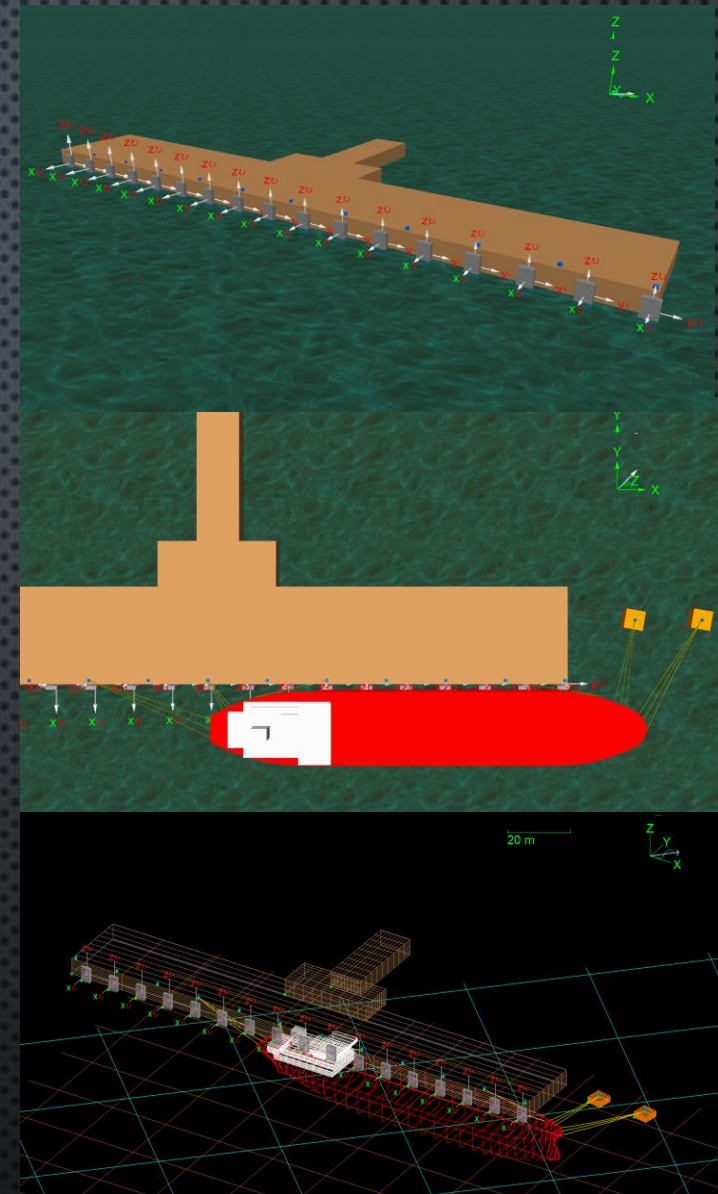


MOORING ANALYSIS USING ORCAFLEX

BY: NUGIE RAMADHAN

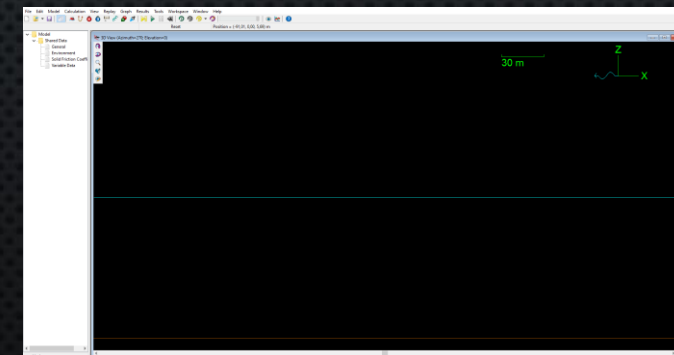
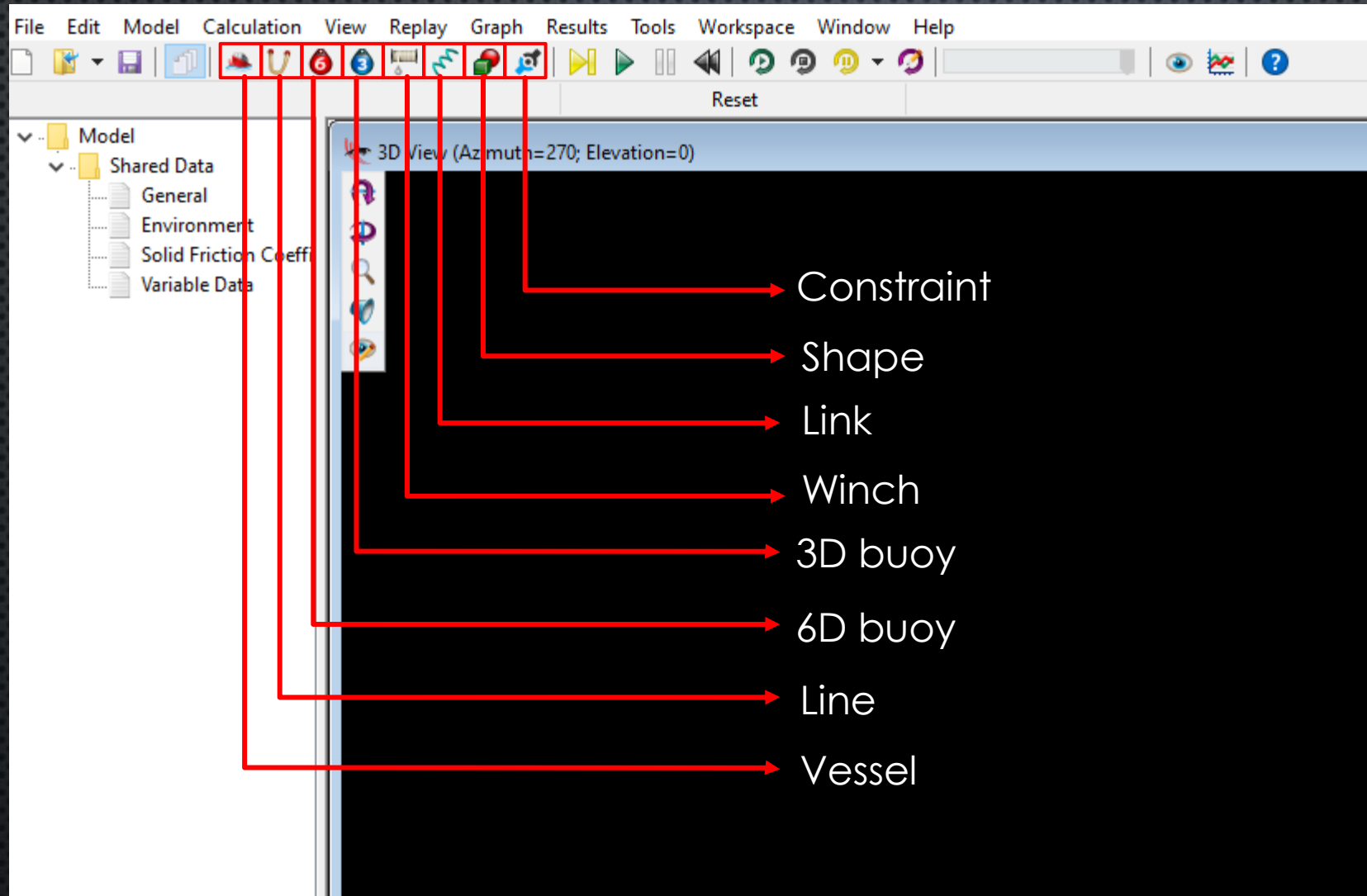


Jetty Mooring System

BAB 1

INTRODUCTION

Orcaflex Operation System



BAB 2

VESSEL

Vessel Data

File Edit Model Calculation View Replay Graph Results Tools Workspace Window Help

Reset

Model

- Shared Data
 - General
 - Environment
 - Solid Friction Coefficient
 - Code Checks
 - SHEAR7 Data
 - VIVA Data
 - Line Contact Data
 - All Objects Data
 - Variable Data
 - Vessel Types
 - Vessel Type1
 - Adria**
 - Line Types
- PPL-Dia.80.81mm
- Vessel Contact
- Jetty
- Bollards
- Line1
- Line2
- Line3
- Line4
- Line5
- Line6
- Line7
- Line8
- Line9
- Line10
- Line11
- Line12
- Line13
- Line14
- Line15
- Line16
- Super Structure
- Pile1
- Pile2
- Fenders

Edit Vessel Data: Adria

Name: Length (m):

Type: Draught:

Initial Position and Attitude:

Connect to Object	Position (m)			Orientation (deg)		
	x	y	z	Heel	Trim	Heading
Free	190,00	-11,40	-4,51	0,0	0,0	0,0

Calculation Supports Support Coordinates Morison Elements Drawing Shaded Drawing

Included in Static Analysis

- ☐ None
- ☐ 3 DOF
- ☒ 6 DOF

Primary Motion

- ☐ None
- ☐ Prescribed
- ☐ Calculated (3 DOF)
- ☒ Calculated (6 DOF)
- ☐ Time History
- ☐ Externally Calculated

Superimposed Motion

- ☒ None
- ☐ Displacement RAOs + Harmonic Motion
- ☐ Time History

Included Effects

- ☐ Applied Loads
- ☒ Wave Load (1st order)
- ☒ Wave Drift Load (2nd order)
- ☐ Wave Drift Damping
- ☐ Sum Frequency Load (2nd order)
- ☒ Added Mass and Damping
- ☐ Manoeuvring Load
- ☐ Other Damping
- ☒ Current Load
- ☒ Wind Load

Calculation Mode:

- ☒ Filtering
- ☐ QTF modification

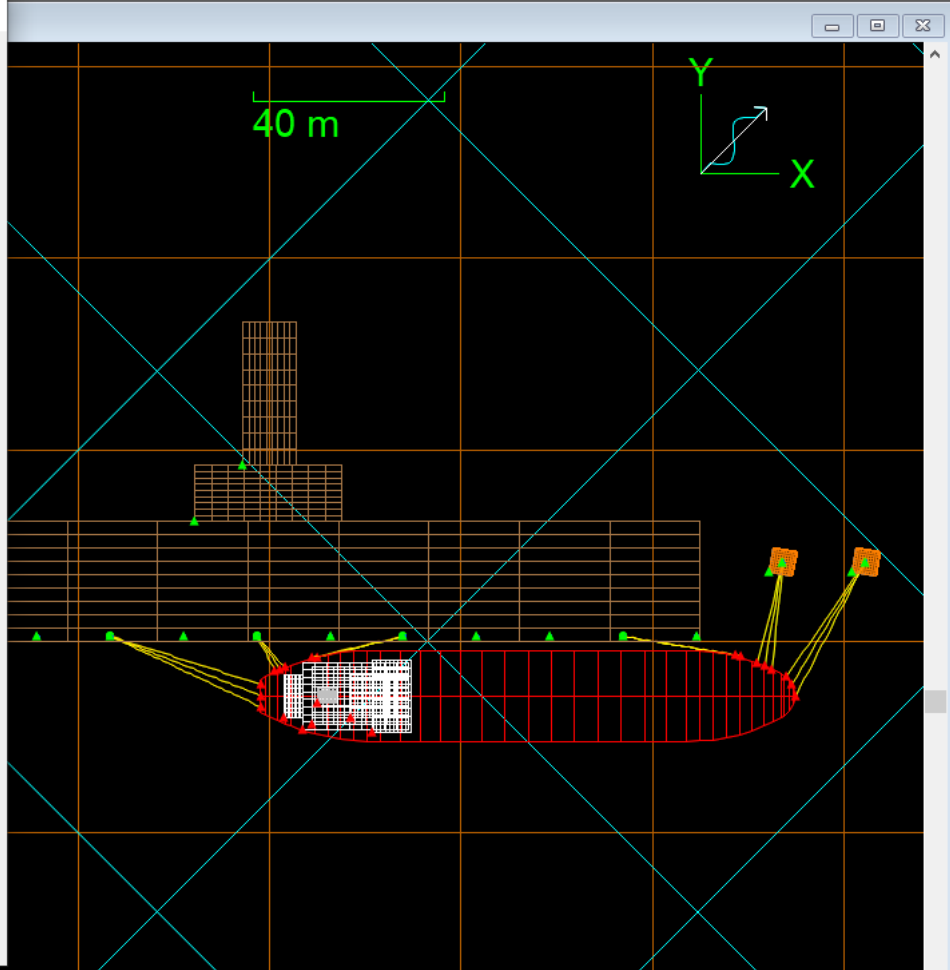
Dividing period (s):

Primary Motion is treated as:

- ☐ Low frequency
- ☐ Wave frequency
- ☒ Both low and wave frequency

Click [here](#) for more information about setting these data items.

Vessel Types... Support Types... Morison Element Types... Report Vessel Response... OK Cancel Next



Klik Vessel Types

Vessel Types : **STRUCTURE**

Edit Vessel Type Data

Vessel Types

Number: 1

Name
Vessel Type1

Jumlah dan Deskripsi vessel

Draughts

Number: 1

Name
Draught1

Properties of Vessel Type: Vessel Type1

Structure Conventions Displacement RAOs Load RAOs Wave Drift QTFs Sum Frequency QTFs Sea State RAOs Stiffness, Added Mass, Damping Other Damping Current Load Wil

Vessel Type length (m): 111,910

LOA

Data for draught Draught1

Mass (te): 7759,00

Displacement

Moment of Inertia Tensor (te.m^2):

x	y	z
521,7E3	0,000	0,000
0,000	8,094E6	0,000
0,000	0,000	8,094E6

$I = \text{Displacement} * RG^2$

Centre of gravity (m):

x	y	z
-51,700	0,000	6,700

Center of Gravity (CoG)

Import... Multibody Data... OK Cancel Next

Vessel Types : **CONVENTIONS**

Edit Vessel Type Data

Vessel Types
Number: 1

Name
Vessel Type1

Draughts
Number: 1

Name
Draught1

Properties of Vessel Type: Vessel Type1

Structure Conventions Displacement RAOs Load RAOs Wave Drift QTFs Sum Frequency QTFs Sea State RAOs Stiffness, Added Mass, Damping Other Damping Current Load Wil

Translational RAO amplitudes are amplitudes due to a wave of unit amplitude.

Displacement RAO rotational amplitudes are amplitudes in degrees due to a wave of unit amplitude.

Waves are referred to by period (s).

RAO and QTF Phases:
phases are in relative to wave
leads degrees crest
occurring at the RAO or QTF phase origin.

Directions are positive when

surge is	sway is to	heave is	roll is starboard	pitch is bow	yaw is bow to
aft	starboard	up	up	up	port

Symmetry is None

QTF Data Source Conventions:
Successive displacement RAO rotations applied in RzRyRx order about Original axes.
The QTF formulation uses a Body-Fixed frame of reference.

Import... Multibody Data... OK Cancel Next

→ Satuan pada analisa difraksi

Referensi yg digunakan pada analisis hidrodinamika (Diffraction Method)

→ Fase dari analisa arah asal difraksi

→ Konversi arah asal dari software difraksi

Vessel Types : *Displacement RAO/Motion RAO*

1

Vessel Type1

1

Draught1

Structure

Conventions

Displacement RAOs

Load RAOs

Wave Drift QTFs

Sum Frequency QTFs

Sea State RAOs

Stiffness, Added Mass, Damping

Other Damping

Current Load

Wii

The settings on the [Conventions page](#) apply to the RAO tables.

