

ERASMUS MUNDUS MSC PROGRAMME

COASTAL AND MARINE ENGINEERING AND MANAGEMENT

CoMEM

STUDY OF FATIGUE DESIGN
ON MARINE CURRENT TURBINE SUPPORT STRUCTURE
BALI - INDONESIA

APPENDICES

UNIVERSITY OF SOUTHAMPTON

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A.1 ENVIRONMENT DATA

A.1.1 Summary of Metocean Parameters Kangean Block Area

Location			Pagerungan Station	
Water Depth (m)			70	
Return Period			1	100
Metocean Parameter	Symbol	Unit		
Wind speed				
60-minute mean	W_{60}	m/s	10.7	19.8
1-minute mean	W_1	m/s	13.3	24.6
3-second gust	W_{gust}	m/s	16.1	29.9
Wave Height				
Significant wave height	H_s	m	3.4	6.2
Significant wave period	T_s	s	6.9	8.9
Significant wave length	L_s	m	73.8	124.8
Max. individual wave height	H_{max}	m	6.1	11.2
Max. individual wave period	T_{max}	s	8.9	11.6
Max. individual wave length	L_{max}	m	124.8	211.0
Water Level				
Highest water level (above MSL)		m	0.95	
Lowest water level (below MSL)		m	0.98	
Storm surge (above MSL)	η	m	0.02	0.09
Current Speed				
Wind- and tide-induced				
0% of depth	V_0	m/s	0.55	0.94
10% of depth	V_{10}	m/s	0.53	0.81
20% of depth	V_{20}	m/s	0.52	0.79
30% of depth	V_{30}	m/s	0.50	0.76
40% of depth	V_{40}	m/s	0.48	0.72
50% of depth	V_{50}	m/s	0.46	0.69
60% of depth	V_{60}	m/s	0.44	0.65
70% of depth	V_{70}	m/s	0.41	0.61
80% of depth	V_{80}	m/s	0.38	0.56
90% of depth	V_{90}	m/s	0.35	0.51
100% of depth	V_{100}	m/s	0.32	0.46

Used for Fatigue Analysis

A.1.2 Percentage of Wave Occurrences on Pagerungan Station (NCEP Data)

$$L(v) = 1 + \frac{1}{4} v^2 \quad \text{for } v \leq 0.6$$

Information for significant wave height (H_s) is obtained from wave hindcasting based on selected wind data. Calculation of individual wave height is performed in the denomination of month.

Monthly spectral parameters needed for the calculation is obtained from monthly significant wave height (H_s) which is then used in Pierson-Moskowitz (PM) spectrum.

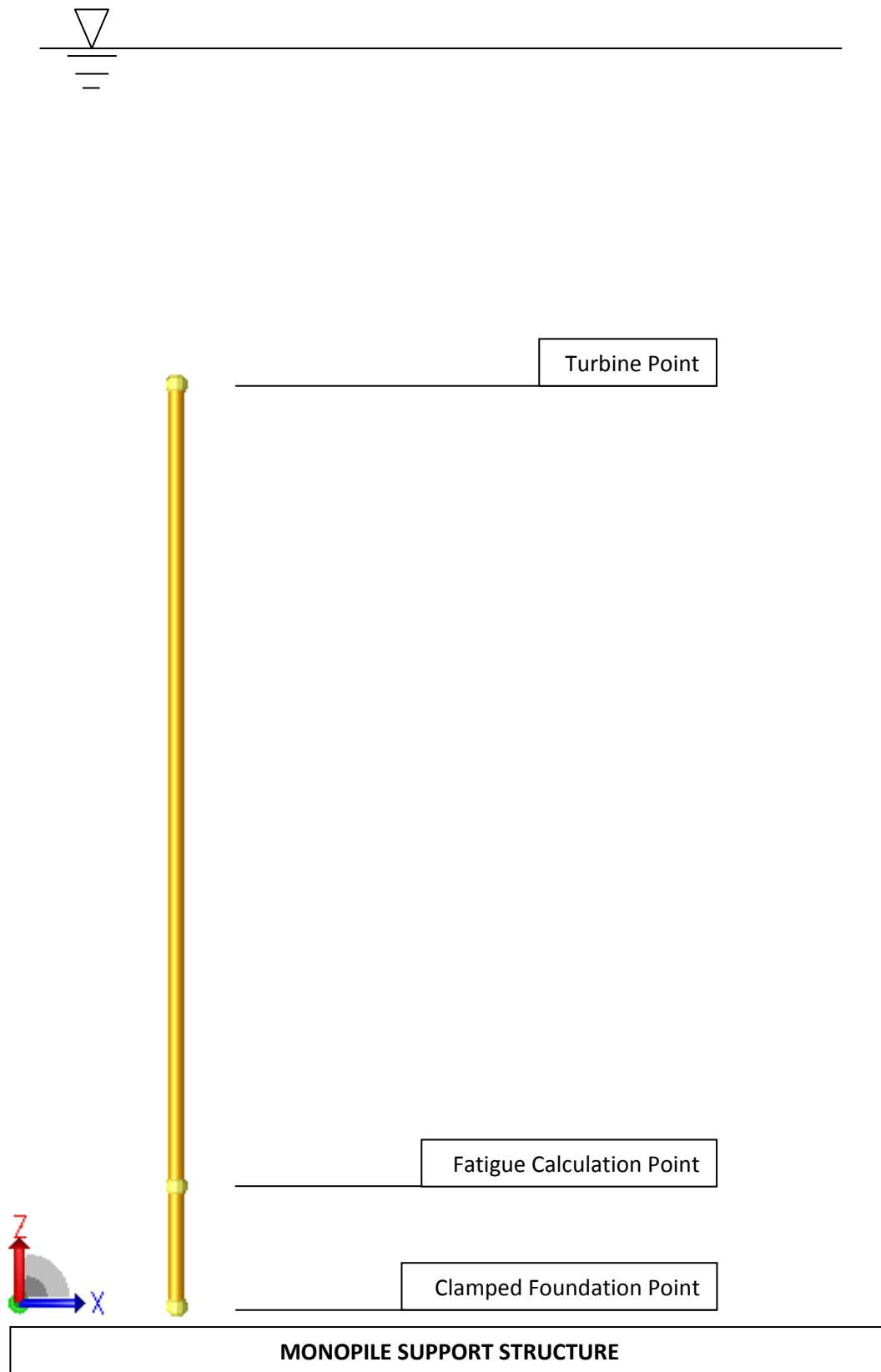
Direction (to)	Wave Height (m)						Total (%)
	0.1-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	>2.5	
North	0.48	0.92	2.48	0.18	0.75	0.10	4.90
North East	0.56	0.49	0.99	0.03	0.11	0.01	2.19
East	0.52	1.31	4.63	1.05	3.42	2.38	13.32
South East	0.67	1.83	7.64	2.59	5.43	3.18	21.34
South	0.52	0.99	2.29	0.23	0.41	0.03	4.46
South West	0.56	0.63	1.53	0.11	0.10	0.00	2.93
West	0.70	1.68	5.78	1.41	3.37	0.85	13.78
North West	0.51	1.83	10.32	2.19	11.57	2.60	29.02
Calm							8.06
Total	4.52	9.69	35.64	7.79	25.16	9.14	100.00

