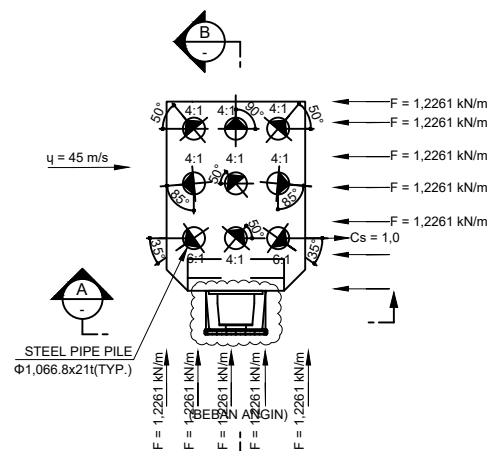
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SCALE 1/150



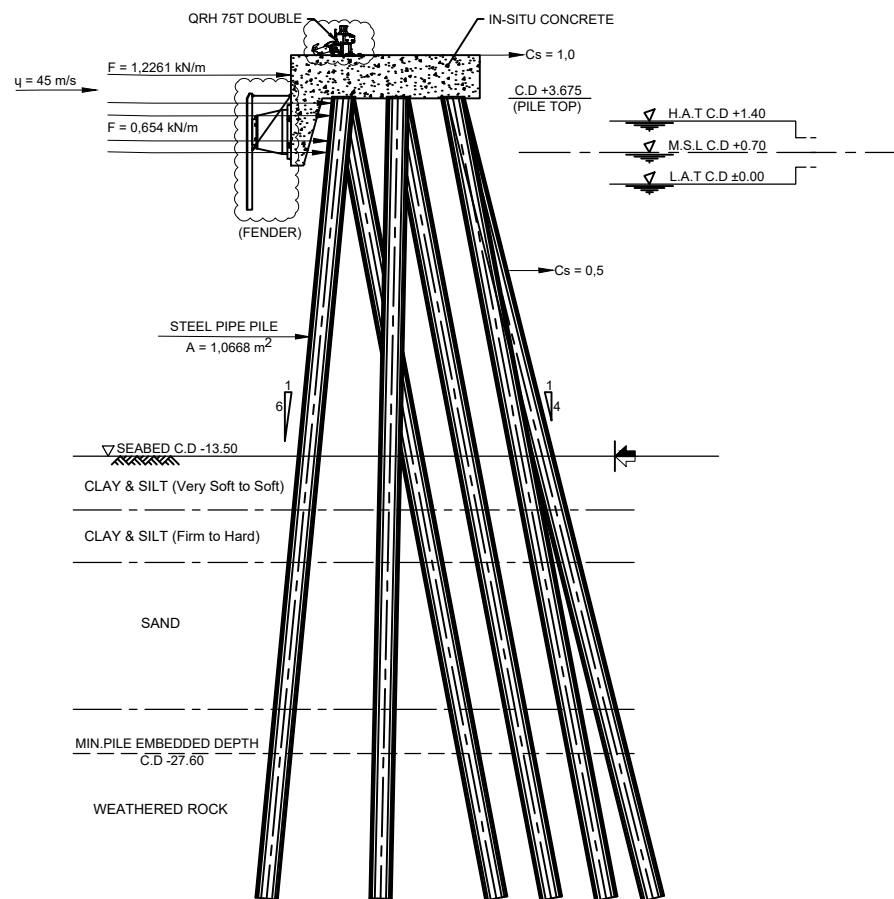
TUGAS AKHIR
SEMESTER GANJIL 2024/2025

ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT

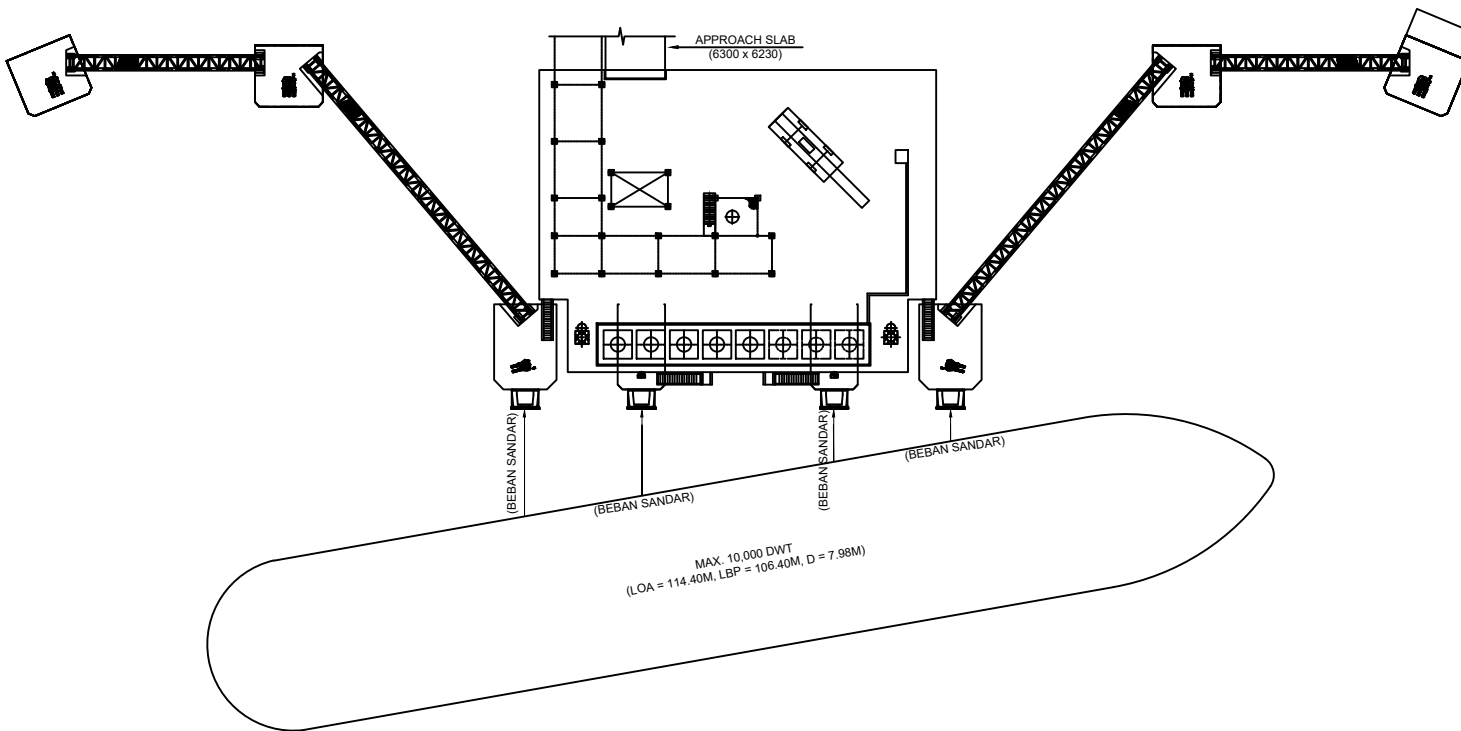
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DOSEN PENGUJI 2 :		
ZULMAHDI DARWIS, S.T., M. Eng NIP. 197706162008011005		
DISETUUJI		PARAF
DOSEN PEMBIMBING 1 :		
Dr. SUBEKTI, S.T., M.T NIP. 197506122008011020		
DOSEN PEMBIMBING 2 :		
BAEHAKI, S.T., M. Eng NIP. 198705082015041001		
GAMBAR		SKALA
Distribusi Pembebanan Angin pada Struktur Breasting Dolphin		1:150
DIGAMBAR		PARAF
RIFDA SYAFRIDA		
3336210010		
UKURAN KERTAS	KODE	HAL
A4		03



TAMPAK ATAS (#5 OBD1)
SCALE 1/150



B TAMPAK SAMPIING (#5 OBD)
SCALE 1/150



BEBAN SANDAR BERTH #5
SCALE 1/300



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TUGAS AKHIR
SEMESTER GANJIL 2024/2025

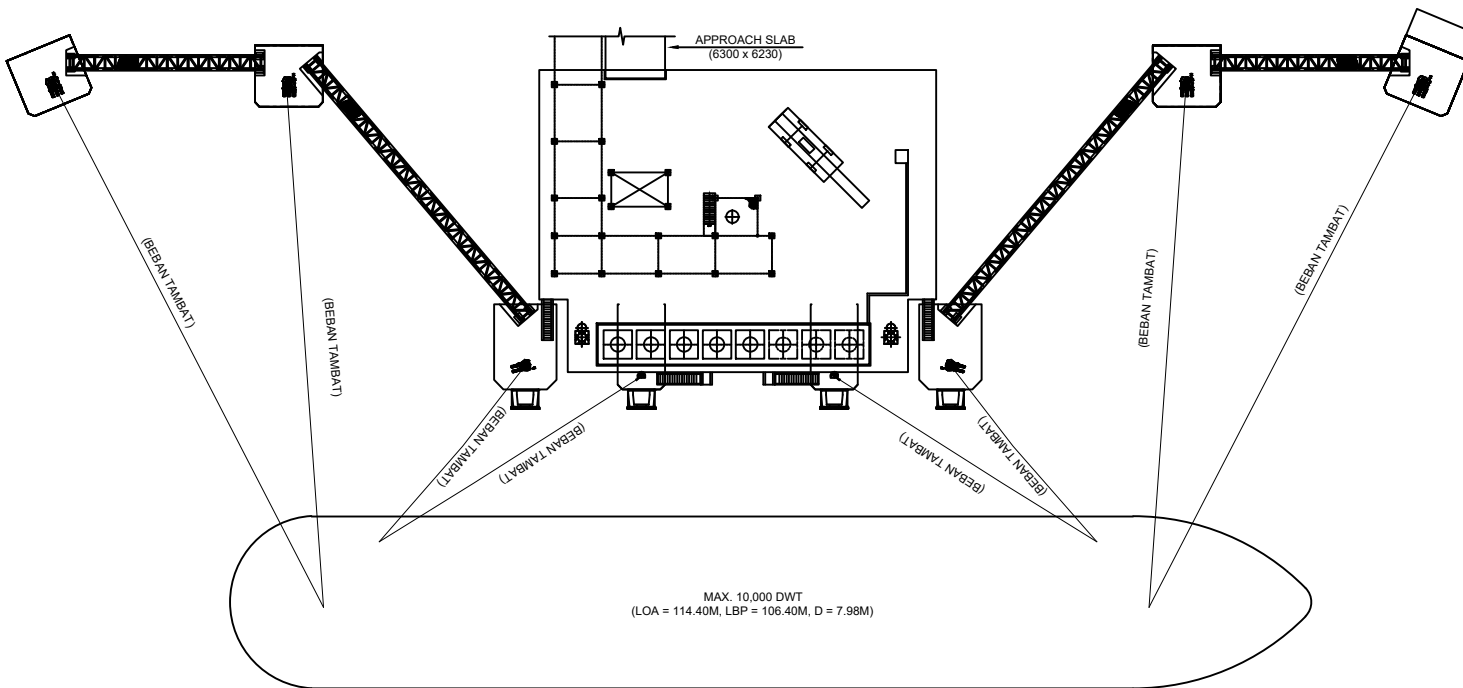
ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT

DIPERIKSA	PARAF
DOSEN PENGUJI 1 : BAMBANG ADHI PRIYAMBODHO S.T., M.T NIP. 197704042009121001	
DOSEN PENGUJI 2 : ZULMAHDI DARWIS, S.T., M. Eng NIP. 197705182008011005	
DISETUJUI	PARAF
DOSEN PEMBIMBING 1 : Dr. SUBEKTI, S.T., M.T NIP. 197506122008011020	
DOSEN PEMBIMBING 2 : BAEHAHI, S.T., M. Eng NIP. 198705082015041001	

GAMBAR	SKALA
Distribusi Beban Sandar pada Struktur Breastng Dolphin	1:300

DIGAMBAR	PARAF
RIFDA SYAFRIDA 3336210010	

UKURAN KERTAS	KODE	HAL
A4		05



BEBAN TAMBAT BERTH #5
SCALE 1/300



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ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT

DIPERIKSA	PARAF
DOSEN PENGUJI 1 : BAMBANG ADHI PRIYAMBODHO S.T., M.T NIP. 197704042009121001	
DOSEN PENGUJI 2 : ZULMAHDI DARWIS, S.T., M. Eng NIP. 197706182008011005	
DISETUJUI	PARAF
DOSEN PEMBIMBING 1 : Dr. SUBEKTI, S.T., M.T NIP. 197506122008011020	
DOSEN PEMBIMBING 2 : BAEHAHI, S.T., M. Eng NIP. 198705082015041001	

GAMBAR	SKALA
Distribusi Beban Tambat pada Struktur Breasting Dolphin	1:300

DIGAMBAR	PARAF
RIFDA SYAFRIDA 3336210010	

UKURAN KERTAS	KODE	HAL
A4		06



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ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT

DIPERIKSA	PARAF
-----------	-------

DOSEN PENGUJI 1 :
BAMBANG ADHI PRIYAMBODHO
S.T., M.T
NIP. 197704042009121001

DOSEN PENGUJI 2 :
ZULMAHDI DARWIS, S.T., M. Eng
NIP. 197705182008011005

DISETUJUI	PARAF
-----------	-------

DOSEN PEMBIMBING 1 :
Dr. SUBEKTI, S.T., M.T
NIP. 197506122008011020

DOSEN PEMBIMBING 2 :
BAEHAKI, S.T., M. Eng
NIP. 198705082015041001

GAMBAR	SKALA
--------	-------

B#5 Mooring Dolphin
Pile Arrangement

1:150

DIGAMBAR	PARAF
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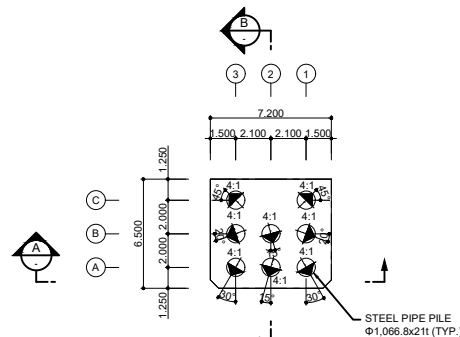
RIFDA SYAFRIDA

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UKURAN KERTAS	KODE	HAL
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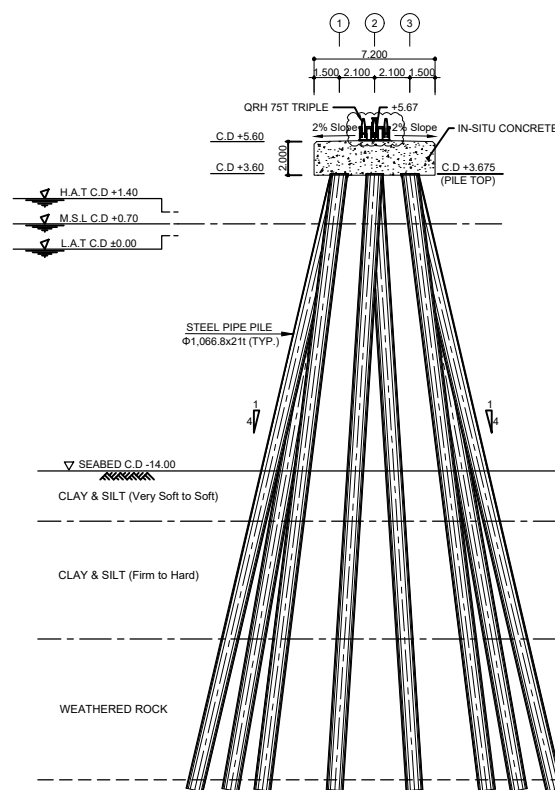
A4

07

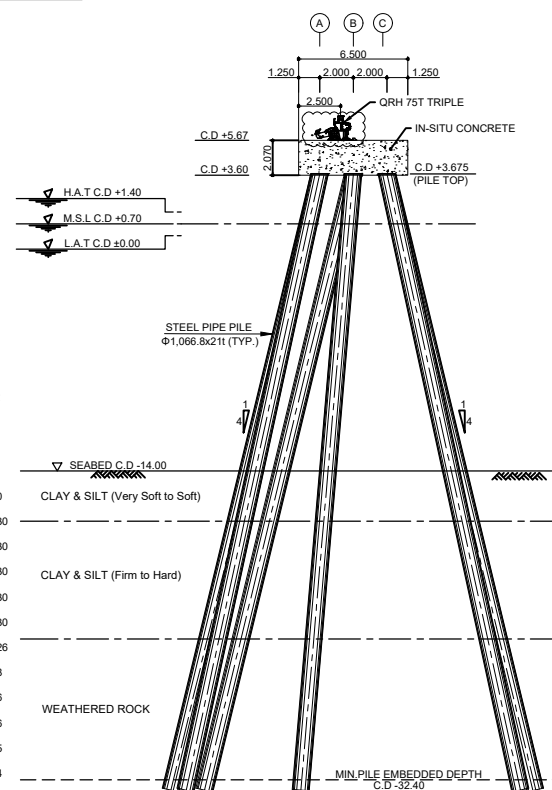


PILE ARRANGEMENT (#4 MD2)

SCALE 1/150



A SECTION
SCALE 1/150



B SECTION
SCALE 1/150

Berth #5, MD2

NBH-08
C.D. -14.0m

0.00

6/30

17/30

23/30

16/30

8.00

14/30

25/30

10.00

50/26

50/8

50/6

50/6

50/5

50/5

50/4

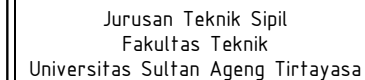
50/5

50/7

50/5

50/5

25.00



ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT

GAMBAR	SKALA
Distribusi Pembebanan Angin pada Struktur Mooring Dolphin	1:150

UKURAN KERTAS	KODE	HAL
A4		08





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ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT

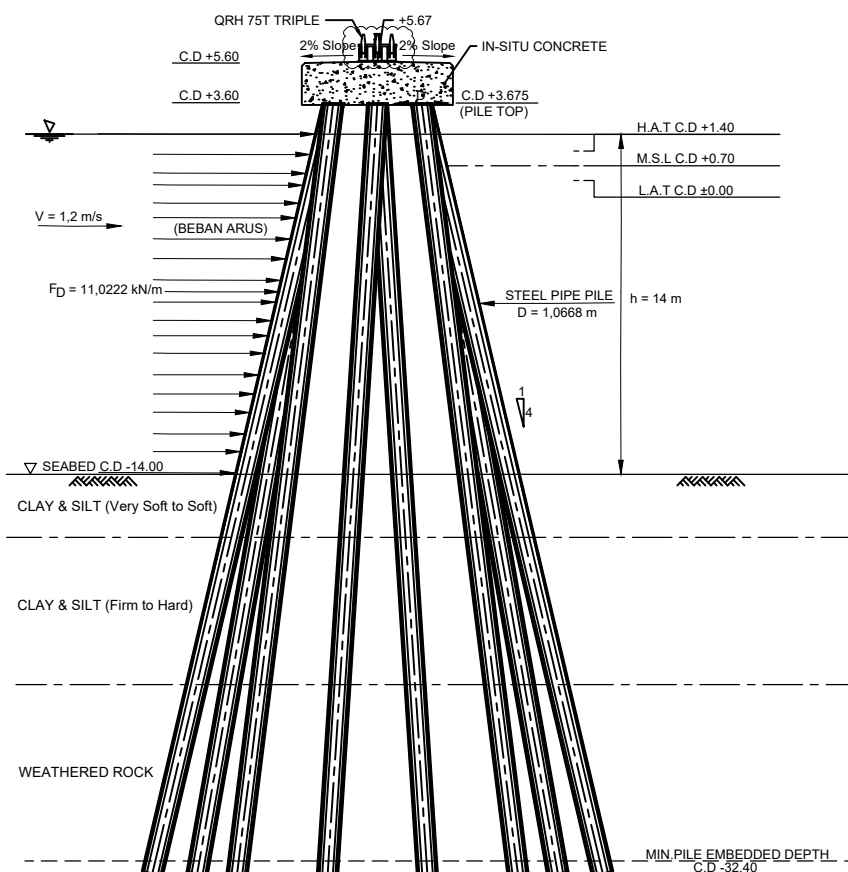
DIPERIKSA	PARAF
DOSEN PENGUJI 1 : BAMBANG ADHI PRIYAMBODHO S.T., M.T NIP. 197704042009121001	
DOSEN PENGUJI 2 : ZULMAHDI DARWIS, S.T., M. Eng NIP. 197705182008011005	

DISETUJUI	PARAF
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DOSEN PEMBIMBING 2 : BAEHAHI, S.T., M. Eng NIP. 198705082015041001	

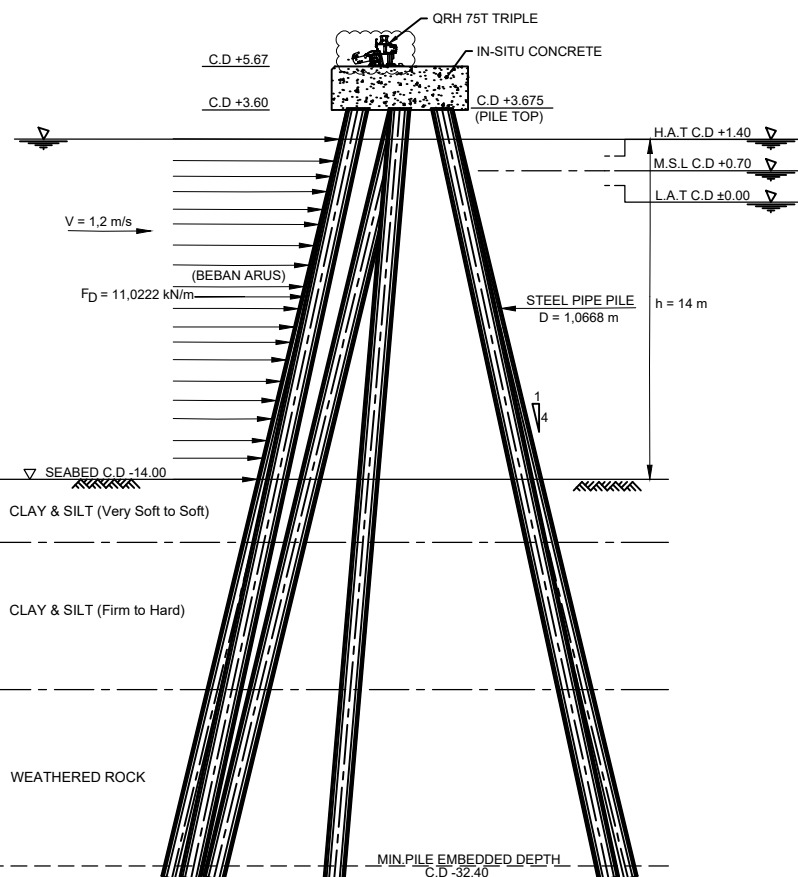
GAMBAR	SKALA
Distribusi Pembebanan Arus pada Struktur Mooring Dolphin	1:150

DIGAMBAR	PARAF
RIFDA SYAFRIDA 3336210010	

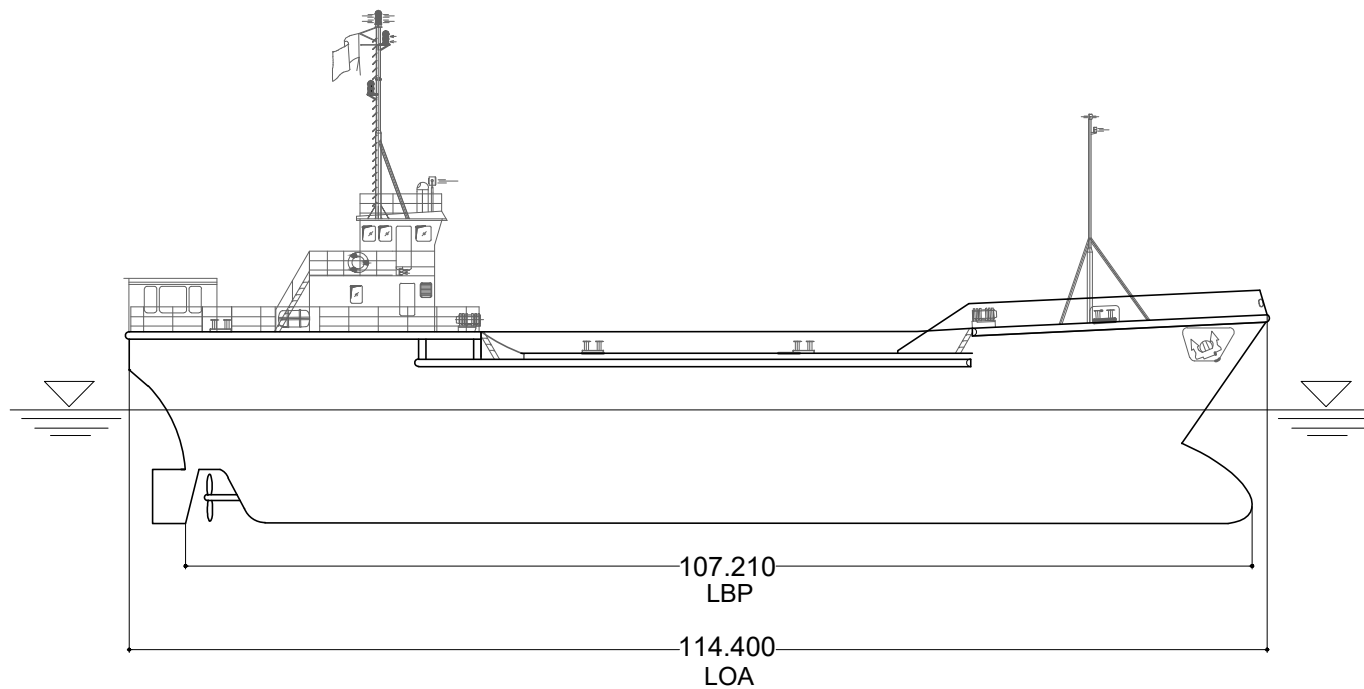
UKURAN KERTAS	KODE	HAL
A4		09



A TAMPAK DEPAN (#5 MD)
SCALE 1/150



B TAMPAK SAMPAING (#5 MD)
SCALE 1/150



TAMPAK SAMPING KAPAL TANKER 10.000 DWT
SCALE 1/100



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SEMESTER GANJIL 2024/2025

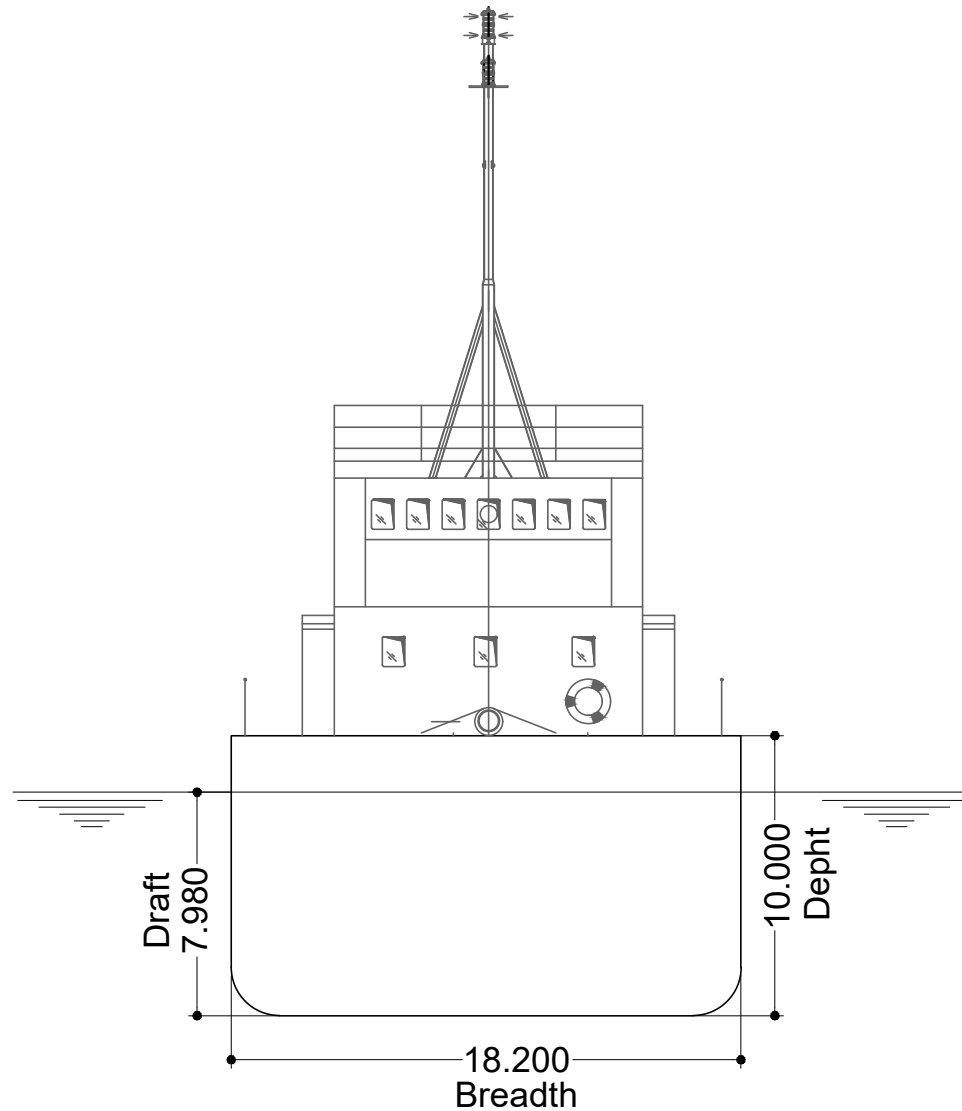
**ANALISIS STRUKTUR
BREASTING DOLPHIN DAN
MOORING DOLPHIN UNTUK
KAPAL TANKER 10.000 DWT**

DIPERIKSA	PARAF
DOSEN PENGUJI 1 : BAMBANG ADHI PRIYAMBODHO S.T., M.T NIP. 197704042009121001	
DOSEN PENGUJI 2 : ZULMAHDI DARWIS, S.T., M. Eng NIP. 197706182008011005	
DISETUJUI	PARAF
DOSEN PEMBIMBING 1 : Dr. SUBEKTI, S.T., M.T NIP. 197506122008011020	
DOSEN PEMBIMBING 2 : BAEHAHI, S.T., M. Eng NIP. 198705082015041001	

GAMBAR	SKALA
TAMPAK SAMPING KAPAL TANKER 10.000 DWT TERENDAM AIR	1:100

DIGAMBAR	PARAF
RIFDA SYAFRIDA 3336210010	

UKURAN KERTAS	KODE	HAL
A4		10



TAMPAK DEPAN KAPAL TANKER 10.000 DWT
SCALE 1/100



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**ANALISIS STRUKTUR
BREASTING DOLPHIN DAN
MOORING DOLPHIN UNTUK
KAPAL TANKER 10.000 DWT**