The RAO origin and Phase origin are relative to vessel axes (not the axes directions specified on the Conventions page).

RAO origin (m):

x	y	z
-51,700	0,000	6,700

Phase origin (m):

x	y	z
~	~	~

Selected direction (deg):

0,00

Delete direction

Insert direction

0°

45°

90°

135°

180°

225°

270°

315°

Wave Heading

Periods:

30

Period (s)	Surge		Sway		Heave		Roll		Pitch		Yaw	
	Ampl. (m/m)	Phase (deg)	Ampl. (m/m)	Phase (deg)	Ampl. (m/m)	Phase (deg)	Ampl. (deg/m)	Phase (deg)	Ampl. (deg/m)	Phase (deg)	Ampl. (deg/m)	Phase (deg)
3,00	0,0020	171,0	0,000	0,0	0,0020	26,0	0,000	0,0	0,0060	220,0	0,000	0,0
4,00	0,011	51,0	0,0010	258,0	0,012	305,0	0,0010	292,0	0,019	54,0	0,0010	11,0
4,50	0,019	105,0	0,000	0,0	0,016	295,0	0,0010	312,0	0,048	87,0	0,0010	0,0
5,00	0,034	250,0	0,000	0,0	0,044	39,0	0,0010	143,0	0,104	252,0	0,000	0,0
5,50	0,039	82,0	0,000	0,0	0,072	277,0	0,0010	347,0	0,262	59,0	0,0010	308,0
6,00	0,056	313,0	0,0010	144,0	0,115	135,0	0,0010	191,0	0,535	334,0	0,0010	200,0
6,50	0,081	224,0	0,0010	89,0	0,238	74,0	0,0020	107,0	0,468	262,0	0,0010	85,0
7,00	0,085	172,0	0,0010	14,0	0,245	42,0	0,0020	15,0	0,667	159,0	0,0020	356,0
7,50	0,043	143,0	0,0010	315,0	0,149	18,0	0,0030	313,0	1,262	116,0	0,0020	297,0
8,00	0,041	270,0	0,0010	278,0	0,014	7,0	0,0040	277,0	1,709	91,0	0,0030	259,0
8,50	0,144	259,0	0,0010	251,0	0,127	155,0	0,0040	251,0	1,967	73,0	0,0040	233,0
9,00	0,251	243,0	0,0010	228,0	0,259	140,0	0,0040	229,0	2,065	57,0	0,0040	211,0

Check RAOs...

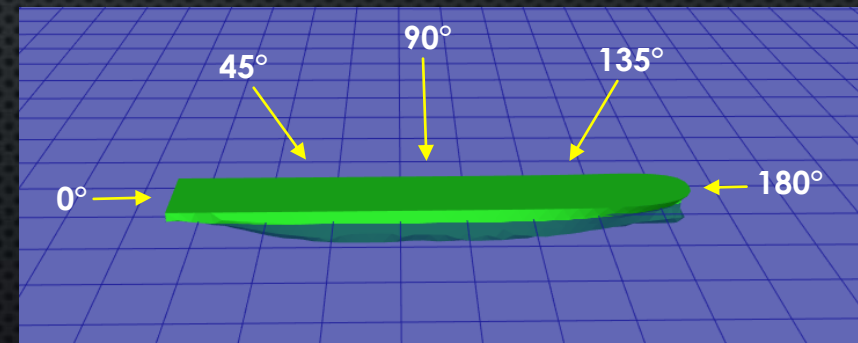
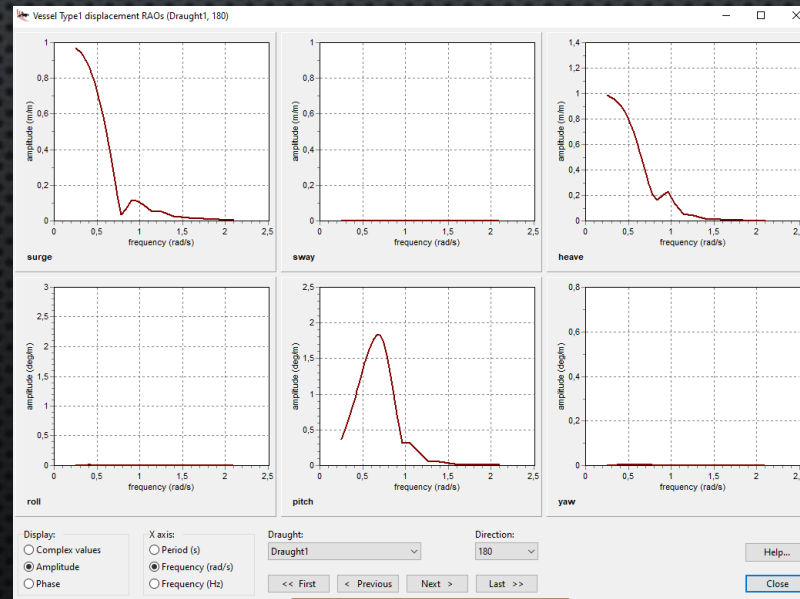
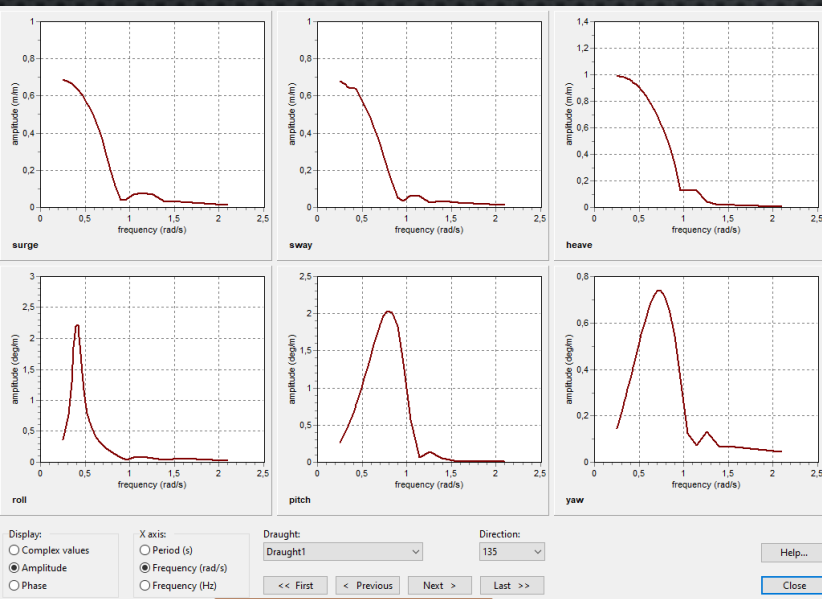
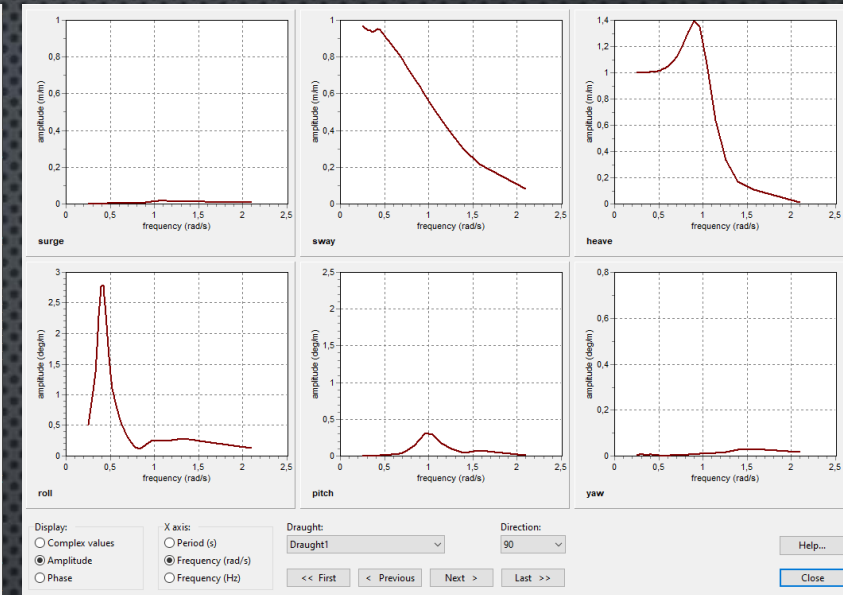
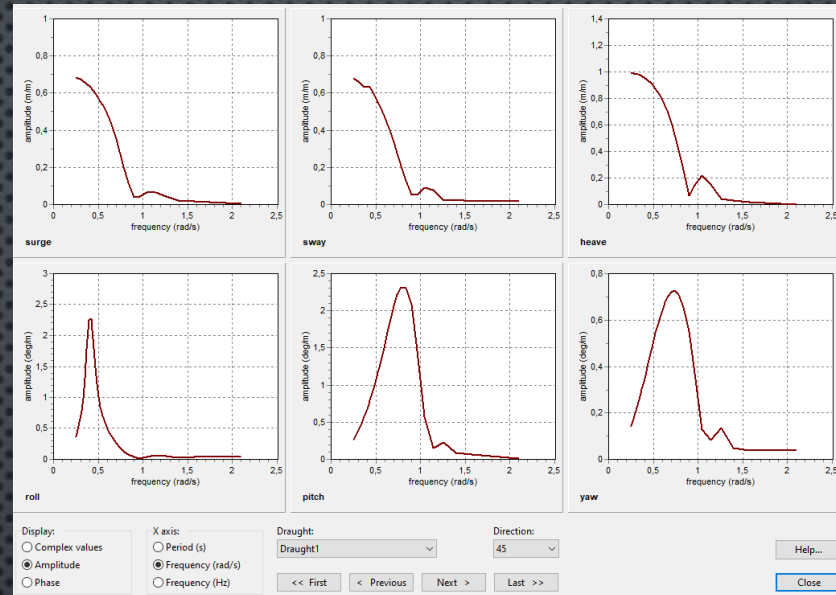
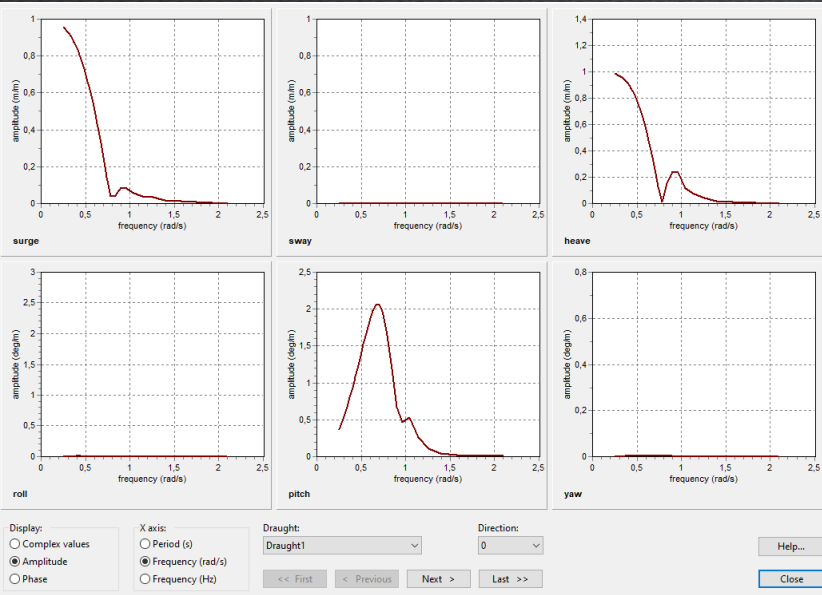
Import...

Multibody Data...

OK

Cancel

Next



Vessel Types : *Load RAO*

1

Vessel Type1

1

Draught1

Properties of Vessel Type: Vessel Type1

StructureConventionsDisplacement RAOsLoad RAOsWave Drift QTFsSum Frequency QTFsSea State RAOsStiffness, Added Mass, DampingOther DampingCurrent LoadWii

The settings on the [Conventions page](#) apply to the RAO tables.

The RAO origin and Phase origin are relative to vessel axes (not the axes directions specified on the Conventions page).

CoG

Wave Load RAOs for draught Draught1

RAO origin (m):

x	y	z
-51,700	0,000	6,700

Phase origin (m):

x	y	z
~	~	~

Selected direction (deg):

0,00

Delete direction

Insert direction

0°45°90°135°180°225°270°315°

Wave Heading

Periods: 30

Period (s)	Surge		Sway		Heave		Roll		Pitch		Yaw	
	Ampl. (tef/m)	Phase (deg)	Ampl. (tef/m)	Phase (deg)	Ampl. (tef/m)	Phase (deg)	Ampl. (tef.m/m)	Phase (deg)	Ampl. (tef.m/m)	Phase (deg)	Ampl. (tef.m/m)	Phase (deg)
3,00	8,566	352,0	0,918	239,0	14,684	205,0	2,243	242,0	700,44	37,0	11,829	257,0
4,00	24,575	246,0	1,020	37,0	27,022	82,0	2,651	71,0	1132,4	232,0	46,907	169,0
4,50	33,957	280,0	0,306	249,0	40,075	109,0	1,122	157,0	1613,2	260,0	46,499	166,0
5,00	52,311	63,0	1,020	301,0	70,462	206,0	3,059	315,0	2257,0	57,0	16,010	327,0
5,50	48,233	247,0	0,510	195,0	65,262	62,0	1,835	185,0	3889,7	215,0	35,690	124,0
6,00	77,091	118,0	0,306	310,0	89,735	253,0	1,020	19,0	5097,8	111,0	28,960	34,0
6,50	89,837	36,0	0,612	251,0	150,00	166,0	1,428	277,0	3701,7	6,0	9,585	292,0
7,00	76,479	329,0	0,510	202,0	154,08	103,0	1,326	209,0	5392,1	252,0	15,194	138,0
7,50	60,775	257,0	0,306	154,0	117,47	41,0	1,020	150,0	9742,4	191,0	25,595	86,0
8,00	66,995	187,0	0,102	65,0	93,406	315,0	0,714	89,0	13,8E3	150,0	28,042	49,0
8,50	85,860	139,0	0,204	318,0	165,70	242,0	0,714	33,0	16,8E3	119,0	26,411	16,0
9,00	104,01	104,0	0,306	285,0	282,36	205,0	0,714	352,0	18,9E3	93,0	23,555	347,0

Check RAOs...

Import...Multibody Data...OKCancelNext

Vessel Types : *Wave Drift*

1

Vessel Type1

1

Draught1

Structure

Conventions

Displacement RAOs

Load RAOs

Wave Drift QTFs

Sum Frequency QTFs

Sea State RAOs

Stiffness, Added Mass, Damping

Other Damping

Current Load

Wii

Some of the settings on the [Conventions page](#) apply to the QTF tables.

The QTF origin, and for Full QTFs the Phase origin, are relative to vessel axes (not the axes directions specified on the Conventions page).

