Tension Technology International Ltd

OPTIMOOR MOORING ANALYSIS

SIMULATION OF NORTHERN FAITH BREAK AWAY AT KOPER TERMINAL ON 4 JULY 2007

CONTENTS

Executive Summary

Simulating the conditions of the vessel moored at the berth for the key 20 minutes period from 1640 to 1700 demonstrated significant outward sway through aft yawing. The vessel yawed 35 m when stern line 3 had a reduced break load of 60% of new MBL as found in the TTI Report TTI-JN-2008-469 and the brakes on the winches had faded to 30 tf.

If line 3 had its new MBL this sway would have been 12.8 m. This demonstrates that the reduced break load of stern line 3 had a dramatic effect on the excursion of the vessel. This line broke within 3 to 4 minutes of the start of the simulations.

When all lines have their as new MBL - none of them break.

Fading of winch brakes was also an important issue as the outward sway doubled when the winch rendering threshold force was reduced from 42 to 30 tf.

Further the vessel side wind area was biased towards the vessel aft due to the position of the above main deck accommodation, control rooms etc causing the wind when blowing beam-on to create an outward sway yawing moment.

1. INTRODUCTION

On 4th July 2007 the Northern Faith Containership when moored at Koper terminal, Slovenia broke a stern line during 45 knot winds. As a result the mooring became unsafe and the vessel stern yawed outwards causing the winches to render excessively. The vessel was out of control until port tugs came to assist and the vessel was remoored and made fast. During this incident one of the vessel's crew was seriously injured.

2. SCOPE OF WORK

The object of the Optimoor analysis is to simulate the early part of the incident where one of the mooring lines broke and the excessive aft yawing that consequently occurred.

Four scenarios were modelled using dynamic analysis:

(i) Assuming all ropes still had their certified minimum break loads (MBL) and all winches rendered at 60% of rope MBL.
(ii) As (i) except the stern line that broke was assumed to have a reduced break load determined through failed rope investigation by TTI (Report: TTI-JN-2008-469)
(iii) As (i) except the winches after initially rendering at 60% of rope MBL (42 tf) did subsequently render at a lower load (30 tf) due to brake fading.
(iv) As (iii) but using the lower rope break load from (ii).

In dynamic mode of analysis, the short-term behaviour is governed by forces which change over seconds and minutes such as the varying wind gusts which may give increased loads over the mean wind speed due to the short term force and inertial effects.

The output data used for discussion and conclusions were maximum surge and sway, highest line loads, highest line slippage and time of line breaks where applicable.

3. DATA SOURCES

Input data for Optimoor was rather scarce and sometimes contradictory. In the absence of necessary data, generic data from within TTI was used. For example, in the case of missing vessel data, estimations were made from similar vessels.

The input data came in e-mails from Captain Dirk Dietrich of the Federal Bureau of Maritime Casualty Investigation, Zoper terminal, Google Earth, TTI and various other internet sites.

4. BERTH DATA

The berth data used by Optimoor is shown in Appendix A.

5. VESSEL DATA

Optimoor assumes that the winch brakes retain their specified holding power in all circumstances. In practice, they will fade by an unknown factor as soon as they start slipping. This is a common defect in winch design, which the OCIMF mooring guidelines warn against. The effect is not serious so long as the brakes serve their primary purpose of levelling out inequalities in tensions of lines within a particular service. However, if brakes slip more than, say, about a metre, their capability is likely to be significantly degraded. As we are modelling an instance of winches rendering then two different vessel files were created representing an example of winch brake fade. One file assumes the winches render at 60% of rope MBL which is 42 tf and the other assumes that they render at 30 tf to represent fading.

The other two variants that go to make a total of four vessel files are the assumption that all the ropes were capable of their certified MBL and that one stern line had only 60% of its new MBL – 42 tf as indicated in the failed rope investigation report by TTI.

The vessel was only partly loaded at the stern and this combined with the above main deck accommodation, control rooms etc produced a longitudinal centre of area that is biased towards the stern of the vessel causing the wind when blowing beam-on to create a significant outward sway yawing moment.

The vessel data files used by Optimoor are shown in Appendix B.

6. MOORING ARRANGEMENT

The mooring arrangement is shown in figure 1.

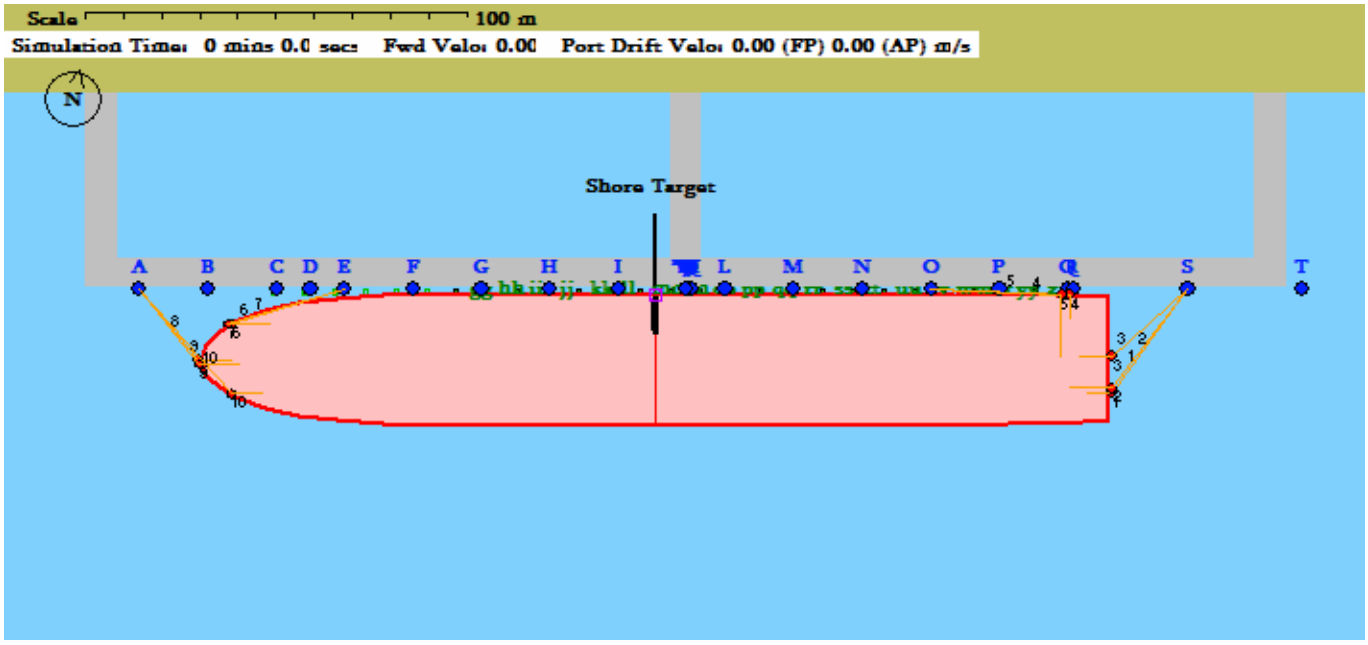

Figure 1: Mooring Arrangement

Two of the three head lines are 6-strand nylon wire laid construction of 70 tf MBL when new, the third is 8-strand plaited polypropylene of 79 tf MBL when new. One of each rope type is used for the forward and aft springs. The three stern lines like the head lines comprise two 6-strand nylons and one 8-strand polypropylene. The nylon lines use winches and the polypropylene lines use warping drums secured on bitts. The pre-tension aim for the winch ropes was 10 tf and for the bitt secured ropes zero tf. The brake limit for the winches was discussed in the Vessel Data – Section 5. The load at which the bitt secured lines slipped was set at 1 tf for all cases.