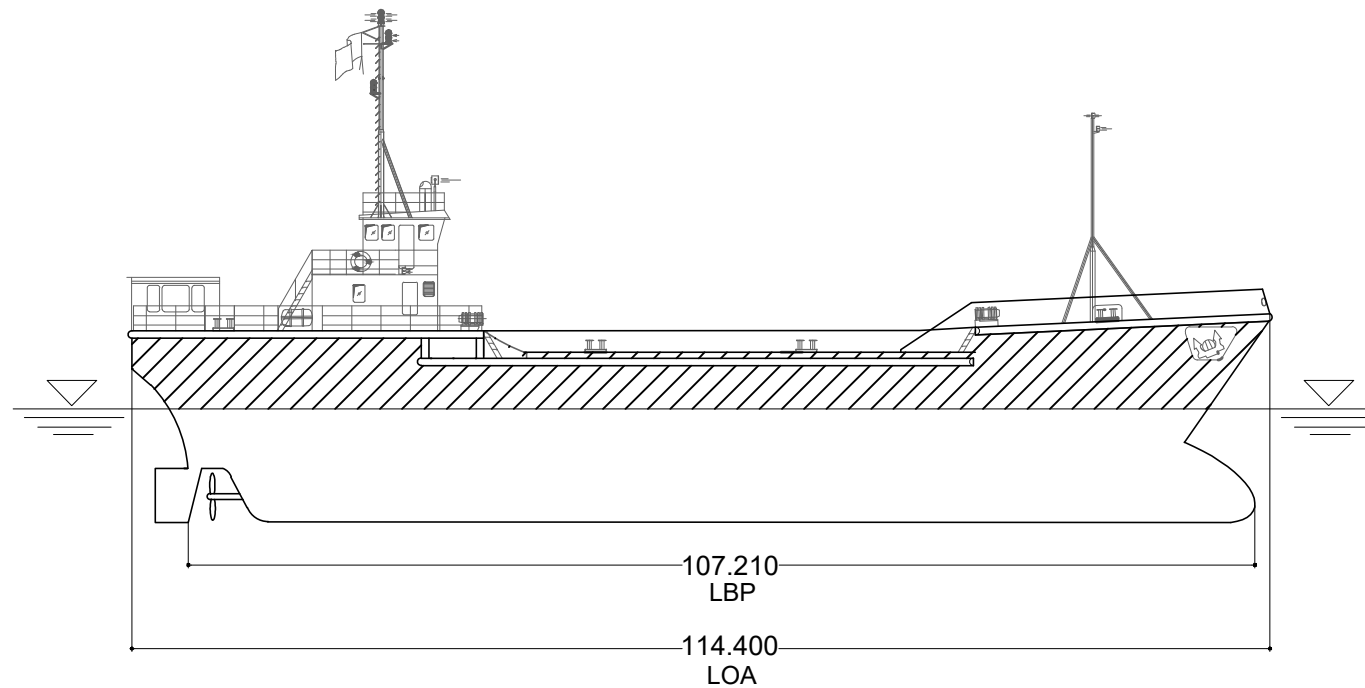
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DOSEN PENGUJI 1 : BAMBANG ADHI PRIYAMBODHO S.T., M.T NIP. 197704042009121001	
DOSEN PENGUJI 2 : ZULMAHDI DARWIS, S.T., M. Eng NIP. 197706182008011005	

DISETUJUI	PARAF
DOSEN PEMBIMBING 1 : Dr. SUBEKTI, S.T., M.T NIP. 197506122008011020	
DOSEN PEMBIMBING 2 : BAEHAKE, S.T., M. Eng NIP. 198705082015041001	

GAMBAR	SKALA
Tampak Depan Kapal Tanker 10.000 DWT	1:100

DIGAMBAR	PARAF
RIFDA SYAFRIDA 3336210010	

UKURAN KERTAS	KODE	HAL
A4		11



TAMPAK SAMPING KAPAL TERKENA ANGIN
SCALE 1/100



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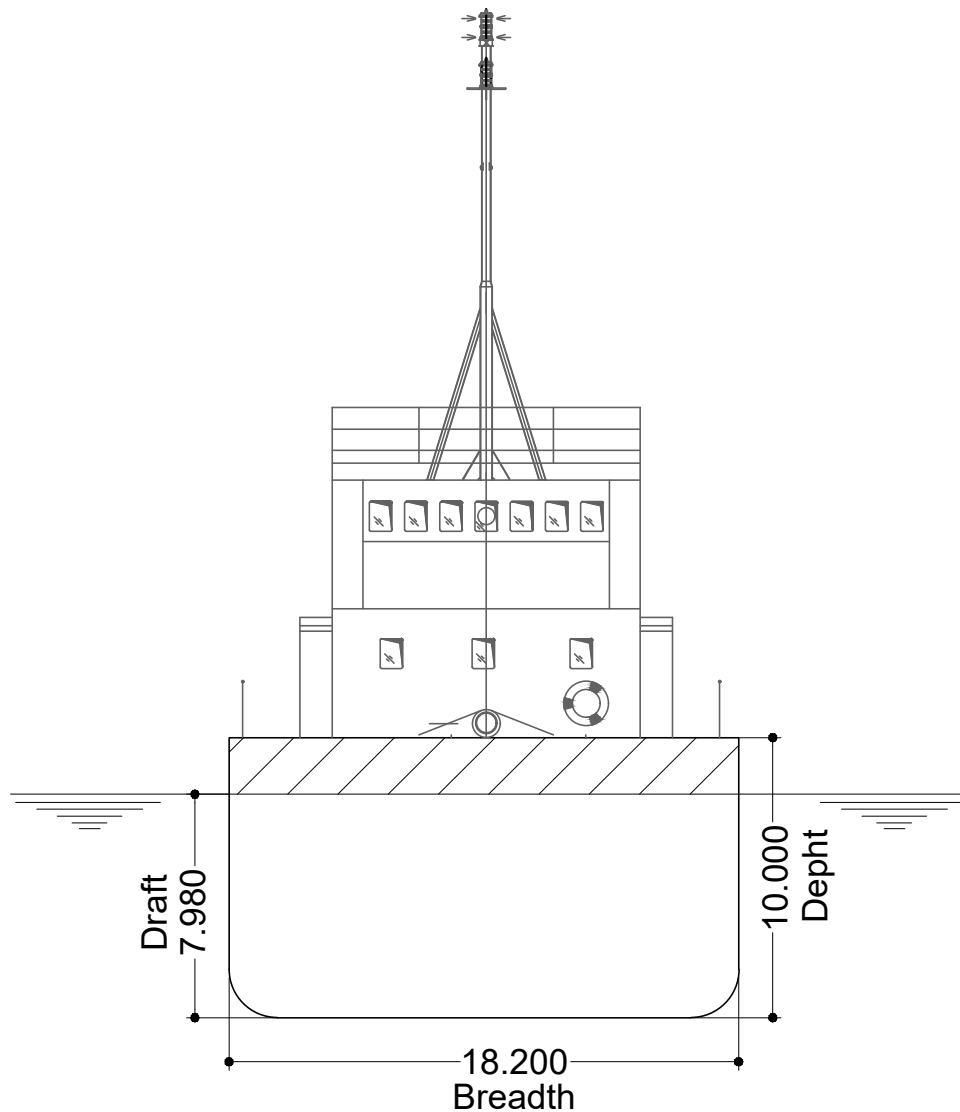
**ANALISIS STRUKTUR
BREASTING DOLPHIN DAN
MOORING DOLPHIN UNTUK
KAPAL TANKER 10.000 DWT**

DIPERIKSA	PARAF
DOSEN PENGUJI 1 : BAMBANG ADHI PRIYAMBODHO S.T., M.T NIP. 197704042009121001	
DOSEN PENGUJI 2 : ZULMAHDI DARWIS, S.T., M. Eng NIP. 197706182008011005	
DISETUJUI	PARAF
DOSEN PEMBIMBING 1 : Dr. SUBEKTI, S.T., M.T NIP. 197506122008011020	
DOSEN PEMBIMBING 2 : BAEHAKE, S.T., M. Eng NIP. 198705082015041001	

GAMBAR	SKALA
TAMPAK SAMPING KAPAL TANKER 10.000 DWT TERENDAM AIR	1:100

DIGAMBAR	PARAF
RIFDA SYAFRIDA 3336210010	

UKURAN KERTAS	KODE	HAL
A4		12



TAMPAK DEPAN KAPAL TERKENA ANGIN
SCALE 1/100



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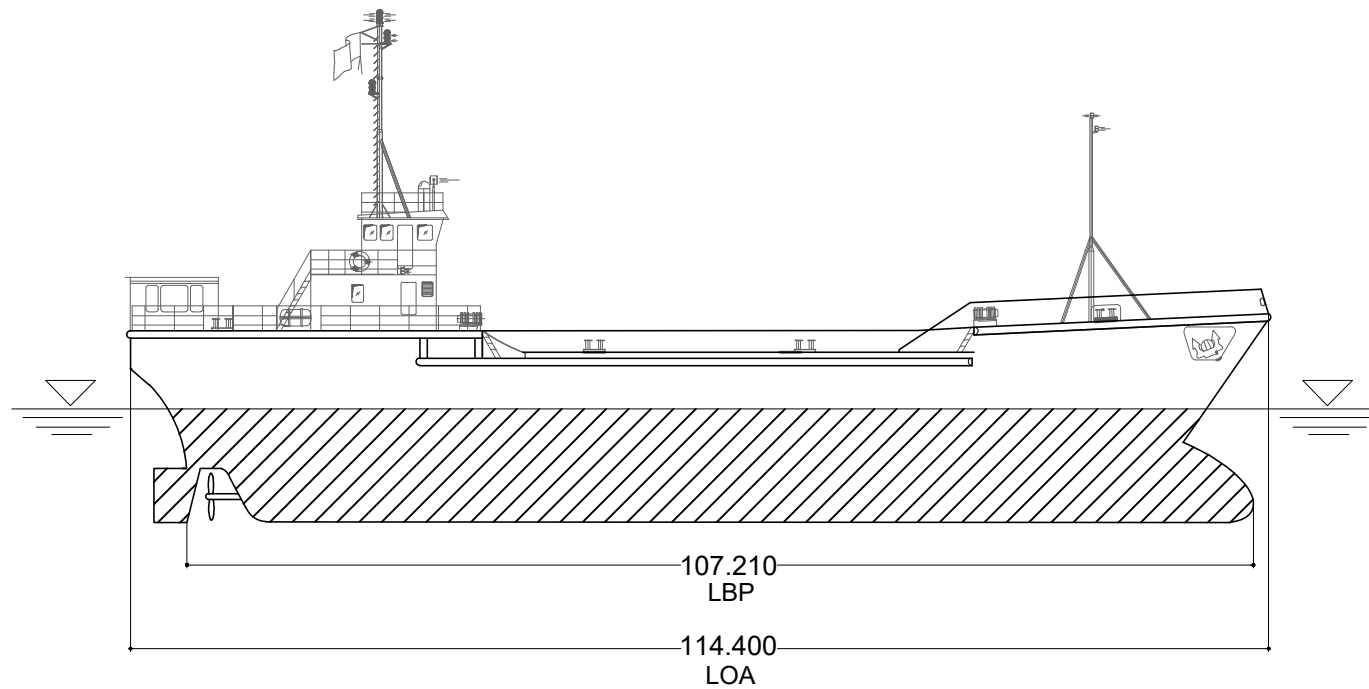
**ANALISIS STRUKTUR
BREASTING DOLPHIN DAN
MOORING DOLPHIN UNTUK
KAPAL TANKER 10.000 DWT**

DIPERIKSA	PARAF
DOSEN PENGUJI 1 : BAMBANG ADHI PRIYAMBODHO S.T., M.T NIP. 197704042009121001	
DOSEN PENGUJI 2 : ZULMAHDI DARWIS, S.T., M. Eng NIP. 197706182008011005	
DISETUJUI	PARAF
DOSEN PEMBIMBING 1 : Dr. SUBEKTI, S.T., M.T NIP. 197506122008011020	
DOSEN PEMBIMBING 2 : BAEHAQI, S.T., M. Eng NIP. 198705082015041001	

GAMBAR	SKALA
Tampak Depan Luas Kapal Tanker 10.000 DWT Terkena Angin	1:100

DIGAMBAR	PARAF
RIFDA SYAFRIDA 3336210010	

UKURAN KERTAS	KODE	HAL
A4		13



TAMPAK SAMPING KAPAL TERENDAM AIR
SCALE 1/100



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Universitas Sultan Ageng Tirtayasa

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SEMESTER GANJIL 2024/2025

**ANALISIS STRUKTUR
BREASTING DOLPHIN DAN
MOORING DOLPHIN UNTUK
KAPAL TANKER 10.000 DWT**

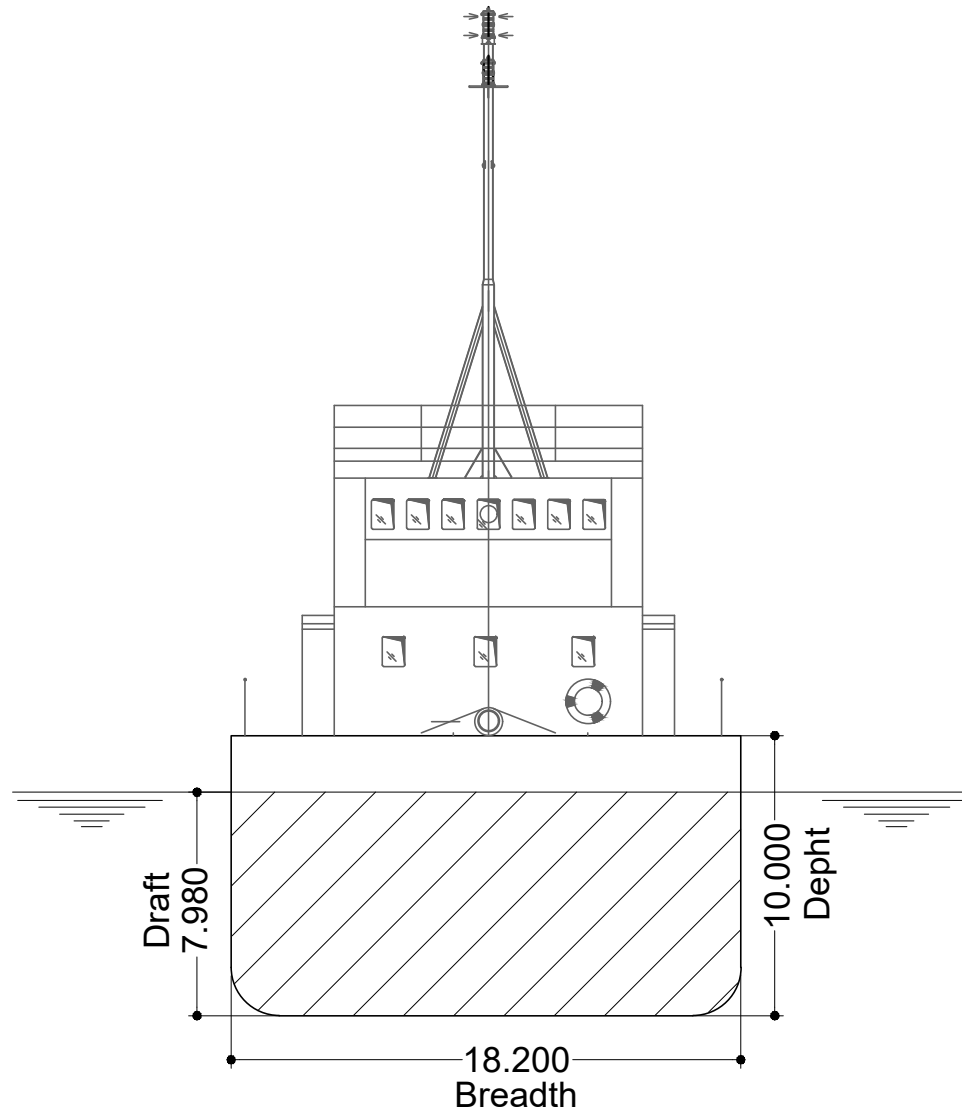
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DOSAN PENGUJI 1 : BAMBANG ADHI PRIYAMBODHO S.T., M.T NIP. 197704042009121001	
DOSAN PENGUJI 2 : ZULMAHDI DARWIS, S.T., M. Eng NIP. 197706182008011005	

DISETUJUI	PARAF
DOSAN PEMBIMBING 1 : Dr. SUBEKTI, S.T., M.T NIP. 197506122008011020	
DOSAN PEMBIMBING 2 : BAEHAKI, S.T., M. Eng NIP. 198705082015041001	

GAMBAR	SKALA
TAMPAK SAMPING KAPAL TANKER 10.000 DWT TERENDAM AIR	1:100

DIGAMBAR	PARAF
RIFDA SYAFRIDA 3336210010	

UKURAN KERTAS	KODE	HAL
A4		14



TAMPAK DEPAN KAPAL TERENDAM AIR
SCALE 1/100



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SEMESTER GANJIL 2024/2025

**ANALISIS STRUKTUR
BREASTING DOLPHIN DAN
MOORING DOLPHIN UNTUK
KAPAL TANKER 10.000 DWT**

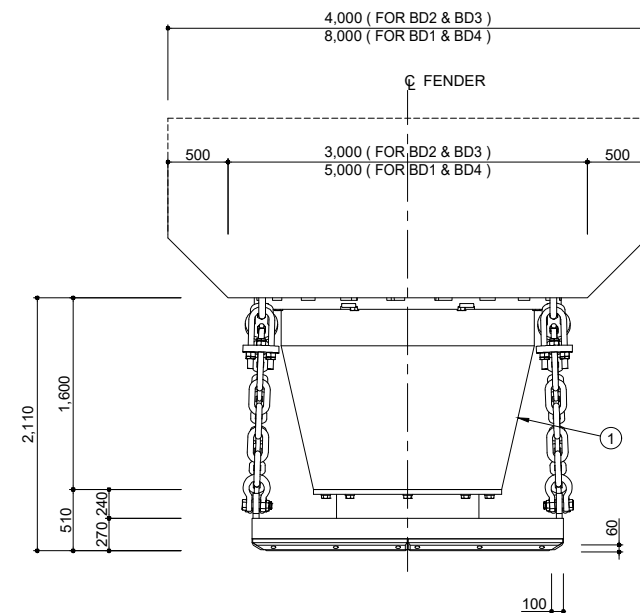
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DOSEN PENGUJI 1 : BAMBANG ADHI PRIYAMBODHO S.T., M.T NIP. 197704042009121001	
DOSEN PENGUJI 2 : ZULMAHDI DARWIS, S.T., M. Eng NIP. 197706182008011005	
DISETUJUI	PARAF
DOSEN PEMBIMBING 1 : Dr. SUBEKTI, S.T., M.T NIP. 197506122008011020	
DOSEN PEMBIMBING 2 : BAEHAHI, S.T., M. Eng NIP. 198705082015041001	

GAMBAR	SKALA
Tampak Depan Luas Kapal Tanker 10.000 DWT Terendam Air	1:100

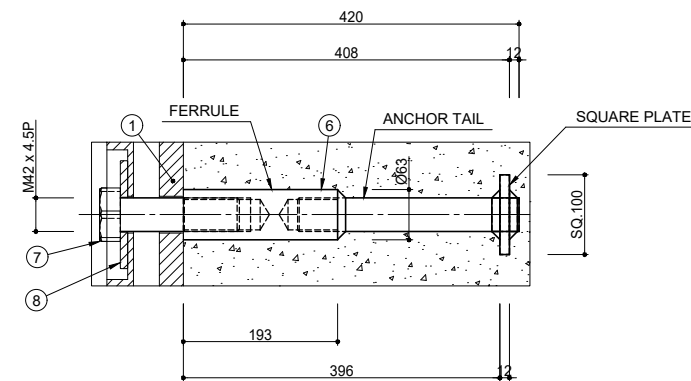
DIGAMBAR	PARAF
RIFDA SYAFRIDA 3336210010	

UKURAN KERTAS	KODE	HAL
A4		15

LAMPIRAN



TOP VIEW

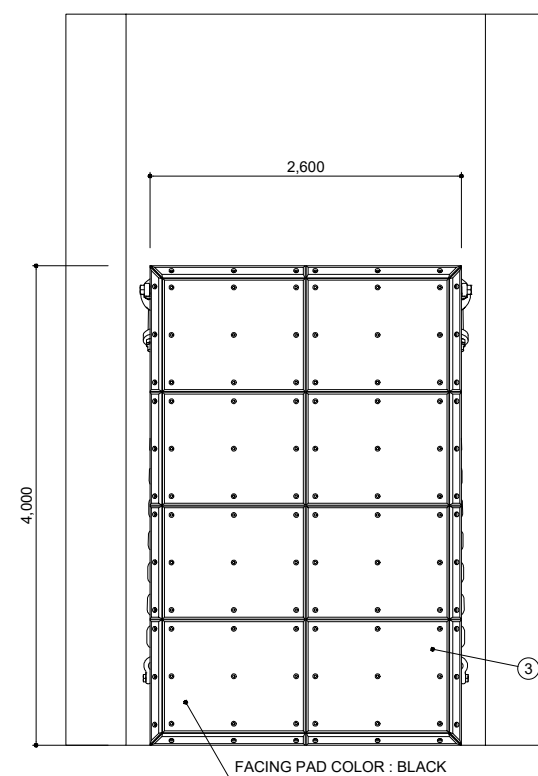
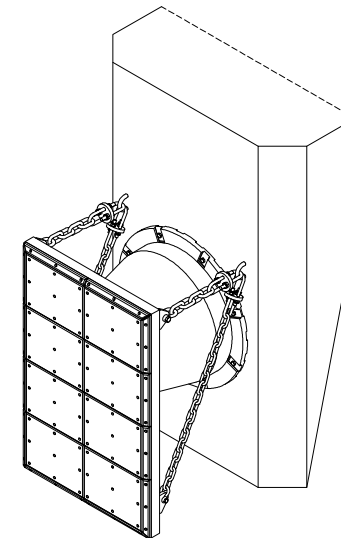


1 DETAIL

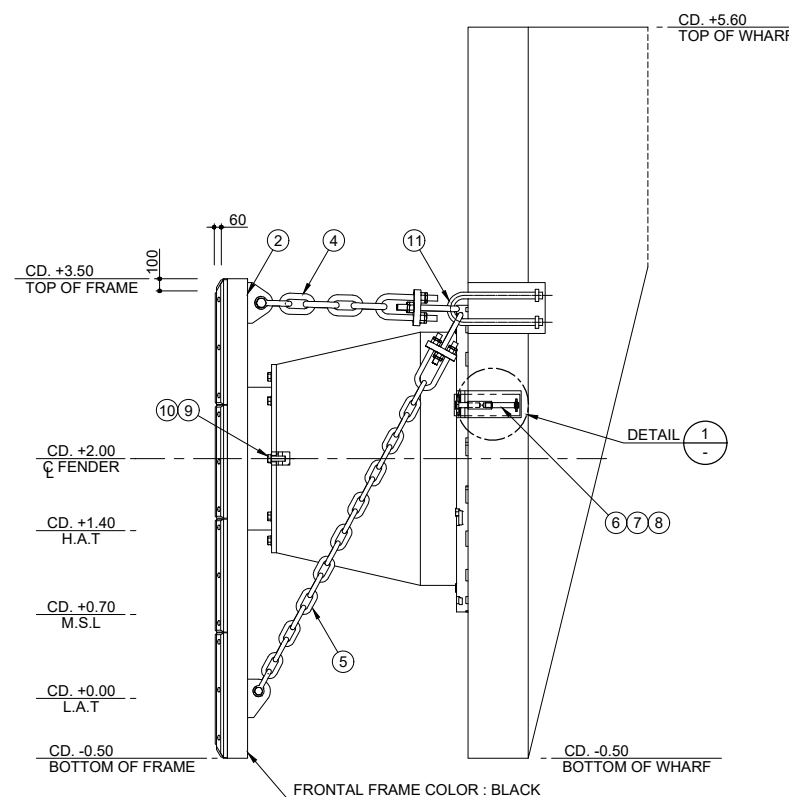
6. NC3 ANCHOR(NON-THROUGH TYPE), M42 x 4.5P
(FOR FENDER TO WHARF FIXING)
MATERIAL : ANCHOR FERRULE : SS316
ANCHOR TAIL : #45 (PAINTED) (PRIMER : 70 MICRON)
SQUARE PLATE : Q235B/EQUIV. (PAINTED) (PRIMER : 70 MICRON)
QTY / SYSTEM : 8 Nos.

Part no.	Description	Size	Qty / system	Material
1	SCN Fender	SCN1600 F0.9	1	Rubber + Steel
2	Frontal frame	4000 x 2600 x 230	1	Q355B / Equiv. (Painted)
3	Facing pad (Colour : Black)	40mm thk.	1	UHMW-PE
4	Tension chain	Ø48 x 4D, Open link	2	Gr. U3, Gr. S, Gr. 8.8, Gr. 8 Q355B / Equiv (HDG)
5	Weight chain	Ø32 x 4D, Open link	2	Gr. U3, Gr. S, Gr. 8.8, Gr. 8 Q355B / Equiv (HDG)
6	NC3 Anchor (Non-through type)	M42 x 4.5P	8	SS316 + #45 (Painted) + Q235B/Equiv. (Painted)
7	Hex Bolt	M42 x 4.5P (Fully threaded)	8	SS316
8	L washer	Suitable for SCN1600	8	SS316
9	Hex Bolt	M42 x 4.5P (Fully threaded)	8	SS316
10	Round washer for M42	OD 78 x ID 43 x 7 thk.	8	SS316
11	Cast-in 'U' anchor	-	2	SS316

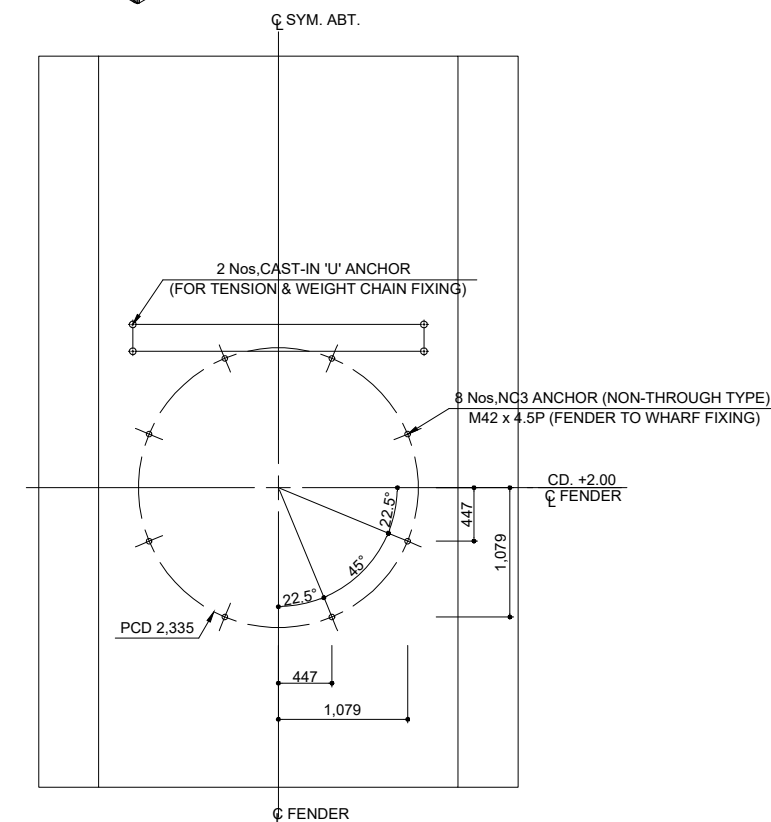
Performance table (CV)	
Fender Type	SCN1600 F0.9
Fender deflection	72 %
Fender energy	1381.5 kNm
Fender reaction	1447.2 kN
Performance tolerance	Energy : -10% Reaction : +10%
Dimensional tolerance	±3 % or ±2mm (whichever is the greater)



FRONT VIEW



SIDE VIEW



ANCHOR LAYOUT DETAIL

KEY PLAN

*NOTES

1. THIS DRAWING IS FOR APPROVAL PURPOSE ONLY. DIMENSIONS & DETAILS SHOWN ARE PRELIMINARY AND MAY CHANGE DURING FINAL DESIGN STAGES.
2. ALL DIMENSIONS ARE IN MM OTHERWISE AS SPECIFIED.
3. MINIMUM EDGE DISTANCE FROM NEAREST ANCHOR SHALL BE 1.5 TIMES OF ANCHOR EMBEDMENT DEPTH OR ELSE REINFORCEMENT SHALL BE PROVIDED AS PER ACI 318 RD 5.2.9.
4. ALL HEX BOLTS SHALL BE IN ACCORDING TO DIN933.
5. All round washers shall be in according to DIN125.
6. DIMENSIONAL TOLERANCE FOR ALL STEEL STRUCTURE SHALL BE AS PER EN ISO 13920, CLASS-C.
7. ALL DIMENSIONS ARE INDICATIVE ONLY AND MAY GET CHANGE AT THE TIME OF FINAL DESIGN.
8. THE HULL PRESSURE FOR THE FRONTAL FRAME DESIGN IS CONSIDERED TO BE 200 kPa.
9. THIS DRAWING IS INDICATIVE ONLY DEVELOPMENT OF THIS DRAWING WILL BE UPDATED BY THE SUPPLIER.

REFERENCE DRAWING

DRAWING NO.	TITLE

△						
△						
△						
△	25.OCT.'22	ISSUED FOR CONSTRUCTION	O.S.C	B.H.P	Z.C.K	S.Y.P
△	19.JUL.'22	ISSUED FOR APPROVAL	O.S.C	B.H.P	Z.C.K	S.Y.P
REV	DATE	DESCRIPTION	DWN	DGN	CHK	APP

THIS DWG IS PROPERTY OF CLIENT THE INFORMATION CONTAINED
HERE ON MAY NOT BE USED OR COPIED IN ANY MANNER WITHOUT
THE WRITTEN PERMISSION OF THE OWNER.

