

M/V HAYAT N

KAZA TEKNİK DEĞERLENDİRME RAPORU



TMMOB GEMİ MÜHENDİSLERİ ODASI

19 Kasım 2008

M/V HAYAT N GEMİSİ KAZA RAPORU

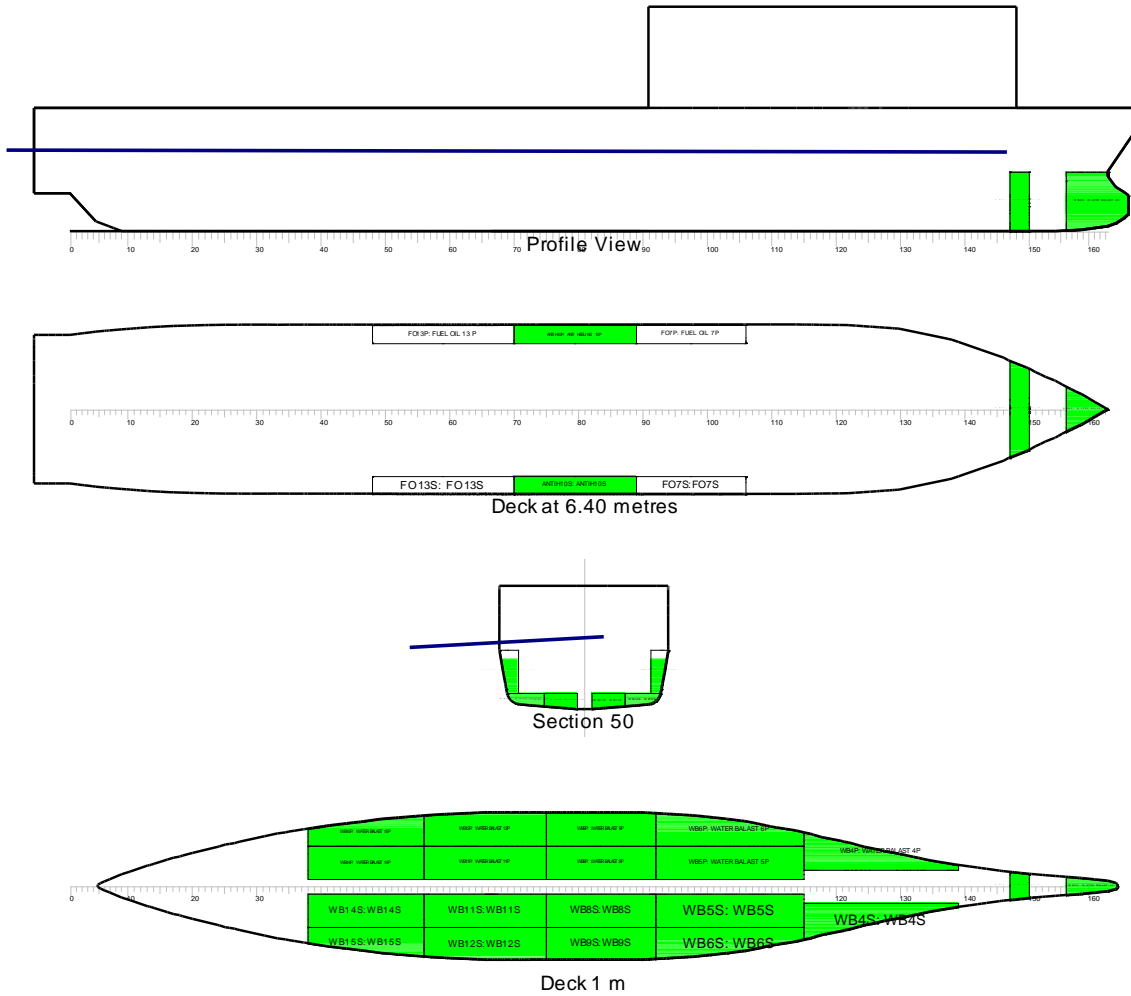
DURUM 1

Gemi limanda ve sancağa 3 derece yatık;

Gemi durumu:

- Balast tankları tamamen dolu,
- Gemide toplam 2331 ton ağırlığında araç mevcut, 35 araç üst güvertede, 38 araç ve 2 otomobil ana güvertede bulunmakta, alt güvertede ise araç yok,
- Anti-heeling tanklarında 75 er ton su var,
- Bordada bulunan su geçirmez kapılar açık.

Geminin bu duruma ait bilgileri:



Key

Key	Name	Density (t/m3)
	WB	1.0250

Intact State

Intact State

Title	Frames	Cargo	% full	SG (t/m3)	Weight (t)	LCG (m)	TCG (m)	VCG (m)	FSM (t-m)	S M
<i>WATER BALAST</i>										
ANTI10P: ANTI HEELING 10P	70-89	WB	5	1.025	75.0	54.83	- 7.96	3.79	6.9	
ANTI10S: ANTI10S	70-89	WB	50	1.025	75.0	54.83	7.96	3.79	6.9	
WB11P: WATER BALAST 11P	56-75	WB	100.0	1.025	80.7	45.05	- 2.54	0.98	0.0	
WB11S: WB11S	56-75	WB	100.0	1.025	80.7	45.05	2.54	0.98	0.0	
WB12P: WATER BALAST 12P	56-75	WB	100.0	1.025	65.2	45.13	- 6.14	1.16	0.0	
WB12S: WB12S	56-75	WB	100.0	1.025	65.2	45.13	6.14	1.16	0.0	
WB14P: WATER BALAST 14P	38-56	WB	100.0	1.025	76.2	32.09	- 2.54	0.98	0.0	
WB14S: WB14S	38-56	WB	100.0	1.025	76.2	32.09	2.54	0.98	0.0	
WB15P: WATER BALAST 15P	38-56	WB	100.0	1.025	47.8	32.61	- 5.79	1.18	0.0	
WB15S: WB15S	38-56	WB	100.0	1.025	47.8	32.61	5.79	1.18	0.0	
WB2C: WATER BALAST 2C	156- 167	WB	100.0	1.025	79.4	110.74	0.00	3.49	0.0	
WB3C: WATER BALAST 3C	147- 150	WB	100.0	1.025	73.3	103.11	0.00	4.06	0.0	
WB4P: WATER BALAST 4P	115- 139	WB	100.0	1.025	57.0	85.74	- 3.18	1.15	0.0	
WB4S: WB4S	115- 139	WB	100.0	1.025	57.0	85.74	3.18	1.15	0.0	
WB5P: WATER BALAST 5P	92-115	WB	100.0	1.025	98.3	71.63	- 2.55	0.97	0.0	
WB5S: WB5S	92-115	WB	100.0	1.025	98.3	71.63	2.55	0.97	0.0	
WB6P: WATER BALAST 6P	92-115	WB	100.0	1.025	62.4	70.66	- 5.85	1.18	0.0	
WB6S: WB6S	92-115	WB	100.0	1.025	62.4	70.66	5.85	1.18	0.0	
WB8P: WATER BALAST 8P	75-92	WB	100.0	1.025	72.5	57.64	- 2.55	0.97	0.0	
WB8S: WB8S	75-92	WB	100.0	1.025	72.5	57.64	2.55	0.97	0.0	
WB9P: WATER BALAST	75-92	WB	100.0	1.025	59.7	57.64	-	1.15	0.0	

Title	Frames	Cargo	% full	SG (t/m3)	Weight (t)	LCG (m)	TCG (m)	VCG (m)	FSM (t-m)	S M
9P							6.15			
WB9S: WB9S	75-92	WB	100.0	1.025	59.7	57.64	6.15	1.15	0.0	
Total WATER BALAST					1542.3	60.72	0.00	1.59	13.8	
<i>Araçlar</i>										
35 Araç Üst Güverte					1117.0	52.00	0.08	16.07	0.0	
38 Araç Ana Güvertede					1214.0	52.00	0.08	9.18	0.0	
Total Araçlar					2331.0	52.00	0.08	12.48	0.0	
Lightweight					4424.0	49.10	0.00	9.00	0.0	
Deadweight					3873.3	55.47	0.05	8.14	13.7	
Total Displacement					8297.3	52.08	0.02	8.60	13.7	
Buoyancy					8297.3	52.06	0.32	3.28	47553.0	
Total Buoyancy					8297.3	52.06	0.32	3.28	47553.0	