Wave Drift QTFs for draught Draught1

QTF Specification Method

☒ Newman's approximation

☐ Full QTFs

Origin (m):

x	y	z
-51,700	0,000	6,700

→ CoG

Selected direction (deg):

0,00

Delete direction

Insert direction

0°

45°

90°

135°

180°

225°

270°

315°

→ Wave Heading

Periods:

30

Period (s)	Surge (tef/m^2)	Sway (tef/m^2)	Heave (tef/m^2)	Roll (tef.m/m^2)	Pitch (tef.m/m^2)	Yaw (tef.m/m^2)
3,00	11,329	0,337	-5,058	-2,233	511,694	23,708
4,00	97,668	0,449	-10,676	-1,591	1264,18	84,239
4,50	89,868	0,275	-12,400	-0,959	1302,07	86,003
5,00	67,964	0,143	-14,327	-0,214	1323,46	62,396
5,50	57,298	0,826	-16,040	-5,874	1382,96	119,511
6,00	49,772	-0,041	-17,774	1,509	1450,35	42,441
6,50	46,591	0,010	-18,233	1,213	1439,18	46,163
7,00	44,541	0,020	-17,998	1,111	1375,23	45,887
7,50	43,511	0,020	-17,957	1,050	1342,73	46,305
8,00	42,726	0,020	-17,396	0,969	1271,54	46,876
8,50	42,124	0,061	-16,632	0,571	1188,21	47,886
9,00	41,615	0,061	-16,010	0,520	1122,82	48,090

Import...

Multibody Data...

OK

Cancel

Next

Vessel Types : *Stiffness, Added Mass, & Damping*

Stiffness Formula:

- Heave = $\rho * g * WPA$
- Heave-Pitch = $\rho * g * WPA * (LCF - LCB)$
- Roll = $\rho * g * v * GMT$
- Pitch = $\rho * g * v * GMT$

Edit Vessel Type Data

Vessel Types
Number: 1

Name
Vessel Type1

Draughts
Number: 1

Name
Draught1

Properties of Vessel Type: Vessel Type1

Structure Conventions Displacement RAOs Load RAOs Wave Drift QTFs Sum Frequency QTFs Sea State RAOs **Stiffness, Added Mass, Damping** Other Damping Current Load Wil

The [direction settings](#) on the Conventions page apply to the Hydrostatic Stiffness, Added Mass and Damping matrices.

Click [here](#) for full details on the units used for these data.

Data for draught Draught1

Added Mass and Damping Method
☐ Constant
☒ Frequency Dependent

Reference Origin (m):

x	y	z
-51,700	0,000	6,700

Reference Origin datum position:

Z (m)	Heel (deg)	Trim (deg)
0,000	0,000	0,000

Displaced Volume (m^3):

Centre of Buoyancy (m):

x	y	z
~	~	~

Hydrostatic Stiffness:

Heave	Roll	Pitch
1508,47	0,000	648,641
0,000	14,04E3	0,000
648,641	0,000	969,9E3

Frequency Dependent Added Mass and Damping

Cutoff time (s): ~ Cutoff tolerance (%): 4,00

Show Graphs...

Periods: 30

Added Mass at 25,000s:

Surge	Sway	Heave	Roll	Pitch	Yaw
626,090	-10,933	-678,01	-11,416	35,90E3	-270,70
-10,933	6407,73	21,723	8549,74	470,865	16,05E3
-678,01	21,723	25,07E3	105,724	-53,9E3	1266,79
-11,416	8549,74	105,724	131,4E3	15,49E3	-4071,8
35,90E3	470,865	-53,9E3	15,49E3	10,47E6	174,9E3
-270,70	16,05E3	1266,79	-4071,8	174,9E3	4,452E6

Damping at 25,000s:

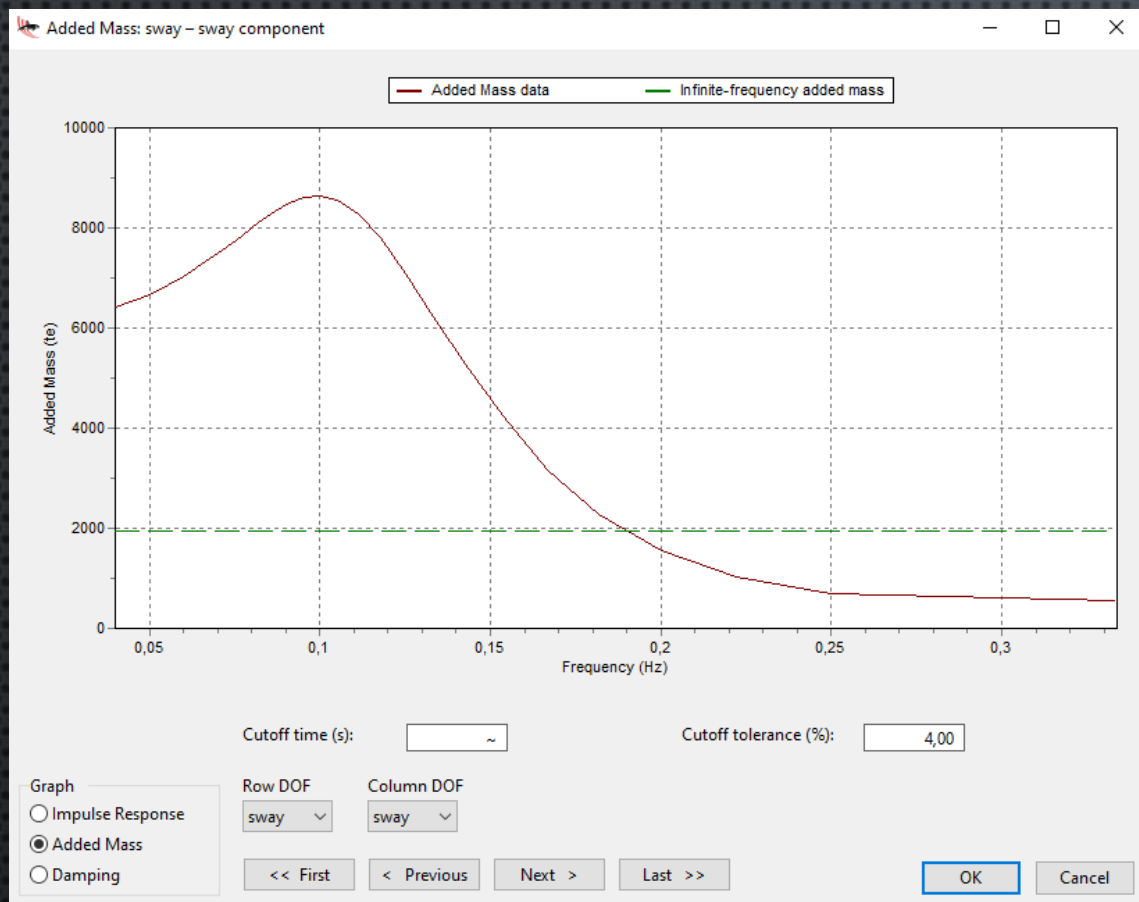
Surge	Sway	Heave	Roll	Pitch	Yaw
8,340	-0,0014	-6,272	-0,0037	-38,527	-0,023
-0,0014	36,252	0,253	239,464	0,032	-1854,4
-6,272	0,253	220,574	0,899	2292,02	14,455
-0,0037	239,464	0,899	3713,77	89,295	-12,4E3
-38,527	0,032	2292,02	89,295	336,0E3	1402,47
-0,023	-1854,4	14,455	-12,4E3	1402,47	224,1E3

Matrix Kekakuan (Stiffness)

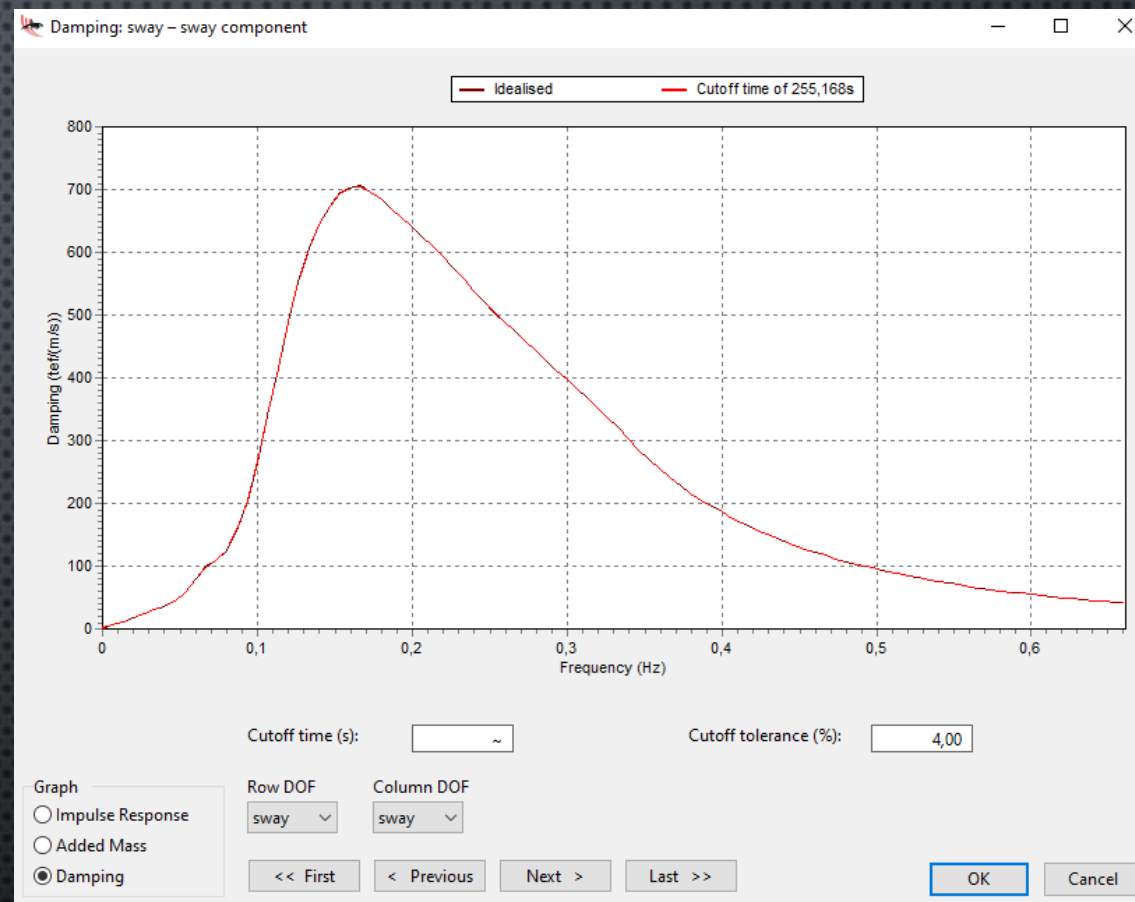
Matrix 6x6 Added Mass

Matrix 6x6 Damping

Import... Multibody Data... OK Cancel Next



Added Mass



Damping

Vessel Types : *Current Load*

Edit Vessel Type Data

Vessel Types
Number: 1

Name
Vessel Type1

Draughts
Number: 1

Name
Draught1

Properties of Vessel Type: Vessel Type1

Structure Conventions Displacement RAOs Load RAOs Wave Drift QTFs Sum Frequency QTFs Sea State RAOs Stiffness, Added Mass, Damping Other Damping **Current Load**

Current load symmetry: XZ plane

Current load data for draught Draught1

Areas and area moment:

Surge area (m ²)	Sway area (m ²)	Yaw area moment (m ³)
106,075	586,205	61,55E3

Current load origin (m):

x	y	z
-48,300	0,000	2,500

Load coefficients:

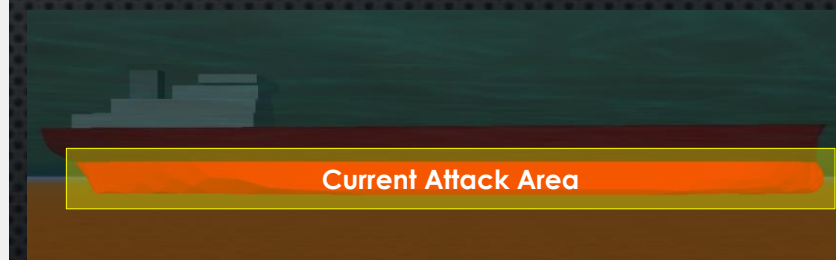
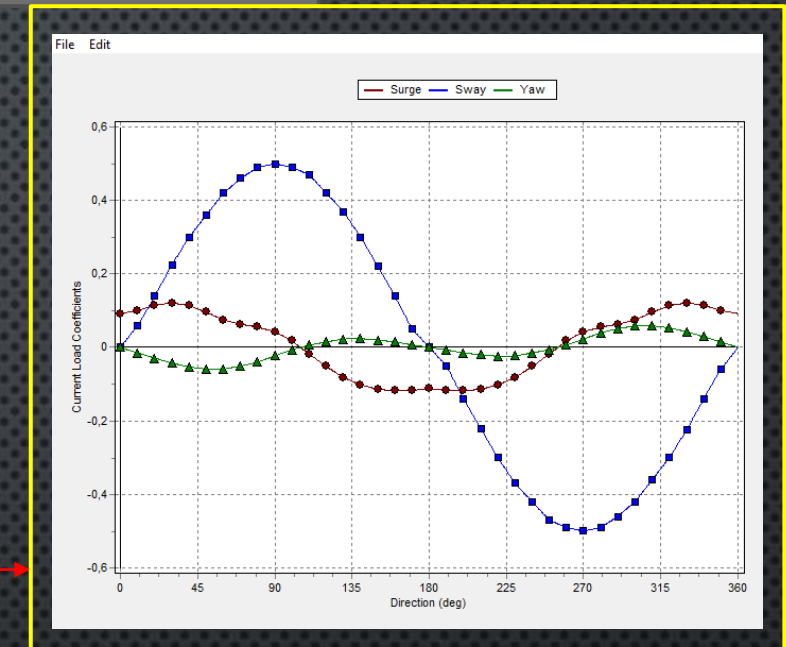
Directions: 19 View Coefficients

Direction	Surge	Sway	Yaw
0,0	0,092	0,000	0,000
10,0	0,100	0,060	-0,015
20,0	0,115	0,140	-0,029
30,0	0,121	0,225	-0,043
40,0	0,114	0,300	-0,053
50,0	0,096	0,360	-0,059
60,0	0,075	0,420	-0,059
70,0	0,063	0,460	-0,051
80,0	0,055	0,490	-0,040
90,0	0,043	0,500	-0,023
100,0	0,018	0,490	-0,0060
110,0	-0,018	0,470	0,0060
120,0	-0,052	0,420	0,015

Drag due to Yaw Rate:

Surge Force Factor (m ⁴)	Sway Force Factor (m ⁴)	Yaw Moment Factor (m ⁵)
0,000	0,000	28,54E6