PROJECT

LINE PROJECT (WP5&7)

OWNER



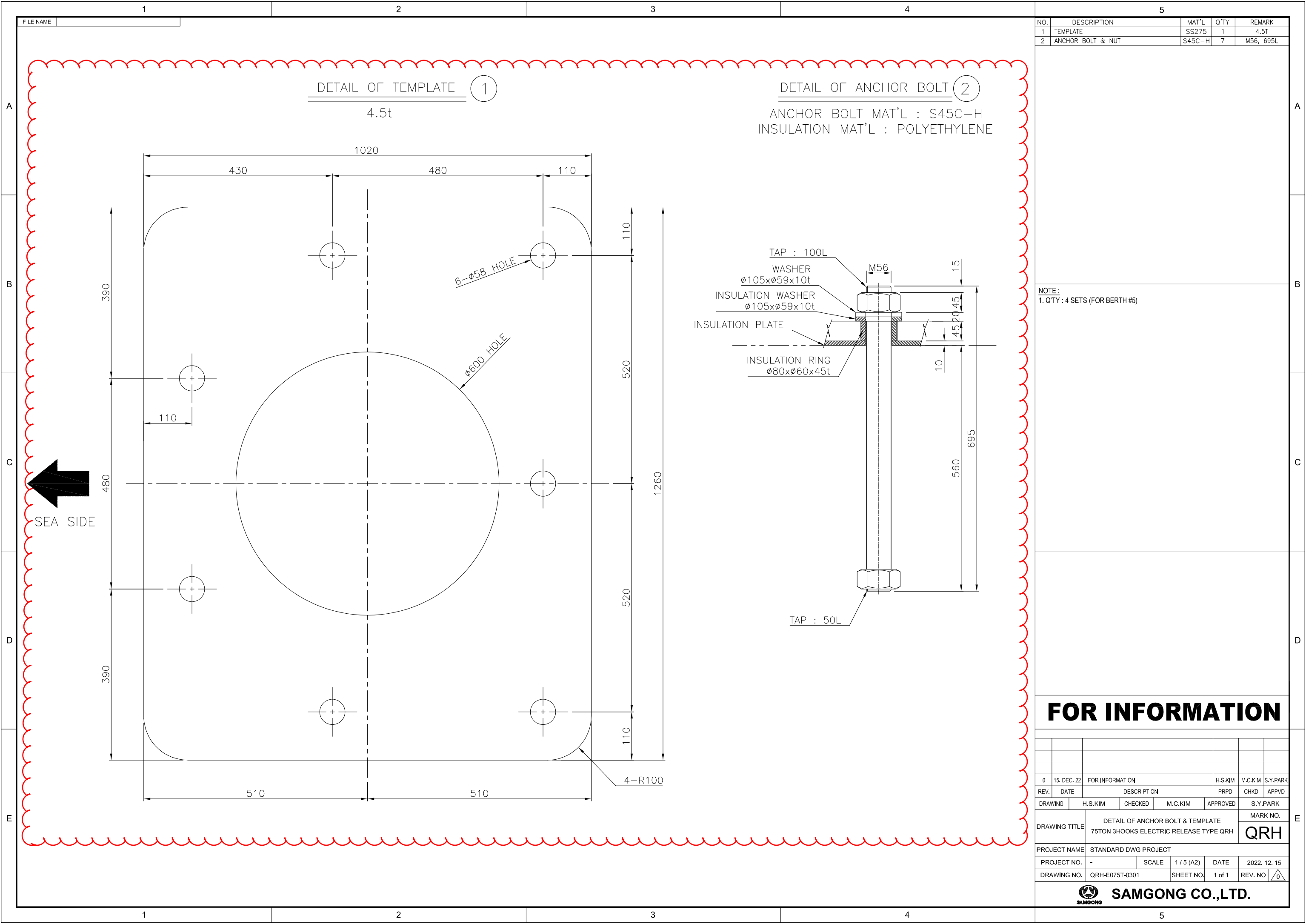
CONTRACTOR



TITLE

FENDER DETAILS (SCN 1600 F0.9)

SCALE N.T.S	JOB NO. 15005	CWA NO. 0000	DWG. NO. LINE-906-CG-1-4055	REV. NO. 0
----------------	------------------	-----------------	--------------------------------	---------------



NO.

DESCRIPTION

MAT'L

Q'TY

REMARK

1

TEMPLATE

SS275

1

4.5T

2

ANCHOR BOLT & NUT

S45C-H

7

M56, 695L

NOTE :

1. QTY : 4 SETS (FOR BERTH #5)

FOR INFORMATION

0

15. DEC. 22

FOR INFORMATION

H.S.KIM

M.C.KIM

S.Y.PARK

REV.

DATE

DESCRIPTION

PRPD

CHKD

APPVD

DRAWING

H.S.KIM

CHECKED

M.C.KIM

APPROVED

S.Y.PARK

DRAWING TITLE

DETAIL OF ANCHOR BOLT & TEMPLATE
75TON 3HOOKS ELECTRIC RELEASE TYPE QRH

MARK NO.
QRH

PROJECT NAME

STANDARD DWG PROJECT

PROJECT NO.

-

SCALE

1 / 5 (A2)

DATE

2022. 12. 15

DRAWING NO.

QRH-E075T-0301

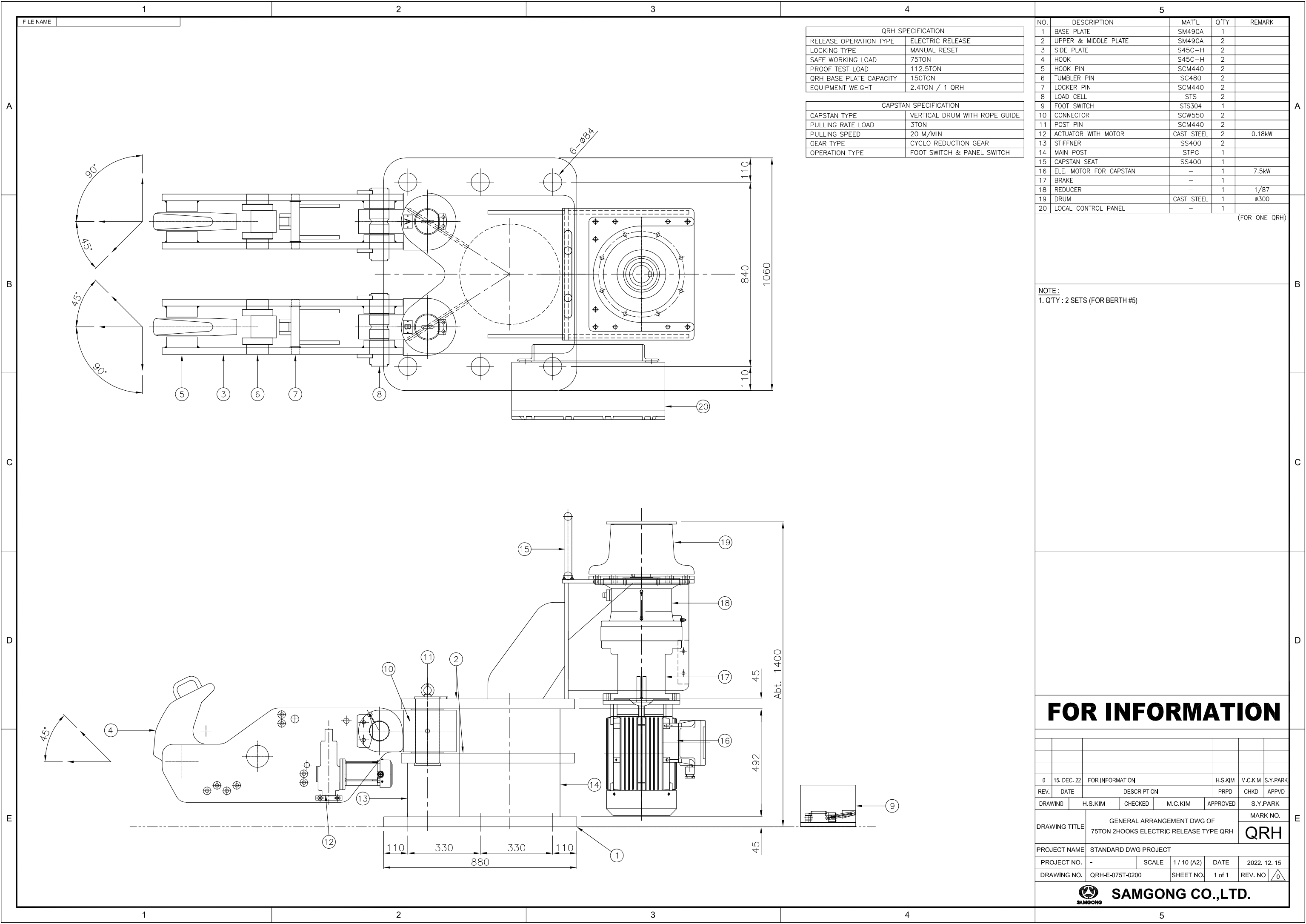
SHEET NO.

1 of 1

REV. NO.

0

SAMGONG CO.,LTD.



A

B

C

D

E

6-ø84

90°

45°

45°

90°

5

3

6

7

8

110

840

1060

110

20

15

19

18

17

16

14

13

12

11

10

2

45

492

45

Abt. 1400

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330

330

110

880

45

1

9

1

2

3

4

5

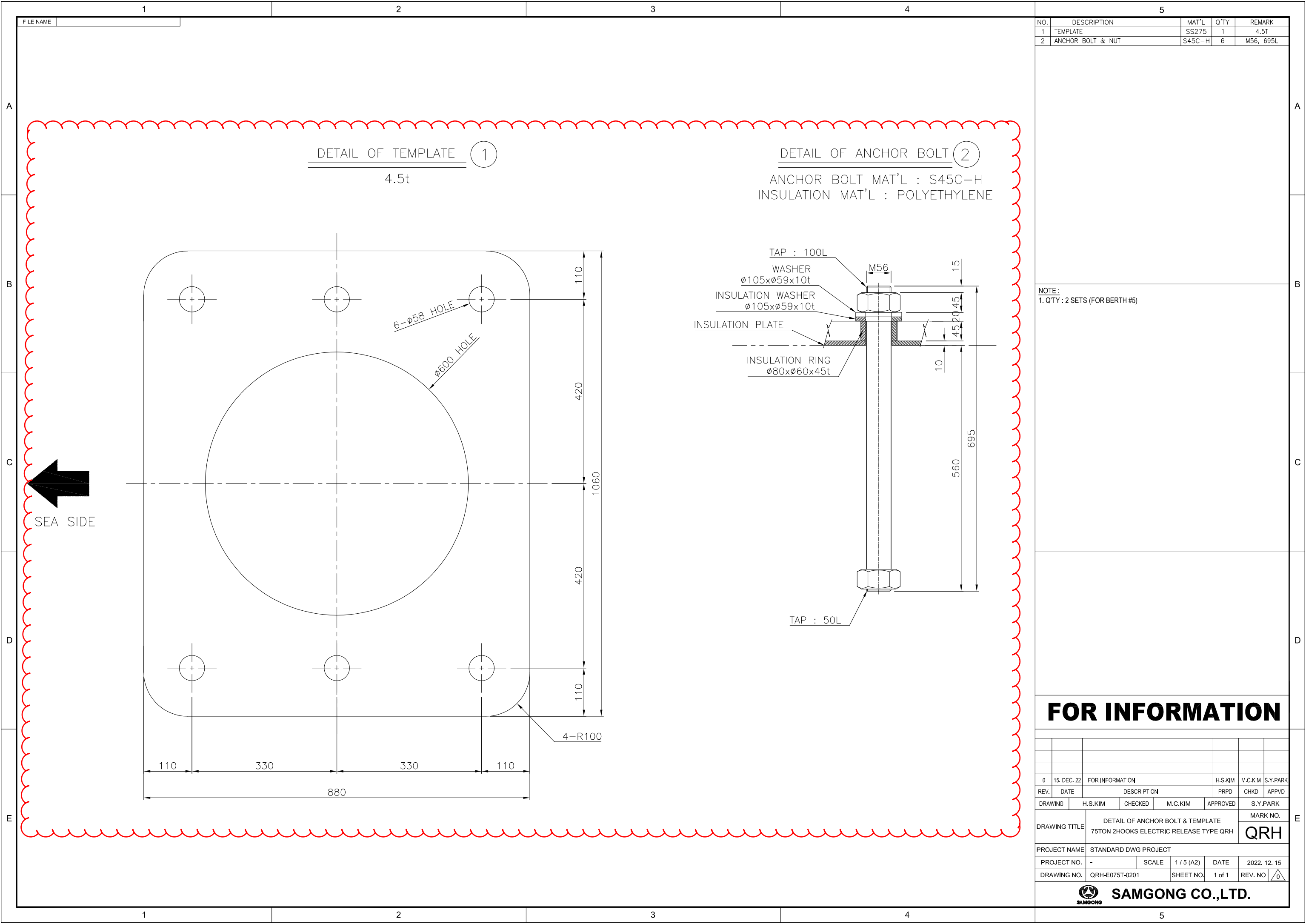
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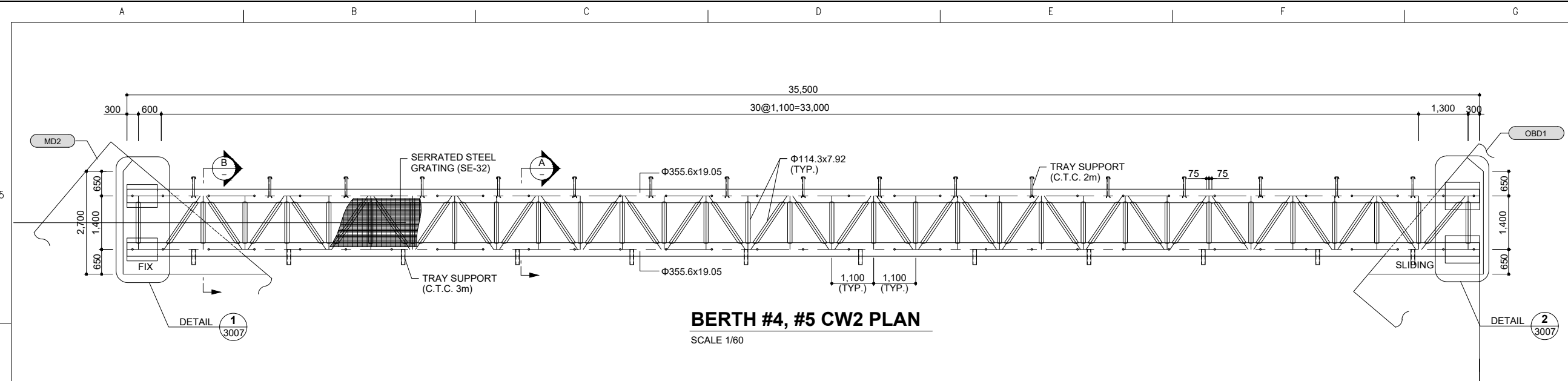
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4

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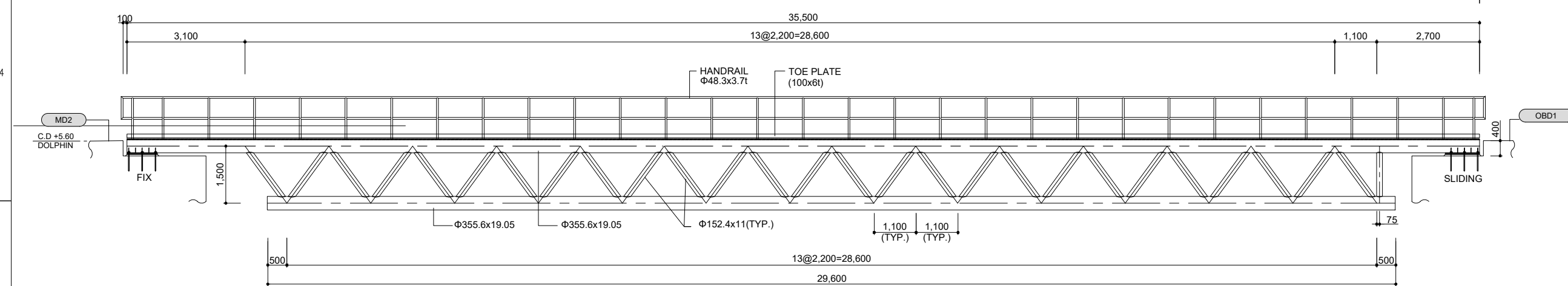


SEA SIDE



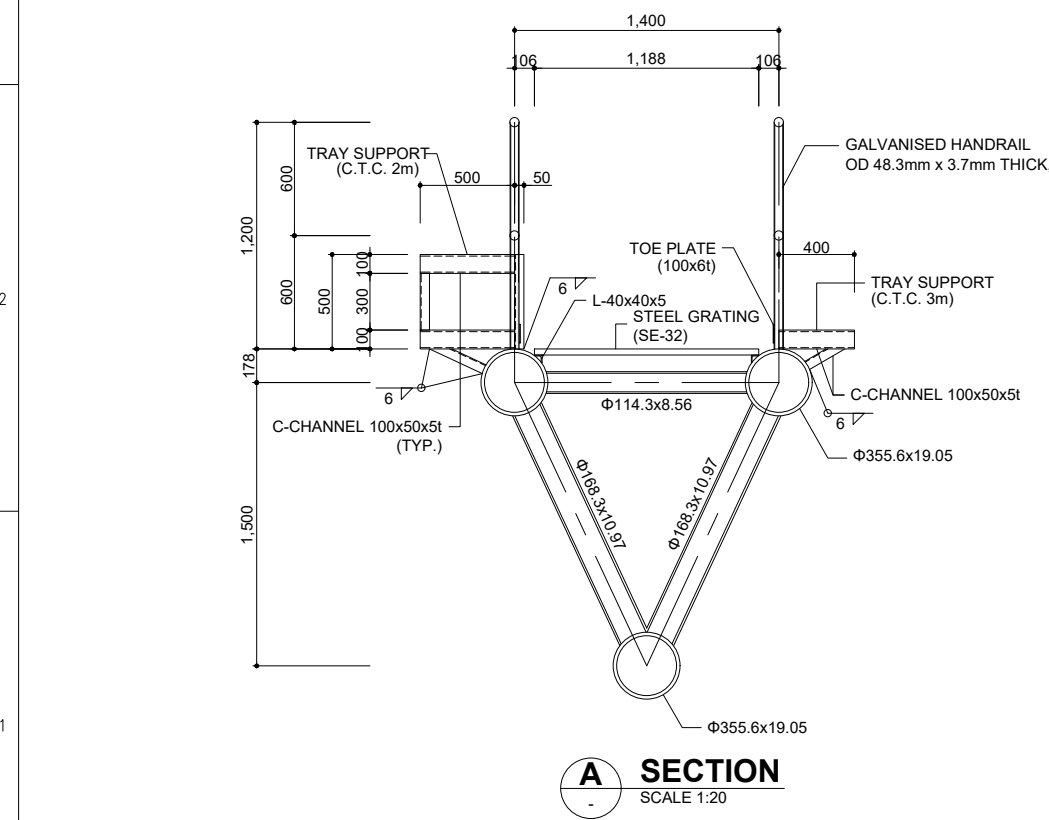
BERTH #4, #5 CW2 PLAN

SCALE 1/60



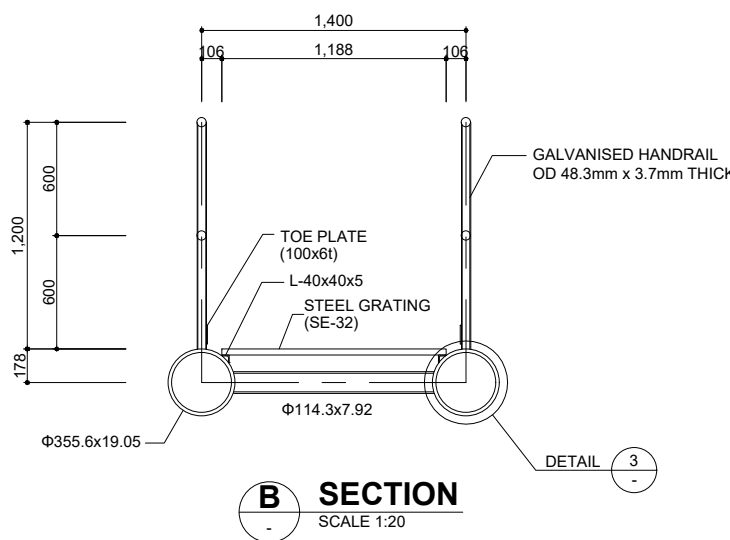
BERTH #4, #5 CW2 ELEVATION

SCALE 1/60



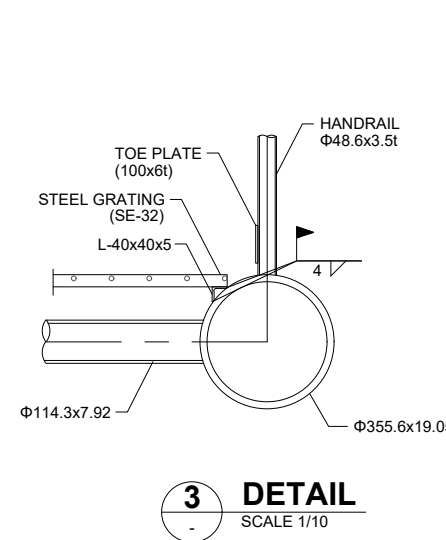
SECTION A

SCALE 1:20



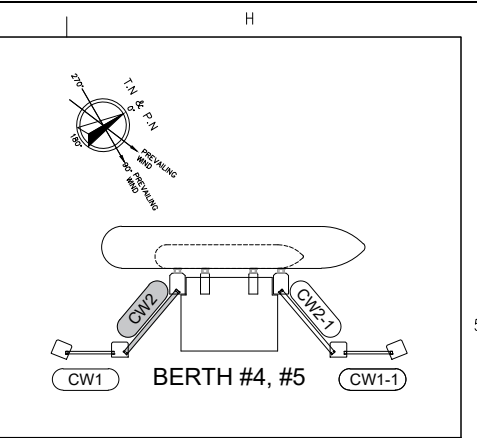
SECTION B

SCALE 1:20



DETAIL 3

SCALE 1/10



KEY PLAN

- *NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
 2. ALL LEVELS ARE IN METERS AND RELATIVE TO CHART DATUM.
 3. STEEL MEMBERS SHALL BE HOP DIP GALVANISED AND PAINTED
 4. INSTALLATION LOCATION OF CATWALK SUPPORT CAN BE REVISED ACCORDING TO FABRICATION CONDITION OF CATWALK.
 5. ALL STEEL WORK TO BE A53 GRADE B OR EQUIVALENT.
 6. STRUCTURAL STEEL WORK FABRICATION SHALL BE ACCORDING TO AISC 207-16.
 7. UNLESS OTHERWISE NOTES WELDED JOINTS ARE FULL STRENGTH TYPE.
 8. PAINTING AND COATING OF STEEL MEMBERS SHOULD BE APPLIED ACCORDING TO CLIENT REQUIREMENTS.

REFERENCE DRAWING							
DRAWING NO.			TITLE				
LINE-906-CG-1-1000			NEW BERTH #2 GENERAL LAYOUT PLAN & PROFILE				
							
	30.OCT.'23	ISSUED FOR CONSTRUCTION	O.S.C	B.H.P	S.G.K	K.H.P	
	30.SEP.'22	ISSUED FOR CONSTRUCTION	O.S.C	B.H.P	Z.C.K	S.Y.P	
	29.JUL.'22	ISSUED FOR CONSTRUCTION	O.S.C	B.H.P	Z.C.K	S.Y.P	
	30.JUN.'22	ISSUED FOR APPROVAL	O.S.C	B.H.P	Z.C.K	S.Y.P	
REV	DATE	DESCRIPTION	DWN	DGN	CHK	APP	
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PROJECT LINE PROJECT (WP5&7)							
OWNER  PT LOTTE CHEMICAL INDONESIA							
CONTRACTOR  LOTTE E&C							
TITLE NEW BERTH #4, #5 CW2 PLAN & ELEVATION							
SCALE AS SHOWN	JOB NO. 15005	CWA NO. 7AJ2	DWG. NO. LINE-906-CG-1-3004	REV. NO. 			

LAMPIRAN

TUTORIAL ANALISIS STRUKTUR
***BREASTING DOLPHIN* DAN**
MOORING DOLPHIN
MENGGUNAKAN SAP2000



Disusun oleh:
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JURUSAN TEKNIK SIPIL
FAKULTAS TEKNIK
UNIVERSITAS SULTAN AGENG TIRTAYASA
BANTEN
TAHUN 2025

Analisis Struktur *Breasting Dolphin*

Ketentuan analisis permodelan struktur *breasting dolphin* adalah sebagai berikut :

a. Spesifikasi

Permodelan struktur *breasting dolphin* dengan spesifikasi baja dan material beton dalam satuan ukuran milimeter dengan ketentuan seperti berikut :

1) Mutu bahan : Baja BJ50

Langkah dalam mendefinisikan material adalah sebagai berikut :

- Klik menu *Define > Materials > add new material*
- Beri nama material “ASTM A-252 Gr.25”
- Isikan data – data sesuai gambar berikut :

The screenshot shows the 'Material Property Data' dialog box with the following fields and values:

General Data	
Material Name and Display Color	ASTMA252 Gr.25
Material Type	Steel
Material Notes	Modify/Show Notes...

Weight and Mass	
Weight per Unit Volume	7,698E-05
Mass per Unit Volume	7,850E-09

Units	
	N, mm, C

Isotropic Property Data	
Modulus of Elasticity, E	210000
Poisson's Ratio, U	0,3
Coefficient of Thermal Expansion, A	1,170E-05
Shear Modulus, G	80769,23

Other Properties for Steel Materials	
Minimum Yield Stress, Fy	310
Minimum Tensile Stress, Fu	455
Effective Yield Stress, Fye	310
Effective Tensile Stress, Fue	455

☐ Switch To Advanced Property Display

OK Cancel

Gambar 1 *Define Material Baja Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

2) Mutu beton : Fc' 35 MPa

Langkah dalam mendefinisikan material adalah sebagai berikut :

- Klik menu *Define > Materials > add new material*
- Beri nama material “Mutu Beton Fc-35”
- Isikan data – data sesuai gambar berikut :

The dialog box is titled "Material Property Data". It contains several sections:

- General Data:**
 - Material Name and Display Color: MUTU BETON FC-35 (with a blue color swatch)
 - Material Type: Concrete (dropdown menu)
 - Material Notes: (empty text area)
- Weight and Mass:**
 - Weight per Unit Volume: 2.356E-05
 - Mass per Unit Volume: 2.403E-09
- Units:**
 - Units: N, mm, C (dropdown menu)
- Isotropic Property Data:**
 - Modulus of Elasticity, E: 27805.57498
 - Poisson's Ratio, U: 0.3
 - Coefficient of Thermal Expansion, A: 9.900E-06
 - Shear Modulus, G: 9559.8378
- Other Properties for Concrete Materials:**
 - Specified Concrete Compressive Strength, f_c: 35
 - ☐ Lightweight Concrete
 - Shear Strength Reduction Factor: (empty text field)
- Switch To Advanced Property Display:** (checkbox, currently unchecked)

Buttons: OK, Cancel

Gambar 2 *Define Material Beton Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

3) Profil Baja : PIPE

Langkah dalam mendefinisikan profil baja adalah sebagai berikut :

- Klik menu *Define > Section Properties > Frame Sections*
- Klik *Add New Property*
- Pada kotak dialog selanjutnya, pilih jenis profil *Pipe*
- Isi *section name* menjadi "PIPE 1066,8 Thk 21"
- Isi data *dimension* seperti gambar berikut :

The dialog box is titled "Pipe Section". It contains the following sections:

- Section Name:** PIPE 1066,8 Thk 21
- Section Notes:** (empty text area)
- Properties:**
 - Section Properties... (button)
- Property Modifiers:**
 - Set Modifiers... (button)
- Material:**
 - + ASTM A-572 Gr.50 (dropdown menu)
- Dimensions:**
 - Outside diameter [t3]: 1.0668
 - Wall thickness [tw]: 0.021
- Display Color:** (checkbox, currently unchecked)

Buttons: OK, Cancel

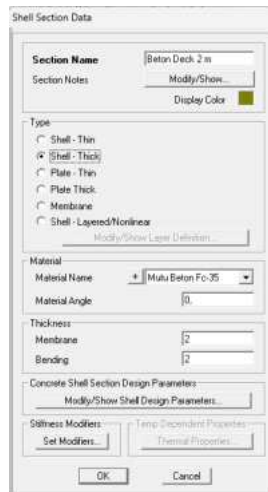
Gambar 3 *Pipe Baja Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

4) Tebal Balok : 2 m

Berikut merupakan langkah dalam mendefinisikan balok :

- a) Klik *Define > Sections Properties > Area Sections*
- b) Klik *Add New Sections*
- c) Beri nama penampang pada *Section Name* menjadi “Beton Deck 2 m”
- d) Pilih type “*Shell - thick*”
- e) Pilih material yang sesuai pada pilihan material: “Mutu Beton Fc-35”
- f) Isi data *Thickness* seperti gambar berikut :

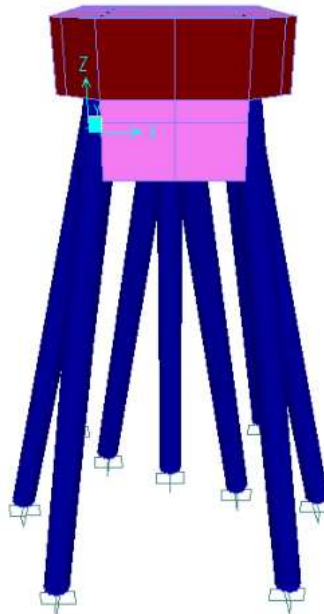


Gambar 4 *Slab Property Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

b. Gambar Permodelan

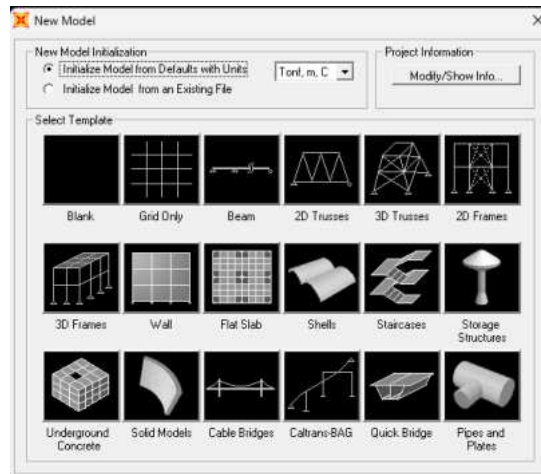
Berikut merupakan gambar langkah permodelan dari *case* yang akan dibuat :