7. ENVIRONMENTAL DATA

The berth position is along the middle of the jetty as indicated in figure 2.

Figure 2: Koper Container Jetty

The surrounding area to Koper terminal is shown in figure 3.

Figure 3: Surrounding Area to Koper Terminal

Forty-five knot mean wind speeds were blowing on to the terminal from a North to North-Easterly direction. No wave, swell or current data was provided. As the terminal is in a sheltered bay and there are no significant fetches to generate wind blown waves then the only environment applied to the vessel was wind.

A mean wind direction of 20 degrees was chosen as representing the North to North-Easterly directions.

A Davenport Gusting Coefficient, k of 0.01 was used. Davenport (ref. 2) gives the following definitions for roughness parameter k:-

- 0.005 open unobstructed country e.g. prairie-type grassland, tundra, desert
- 0.015 to 0.020 country broken by low clustered obstructions such as trees and houses (below 10 metres)
- 0.050 heavily built-up urban centres with tall buildings

The appropriate k value for the surrounding area is not known, so 0.01 is an approximation. A coefficient of 0.01 is equal to a gusting ratio of approximately 1.4, which is the peak gust wind speed over the mean wind speed.

Figure 4 shows a diagram of the vessel being securely moored at 1640 through to it being controlled by assistant tugs at 1800. As no data was available for the tugs and the initial activity is the most important since this dictates the later excursion of the vessel then the dynamic analysis was conducted from 1640 to 1700.

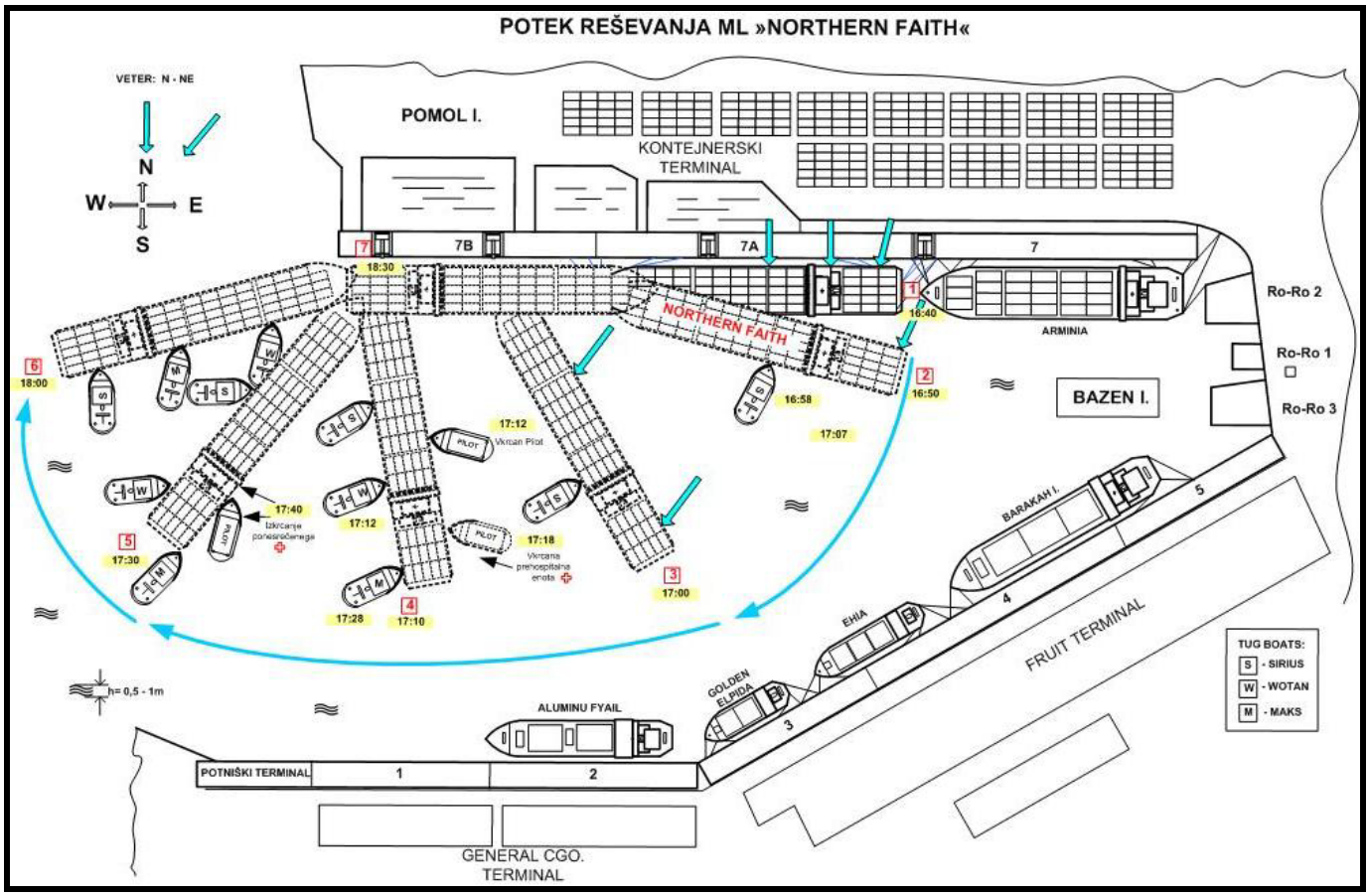

Figure 4: Northern Faith Movement

8. PROPOSED RUNS

Each of the four cases was run under the same conditions except for the differences shown in table 1 as follows:

Wind Speed:	45 knots
Direction:	20 degrees true
Davenport Gusting coefficient:	0.01
Duration:	20 minutes (1640 – 1700)
Current:	None
Waves/Swell:	None

Table 1: Difference Between the Four Cases

Case No.	Centre Aft Line Break Load	Winch Brake Limit (tf)
1	70 tf (MBL)	42 tf (60% of MBL)
2	60% of MBL	42 tf (60% of MBL)
3	70 tf (MBL)	30 tf (43% of MBL)
4	60% of MBL	30 tf (43% of MBL)

The line that broke during the mooring and 45 knot wind was the centre aft line, therefore Case 1 was run with that line having its new certified MBL of 70 tf and the winch brake limit set at 60% of this (42 tf).

Case 2 assumes the same winch brake limit but the break load of this rope was reduced to 42 tf consistent with the post-mortem estimation of this rope's break load. The winch brake load remains at 42 tf. For practical reasons the winch brake load was adjusted to be just above the line break load otherwise the winch would render just below the line's break load.

Case 3 assumes new certified rope MBL and that the winch brakes fade to 30 tf from initially and momentarily being 42 tf.

Case 4 assumes both the reduced rope break load and reduced winch brake load.