Import... Multibody Data... OK Cancel Next



Vessel Types : *Wind Load*

Edit Vessel Type Data

Vessel Types
Number: 1

Name
Vessel Type1

Draughts
Number: 1

Name
Draught1

Properties of Vessel Type: Vessel Type1

Load RAOs Wave Drift QTFs Sum Frequency QTFs Sea State RAOs Stiffness, Added Mass, Damping Other Damping Current Load **Wind Load** Drawing Shaded Drawing

Wind load symmetry: XZ plane

Wind load data for draught Draught1

Areas and area moment:

Surge area (m ²)	Sway area (m ²)	Yaw area moment (m ³)
45,334	250,530	4760,07

Wind load origin (m):

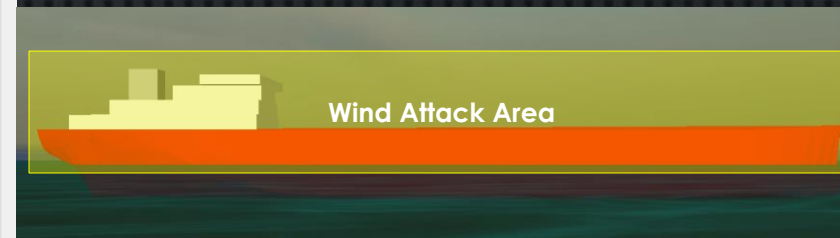
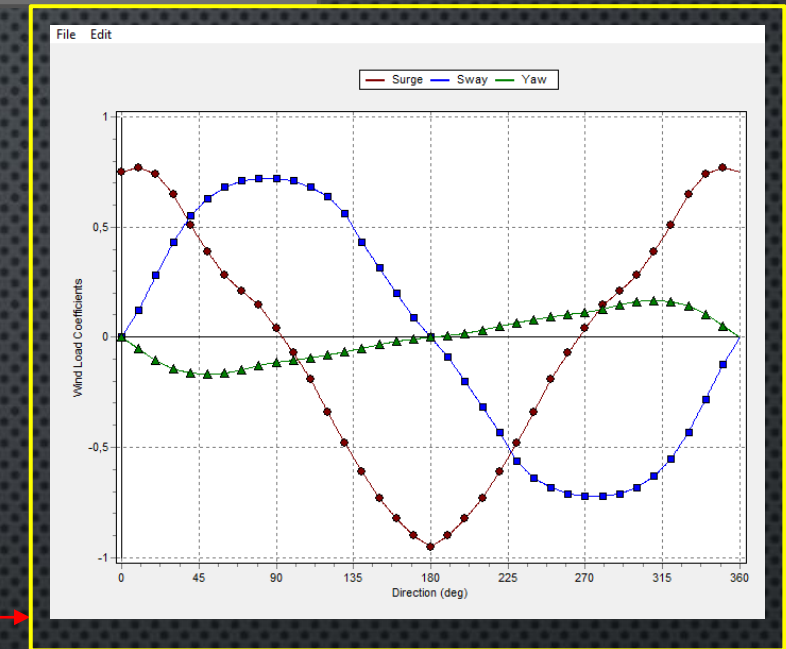
x	y	z
-20,600	0,000	8,200

Load coefficients:

Directions: 19 View Coefficients

Direction	Surge	Sway	Yaw
0,0	0,750	0,000	0,000
10,0	0,770	0,125	-0,053
20,0	0,740	0,280	-0,106
30,0	0,650	0,430	-0,144
40,0	0,510	0,550	-0,162
50,0	0,390	0,630	-0,167
60,0	0,280	0,680	-0,163
70,0	0,210	0,710	-0,148
80,0	0,145	0,720	-0,127
90,0	0,040	0,720	-0,113
100,0	-0,070	0,710	-0,104
110,0	-0,190	0,680	-0,093
120,0	-0,340	0,640	-0,080

Import... Multibody Data... OK Cancel Next



Vessel Types : *Drawing*

Edit Vessel Type Data

Vessel Types
Number: 1

Name
Vessel Type1

Draughts
Number: 1

Name
Draught1

Properties of Vessel Type: Vessel Type1

Load RAOs Wave Drift QTFs Sum Frequency QTFs Sea State RAOs Stiffness, Added Mass, Damping Other Damping Current Load Wind Load Drawing Shaded Drawing

Vertices: 1079

No.	x (m)	y (m)	z (m)
1	-111,91	0,000	9,277
2	-111,91	3,321	9,263
3	-111,91	2,506	7,919
4	-111,91	1,395	6,804
5	-111,91	0,000	6,133
6	-110,72	0,000	5,522
7	-110,72	1,229	6,156
8	-110,72	2,326	7,024
9	-110,72	3,264	8,058
10	-110,72	3,981	9,255
11	-110,72	0,000	9,277
12	-110,72	0,000	9,277
13	-110,72	3,981	9,255
14	-110,72	3,264	8,058
15	-110,72	2,326	7,024
16	-110,72	1,229	6,156
17	-110,72	0,000	5,522
18	-108,29	0,000	4,270
19	-108,29	1,172	5,110
20	-108,29	2,347	5,964

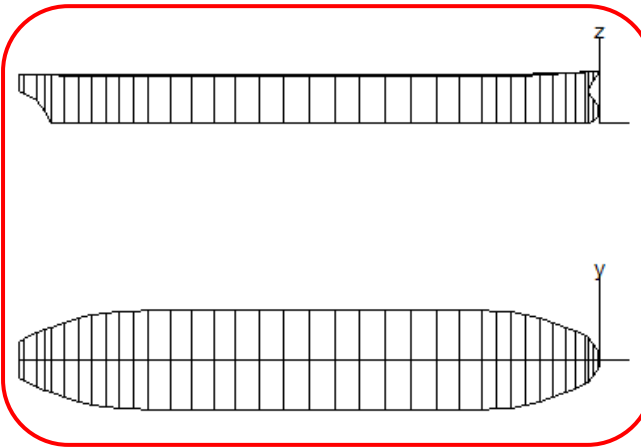
Edges: 1078

No.	From	To	Diameter (m)
1	1	2	~
2	2	3	~
3	3	4	~
4	4	5	~
5	5	6	~
6	6	7	~
7	7	8	~
8	8	9	~
9	9	10	~
10	10	11	~
11	11	1	~
12	12	13	~
13	13	14	~
14	14	15	~
15	15	16	~
16	16	17	~
17	17	18	~
18	18	19	~
19	19	20	~
20	20	21	~

Pen:

Width	Style	Colour
1	—	Red

Preview



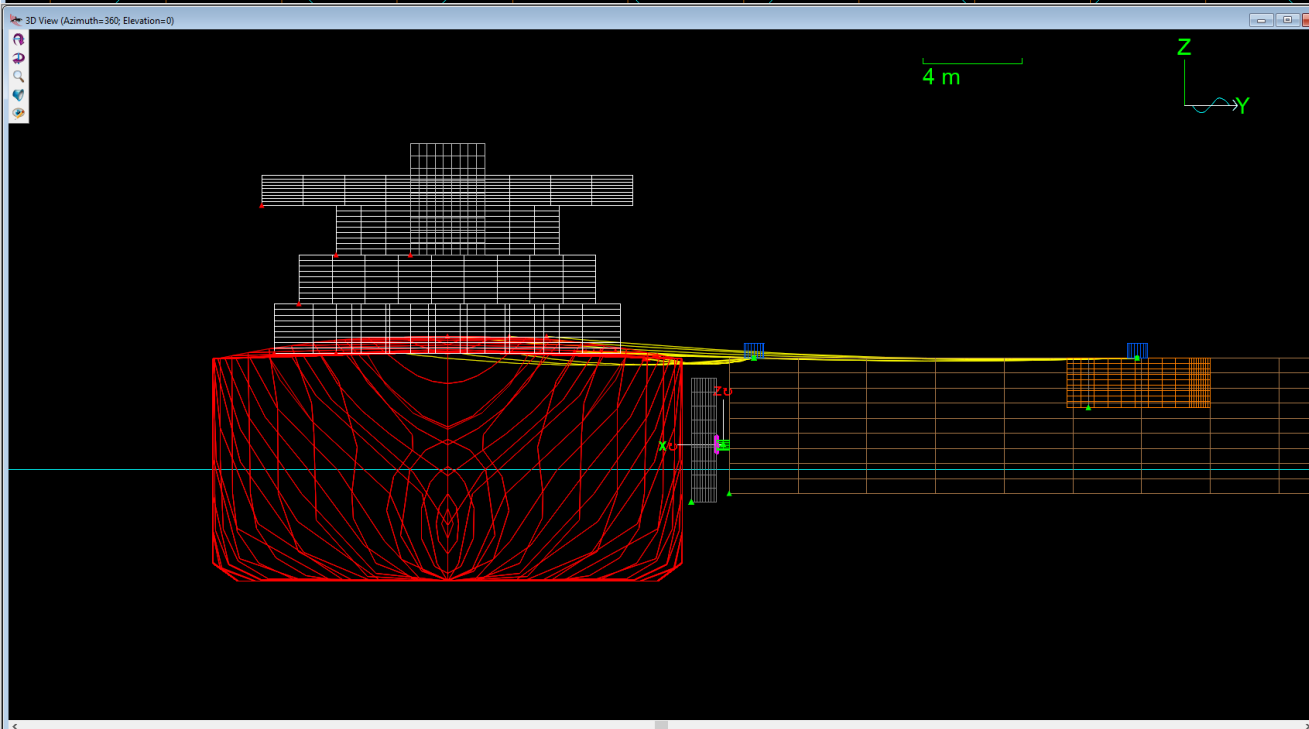
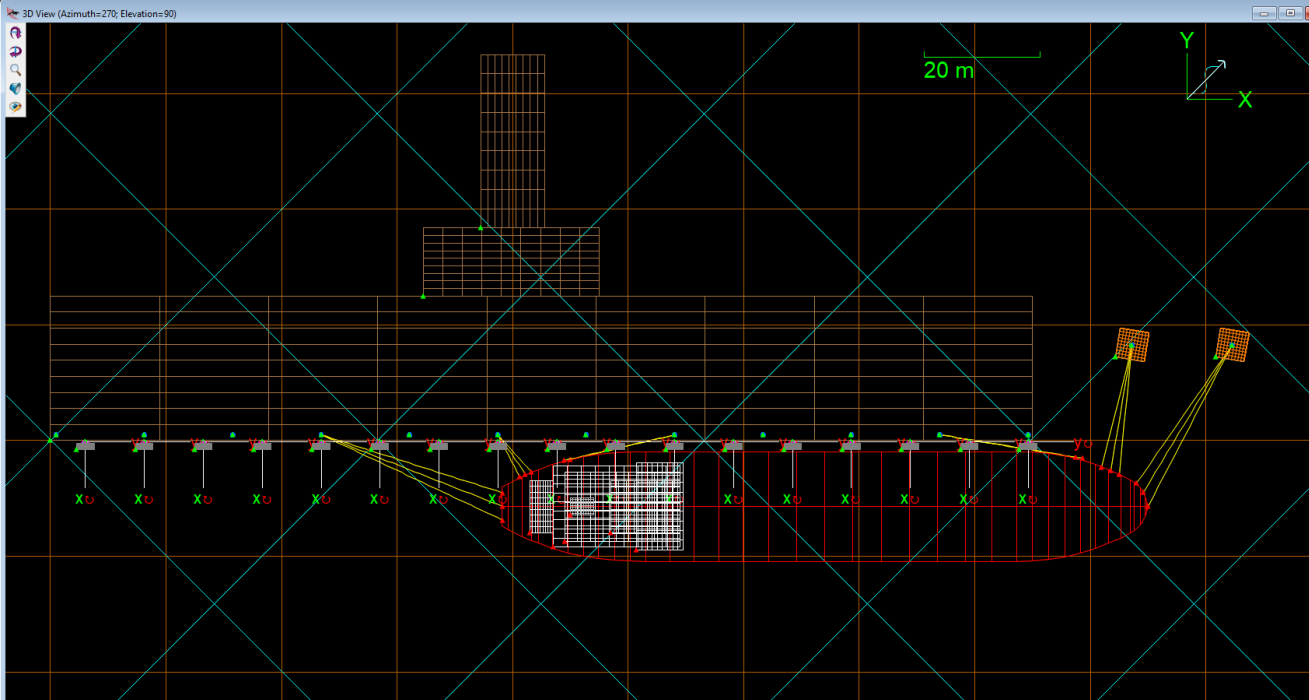
OK Cancel Next

Tips:

Jika ingin memodelkan struktur kapal seperti pada gambar disamping, caranya adalah membuat points dan member dalam bentuk **strip/pias**

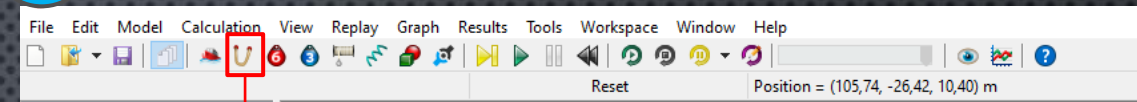
BAB 3

LINE



Mooring Lines

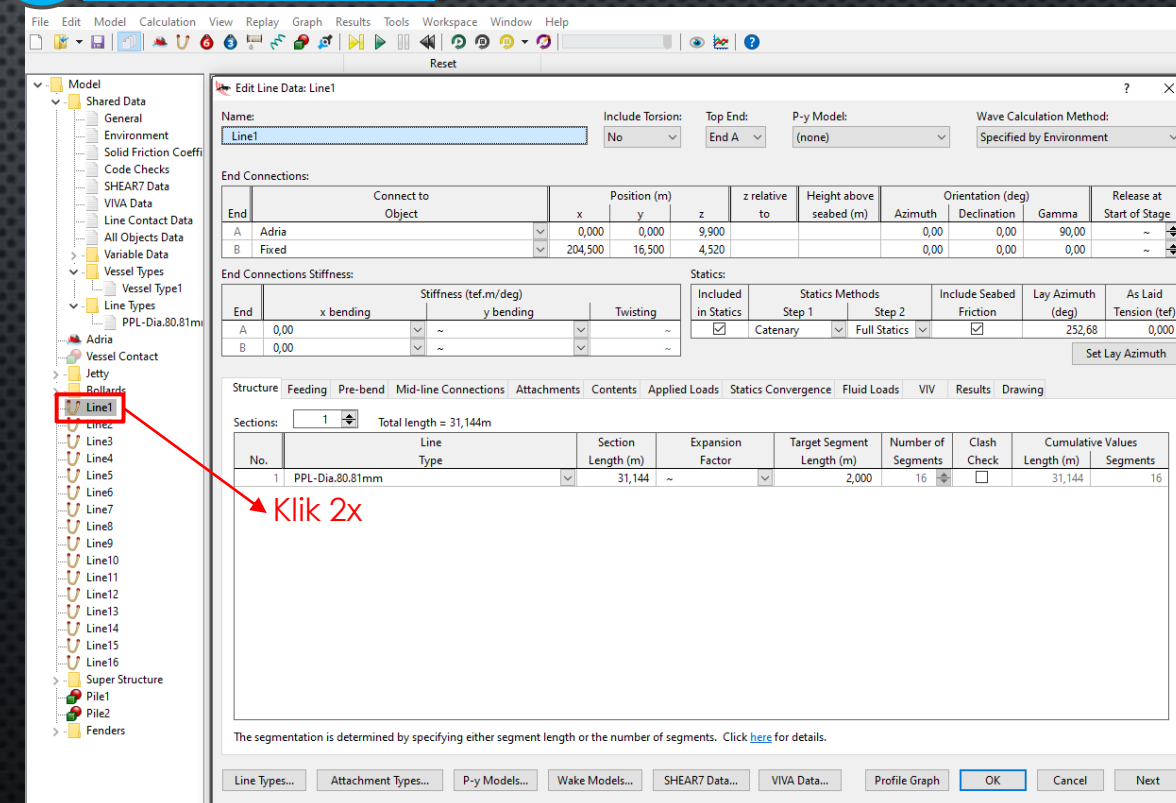
1



Klik icon "line"

2

Edit line Data



3

Edit line Data

File Edit Model Calculation View Replay Graph Results Tools Workspace Window Help

Model

- Shared Data
 - General
 - Environment
 - Solid Friction Coefficient
 - Code Checks
 - SHEAR7 Data
 - VIVA Data
 - Line Contact Data
 - All Objects Data
 - Variable Data
 - Vessel Types
 - Line Types
 - PPL-Dia.80.81mm
 - Adna
 - Vessel Contact
 - Jetty
 - Bollards
 - Line1
 - Line2
 - Line3
 - Line4
 - Line5
 - Line6
 - Line7
 - Line8
 - Line9
 - Line10
 - Line11
 - Line12
 - Line13
 - Line14
 - Line15
 - Line16
 - Super Structure
 - Pile1
 - Pile2
 - Fenders

Edit Line Type Data

View Mode

☒ All
☐ Individual

Line Types: 1

Category Geometry & Mass Limits Structure Contact Added Mass, Inertia, Slam Drag & Lift Stress Friction Structural Damping Drawing

	Name	Category
1	PPL-Dia.80.81mm	General

Klik 2x

Klik Wizard

Rayleigh Damping Coefficients... Code Checks... OK Cancel Next

Line Type Wizard: PPL-Dia.80.81mm

Welcome to
the Line Type Wizard

which helps to derive the Line Type data for
CHAINS, ROPES, WIRES, LINES WITH
FLOATS, HOMOGENEOUS PIPES, HOSES and
UMBILICALS.