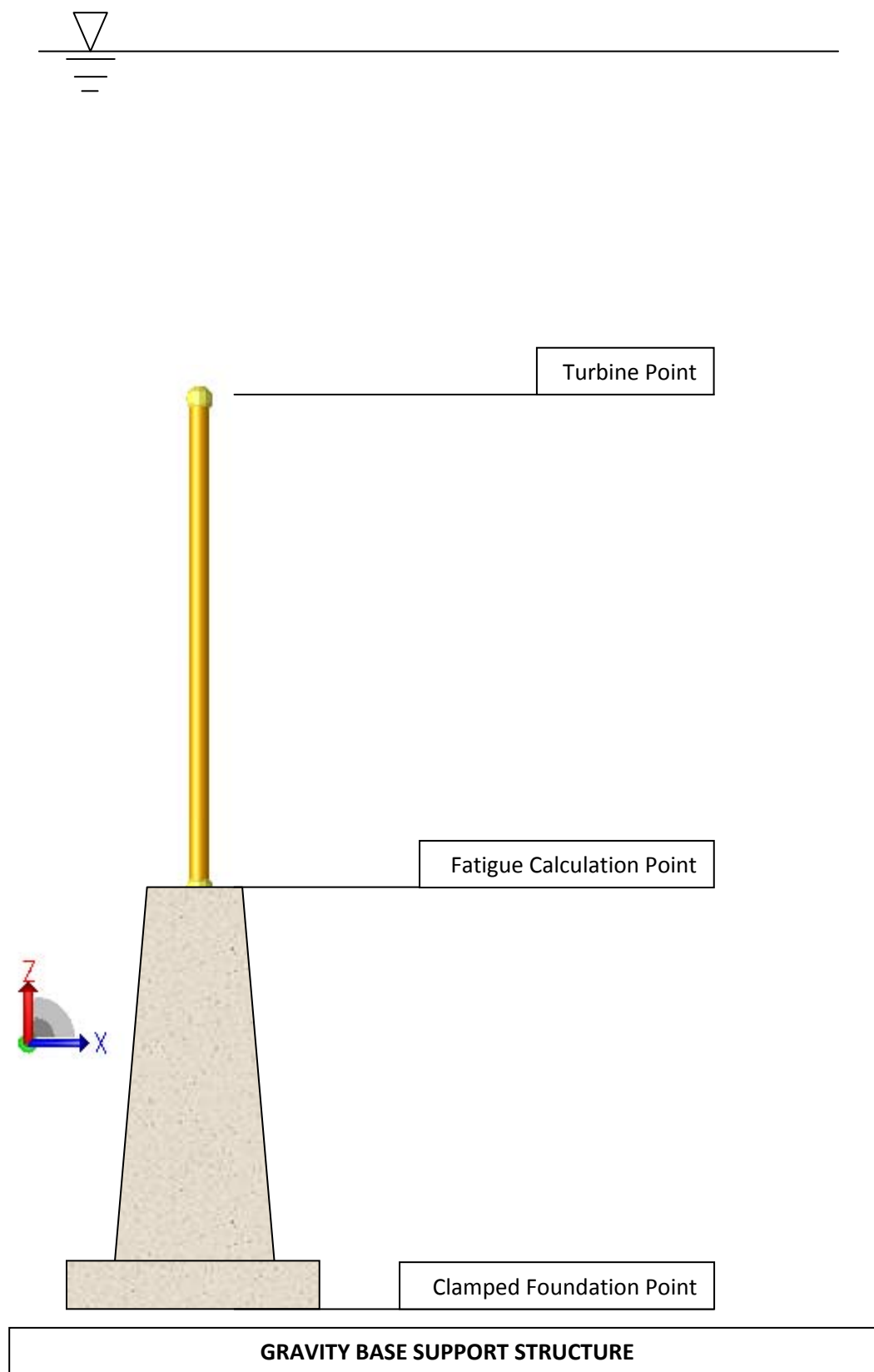
A.1.3 Distribution of Individual Wave Height and Period for Fatigue Analysis at Pagerungan Station

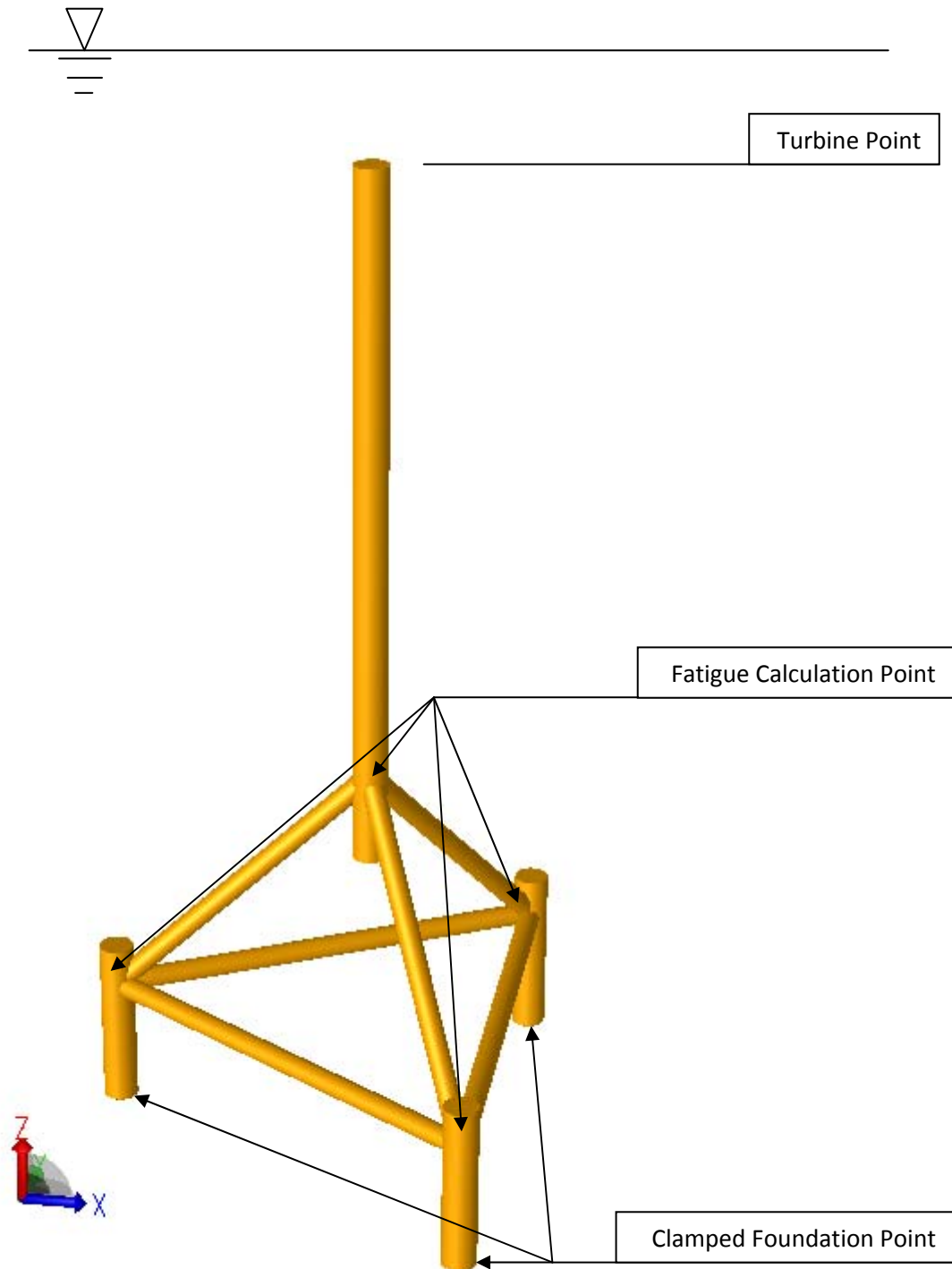
Interval Of wave height	Interval of wave period (sec)															Total
	0.0-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	13.0-14.0	14.0-15.0	
(m)	0.0-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	13.0-14.0	14.0-15.0	
0.0-0.5	740703	2900025	3695034	1562454	597726	263625	133604	75434	46242	30176	20686	14748	10856	8207	6342	10105862
0.5-1.0	0	148073	2900383	2516595	829251	265945	99853	43754	21733	11889	7015	4393	2872	1953	1362	6855071
1.0-1.5	0	104	259099	746868	278661	64183	15815	4606	1544	561	212	77	25	1	0	1371756
1.5-2.0	0	0	7824	98626	53935	8926	1195	133	3	0	0	0	0	0	-0	170642
2.0-2.5	0	0	78	7764	6590	678	10	0	0	0	0	0	0	0	0	15120
2.5-3.0	0	0	0	330	430	6	0	0	0	0	0	0	0	0	0	766
3.0-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	740703	3048202	6862418	4932637	1766593	603363	250477	123927	69522	42626	27913	19218	13753	10161	7704	18519217