9. RESULTS

The dynamic analysis performs calculations at the rate of ten per second for these runs over the twenty minute duration. Snapshots were displayed every 10 seconds and from this data I have taken the most relevant at the 10 and 20 minute intervals. Key data is shown in table 2 and vessel positions relative to the berth are shown in figures 5 to 12.

Table 2: Results Summary

Case No.	Broken Lines	After 10 Minutes				After 20 Minutes			
		Surge (m)	Sway (m)	Highest Loaded Line	Maximum Line Slippage (m)	Surge (m)	Sway (m)	Highest Loaded Line	Maximum Line Slippage (m)
1	None	1.6 fwd	0.8 out	Fwd sprg (7-E) 36%	Stern (2-S) 5.3 m	2.4 fwd	5.6 out	Fwd sprg (7-E) 32%	Stern (2-S) 10.9 m
2	Stern Line 3 – S between 200 and 210 secs	6.8 fwd	13.4 out	Fwd sprg (7-E) 34%	Stern (2-S) 26.7 m	12.5 fwd	18.0 out	Aft sprg (4-O) 32%	Stern (2-S) 37.2 m
3	None	2.4 fwd	6.1 out	Fwd sprg (7-E) 19%	Stern (2-S) 13.2 m	5.5 fwd	12.8 out	Stern Line (1-S) 30%	Stern (2-S) 22.0 m
4	Stern Line 3 – S between 190 and 200 secs	25.7 fwd	24.7 out	Fwd sprg (7-E) 31%	Stern (2-S) 58.6 m	27.4 fwd	35.1 out	Stern Line (1-S) 40%	Stern (2-S) 74.1 m

9.1 Case 1

Case 1 has all ropes with new certified break load and winch brakes set at 42 tf. After 10 minutes there are no broken lines, acceptable vessel excursion, a highest loaded line of 36% MBL and maximum rendered line of 5.3 m. In the circumstances of a mean wind speed of 45 knots beam on blowing off the jetty this is an acceptable position. Figure 5 depicts this position.

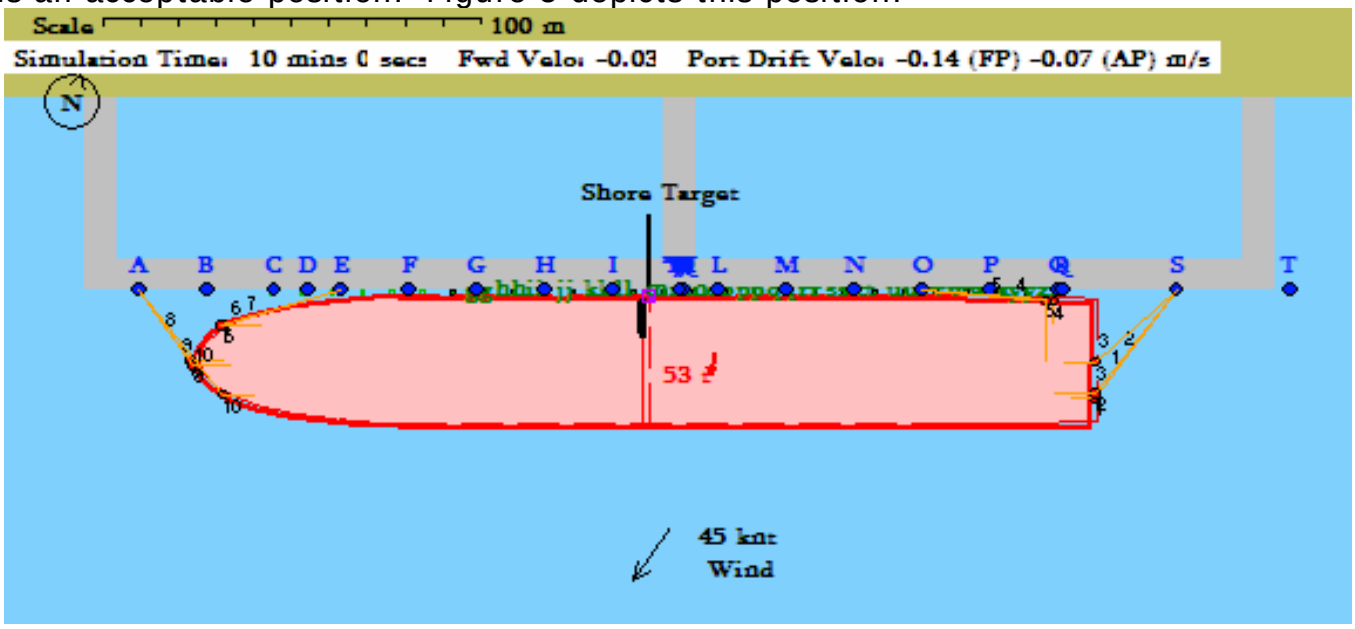

Figure 5: Case 1 After 10 Minutes

After 20 minutes, there are still no broken lines, vessel excursion is high at 2.4 m forward surge and 5.6 m outwards sway. Highest loaded line 32% MBL and maximum rendered line length is 10.9 m. Again in the circumstances of a mean wind speed of 45 knots beam on blowing off the jetty this maybe an expected position but the vessel is not out of control and does not bear resemblance to the Northern Faith's position after the same time interval depicted in figure 4.