Gambar 5 Permodelan *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

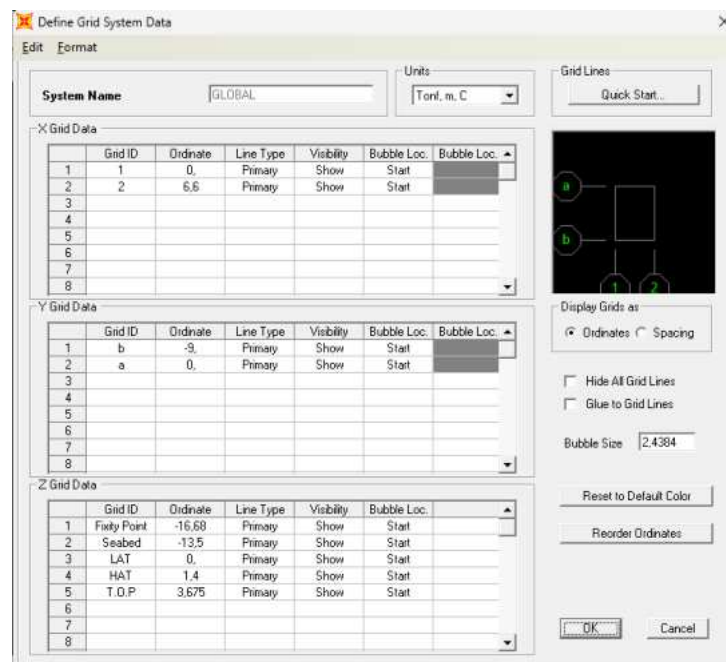
- 1) Membuat file baru :
 - a) Klik menu *File > New Model...*
 - b) Klik pilihan *Initialize Model from Defaults with Units*, pilih satuan Ton, m, C
 - c) Klik tombol *Blank*



Gambar 6 *New Model Quick Template Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

- 2) Mengatur dimensi permodelan sesuai ketentuan
 Atur dimensi sesuai ketentuan dengan klik kanan pada *mouse* lalu pilih edit / *modify grid*



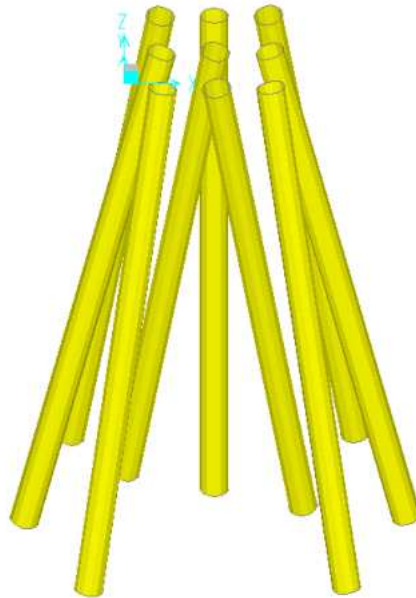
Gambar 7 Dimensi Permodelan *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

3) Menggambar model struktur

a) Klik menu *Draw > draw Frame / cable / tendon*

b) Pada kotak dialog, pilih penampang profil “PIPE 1066,8 Thk 21”
kemudian gambar *frame* struktur



Gambar 8 Model Struktur *Breasting Dolphin*

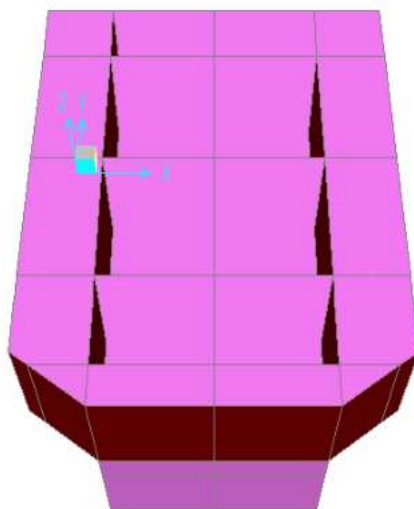
(Sumber: Analisa Penulis, 2025)

4) Menggambar elemen balok

a) Klik *Draw > Draw Poly Area*

b) Pada kotak dialog *properties of object*, pilih *section* “Beton Deck 2 m”

c) Pilih pada elemen yang akan didefinisikan sebagai balok



Gambar 9 *Define Area Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

5) Mengganti tumpuan struktur

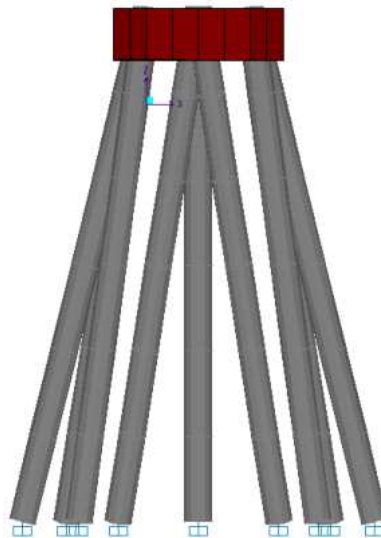
a) Klik semua tumpuan atau *block* keseluruhan

b) Klik menu *Assign > Joint > Restraints* pilih tumpuan jepit



Gambar 10 Input Tumpuan Struktur *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)



Gambar 11 Permodelan dengan Tumpuan *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

c. Pembebanan

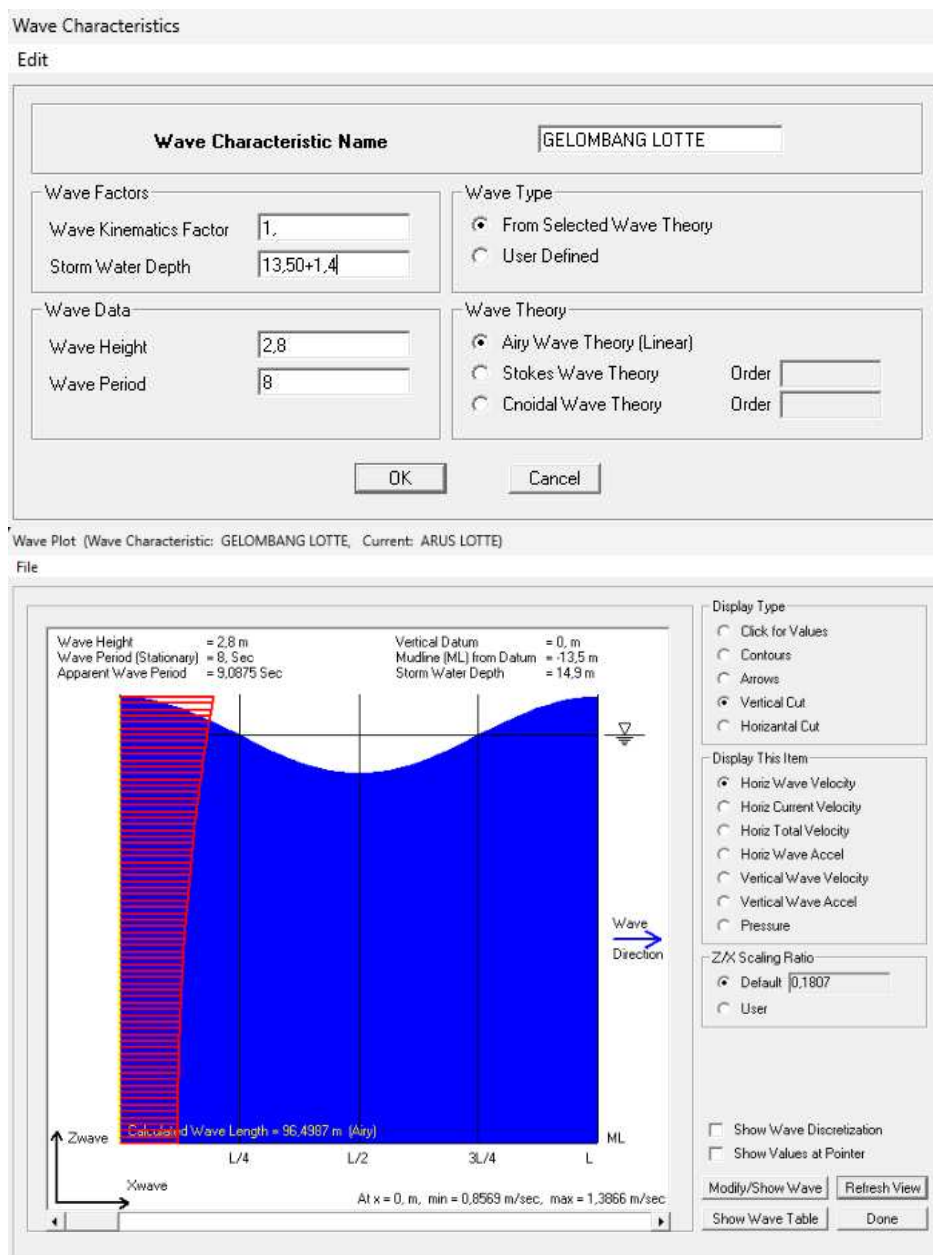
1) Mendefinisikan tipe pembebanan dengan klik *Define > Load Patterns...*



Gambar 12 *Define Load Patterns Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

- 2) Menambahkan karakteristik arus dan gelombang dengan cara sebagai berikut :
 - a) Klik menu *Define > Load Cases*
 - b) Pilih *Load Pattern Name* 'Gelombang X/Y'
 - c) Kemudian pilih API WSD2000 pada *Auto Lateral Load Pattern*, klik *Modify Lateral Load Pattern*
 - d) Selanjutnya pada *Wave Characteristics* klik *Add* dan isi data gelombang seperti gambar berikut :



Gambar 13 *Wave Characteristics Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

- e) Selanjutnya pada *Current Profile* klik *Add* dan isi data arus seperti gambar berikut :

Current Profile Data

Edit

Current Profile Name ARUS LOTTE

Current Profile Factors

Current Blockage Factor 0,9

Current Profile Stretching Option Linear

Data Is Specified at This Number of Elevations

Number of Elevations 1

Current Profile Data

	Vert from Datum	Current Velocity	Current Direction
1	0,	1,2	0,

Order Rows

OK

Cancel

Wave Plot (Wave Characteristic: GELOMBANG LOTTE, Current: ARUS LOTTE)

File

Wave Height = 2,8 m
Wave Period (Stationary) = 8, Sec
Apparent Wave Period = 9,0075 Sec

Vertical Datum = 0, m
Mudline (ML) from Datum = -13,5 m
Storm Water Depth = 14,9 m

Calculated Wave Length = 96,4567 m (Avg)

min = 0, m/sec, max = 1,3965 m/sec

Display Type

☐ Click for Values

☐ Contours

☒ Arrows

☐ Vertical Cut

☐ Horizontal Cut

Display This Item

☒ Resultant Velocity w/o Current

☐ Resultant Velocity w/ Current

☐ Resultant Acceleration

Z/X Scaling Ratio

☒ Default 0,1007

☐ User

☐ Show Arrows at Actual Angle

☐ Show Wave Discretization

☐ Show Values at Pointer

Modify/Show Wave Refresh View

Show Wave Table Done

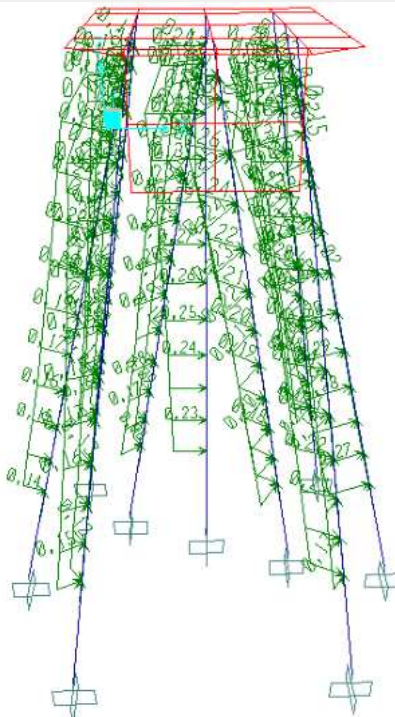
Gambar 14 *Current Profile Data Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

- f) Ubah *Wave Characteristics* menjadi “GELOMBANG LOTTE” dan ubah *Current Profile* menjadi “ARUS LOTTE”
- g) Pada kolom *Other Vertical Elevations Relative To Datum* mengisi *Mudline from Datum* dengan elevasi *Seabed* sebesar -13,50 m dan *High Tide From Datum* dengan elevasi HAT sebesar 1,4 m

Wave Load Pattern

Wave Load Pattern Parameters			
Wave Characteristics	GELOMBANG LOTTE	Add	Modify/Show Delete
Current Profile	ARUS LOTTE	Add	Modify/Show Delete
Marine Growth	None	Add	Modify/Show Delete
Drag and Inertia Coefficients	API Default	Add	Modify/Show Delete
Wind Load	None	Add	Modify/Show Delete
☒ Include Buoyant Loads			
Wave Load Pattern Discretization		Vertical Reference Elevation for Wave	
Maximum Discretization Segment Size		Global Z Coordinate of Vertical Datum	
1,524		0.	
Wave Crest Position		Other Vertical Elevations Relative To Datum	
Global X Coord of Pt on Initial Crest Position		Mudline from Datum	
0.		-13.50	
Global Y Coord of Pt on Initial Crest Position		High Tide from Datum	
0.		1.4	
Number of Wave Crest Positions Considered		1	
Wave Direction		Sea Water Properties	
Wave Approach Angle in Degrees		Water Weight Density	
0.		1.0252	
Show Wave Table		Show Wave Plot	
OK		Cancel	

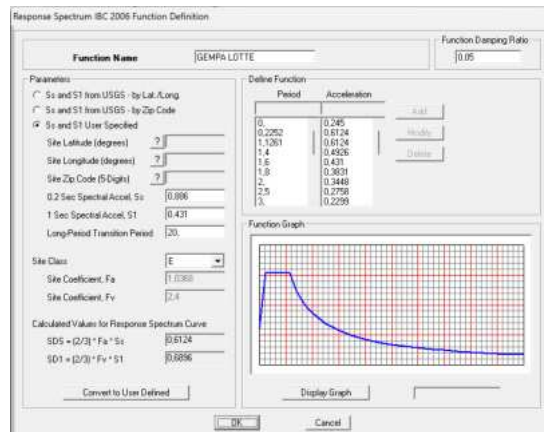


Gambar 15 *Wave Load Pattern Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

3) Menambahkan Pembebanan Gempa

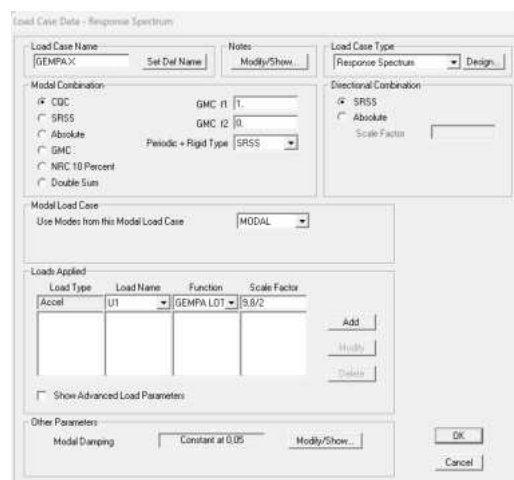
- a) Menginput nilai *response spectrum* dengan cara klik menu *Define > Function > Respons Spectrum*
- b) Pilih IBC 2006 pada *Choose Function Type to Add*
- c) Klik *Add New Function*
- d) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 16 *Properties Response Spectrum Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

- e) Selanjutnya menambahkan fungsi *Response Spectrum* dengan merubah tipe beban menjadi Respons Spektrum yang sebelumnya sudah diinput
- (1) Klik menu *Define > Load Cases*
 - (2) Kemudian pada *Load Case Type* ubah menjadi “*Response Spectrum*” klik *Modify/Show Case*
 - (3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 17 *Load Case Data Response Spectrum Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

- 4) Menambahkan beban mati tambahan
 - a) Klik menu *Define > Load Cases*
 - b) Kemudian pada *Load Case Type* ubah menjadi “*Response Spectrum*”
klik *Modify/Show Case*
 - c) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

Load Type	Load Name	Scale Factor
Load Pattern	BOLLARD	1
Load Pattern	FENDER	1
Load Pattern	ISIAN BETON	1
Load Pattern	SDL CATWALK	1
Load Pattern	DL CATWALK	1

Gambar 18 *Load Case Data SDL Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

- 5) Menambahkan beban hidup tambahan
 - a) Klik menu *Define > Load Cases*
 - b) Kemudian pada *Load Case Type* ubah menjadi “*Response Spectrum*”
klik *Modify/Show Case*
 - c) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

Load Type	Load Name	Scale Factor
Load Pattern	LL	1
Load Pattern	LL CATWALK	1

Gambar 19 *Load Case Data LL Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

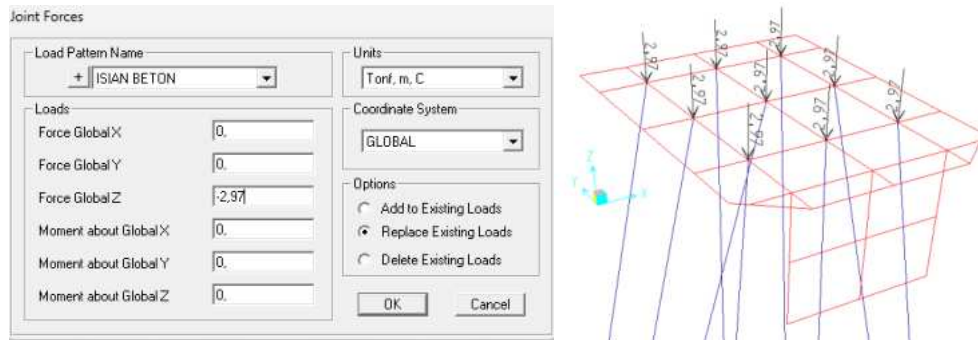
6) Mengaplikasikan pembebanan pada struktur:

a) Beban Isian Beton pada *Steel Pile*

(1) Klik semua joint bagian atas *Steel Pile*

(2) *Assign > Frame Loads > Distributed....*

(3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 20 Beban Isian Beton pada *Steel Pile Breasting Dolphin*

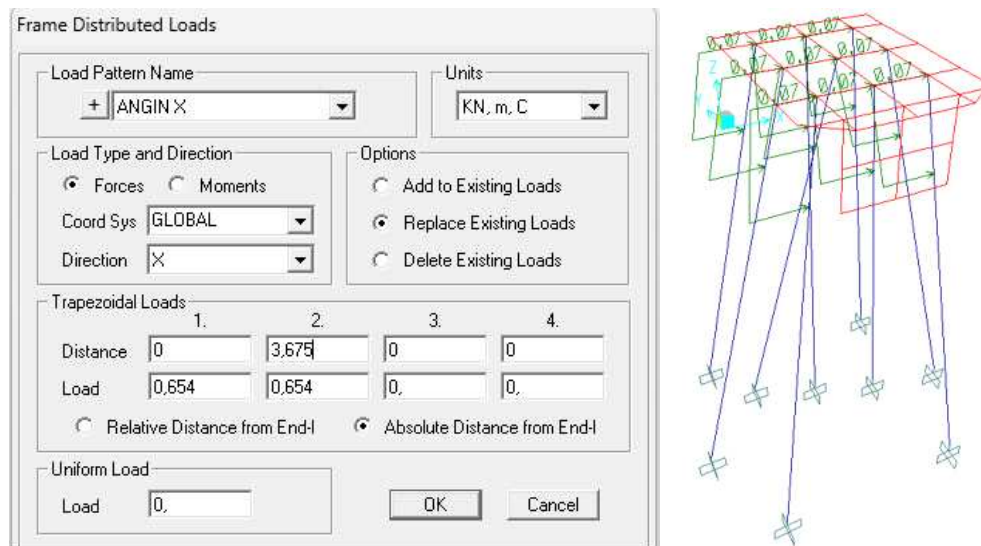
(Sumber: Analisa Penulis, 2025)

b) Beban Angin arah x dan y pada *Steel Pile*

(1) Klik semua *Steel Pile*

(2) *Assign > Frame Loads > Distributed....*

(3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

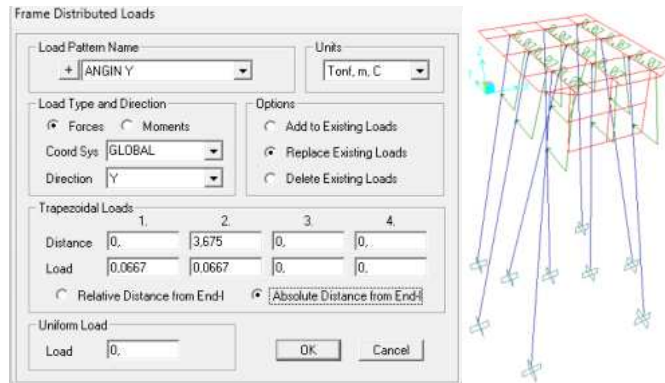


Gambar 21 Beban Angin Arah x pada *Steel Pile Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

(4) Kemudian untuk pembebanan angin arah y dengan mengulangi langkah 1-2

(5) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

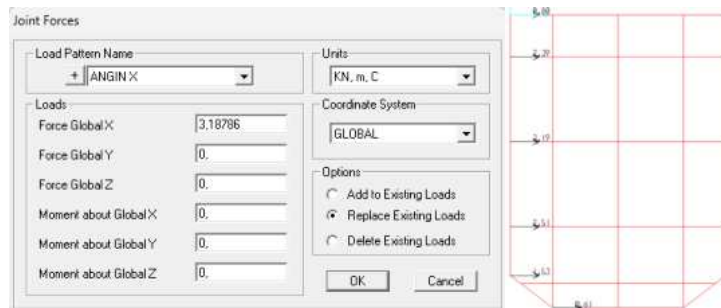


Gambar 22 Beban Angin Arah y pada *Steel Pile Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

c) Beban Angin arah x dan y pada Balok

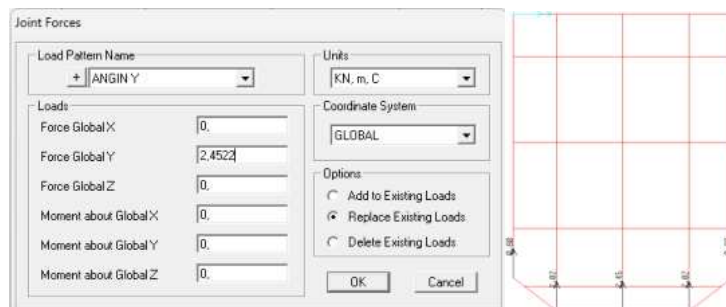
- (1) Untuk pembebanan angin arah x, klik bagian *joint* sebelah kanan / kiri pada balok
- (2) *Assign > Joint Loads > Forces*
- (3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 23 Beban Angin Arah x pada Balok *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

- (4) Kemudian untuk pembebanan angin arah y pada balok, klik bagian depan *joint* dan mengulangi langkah 2
- (5) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 24 Beban Angin Arah y pada Balok *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

d) **Beban Hidup**

- (1) Klik semua balok
- (2) *Assign > Area Loads > Uniform (Shell)*
- (3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

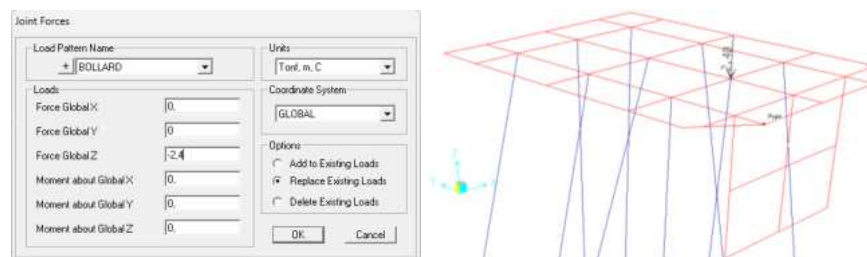


Gambar 25 Beban Hidup *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

e) **Beban *Bollard***

- (1) Klik salah satu bagian *joint*
- (2) *Assign > Joint Loads > Forces*
- (3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

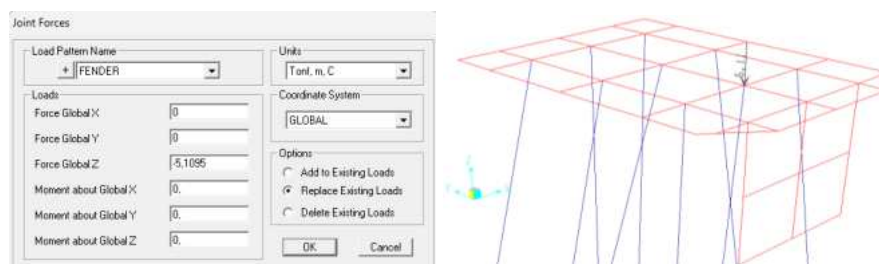


Gambar 26 Beban *Bollard Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

f) **Beban *Fender***

- (1) Klik salah satu bagian *joint*
- (2) *Assign > Joint Loads > Forces*
- (3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 27 Beban *Fender Breasting Dolphin*

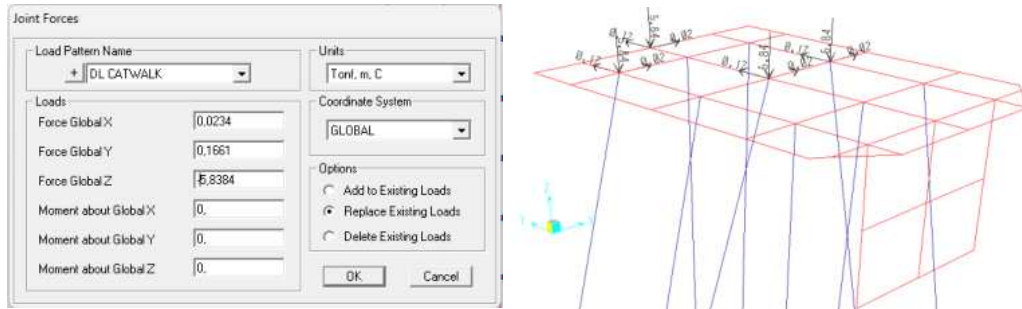
(Sumber: Analisa Penulis, 2025)

g) Beban *Catwalk*

(1) Klik salah 4 bagian *joint*

(2) *Assign > Joint Loads > Forces*

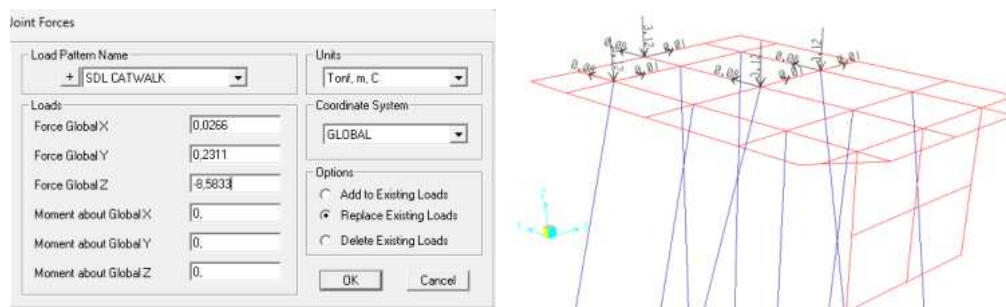
(3) Isikan data beban mati sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 28 Beban Mati *Catwalk Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

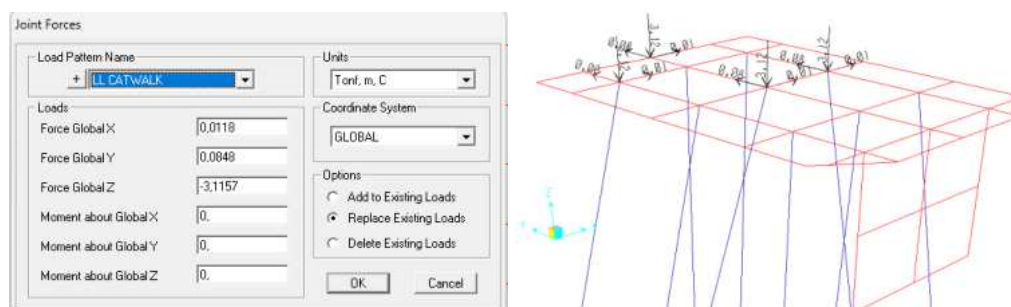
(4) Ulangi langkah 1-2 untuk beban mati tambahan dengan ketentuan yang diberikan seperti gambar berikut :



Gambar 29 Beban Mati Tambahan *Catwalk Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

(5) Kemudian, ulangi langkah 1-2 untuk beban hidup dengan ketentuan yang diberikan seperti gambar berikut :

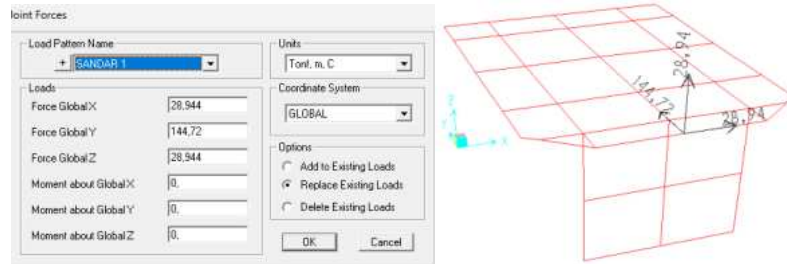


Gambar 30 Beban Hidup *Catwalk Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

h) Beban Sandar

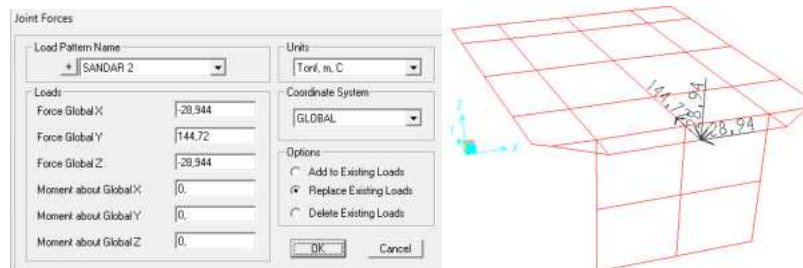
- (1) Klik salah 1 bagian depan *joint*
- (2) *Assign > Joint Loads > Forces*
- (3) Isikan data beban sandar 1 sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 31 Beban Sandar 1 *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

- (6) Ulangi langkah 1-2 untuk beban sandar 2 dengan ketentuan yang diberikan seperti gambar berikut :

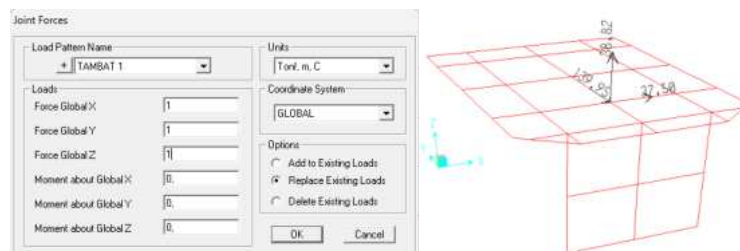


Gambar 32 Beban Sandar 2 *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

i) Beban Tambat

- (1) Klik salah 1 bagian *joint*
- (2) *Assign > Joint Loads > Forces*
- (3) Isikan data beban tambat 1 sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 33 Beban Tambat 1 *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

- (4) Klik kembali salah satu bagian *joint*, kemudian pilih menu edit > *Interactive Database Editing...*
 - (5) Beri tanda silang pada *Joint Assignments > Joint Load Assignments > Table : Joint Loads - Force*
 - (6) Pada kolom *Load Patterns (Model Def)*, klik *Select Load Patterns* kemudian pilih Tambat 1 dan OK
 - (7) Kemudian *import* tabel dari program dengan memilih *To Exel*
 - (8) Salin tabel yang ada dilembar kerja sebelumnya ke tabel lembar kerja yang telah di *import* dari program
 - (9) Selanjutnya kembali ke program dengan memilih *From Exel > Apply To Model > Done*
- 7) Mendefinisikan kombinasi pembebanan
- a) *Define > Load Combination...*
 - b) Klik tombol *Add New Combo...*

Berikut merupakan kombinasi pembebanan *service* dan ultimit yang diberikan pada permodelan ini :

Kombinasi pembebanan *service* :

- a) D + SDL + LL + Env

Load Combination Data

Load Combination Name (User-Generated): S Case1 - 01

Notes: Modify/Show Notes...