A.2 COMPUTER MODEL PLOT

A.2.1 Isometric View

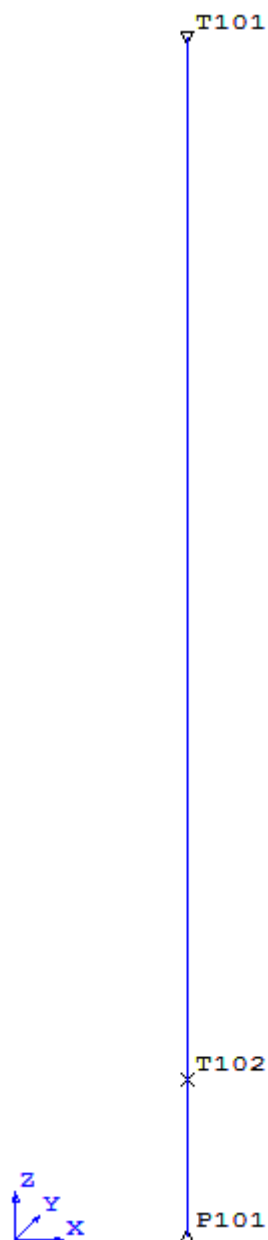




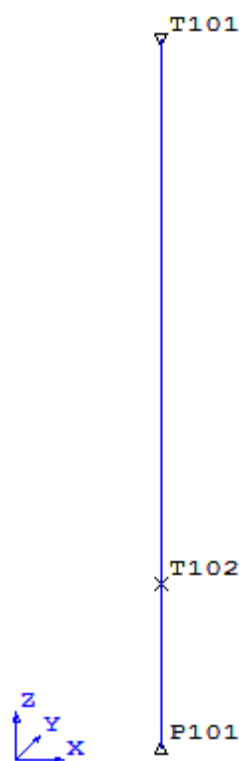


TRIPOD SUPPORT STRUCTURE

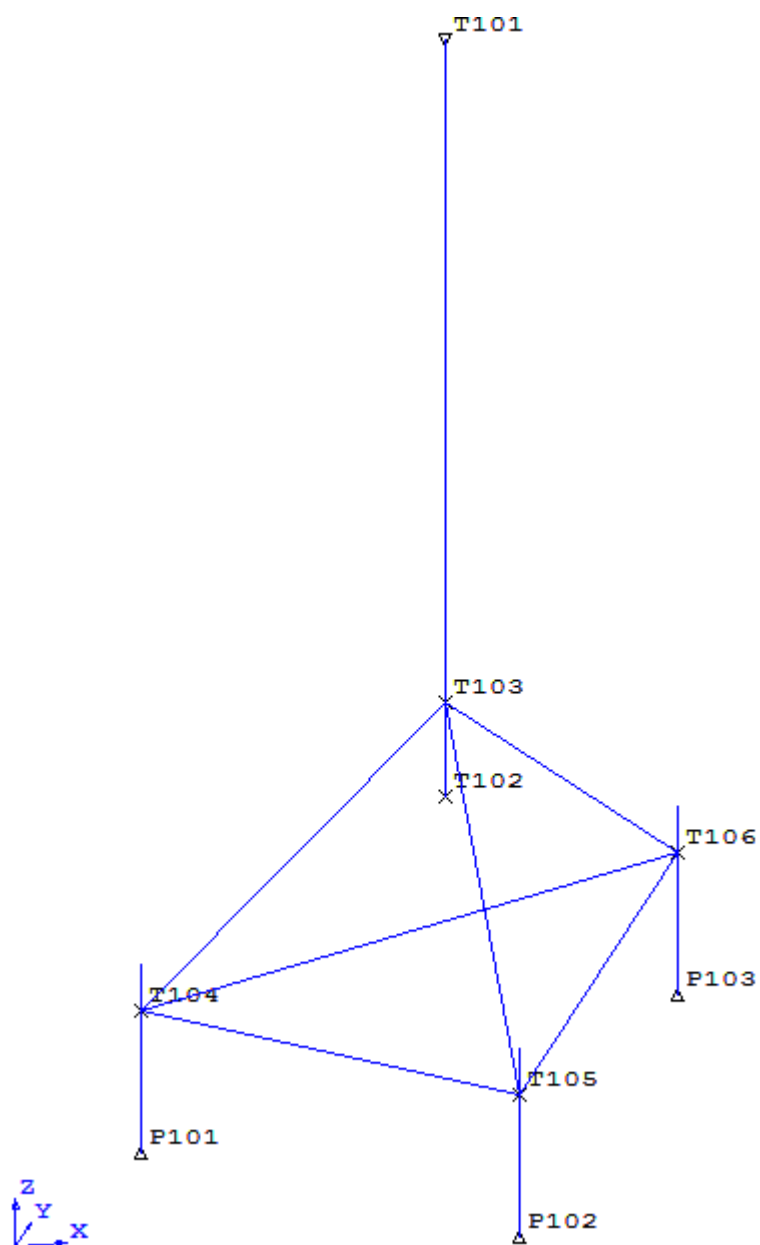
A.2.2 Node Number



MONOPILE SUPPORT STRUCTURE



GRAVITY BASE SUPPORT STRUCTURE

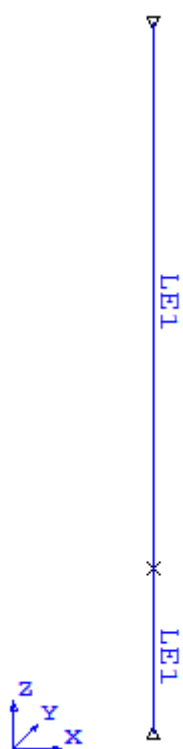


TRIPOD SUPPORT STRUCTURE

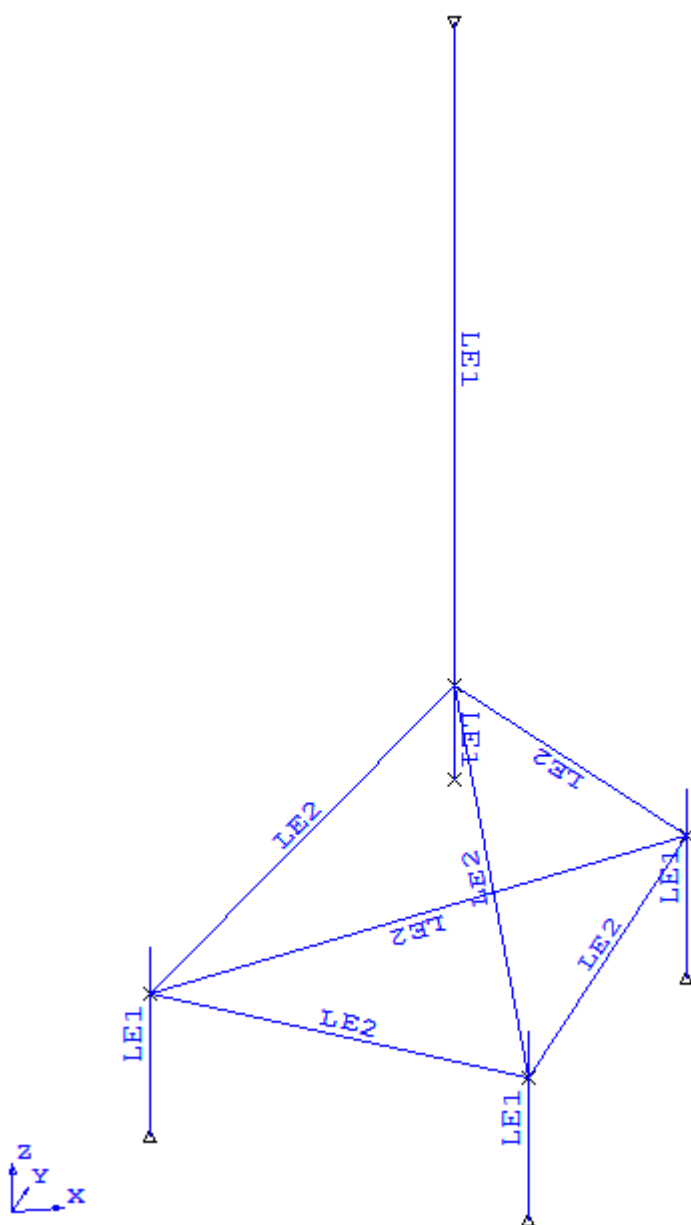
A.2.3 Group Member



MONOPILE SUPPORT STRUCTURE



GRAVITY BASE SUPPORT STRUCTURE



TRIPOD SUPPORT STRUCTURE

A.2.4 SACS Input

A.2.4.1 Monopile

```

LDOPT      NF+Z    1.025    7.85  -20.00   20.00GLOBMN      CMB
Marine Current Turbine - Spectral Fatigue Analysis
*****
*
*                      MARINE CURRENT TURBINE
*          -----
*
*      A. Platform information :
*      - Location              : Pagerungan - Indonesia
*      - Function              : Marine Current Turbine (Monopile)
*      - Water depth           : 20 m
*
*      B. Model description :
*      General :
*      - All input data are taken from :
*          1.LAPI ITB, 2005,
*            Final report of Metocean Design Criteria
*            for General Kangean Block Area
*          2.API RP2A WSD 2000 21th Edition
*
*      Basic Load case description :
*      LC      DESCRIPTION:
*      1      SELF-WEIGHT INC. BUOYANCY
*      2      SELF-WEIGHT NO BUOYANCY
*      3      TOPSIDE LOAD
*
*      Loading :
*      - Assumed 20% contingency will be added on
*        load case 3
*
*      Seastate :
*      - Consider wave kinematic factor 1.0 for fatigue analysis
*      - CD/CM increase of 5% due to Anode (API RP 2A - WSD)
*        Fouled : CD = 1.05 * 0.80 = 0.840 ,   CM = 1.05 * 2.00 = 2.10
*        Clean  : CD = 1.05 * 0.50 = 0.525 ,   CM = 1.05 * 2.00 = 2.10
*      - Marine Growth thickness of 5cm from seabed to LAT
*
* Prepared by: TA
*
*=====
*
OPTIONS      MN      SDUC    5 2    DC  APT  PTPTPTPTPTPTPTPT
*
LCSEL ST      MASS
*
UCPART      0.00 0.50 0.50 1.00 1.001.+04
GRUP
*
GRUP LE1      20.000 2.500 20.00 8.0034.50 1    1.001.00    0.50F 7.850