Line Type Name:
PPL-Dia.80.81mm

Special Category:

☐ Chain
☒ Rope/Wire
☐ Line with Floats
☐ Homogeneous Pipe
☐ Hose
☐ Umbilical

INSTRUCTIONS

1. The selected Line Type is displayed above (for a different one press Cancel to return to Line Types form and select the required Line Type). Select the special category of line type you want to set up.
2. Set the data associated with the special category - the resulting derived data and properties are automatically calculated and displayed.
3. All Line Type data will then be displayed allowing final editing of values.

< Back Next > Cancel

Line Type Wizard: PPL-Dia.80.81mm [Rope/Wire]

2. Set the associated Rope/Wire Data.
Then click 'Next' to proceed.

Rope/Wire Data

Rope/Wire Nominal Diameter (m):
0,808

The derived line type outer diameter is less than this nominal diameter, in order to give the correct buoyancy. Cd and Ca values may require adjustment. Select Rope/Wire Nominal Diameter and press F1 for details.

Construction:
Polypropylene (8-strand Multiplait)

Derived Line Type Data

Geometry, Mass:

Diameters (m)		Mass per Unit Length (te/m)
Outer	Inner	
0,646	0,000	0,296

Tension, Bending:

Bending Stiffness (tef.m^2)		Axial Stiffness (tef)	Compression is limited
x	y		
0,000	~	70,585E3	<input type="checkbox"/>

Properties

ROPE/WIRE PROPERTIES
[per unit length]
Weight in air: 0,296tef/m (0,296te/m)
Displacement: 0,336tef/m (0,336te/m)
Weight in water: -0,041tef/m (-0,041te/m)
Diam/Wt Ratio: -15,809m/(tef/m) (-15,809m/(te/m))

USED IN

Line3
Line4
Line7
Line14
Line9
Line11
Line2
Line5
Line6
Line8
Line10
Line12
Line13
Line15
Line16
Line1

BAB 4

ENVIRONMENT

ENV : *Seabed*

File Edit Model Calculation View Replay Graph Results Tools Workspace Window Help

Reset

Model

- Shared Data
 - General
 - Environment
 - Solid Friction Coefficient
 - Code Checks
 - SHEAR7 Data
 - VIVA Data
 - Line Contact Data
 - All Objects Data
 - Variable Data
 - Vessel Types
 - Vessel Type1
 - Line Types
 - PPL-Dia.80.81mm
- Adria

Edit Environment Data

Sea Sea Density Seabed Waves Wave Calculation Waves Preview Current Wind Drawing

Shape:

Type	Seabed Origin (m)				Direction (deg)	Slope (deg)
	X	Y	Z	Depth		
Flat	0,00	0,00	-17,00	17,00	0,00	0,000

Seabed Model

☒ Elastic

☐ Nonlinear soil model

Stiffness & Damping:

Stiffness (tef/m/m^2)		Damping (% Critical)
Normal	Shear	
10,197	10,197	100,000



ENV : Wave

Edit Environment Data

Sea Sea Density Seabed **Waves** Wave Calculation Waves Preview Current Wind Drawing

Wave Trains
Number: 1

Wave Train Name
Wave1

Simulation Time Origin (s): 335,000

Kinematic Stretching Method:
Vertical Stretching

☐ User specified seeds

Frequency Spectrum Discretisation Method:
☐ Arithmetic progression
☐ Geometric progression
☒ Equal energy

Data for Wave Train: Wave1
Wave Data:

Direction (deg)	Hs (m)	Tz (s)	Wave Origin X (m)	Wave Origin Y (m)	Wave Time Origin (s)	Wave Type	Number of wave directions
45,00	0,97	6,54	0,00	0,00	0,000	Ochi-Hubble	1

Spectral Parameters: Automatic

Lower Frequency			Higher Frequency		
Hs1 (m)	fm1 (Hz)	λ_1	Hs2 (m)	fm2 (Hz)	λ_2
0,8159	0,1065	3,0000	0,5245	0,1762	1,4501

Wave Type dropdown menu:

- Airy
- Dean Stream
- Stokes' 5th
- Cnoidal
- JONSWAP
- ISSC
- Ochi-Hubble**
- Torsethaugen
- Gaussian Swell
- User Defined Spectrum
- Time History
- User Specified Components
- Response Calculation

Tentukan arah datang gelombang

Waktu awal gelombang dinamis

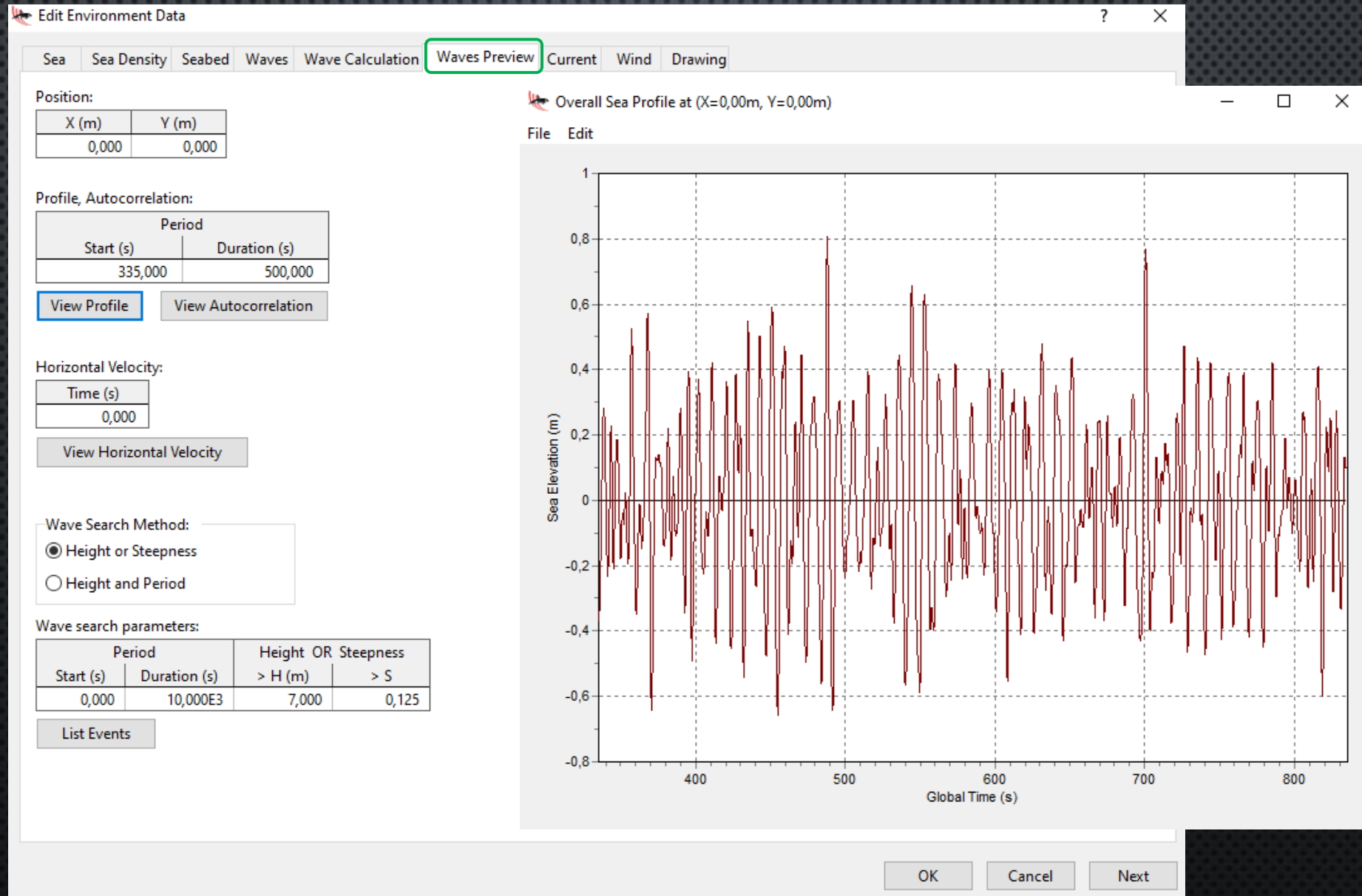
Tentukan wave type kemudian isi parameternya

View Frequency Spectrum

View Wave Components

OK Cancel Next

ENV : *Wave Preview*



ENV : *Current*

Edit Environment Data

Sea Sea Density Seabed Waves Wave Calculation Waves Preview **Current** Wind Drawing

☐ Multiple sets of current data can be defined

☐ Ramp during build-up

Horizontal Current Variation

Horizontal Variation Factor:

~

Vertical Current Variation

☐ Apply Vertical Stretching

Current Method

☒ Interpolated

☐ Power Law

Current Data:

Speed (m/s)	Direction (deg)
1,029	45,000

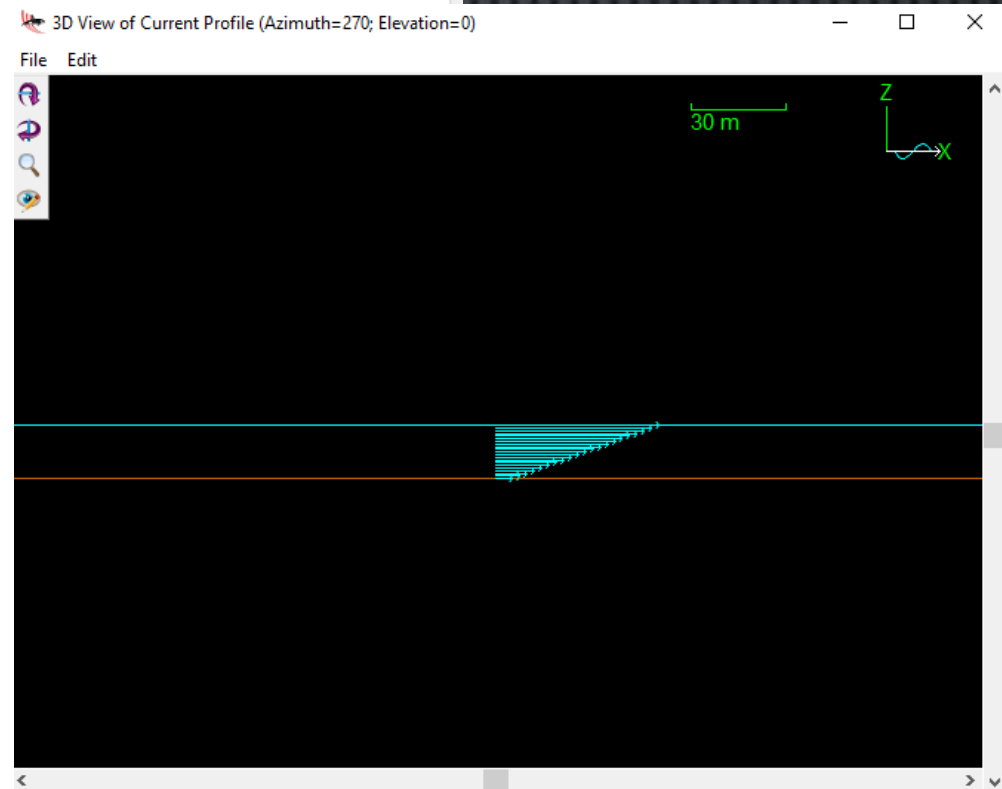
View Vertical Profile Graph

View Vertical Profile 3D View

Profile: 2

Number	Depth (m)	Factor	Rotation (deg)
1	0,000	1,000	0,000
2	17,000	0,100	0,000

OK Cancel Next



ENV : *Wind*

Edit Environment Data

Sea Sea Density Seabed Waves Wave Calculation Waves Preview Current **Wind** Drawing

Include wind loads on:

- ☒ Vessels
- ☒ Lines
- ☒ 6D Buoy Wings

Vertical Wind Variation

Vertical Variation Factor: ~

Air Density (te/m^3): 0,0013

Air Kinematic Viscosity (m^2/s): 15,000E-6

Wind Type: Constant

Wind Data:

Speed (m/s)	Direction (deg)
10,290	45,000

Wind Type:

- Constant
- Constant
- NPD Spectrum
- API Spectrum
- Time History (Speed)
- Time History (Speed & Direction)

OK Cancel Next

BAB 5

RUN SIMULATION

RUN : *SETUP VESSEL CALCULATION*

File Edit Model Calculation View Replay Graph Results Tools Workspace Window Help

Reset

Model

- Shared Data
 - General
 - Environment
 - Solid Friction Coefficient
 - Code Checks
 - SHEAR7 Data
 - VIVA Data
 - Line Contact Data
 - All Objects Data
 - Variable Data
- Vessel Types
 - Vessel Type1
- Line Types
 - PPL-Dia.80.81mm
- Adria
- Vessel Contact
- Jetty
- Bollards
 - Line1
 - Line2
 - Line3
 - Line4
 - Line5
 - Line6
 - Line7
 - Line8
 - Line9
 - Line10
 - Line11
 - Line12
 - Line13
 - Line14
 - Line15
 - Line16
- Super Structure
 - Pile1
 - Pile2
- Fenders

Edit Vessel Data: Adria

Name: Adria Length (m): ~

Type: Vessel Type1 Draught: Draught1

Initial Position and Attitude:

Connect to Object	Position (m)			Orientation (deg)		
	x	y	z	Heel	Trim	Heading
Free	190,00	-11,40	-4,51	0,0	0,0	0,0

Calculation Supports Support Coordinates Morison Elements Drawing Shaded Drawing

Included in Static Analysis

- ☐ None
- ☐ 3 DOF
- ☒ 6 DOF

Primary Motion

- ☐ None
- ☐ Prescribed
- ☐ Calculated (3 DOF)
- ☒ Calculated (6 DOF)
- ☐ Time History
- ☐ Externally Calculated

Superimposed Motion

- ☒ None
- ☐ Displacement RAOs + Harmonic Motion
- ☐ Time History

Included Effects

- ☐ Applied Loads
- ☒ Wave Load (1st order)
- ☒ Wave Drift Load (2nd order)
- ☐ Wave Drift Damping
- ☐ Sum Frequency Load (2nd order)
- ☒ Added Mass and Damping
- ☐ Manoeuvring Load
- ☐ Other Damping
- ☒ Current Load
- ☒ Wind Load

Primary Motion is treated as:

- ☐ Low frequency
- ☐ Wave frequency
- ☒ Both low and wave frequency

Calculation Mode:

- ☒ Filtering
- ☐ QTF modification

Dividing period (s): 10,00

Click [here](#) for more information about setting these data items.