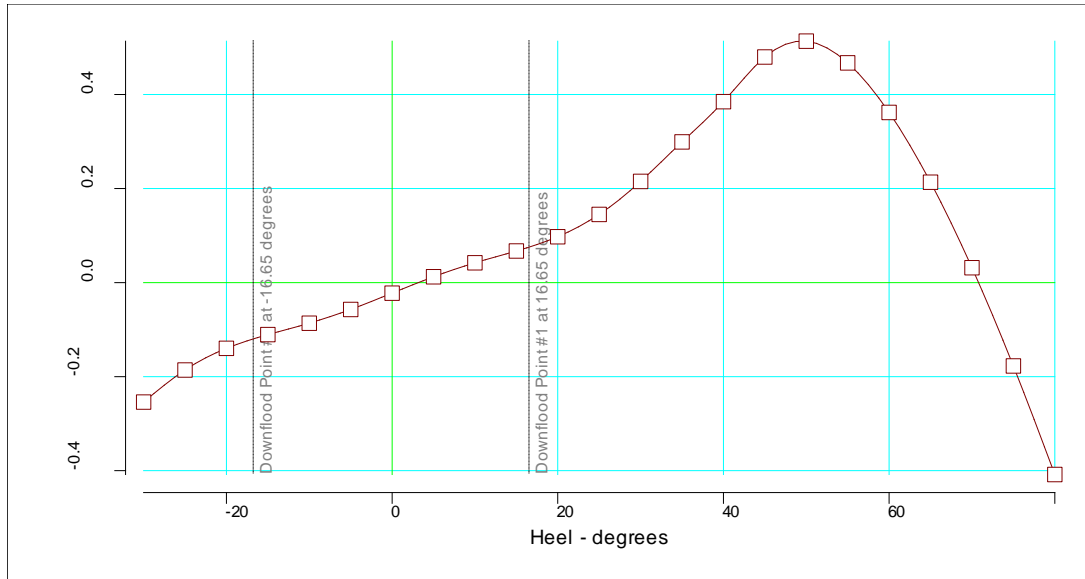
Intact State

Drafts at equilibrium angle

Draft at LCF	5.775	metres
Draft aft at marks	5.871	metres
Draft fwd at marks	5.652	metres
Draft at AP	5.871	metres
Draft at FP	5.652	metres
Mean draft at midships	5.762	metres

Hydrostatics at equilibrium angle

Density of water	1.0250	tonnes/cu.m
Heel to starboard	3.20	degrees
Trim by the stern	0.219	metres
KG	8.601	metres
FSC	0.002	metres
KGf	8.602	metres



Righting Lever (GZ) Curve

Heel to Stbd (deg)	GZ (m)	Slope (m/rad)	Trim (m)	WLrad (m)	Freeboard (m)	Unprotected (m)
-30.00	-0.2541	0.9046	0.074	4.653	2.36[1]	-1.86[0]
-25.00	-0.1858	0.6710	-0.007	4.988	3.28[1]	-1.19[0]
-20.00	-0.1398	0.4234	-0.084	5.262	4.19[1]	-0.49[0]
-15.00	-0.1107	0.2930	-0.151	5.479	5.09[1]	0.23[0]
-10.00	-0.0863	0.2921	-0.197	5.635	5.97[1]	0.98[0]
-5.00	-0.0572	0.3853	-0.216	5.733	6.82[1]	1.75[0]
0.00	-0.0225	0.3999	-0.220	5.767	7.63[0]	2.54[0]
5.00	0.0124	0.3892	-0.216	5.733	6.82[0]	1.75[1]
10.00	0.0420	0.2999	-0.197	5.635	5.97[0]	0.98[1]
15.00	0.0673	0.3046	-0.151	5.479	5.09[0]	0.23[1]
20.00	0.0976	0.4388	-0.084	5.262	4.19[0]	-0.49[1]
25.00	0.1451	0.6900	-0.007	4.988	3.28[0]	-1.19[1]
30.00	0.2152	0.9270	0.074	4.653	2.36[0]	-1.86[1]
35.00	0.2993	0.9897	0.152	4.248	1.47[0]	-2.47[1]
40.00	0.3849	1.0259	0.218	3.762	0.61[0]	-3.03[1]
45.00	0.4799	0.9271	0.276	3.196	-0.21[0]	-3.51[1]
50.00	0.5135	-0.1020	0.346	2.595	-1.01[0]	-3.95[1]
55.00	0.4674	-0.8912	0.414	1.983	-1.81[0]	-4.37[1]
60.00	0.3620	-1.4702	0.482	1.365	-2.61[0]	-4.77[1]
65.00	0.2136	-1.8921	0.551	0.742	-3.39[0]	-5.13[1]
70.00	0.0317	-2.2411	0.624	0.117	-4.16[0]	-5.45[1]
75.00	-0.1773	-2.5152	0.698	-0.510	-4.88[0]	-5.72[1]
80.00	-0.4083	-2.7646	0.755	-1.139	-5.57[0]	-5.95[1]

749 Intact Stability Criteria non - passenger

#	Criterion	Actual Value	Critical Value	
1	Area under GZ curve up to 30 degrees > 0.055	0.009	0.055	F
2	Area under GZ curve from 30 to 40 deg. or downflood > 0.03	0.000	0.030	F
3	Area under GZ curve up to 40 deg. or downflood > 0.09	0.009	0.090	F
4	Initial GM to be at least 0.15 metres	Not Appl..	0.150	
5	GZ to be at least 0.20m at an angle > 30 degrees	0.514	0.200	
6	Max GZ to be at an angle > 30 degrees	49.424	30.000	

Unprotected Openings

Point #	X position (m)	Y position (m)	Z position (m)	Ht. above WL (m)	Flood Angle (deg)	Downflood Compartment
0	7.000	-9.021	8.400	3.051	-16.646	
1	7.000	9.021	8.400	2.042	16.646	