MEMBER
*
MEMBER T101T102 LE1      2.002.00
MEMBER T102P101 LE1
JOINT
*
JOINT P101      0.      0.    -21.      -50.000 111111
JOINT T101      0.      0.    -10.      222000
JOINT T102      0.      0.    -20.
CDM
CDM      0.10 0.525      2.100      0.840      2.100
CDM      300.00 0.525      2.100      0.840      2.100
MGROV
MGROV      0.000 200.000    5.000      1.233
LOAD
*
*===== L O A D I N G S =====*
*
LOADCN      1

```

```

LOADLB 1 SELF-WEIGHT INC. BUOYANCY
DEAD
DEAD -Z 20.000 1.025M
*
LOADCN 2
LOADLB 2 SELF-WEIGHT NO BUOYANCY
DEAD
DEAD -Z -20.000 0.001M
*
LOADCN 3
LOADLB 3 TOPSIDE LOAD
LOAD Z T101T102 -98.100 GLOB CONC TOPMASS
*
===== LOAD COMBINATIONS =====*
*
LCOMB
LCOMB DW 1 1.000 20.0500 3 1.200
LCOMB MASS 20.0500 3 1.200
END

```

A.2.4.2 GBS

```

LDOPT NF+Z 1.025 7.85 -20.00 20.00GLOBMN CMB
Marine Current Turbine - Spectral Fatigue Analysis
*****
*
* MARINE CURRENT TURBINE
* -----
*
* A. Platform information :
* - Location : Pagerungan - Indonesia
* - Function : Marine Current Turbine (GBS)
* - Water depth : 20 m
*
* B. Model description :
* General :
* - All input data are taken from :
* 1.LAPI ITB, 2005,
* Final report of Metocean Design Criteria
* for General Kangean Block Area
* 2.API RP2A WSD 2000 21th Edition
*
* Basic Load case description :
* LC DESCRIPTION:
* 1 SELF-WEIGHT INC. BUOYANCY
* 2 SELF-WEIGHT NO BUOYANCY
* 3 TOPSIDE LOAD
*
* Loading :
* - Assumed 20% contingency will be added on
* load case 3
*
* Seastate :
* - Consider wave kinematic factor 1.0 for fatigue analysis
* - CD/CM increase of 5% due to Anode (API RP 2A - WSD)
* Fouled : CD = 1.05 * 0.80 = 0.840 , CM = 1.05 * 2.00 = 2.10
* Clean : CD = 1.05 * 0.50 = 0.525 , CM = 1.05 * 2.00 = 2.10
* - Marine Growth thickness of 5cm from seabed to LAT
*
* Prepared by: TA
*
* =====
*
OPTIONS MN SDUC 5 2 DC APT PTPTPTPTPTPTPT
*
LCSEL ST MASS
*
UCPART 0.00 0.50 0.50 1.00 1.001.+04
GRUP
*
GRUP LE1 20.000 2.500 20.00 8.0034.50 1 1.001.00 0.50F 7.850
MEMBER
*
MEMBER T101T102 LE1 2.002.00