Vessel Types... Support Types... Morison Element Types... Report Vessel Response... OK Cancel Next

RUN : *GENERAL SETTING*

1

General Setting Static

File Edit Model Calculation View Replay Graph Results Tools Workspace Window Help

Reset

Model

- Shared Data
 - General
 - Environment
 - Solid Friction Coefficient
 - Code Checks
 - SHEAR7 Data
 - VIVA Data
 - Line Contact Data
 - All Objects Data
- Variable Data
- Vessel Types
 - Vessel Type1
- Line Types
 - PPL-Dia.80.81mm

Adria

Vessel Contact

Jetty

Bollards

- Line1
- Line2
- Line3
- Line4
- Line5
- Line6
- Line7
- Line8
- Line9
- Line10
- Line11
- Line12
- Line13
- Line14
- Line15
- Line16

Super Structure

- Pile1
- Pile2

Fenders

Edit General Data

Comments:

Units:

System	Length	Mass	Force	Time	Temperature	g (m/s^2)
User	m	te	tcf	s	°C	9,80665

Statics Dynamics Stages Numerical Damping Results Post Calculation Actions Drawing

Buoy degrees of freedom included in Static Analysis:

All

Starting Velocity:

Speed (m/s)	Direction (deg)
0,00	0,00

Line Statics Step 1 Policy:

☐ None

☐ Master lines excluded

☒ All lines included

Line Statics Step 2 Policy:

☐ None

☐ Master lines excluded

☒ Solve coupled systems

☒ Whole System Statics Enabled

Whole System Statics Convergence Parameters:

Max Iterations	Tolerance	Min Damping	Max Damping
400	1,0E-6	1,000	10,000

Set to default

OK Cancel Next

RUN : *GENERAL SETTING*

2 General Setting Dynamics

Edit General Data

Comments:

Units:

System	Length	Mass	Force	Time	Temperature	g (m/s ²)
User	m	te	tcf	s	°C	9,80665

Statics **Dynamics** Stages Numerical Damping Results Post Calculation Actions Drawing

Solution Method

☐ Implicit time domain

☒ Explicit time domain

☐ Frequency domain

☒ Always use recommended time steps

Time Steps (s):

Inner	Target Outer	Actual Outer
0,00028	0,0084	0,0084

Logging:

Precision	Target Sample Interval (s)	Actual Sample Interval (s)	Start Time (s)
Single	0,1000	0,1000	~

Recommended time step settings:

Inner time step (fraction of shortest natural period)	Outer time step (multiple of inner time step)	Outer time step (fraction of wave period or Tz)
10	30	40

Set to default

OK Cancel Next

3 General Setting Stages

Edit General Data

Comments:

Units:

System	Length	Mass	Force	Time	Temperature	g (m/s ²)
User	m	te	tcf	s	°C	9,80665

Statics Dynamics **Stages** Numerical Damping Results Post Calculation Actions Drawing

Stages: 1

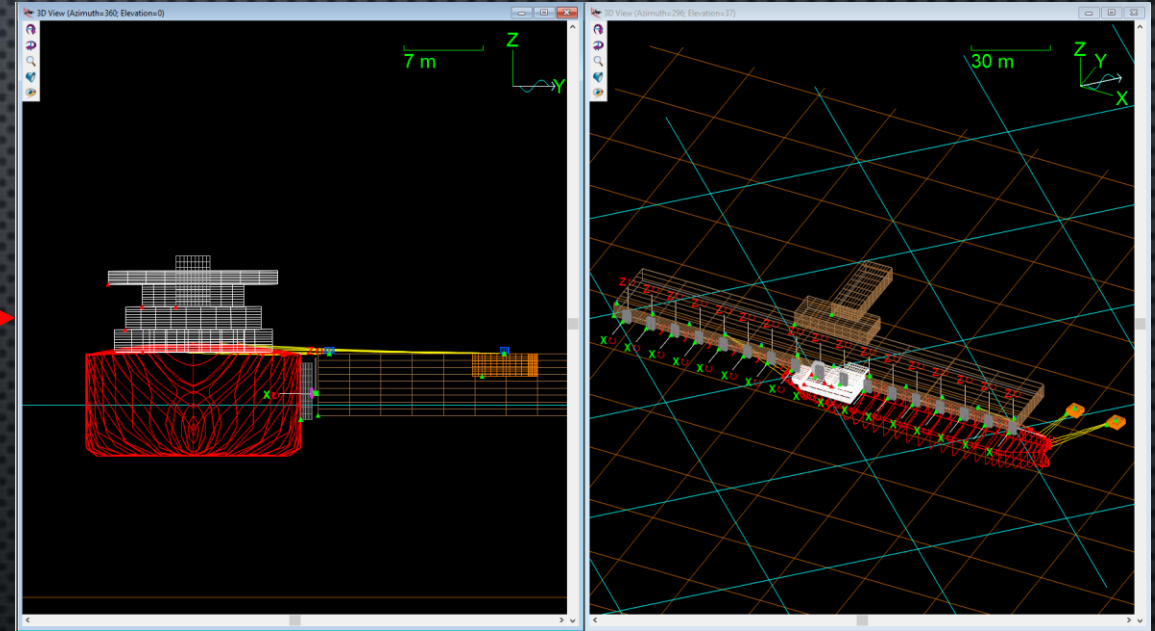
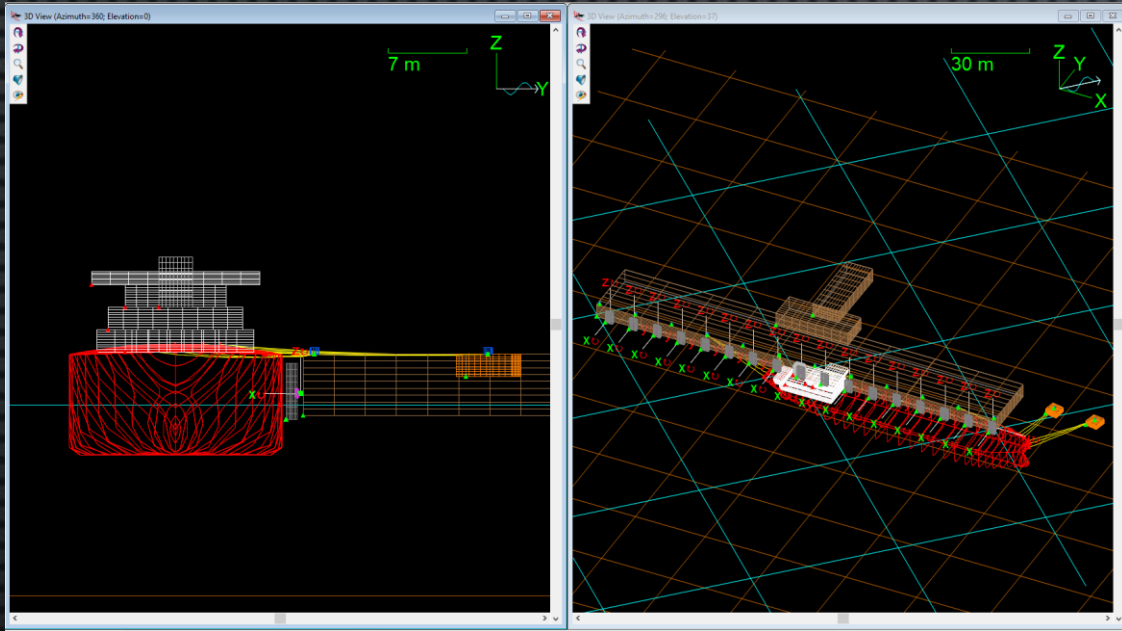
Stage Number	Duration (s)	Simulation Time at stage end (s)
0	20,000	0,000
1	300,000	300,000

OK Cancel Next

RUN : *STATIC*



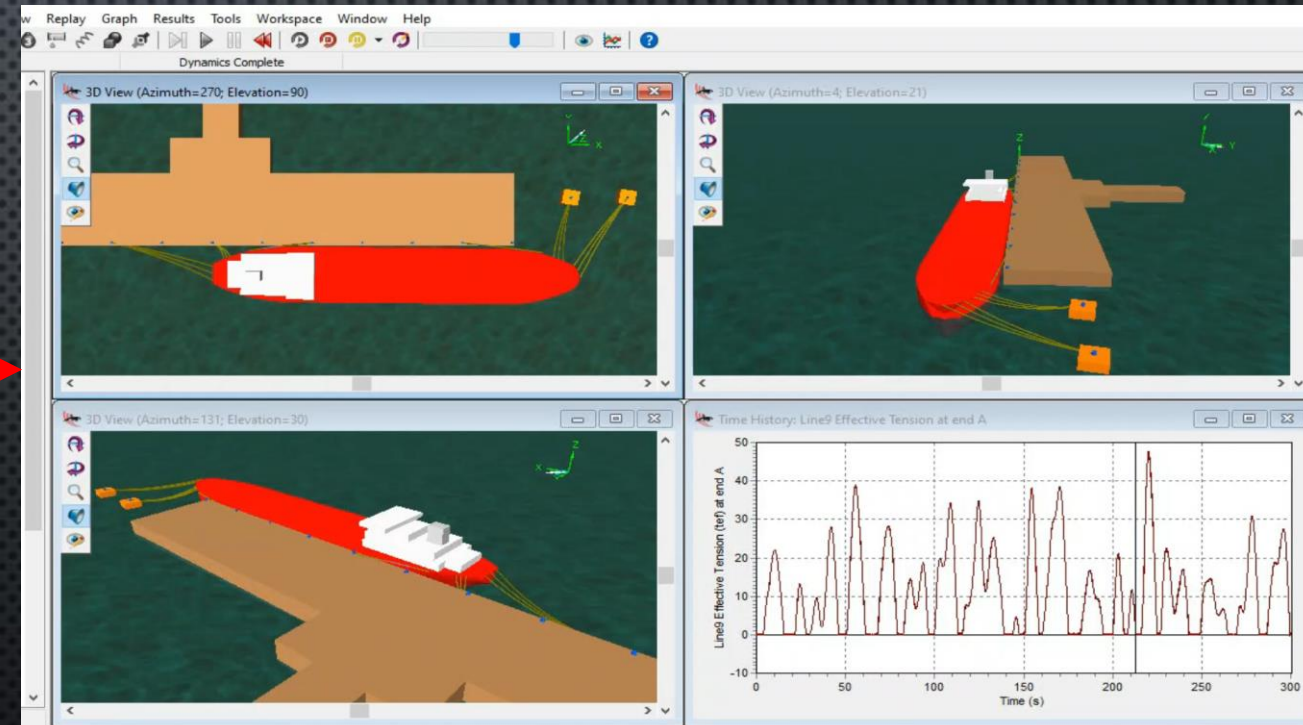
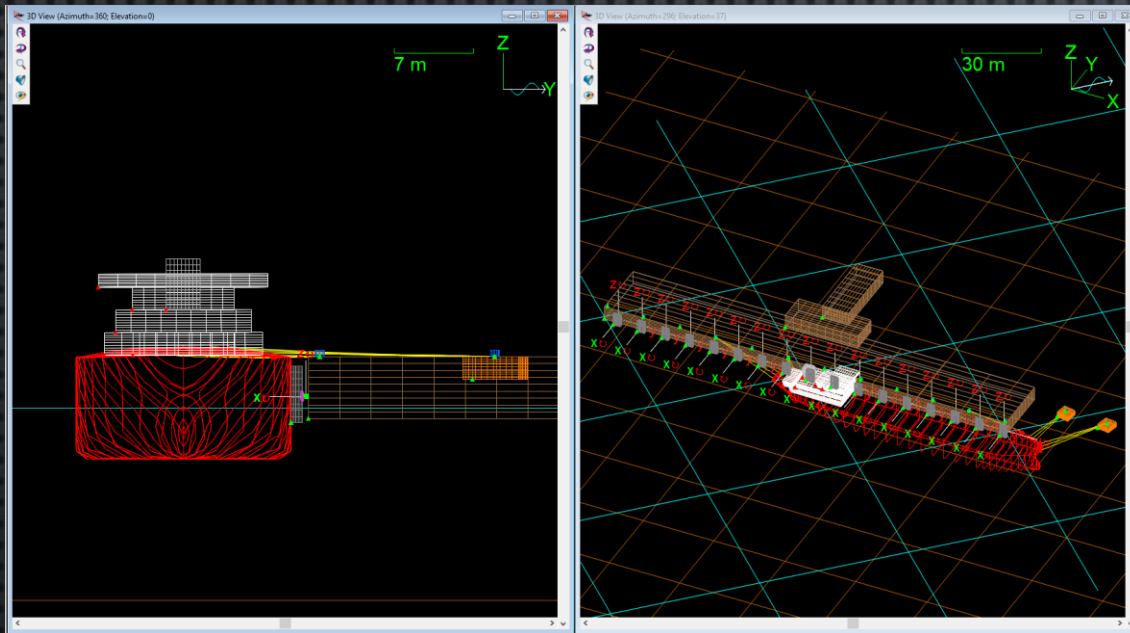
Running Static