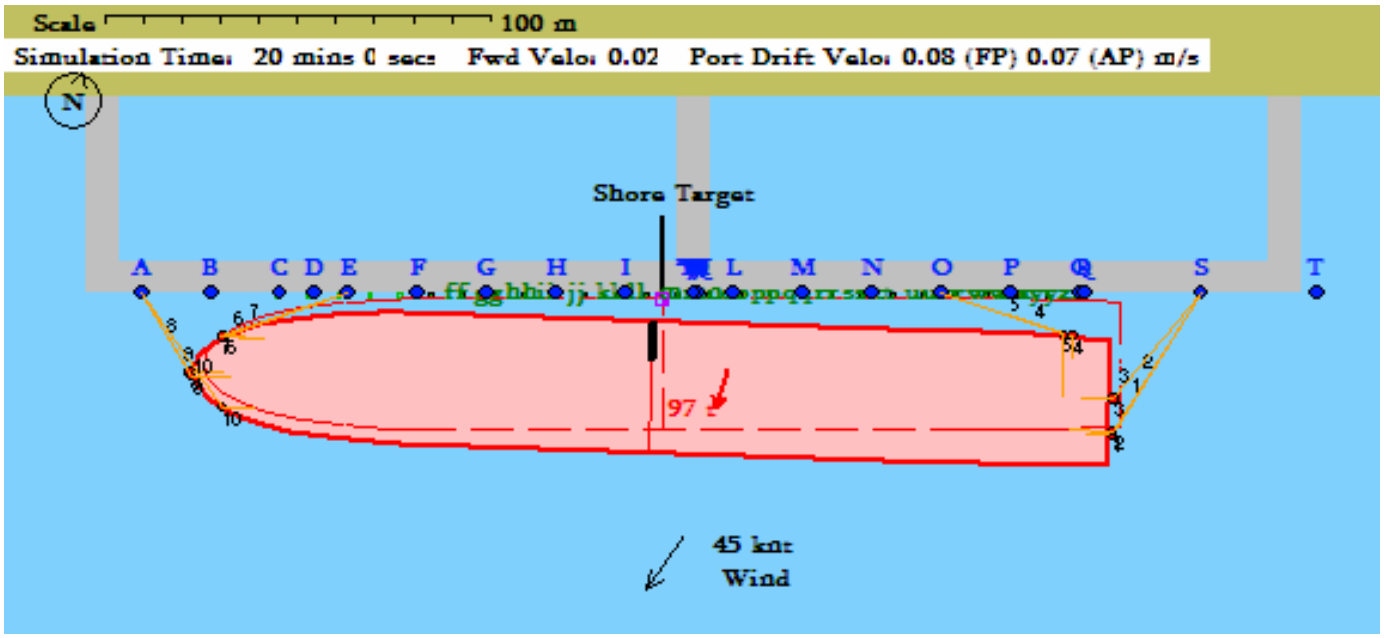

Figure 6: Case 1 After 20 Minutes

9.2 Case 2

Case 2 has all ropes with new certified break load and winch brakes set at 42 tf except line 3 which has a breaking load of 42 tf. Between 3 and 4 minutes line 3 has broken because the line loads were too high. After 10 minutes there is unacceptable vessel excursion of 6.8 m forward surge and 13.4 m outwards sway, a highest loaded line of 34% MBL and maximum rendered line of 26.7 m. In these circumstances of a mean wind speed of 45 knots beam on blowing off the jetty the vessel is no longer securely moored with only one winch stern line and one on bitts. Figure 7 depicts this position and it is noted that it is not dissimilar to the actual displacement of the Northern faith shown in figure 4 after 10 minutes.

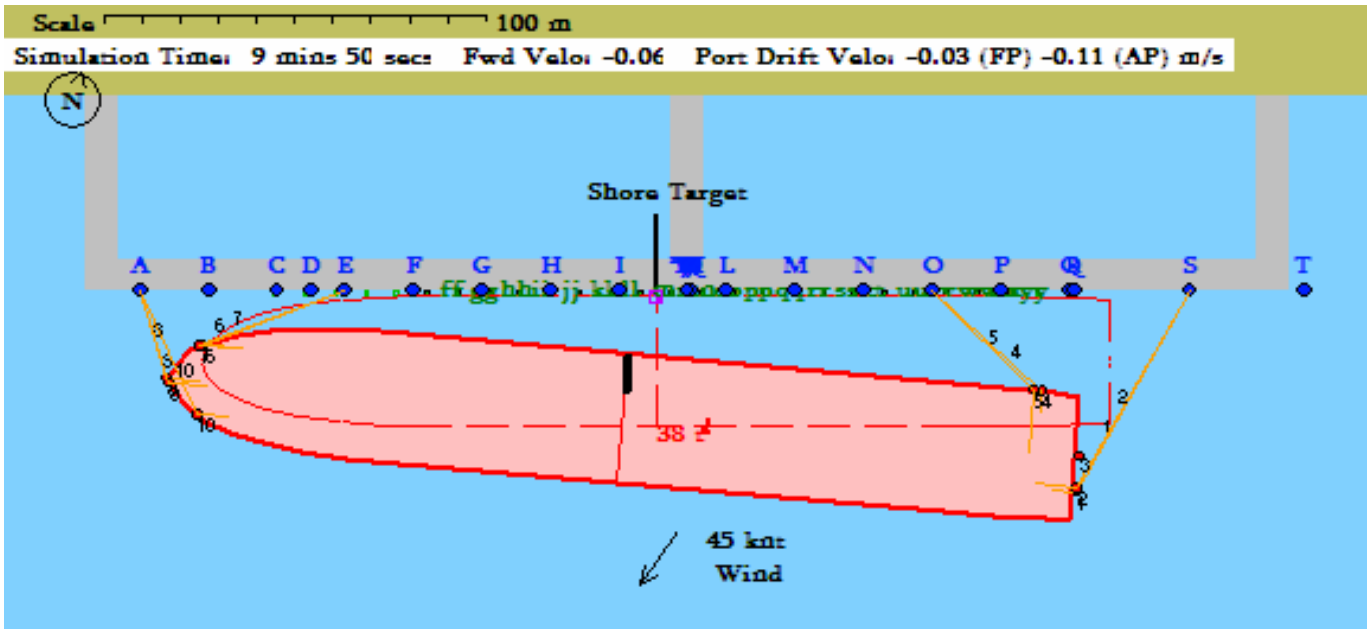

Figure 7: Case 2 After 10 Minutes

After 20 minutes things have got progressively worse with vessel excursion of 12.5 m forward surge and 18.0 m outwards sway, a highest loaded line of 32% MBL and maximum rendered line of 37.2 m. Figure 8 depicts this position. The actual displacement of the Northern Faith shown in figure 4 after 20 minutes is worse than this case 2 simulation after 20 minutes.

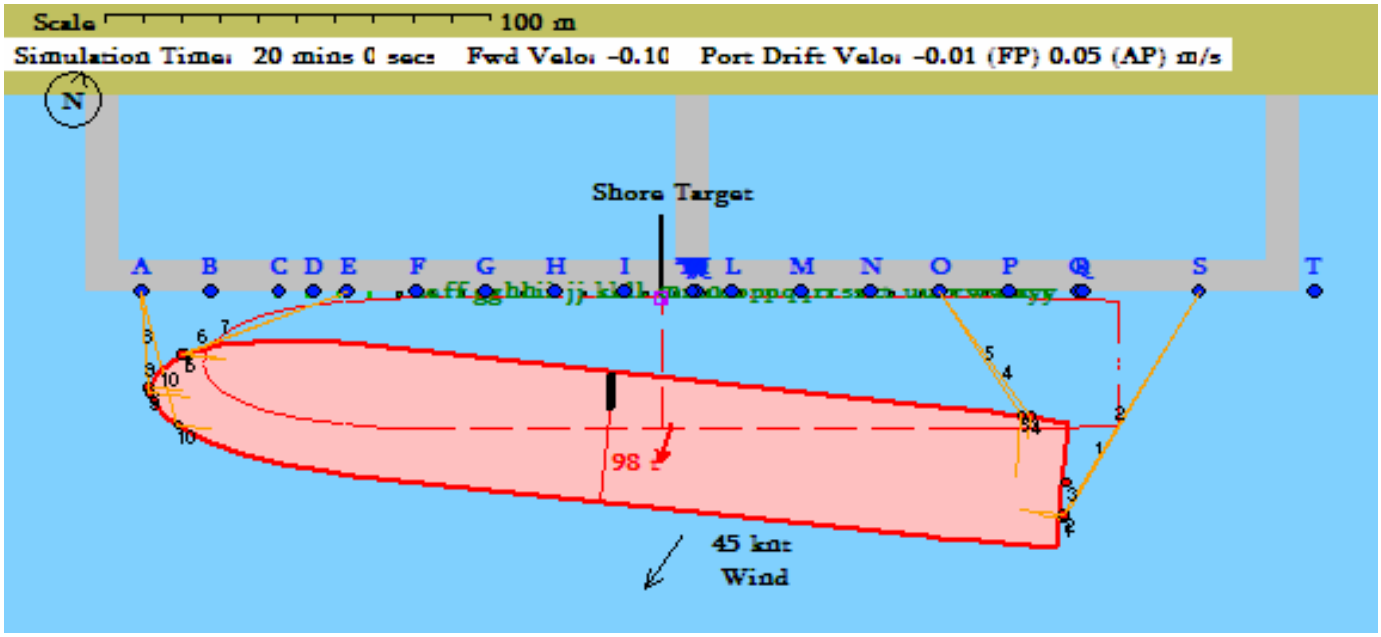

Figure 8: Case 2 After 20 Minutes

9.3 Case 3

Case 3 has all ropes with new certified break load but winch brakes set at 30 tf as an example of brake fade occurring as discussed earlier. After 10 minutes there are no broken lines, 2.4 m forward vessel surge and 6.1 m outwards sway, a highest loaded line of 19% MBL and maximum rendered line of 13.2 m. Case 3 is similar to Case 1 with the exception of lower winch load rendering and therefore the additional vessel excursion is consistent with this. Figure 9 depicts this position.