Load Combination Type: Linear Add

Options:

Convert to User Load Combo Create Nonlinear Load Case from Load Combo

Define Combination of Load Case Results

Load Case Name	Load Case Type	Scale Factor
DEAD	Linear Static	1.
DEAD	Linear Static	1.
SDL	Linear Static	1.
LL	Linear Static	1.
ANGIN X	Linear Static	1.
ARUS X	Linear Static	1.
GELOMBANG X	Linear Static	1.

Add Modify Delete

OK Cancel

Gambar 34 S Case1 Breasting Dolphin

(Sumber: Analisa Penulis, 2025)

b) D + SDL + LL + Env + B

Load Combination Data

Load Combination Name (User-Generated): S Case2 - 01

Notes: Modify/Show Notes...

Load Combination Type: Linear Add

Options: Convert to User Load Combo Create Nonlinear Load Case from Load Combo

Define Combination of Load Case Results:

Load Case Name	Load Case Type	Scale Factor
DEAD	Linear Static	1.
DEAD	Linear Static	1.
SDL	Linear Static	1.
LL	Linear Static	1.
WINDIN X	Linear Static	1.
WINDUS X	Linear Static	1.
GELOMBANG X	Linear Static	1.
SANDARI 1	Linear Static	1.

Add Modify Delete

OK Cancel

Gambar 35 S Case2 Breasting Dolphin
(Sumber: Analisa Penulis, 2025)

c) D + SDL + LL + Env + M

Load Combination Data

Load Combination Name (User-Generated): S Case3 - 01

Notes: Modify/Show Notes...

Load Combination Type: Linear Add

Options: Convert to User Load Combo Create Nonlinear Load Case from Load Combo

Define Combination of Load Case Results:

Load Case Name	Load Case Type	Scale Factor
DEAD	Linear Static	1.
DEAD	Linear Static	1.
SDL	Linear Static	1.
LL	Linear Static	1.
WINDIN X	Linear Static	1.
WINDUS X	Linear Static	1.
GELOMBANG X	Linear Static	1.
TAMBAT 1	Linear Static	1.

Add Modify Delete

OK Cancel

Gambar 35 S Case3 Breasting Dolphin
(Sumber: Analisa Penulis, 2025)

d) D + SDL + LL + E

Load Combination Data

Load Combination Name (User-Generated): S Case4 - 01

Notes: Modify/Show Notes...

Load Combination Type: Linear Add

Options: Convert to User Load Combo Create Nonlinear Load Case from Load Combo

Define Combination of Load Case Results:

Load Case Name	Load Case Type	Scale Factor
DEAD	Linear Static	1.
DEAD	Linear Static	1.
SDL	Linear Static	1.
LL	Linear Static	1.
GEMPA X	Response Spectrum	0.7
GEMPA Y	Response Spectrum	0.3

Add Modify Delete

OK Cancel

Gambar 36 S Case4 Breasting Dolphin
(Sumber: Analisa Penulis, 2025)

Kombinasi pembebanan ultimit :

a) $1,4D + 1,4SDL + 1,6LL + 1,4Env$

Load Combination Data

Load Combination Name (User-Generated): U Case 1 - 01

Notes: Modify/Show Notes...

Load Combination Type: Linear Add

Options: Convert to User Load Combo Create Nonlinear Load Case from Load Combo

Define Combination of Load Case Results

Load Case Name	Load Case Type	Scale Factor
DEAD	Linear Static	1.4
SDL	Linear Static	1.4
LL	Linear Static	1.6
ANGIN X	Linear Static	1.4
ARIUS X	Linear Static	1.4
GELOMBANG X	Linear Static	1.4

Buttons: Add, Modify, Delete, OK, Cancel

Gambar 37 U Case1 Breasting Dolphin

(Sumber: Analisa Penulis, 2025)

b) $1,4D + 1,4SDL + 1,6LL + 1,4Env + 1,2B$

Load Combination Data

Load Combination Name (User-Generated): U Case 2 - 01

Notes: Modify/Show Notes...

Load Combination Type: Linear Add

Options: Convert to User Load Combo Create Nonlinear Load Case from Load Combo

Define Combination of Load Case Results

Load Case Name	Load Case Type	Scale Factor
DEAD	Linear Static	1.4
SDL	Linear Static	1.4
LL	Linear Static	1.6
ANGIN X	Linear Static	1.4
ARIUS X	Linear Static	1.4
GELOMBANG X	Linear Static	1.4
SANDAR 1	Linear Static	1.2

Buttons: Add, Modify, Delete, OK, Cancel

Gambar 38 U Case2 Breasting Dolphin

(Sumber: Analisa Penulis, 2025)

c) $1,4D + 1,4SDL + 1,6LL + 1,4Env + 1,2M$

Load Combination Data

Load Combination Name (User-Generated): U Case 3 - 01

Notes: Modify/Show Notes...

Load Combination Type: Linear Add

Options: Convert to User Load Combo Create Nonlinear Load Case from Load Combo

Define Combination of Load Case Results

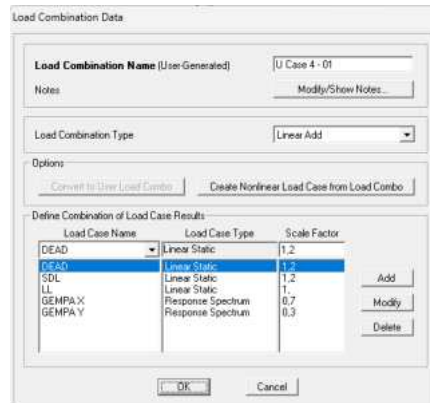
Load Case Name	Load Case Type	Scale Factor
DEAD	Linear Static	1.4
SDL	Linear Static	1.4
LL	Linear Static	1.6
ANGIN X	Linear Static	1.4
ARIUS X	Linear Static	1.4
GELOMBANG X	Linear Static	1.4
TAMBAT 1	Linear Static	1.2

Buttons: Add, Modify, Delete, OK, Cancel

Gambar 39 U Case3 Breasting Dolphin

(Sumber: Analisa Penulis, 2025)

d) $1,2D + 1,2SDL + LL + E$



Gambar 40 U Case4 Breasting Dolphin

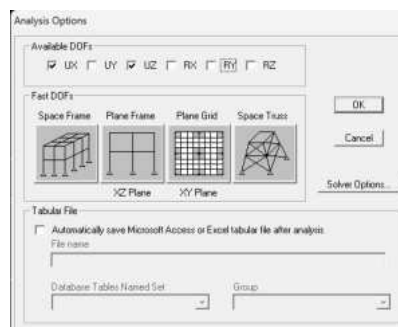
(Sumber: Analisa Penulis, 2025)

d. Analisis dan output

1) Tipe Analisis

Tipe analisis struktur yang digunakan adalah *Space Truss*

Define > Set Analysis lalu pilih *Space Truss* lalu OK

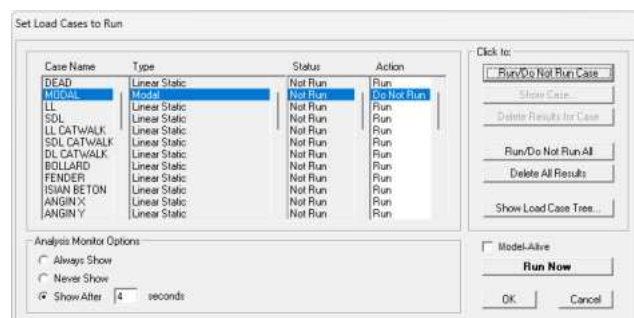


Gambar 41 Tipe Analisis Breasting Dolphin

(Sumber: Analisa Penulis, 2025)

Selanjutnya, klik *Analyze > Set Analysis To Run*, lalu pada *Modal* pilih

Run/Do Not Run Case. Lalu klik *Run Now*



Gambar 42 Run Analysis Breasting Dolphin

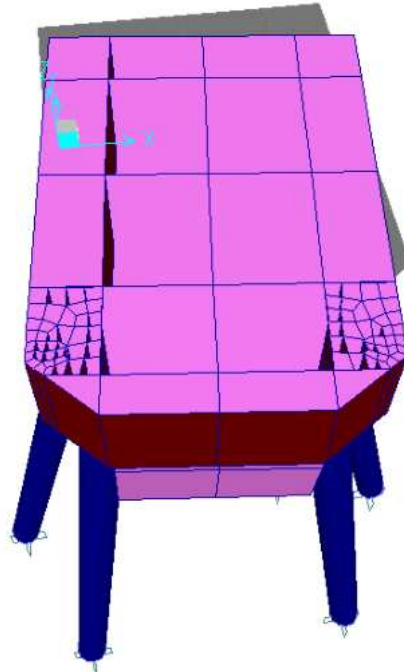
(Sumber: Analisa Penulis, 2025)

2) Output

Berikut terlampir hasil output – output dari proses desain dan analisis model struktur *breasting dolphin* :

a) Deformasi Struktur

Deformasi struktur merupakan bentuk perubahan struktur yang terjadi akibat adanya gaya dari luar maupun dari dalam.



Gambar 43 *Deformed Shape Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

Tabel 1 Defleksi *Breasting Dolphin*

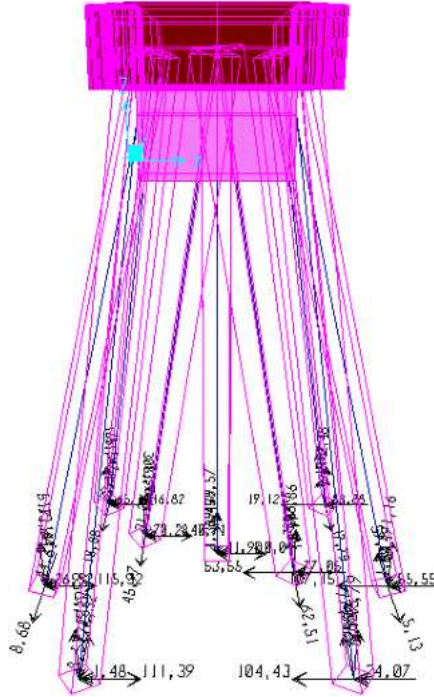
Kombinasi Beban	Case Type Text	U1 cm	U2 cm	U3 cm
Comb 1 - DL + LL + Env	Max	0,0031	-0,0013	-0,0005
	Min	0,0001	-0,0031	-0,0015
Comb 2 - DL + LL + Env + <i>Berthing</i>	Max	0,0061	0,0184	0,0015
	Min	-0,0076	0,0094	-0,0015
Comb 3 - DL + LL + Env + <i>Mooring</i>	Max	0,0182	-0,0069	0,0009
	Min	0,0001	-0,0212	-0,0041
Comb 4 - Gempa	Max	0,0082	0,0076	0,0004
	Min	-0,0092	-0,0124	-0,0023

(Sumber: Analisa Penulis, 2025)

Pengecekan defleksi pada dermaga biasanya tidak lebih dari 0,6 cm dan defleksi maksimum yang didapat sebesar 0,0182 cm. Maka, defleksi struktur *breasting dolphin* dikatakan memenuhi syarat.

b) Reaksi Perletakan

Tumpuan adalah tempat bersandarnya suatu konstruksi & tempat bekerjanya reaksi. Untuk menampilkan reaksi tumpuan yaitu dengan cara klik *Display > Show Force/Stresses > Joint...*



Gambar 44 Reaksi Perletakan *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

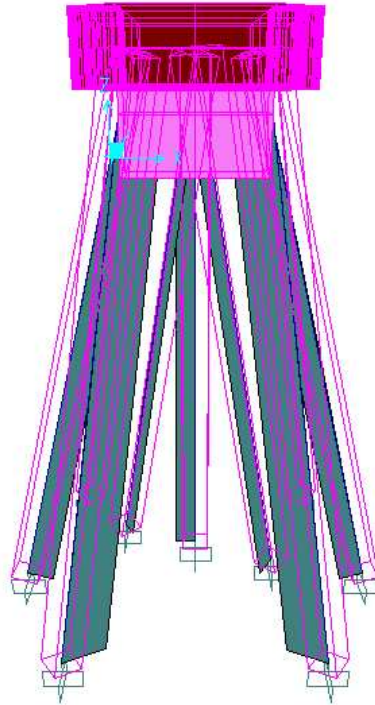
Tabel 2 Joint Reaksi *Breasting Dolphin*

Kombinasi Beban	Case Type Text	F1 Tonf	F2 Tonf	F3 Tonf	M1 Tonf-m	M2 Tonf-m	M3 Tonf-m
Comb 1 - DL + LL + Env	Max	11,7233	9,2309	98,2959	1,3652	-0,2782	3,5361
	Min	-20,2201	-10,3357	7,5418	-10,5283	-21,6257	-3,7716
Comb 2 - DL + LL + Env + <i>Berthing</i>	Max	30,0186	-2,2653	229,0294	65,9792	28,6442	23,3249
	Min	-39,7791	-46,6540	-66,8904	17,2800	-32,9870	-13,6197
Comb 3 - DL + LL + Env + <i>Mooring</i>	Max	27,3584	42,4835	220,7187	-9,5887	0,6338	10,6417
	Min	-47,9747	-8,0946	-188,3067	-70,0277	-78,0218	-34,9923
Comb 4 - DL + LL + Gempa	Max	29,7223	18,6843	172,9514	29,7162	37,8674	16,4229
	Min	-28,4678	-29,5739	-66,2294	-39,9873	-33,9104	-15,6185

(Sumber: Analisa Penulis, 2025)

Berdasarkan analisis struktur *breasting dolphin* didapat daya dukung aksial (P_u) pada kondisi tekan sebesar 229,0294 ton dan kondisi tarik sebesar -188,3067 ton. Sedangkan, daya dukung lateral (H_u) tiang pancang Ø1066.8x21t pada kondisi tekan sebesar 42,4835 ton.

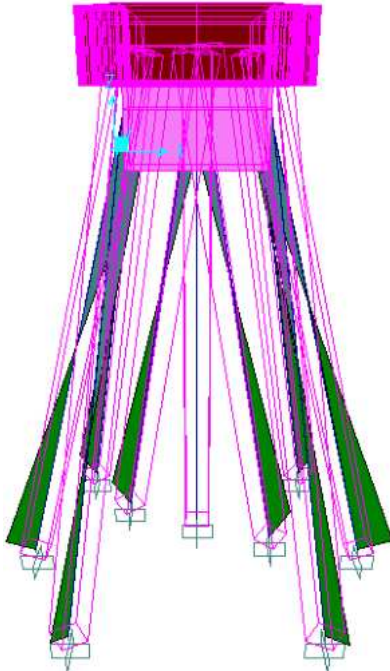
c) Gaya dan Diagram Reaksi Perletakan
(1) *Axial Force*



Gambar 45 *Axial Force Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

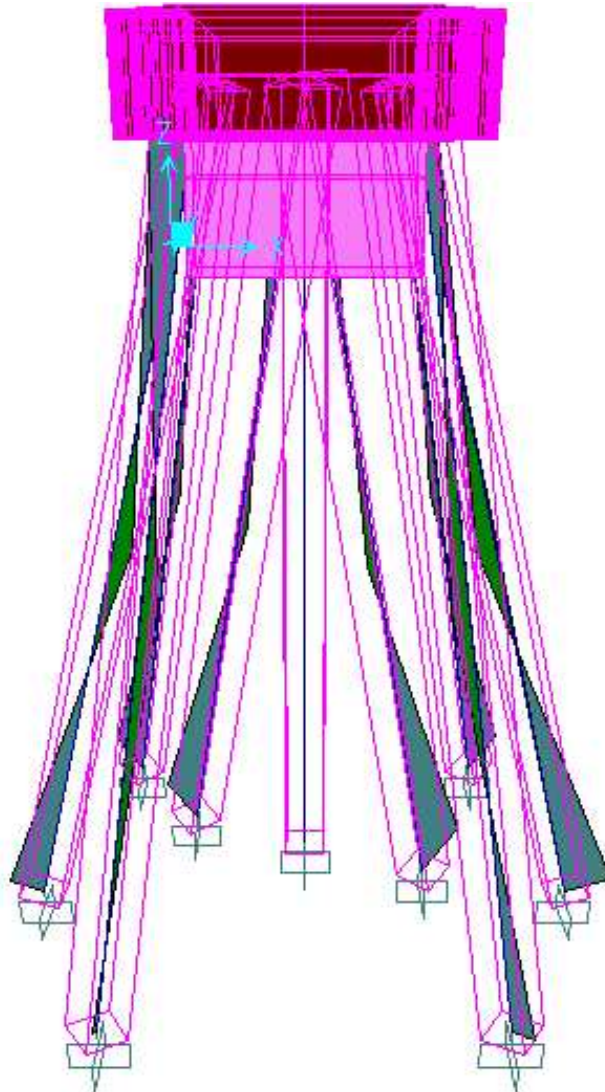
(2) *Shear 2-2*



Gambar 46 *Shear 2-2 Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

(3) *Moment 3-3*



Gambar 47 *Moment 3-3 Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

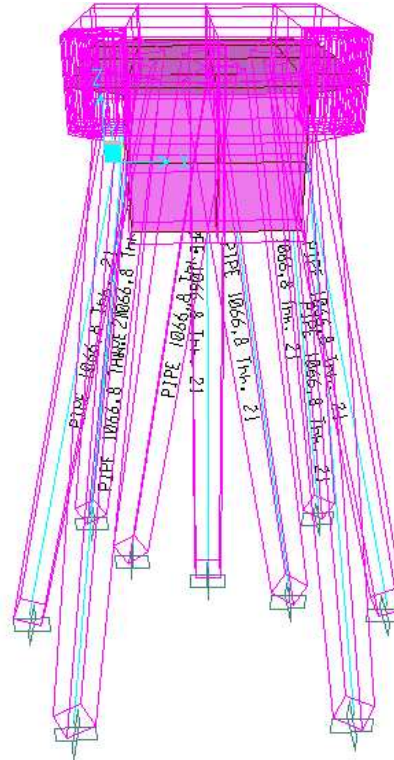
Tabel 3 Gaya Dalam *Breasting Dolphin*

Kombinasi Beban	Case Type Text	P Tonf	V2 Tonf	V3 Tonf	T Tonf-m	M2 Tonf-m	M3 Tonf-m
Comb 1 - DL + LL + Env	Max	0,6571	3,6723	1,6668	-1,0778	20,1120	19,2428
	Min	-99,2129	-2,8900	-2,7119	-1,6254	-12,3769	-21,2013
Comb 2 - DL + LL + Env + <i>Berthing</i>	Max	77,9135	5,9157	5,6313	4,3481	65,0287	46,9278
	Min	-237,0608	-5,9691	-7,8409	-15,1564	-81,5134	-50,2344
Comb 3 - DL + LL + Env + <i>Mooring</i>	Max	203,9006	8,6741	10,6399	18,4507	106,1142	73,7796
	Min	-223,7219	-8,0491	-7,5307	1,4380	-95,1508	-80,9980
Comb 4 - Gempa	Max	80,3875	4,3934	4,0606	12,4265	45,6235	29,7699
	Min	-175,5969	-3,9604	-3,9117	-14,5686	-44,6811	-36,8047

(Sumber: Analisa Penulis, 2025)

(4) Keamanan Struktur

Dilakukan keamanan struktur dengan klik *Design > Concrete Frame Design > Start/Design Check..*



Gambar 48 Keamanan Struktur *Breasting Dolphin*

(Sumber: Analisa Penulis, 2025)

Tabel 4 Rasio *Breasting Dolphin*

Kombinasi Beban	Ratio Unitless	Syarat Batas Unitless	Keterangan Text
Comb 1 - DL + LL + Env	0,1445	1,00	AMAN
Comb 2 - DL + LL + Env + <i>Berthing</i>	0,3428	1,00	AMAN
Comb 3 - DL + LL + Env + <i>Mooring</i>	0,4245	1,00	AMAN
Comb 4 - Gempa	0,2092	1,00	AMAN

(Sumber: Analisa Penulis, 2025)

Kekuatan struktur tiang dilihat dari tiang pancang yang menopang. Apabila rasio (PMM) tiang pancang lebih dari 1,00 maka tiang pancang tersebut mengalami *overstressed* atau melebihi kapasitas kekuatannya. Berdasarkan analisis struktur *breasting dolphin* rasio terbesar didapat pada kondisi kombinasi pembebanan 3 yaitu sebesar 0,4245 dan syarat batas sebesar 1. Maka, kapasitas struktur *breasting dolphin* yang direncanakan mampu menahan beban-beban yang bekerja.

Analisis Struktur *Mooring Dolphin*

Ketentuan analisis permodelan struktur *mooring dolphin* adalah sebagai berikut :

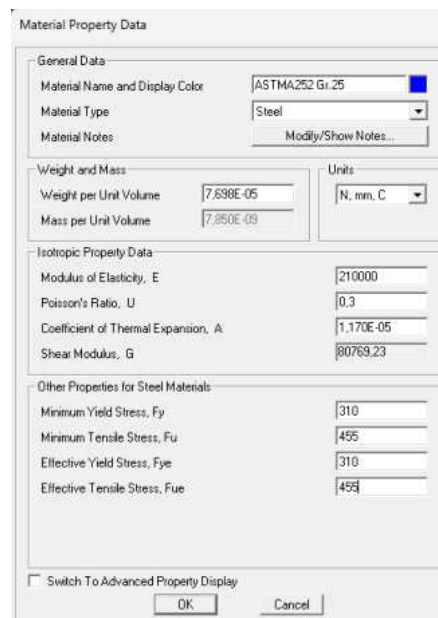
a. Spesifikasi

Permodelan struktur *breasting dolphin* dengan spesifikasi baja dan material beton dalam satuan ukuran milimeter dengan ketentuan seperti berikut :

1) Mutu bahan : Baja BJ50

Langkah dalam mendefinisikan material adalah sebagai berikut :

- Klik menu *Define > Materials > add new material*
- Beri nama material “ASTM A252 Gr.3”
- Isikan data – data sesuai gambar berikut :



The image shows a 'Material Property Data' dialog box for a material named 'ASTMA252 Gr.25'. The 'General Data' section includes the material name, type (Steel), and a 'Modify/Show Notes...' button. The 'Weight and Mass' section shows 'Weight per Unit Volume' as 7.698E-05 and 'Mass per Unit Volume' as 7.850E-05, with units set to 'N, mm, C'. The 'Isotropic Property Data' section includes 'Modulus of Elasticity, E' (210000), 'Poisson's Ratio, U' (0.3), 'Coefficient of Thermal Expansion, A' (1.170E-05), and 'Shear Modulus, G' (80769.23). The 'Other Properties for Steel Materials' section includes 'Minimum Yield Stress, Fy' (310), 'Minimum Tensile Stress, Fu' (455), 'Effective Yield Stress, Fye' (310), and 'Effective Tensile Stress, Fue' (455). At the bottom, there is a checkbox for 'Switch To Advanced Property Display' and 'OK' and 'Cancel' buttons.

Gambar 49 *Define Material Baja Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

2) Mutu beton : $F_c' 35 \text{ MPa}$

Langkah dalam mendefinisikan material adalah sebagai berikut :

- Klik menu *Define > Materials > add new material*
- Beri nama material “Mutu Beton Fc-35”
- Isikan data – data sesuai gambar berikut :

The dialog box is titled "Material Property Data". It contains several sections:

- General Data:**
 - Material Name and Display Color: Mutu Beton Fc' 35 MPa (with a green color swatch)
 - Material Type: Concrete (dropdown menu)
 - Material Notes: (text area with a "Modify/Show Notes..." button)
- Weight and Mass:**
 - Weight per Unit Volume: 2,354E-05
 - Mass per Unit Volume: 2,400E-09
 - Units: N, mm, C (dropdown menu)
- Isotropic Property Data:**
 - Modulus of Elasticity, E: 27806
 - Poisson's Ratio, U: 0.3
 - Coefficient of Thermal Expansion, A: 9.900E-06
 - Shear Modulus, G: 10694.615
- Other Properties for Concrete Materials:**
 - Specified Concrete Compressive Strength, Fc: 35
 - ☐ Lightweight Concrete
 - Shear Strength Reduction Factor: (empty text field)

At the bottom, there is a checkbox "Switch To Advanced Property Display" and "OK" and "Cancel" buttons.

Gambar 50 Define Material Beton Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

3) Profil Baja : PIPE

Langkah dalam mendefinisikan profil baja adalah sebagai berikut :

- Klik menu *Define > Section Properties > Frame Sections*
- Klik *Add New Property*
- Pada kotak dialog selanjutnya, pilih jenis profil *Pipe*
- Isi *section name* menjadi "PIPE 1066,8 Thk 21"
- Isi data *dimension* seperti gambar berikut :

The dialog box is titled "Pipe Section". It contains the following fields and controls:

- Section Name:** PIPE 1066.8 Thk 21 mm
- Section Notes:** (text area with a "Modify/Show Notes..." button)
- Properties:**
 - Section Properties: (button)
 - Property Modifiers: (button)
 - Material: ASTM A572 Gr 50 (dropdown menu)
- Dimensions:**
 - Outside diameter (D): 1.0668
 - Wall thickness (t): 0.021
- Display Color:** (color swatch)

At the bottom, there are "OK" and "Cancel" buttons.