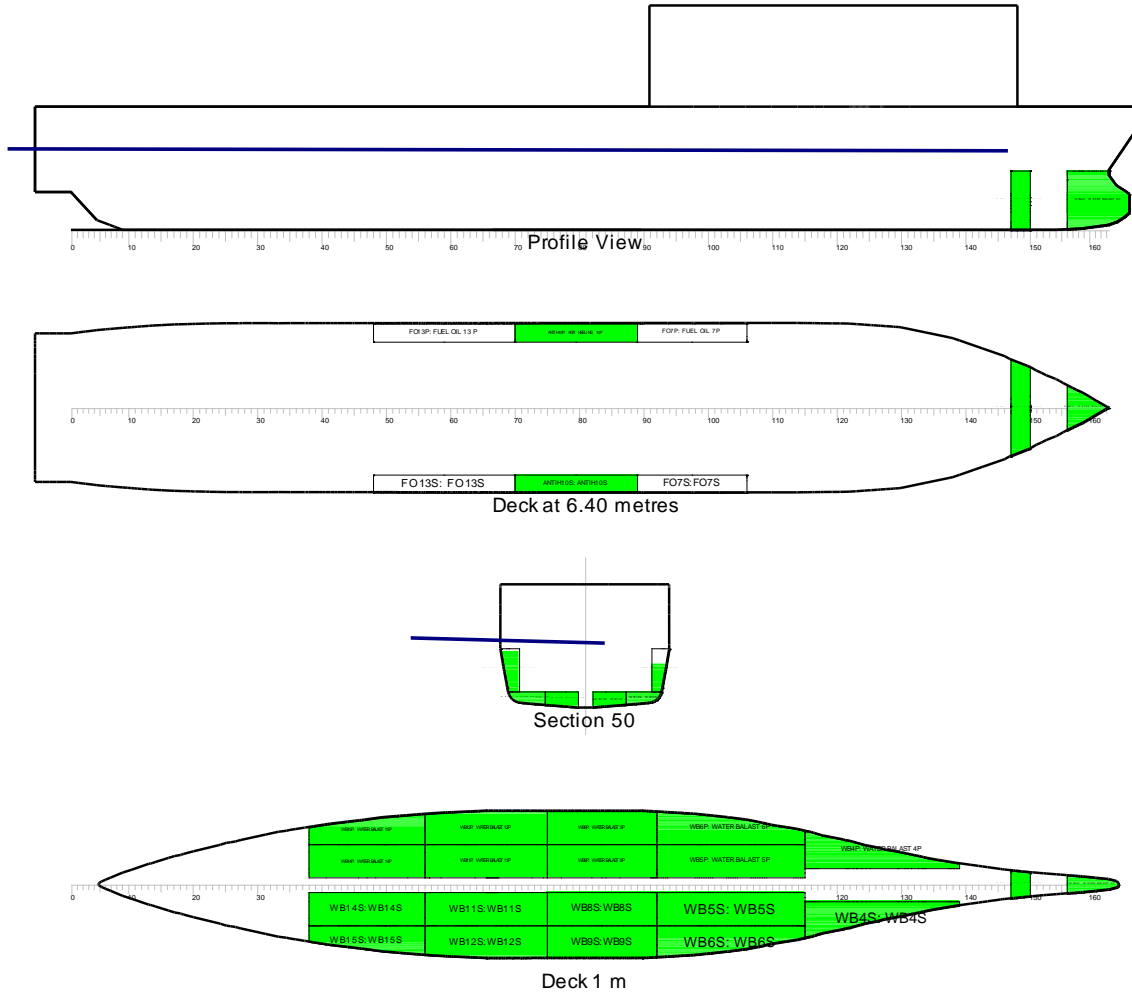
DURUM 2

Gemi seyir başlangıcında 3 derece sancaktaki meyili düzelterek 1.5 derece iskeleye yatıyor ;

Gemi durumu:

- Balast tankları tamamen dolu,
- Gemide toplam 2331 ton ağırlığında araç mevcut, 35 araç üst güvertede, 38 araç ve 2 otomobil ana güvertede bulunmakta, alt güvertede ise araç yok,
- Sancak taraftaki anti-heeling tanktan iskeleye 17 ton su transferi,
- Bordada bulunan su geçirmez kapılar açık.
- Gemi yol almaya başlıyor, 7-8 knot sürata çıkıyor;
- Sancaktan 5 beaufort şiddetinde rüzgar etkisi altında;
- Sancağa dönüş manevrası nedeniyle iskeleye meyil oluşuyor;

Geminin bu duruma ait bilgileri:



Key

Key	Name	Density (t/m3)
	WB	1.0250

Intact State

Intact State

Title	Frames	Cargo	% full	SG (t/m3)	Weight (t)	LCG (m)	TCG (m)	VCG (m)	FSM (t-m)	S M
<i>WATER BALAST</i>										
ANTI10P: ANTI HEELING 10P	70-89	WB	62	1.025	92.0	54.83	- 7.99	4.16	8.2	
ANTI10S: ANTI10S	70-89	WB	38	1.025	58.0	54.82	7.92	3.39	5.6	
WB11P: WATER BALAST 11P	56-75	WB	100.0	1.025	80.7	45.05	- 2.54	0.98	0.0	
WB11S: WB11S	56-75	WB	100.0	1.025	80.7	45.05	2.54	0.98	0.0	
WB12P: WATER BALAST 12P	56-75	WB	100.0	1.025	65.2	45.13	- 6.14	1.16	0.0	
WB12S: WB12S	56-75	WB	100.0	1.025	65.2	45.13	6.14	1.16	0.0	
WB14P: WATER BALAST 14P	38-56	WB	100.0	1.025	76.2	32.09	- 2.54	0.98	0.0	
WB14S: WB14S	38-56	WB	100.0	1.025	76.2	32.09	2.54	0.98	0.0	
WB15P: WATER BALAST 15P	38-56	WB	100.0	1.025	47.8	32.61	- 5.79	1.18	0.0	
WB15S: WB15S	38-56	WB	100.0	1.025	47.8	32.61	5.79	1.18	0.0	
WB2C: WATER BALAST 2C	156- 167	WB	100.0	1.025	79.4	110.74	0.00	3.49	0.0	
WB3C: WATER BALAST 3C	147- 150	WB	100.0	1.025	73.3	103.11	0.00	4.06	0.0	
WB4P: WATER BALAST 4P	115- 139	WB	100.0	1.025	57.0	85.74	- 3.18	1.15	0.0	
WB4S: WB4S	115- 139	WB	100.0	1.025	57.0	85.74	3.18	1.15	0.0	
WB5P: WATER BALAST 5P	92-115	WB	100.0	1.025	98.3	71.63	- 2.55	0.97	0.0	
WB5S: WB5S	92-115	WB	100.0	1.025	98.3	71.63	2.55	0.97	0.0	
WB6P: WATER BALAST 6P	92-115	WB	100.0	1.025	62.4	70.66	- 5.85	1.18	0.0	
WB6S: WB6S	92-115	WB	100.0	1.025	62.4	70.66	5.85	1.18	0.0	
WB8P: WATER BALAST 8P	75-92	WB	100.0	1.025	72.5	57.64	- 2.55	0.97	0.0	
WB8S: WB8S	75-92	WB	100.0	1.025	72.5	57.64	2.55	0.97	0.0	
WB9P: WATER BALAST	75-92	WB	100.0	1.025	59.7	57.64	-	1.15	0.0	

Title	Frames	Cargo	% full	SG (t/m3)	Weight (t)	LCG (m)	TCG (m)	VCG (m)	FSM (t-m)	S M
9P							6.15			
WB9S: WB9S	75-92	WB	100.0	1.025	59.7	57.64	6.15	1.15	0.0	
Total WATER BALAST					1542.3	60.72	- 0.18	1.60	13.8	
<i>Araçlar</i>										
35 Araç Üst Güverte					1117.0	52.00	0.08	16.07	0.0	
38 Araç Ana Güvertede					1214.0	52.00	0.08	9.18	0.0	
Total Araçlar					2331.0	52.00	0.08	12.48	0.0	
Lightweight					4424.0	49.10	0.00	9.00	0.0	
Deadweight					3873.3	55.47	- 0.02	8.15	13.8	
Total Displacement					8297.3	52.08	- 0.01	8.60	13.8	
Buoyancy					8297.3	52.06	- 0.15	3.27	47555.5	
Total Buoyancy					8297.3	52.06	- 0.15	3.27	47555.5	

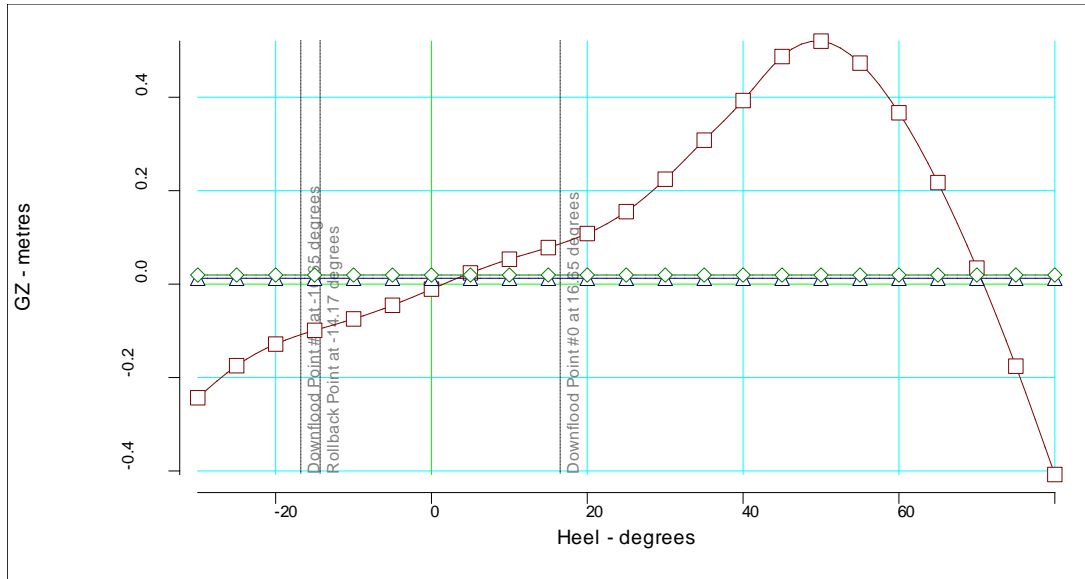
Intact State

Drafts at equilibrium angle

Draft at LCF	5.779	metres
Draft aft at marks	5.875	metres
Draft fwd at marks	5.656	metres
Draft at AP	5.875	metres
Draft at FP	5.656	metres
Mean draft at midships	5.766	metres