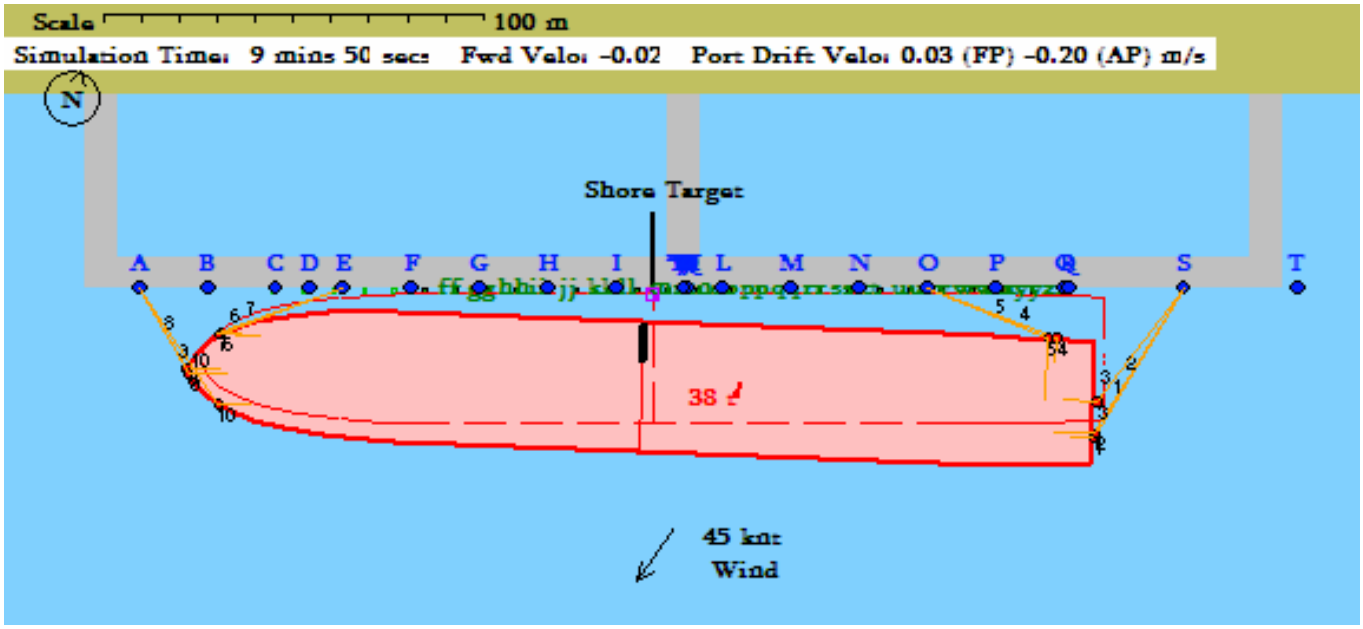

Figure 9: Case 3 After 10 Minutes

After 20 minutes there are still no broken lines but surge and outwards sway have increased to 5.5 and 12.8 m respectively, highest loaded line is 30% MBL and maximum rendered line of 22.0 m. Again with Case 3 being similar to Case 1 bar

the reduced rendering load the additional vessel excursion is consistent with this but the vessel displacement is not as severe as that experienced by the Northern Faith from the figure 4 diagram.

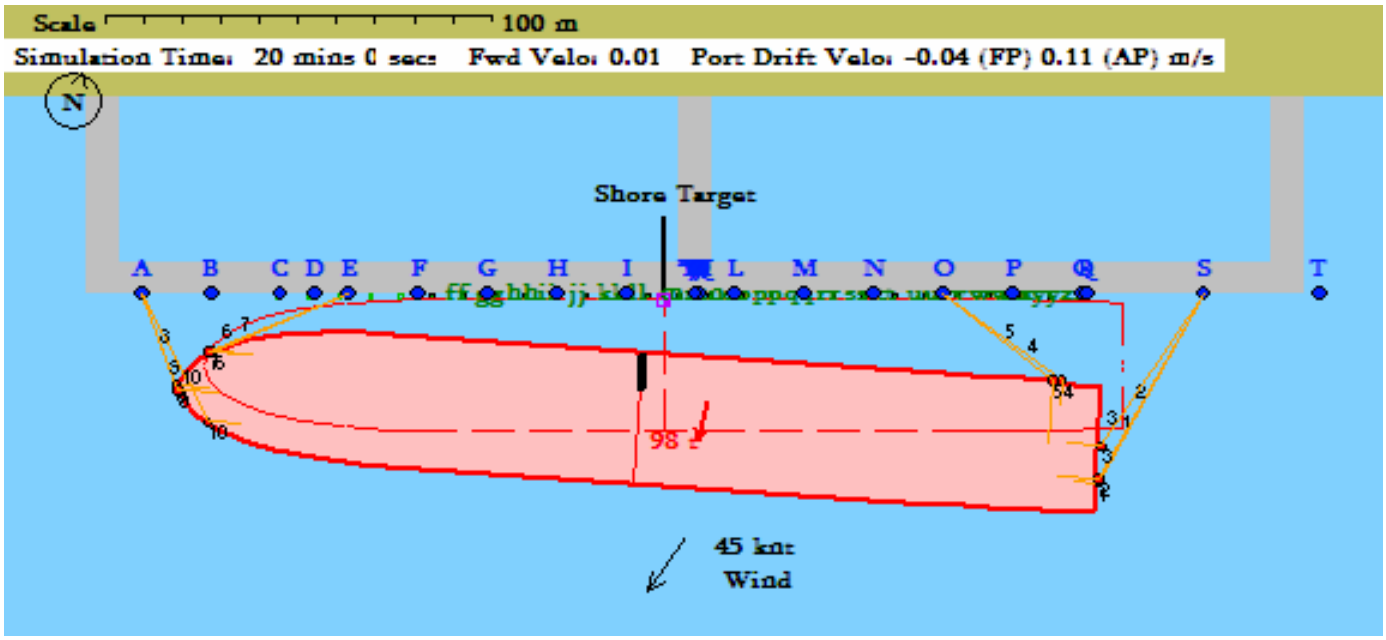

Figure 10: Case 3 After 20 Minutes

9.4 Case 4

Case 4 has all ropes with new certified break load except line 3 which has a breaking load of 42 tf and winch brakes set at 30 tf. Between 3 and 4 minutes line 3 has broken because the line loads were too high. After 10 minutes there is unacceptable vessel excursion of 25.7 m forward surge and 24.7 m outwards sway, a highest loaded line of 31% MBL and maximum rendered line of 58.6 m. Clearly a desperate situation and the worst of the four cases investigated at the 10 minute time interval and very similar to the Northern Faith graphic at the same time interval (see figure 4).