Gambar 51 Pipe Baja Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

4) Tebal Balok : 2 m

Berikut merupakan langkah dalam mendefinisikan balok :

- Klik *Define > Sections Properties > Area Sections*
- Klik *Add New Sections*

- c) Beri nama penampang pada *Section Name* menjadi “Beton Deck 2 m”
- d) Pilih *type* “*Shell - thick*”
- e) Pilih material yang sesuai pada pilihan material: “Mutu Beton Fc-35”
- f) Isi data *Thickness* seperti gambar berikut :

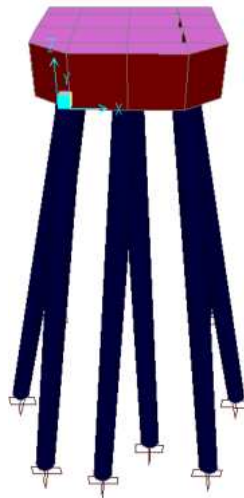


Gambar 52 Slab Property Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

b. Gambar Permodelan

Berikut merupakan gambar langkah permodelan dari *case* yang akan dibuat :

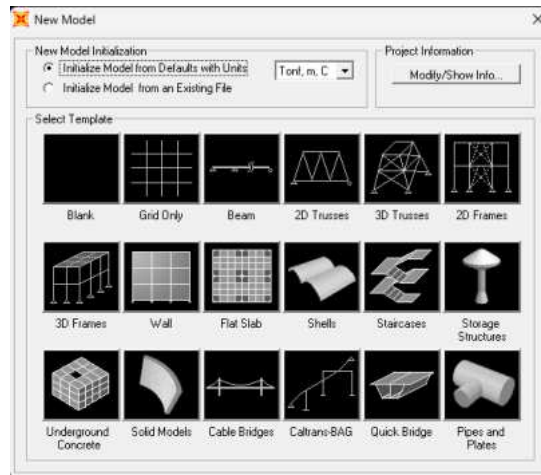


Gambar 53 Permodelan Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

1) Membuat file baru :

- a) Klik menu *File > New Model...*
- b) Klik pilihan *Initialize Model from Defaults with Units*, pilih satuan Ton, m, C
- c) Klik tombol *Blank*

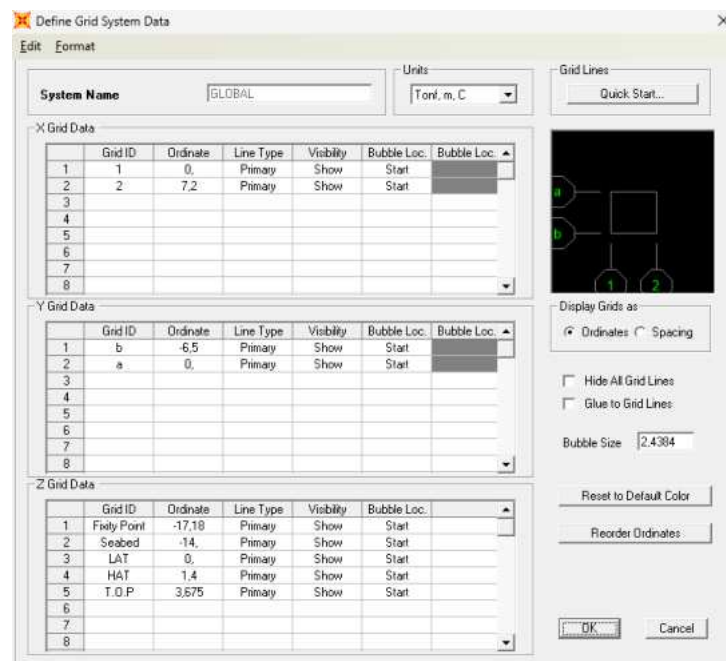


Gambar 54 *New Model Quick Template Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

2) Mengatur dimensi permodelan sesuai ketentuan

Atur dimensi sesuai ketentuan dengan klik kanan pada *mouse* lalu pilih edit / modify grid



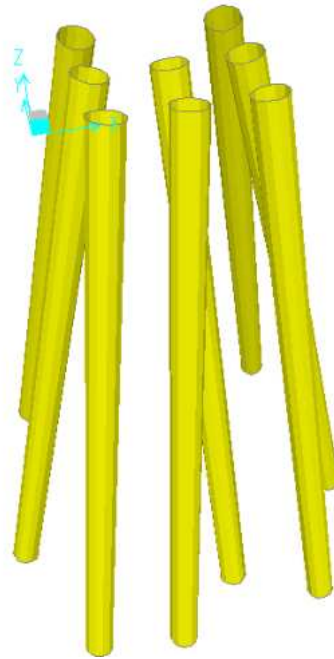
Gambar 55 Dimensi Permodelan *Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

3) Menggambar model struktur

a) Klik menu *Draw > draw Frame / cable / tendon*

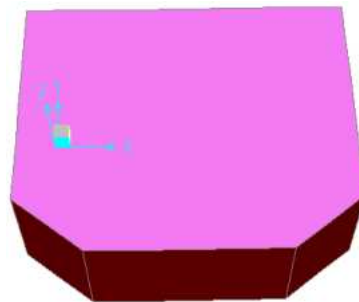
b) Pada kotak dialog, pilih penampang profil “PIPE 1066,8 Thk 21” kemudian gambar *frame* struktur



Gambar 56 Model Struktur *Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

- 4) Menggambar elemen balok
 - a) Klik *Draw > Draw Poly Area*
 - b) Pada kotak dialog *properties of object*, pilih *section* “Beton Deck 2 m”
 - c) Pilih pada elemen yang akan didefinisikan sebagai balok



Gambar 57 *Define Area Mooring Dolphin*

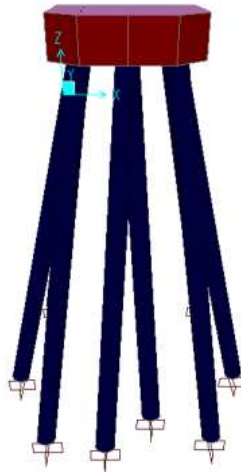
(Sumber: Analisa Penulis, 2025)

- 5) Mengganti tumpuan struktur
 - a) Klik semua tumpuan atau *block* keseluruhan
 - b) Klik menu *Assign > Joint > Restraints* pilih tumpuan jepit



Gambar 58 Input Tumpuan Struktur *Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

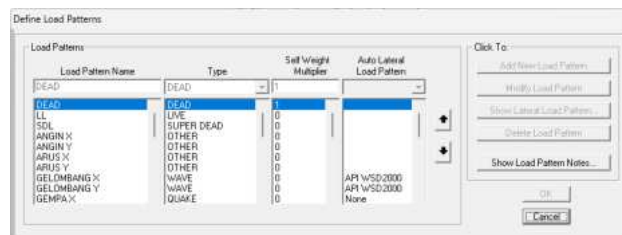


Gambar 59 Permodelan dengan Tumpuan *Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

c. Pembebanan

- 1) Mendefinisikan tipe pembebanan dengan klik *Define > Load Patterns...*

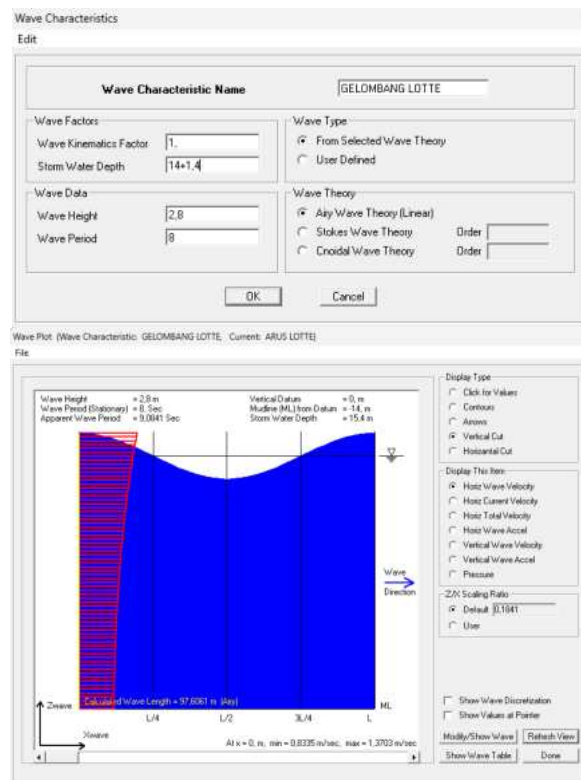


Gambar 60 *Define Load Patterns Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

- 2) Menambahkan karakteristik arus dan gelombang dengan cara sebagai berikut :
 - a) Klik menu *Define > Load Cases*
 - b) Pilih *Load Pattern Name* 'Gelombang X/Y'
 - c) Kemudian pilih API WSD2000 pada *Auto Lateral Load Pattern*, klik *Modify Lateral Load Pattern*

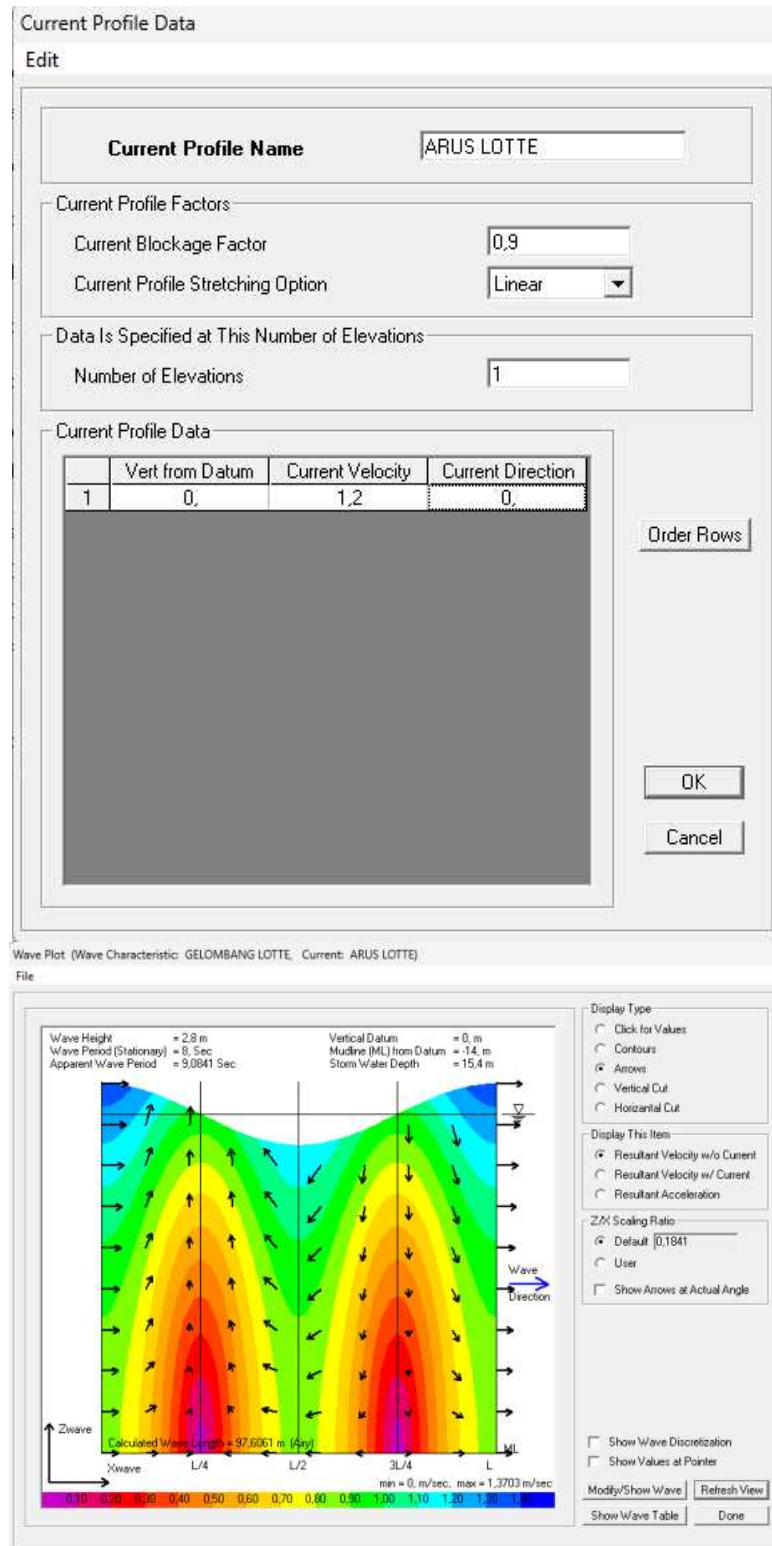
- d) Selanjutnya pada *Wave Characteristics* klik *Add* dan isi data gelombang seperti gambar berikut :



Gambar 61 *Wave Characteristics Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

- e) Selanjutnya pada *Current Profile* klik *Add* dan isi data arus seperti gambar berikut :



Gambar 62 Current Profile Data Mooring Dolphin

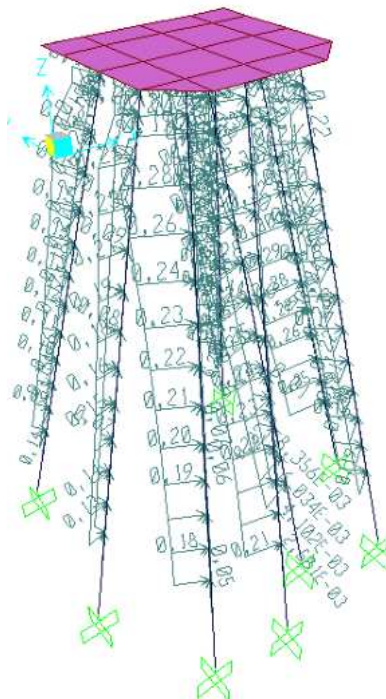
(Sumber: Analisa Penulis, 2025)

- f) Ubah *Wave Characteristics* menjadi “GELOMBANG LOTTE” dan ubah *Current Profile* menjadi “ARUS LOTTE”

- g) Pada kolom *Other Vertical Elevations Relative To Datum* mengisi *Mudline from Datum* dengan elevasi *Seabed* sebesar -14,00 m dan *High Tide from Datum* dengan elevasi HAT sebesar 1,4 m

Wave Load Pattern

Wave Load Pattern Parameters			
Wave Characteristics	GELOMBANG LOTTE	Add	Modify/Show Delete
Current Profile	ARUS LOTTE	Add	Modify/Show Delete
Marine Growth	None	Add	Modify/Show Delete
Drag and Inertia Coefficients	API Default	Add	Modify/Show Delete
Wind Load	None	Add	Modify/Show Delete
☒ Include Buoyant Loads			
Wave Load Pattern Discretization		Vertical Reference Elevation for Wave	
Maximum Discretization Segment Size		Global Z Coordinate of Vertical Datum	
1,524		0.	
Wave Crest Position		Other Vertical Elevations Relative To Datum	
Global X Coord of Pt on Initial Crest Position		Mudline from Datum	
0.		-14.	
Global Y Coord of Pt on Initial Crest Position		High Tide from Datum	
0.		1,4	
Number of Wave Crest Positions Considered			
1			
Wave Direction		Sea Water Properties	
Wave Approach Angle in Degrees		Water Weight Density	
0.		1.0252	
Show Wave Table		Show Wave Plot	
OK		Cancel	

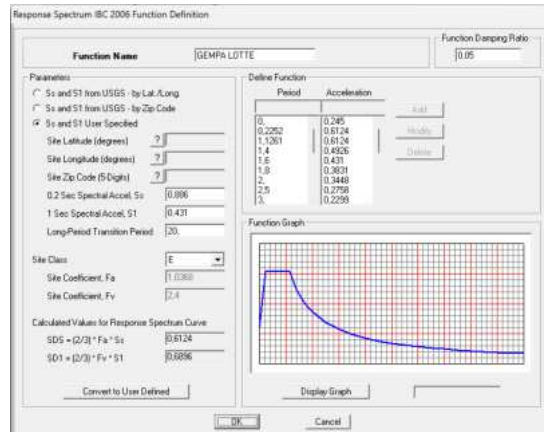


Gambar 63 Wave Load Pattern Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

3) Menambahkan Pembebanan Gempa

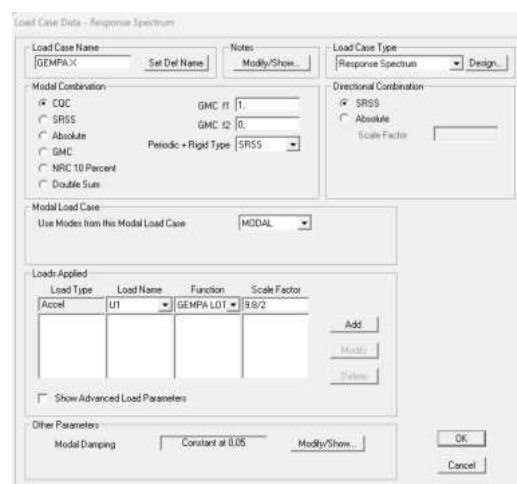
- a) Menginput nilai *response spectrum* dengan cara klik menu *Define > Function > Respons Spectrum*
- b) Pilih IBC 2006 pada *Choose Function Type to Add*
- c) Klik *Add New Function*
- d) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 64 *Properties Response Spectrum Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

- e) Selanjutnya menambahkan fungsi *Response Spectrum* dengan merubah tipe beban menjadi Respons Spektrum yang sebelumnya sudah diinput
 - (1) Klik menu *Define > Load Cases*
 - (2) Kemudian pada *Load Case Type* ubah menjadi “*Response Spectrum*” klik *Modify/Show Case*
 - (3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 65 *Load Case Data Response Spectrum Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

- 4) Menambahkan beban mati tambahan
 - a) Klik menu *Define > Load Cases*
 - b) Kemudian pada *Load Case Type* ubah menjadi “*Response Spectrum*”
klik *Modify/Show Case*
 - c) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

Load Type	Load Name	Scale Factor
Load Pattern	BOLLARD	1.
Load Pattern	ISIAN BETON	1.
Load Pattern	SDL CATWALK	1.
Load Pattern	DL CATWALK	1.

Gambar 66 Load Case Data SDL Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

- 5) Menambahkan beban hidup tambahan
 - a) Klik menu *Define > Load Cases*
 - b) Kemudian pada *Load Case Type* ubah menjadi “*Response Spectrum*”
klik *Modify/Show Case*
 - c) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

Load Type	Load Name	Scale Factor
Load Pattern	LL	1.
Load Pattern	LL	1.
Load Pattern	LL CATWALK	1.

Gambar 67 Load Case Data LL Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

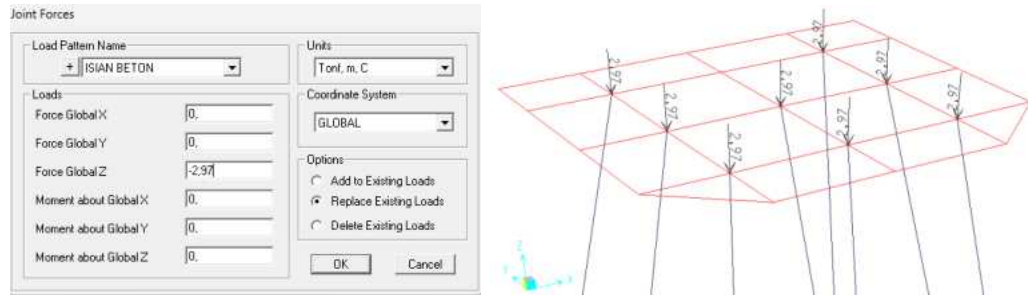
6) Mengaplikasikan pembebanan pada struktur:

a) Beban Isian Beton pada *Steel Pile*

(1) Klik semua joint bagian atas *Steel Pile*

(2) *Assign > Frame Loads > Distributed....*

(3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 68 Beban Isian Beton pada *Steel Pile Mooring Dolphin*

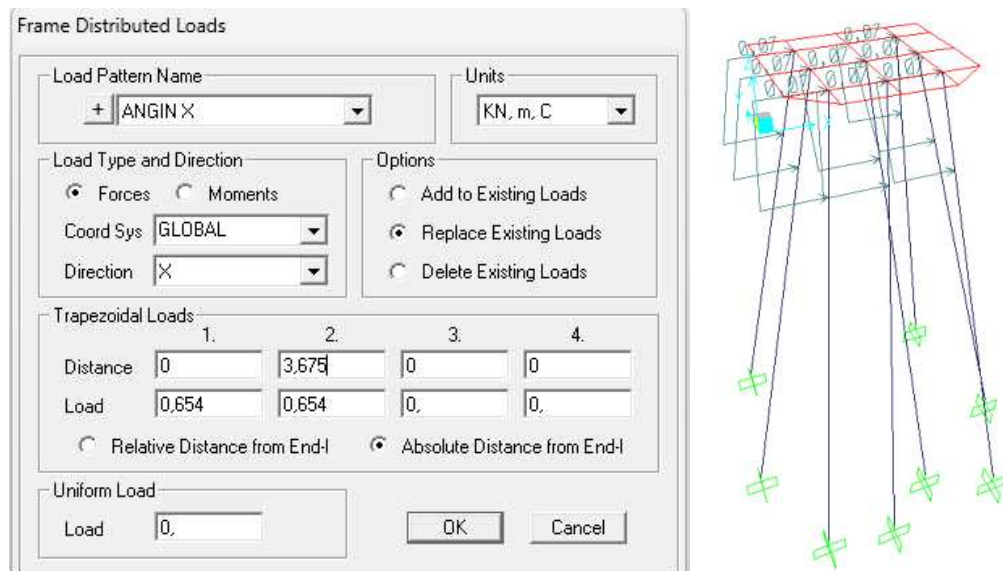
(Sumber: Analisa Penulis, 2025)

b) Beban Angin arah x dan y pada *Steel Pile*

(1) Klik semua *Steel Pile*

(2) *Assign > Frame Loads > Distributed....*

(3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

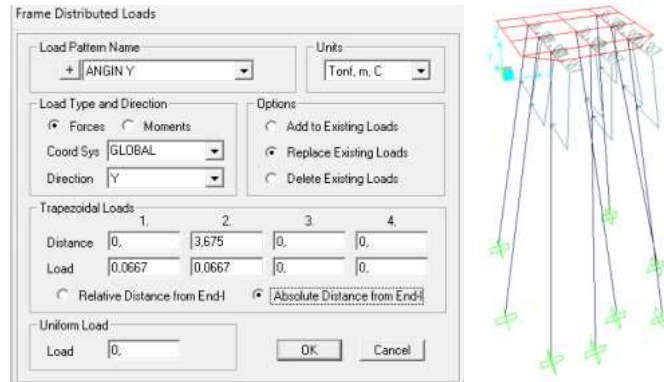


Gambar 69 Beban Angin Arah x *Steel Pile Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

(4) Kemudian untuk pembebanan angin arah y dengan mengulangi langkah 1-2

(5) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 70 Beban Angin Arah y *Steel Pile Mooring Dolphin*

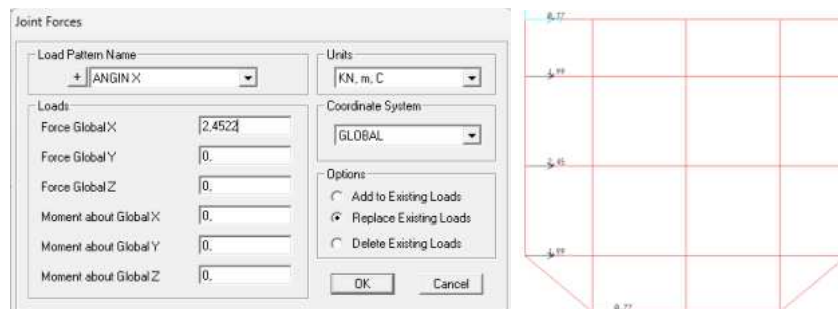
(Sumber: Analisa Penulis, 2025)

c) Beban Angin arah x dan y pada Balok

(1) Untuk pembebanan angin arah x, klik bagian *joint* sebelah kanan / kiri pada balok

(2) *Assign > Joint Loads > Forces*

(3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

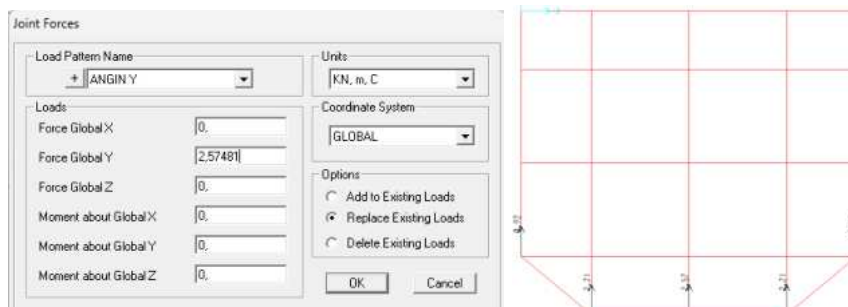


Gambar 71 Beban Angin arah x pada Balok *Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

(4) Kemudian untuk pembebanan angin arah y pada balok, klik bagian depan *joint* dan mengulangi langkah 2

(5) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

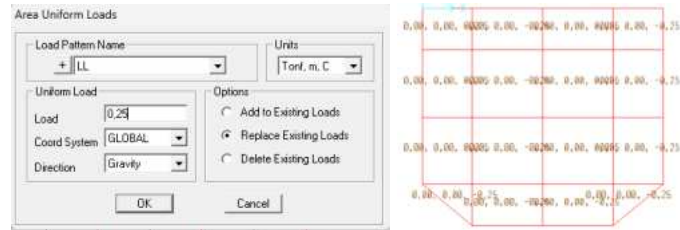


Gambar 72 Beban Angin arah y pada Balok *Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

d) **Beban Hidup**

- (1) Klik semua balok
- (2) *Assign > Area Loads > Uniform (Shell)*
- (3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

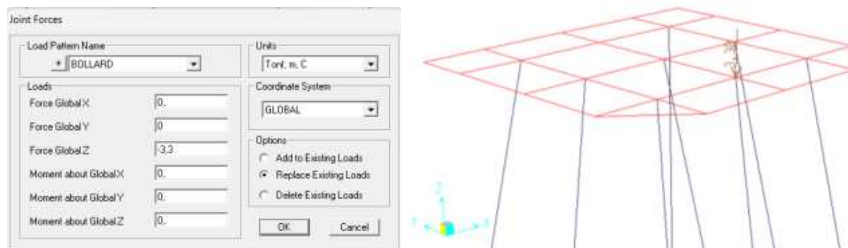


Gambar 73 Beban Hidup *Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

e) **Beban *Bollard***

- (1) Klik salah satu bagian *joint*
- (2) *Assign > Joint Loads > Forces*
- (3) Isikan data sesuai ketentuan yang diberikan seperti gambar berikut :

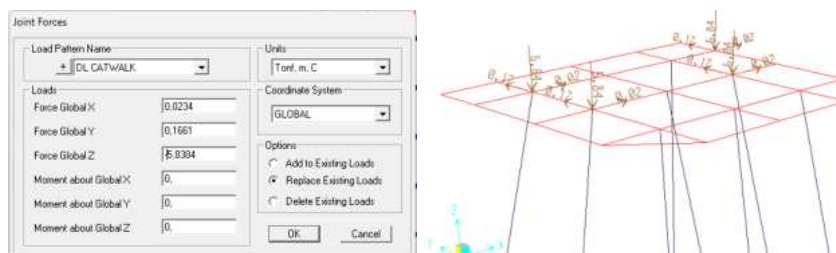


Gambar 74 Beban *Bollard Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

f) **Beban *Catwalk***

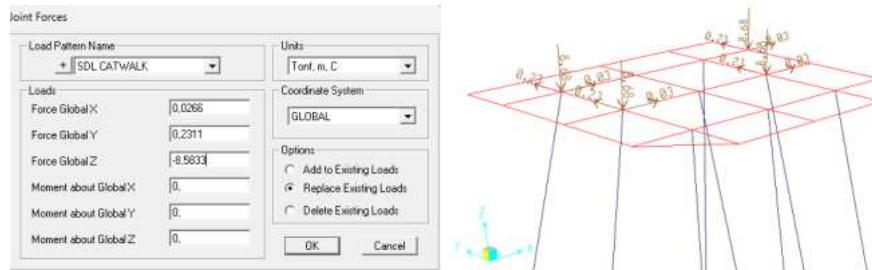
- (1) Klik salah 4 bagian *joint*
- (2) *Assign > Joint Loads > Forces*
- (3) Isikan data beban mati sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 75 Beban Mati *Catwalk Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

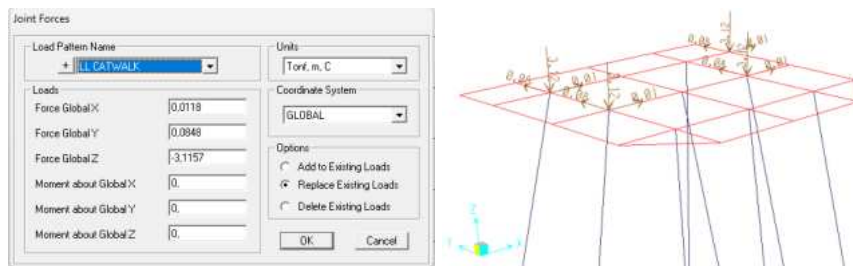
- (4) Ulangi langkah 1-2 untuk beban mati tambahan dengan ketentuan yang diberikan seperti gambar berikut :



Gambar 76 Beban Mati Tambahan *Catwalk Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

- (5) Kemudian, ulangi langkah 1-2 untuk beban hidup dengan ketentuan yang diberikan seperti gambar berikut :

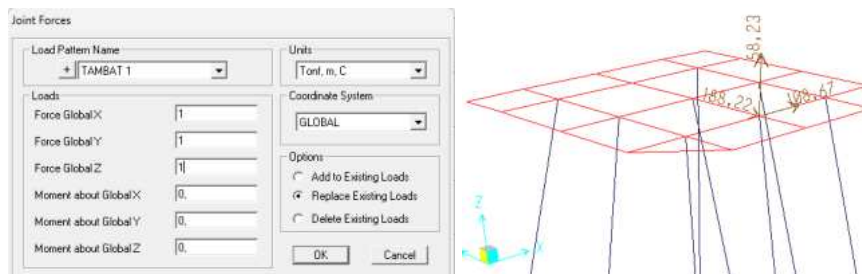


Gambar 77 Beban Hidup *Catwalk Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

g) Beban Tambat

- (1) Klik salah 1 bagian *joint*
- (2) *Assign > Joint Loads > Forces*
- (3) Isikan data beban tambat 1 sesuai ketentuan yang diberikan seperti gambar berikut :



Gambar 78 Beban Tambat 1 *Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

- (4) Klik kembali salah satu bagian *joint*, kemudian pilih menu edit > *Interactive Database Editing...*

- (5) Beri tanda silang pada *Joint Assigments* > *Joint Load Assigments* > *Table : Joint Loads - Force*
- (6) Pada kolom *Load Patterns (Model Def)*, klik *Select Load Patterns* kemudian pilih Tambat 1 dan OK
- (7) Kemudian *import* tabel dari program dengan memilih *To Exel*
- (8) Salin tabel yang ada dilembar kerja sebelumnya ke tabel lembar kerja yang telah di *import* dari program
- (9) Selanjutnya kembali ke program dengan memilih *From Exel* > *Apply To Model* > *Done*

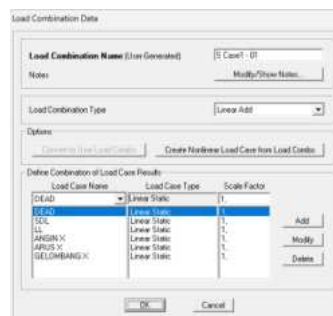
7) Mendefinisikan kombinasi pembebanan

- a) *Difine* > *Load Combination...*
- b) Klik tombol *Add New Combo...*

Berikut merupakan kombinasi pembebanan service dan ultimit yang diberikan pada permodelan ini :

Kombinasi pembebanan service

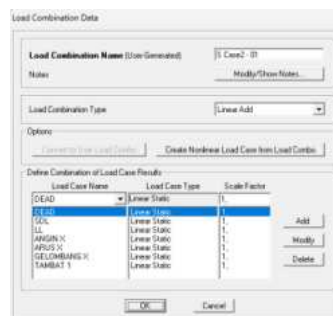
- a) D + SDL + LL + Env



Gambar 79 S Case1 Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

- b) D + SDL + LL + Env + M



Gambar 80 S Case1 Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

c) $D + SDL + LL + E$

Load Case Name	Load Case Type	Scale Factor
DEAD	Linear Static	1.0
SDL	Linear Static	1.0
LL	Linear Static	1.0
GEMPA X	Response Spectrum	0.7
GEMPA Y	Response Spectrum	0.3

Gambar 81 S Case1 Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

Kombinasi pembebanan ultimit

a) $1,4D + 1,4SDL + 1,6LL + 1,4Env$

Load Case Name	Load Case Type	Scale Factor
DEAD	Linear Static	1.4
SDL	Linear Static	1.4
LL	Linear Static	1.6
ANGIN X	Linear Static	1.4
ARIUS X	Linear Static	1.4
GELOMBANG X	Linear Static	1.4

Gambar 82 U Case1 Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

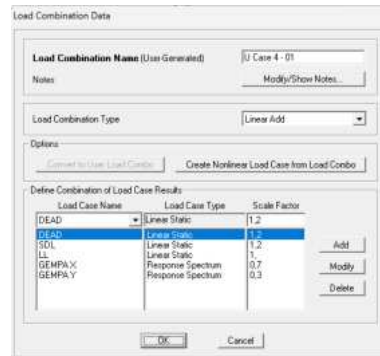
b) $1,4D + 1,4SDL + 1,6LL + 1,4Env + 1,2M$

Load Case Name	Load Case Type	Scale Factor
DEAD	Linear Static	1.4
SDL	Linear Static	1.4
LL	Linear Static	1.6
ANGIN X	Linear Static	1.4
ARIUS X	Linear Static	1.4
GELOMBANG X	Linear Static	1.4
TAMBAT 1	Linear Static	1.2

Gambar 83 U Case2 Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

c) 1,2D + 1,2SDL + LL + E



Gambar 84 U Case3 Mooring Dolphin

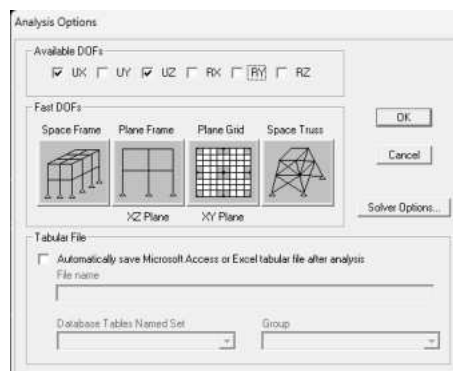
(Sumber: Analisa Penulis, 2025)

d. Analisis dan output

1) Tipe Analisis

Tipe analisis struktur yang digunakan adalah *Space Truss*

Define > Set Analysis lalu pilih *Space Truss* lalu OK

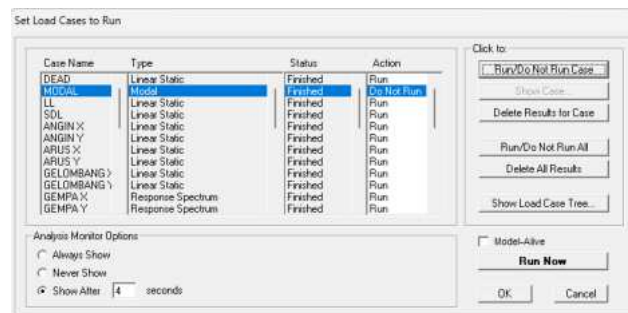


Gambar 85 Tipe Analisis Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

Selanjutnya, klik *Analyze > Set Analysis To Run*, lalu pada *Modal* pilih

Run/Do Not Run Case. Lalu klik *Run Now*



Gambar 86 Run Analysis Mooring Dolphin

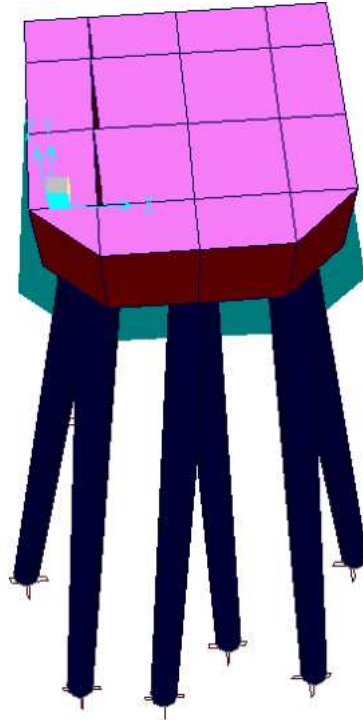
(Sumber: Analisa Penulis, 2025)

2) Output

Berikut terlampir hasil output – output dari proses desain dan analisis model struktur *mooring dolphin* :

a) Deformasi Struktur

Deformasi struktur merupakan bentuk perubahan struktur yang terjadi akibat adanya gaya dari luar maupun dari dalam.