Hydrostatics at equilibrium angle

Density of water	1.0250	tonnes/cu.m
Heel to port	1.54	degrees
Trim by the stern	0.220	metres
KG	8.602	metres
FSC	0.002	metres
KGf	8.604	metres
GMt	0.401	metres



Righting Lever (GZ) Curve

Heel to Port (deg)	GZ (m)	Slope (m/rad)	Trim (m)	WLRad (m)	Freeboard (m)	Unprotected (m)	Turning (m)	Wind (m)
-30.00	-0.2433	0.9092	0.074	4.653	2.36[0]	-1.86[1]	0.0124	0.0194
-25.00	-0.1746	0.6747	-0.007	4.988	3.28[0]	-1.19[1]	0.0124	0.0194
-20.00	-0.1283	0.4261	-0.084	5.262	4.19[0]	-0.49[1]	0.0124	0.0194
-15.00	-0.0990	0.2946	-0.151	5.479	5.09[0]	0.23[1]	0.0124	0.0194
-10.00	-0.0745	0.2927	-0.197	5.635	5.97[0]	0.98[1]	0.0124	0.0194
-5.00	-0.0454	0.3849	-0.216	5.733	6.82[0]	1.75[1]	0.0124	0.0194
0.00	-0.0108	0.3985	-0.220	5.767	7.63[0]	2.54[0]	0.0124	0.0194
5.00	0.0239	0.3868	-0.216	5.733	6.82[1]	1.75[0]	0.0124	0.0194
10.00	0.0533	0.2964	-0.197	5.635	5.97[1]	0.98[0]	0.0124	0.0194
15.00	0.0782	0.3002	-0.151	5.479	5.09[1]	0.23[0]	0.0124	0.0194
20.00	0.1081	0.4334	-0.084	5.262	4.19[1]	-0.49[0]	0.0124	0.0194
25.00	0.1551	0.6838	-0.007	4.988	3.28[1]	-1.19[0]	0.0124	0.0194
30.00	0.2246	0.9199	0.074	4.653	2.36[1]	-1.86[0]	0.0124	0.0194
35.00	0.3081	0.9819	0.152	4.248	1.47[1]	-2.47[0]	0.0124	0.0194
40.00	0.3930	1.0173	0.218	3.762	0.61[1]	-3.03[0]	0.0124	0.0194
45.00	0.4872	0.9178	0.276	3.196	-0.21[1]	-3.51[0]	0.0124	0.0194
50.00	0.5200	-0.1119	0.346	2.595	-1.01[1]	-3.95[0]	0.0124	0.0194
55.00	0.4730	-0.9016	0.414	1.983	-1.81[1]	-4.37[0]	0.0124	0.0194
60.00	0.3667	-1.4810	0.482	1.365	-2.61[1]	-4.77[0]	0.0124	0.0194
65.00	0.2173	-1.9034	0.551	0.742	-3.39[1]	-5.13[0]	0.0124	0.0194
70.00	0.0343	-2.2526	0.624	0.117	-4.16[1]	-5.45[0]	0.0124	0.0194
75.00	-0.1756	-2.5269	0.698	-0.510	-4.88[1]	-5.72[0]	0.0124	0.0194
80.00	-0.4077	-2.7764	0.755	-1.139	-5.57[1]	-5.95[0]	0.0124	0.0194

IMO 749 Intact stability Non-Passenger

#	Criterion	Actual Value	Critical Value	
1	Area under GZ curve up to 30 degrees > 0.055	0.012	0.055	F
2	Area under GZ curve from 30 to 40 deg. or downflood > 0.03	0.000	0.030	F
3	Area under GZ curve up to 40 deg. or downflood > 0.09	0.012	0.090	F
4	Initial GM to be at least 0.15 metres	Not Appl..	0.150	
5	GZ to be at least 0.20m at an angle > 30 degrees	0.225	0.200	
6	Max GZ to be at an angle > 30 degrees	49.370	30.000	
7	Angle of heel for turning < 10 degrees	3.321	10.000	
8	IMO Weather Criterion (Maximum Initial Angle Of Heel)	3.393	16.000	

Unprotected Openings

Point #	X position (m)	Y position (m)	Z position (m)	Ht. above WL (m)	Flood Angle (deg)	Downflood Compartment
0	7.000	-9.021	8.400	2.302	16.646	
1	7.000	9.021	8.400	2.787	-16.646	

Deck Edge

Point #	X position (m)	Y position (m)	Z position (m)	Ht. above WL (m)	Flood Angle (deg)
0	56.400	9.175	13.400	7.885	Not immersed
1	56.400	-9.175	13.400	7.392	43.735

Sonuç:

Mevcut ifade ve delillerden yola çıkıldığında;

- Geminin söz konusu yükü almış haliyle stabilite kriterlerinin bir kısmını sağlamadığı yukarıdaki tablolarda görülmektedir. Ancak geminin batma veya alabora olması söz konusu değildir.
- Geminin limandan çıkış manevrası sırasında gerek manevra gerek rüzgar nedeniyle oluşan olumsuz etkiler gemiyi yaklaşık 5 derece meyil ettirmektedir. Buna rağmen geminin yüzme ve denge durumunun batışına veya yük kaymasına neden olacak derecede bozulmadığı görülmektedir. Ancak Imo stabilite kriterlerine göre uygunsuzluk devam etmektedir.
- İfadelerden , geminin ana güvertesinin üzerinde bordada su geçirmez kapıların açık olduğu anlaşılmalı beraber bu kapılar yukarıda tabloda görüldüğü gibi 16 derecede suya girmektedir. Geminin bu durum için bu kapılardan su alma riski yoktur.

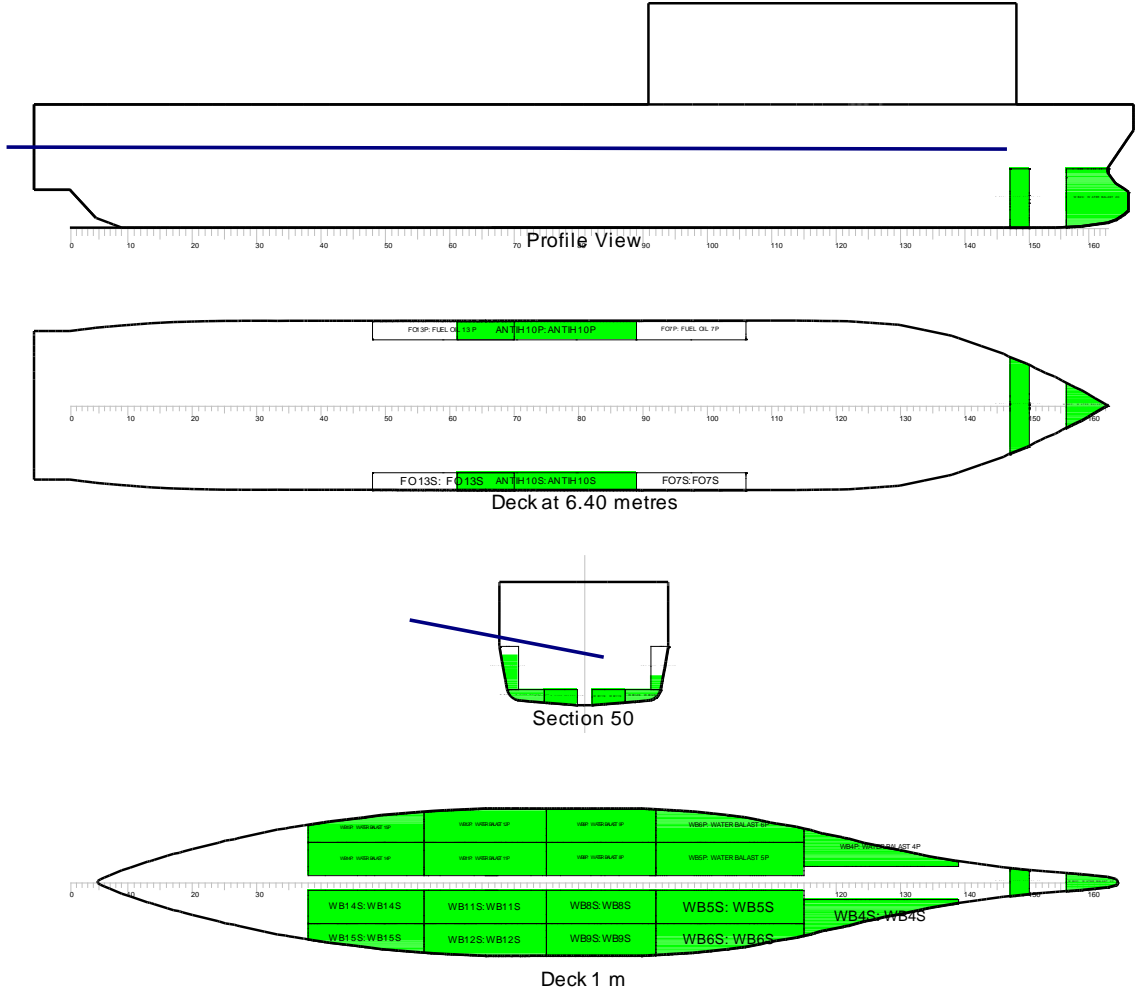
- Ancak geminin iskeleye doğru yattığı ve bu taraftan battığı sabit olduğuna göre yukarıdaki durumlar dışında başka etkenler düşünülmesi gerekir. Bu etkenlere yönelik senaryolar aşağıdaki gibidir:

Senaryo 1:

Yanlış balast operasyonu:

İfadelerde, geminin iskele demiri almasıyla 1.5 derece iskeleye yattığı ve bu meyili düzeltmek için balast operasyonu yapıldığı yer almaktadır. Bu operasyonun yanlışlıkla sancak yerine iskeleye yapılması halinde; yaklaşık 20 ton balast transferi sonucu gemi 11 derecenin üzerinde meyil yapmaktadır. Bu meyil yük kaymasına neden olacaktır. Yükün enine ağırlık merkezinin (TCG) 8 cm kaymasıyla gemi ana güvertedeki açık kapılardan su almaya başlayacaktır. Su alması sonucu doğrulma şansı kalmayan gemi hızla iskeleye doğru yatarak açık güvertedeki yüklerden denize düşenler olacak ve gemi iskele alabandasının üzerine alabora olacaktır. Bu senaryonun geçerli olabilmesi için geminin çıkarılması sürecinde transfer pompaları ve vanalarının pozisyonlarının incelenmesi gereklidir.

Bu senaryo ile ilgili veriler aşağıda gösterilmiştir:



Key

Key	Name	Density (t/m ³)
	WB	1.0250

Intact State

Intact State

Title	Frames	Cargo	% full	SG (t/m ³)	Weight (t)	LCG (m)	TCG (m)	VCG (m)	FSM (t-m)	S M
<i>WATER BALAST</i>										
ANTIH10P: ANTIH10P	61-89	WB	75.0	1.025	112.0	51.65	- 7.97	3.79	10.2	
ANTIH10S: ANTIH10S	61-89	WB	25.4	1.025	38.0	51.59	7.86	2.55	5.0	
WB11P: WATER BALAST 11P	56-75	WB	100.0	1.025	80.7	45.05	- 2.54	0.98	0.0	
WB11S: WB11S	56-75	WB	100.0	1.025	80.7	45.05	2.54	0.98	0.0	
WB12P: WATER BALAST 12P	56-75	WB	100.0	1.025	65.2	45.13	- 6.14	1.16	0.0	
WB12S: WB12S	56-75	WB	100.0	1.025	65.2	45.13	6.14	1.16	0.0	
WB14P: WATER BALAST 14P	38-56	WB	100.0	1.025	76.2	32.09	- 2.54	0.98	0.0	
WB14S: WB14S	38-56	WB	100.0	1.025	76.2	32.09	2.54	0.98	0.0	
WB15P: WATER BALAST 15P	38-56	WB	100.0	1.025	47.8	32.61	- 5.79	1.18	0.0	
WB15S: WB15S	38-56	WB	100.0	1.025	47.8	32.61	5.79	1.18	0.0	
WB2C: WATER BALAST 2C	156- 167	WB	100.0	1.025	79.4	110.74	0.00	3.49	0.0	
WB3C: WATER BALAST 3C	147- 150	WB	100.0	1.025	73.3	103.11	0.00	4.06	0.0	
WB4P: WATER BALAST 4P	115- 139	WB	100.0	1.025	57.0	85.74	- 3.18	1.15	0.0	
WB4S: WB4S	115- 139	WB	100.0	1.025	57.0	85.74	3.18	1.15	0.0	
WB5P: WATER BALAST 5P	92-115	WB	100.0	1.025	98.3	71.63	- 2.55	0.97	0.0	
WB5S: WB5S	92-115	WB	100.0	1.025	98.3	71.63	2.55	0.97	0.0	
WB6P: WATER BALAST 6P	92-115	WB	100.0	1.025	62.4	70.66	- 5.85	1.18	0.0	
WB6S: WB6S	92-115	WB	100.0	1.025	62.4	70.66	5.85	1.18	0.0	
WB8P: WATER BALAST 8P	75-92	WB	100.0	1.025	72.5	57.64	- 2.55	0.97	0.0	
WB8S: WB8S	75-92	WB	100.0	1.025	72.5	57.64	2.55	0.97	0.0	
WB9P: WATER BALAST	75-92	WB	100.0	1.025	59.7	57.64	-	1.15	0.0	

Title	Frames	Cargo	% full	SG (t/m3)	Weight (t)	LCG (m)	TCG (m)	VCG (m)	FSM (t-m)	S M
9P							6.15			
WB9S: WB9S	75-92	WB	100.0	1.025	59.7	57.64	6.15	1.15	0.0	
Total WATER BALAST					1542.3	60.41	- 0.38	1.56	15.2	
<i>Araçlar</i>										
35 Araç Üst Güverte					1117.0	52.00	0.00	16.07	0.0	
38 Araç Ana Güvertede					1214.0	52.00	0.00	9.18	0.0	
Total Araçlar					2331.0	52.00	0.00	12.48	0.0	
Lightweight					4424.0	49.10	0.00	9.00	0.0	
Deadweight					3873.3	55.35	- 0.15	8.13	15.2	
Total Displacement					8297.3	52.02	- 0.07	8.60	15.2	
Buoyancy					8297.3	52.01	- 1.08	3.37	46694.9	
Total Buoyancy					8297.3	52.01	- 1.08	3.37	46694.9	

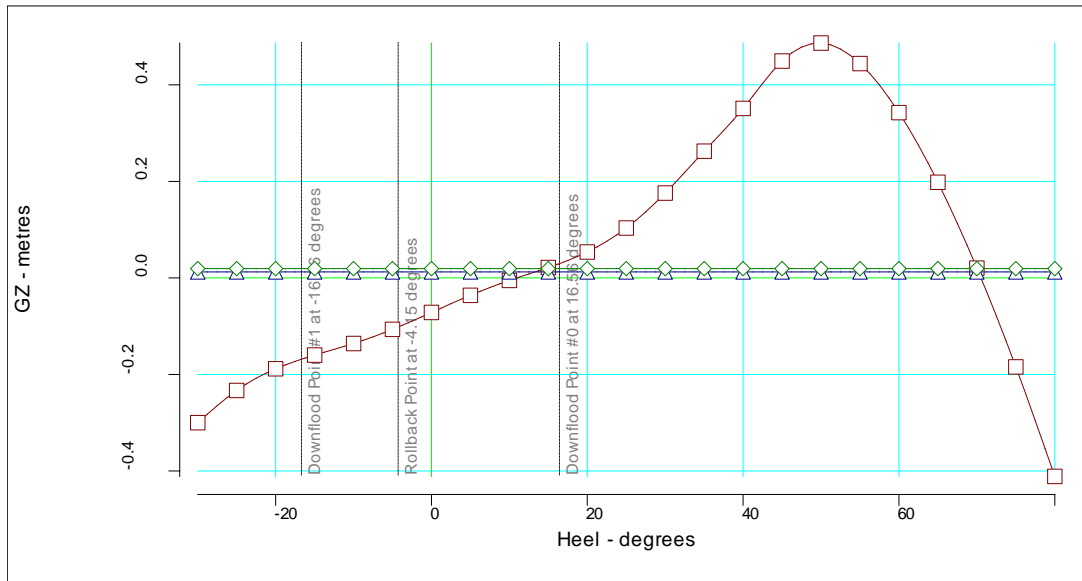
Intact State

Drafts at equilibrium angle

Draft at LCF	5.724	metres
Draft aft at marks	5.825	metres
Draft fwd at marks	5.599	metres
Draft at AP	5.825	metres
Draft at FP	5.599	metres
Mean draft at midships	5.712	metres