```

A.2.4.3 Tripod

2-12	Appendices
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```

*
* Prepared by: TA
*
*=====*
*
OPTIONS      MN      SDUC   5 2   DC  APT  PTPTPTPTPTPTPTPT
*
LCSEL ST      MASS
*
UCPART      0.00 0.50 0.50 1.00 1.001.+04
GRUP
*
GRUP LE1      40.000 2.500 20.00 8.0034.50 1      1.001.00      0.50F 7.850
GRUP LE2      25.000 1.500 20.00 8.0034.50 1      1.001.00      0.50F 7.850
*
MEMBER
MEMBER1P102T105 LE1
MEMBER OFFSETS      50.00
MEMBER1P103T106 LE1
MEMBER OFFSETS      50.00
MEMBER T101T103 LE1      2.002.00
MEMBER T103T102 LE1      2.002.00
MEMBER1P101T104 LE1
MEMBER OFFSETS      50.00
MEMBER T104T103 LE2
MEMBER T104T105 LE2
MEMBER T105T103 LE2
MEMBER T105T106 LE2
MEMBER T106T103 LE2
MEMBER T106T104 LE2
JOINT
*
JOINT P101      -3.      0.      -31.      -50.000 111111
JOINT P102      1.      -2.      -31. 50.000-59.808-50.000 111111
JOINT P103      1.      2.      -31. 50.000 59.808-50.000 111111
JOINT T101      0.      0.      -20.      222000
JOINT T102      0.      0.      -28.
JOINT T103      0.      0.      -27.
JOINT T104      -3.      0.      -30.
JOINT T105      1.      -2.      -30. 50.000-59.808
JOINT T106      1.      2.      -30. 50.000 59.808
CDM
CDM      0.10 0.525      2.100      0.840      2.100
CDM      300.00 0.525      2.100      0.840      2.100
MGROV
MGROV      0.000 200.000      5.000      1.233
LOAD
*
*===== L O A D I N G S =====*
*
LOADCN      1
LOADLB      1 SELF-WEIGHT INC. BUOYANCY
DEAD
DEAD      -Z      20.000      1.025M
*
LOADCN      2
LOADLB      2 SELF-WEIGHT NO BUOYANCY
DEAD
DEAD      -Z      -20.000      0.001M
*
LOADCN      3
LOADLB      3 TOPSIDE LOAD
LOAD Z T101T103      -98.100      GLOB CONC      TOPMASS
*
*===== LOAD COMBINATIONS =====*
*
LCOMB
LCOMB DW      1 1.000      20.0500      3 1.200
LCOMB MASS      20.0500      3 1.200
END

```

A.2.4.4 Dynamic Input

OYONG DYNAMIC ANALYSIS FOR MODE SHAPES AND NATURAL PERIOD
 DYNOPT +ZMN 3CONS 7.85 1.0 SA-Z
 END

A.2.4.5 Wave Response

LDOPT	IN	NF+Z	1.025	7.85	-20.0	20.00	GLOBMN	DYN	FLD	MPT	NP
*											
FILE S											
*											
LOAD											
LOADCN	1										
WAVE											
WAVE1.00AIRY	6.900		16.00		0.00	D		20.00	18MS10	1	
LOADCN	2										
WAVE											
WAVE1.00AIRY	6.900		15.75		0.00	D		20.00	18MS10	1	
LOADCN	3										
WAVE											
WAVE1.00AIRY	6.900		15.50		0.00	D		20.00	18MS10	1	
LOADCN	4										
WAVE											
WAVE1.00AIRY	6.900		15.25		0.00	D		20.00	18MS10	1	
LOADCN	5										
WAVE											
WAVE1.00AIRY	6.900		15.00		0.00	D		20.00	18MS10	1	
LOADCN	6										
WAVE											
WAVE1.00AIRY	6.900		14.75		0.00	D		20.00	18MS10	1	
LOADCN	7										
WAVE											
WAVE1.00AIRY	6.900		14.50		0.00	D		20.00	18MS10	1	
LOADCN	8										
WAVE											
WAVE1.00AIRY	6.900		14.25		0.00	D		20.00	18MS10	1	
LOADCN	9										
WAVE											
WAVE1.00AIRY	6.900		14.00		0.00	D		20.00	18MS10	1	
LOADCN	10										
WAVE											
WAVE1.00AIRY	6.900		13.75		0.00	D		20.00	18MS10	1	
LOADCN	11										
WAVE											
WAVE1.00AIRY	6.900		13.50		0.00	D		20.00	18MS10	1	
LOADCN	12										
WAVE											
WAVE1.00AIRY	6.900		13.25		0.00	D		20.00	18MS10	1	
LOADCN	13										
WAVE											
WAVE1.00AIRY	6.900		13.00		0.00	D		20.00	18MS10	1	
LOADCN	14										
WAVE											
WAVE1.00AIRY	6.900		12.75		0.00	D		20.00	18MS10	1	
LOADCN	15										
WAVE											
WAVE1.00AIRY	6.900		12.50		0.00	D		20.00	18MS10	1	
LOADCN	16										
WAVE											
WAVE1.00AIRY	6.900		12.25		0.00	D		20.00	18MS10	1	
LOADCN	17										
WAVE											
WAVE1.00AIRY	6.900		12.00		0.00	D		20.00	18MS10	1	
LOADCN	18										
WAVE											
WAVE1.00AIRY	6.900		11.75		0.00	D		20.00	18MS10	1	
LOADCN	19										
WAVE											
WAVE1.00AIRY	6.900		11.50		0.00	D		20.00	18MS10	1	
LOADCN	20										
WAVE											
WAVE1.00AIRY	6.900		11.25		0.00	D		20.00	18MS10	1	

LOADCN 21							
WAVE							
WAVE1.00AIRY 6.900	11.00	0.00	D	20.00	18MS10	1	
LOADCN 22							
WAVE							
WAVE1.00AIRY 6.900	10.75	0.00	D	20.00	18MS10	1	
LOADCN 23							
WAVE							
WAVE1.00AIRY 6.900	10.75	0.00	D	20.00	18MS10	1	
LOADCN 24							
WAVE							
WAVE1.00AIRY 6.900	10.50	0.00	D	20.00	18MS10	1	
LOADCN 25							
WAVE							
WAVE1.00AIRY 6.900	10.25	0.00	D	20.00	18MS10	1	
LOADCN 26							
WAVE							
WAVE1.00AIRY 6.900	10.00	0.00	D	20.00	18MS10	1	
LOADCN 27							
WAVE							
WAVE1.00AIRY 6.900	9.75	0.00	D	20.00	18MS10	1	
LOADCN 28							
WAVE							
WAVE1.00AIRY 6.900	9.50	0.00	D	20.00	18MS10	1	
LOADCN 29							
WAVE							
WAVE1.00AIRY 6.838	9.25	0.00	D	20.00	18MS10	1	
LOADCN 30							
WAVE							
WAVE1.00AIRY 6.473	9.00	0.00	D	20.00	18MS10	1	
LOADCN 31							
WAVE							
WAVE1.00AIRY 6.118	8.75	0.00	D	20.00	18MS10	1	
LOADCN 32							
WAVE							
WAVE1.00AIRY 5.774	8.50	0.00	D	20.00	18MS10	1	
LOADCN 33							
WAVE							
WAVE1.00AIRY 5.439	8.25	0.00	D	20.00	18MS10	1	
LOADCN 34							
WAVE							
WAVE1.00AIRY 5.115	8.00	0.00	D	20.00	18MS10	1	
LOADCN 35							
WAVE							
WAVE1.00AIRY 4.800	7.75	0.00	D	20.00	18MS10	1	
LOADCN 36							
WAVE							
WAVE1.00AIRY 4.495	7.50	0.00	D	20.00	18MS10	1	
LOADCN 37							
WAVE							
WAVE1.00AIRY 4.201	7.25	0.00	D	20.00	18MS10	1	
LOADCN 38							
WAVE							
WAVE1.00AIRY 3.916	7.00	0.00	D	20.00	18MS10	1	
LOADCN 39							
WAVE							
WAVE1.00AIRY 3.641	6.75	0.00	D	20.00	18MS10	1	
LOADCN 40							
WAVE							
WAVE1.00AIRY 3.376	6.50	0.00	D	20.00	18MS10	1	
LOADCN 41							
WAVE							
WAVE1.00AIRY 3.122	6.25	0.00	D	20.00	18MS10	1	
LOADCN 42							
WAVE							
WAVE1.00AIRY 2.877	6.00	0.00	D	20.00	18MS10	1	
LOADCN 43							
WAVE							
WAVE1.00AIRY 2.642	5.75	0.00	D	20.00	18MS10	1	
LOADCN 44							
WAVE							
WAVE1.00AIRY 2.417	5.50	0.00	D	20.00	18MS10	1	
LOADCN 45							
WAVE							
WAVE1.00AIRY 2.203	5.25	0.00	D	20.00	18MS10	1	
LOADCN 46							

```

WAVE
WAVE1.00AIRY 1.998      5.00      0.00      D      20.00 18MS10 1
LOADCN 47
WAVE
WAVE1.00AIRY 1.924      4.91      0.00      D      20.00 18MS10 1
LOADCN 48
WAVE
WAVE1.00AIRY 1.909      4.89      0.00      D      20.00 18MS10 1
LOADCN 49
WAVE
WAVE1.00AIRY 1.893      4.87      0.00      D      20.00 18MS10 1
LOADCN 50
WAVE
WAVE1.00AIRY 1.877      4.85      0.00      D      20.00 18MS10 1
LOADCN 51
WAVE
WAVE1.00AIRY 1.862      4.83      0.00      D      20.00 18MS10 1
LOADCN 52
WAVE
WAVE1.00AIRY 1.803      4.75      0.00      D      20.00 18MS10 1
LOADCN 53
WAVE
WAVE1.00AIRY 1.618      4.50      0.00      D      20.00 18MS10 1
LOADCN 54
WAVE
WAVE1.00AIRY 1.443      4.25      0.00      D      20.00 18MS10 1
LOADCN 55
WAVE
WAVE1.00AIRY 1.279      4.00      0.00      D      20.00 18MS10 1
LOADCN 56
WAVE
WAVE1.00AIRY 1.124      3.75      0.00      D      20.00 18MS10 1
LOADCN 57
WAVE
WAVE1.00AIRY 0.979      3.50      0.00      D      20.00 18MS10 1
LOADCN 58
WAVE
WAVE1.00AIRY 0.844      3.25      0.00      D      20.00 18MS10 1
LOADCN 59
WAVE
WAVE1.00AIRY 0.719      3.00      0.00      D      20.00 18MS10 1
LOADCN 60
WAVE
WAVE1.00AIRY 0.604      2.75      0.00      D      20.00 18MS10 1
LOADCN 61
WAVE
WAVE1.00AIRY 0.499      2.50      0.00      D      20.00 18MS10 1
END

```

A.2.4.6 Spectral Fatigue Curve F3

```

TITLE Marine Current Turbine - Spectral Fatigue Analysis
FTOPTGB 80. 1.0 1. SMC F3 SK MNSK K LPEFT
FTOPT2 PTPT VC PV TI21.75
* scf = 1.453 * 1.61 = 2.339 ----- curve F3
SCFLM2.3392.339
*DNV curve F3
SN-USR CF3 3.2 0.2525.532 1E4 5.501 1E6 2.189 1E8 1.381 1E9
RELIEF
SEAS

```

A.2.4.7 Spectral Fatigue Curve F

```

FTOPT B 80. 1.0 1. SMCVF SK MNSK K LPEFT
FTOPT2 PTPT VC PV TI21.75
* 1.453*1.27 = 1.845 -- Curve F
SCFLM1.8451.845
*DNV curve F
SN-USR CVF 3.2 0.2532.365 1E4 6.973 1E6 2.775 1E8 1.751 1E9
RELIEF
SEAS

```

A.2.4.8 Spectral Fatigue Curve D

```

TITLE Marine Current Turbine - Spectral Fatigue Analysis
FTOPTGB 80. 1.0 1. SMCVD SK MNSK K LPEFT
FTOPT2 PT VC PV AP 2. -3. 10.5DN2 -42.7 46.25TI21.75
SCFLM 1.453
EFTOPT MAX
*DNV curve D
SN-USR CVD 3.2 0.2040.557 1E4 8.738 1E6 3.477 1E8 2.194 1E9
RELIEF
SEAS

```

A.2.4.9 Spectral Fatigue Curve AXP