RUN : *DYNAMIC*



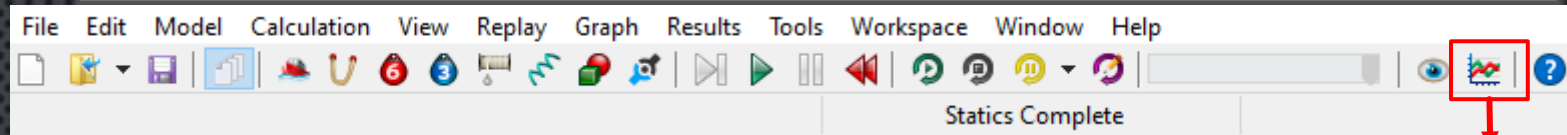
Running Dynamic



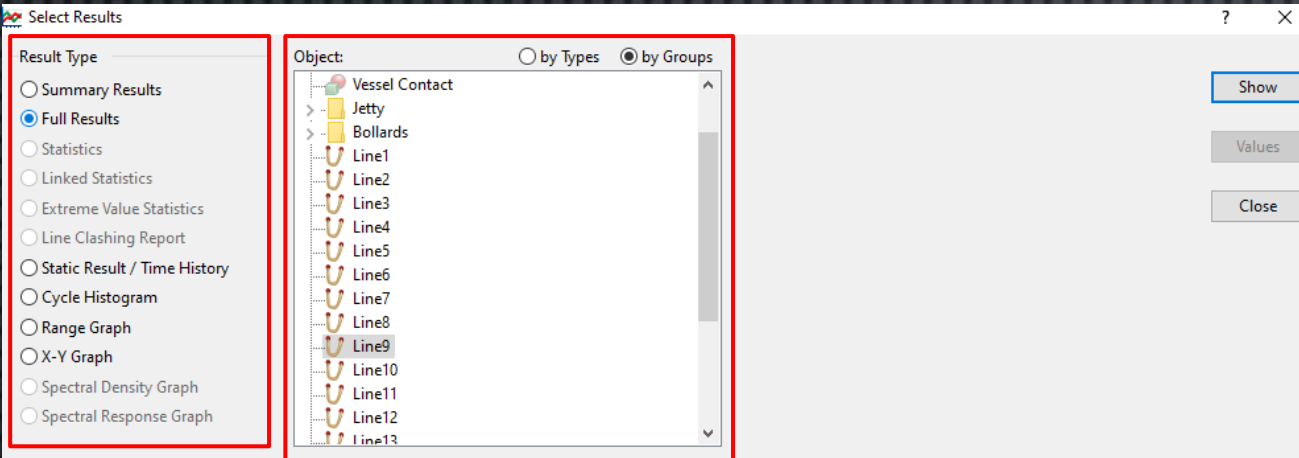
BAB 6

RESULTS

RESULTS **STATIC**



Klik icon atau tekan F5



Pilih jenis
Output

Pilih Object pada
Static Analysis

Full Results for Line9 in static state

OrcaFlex 10.2d: S2-N2 - M01 - D1.dat (modified 20:20 on 18/06/2021 by OrcaFlex 10.2d)

Shortest nodal natural period = 0,002960s.

Axial damping factors range from 0,000 to 0,000 % of critical damping.

End A	
Total Force (tef)	9,9367
End Tension (tef)	9,9367
End Shear Force (tef)	0,0021
Total Moment (tef.m)	0,0
End Bend Moment (tef.m)	0,0
End Torque (tef.m)	0,0
End Curvature (rad/m)	0,0
End Ez-angle (deg)	89,3523
End Force Azimuth (deg)	12,3035
End Force Declination (deg)	89,3216
End Force Ez-angle (deg)	89,3641
End Force Exy-angle (deg)	12,3222

End A components						
Load	Magnitude	End Axes			Global Axes	
		Ex	Ey	Ez	GX	GZ
Force (tef)	9,9367	9,7072	2,1204	0,1103	9,7078	0,1177
Moment (tef.m)	0,0	0,0	0,0	0,0	0,0	0,0

End B	
Total Force (tef)	9,936
End Tension (tef)	9,936
End Shear Force (tef)	0,0021
Total Moment (tef.m)	0,0
End Bend Moment (tef.m)	0,0
End Torque (tef.m)	0,0
End Curvature (rad/m)	0,0
End Ez-angle (deg)	89,821
End Force Azimuth (deg)	12,2861
End Force Declination (deg)	89,8092
End Force Ez-angle (deg)	89,8092
End Force Exy-angle (deg)	12,2861

RESULTS DYNAMICS



Klik icon atau tekan F5

Select Results

Result Type

- ☐ Summary Results
- ☐ Full Results
- ☐ Statistics
- ☐ Linked Statistics
- ☐ Extreme Value Statistics
- ☐ Line Clashing Report
- ☒ Static Result / Time History
- ☐ Cycle Histogram
- ☐ Range Graph
- ☐ X-Y Graph
- ☐ Spectral Density Graph
- ☐ Spectral Response Graph

Object:

☐ by Types ☒ by Groups

- General
- Environment
- Adria
- Vessel Contact
- Jetty
- Bollards
- \$ Line1
- \$ Line2
- \$ Line3
- \$ Line4
- \$ Line5
- \$ Line6
- \$ Line7
- \$ Line8
- \$ Line9
- \$ Line10

Period:

- Static State
- Instantaneous Value
- Specified Period
- Whole Simulation
- Build-up
- Stage 1

Variable:

- End Force
- End Moment
- Bend Restrictor Load
- Effective Tension
- Wall Tension
- Normalised Tension
- Contents Density
- Bend Moment
- x-Bend Moment
- y-Bend Moment
- Bend Moment component
- In-plane Bend Moment
- Out-of-plane Bend Moment
- Curvature
- Normalised Curvature
- x-Curvature
- y-Curvature
- Curvature component
- In-plane Curvature
- Out-of-plane Curvature
- Bend Radius
- x-Bend Radius
- y-Bend Radius
- Bend Radius component

Show:

- ☐ Positions
- ☐ Motions
- ☐ Angles
- ☒ Forces
- ☒ Moments
- ☐ Contact
- ☐ Pipe Stress / Strain
- ☐ Code Checks
- ☐ Fluid Loads
- ☒ End Loads
- ☐ End Loads (Global)
- ☐ End Loads (Local)
- ☐ End Loads (End Axes)

Pilih Waktu Analysis

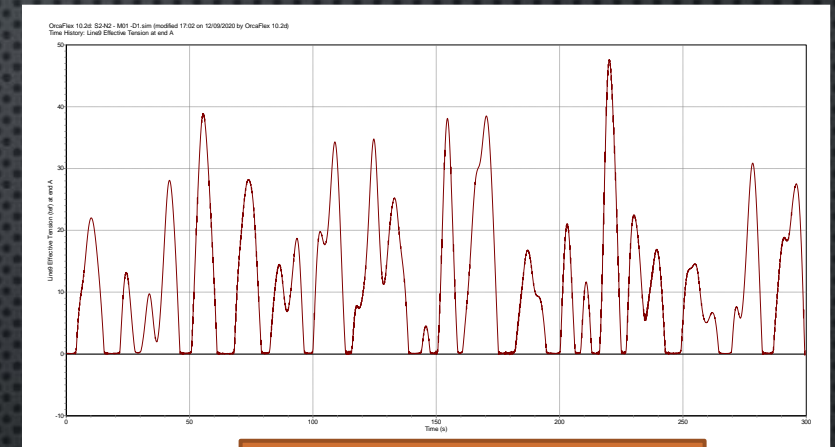
Pilih jenis Output

Usually this means that finer segmentation is needed in some sections of these lines in order to model compression adequately. The Summary Results tables report which segments have infringed their Euler limits.

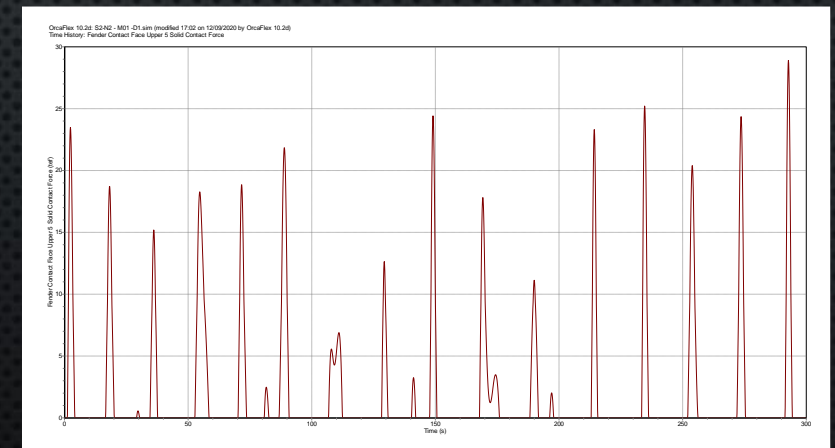
Pilih Object pada Dynamics Analysis

Position	No	Value
Touchdown	~	~
End B	~	18,355

Pilih hasil data yang diperlukan



Grafik Tension Time History



Grafik Bollard contact Time History

End of Slide

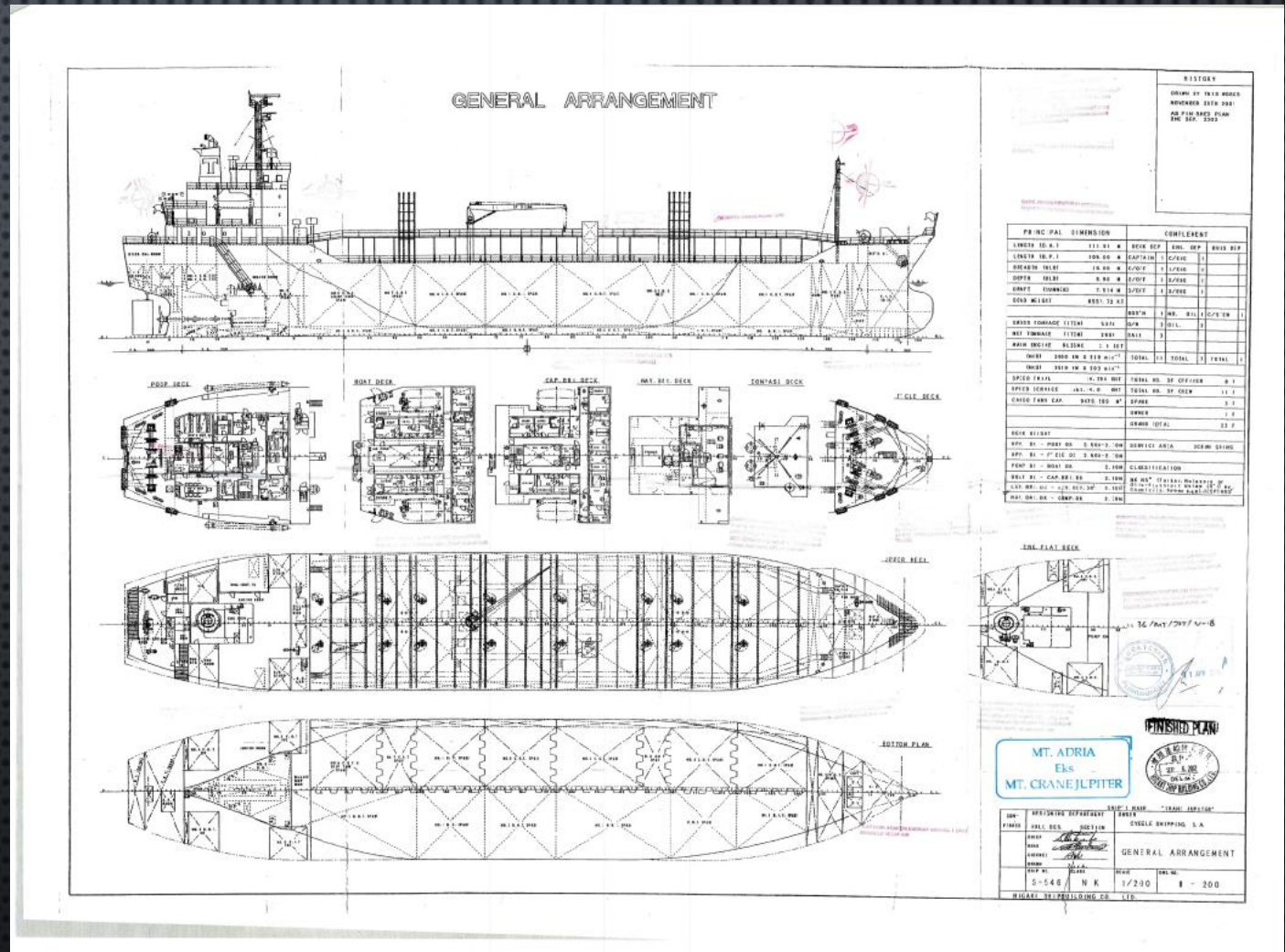
TERIMA KASIH

Principal Dimension

PARAMETER	VALUES	UNIT
Capacity	8558	DWT
Length of all (LOA)	111,910	m
Length of perpendicular (LPP)	105,000	m
Breadth	19,000	m
Depth	9,900	m
Draft	7,514	m
Deadweight		

BALLAST DRAFT

Displacement	7759	t
Draft	4,510	m
Trim	0,000	deg
KMT	8,390	m
KG	6,700	m
CoG _x	51,700	m
R _{xx}	8,251	m
R _{yy}	30,311	m
R _{zz}	30,311	m
GMT	1,400	m
MTC	80,600	m
WPA	1759,201	m ²
LCF	54,160	m
LCB	53,530	m
KML	173,600	m
BMT	6,110	m
BML	171,310	m