Hydrostatics at equilibrium angle

Density of water	1.0250	tonnes/cu.m
Heel to port	10.95	degrees
Trim by the stern	0.226	metres
KG	8.595	metres
FSC	0.002	metres
KGf	8.597	metres
GMt	0.305	metres



Righting Lever (GZ) Curve

Heel to Port (deg)	GZ (m)	Slope (m/rad)	Trim (m)	WLrad (m)	Freeboard (m)	Unprotected (m)	Turning (m)	Wind (m)
-30.00	-0.2998	0.8848	0.043	4.651	2.37[0]	-1.87[1]	0.0124	0.0194
-25.00	-0.2331	0.6555	-0.039	4.987	3.28[0]	-1.20[1]	0.0124	0.0194
-20.00	-0.1882	0.4125	-0.117	5.261	4.19[0]	-0.50[1]	0.0124	0.0194
-15.00	-0.1598	0.2867	-0.183	5.477	5.09[0]	0.22[1]	0.0124	0.0194
-10.00	-0.1358	0.2906	-0.229	5.634	5.97[0]	0.97[1]	0.0124	0.0194
-5.00	-0.1066	0.3876	-0.248	5.731	6.82[0]	1.74[1]	0.0124	0.0194
0.00	-0.0716	0.4060	-0.251	5.765	7.64[0]	2.53[0]	0.0124	0.0194
5.00	-0.0360	0.4000	-0.248	5.731	6.82[1]	1.74[0]	0.0124	0.0194
10.00	-0.0052	0.3155	-0.229	5.634	5.97[1]	0.97[0]	0.0124	0.0194
15.00	0.0216	0.3237	-0.183	5.477	5.09[1]	0.22[0]	0.0124	0.0194
20.00	0.0538	0.4614	-0.117	5.261	4.19[1]	-0.50[0]	0.0124	0.0194
25.00	0.1034	0.7160	-0.039	4.987	3.28[1]	-1.20[0]	0.0124	0.0194
30.00	0.1759	0.9563	0.043	4.651	2.37[1]	-1.87[0]	0.0124	0.0194
35.00	0.2626	1.0219	0.121	4.246	1.47[1]	-2.49[0]	0.0124	0.0194
40.00	0.3512	1.0611	0.189	3.761	0.61[1]	-3.04[0]	0.0124	0.0194
45.00	0.4494	0.9669	0.248	3.195	-0.21[1]	-3.53[0]	0.0124	0.0194
50.00	0.4865	-0.0612	0.318	2.594	-1.01[1]	-3.97[0]	0.0124	0.0194
55.00	0.4441	-0.8481	0.386	1.983	-1.81[1]	-4.39[0]	0.0124	0.0194
60.00	0.3426	-1.4250	0.452	1.364	-2.61[1]	-4.78[0]	0.0124	0.0194
65.00	0.1982	-1.8451	0.521	0.742	-3.39[1]	-5.14[0]	0.0124	0.0194
70.00	0.0204	-2.1933	0.593	0.117	-4.16[1]	-5.46[0]	0.0124	0.0194
75.00	-0.1844	-2.4680	0.666	-0.511	-4.88[1]	-5.74[0]	0.0124	0.0194
80.00	-0.4112	-2.7185	0.721	-1.140	-5.57[1]	-5.97[0]	0.0124	0.0194

IMO 749 Intact stability Non-Passenger

#	Criterion	Actual Value	Critical Value	
1	Area under GZ curve up to 30 degrees > 0.055	0.001	0.055	F
2	Area under GZ curve from 30 to 40 deg. or downflood > 0.03	0.000	0.030	F
3	Area under GZ curve up to 40 deg. or downflood > 0.09	0.001	0.090	F
4	Initial GM to be at least 0.15 metres	Not Appl..	0.150	
5	GZ to be at least 0.20m at an angle > 30 degrees	0.176	0.200	F
6	Max GZ to be at an angle > 30 degrees	49.651	30.000	
7	Angle of heel for turning < 10 degrees	13.312	10.000	F
8	IMO Weather Criterion (Maximum Initial Angle Of Heel)	13.409	16.000	

Unprotected Openings

Point #	X position (m)	Y position (m)	Z position (m)	Ht. above WL (m)	Flood Angle (deg)	Downflood Compartment
0	7.000	-9.021	8.400	0.833	16.559	
1	7.000	9.021	8.400	4.261	-16.559	

Deck Edge

Point #	X position (m)	Y position (m)	Z position (m)	Ht. above WL (m)	Flood Angle (deg)
0	56.400	9.175	13.400	9.295	Not immersed
1	56.400	-9.175	13.400	5.809	43.741

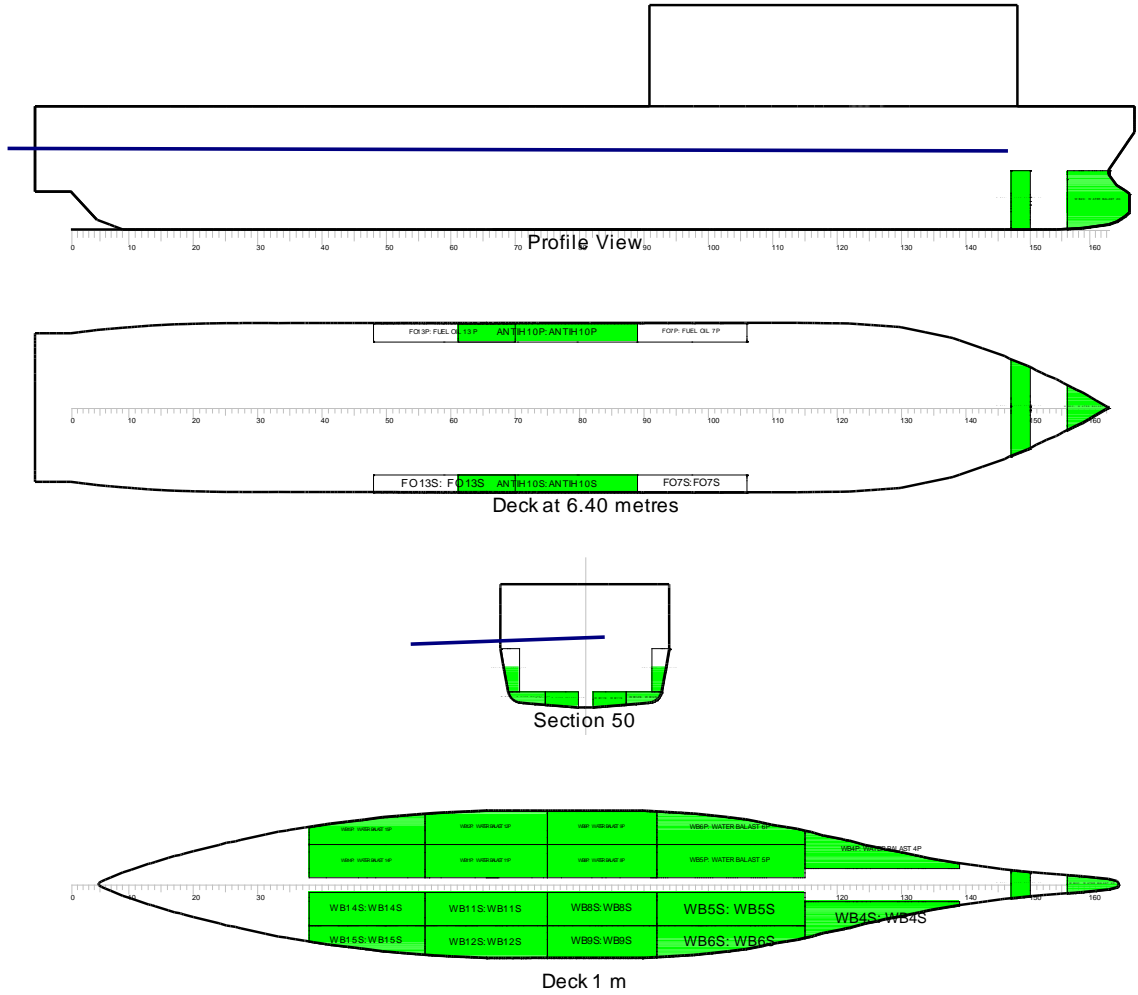
Senaryo 2:

Balast tanklarının %97 dolu olması durumu:

Geminin söz konusu balast durumunda stabilite kriterlerinin büyük bir kısmının IMO kriterlerini sağlamadığı aşağıdaki tablolarda görülmektedir.