Gambar 87 Deformed Shape Mooring Dolphin

(Sumber: Analisa Penulis, 2025)

Tabel 5 Defleksi Mooring Dolphin

Kombinasi Beban	Case Type Text	U1 cm	U2 cm	U3 cm
Comb 1 - DL + LL + Env	Max	0,0038	0,0038	-0,0002
	Min	0,0010	0,0027	-0,0017
Comb 2 - DL + LL + Env + Mooring	Max	0,0293	-0,0069	0,0052
	Min	-0,0010	-0,0236	-0,0043
Comb 3 - Gempa	Max	0,0090	0,0098	0,0008
	Min	-0,0095	-0,0044	-0,0030

(Sumber: Analisa Penulis, 2025)

Pengecekan defleksi pada dermaga biasanya tidak lebih dari 0,6 cm dan defleksi maksimum yang didapat sebesar 0,0293 cm. Maka, defleksi struktur *mooring dolphin* dikatakan memenuhi syarat.

b) Reaksi Perletakan

Tumpuan adalah tempat bersandarnya suatu konstruksi & tempat bekerjanya reaksi. Untuk menampilkan reaksi tumpuan yaitu dengan cara klik *Display > Force/Stress Diagram > Support/Spring Reaction...*



Gambar 88 Reaksi Perletakan *Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

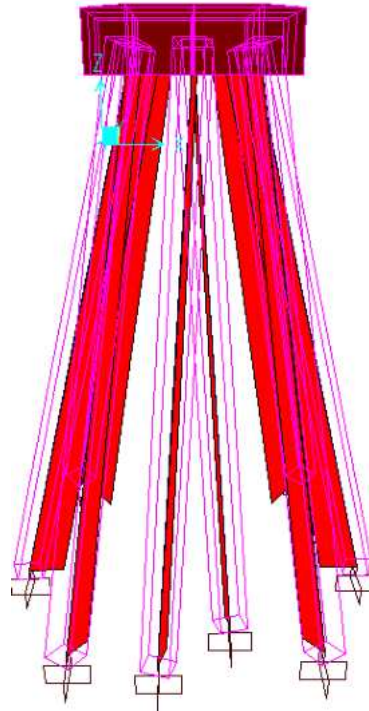
Tabel 6 Joint Reaksi *Mooring Dolphin*

Kombinasi Beban	Case Type Text	F1 Tonf	F2 Tonf	F3 Tonf	M1 Tonf-m	M2 Tonf-m	M3 Tonf-m
Comb 1 - DL + LL + Env	Max	13,2012	7,3523	91,2070	16,4172	-2,2925	5,7413
	Min	-17,8597	-17,0207	17,3545	4,6122	-24,6547	-5,6905
Comb 2 - DL + LL + Env + <i>Mooring</i>	Max	18,0556	77,9389	294,3652	-11,8457	6,4805	21,9123
	Min	-55,2666	-6,8030	-141,2883	-89,5841	-113,8216	-36,0228
Comb 3 - Gempa	Max	26,5922	23,0789	142,1139	38,4358	38,7447	10,7736
	Min	-26,1647	-27,5342	-46,2510	-21,2886	-36,0176	-10,8878

(Sumber: Analisa Penulis, 2025)

Berdasarkan analisis struktur *mooring dolphin* didapat daya dukung aksial (P_u) pada kondisi tekan sebesar 294,3652 ton dan kondisi tarik sebesar -141,2883 ton. Sedangkan, daya dukung lateral (H_u) tiang pancang Ø1066.8x21t sebesar 77,9389 ton.

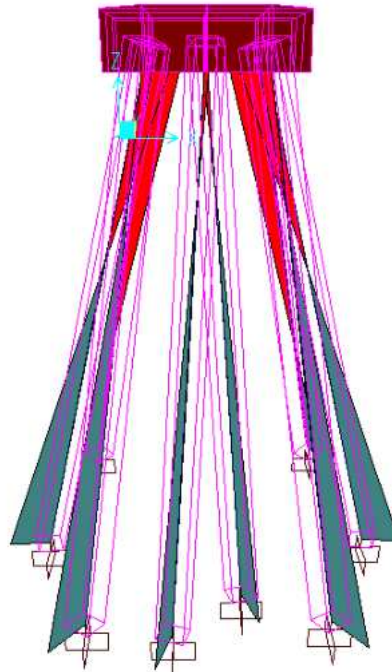
- c) Gaya dan Diagram Reaksi Perletakan
(1) *Axial Force*



Gambar 89 *Axial Force Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

- (2) *Shear 2-2*



Gambar 90 *Shear 2-2 Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

(3) *Moment 3-3*



Gambar 91 *Moment 3-3 Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

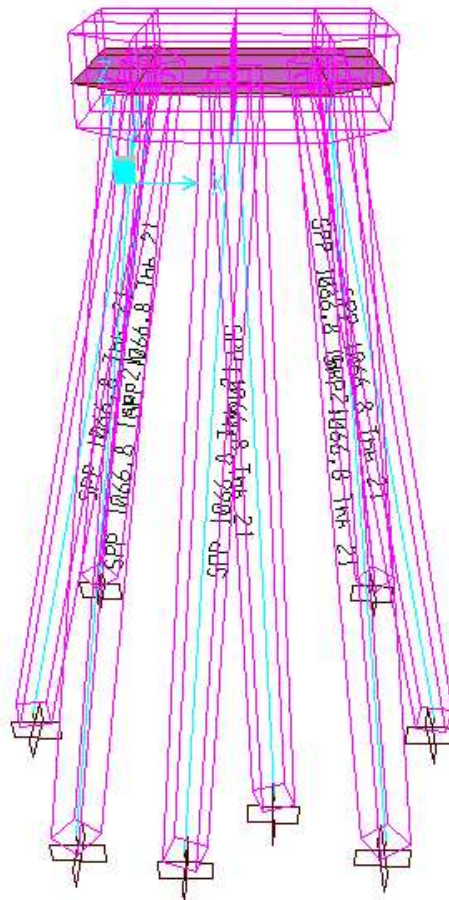
Tabel 7 Gaya Dalam *Mooring Dolphin*

Kombinasi Beban	Case Type Text	P Tonf	V2 Tonf	V3 Tonf	T Tonf-m	M2 Tonf-m	M3 Tonf-m
Comb 1 - DL + LL + Env	Max	-9,5968	4,1782	3,2407	0,8139	20,2023	17,1698
	Min	-94,1841	-2,3914	-2,6497	-0,0865	-23,3624	-26,3936
Comb 2 - DL + LL + Env + <i>Mooring</i>	Max	156,2719	12,1280	14,6314	21,3076	153,8213	111,7071
	Min	-305,2969	-10,3054	-9,1133	-1,8461	-130,1757	-110,9492
Comb 3 - Gempa	Max	60,1630	5,0850	3,7252	4,8909	45,2299	39,3142
	Min	-146,8792	-5,0648	-4,1071	-3,9461	-49,9853	-49,5522

(Sumber: Analisa Penulis, 2025)

(4) Keamanan Struktur

Dilakukan keamanan struktur dengan klik *Design > Concrete Frame Design > Start/Design Check..*



Gambar 92 Keamanan Struktur *Mooring Dolphin*

(Sumber: Analisa Penulis, 2025)

Tabel 8 Rasio *Mooring Dolphin*

Kombinasi Beban	Ratio Unitless	Syarat Batas Unitless	Keterangan Text
Comb 1 - DL + LL + Env	0,1407	1,00	AMAN
Comb 2 - DL + LL + Env + <i>Mooring</i>	0,6181	1,00	AMAN
Comb 3 - Gempa	0,2019	1,00	AMAN

(Sumber: Analisa Penulis, 2025)

Kekuatan struktur tiang dilihat dari tiang pancang yang menopang. Apabila rasio (PMM) tiang pancang lebih dari 1,00 maka tiang pancang tersebut mengalami *overstressed* atau melebihi kapasitas kekuatannya. Berdasarkan analisis struktur *mooring dolphin* rasio terbesar didapat pada kondisi kombinasi pembebanan 2 yaitu sebesar 0,6181 dan syarat batas sebesar 1. Maka, kapasitas struktur *mooring dolphin* yang direncanakan mampu menahan beban-beban yang bekerja.

LAMPIRAN

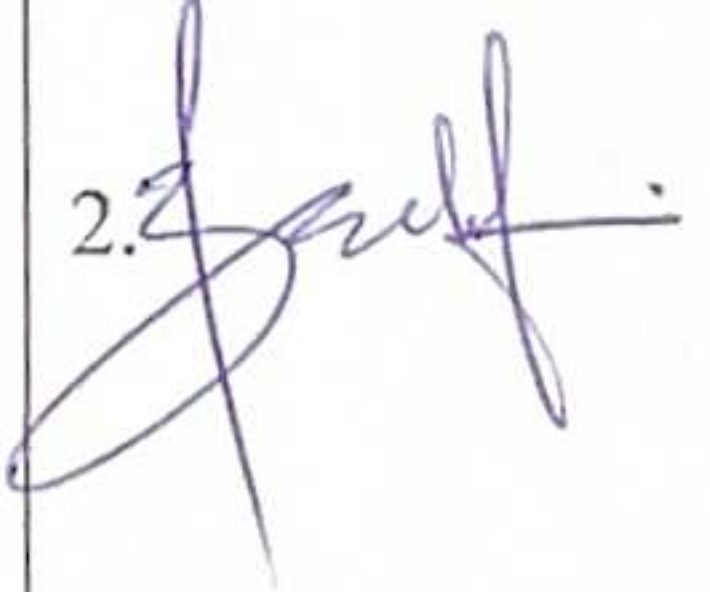


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Telepon (0254) 376712 Laman: ft.untirta.ac.id

FORM PENETAPAN DOSEN PEMBIMBING TA

Nama : Rifda Syafrida
NIM : 3336210010
Program Studi : Teknik Sipil
Semester : Ganjil/~~Genap~~ *) Tahun Akademik 2024/2025
KBK : Sumber Daya Air
Judul Tugas Akhir : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota Cilegon)

No	Uraian	Nama Dosen	Paraf Dosen
1.	Pembimbing 1	1. Dr. Subekti, S.T., M.T.	1. 
2.	Pembimbing 2	2. Baehaki, S.T., M. Eng	2. 

Cilegon, 17 Mei 2024
Ketua KBK


Ngakan Putu Purnaditya, S.T., M.T.
NIP. 198909142019031008

*) coret yang tidak perlu



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FORM PERSETUJUAN TANGGAL SIDANG

Nama : Rifda Syafrida
NIM : 3336210010
Jurusan : Teknik Sipil
Rencana Sidang : Seminar Proposal/ ~~Seminar Hasil/ Sidang Akhir~~ *)
Waktu Sidang :
Hari/ Tanggal : Jumat, 27 September 2024
Jam : 10.00 WIB

No	Nama Dosen	Pembimbing	Penguji	Tanda Tangan
1	Dr. Subekti, S.T., M.T.	I		Tanggal: 18/9/2024 Paraf:
2	Baehaki, S.T., M. Eng	II		Tanggal: 19/9/2024 Paraf:
3	Bambang Adhi Priyambodho, S.T., M.T.		I	Tanggal: 19/9/2024 Paraf:
4	Zulmahdi Darwis, S.T., M. Eng		II	Tanggal: 19/9/2024 Paraf:

Cilegon, 18 September 2024
Koordinator TA

Siti Asyiah, S.Pd., M.T.
NIP. 198601312019032009

*) coret yang tidak perlu



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Telepon (0254) 376712 Laman: ft.untirta.ac.id

Smp-01

SURAT PERMOHONAN SEMINAR PROPOSAL SKRIPSI

Yang bertanda tangan di bawah ini, saya mahasiswa Program Sarjana Jurusan Teknik Sipil Fakultas Teknik Universitas Sultan Ageng Tirtayasa,

Nama Mahasiswa : Rifda Syafrida
Nomor Mahasiswa : 3336210010
Alamat Mahasiswa : Jl. TB Buang Link. Cikuasa RT 01 RW 01 No. 05 Kelurahan Gerem,
Kecamatan Gerogol, Kota Cilegon, Banten ID 42438
Dosen Pembimbing : 1. Dr. Subekti, S.T., M.T.
2. Baehaki, S.T., M. Eng

dengan prestasi studi 3,63 sampai dengan tanggal: 19 September 2024 seperti terlampir. Dengan ini saya mengajukan permohonan untuk dapat menyelenggarakan seminar proposal skripsi.

Cilegon, 19 September 2024

Rifda Syafrida

PEMERIKSAAN (oleh Koord. Skripsi)

No	Perihal	Catatan
1.	Hasil studi kumulatif (≥ 116 sks dan $IPK \geq 2,00$)	141..... SKS & IPK ..3,63..
2.	Nilai D maksimal 10% dari total SKS mata kuliah	0..... %
3.	Kerja Praktek	
4.	Mengontrak mata kuliah Skripsi dalam KRS berjalan	
5.	Melakukan pendaftaran pada SISTA (TA-01)	
6.	Draf proposal telah disetujui Dosen Pembimbing (TA-02) Salinan sebanyak 4 eksemplar masing-masing untuk pembimbing dan penguji	
7.	Naskah seminar telah disetujui Dosen Pembimbing (TA-02) Salinan sebanyak 10-15 eksemplar untuk peserta sidang	
8.	Berita Acara Seminar Proposal (Smp-02)	
9.	Lembar saran & masukan (Smp-03)	
10.	Daftar hadir dosen (Smp-04)	
11.	Daftar hadir peserta seminar (Smp-05)	

Seminar tersebut dapat dilaksanakan, waktu dan tempat seminar harap dikonsultasikan dengan Dosen Pembimbing dan Dosen Penguji.

Cilegon, 19 September 2024
Koordinator Skripsi,

Siti Asyiah, S.Pd., M.T.
NIP. 198601312019032009

Dibuat rangkap 2 untuk:

1. Mahasiswa ybs
2. Koord. Skripsi

* Pendaftaran Seminar Proposal Skripsi selambat-lambatnya 2 hari kerja sebelum seminar dilaksanakan.



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FAKULTAS TEKNIK

Jl. Jendral Soedirman Km. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

Smp-02

BERITA ACARA SEMINAR PROPOSAL SKRIPSI
JURUSAN TEKNIK SIPIL UNTIRTA

Pada hari ini Jum'at tanggal 27 bulan September tahun 2024, telah dilaksanakan Seminar Proposal Skripsi dari mahasiswa/mahasiswi, yaitu :

Nama : Rifda Syafrida

NPM : 3336210010

Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota Cilegon)

Dosen pembimbing I : Dr. Subekti, S.T., M.T.

Dosen pembimbing II: Baehaki, S.T., M. Eng

Dosen Penguji I : Dr. Eng. B. Adhi Priyambodho, S.T., M.T.

Dosen Penguji II : Zulmahdi Darwis, S.T., M. Eng

Dari Seminar Proposal Skripsi ini dinyatakan bahwa mahasiswa tersebut telah dinyatakan MEMENUHI PERSYARATAN / ~~TIDAK MEMENUHI PERSYARATAN~~ untuk melanjutkan Penelitian (Skripsi) *)

Demikian Berita Acara ini dibuat dan selanjutnya untuk dapat dipergunakan sebagaimana mestinya.

Cilegon, 27 September 2024

Dosen Penguji I

Dr. Eng. B. Adhi Priyambodho, S.T., M.T.
NIP. 197704042009121001

Dosen Penguji II

Zulmahdi Darwis, S.T., M. Eng
NIP. 197706182008011005

Dosen Pembimbing I

Dr. Subekti, S.T., M.T.
NIP. 197506122008011020

Dosen Pembimbing II

Baehaki, S.T., M. Eng
NIP. 198705082015041001

Ket : *) coret yang tidak perlu

CC : Arsip



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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FAKULTAS TEKNIK

Smp-03

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SARAN / MASUKAN
SEMINAR PROPOSAL SKRIPSI

Hari/Tgl : Jum'at, 27 September 2024 Waktu : 10.00 WIB
Nama Peserta : Rifda Syafrida NPM : 3336210010
Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal
Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota
Cilegon)

NO	HAL	MASUKAN/SARAN/KOREKSI/DLL	KET.
1		Tata tulis perbaiki kalimat	
2		Teori pembebanan dan rumus harus diselaraskan dan teori nya analisis	

Cilegon, 27 September 2024
Dosen Pembimbing I

Dr. Subekti, S.T., M.T.
NIP. 197506122008011020



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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Telepon (0254) 376712 Laman: ft.untirta.ac.id

Smp-03

SARAN / MASUKAN
SEMINAR PROPOSAL SKRIPSI.

Hari/Tgl : Jum'at, 27 September 2024 Waktu : 10.00 WIB
Nama Peserta : Rifda Syafrida NPM : 3336210010
Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota Cilegon)

NO	HAL	MASUKAN/SARAN/KOREKSI/DLL	KET.
		1. Tambahkan gambar detail struktur (sample) penelitian) pd Metode Penelitian objek 2. Rincian data primer dan sekunder? 3. Perbaiki Flow chart pd bagian "Analysis Design". ? 4. Tidak perlu ditampilkan pengelompokan menggunakan software SAP 2000. 5. Tambahkan teori struktur. 6. Geoteknik / goda 7. Cdk 801 Gempa Dermaga. → pelajari! Dermaga → Struktur bangunan non gedung menyerupai gedung	

8. Dermaga ini apakah dapat diakses oleh masyarakat umum?

Cilegon, 27 September 2024
Dosen Pembimbing II

Baehaki, S.T., M. Eng
NIP. 198705082015041001



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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Telepon (0254) 376712 Laman: ft.untirta.ac.id

SARAN / MASUKAN
SEMINAR PROPOSAL SKRIPSI

Hari/Tgl : Jum'at, 27 September 2024 Waktu : 10.00 WIB
Nama Peserta : Rifda Syafrida NPM : 3336210010
Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal
Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota
Cilegon)

NO	HAL	MASUKAN/SARAN/KOREKSI/DLL	KET.
		Mohon jabarkan cara memperoleh data primer dan sekunder, dan penerapan rumus (persamaan) dalam metodologi dan atau software	

Cilegon, 27 September 2024
Dosen Penguji I

Dr. Eng. B. Adhi Priyambodho, S.T., M.T.
NIP. 197704042009121001



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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Smp-03

Jl. Jendral Soedirman Km. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

SARAN / MASUKAN
SEMINAR PROPOSAL SKRIPSI

Hari/Tgl : Jum'at, 27 September 2024 Waktu : 10.00 WIB
Nama Peserta : Rifda Syafrida NPM : 3336210010
Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal
Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota
Cilegon)

NO	HAL	MASUKAN/SARAN/KOREKSI/DLL	KET.
1		Awal kalimat usahakan tidak menggunakan kata depan, kata sambung dan kata pengandaian	
2		Latar belakang → Kenapa penelitian ini dilakukan ???	
3		Beban gelombang teori / menjadi Beban terpusat..	

Cilegon, 27 September 2024
Dosen Penguji II

Zulmahdi Darwis, S.T., M. Eng
NIP. 197706182008011005



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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Smp-04

DAFTAR HADIR SEMINAR PROPOSAL SKRIPSI

Hari/Tgl : Jum'at, 27 September 2024
Waktu : 10.00 WIB
Nama Peserta : Rifda Syafrida
NPM : 3336210010
Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota Cilegon)

NO	NAMA	NIP	TANDA-TANGAN
1.	Dr. Subekti, S.T., M.T.	197506122008011020	1.
2.	Baehaki, S.T., M. Eng	198705082015041001	2.
3.	Dr. Eng. B. Adhi Priyambodho, S.T., M.T.	197704042009121001	3.
4.	Zulmahdi Darwis, S.T., M. Eng	197706182008011005	4.

Cilegon, 27 September 2024
Koordinator Skripsi

Siti Asyiah, S.Pd., M.T.
NIP.198601312019032009



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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Smp-05

DAFTAR HADIR SEMINAR PROPOSAL SKRIPSI

Hari/Tgl : Jum'at, 27 September 2024
Waktu : 10.00 WIB
Nama Peserta : Rifda Syafrida
NPM : 3336210010
Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota Cilegon)

NO	NAMA	NPM	TANDA-TANGAN	KET.
1.	Mulyanah	3336210003	1.	
2.	Syahdan Raihan	3336210014	2.	
3.	Robby Firman H	3336210099	3.	
4.	Ardiansyah dimas	3336210094	4.	
5.	Shauqi Aiman	3336210089	5.	
6.	M NAUVAL PUSPITO M	3336210089	6.	
7.	Eri Abdullah Muhyi	3336210076	7.	
8.	Hafiz Pranata	3336210028	8.	
9.	Andien Puspito Syahrani	3336210077	9.	
10.			10.	
11.			11.	
12.			12.	
13.			13.	
14.			14.	
15.			15.	

Cilegon, 27 September 2024
Koordinator Skripsi

Siti Asyiah, S.Pd., M.T.
NIP.198604312019032009



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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Smp-06

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BUKTI PERBAIKAN PROPOSAL SKRIPSI

Nama Peserta : Rifda Syafrida
NPM : 3336210010

NO	HARI/ TANGGAL	PERIHAL	BAB	HALAMAN
	02 / 10 2024	- perbaikan kalimat - penambahan teori pembebanan dan rumus yang digunakan		

Cilegon, 27 September 2024
Dosen Pembimbing

Dr. Subekti S.T., M.T.
NIP. 197506122008011020



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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Smp-06

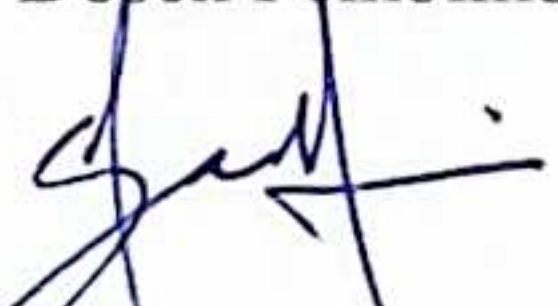
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Telepon (0254) 376712 Laman: ft.untirta.ac.id

BUKTI PERBAIKAN PROPOSAL SKRIPSI

Nama Peserta : Rifda Syafrida
NPM : 3336210010

NO	HARI/ TANGGAL	PERIHAL	BAB	HALAMAN
	22 / 10 2024	- Perbaikan skematis pembebanan - perbaikan gambar detail struktur - penambahan tiori struktur dolphin		8

Cilegon, 27 September 2024
Dosen Pembimbing


Baehaki, S.T., M. Eng
NIP. 198705082015041001



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
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BUKTI PERBAIKAN PROPOSAL SKRIPSI

Nama Peserta : Rifda Syafrida
NPM : 3336210010

NO	HARI/ TANGGAL	PERIHAL	BAB	HALAMAN
	04 / 10 / 2024	- Perbaikan data sekunder yang digunakan - Penambahan rumus / persamaan dalam metode logi		

Cilegon, 24 September 2024
Dosen Penguji

Dr. Eng. B. Adhi Priyambodho, S.T., M.T.
NIP. 197704042009121001



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
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Smp-07

Jalan Jenderal Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

FORM BIMBINGAN TUGAS AKHIR

Nama Mahasiswa : Rifda Syafrida
NIM : 3336210010
Program Studi : Teknik Sipil
Semester : Ganjil
Pembimbing I : Dr. Subekti, S.T., M.T.
Judul Tugas Akhir : ANALISIS STRUKTUR BREASTING DOLPHIN DAN
MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT
(Studi Kasus: Dermaga Tipe Jetty PT. XYZ Kota Cilegon)

No.	Tanggal	Topik Pembahasan	Paraf Pembimbing
1.	12 Februari 2024	- Pembinaan penyusunan proposal - Pengajuan surat untuk data TA	<i>Subekti</i>
2.	20 Februari 2024	Pemilihan metode pengisian data pasang surut	<i>Subekti</i>
3.	08 Mei 2024	- Revisi Judul - Pengajuan surat permohonan perminaan data angin dengan tarif nol rupiah ke BMKG - Revisi Bab 1, 3 dan 4	<i>Subekti</i>
4.	13 Mei 2024	Acc Judul	<i>Subekti</i>
5.	18 Mei 2024	Revisi Bab 2 dan bab 3	<i>Subekti</i>
6.	12 Juni 2024	Pengisian data angin dengan WRPLDT	<i>Subekti</i>
7.	27 Juni 2024	Penentuan alur pengerjaan Bab 5	<i>Subekti</i>
8.	03 Juli 2024	- Penambahan teori dasar mengenai redaman alur - Perhitungan redaman alur	<i>Subekti</i>



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9.	09 Agustus 2024	- Penjabaran isi dari bab 5 - membuat layout kapal tanker 10.000 DWT - membuat plot lokasi bangunan dermaga	
10.	14 Agustus 2024	- Revisi plot gambar - Revisi tujuan masalah & latar belakang - Prosedur bollard dan fender	
11.	12 September 2024	Penambahan flowchart gaya & yang bekerja pada struktur dolphin	
12.	18 September 2024	Acc Seminar Proposal	
13.	02 Oktober 2024	Perbaikan : latar belakang, prosedur penelitian dan data penelitian Bab : Pembahasan vertikal dan horizontal	
14.	04 Oktober 2024	- latar belakang dan teori pembebanan gelombang - kesimpulan dan saran	
15.	05 Oktober 2024	- Revisi kesimpulan - Acc Seminar Hasil	
16.	06 Januari 2025	- Perbaikan : Pembebanan sandar $\left(\frac{wv^3}{g}\right) d (V' = \dots \times \sin 10^\circ)$	
17.	23 Januari 2025	Acc sidang akhir	

Cilegon, 07 Januari 2025
Mahasiswa,

Rifda Syafrida
NIM. 3336210010

Mengetahui,
Pembimbing I Skripsi,

Dr. Subekti, S.T., M.T.
NIP. 197506122008011020



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS SULTAN AGENG TIRTAYASA
FAKULTAS TEKNIK

Smp-07

Jalan Jenderal Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

FORM BIMBINGAN TUGAS AKHIR

Nama Mahasiswa : Rifda Syafrida
NIM : 3336210010
Program Studi : Teknik Sipil
Semester : Ganjil
Pembimbing II : Baehaki, S.T., M. Eng
Judul Tugas Akhir : ANALISIS STRUKTUR BREASTING DOLPHIN DAN
MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT
(Studi Kasus: Dermaga Tipe Jetty PT. XYZ Kota Cilegon)

No.	Tanggal	Topik Pembahasan	Paraf Pembimbing
1.	04 September 2024	Pendistribusian beban-beban yang bekerja pada struktur Breastling dolphin & mooring dolphin	
2.	18 September 2024	Daya dukung lateral tiang pancang	
3.	16 Oktober 2024	<i>Revisi Beban 1 2 Angka Beban 2 - Rumus 3 2 Aksi 1 2</i> } <i>dicet</i>	
4.	22 Oktober 2024	Struktur pembebanan pada nainah laporan	
5.	28 Oktober 2024	Input pembebanan angin dan revisi material	
6.	13 November 2024	Perhitungan daya dukung lateral tiang pancang	
7.	14 November 2024	Perhitungan daya dukung aksial tiang pancang	
8.	24 Desember 2024	Perhitungan joint reaksi & daya dukung aksial tiang	



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9.	06 Januari 2025	Perhitungan arsitek teman (N-SPT & mutu bahan)	4
10.	20 Januari 2025	Acc sidang akhir	2

Cilegon, 07 Januari 2025
Mahasiswa,

Rifda Syafrida
NIM. 3336210010

Mengetahui,
Pembimbing II Skripsi,

Baehaki, S.T., M. Eng
NIP. 198705082015041001



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS SULTAN AGENG TIRTAYASA
FAKULTAS TEKNIK

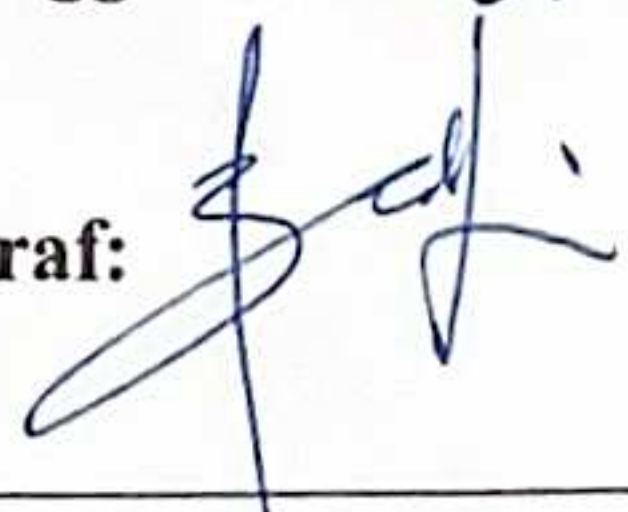
Jalan Jendral Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

FORM PERSETUJUAN TANGGAL SIDANG

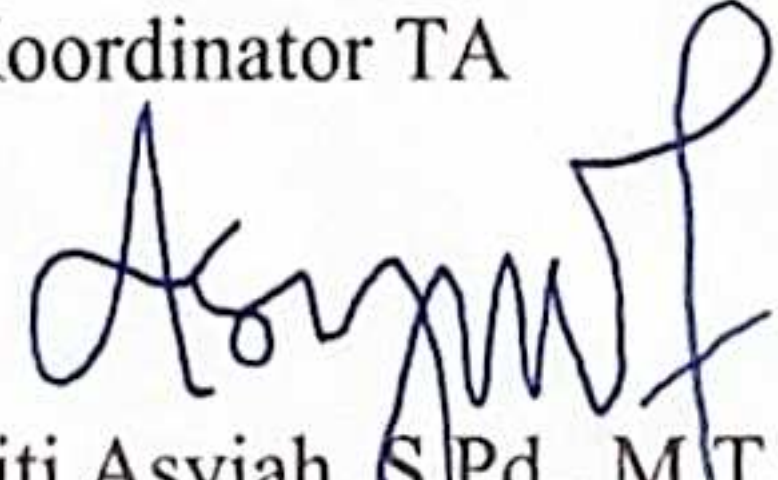
Nama : Rifda Syafrida
NIM : 3336210010
Jurusan : Teknik Sipil
Rencana Sidang : ~~Seminar Proposal~~/ Seminar Hasil/ ~~Sidang Akhir~~ *)
Waktu Sidang :

Hari/ Tanggal : Senin, 25 November 2024

Jam : 13.00 s/d Selesai

No	Nama Dosen	Pembimbing	Penguji	Tanda Tangan
1	Dr. Subekti, S.T., M.T.	I		Tanggal: 20 - 11 - 2024 Paraf: 
2	Bachaki, S.T., M. Eng	II		Tanggal: 21 - 11 - 2024 Paraf: 

Cilegon, 20 November 2024
Koordinator TA


Siti Asyiah, S.Pd., M.T.
NIP. 198601312019032009

*) coret yang tidak perlu



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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FAKULTAS TEKNIK

Hsl-01

Jalan Jenderal Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
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**BERITA ACARA SEMINAR HASIL SKRIPSI
JURUSAN TEKNIK SIPIL UNTIRTA**

Pada hari ini Senin tanggal 25 bulan November tahun 2024, telah dilaksanakan Seminar Hasil Skripsi dari mahasiswa/mahasiswi, yaitu :

Nama : Rifda Syafrida

NPM : 3336210010

Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota Cilegon)

Dosen pembimbing I : Dr. Subekti, S.T., M.T.