```

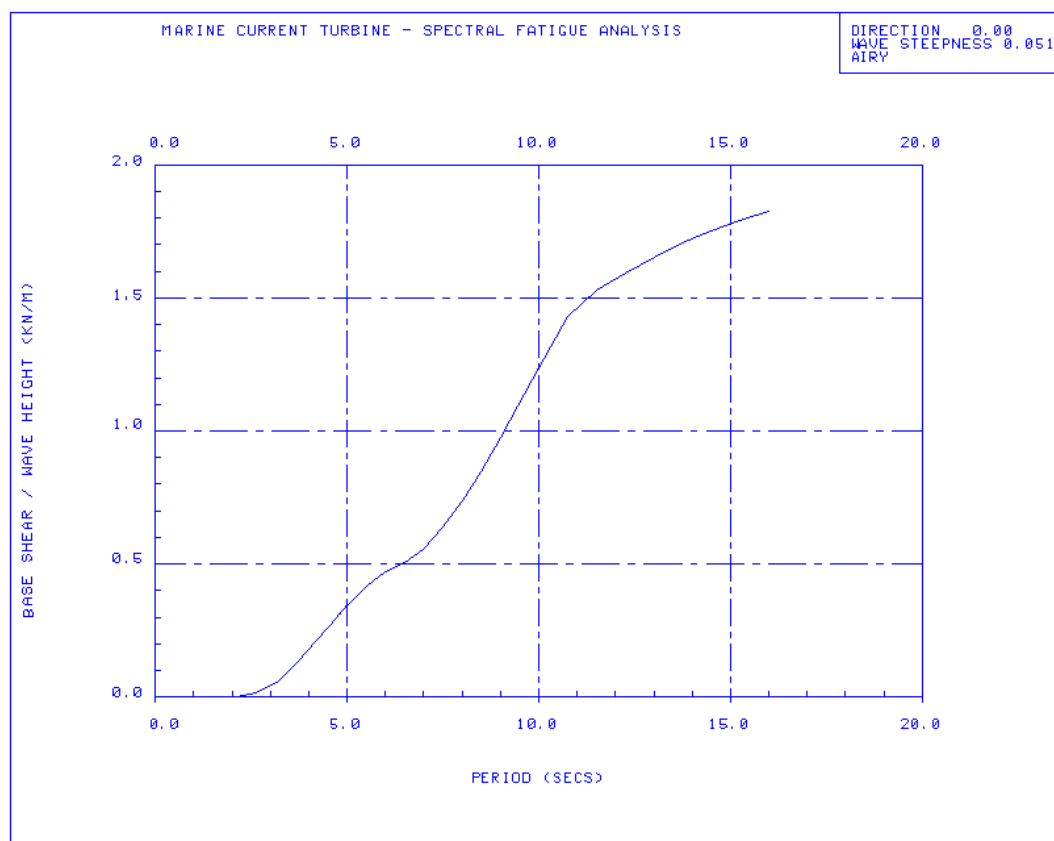
TITLE Marine Current Turbine - Spectral Fatigue Analysis
FTOPTGB 80. 1.0 1. SMAXP SK MNSK K LPEFT
FTOPT2 PTPTVC PV TI21.75
SCFLM 2.0
EFTOPT MAX
RELIEF
SEAS

```

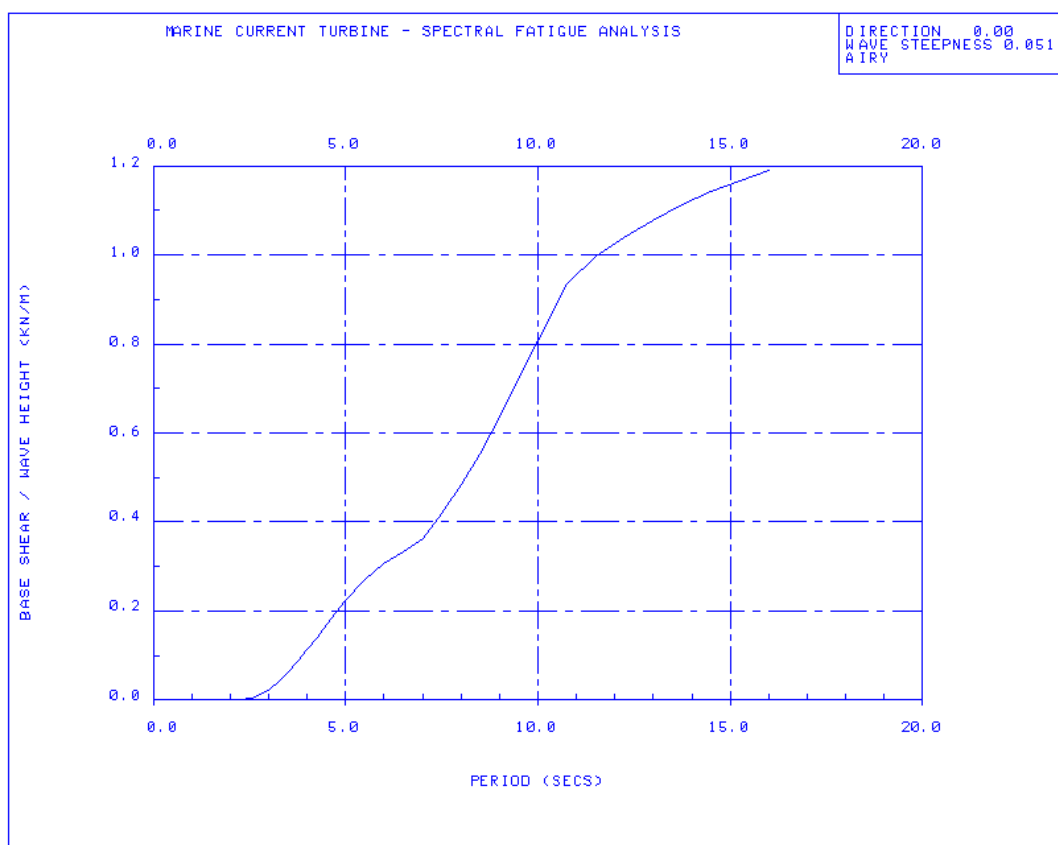
A.3 OUTPUT LISTING

A.3.1 Transfer Function

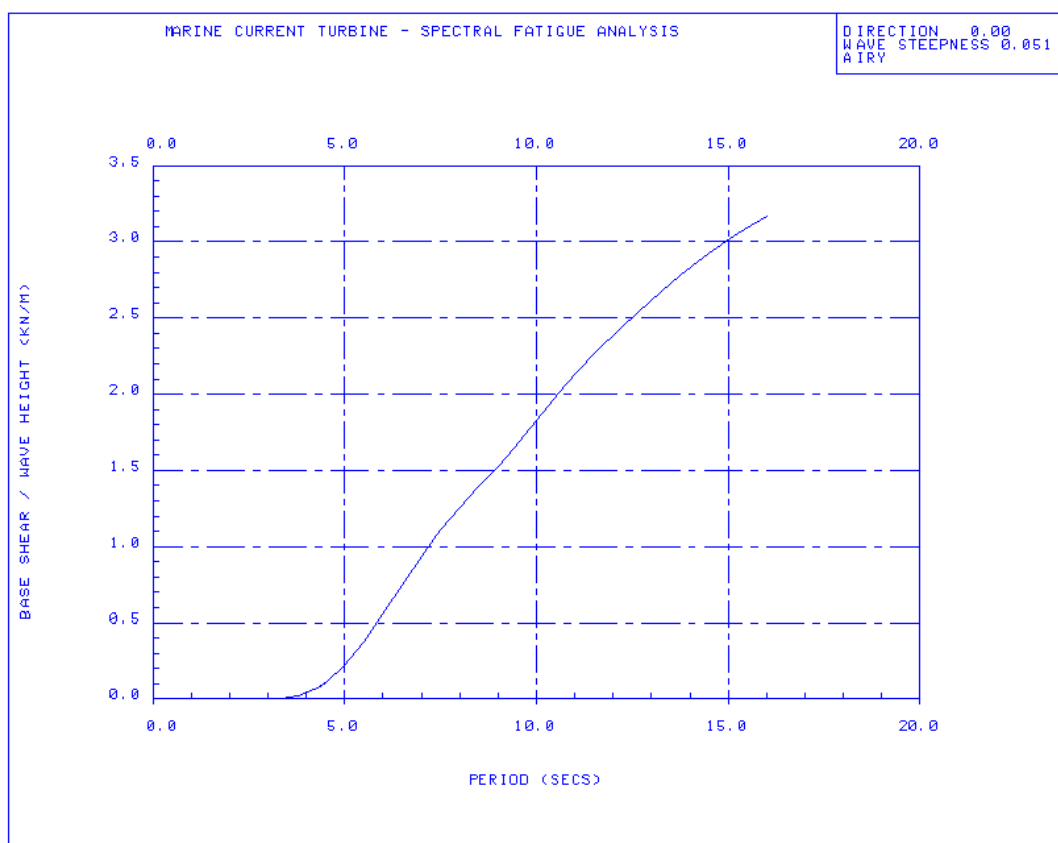
A.3.1.1 Monopile



A.3.1.2 GBS

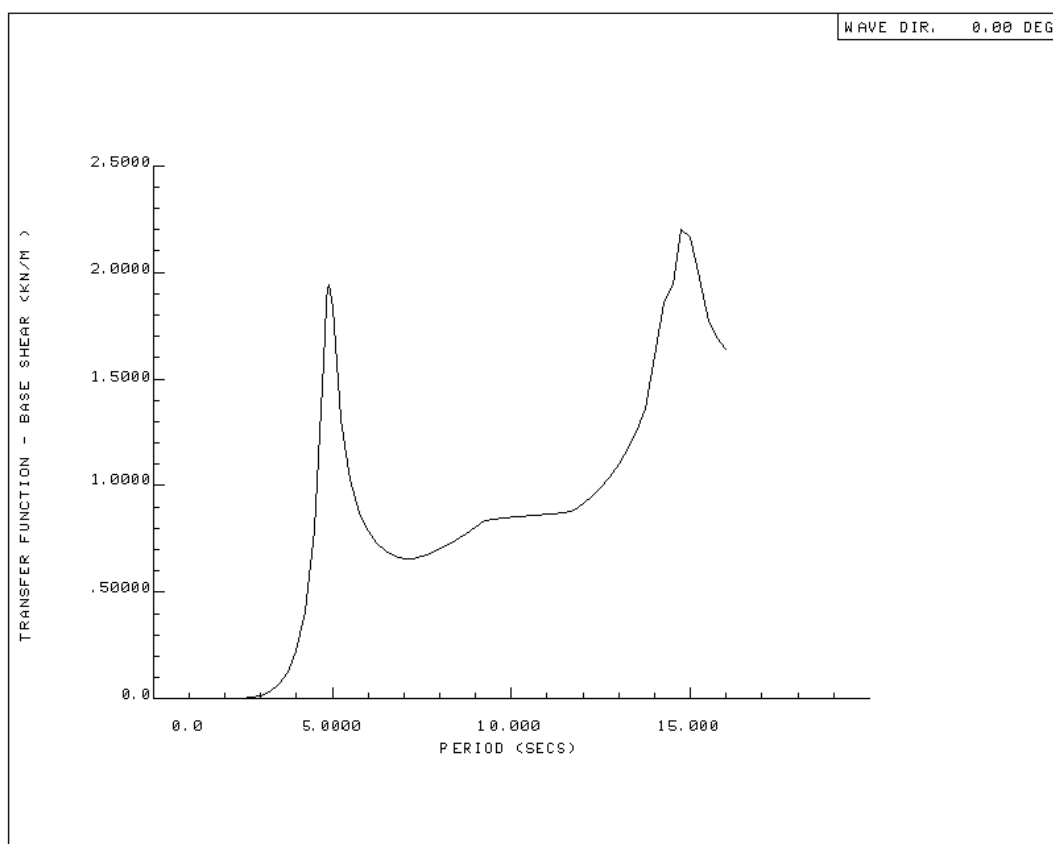


A.3.1.3 Tripod

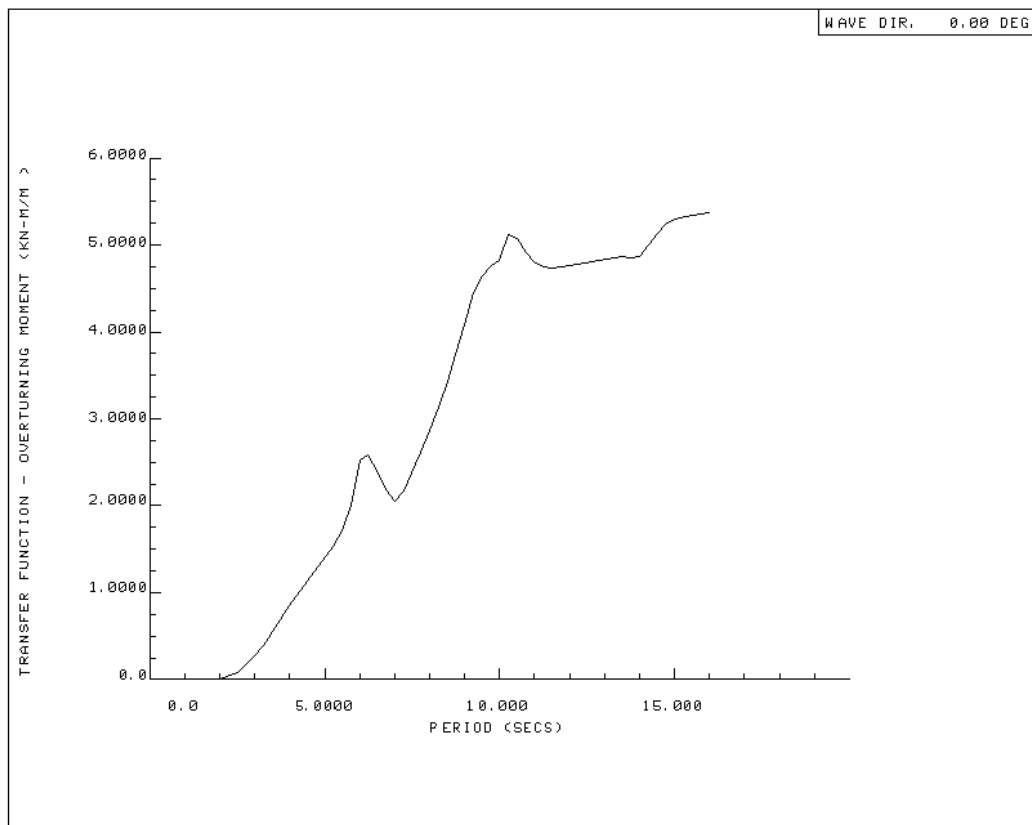


A.3.2 Wave Response

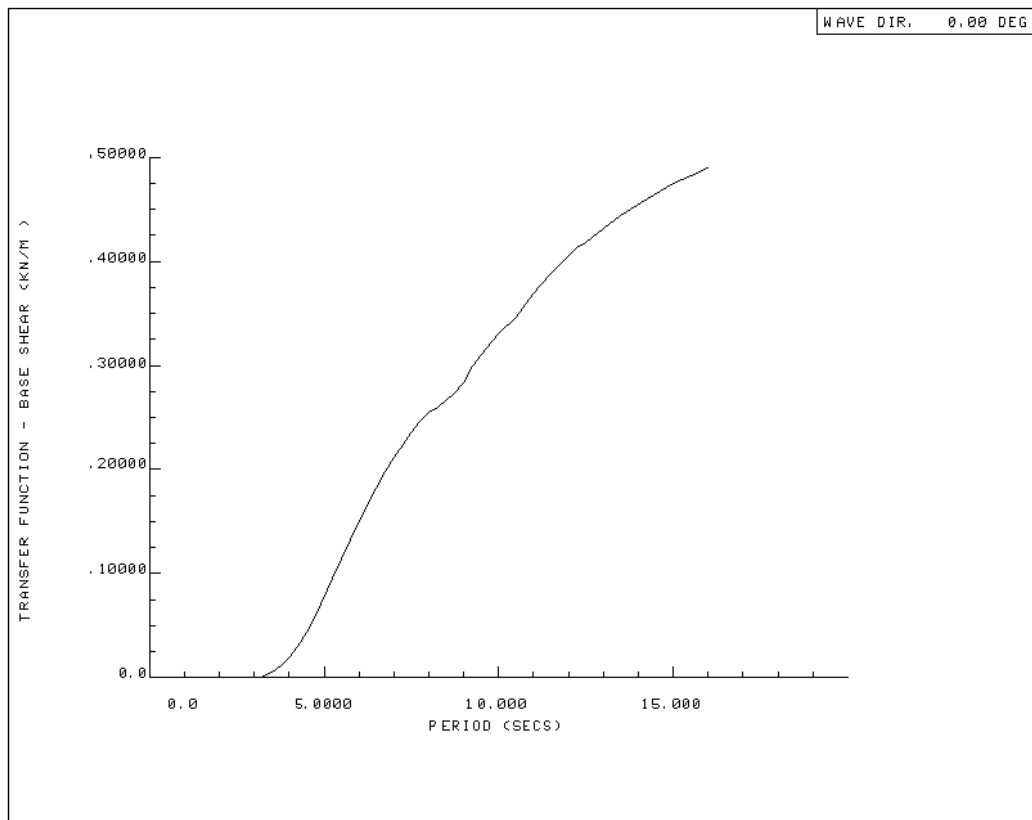
A.3.2.1 Monopile



A.3.2.2 GBS



A.3.2.3 Tripod



A.3.3 SACS Output

A.3.3.1 Monopile

* * * M E M B E R F A T I G U E R E P O R T * * *																			
(JOINT ORDER)																			
JOINT	MEMBER	GRUP	TYPE	ORIGINAL	WT	JNT	MEM	CHORD	GAP	* STRESS	CONC.	FACTORS	* FATIGUE	RESULTS	REQUIRED				
		ID	ID	OD	(CM)	TYP	TYP	LEN,	(CM)	AX-CR	AX-SD	IN-PL	OU-PL	DAMAGE	LOC	SVC	LIFE	OD	WT
				(CM)	(CM)			(M)										(CM)	(CM)
P101	T102-P101	LE1	TUB	20.00	2.500					5.00	5.00	5.00	5.00	202.2530	TR	.3955442			

T101	T101-T102	LE1	TUB	20.00	2.500					5.00	5.00	5.00	5.00	.0000000	TR	INFINITE			

T102	T101-T102	LE1	TUB	20.00	2.500					1.85	1.85	1.85	1.85	4.456093	TR	17.95295			
T102	T102-P101	LE1	TUB	20.00	2.500					1.85	1.85	1.85	1.85	4.456093	TR	17.95295			

A.3.3.2 GBS

* * * M E M B E R F A T I G U E R E P O R T * * *																		
(JOINT ORDER)																		
JOINT	MEMBER	GRUP ID	TYPE ID	ORIGINAL		JNT TYP	MEM TYP	CHORD LEN. (M)	GAP (CM)	* STRESS CONC. FACTORS *				FATIGUE RESULTS			REQUIRED	
				OD (CM)	WT (CM)					AX-CR	AX-SD	IN-PL	OU-PL	DAMAGE	LOC	SVC LIFE	OD (CM)	WT (CM)
P101	T102-P101	LE1	TUB	20.00	2.500					5.00	5.00	5.00	5.00	.0350267	B	2283.971		