Bu konumda rüzgar ve manevra etkisiyle geminin 8.5 dereceye kadar yattığı görülmektedir. Bu açının gemide yük kayması ve alaboraya yönelik bir etkisi olmayacaktır. Bu etkinin oluşabilmesi için ilave bir etken gerekmektedir. Akla gelen yanlış balast operasyonunun bu şartlarda yapılması halinde 15 tonluk bir balast transferi sonucu gemi, 13 derece yatmakta böylece yük kayması, ana güvertenin su alması ve iskele alabandaya alabora gerçekleşecektir.

Bu senaryo ile ilgili veriler aşağıda gösterilmiştir:



Key

Key Name	Density (t/m3)
WB	1.0250

Intact State

Intact State

Title	Frames	Cargo	% full	SG (t/m3)	Weight (t)	LCG (m)	TCG (m)	VCG (m)	FSM (t-m)	S M
<i>WATER BALAST</i>										
ANTI10P: ANTI10P	61-89	WB	50.2	1.025	75.0	51.63	- 7.92	3.20	7.5	
ANTI10S: ANTI10S	61-89	WB	50.1	1.025	75.0	51.63	7.92	3.20	7.5	
WB11P: WATER BALAST 11P	56-75	WB	97.0	1.025	78.2	45.05	- 2.54	0.95	53.0	
WB11S: WB11S	56-75	WB	97.0	1.025	78.2	45.05	2.54	0.95	53.0	
WB12P: WATER BALAST 12P	56-75	WB	97.0	1.025	63.3	45.14	- 6.13	1.14	70.9	
WB12S: WB12S	56-75	WB	97.0	1.025	63.3	45.14	6.13	1.14	70.9	
WB14P: WATER BALAST 14P	38-56	WB	97.0	1.025	73.9	32.09	- 2.54	0.95	50.2	
WB14S: WB14S	38-56	WB	97.0	1.025	73.9	32.09	2.54	0.95	50.2	
WB15P: WATER BALAST 15P	38-56	WB	97.0	1.025	46.4	32.62	- 5.78	1.16	43.6	
WB15S: WB15S	38-56	WB	97.0	1.025	46.4	32.62	5.78	1.16	43.6	
WB2C: WATER BALAST 2C	156- 167	WB	97.0	1.025	77.1	110.78	0.00	3.40	12.1	
WB3C: WATER BALAST 3C	147- 150	WB	97.0	1.025	71.1	103.11	0.00	3.99	165.3	
WB4P: WATER BALAST 4P	115- 139	WB	97.0	1.025	55.3	85.72	- 3.17	1.13	75.3	
WB4S: WB4S	115- 139	WB	97.0	1.025	55.3	85.72	3.17	1.13	75.3	
WB5P: WATER BALAST 5P	92-115	WB	97.0	1.025	95.3	71.63	- 2.55	0.95	64.2	
WB5S: WB5S	92-115	WB	97.0	1.025	95.3	71.63	2.55	0.95	64.2	
WB6P: WATER BALAST 6P	92-115	WB	97.0	1.025	60.6	70.65	- 5.84	1.16	59.4	
WB6S: WB6S	92-115	WB	97.0	1.025	60.6	70.65	5.84	1.16	59.4	
WB8P: WATER BALAST 8P	75-92	WB	97.0	1.025	70.3	57.64	- 2.55	0.95	47.4	

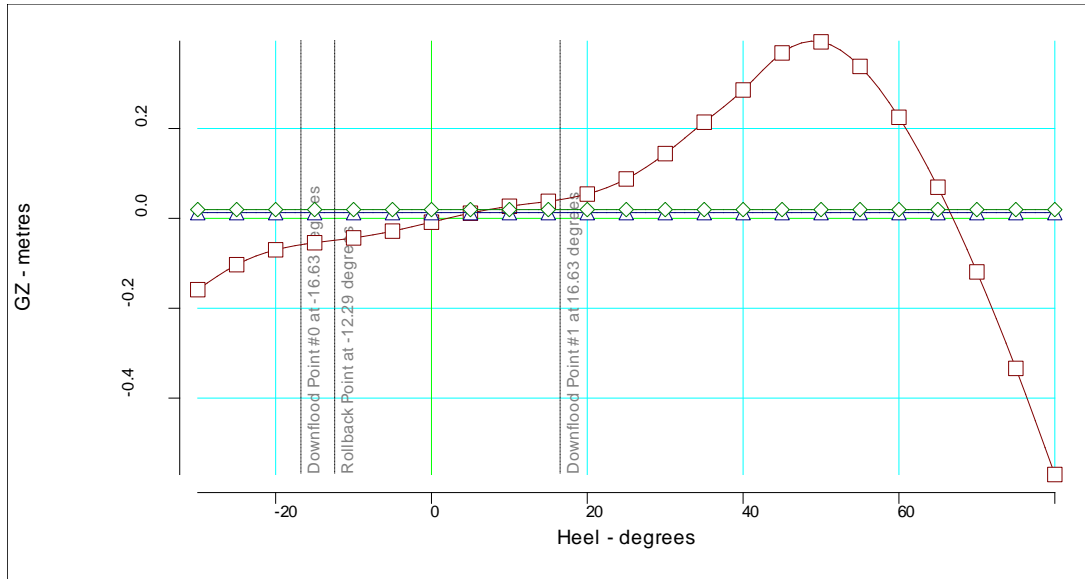
Title	Frames	Cargo	% full	SG (t/m3)	Weight (t)	LCG (m)	TCG (m)	VCG (m)	FSM (t-m)	S M
WB8S: WB8S	75-92	WB	97.0	1.025	70.3	57.64	2.55	0.95	47.4	
WB9P: WATER BALAST 9P	75-92	WB	97.0	1.025	57.9	57.64	- 6.14	1.13	62.0	
WB9S: WB9S	75-92	WB	97.0	1.025	57.9	57.64	6.14	1.13	62.0	
Total WATER BALAST					1500.6	60.39	0.00	1.52	1244.4	
<i>Araçlar</i>										
35 Araç Üst Güverte					1117.0	52.00	0.03	16.07	0.0	
38 Araç Ana Güvertede					1214.0	52.00	0.03	9.18	0.0	
Total Araçlar					2331.0	52.00	0.03	12.48	0.0	
Lightweight					4424.0	49.10	0.00	9.00	0.0	
Deadweight					3831.6	55.28	0.02	8.19	1244.2	
Total Displacement					8255.6	51.97	0.01	8.62	1244.2	
Buoyancy										
					8255.6	51.96	0.21	3.26	47427.8	
Total Buoyancy										
					8255.6	51.96	0.21	3.26	47427.8	

Drafts at equilibrium angle

Draft at LCF	5.756	metres
Draft aft at marks	5.880	metres
Draft fwd at marks	5.598	metres
Draft at AP	5.880	metres
Draft at FP	5.598	metres
Mean draft at midships	5.739	metres