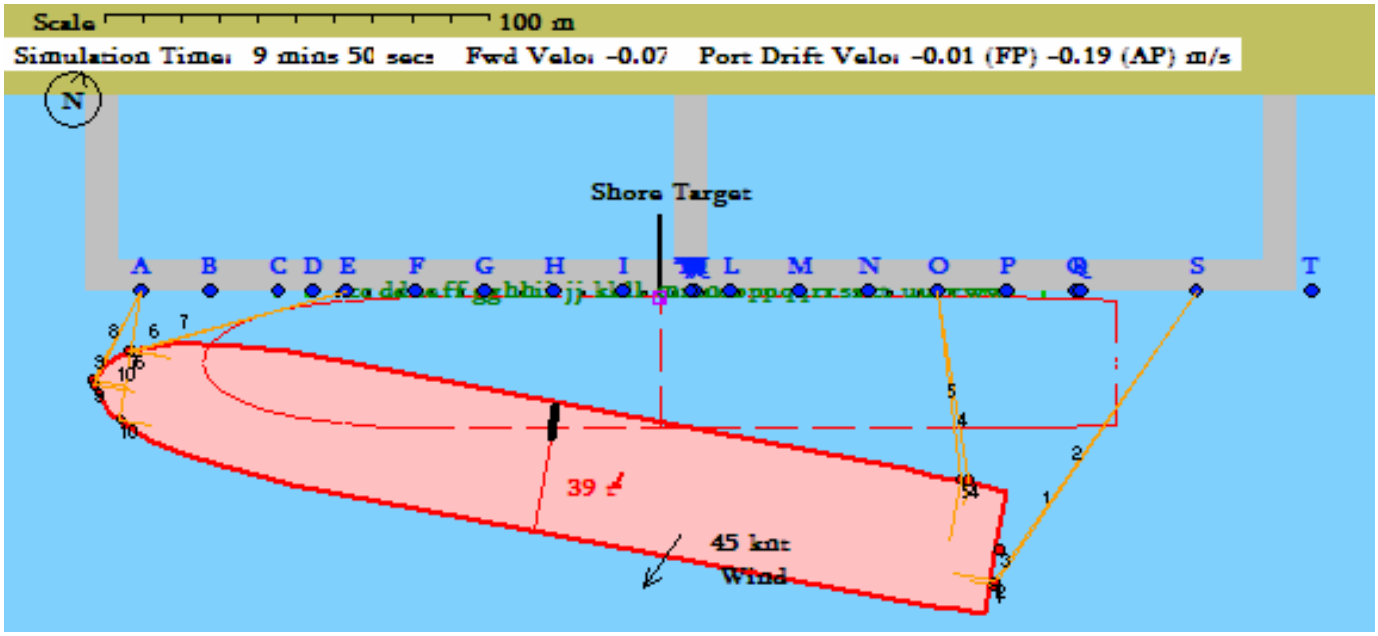

Figure 11: Case 4 After 10 Minutes

After 20 minutes things have got progressively worse with vessel excursion of 27.4 m forward surge and 35.1 m outwards sway, a highest loaded line of 40% MBL and maximum rendered line of 74.1 m. Figure 12 depicts this position. The actual displacement of the Northern Faith (fig. 4) after 20 minutes is similar to this Case 4 after 20 minutes.

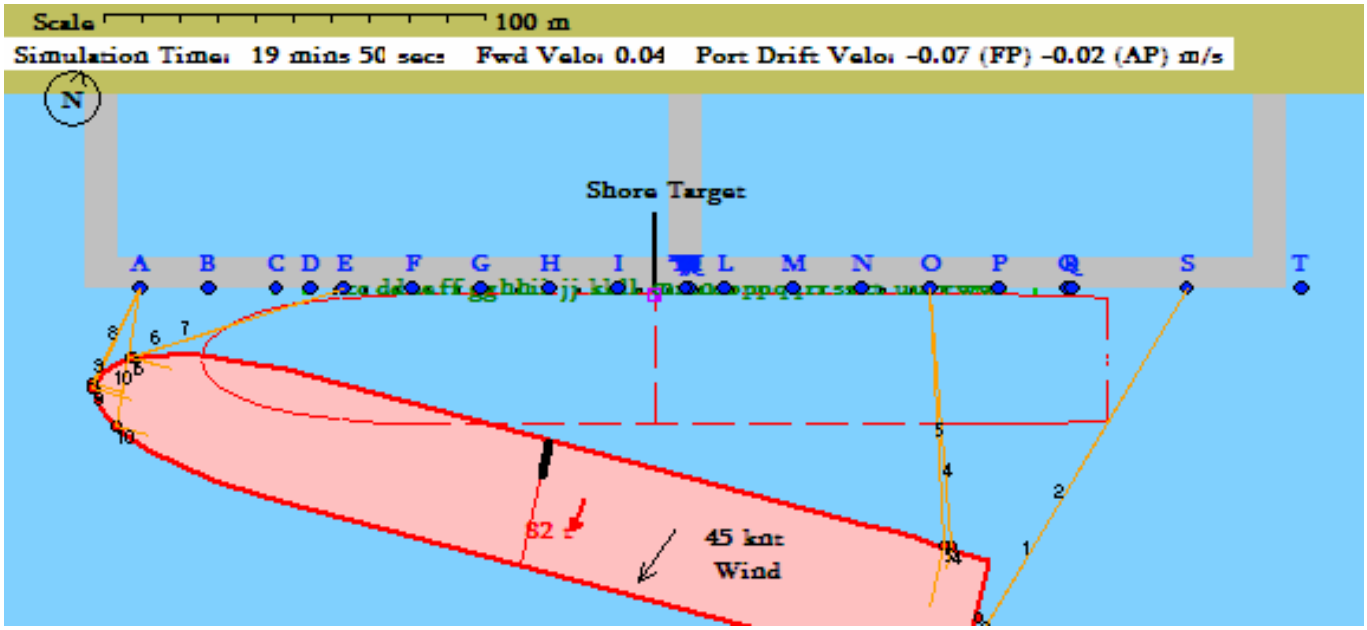

Figure 12: Case 4 After 20 Minutes

10. DISCUSSION

The case that most closely represents the movement of the Northern Faith is Case 4 where stern line number 3 has a reduced break load of 42 tf consistent with post-mortem analysis on this rope by TTI and where the winch brakes fade to 30 tf after initially having a rendering load threshold of 42 tf.

Comparing Cases 1 and 2 with 3 and 4 it is shown that reducing the load at which the rope renders from the winch has a bigger effect on vessel excursion than the reduction in one of the stern lines from 70 to 42 tf.