T101	T101-T102	LE1	TUB	20.00	2.500					5.00	5.00	5.00	5.00	.0000000	TR	INFINITE		

T102	T101-T102	LE1	TUB	20.00	2.500					1.85	1.85	1.85	1.85	.30171-4	B	2651550.		
T102	T102-P101	LE1	TUB	20.00	2.500					1.85	1.85	1.85	1.85	.30171-4	B	2651550.		

A.3.3.3 Tripod

* * * M E M B E R F A T I G U E R E P O R T * * *																		
(JOINT ORDER)																		
JOINT	MEMBER	GRUP ID	TYPE ID	ORIGINAL		JNT TYP	MEM TYP	CHORD LEN. (M)	GAP (CM)	* STRESS CONC. FACTORS *				FATIGUE RESULTS			REQUIRED	
				OD (CM)	WT (CM)					AX-CR	AX-SD	IN-PL	OU-PL	DAMAGE	LOC	SVC LIFE	OD (CM)	WT (CM)
P101	P101-T104	LE1	TUB	40.00	2.500					5.00	5.00	5.00	5.00	.0000000	TR	INFINITE		

P102	P102-T105	LE1	TUB	40.00	2.500					5.00	5.00	5.00	5.00	.0000000	TR	INFINITE		

P103	P103-T106	LE1	TUB	40.00	2.500					5.00	5.00	5.00	5.00	.0000000	TR	INFINITE		

T101	T101-T103	LE1	TUB	40.00	2.500					5.00	5.00	5.00	5.00	.0000000	TR	INFINITE		

T102	T103-T102	LE1	TUB	40.00	2.500					5.00	5.00	5.00	5.00	.0000000	TR	INFINITE		

T103	T104-T103	LE2	TUB	25.00	1.500	Y	BRC	8.00		4.28	3.05	2.49	2.09	.0000000	T	INFINITE		
T103	T103-T102	LE1	TUB	40.00	2.500	Y	CHD	8.00		5.33	4.72	2.00	2.49	.0000000	T	INFINITE		
T103	T105-T103	LE2	TUB	25.00	1.500	Y	BRC	8.00		4.28	3.05	2.49	2.09	.0000000	T	INFINITE		
T103	T103-T102	LE1	TUB	40.00	2.500	Y	CHD	8.00		5.33	4.72	2.00	2.49	.0000000	T	INFINITE		
T103	T106-T103	LE2	TUB	25.00	1.500	Y	BRC	8.00		4.28	3.05	2.49	2.09	.0000000	T	INFINITE		
T103	T103-T102	LE1	TUB	40.00	2.500	Y	CHD	8.00		5.33	4.72	2.00	2.49	.0000000	T	INFINITE		

* * * M E M B E R F A T I G U E R E P O R T * * *																
(JOINT ORDER)																
JOINT	MEMBER	GRUP	TYPE	ORIGINAL	WT	JNT	MEM	CHORD	GAP	* STRESS	CONC.	FACTORS	* FATIGUE	RESULTS	REQUIRED	