Dosen pembimbing II: Baehaki, S.T., M. Eng

Dari Seminar Hasil Skripsi ini dinyatakan bahwa mahasiswa tersebut telah dinyatakan MEMENUHI PERSYARATAN / ~~TIDAK MEMENUHI PERSYARATAN~~ untuk melanjutkan ke Sidang Akhir *)

Demikian Berita Acara ini dibuat dan selanjutnya untuk dapat dipergunakan sebagaimana mestinya.

Cilegon, 25 November 2024

Dosen Pembimbing I

Dr. Subekti, S.T., M.T.

NIP. 197506122008011020

Dosen Pembimbing II

Baehaki, S.T., M. Eng

NIP. 198705082015041001

Ket : *) coret yang tidak perlu

CC : Arsip



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS SULTAN AGENG TIRTAYASA
FAKULTAS TEKNIK

Hsl-02

Jalan Jenderal Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

SARAN / MASUKAN
SEMINAR HASIL SKRIPSI

Hari/Tgl : Senin, 25 November 2024 Waktu : 13.00 WIB
Nama Peserta : Rifda Syafrida NPM : 3336210010
Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota Cilegon)

NO	HAL	MASUKAN/SARAN/KOREKSI/DLL	KET.
1.		Tata tulis laporan mohon diperhatikan	
2.		perhitungan gaya sandar mengacu pada buku Bambang triatmodjo.	

Cilegon, 25 November 2024
Dosen Pembimbing I

Dr. Subekti, S.T., M.T.
NIP. 197506122008011020



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS SULTAN AGENG TIRTAYASA
FAKULTAS TEKNIK

Hsl-02

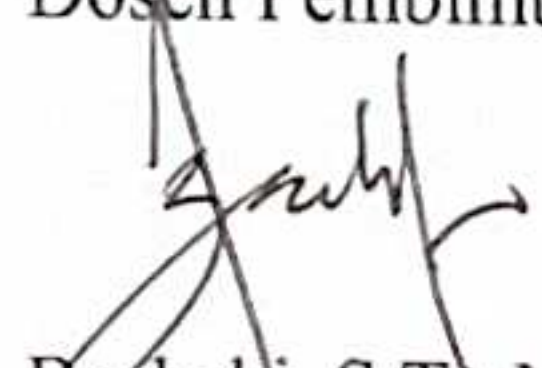
Jalan Jenderal Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

SARAN / MASUKAN
SEMINAR HASIL SKRIPSI

Hari/Tgl : Senin, 25 November 2024 Waktu : 13.00 WIB
Nama Peserta : Rifda Syafrida NPM : 3336210010
Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota Cilegon)

NO	HAL	MASUKAN/SARAN/KOREKSI/DLL	KET.
		Cek kembali gaya aksial tarikan yang terjadi pada reaksi penarikkan serta perhitungan kebutuhan tiang yang diperlukan	

Cilegon, 25 November 2024
Dosen Pembimbing II


Baehaki, S.T., M. Eng
NIP. 198705082015041001



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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Hsl-03

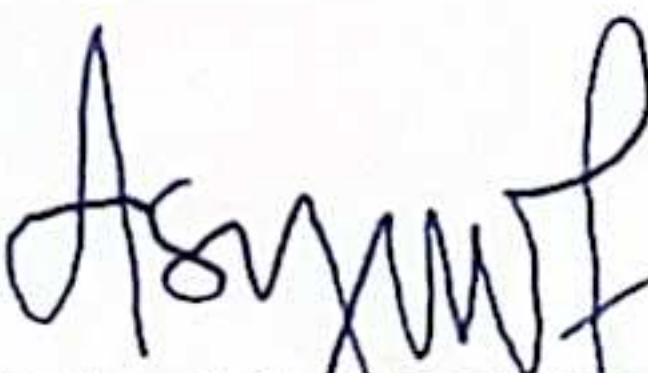
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Telepon (0254) 376712 Laman: ft.untirta.ac.id

DAFTAR HADIR SEMINAR HASIL SKRIPSI

Hari/Tgl : Senin, 25 November 2024
Waktu : 13.00 WIB
Nama Peserta : Rifda Syafrida
NPM : 3336210010
Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota Cilegon)

NO	NAMA	NIP	TANDA-TANGAN
1.	Dr. Subekti, S.T., M.T.	197506122008011020	1. 
2.	Baehaki, S.T., M. Eng	198705082015041001	2. 

Cilegon, 25 November 2024
Koordinator Skripsi


Siti Asyiah, S.Pd., M.T.
NIP.198601312019032009



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS SULTAN AGENG TIRTAYASA
FAKULTAS TEKNIK

Hsl-04

Jalan Jenderal Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

DAFTAR HADIR SEMINAR HASIL SKRIPSI

Hari/Tgl : Rabu, 25 November 2024
Waktu : 13.00 WIB
Nama Peserta : Rifda Syafrida
NPM : 3336210010
Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota Cilegon)

NO	NAMA	NPM	TANDA-TANGAN	KET.
1.	Nazwa Haya Salsabil	3336210071	1.	
2.	Almal Sulthon Al-Mubarak	3336210091	2.	
3.	Puput Pauriah	3336210007	3.	
4.	Zahran G	3336210078	4.	
5.	Ardiansyah dunes	3336210094	5.	
6.	Robby Firman Hidayat	3336210099	6.	
7.	Redina Rahmawati	3336210022	7.	
8.	Shaugi Aiman	3336210029	8.	
9.	M. Faisal Sumatto	3336210035	9.	
10.	M. Rendi Ardiansyah	3336210016	10.	
11.	Azyumarni Abra Harifah	3336210108	11.	
12.	Syahdan Raihan	3336210014	12.	
13.	Acheyba Vitania . S. S	3336210049	13.	
14.	Mulranah	3336210003	14.	
15.			15.	

Cilegon, 25 November 2024
Koordinator Skripsi

Siti Asyiah S.Pd., M.T.
NIP.198601312019032009



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS SULTAN AGENG TIRTAYASA
FAKULTAS TEKNIK
Jalan Jenderal Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

Hsl-05

BUKTI PERBAIKAN LAPORAN HASIL SKRIPSI

Nama Peserta : Rifda Syafrida
NPM : 3336210010

NO	HARI/ TANGGAL	PERIHAL	BAB	HALAMAN
		Acc revisi laporan Hasil Skripsi <i>[Signature]</i>		

Cilegon, 25 November 2024
Dosen Pembimbing I

Dr. Subekti, S.T., M.T.
NIP. 197506122008011020



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS SULTAN AGENG TIRTAYASA
FAKULTAS TEKNIK

Hsl-05

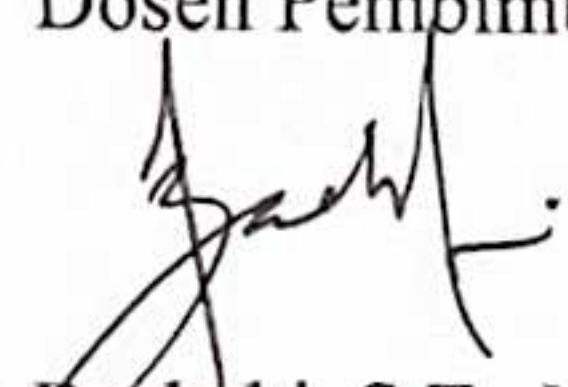
Jalan Jenderal Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

BUKTI PERBAIKAN LAPORAN HASIL SKRIPSI

Nama Peserta : Rifda Syafrida
NPM : 3336210010

NO	HARI/ TANGGAL	PERIHAL	BAB	HALAMAN
		ACL perhitungan daya dorong aksial tang Pancang		

Cilegon, 25 November 2024
Dosen Pembimbing II


Baehaki, S.T., M. Eng
NIP. 198705082015041001



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS SULTAN AGENG TIRTAYASA
FAKULTAS TEKNIK

Hsl-06

Jalan Jenderal Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

BUKTI KEHADIRAN TELAH MENGIKUTI SEMINAR

Nama Peserta : Rifda Syafrida
NPM : 3336210010

SEMINAR YANG PERNAH DIKUTI

NO	JUDUL	Mahasiswa	Paraf ¹
1	Analisis karakteristik dan kebutuhan ruang parkir berbasis green transportation (studi kasus : kampus C FKIP UNTIRTA)	Nazwa Haya Salsabil (3336210071)	
2	Analisis beban berlebih (Overload) terhadap umur rencana Perkerasan Jalan pada Jalan tol (studi kasus : ruas jalan tol Tangerang - Merak KM.49 - KM.55)	M. Rasiin Hidayat (3336200074)	
3	Perencanaan rute evakuasi bencana tsunami di wilayah Banten Selatan	Pisra Sendi Winata (3336200014)	
4	Stabilitas tanah lempung dengan menggunakan zeolit bayah dan semen portland terhadap nilai California bearing ratio (CBR) soaked	Lulu Salsabila (3336210048)	
5	Stabilitas tanah lempung menggunakan zeolit bayah dan semen portland terhadap nilai California bearing ratio (CBR) unsoaked	Wiza Yulia Putri (3336210002)	
6	Stabilitas tanah menggunakan abu sawit dan semen portland terhadap nilai CBR soaked (studi kasus : Jalan Raya Sobang desa Ciamis Kecamatan Sobang Kabupaten Pandeglang)	Akhlan Musyafra (3336210008)	
7	Stabilitas tanah menggunakan abu sawit dan semen portland terhadap nilai kuat tekan bebas (studi kasus : Jalan raya Sobang desa Ciamis Kecamatan Sobang Kab. Pandeglang)	Ahmad Daeroby (3336210017)	
8	Stabilitas tanah lempung menggunakan serbuk limbah karet ban terhadap nilai kuat tekan bebas	Zahra Aninda Nur Fazy (3336210063)	
9	Pengaruh penambahan abu sawit dan semen portland terhadap nilai CBR unsoaked (studi kasus : Jl. Raya Sobang, Ciamis, Kecamatan Sobang, Pandeglang, Banten)	Puput Pauziah (3336210007)	
10	Stabilitas tanah lempung menggunakan serbuk limbah karet ban terhadap nilai CBR (California bearing ratio) unsoaked	Siti Djulia Nurcahya (3336210057)	

¹ paraf pembimbing 1 skripsi



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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Jalan Jendral Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

FORM PERSETUJUAN TANGGAL SIDANG

Nama : Rifda Syafrida
NIM : 3336210010
Jurusan : Teknik Sipil
Rencana Sidang : ~~Seminar Proposal/ Seminar Hasil/~~ Sidang Akhir *)
Waktu Sidang :

Hari/ Tanggal : Kamis, 30 Januari 2025

Jam : 09.00 s/d selesai

No	Nama Dosen	Pembimbing	Penguji	Tanda Tangan
1	Dr. Subekti, S.T., M.T.	I		Tanggal: 23/01/2025 Paraf:
2	Baehaki, S.T., M. Eng	II		Tanggal: 23/01/2025 Paraf:
3	Dr. Eng. B. Adhi Priyambodho, S.T., M.T.		I	Tanggal: 23/01/2025 Paraf:
4	Zulmahdi Darwis, S.T., M. Eng		II	Tanggal: Paraf:

Cilegon, 23 Januari 2025
Koordinator TA

Siti Asyiah, S.Pd., M.T.
NIP. 198601312019032009

*) coret yang tidak perlu



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS SULTAN AGENG TIRTAYASA
FAKULTAS TEKNIK

Jalan Jenderal Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

Ahr-01

SURAT PERMOHONAN SIDANG AKHIR SKRIPSI

Yang bertanda tangan di bawah ini, saya mahasiswa Program Sarjana Jurusan Teknik Sipil
Fakultas Teknik Universitas Sultan Ageng Tirtayasa,

Nama Mahasiswa : Rifda Syafrida
Nomor Mahasiswa : 3336210010
Alamat Mahasiswa : Jl. TB Buang Link. Cikuasa RT 01 RW 01 No. 05 Kelurahan
Gerem, Kecamatan Gerogol, Kota Cilegon, Banten ID 42438
Dosen Pembimbing : 1. Dr. Subekti, S.T., M.T.
2. Baehaki, S.T., M. Eng

dengan prestasi studi 3,63 sampai dengan tanggal: 07 Januari 2025 seperti terlampir. Dengan ini
saya mengajukan permohonan untuk dapat menyelenggarakan sidang akhir skripsi.

Cilegon, 07 Januari 2025

Pemohon,

Rifda Syafrida

PEMERIKSAAN (oleh Koord. Skripsi)

No	Perihal	Catatan
1.	Hasil studi kumulatif (≥ 139 sks dan $IPK \geq 2,00$)	..141..sks, $IPK \geq 3,63$.
2.	Hasil studi kumulatif (nilai $D \leq 10\%$)	Nilai D %
3.	Draf laporan telah disetujui Dosen Pembimbing (TA-02) Salinan sebanyak 4 eksemplar	
4.	Formulir Pendaftaran (TA-03) dari Online: SISTA	
5.	Berita Acara Sidang Akhir (TA-04) dari Online: SISTA	
6.	Formulir Penilaian Skripsi (TA-05) dari Online: SISTA	
7.	Formulir Revisi Laporan Skripsi (TA-06) dari Online: SISTA	
8.	Daftar hadir dosen (Ahr-02)	
9.	Formulir saran & masukan (Ahr-03)	
10.	Transkip Nilai Mahasiswa ditandatangani Mahasiswa	
11.	Form bukti pelaksanaan seminar hasil (Hsl-01 sampai Hsl-06)	
12.	Sertifikat TOEFL Lab. Bahasa FT. Untirta (Min. Score 400)	

Sidang Akhir tersebut dapat dilaksanakan, waktu dan tempat seminar harap dikonsultasikan
dengan Dosen Pembimbing dan Dosen Penguji.

Cilegon, 07 Januari 2025

Koordinator Skripsi,

Siti Asyiah, S.Pd., M.T.
NIP. 198601312019032009

Dibuat rangkap 3 untuk:

1. Mahasiswa ybs
2. Koordinator Skripsi

* Pendaftaran Sidang Akhir Skripsi selambat-lambatnya 5 hari kerja sebelum sidang dilaksanakan.



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS SULTAN AGENG TIRTAYASA
FAKULTAS TEKNIK

Ahr-02

Jalan Jenderal Soedirman KM. 3 Kota Cilegon Provinsi Banten 42435
Telepon (0254) 376712 Laman: ft.untirta.ac.id

DAFTAR HADIR SIDANG AKHIR SKRIPSI

Hari/Tgl : Senin, 03 Februari 2025
Waktu : 09.00 WIB
Nama Peserta : Rifda Syafrida
NPM : 3336210010
Judul Skripsi : Analisis Struktur *Breasting Dolphin* dan *Mooring Dolphin* Untuk Kapal Tanker 10.000 DWT (Studi Kasus: Dermaga Tipe *Jetty* PT. XYZ Kota Cilegon)

NO	NAMA	NIP	TANDA-TANGAN
1.	Dr. Subekti, S.T., M.T.	197506122008011020	1.
2.	Baehaki, S.T., M. Eng	198705082015041001	2.
3.	Dr. Eng. B. Adhi Priyambodho, S.T., M.T.	197704042009121001	3.
4.	Zulmahdi Darwis, S.T., M. Eng	197706182008011005	4.

Cilegon, 03 Februari 2025
Koordinator Skripsi

Siti Asyiah, S.Pd., M.T.
NIP.198601312019032009

FORM PENDAFTARAN TUGAS AKHIR

Saya yang bertanda tangan dibawah ini :

Nama Lengkap : RIFDA SYAFRIDA
NIM : 3336210010
Tempat/Tgl Lahir : CILEGON/30 April 2003
Program Studi : Teknik Sipil
Semester Mulai :
Jumlah SKS yang sudah diselesaikan : 139 SKS
IPK : 3.63
Topik TA : Sumber Daya Air
Judul TA : ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT (Studi Kasus: Dermaga Tipe Jetty PT. XYZ Kota Cilegon)
Judul Asing : DOLPHIN AND BREASTING STRUCTURE ANALYSIS DOLPHIN MOORING FOR 10,000 DWT TANKER SHIPS (Case Study: PT. XYZ Jetty Type Pier, Cilegon City)

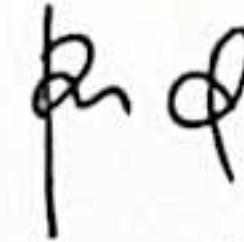
Dengan Persyaratan:

Cilegon, 24 September 2024
Pendaftar,



RIFDA SYAFRIDA
NIM. 3336210010

Mengetahui,
Pembimbing Akademik,



Dr.. RINDU TWIDI BETHARY, S.T., M.T.
NIP. 198212062010122001

Menyetujui
Pembimbing I,



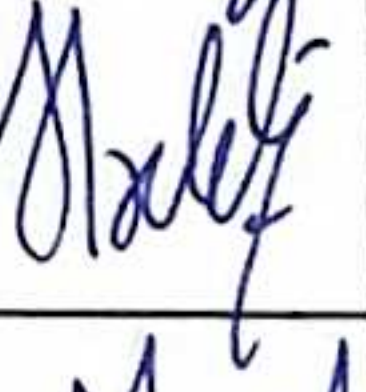
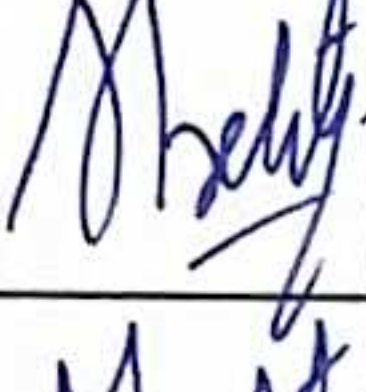
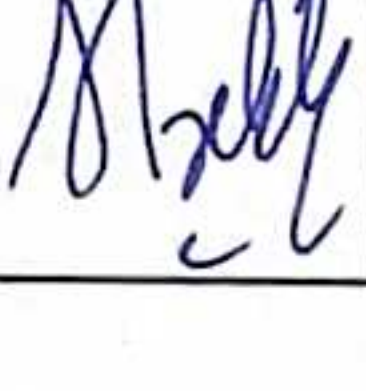
NIP.

FORM BIMBINGAN TUGAS AKHIR

Nama Mahasiswa : RIFDA SYAFRIDA
 NIM : 3336210010
 Program Studi : TEKNIK SIPIL - S1 Reguler
 Semester : Ganjil Tahun Akademik 2024/2025
 Pembimbing 1 : Dr. SUBEKTI, S.T., M.T.

Judul Tugas Akhir:

ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT (Studi Kasus: Dermaga Tipe Jetty PT. XYZ Kota Cilegon)

No	Tanggal	Topik Pembahasan	Paraf Pembimbing
1.	09 Agustus 2024	- latar belakang, metode penelitian dan teori dasar dermaga Jetty - pengajuan surat permohonan data - data yang akan digunakan	
2.	14 September 2024	- Penambahan teori dasar mengenai kedalaman alur & elevasi dermaga - penambahan flow chart gaya-gaya yang bekerja pada struktur dolphin dermaga Jetty	
3.	18 September 2024	ACC Seminar Proposal	
4.	02 Oktober 2024	-Perbaikan : latar belakang, Prosedur penelitian dan data penelitian - Bab 5 pembebanan vertikal dan pembebanan horizontal	
5.	04 Oktober 2024	- latar belakang dan teori pembebanan gelombang - kesimpulan dan saran	
6.	25 Oktober 2024	- Revisi kesimpulan - ACC seminar hasil	
7.	06 Januari 2025	Perbaikan pada perhitungan pembebanan sandar menggunakan $\left(\frac{wv^2}{zg}\right)$ dan $(U' = \dots \times \sin 10^\circ)$	
8.	23 Januari 2025	ACC sidang akhir	

Cilegon, 07 Januari 2025
 Mahasiswa,



RIFDA SYAFRIDA

NIM 3336210010

Mengetahui,
 Pembimbing Akademik,



Dr. RINDU TWIDI BETHARY, S.T., M.T.

NIP 198212062010122001

FORM BIMBINGAN TUGAS AKHIR

Nama Mahasiswa : RIFDA SYAFRIDA
NIM : 3336210010
Program Studi : TEKNIK SIPIL - S1 Reguler
Semester : Ganjil Tahun Akademik 2024/2025
Pembimbing 2 : Baehaki, S.T., M.Eng.

Judul Tugas Akhir:
ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT (Studi Kasus: Dermaga Tipe Jetty PT. XYZ Kota Cilegon)

No	Tanggal	Topik Pembahasan	Paraf Pembimbing
1.	04 september 2024	- Redistribusi beban-beban yang bekerja pada struktur breasting dolphin dan mooring dolphin - Daya dukung lateral tiang pancang	
2.	18 september 2024	ACC Seminar proposal	
3.	22 Oktober 2024	- Skematik pembebanan gaya-gaya yang bekerja - Analisis pembebanan yang bekerja pada struktur - Input pembebanan angin dan revisi mutu material	
4.	13 November 2024	- pengecekan Output - Perhitungan daya dukung lateral tiang pancang	
5.	14 November 2024	- Perhitungan daya dukung aksial tiang pancang - ACC Seminar Hasil	
6.	24 Desember 2024	- Perhitungan Joint reaksi / Pemeriksaan output Joint reaksi - Daya dukung aksial tahanan (spun pile)	
7.	06 Januari 2025	- Perhitungan daya dukung aksial tahanan berdasarkan N-SPT (steel pile) - Perhitungan daya dukung aksial tarik berdasarkan N-SPT (steel pile)	
8.	20 Januari 2025	ACC sidang akhir	

Cilegon, 23 Januari 2025
Mahasiswa,


RIFDA SYAFRIDA
NIM. 3336210010

Mengetahui,
Pembimbing Akademik,


Dr.. RINDU TWIDI BETHARY, S.T., M.T.
NIP. 198212062010122001

FORM PENDAFTARAN SIDANG TA

Nama Mahasiswa : RIFDA SYAFRIDA
NIM : 3336210010
Program Studi : Teknik Sipil
Semester Mulai : Tahun Akademik 2024/2025
Topik TA : Sumber Daya Air
Judul Tugas Akhir :
ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT (Studi Kasus: Dermaga Tipe Jetty PT. XYZ Kota Cilegon)

Dengan ini mengajukan untuk pelaksanaan Sidang Ujian Tugas Akhir dengan menyampaikan persyaratan terlampir.

1.

Cilegon, 07 Januari 2025
Mahasiswa,



RIFDA SYAFRIDA
NIM 3336210010

Mengetahui,
Pembimbing Akademik



Dr.. RINDU TWIDI BETHARY, S.T., M.T.
NIP 198212062010122001

Menyetujui,

Pembimbing 1 : **Dr.. SUBEKTI, S.T., M.T.**
NIP. 197506122008011020

Pembimbing 2 : **Baehaki, S.T., M.Eng.**
NIP. 198705082015041001



Biodata Mahasiswa

NAMA : RIFDA SYAFRIDA
NIM : 3336210010
Tempat/Tanggal Lahir : CILEGON / 30 April 2003
Jenis Kelamin : Perempuan
Agama : ISLAM
Alamat Email : 3336210010@untirta.ac.id
No. Handphone : 085718283035
Alamat : Jl. TB Buang Link. Cikuasa 1 RT 01 RW 01 No 05 Kelurahan Gerem
Kecamatan Gerogol
Fakultas : Teknik
Program Studi : Teknik Sipil
Jumlah SKS : 139 SKS
IPK : 3.63
Angkatan : 2021

**Riwayat Pendidikan**

Sekolah Dasar : SDN Cikuasa 1
SLTP : MTS. Al-khairiyah Rawa Arum
SLTA : MAN 2 Kota Cilegon

Pendidikan Khusus/Pelatihan

Tidak ada Data

Data Keluarga

Nama Ayah : Fathurohman
No. Handphone Ayah : 087774641503
Nama Ibu : Herawati
No. Handphone Ibu : 083848772930
Jumlah Kakak : 0
Jumlah Adik : 3
Alamat Orang Tua : Jl. TB Buang Link Cikuasa No 05 RT 01 RW 01
Kantor Orang Tua : Jl. Raya Merak, Km. 117, RT. 002/04, Gerem, Pulo Merak, Cilegon, Jawa Barat, 42438,
Indonesia
Alamat Kantor Orang Tua : Jl. Raya Merak, Km. 117, RT. 002/04, Gerem, Pulo Merak, Cilegon, Jawa Barat, 42438,
Indonesia

Prestasi Terbaik Pribadi

Tidak ada Data

Riwayat Organisasi

Tidak ada Data

Riwayat Kepanitiaan

Tidak ada Data

Kompetensi yang dikuasai

Tidak ada Data

Serang, 07 Januari 2025
Mahasiswa,

RIFDA SYAFRIDA
NIM. 3336210010

BERITA ACARA SIDANG SKRIPSI / TUGAS AKHIR

Pada hari ini, Tanggal 13 Bulan Januari Tahun 2025, bertempat di III-20 (R.Sidang) Fakultas Universitas Sultan Ageng Tirtayasa, telah dilaksanakan Ujian Sidang Skripsi/Tugas Akhir atas nama:

Nama Mahasiswa : RIFDA SYAFRIDA
NIM : 3336210010
Penguji : Ketua Sidang : Dr. SUBEKTI, S.T., M.T.
Penguji I : Dr. Eng. B. Adhi Priyambodho, S.T., M.T.
Penguji II : ZULMAHDI DARWIS, S.T., M.Eng.
Penguji III : Baehaki, S.T., M.Eng.
Judul TA : ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER
Waktu : 10.000 DWT (Studi Kasus: Dermaga Tipe Jetty PT. XYZ Kota Cilegon)
Catatan Kejadian : 09:00

Demikian Berita Acara ini dibuat dengan sebenarnya untuk diketahui dan dipergunakan sebagaimana mestinya.

Cilegon, 13 Januari 2025

Ketua Sidang : Dr. SUBEKTI, S.T., M.T.
NIP. 197506122008011020

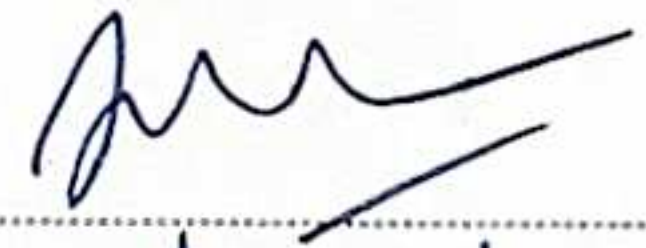
Penguji I : Dr. Eng. B. Adhi Priyambodho, S.T., M.T.
NIP. 197704042009121001

Penguji II : ZULMAHDI DARWIS, S.T., M.Eng.
NIP. 197706182008011005

Penguji III : Baehaki, S.T., M.Eng.
NIP. 198705082015041001









FORM REVISI LAPORAN SKRIPSI/TUGAS AKHIR

Nama : RIFDA SYAFRIDA
NIM : 3336210010
Program Studi : TEKNIK SIPIL
Tanggal Sidang : 13 Januari 2025
Semester Mulai : Ganjil 2024/2025
Judul Tugas Akhir :

ANALISIS STRUKTUR BREASTING DOLPHIN DAN MOORING DOLPHIN UNTUK KAPAL TANKER 10.000 DWT (Studi Kasus: Dermaga Tipe Jetty PT. XYZ Kota Cilegon)

NO	NAMA PENGUJI	HAL YANG PERLU DIREVISI	PARAF
1	Dr.. SUBEKTI, S.T., M.T.		Tgl: 
2	Dr. Eng.. B. Adhi Priyambodho, S.T., M.T.		Tgl: 
3	ZULMAHDI DARWIS, S.T., M.Eng.		Tgl: 
4	Bachaki, S.T., M.Eng.		Tgl: 

Cilegon, 13 Januari 2025
Pembimbing Akademik,



Dr.. RINDU TWIDI BETHARY, S.T., M.T.
NIP. 198212062010122001