If stern line 3 had its new certified break load then with winches rendering at either 42 or 30 tf (Cases 1 and 3) then after 20 minutes the vessel would not have swayed outwards to the point of being out of control although tugs would still have being required to keep the vessel close to the berth.

No current, waves or swell were included in this analysis. Such data may have had an affect on the results.

11. REFERENCES

1. OPTIMOOR, mooring analyses software for tankers and gas carriers by Tension Technology International, version 5.3.0, Feb 6, 2008
2. Davenport A.G., The spectrum of horizontal gustiness near the ground in high winds, Dept of Civil Engineering, Univ. Bristol, 1960.

APPENDIX A. BERTH DATA

Optimoor Jobs\Northern Faith Accident\Case Files\Koper.bth)
Units in m & tonnes
Solid Pier Shields Wind

Permissible Surge Excursion Fwd/Aft: ± 1.50
Permissible Sway Excursion Port/Stbd: ± 1.50
Dist of Berth Target to Right of Origin: -8.0
Wind Speed Specified at Height: 10.0
Current Specified at Depth: mean

Hook/ Bollard	X-Dist to Origin	Dist to Fender Line	Ht above Berth
A	-143.5	1.5	0.0
B	-125.4	1.5	0.0
C	-107.5	1.5	0.0
D	-98.6	1.5	0.0
E	-89.7	1.5	0.0
F	-71.6	1.5	0.0
G	-53.7	1.5	0.0
H	-35.7	1.5	0.0
I	-17.7	1.5	0.0
J	0.0	1.5	0.0
K	1.3	1.5	0.0
L	10.3	1.5	0.0
M	28.3	1.5	0.0
N	46.4	1.5	0.0
O	64.5	1.5	0.0
P	82.4	1.5	0.0
Q	100.4	1.5	0.0
R	101.7	1.5	0.0
S	131.8	1.5	0.0
T	161.8	1.5	0.0
U	0.0	1.5	0.0
V	0.0	1.5	0.0
W	0.0	1.5	0.0
X	0.0	1.5	0.0
Y	0.0	1.5	0.0
Z	0.0	1.5	0.0
*A	0.0	1.5	0.0
*B	0.0	1.5	0.0
*C	0.0	1.5	0.0
*D	0.0	1.5	0.0
*E	0.0	1.5	0.0
*F	0.0	1.5	0.0
*G	0.0	1.5	0.0
*H	0.0	1.5	0.0
*I	0.0	1.5	0.0
*J	0.0	1.5	0.0
*K	0.0	1.5	0.0
*L	0.0	1.5	0.0
*M	0.0	1.5	0.0
*N	0.0	1.5	0.0
*O	0.0	1.5	0.0
*P	0.0	1.5	0.0
*Q	0.0	1.5	0.0
*R	0.0	1.5	0.0
*S	0.0	1.5	0.0
*T	0.0	1.5	0.0
*U	0.0	1.5	0.0
*V	0.0	1.5	0.0
*W	0.0	1.5	0.0
*X	0.0	1.5	0.0
*Y	0.0	1.5	0.0
*Z	0.0	1.5	0.0

Fender	X-Dist to Origin	Ht above Datum	Width Along Side	Face Contact Area (m²)
aa	-108.0	7.5	1.0	1.8
bb	-100.0	7.5	1.0	1.8
cc	-92.0	7.5	1.0	1.8

dd	-84.0	7.5	1.0	1.8
ee	-76.0	7.5	1.0	1.8
ff	-68.0	7.5	1.0	1.8
gg	-60.0	7.5	1.0	1.8
hh	-52.0	7.5	1.0	1.8
ii	-44.0	7.5	1.0	1.8
jj	-36.0	7.5	1.0	1.8
kk	-28.0	7.5	1.0	1.8
ll	-20.0	7.5	1.0	1.8
mm	-12.0	7.5	1.0	1.8
nn	-4.0	7.5	1.0	1.8
oo	4.0	7.5	1.0	1.8
pp	12.0	7.5	1.0	1.8
qq	20.0	7.5	1.0	1.8
rr	28.0	7.5	1.0	1.8
ss	36.0	7.5	1.0	1.8
tt	44.0	7.5	1.0	1.8
uu	52.0	7.5	1.0	1.8
vv	60.0	7.5	1.0	1.8
ww	68.0	7.5	1.0	1.8
xx	76.0	7.5	1.0	1.8
yy	84.0	7.5	1.0	1.8
zz	92.0	7.5	1.0	1.8

Fender Load-Compression Data

aa	7	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
bb	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
cc	200	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
dd	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
ee	200	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
ff	200	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
gg	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
hh	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
ii	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
jj	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
kk	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
ll	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
mm	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
nn	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
oo	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
pp	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
qq	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m
rr	0	13	20	27	34	40	47	54	61	67	tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60	m

ss	0	13	20	27	34	40	47	54	61	67 tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60 m
tt	0	13	20	27	34	40	47	54	61	67 tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60 m
uu	0	13	20	27	34	40	47	54	61	67 tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60 m
vv	0	13	20	27	34	40	47	54	61	67 tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60 m
ww	0	13	20	27	34	40	47	54	61	67 tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60 m
xx	0	13	20	27	34	40	47	54	61	67 tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60 m
yy	0	13	20	27	34	40	47	54	61	67 tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60 m
zz	0	13	20	27	34	40	47	54	61	67 tonnes
	0.02	0.08	0.21	0.30	0.38	0.44	0.50	0.54	0.58	0.60 m

APPENDIX B. VESSEL DATA

VESSEL DATA CASE 1

Vessel Data for Northern Faith

(file G:\TTI\Optimoor Jobs\Northern Faith Accident\Case Files\Northern Faith - Line new BL - 42 t brake.vsl)
Units in m, mm, & tonnes
Longitudinal datum at Midship

LBP:	225.2
Breadth:	32.2
Depth:	19.0
Target:	0.0 fwd from midship and 0.0 above deck at side
End-on projected windage area:	794 above deck level
Side projected windage area:	1784 above deck level
Longitudinal Centroid:	-0.5 fwd midship
Fendering possible from:	0.480 LBP aft of midship
to:	0.257 LBP fwd of midship
Current drag data based on:	OCIMF (Conventional Bow)
Wind drag data based on:	Container Ship (L/B = 6.4)
Wave motion data based on:	Post-Panamax Containership
Roll Damping Coeff:	5% of Critical
Cb:	0.55

Flatside Contour

X-dist	-108.0	57.8
Depth	14.3	14.3

Line No.	Fair-Lead X	Fair-Lead Y	Ht on Deck	Dist to Winch	Brake Limit	Pre-Tension	Line Size	Line Type	Line BL	Tail Segment-1 Lgth	Tail Segment-1 Size	Tail Segment-1 Type	Tail Segment-1 BL
1	-120.0	-8.0	0.5	7.0	42	10	60	ATw	70				
2	-120.0	-7.0	0.5	11.5	1	0	64	ppw	79				
3	-120.0	0.9	0.5	9.0	42	10	60	ATw	70				
4	-108.9	16.1	0.5	6.1	42	10	60	ATw	70				
5	-106.7	16.1	0.5	15.8	1	0	64	ppw	79				
6	111.2	8.9	-2.5	10.7	1	0	64	ppw	79				
7	112.0	8.8	-2.5	9.2	42	10	60	ATw	70				
8	120.0	0.0	-2.5	9.2	42	10	60	ATw	70				
9	119.6	-1.1	-2.5	11.0	1	0	64	ppw	79				
10	111.3	-8.4	-2.5	8.8	42	10	60	ATw	70				