		ID	ID	OD	(CM)	TYP	TYP	LEN.	(CM)	AX-CR	AX-SD	IN-PL	OU-PL	DAMAGE	LOC	SVC LIFE
				(CM)	(CM)			(M)								
T104	T104-T103	LE2	TUB	25.00	1.500	Y	BRC	2.00		2.70	2.67	2.49	2.09	.0000000	T	INFINITE
T104	P101-T104	LE1	TUB	40.00	2.500	Y	CHD	2.00		2.55	2.97	2.00	2.48	.0000000	T	INFINITE
T104	T104-T105	LE2	TUB	25.00	1.500	T	BRC	2.00		2.70	4.67	2.17	3.63	.0000000	T	INFINITE
T104	P101-T104	LE1	TUB	40.00	2.500	T	CHD	2.00		2.60	4.91	2.00	4.32	.0000000	T	INFINITE
T104	T106-T104	LE2	TUB	25.00	1.500	T	BRC	2.00		2.70	4.67	2.17	3.63	.0000000	T	INFINITE
T104	P101-T104	LE1	TUB	40.00	2.500	T	CHD	2.00		2.60	4.91	2.00	4.32	.0000000	T	INFINITE
T105	T104-T105	LE2	TUB	25.00	1.500	T	BRC	2.00		2.70	4.67	2.17	3.63	.0000000	T	INFINITE
T105	P102-T105	LE1	TUB	40.00	2.500	T	CHD	2.00		2.60	4.91	2.00	4.32	.0000000	T	INFINITE
T105	T105-T103	LE2	TUB	25.00	1.500	Y	BRC	2.00		2.70	2.67	2.49	2.09	.0000000	T	INFINITE
T105	P102-T105	LE1	TUB	40.00	2.500	Y	CHD	2.00		2.55	2.97	2.00	2.48	.0000000	T	INFINITE
T105	T105-T106	LE2	TUB	25.00	1.500	T	BRC	2.00		2.70	4.67	2.17	3.63	.0000000	T	INFINITE
T105	P102-T105	LE1	TUB	40.00	2.500	T	CHD	2.00		2.60	4.91	2.00	4.32	.0000000	T	INFINITE
T106	T105-T106	LE2	TUB	25.00	1.500	T	BRC	2.00		2.70	4.67	2.17	3.63	.0000000	T	INFINITE
T106	P103-T106	LE1	TUB	40.00	2.500	T	CHD	2.00		2.60	4.91	2.00	4.32	.0000000	T	INFINITE
T106	T106-T103	LE2	TUB	25.00	1.500	Y	BRC	2.00		2.70	2.67	2.49	2.09	.0000000	T	INFINITE
T106	P103-T106	LE1	TUB	40.00	2.500	Y	CHD	2.00		2.55	2.97	2.00	2.48	.0000000	T	INFINITE
T106	T106-T104	LE2	TUB	25.00	1.500	T	BRC	2.00		2.70	4.67	2.17	3.63	.0000000	T	INFINITE
T106	P103-T106	LE1	TUB	40.00	2.500	T	CHD	2.00		2.60	4.91	2.00	4.32	.0000000	T	INFINITE