Displacement RAO/Motion RAO from MOSES

```

*****
*                                     *** MOSES ***                               *
*                                     -----                               *
*      Diffraction Analysis                                                    *
*                                     *                                           *
* Draft      = 4.51 Meters      Trim Angle   = 0.00 Deg.      GMT           = 1.4 Meters *
* Roll Gy. Radius = 8.25 Meters  Pitch Gy. Radius = 30.31 Meters  Yaw Gy. Radius = 30.31 Meters *
* Heading     = 0.00 Deg.      Forward Speed = 0.00 Knots     Linearization Based on 1/ 20 *
*                                     *                                           *
*****

+++ M O T I O N   R E S P O N S E   O P E R A T O R S +++
=====

Process = DEFAULT: Units = Degrees, Meters, M-Tons, and MPA Unless Stated

Results are in the Body System

Of Point On Body Adria At X = -51.7 Y = 0.0 Z = 6.7

E N C O U N T E R
-----
Frequency / Period / Surge / Sway / Heave / Roll / Pitch / Yaw /
-(Rad/Sec)- (Sec)- / Wave Ampl. / Wave Ampl. / Wave Ampl. / Wave Ampl. / Wave Ampl. / Wave Ampl.
/-----/ /-----/ /-----/ /-----/ /-----/ /-----/
Ampl. Phase Ampl. Phase Ampl. Phase Ampl. Phase Ampl. Phase Ampl. Phase

0.2513 25.00 0.994 67 0.000 0 0.971 -23 0.000 0 0.363 -112 0.000 0
0.2968 21.17 0.923 58 0.000 0 0.943 -33 0.000 0 0.499 -121 0.000 0
0.3423 18.35 0.880 47 0.000 0 0.900 -43 0.000 0 0.648 -132 0.000 0
0.3878 16.20 0.823 35 0.000 0 0.835 -56 0.000 0 0.801 -143 0.000 0
0.4333 14.50 0.750 22 0.000 0 0.746 -69 0.000 0 0.947 -156 0.000 0
0.4788 13.12 0.662 7 0.000 0 0.629 -84 0.001 131 1.071 -171 0.000 0
0.5243 11.98 0.558 -10 0.000 0 0.487 -100 0.001 -58 1.153 173 0.000 0
0.5698 11.03 0.441 -27 0.000 0 0.328 -114 0.000 0 1.167 156 0.000 0
0.6153 10.21 0.317 -45 0.000 0 0.170 -120 0.000 0 1.091 138 0.000 0
0.6608 9.51 0.198 -62 0.000 0 0.079 -70 0.000 0 0.916 120 0.000 0
0.7063 8.90 0.098 -70 0.000 0 0.172 -36 0.000 0 0.669 107 0.000 0
0.7518 8.36 0.045 -39 0.000 0 0.276 -50 0.000 0 0.425 108 0.000 0
0.7974 7.88 0.062 -9 0.000 0 0.333 -73 0.000 0 0.373 135 0.000 0
0.8428 7.45 0.078 -22 0.000 0 0.309 -99 0.000 0 0.565 142 0.000 0
0.8883 7.07 0.072 -47 0.000 0 0.217 -117 0.000 0 0.744 124 0.000 0
0.9337 6.73 0.048 -77 0.000 0 0.160 -112 0.000 0 0.737 99 0.000 0
0.9793 6.42 0.021 -106 0.000 0 0.174 -112 0.000 0 0.563 78 0.000 0
1.0248 6.13 0.004 -126 0.000 0 0.160 -127 0.000 0 0.404 75 0.000 0
1.0704 5.87 0.003 133 0.000 0 0.114 -145 0.000 0 0.374 82 0.000 0
1.1158 5.63 0.008 128 0.000 0 0.072 -156 0.000 0 0.343 74 0.000 0
1.1614 5.41 0.013 108 0.000 0 0.055 -145 0.000 0 0.261 59 0.000 0
1.2069 5.21 0.015 86 0.000 0 0.052 -134 0.000 0 0.182 50 0.000 0
1.2524 5.02 0.015 81 0.000 0 0.045 -138 0.000 0 0.151 58 0.000 0
1.2979 4.84 0.013 91 0.000 0 0.036 -147 0.000 0 0.138 62 0.000 0
1.3434 4.68 0.012 95 0.000 0 0.017 -95 0.000 0 0.103 59 0.000 0
1.3889 4.52 0.015 89 0.000 0 0.023 -119 0.000 0 0.087 64 0.000 0
1.4342 4.38 0.012 96 0.000 0 0.018 -121 0.000 0 0.083 76 0.000 0
1.4798 4.25 0.011 97 0.000 0 0.015 -128 0.000 0 0.064 69 0.000 0
1.5254 4.12 0.011 94 0.000 0 0.014 -116 0.000 0 0.055 65 0.000 0
1.5708 4.00 0.011 99 0.000 0 0.011 -113 0.000 0 0.044 76 0.000 0

```


Load RAO (linearized wave forces) - 1st order from MOSES

```
*****
*                                     *** MOSES ***
*                                     -----
*
*      Diffraction Analysis
*
*      Draft      = 4.51 Meters      Trim Angle = 0.00 Deg.
*      Heading    = 0.00 Deg.        Linearization Based on 1/ 20
*
*****

+++ L I N E A R I Z E D   W A V E   F R E Q U E N C Y   F O R C E S +++
=====

Process = DEFAULT: Units = Degrees, Meters, M-Tons, and MPA Unless Stated

Results are in the Body System

At Point On Body Adria At X = -51.7 Y = -0.0 Z = 6.7

E N C O U N T E R
-----
Frequency / Period / Surge Force / Sway Force / Heave Force / Roll Moment / Pitch Moment / Yaw Moment /
(Rad/Sec)- (Sec)-  / Wave Ampl. / Wave Ampl. / Wave Ampl. / Wave Ampl. / Wave Ampl. / Wave Ampl.
Ampl. Phase  Ampl. Phase  Ampl. Phase  Ampl. Phase  Ampl. Phase  Ampl. Phase  Ampl. Phase
-----
0.2513 25.00 114 -112 0 0 2400 -19 0 0 26803 -128 0 0
0.2968 21.17 150 -121 0 0 2195 -26 0 0 34553 -132 0 161
0.3423 18.35 183 -131 0 0 1968 -33 0 0 41858 -139 0 142
0.3878 16.20 209 -143 0 0 1724 -41 0 0 47706 -148 0 109
0.4333 14.50 224 -154 0 0 1461 -50 0 0 51306 -158 0 74
0.4788 13.12 226 -166 0 0 1177 -59 0 0 52302 -168 0 29
0.5243 11.98 214 -178 0 0 877 -68 0 0 50757 -179 0 -23
0.5698 11.03 190 171 0 0 575 -75 0 0 46909 171 1 -64
0.6153 10.21 154 162 0 0 314 -70 0 0 40895 160 1 -103
0.6608 9.51 110 156 0 0 193 -33 0 0 32851 151 1 -138
0.7063 8.90 70 166 0 0 258 -4 0 0 23430 145 1 -172
0.7518 8.36 63 -163 0 0 331 -2 0 0 14950 152 1 153
0.7974 7.88 84 -151 0 0 348 -9 0 0 12337 179 1 114
0.8428 7.45 101 -155 0 0 306 -16 0 0 15241 -166 0 19
0.8883 7.07 101 -163 0 0 231 -15 0 0 17620 -169 1 -96
0.9337 6.73 85 -168 0 0 189 1 0 0 17063 -176 1 -126
0.9793 6.42 66 -165 0 0 216 16 0 40 13696 179 2 179
1.0248 6.13 62 -152 0 0 239 16 0 35 10823 -172 1 140
1.0704 5.87 69 -141 0 0 216 9 0 30 11530 -155 0 46
1.1158 5.63 68 -134 0 0 170 5 0 25 12809 -151 0 -160
1.1614 5.41 64 -129 0 0 150 19 0 26 11643 -156 2 -163
1.2069 5.21 64 -128 0 0 160 32 0 24 9418 -158 2 174
1.2524 5.02 68 -124 0 0 155 33 0 21 8924 -146 1 113
1.2979 4.84 64 -116 0 0 134 31 0 18 9430 -137 0 158
1.3434 4.68 61 -111 0 0 140 38 0 14 8696 -139 2 -174
1.3889 4.52 63 -114 0 0 131 47 0 6 7320 -141 2 164
1.4342 4.38 65 -108 0 0 117 46 0 6 7330 -132 1 76
1.4798 4.25 57 -96 0 0 106 48 0 6 7390 -122 1 166
1.5254 4.12 58 -95 0 0 112 60 0 5 6283 -122 2 -168
1.5708 4.00 67 -90 0 0 96 67 0 2 6702 -114 1 77
```

Wave Drift Quadratic Transfer Function (QTF) 2nd order from MOSES

```

*****
*                                     *
*                               *** MOSES ***                               *
*                               -----                               *
*      Diffraction Analysis                                         *
*                                     *
*                               Heading = 0.00 Deg.                               *
*                                     *
*****

```

```
+++ M E A N   D R I F T   F O R C E S +++
=====
```

Process = DEFAULT: Units = Degrees, Meters, M-Tons, and MPA Unless Stated

Reported in the Body System

Body Name = Adria Drift Name = Adria Drift Method = Near Field

Force Factor = 1.0000 Radiation Factor = 1.0000 Coriolis Factor = 0.0000

Mean Drift Force / (Wave Amplitude)**2

ENCOUNTER		TRANSLATION			ROTATION		
Frequency	Period	Surge	Sway	Heave	Roll	Pitch	Yaw
0.2513	25.000	80.5	-0.0	5.0	0.0	1444.5	-5.2
0.2968	21.168	129.2	-0.0	2.1	0.0	1599.1	-8.9
0.3423	18.354	192.9	0.0	-0.9	-0.1	1855.7	-14.5
0.3878	16.201	266.9	0.0	-3.9	-0.1	2176.6	-20.8
0.4333	14.500	359.4	0.0	-7.1	-0.1	2621.9	-28.8
0.4788	13.122	509.3	-0.0	-10.5	-0.1	3492.5	-41.9
0.5243	11.983	761.8	0.0	-14.1	-0.2	5159.1	-65.0
0.5698	11.027	1090.9	-0.0	-17.2	-0.2	7468.1	-95.2
0.6153	10.211	1415.8	-0.0	-19.3	-0.3	9854.9	-125.9
0.6608	9.508	1823.0	-0.0	-20.7	-0.4	13032.4	-164.9
0.7063	8.896	2518.3	-0.0	-22.0	-0.6	18596.7	-232.4
0.7518	8.357	3381.1	-0.0	-22.7	-0.8	25564.3	-319.0
0.7974	7.880	4255.5	-0.0	-22.8	-1.0	32617.5	-409.3
0.8428	7.455	5560.4	-0.0	-24.7	-1.3	42870.2	-545.1
0.8883	7.073	7213.2	-0.0	-28.8	-1.7	55624.7	-720.9
0.9337	6.729	8985.8	-0.0	-34.7	-2.1	69165.0	-918.3
0.9793	6.416	11100.6	-0.0	-42.0	-2.7	85399.1	-1162.0
1.0248	6.131	13311.4	-0.0	-48.2	-3.4	102537.8	-1423.6
1.0704	5.870	16309.2	-0.0	-55.1	-4.2	125903.7	-1785.2
1.1158	5.631	19124.9	-0.1	-62.0	-5.1	147739.9	-2141.9
1.1614	5.410	22865.5	-0.1	-72.0	-6.2	176678.8	-2615.6
1.2069	5.206	26102.7	-0.1	-80.6	-7.2	201716.5	-3028.1
1.2524	5.017	29720.5	-0.1	-89.7	-8.3	229726.8	-3487.6
1.2979	4.841	32582.9	-0.1	-96.8	-9.1	251884.8	-3828.9
1.3434	4.677	39225.8	-0.1	-114.0	-10.9	303308.7	-4577.8
1.3889	4.524	43255.3	-0.1	-124.9	-11.7	334460.8	-4949.5
1.4342	4.381	52170.6	-0.1	-146.9	-13.8	403482.6	-5812.3
1.4798	4.246	54150.9	-0.1	-151.0	-13.7	418842.0	-5796.2
1.5254	4.119	59682.9	-0.1	-164.7	-14.6	461670.7	-6164.6
1.5708	4.000	70372.2	-0.2	-192.0	-16.6	544401.1	-6988.1

Back

Added mass & Damping matrices from MOSES

```

$ MATRICES
$ Dimensions are Meters and M-Tons
Frequency 0.2513 Period 25.0000
Added Mass
5.31290E-02 -4.45677E-06 -4.91690E-02 1.55577E-04 8.96847E+00 2.88300E-04
-1.15822E-05 8.90914E-01 -1.93894E-05 -3.56361E-01 -1.87042E-03 -4.56011E+00
-1.87390E-02 -1.40868E-05 2.87602E+00 1.30904E-04 -8.83921E+00 3.38300E-03
1.55577E-04 -3.56361E-01 1.30904E-04 1.26467E+01 2.74101E-02 -1.87266E+01
8.96847E+00 -1.87042E-03 -8.83921E+00 -1.25700E-02 2.47278E+03 -6.51453E-02
2.88300E-04 -4.56011E+00 3.38300E-03 -1.81773E+01 4.54653E-02 9.15332E+02
Damping
3.25778E-04 1.20127E-08 -3.30988E-03 1.13394E-06 6.04531E-02 2.41375E-06
-9.76128E-08 1.02889E-03 -3.17768E-06 -1.19097E-03 3.60740E-06 -2.94474E-03
1.40303E-04 2.20450E-07 2.50631E-01 1.94035E-05 -4.54861E-01 5.28570E-04
1.13394E-06 -1.19097E-03 1.94035E-05 2.10030E-03 1.99213E-03 -1.02163E-03
6.04531E-02 3.60740E-06 -4.54861E-01 -2.79862E-03 -2.60874E+00 -4.78248E-02
2.41375E-06 -2.94474E-03 5.28570E-04 8.96607E-03 1.35685E-02 -1.03695E-02
Frequency 0.2968 Period 21.1680
Added Mass
5.56997E-02 -3.92826E-06 -4.70875E-02 1.64880E-04 9.41491E+00 2.77952E-04
-1.19641E-05 9.22430E-01 -1.44736E-05 -3.74016E-01 -1.82140E-03 -4.65040E+00
-1.86290E-02 -1.51514E-05 2.69360E+00 1.05937E-04 -8.61064E+00 2.86538E-03
1.64880E-04 -3.74016E-01 1.05937E-04 1.26902E+01 2.78555E-02 -1.89310E+01
9.41491E+00 -1.82140E-03 -8.61064E+00 -8.58611E-03 2.59191E+03 -1.50698E-02
2.77952E-04 -4.65040E+00 2.86538E-03 -1.83110E+01 3.04105E-02 9.30388E+02
Damping
9.39229E-04 4.45867E-08 -4.78972E-03 3.24659E-06 1.73124E-01 5.31763E-06
-2.73092E-07 3.27135E-03 -4.02029E-06 -3.66574E-03 -4.92542E-07 -9.31890E-03
2.75379E-04 4.75598E-07 3.55283E-01 2.69575E-05 -6.63062E-01 7.38075E-04
3.24659E-06 -3.66574E-03 2.69575E-05 6.45138E-03 3.22914E-03 -4.48060E-03
1.73124E-01 -4.92542E-07 -6.63062E-01 -3.77882E-03 1.69486E+01 -6.73185E-02
5.31763E-06 -9.31890E-03 7.38075E-04 2.59747E-02 2.01184E-02 5.53214E-03
Frequency 0.3423 Period 18.3540
Added Mass
5.82161E-02 -3.18132E-06 -4.43517E-02 1.74368E-04 9.84321E+00 2.64774E-04
-1.23575E-05 9.63141E-01 -9.39457E-06 -3.95734E-01 -1.87907E-03 -4.76629E+00
-1.86200E-02 -1.41525E-05 2.47200E+00 9.90397E-05 -8.30670E+00 2.30151E-03
1.74368E-04 -3.95734E-01 9.90397E-05 1.27423E+01 2.82694E-02 -1.92083E+01
9.84321E+00 -1.87907E-03 -8.30670E+00 -5.58164E-03 2.70997E+03 3.83191E-02
2.64774E-04 -4.76629E+00 2.30151E-03 -1.85184E+01 1.55523E-02 9.50384E+02
Damping
2.19848E-03 1.40267E-07 -6.35294E-03 7.71755E-06 4.02196E-01 1.07991E-05
-6.35760E-07 8.77807E-03 -4.50215E-06 -9.43529E-03 1.89855E-06 -2.49064E-02
4.64004E-04 6.66442E-07 4.60124E-01 3.53162E-05 -8.96230E-01 9.28227E-04
7.71755E-06 -9.43529E-03 3.53162E-05 1.64359E-02 5.14583E-03 -1.61504E-02
4.02196E-01 1.89855E-06 -8.96230E-01 -4.75363E-03 6.42170E+01 -8.44028E-02
1.07991E-05 -2.49064E-02 9.28227E-04 6.10699E-02 2.85522E-02 1.70540E-01

```