Codes for Types of Line:
pp: polypropylene dry (broken-in)
ppw: polypropylene wet (broken-in)
ATw: Atlas 6-Strand Nylon Multi/Mono

VESSEL DATA CASE 2

Vessel Data for Northern Faith

(file G:\TTI\Optimoor Jobs\Northern Faith Accident\Case Files\Northern Faith - Line new BL - 42 t brake.vsl)
Units in m, mm, & tonnes
Longitudinal datum at Midship

LBP:	225.2
Breadth:	32.2
Depth:	19.0
Target:	0.0 fwd from midship and 0.0 above deck at side
End-on projected windage area:	794 above deck level
Side projected windage area:	1784 above deck level
Longitudinal Centroid:	-0.5 fwd midship
Fendering possible from:	0.480 LBP aft of midship
to:	0.257 LBP fwd of midship
Current drag data based on:	OCIMF (Conventional Bow)
Wind drag data based on:	Container Ship (L/B = 6.4)
Wave motion data based on:	Post-Panamax Containership
Roll Damping Coeff:	5% of Critical
Cb:	0.55

Flatside Contour

X-dist	-108.0	57.8
Depth	14.3	14.3

Line No.	Fair-Lead X	Fair-Lead Y	Ht on Deck	Dist to Winch	Brake Limit	Pre-Tension	Line Size	Line Type	Line BL	Tail Segment-1 Lgth	Tail Segment-1 Size	Tail Segment-1 Type	Tail Segment-1 BL
1	-120.0	-8.0	0.5	7.0	42	10	60	ATw	70				
2	-120.0	-7.0	0.5	11.5	1	0	64	ppw	79				
3	-120.0	0.9	0.5	9.0	42	10	60	ATw	41				
4	-108.9	16.1	0.5	6.1	42	10	60	ATw	70				
5	-106.7	16.1	0.5	15.8	1	0	64	ppw	79				
6	111.2	8.9	-2.5	10.7	1	0	64	ppw	79				
7	112.0	8.8	-2.5	9.2	42	10	60	ATw	70				
8	120.0	0.0	-2.5	9.2	42	10	60	ATw	70				
9	119.6	-1.1	-2.5	11.0	1	0	64	ppw	79				
10	111.3	-8.4	-2.5	8.8	42	10	60	ATw	70				

Codes for Types of Line:
pp: polypropylene dry (broken-in)
ppw: polypropylene wet (broken-in)
ATw: Atlas 6-Strand Nylon Multi/Mono

VESSEL DATA CASE 3

Vessel Data for Northern Faith

(file G:\TTI\Optimoor Jobs\Northern Faith Accident\Case Files\Northern Faith - Line 60% BL - 30 t brake.vsl)
Units in m, mm, & tonnes
Longitudinal datum at Midship

LBP: 225.2
Breadth: 32.2
Depth: 19.0
Target: 0.0 fwd from midship and 0.0 above deck at side
End-on projected windage area: 794 above deck level
Side projected windage area: 1784 above deck level
Longitudinal Centroid: -0.5 fwd midship
Fendering possible from: 0.480 LBP aft of midship
to: 0.257 LBP fwd of midship
Current drag data based on: OCIMF (Conventional Bow)
Wind drag data based on: Container Ship (L/B = 6.4)
Wave motion data based on: Post-Panamax Containership
Roll Damping Coeff: 5% of Critical
Cb: 0.55

Flatside Contour

X-dist	-108.0	57.8
Depth	14.3	14.3

Line No.	Fair-Lead X	Fair-Lead Y	Ht on Deck	Dist to Winch	Brake Limit	Pre-Tension	Line Size-Type-BL	Tail Segment-1 Lgth-Size-Type-BL
1	-120.0	-8.0	0.5	7.0	30	10	60 ATw 70	
2	-120.0	-7.0	0.5	11.5	1	0	64 ppw 79	
3	-120.0	0.9	0.5	9.0	30	10	60 ATw 70	
4	-108.9	16.1	0.5	6.1	30	10	60 ATw 70	
5	-106.7	16.1	0.5	15.8	1	0	64 ppw 79	
6	111.2	8.9	-2.5	10.7	1	0	64 ppw 79	
7	112.0	8.8	-2.5	9.2	30	10	60 ATw 70	
8	120.0	0.0	-2.5	9.2	30	10	60 ATw 70	
9	119.6	-1.1	-2.5	11.0	1	0	64 ppw 79	
10	111.3	-8.4	-2.5	8.8	30	10	60 ATw 70	

Codes for Types of Line:
pp: polypropylene dry (broken-in)
ppw: polypropylene wet (broken-in)
ATw: Atlas 6-Strand Nylon Multi/Mono

VESSEL DATA CASE 4

Vessel Data for Northern Faith

(file G:\TTI\Optimoor Jobs\Northern Faith Accident\Case Files\Northern Faith - Line 60% BL - 30 t brake.vsl)
Units in m, mm, & tonnes
Longitudinal datum at Midship

LBP: 225.2
Breadth: 32.2
Depth: 19.0
Target: 0.0 fwd from midship and 0.0 above deck at side
End-on projected windage area: 794 above deck level
Side projected windage area: 1784 above deck level
Longitudinal Centroid: -0.5 fwd midship
Fendering possible from: 0.480 LBP aft of midship
to: 0.257 LBP fwd of midship
Current drag data based on: OCIMF (Conventional Bow)
Wind drag data based on: Container Ship (L/B = 6.4)
Wave motion data based on: Post-Panamax Containership
Roll Damping Coeff: 5% of Critical
Cb: 0.55

Flatside Contour

X-dist	-108.0	57.8
Depth	14.3	14.3

Line No.	Fair-Lead X	Fair-Lead Y	Ht on Deck	Dist to Winch	Brake Limit	Pre-Tension	Line Size	Line Type	Line BL	Tail Segment-1 Lgth	Tail Segment-1 Size	Tail Segment-1 Type	Tail Segment-1 BL
1	-120.0	-8.0	0.5	7.0	30	10	60	ATw	70				
2	-120.0	-7.0	0.5	11.5	1	0	64	ppw	79				
3	-120.0	0.9	0.5	9.0	42	10	60	ATw	41				
4	-108.9	16.1	0.5	6.1	30	10	60	ATw	70				
5	-106.7	16.1	0.5	15.8	1	0	64	ppw	79				
6	111.2	8.9	-2.5	10.7	1	0	64	ppw	79				
7	112.0	8.8	-2.5	9.2	30	10	60	ATw	70				
8	120.0	0.0	-2.5	9.2	30	10	60	ATw	70				
9	119.6	-1.1	-2.5	11.0	1	0	64	ppw	79				
10	111.3	-8.4	-2.5	8.8	30	10	60	ATw	70				

Codes for Types of Line:
pp: polypropylene dry (broken-in)
ppw: polypropylene wet (broken-in)
ATw: Atlas 6-Strand Nylon Multi/Mono