Hydrostatics at equilibrium angle

Density of water	1.0250	tonnes/cu.m
Heel to starboard	2.10	degrees
Trim by the stern	0.283	metres
KG	8.623	metres
FSC	0.151	metres
KGf	8.774	metres
GMt	0.231	metres



Righting Lever (GZ) Curve

Heel to Stbd (deg)	GZ (m)	Slope (m/rad)	Trim (m)	WLRad (m)	Freeboard (m)	Unprotected (m)	Turning (m)	Wind (m)
-30.00	-0.1587	0.7607	0.017	4.629	2.39[1]	-1.86[0]	0.0128	0.0195
-25.00	-0.1031	0.5252	-0.067	4.964	3.30[1]	-1.19[0]	0.0128	0.0195
-20.00	-0.0700	0.2732	-0.146	5.237	4.22[1]	-0.49[0]	0.0128	0.0195
-15.00	-0.0542	0.1378	-0.213	5.453	5.12[1]	0.23[0]	0.0128	0.0195
-10.00	-0.0436	0.1336	-0.260	5.610	5.99[1]	0.98[0]	0.0128	0.0195
-5.00	-0.0284	0.2210	-0.279	5.707	6.84[1]	1.75[0]	0.0128	0.0195
0.00	-0.0085	0.2303	-0.283	5.741	7.66[0]	2.53[0]	0.0128	0.0195
5.00	0.0115	0.2225	-0.279	5.707	6.84[0]	1.75[1]	0.0128	0.0195
10.00	0.0269	0.1365	-0.260	5.610	5.99[0]	0.98[1]	0.0128	0.0195
15.00	0.0379	0.1422	-0.213	5.453	5.12[0]	0.23[1]	0.0128	0.0195
20.00	0.0541	0.2790	-0.146	5.237	4.22[0]	-0.49[1]	0.0128	0.0195
25.00	0.0877	0.5324	-0.067	4.964	3.30[0]	-1.19[1]	0.0128	0.0195
30.00	0.1440	0.7691	0.017	4.629	2.39[0]	-1.86[1]	0.0128	0.0195
35.00	0.2139	0.8271	0.096	4.224	1.49[0]	-2.48[1]	0.0128	0.0195
40.00	0.2856	0.8691	0.167	3.739	0.63[0]	-3.03[1]	0.0128	0.0195
45.00	0.3681	0.8206	0.227	3.174	-0.19[0]	-3.51[1]	0.0128	0.0195
50.00	0.3927	-0.2022	0.298	2.572	-0.99[0]	-3.95[1]	0.0128	0.0195
55.00	0.3381	-0.9853	0.367	1.959	-1.79[0]	-4.37[1]	0.0128	0.0195
60.00	0.2248	-1.5559	0.435	1.340	-2.59[0]	-4.76[1]	0.0128	0.0195
65.00	0.0693	-1.9694	0.503	0.717	-3.37[0]	-5.12[1]	0.0128	0.0195
70.00	-0.1191	-2.3102	0.577	0.091	-4.13[0]	-5.44[1]	0.0128	0.0195
75.00	-0.3338	-2.5782	0.649	-0.537	-4.86[0]	-5.72[1]	0.0128	0.0195
80.00	-0.5700	-2.8215	0.702	-1.167	-5.54[0]	-5.95[1]	0.0128	0.0195

IMO 749 Intact stability Non-Passenger

#	Criterion	Actual Value	Critical Value	
1	Area under GZ curve up to 30 degrees > 0.055	0.006	0.055	F
2	Area under GZ curve from 30 to 40 deg. or downflood > 0.03	0.000	0.030	F
3	Area under GZ curve up to 40 deg. or downflood > 0.09	0.006	0.090	F
4	Initial GM to be at least 0.15 metres	Not Appl..	0.150	
5	GZ to be at least 0.20m at an angle > 30 degrees	0.144	0.200	F
6	Max GZ to be at an angle > 30 degrees	48.871	30.000	
7	Angle of heel for turning < 10 degrees	5.341	10.000	
8	IMO Weather Criterion (Maximum Initial Angle Of Heel)	5.395	16.000	

Unprotected Openings

Point #	X position (m)	Y position (m)	Z position (m)	Ht. above WL (m)	Flood Angle (deg)	Downflood Compartment
0	7.000	-9.021	8.400	2.875	-16.631	
1	7.000	9.021	8.400	2.213	16.631	

Deck Edge

Point #	X position (m)	Y position (m)	Z position (m)	Ht. above WL (m)	Flood Angle (deg)
0	56.400	9.175	13.400	7.328	43.871
1	56.400	-9.175	13.400	8.000	Not immersed

Senaryo 3:

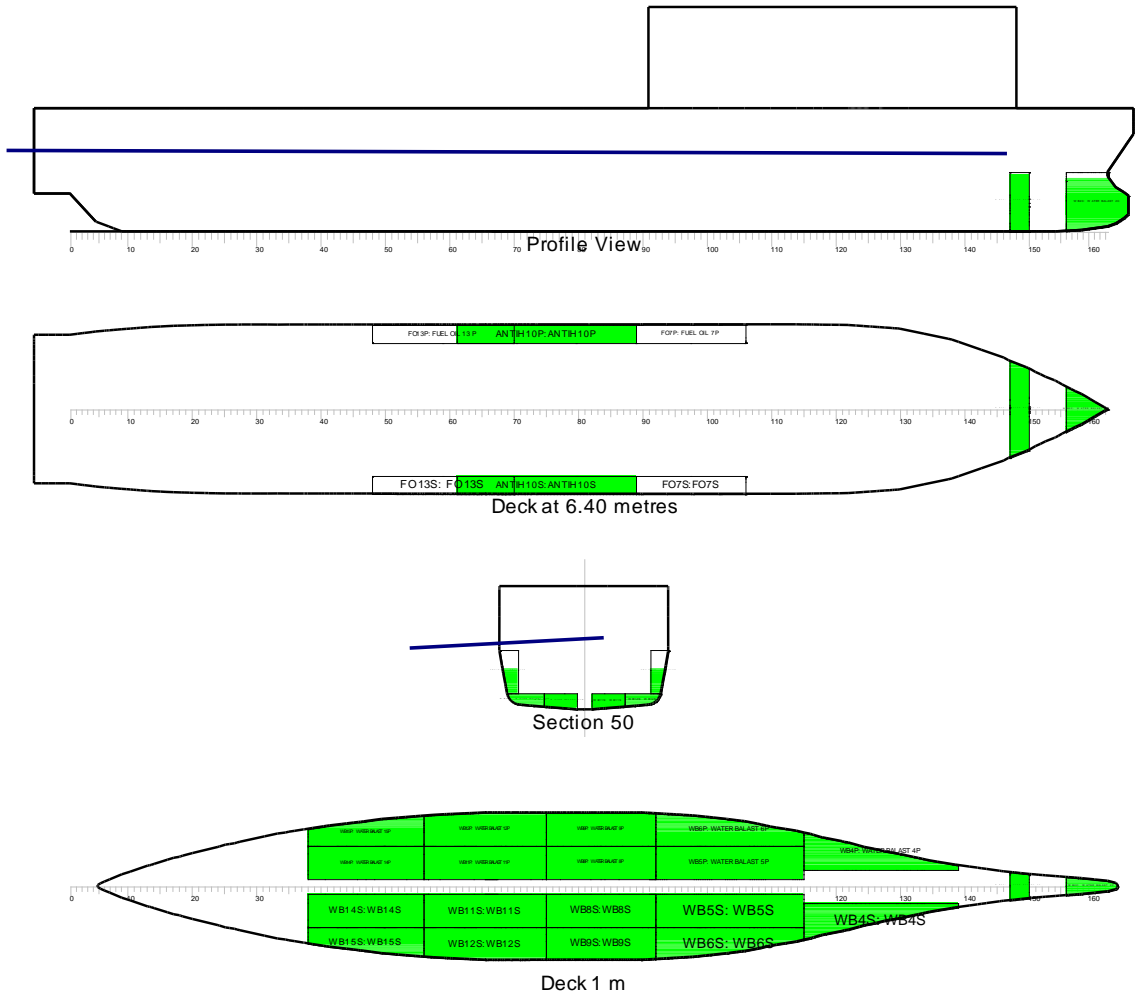
Balast tanklarının %90 dolu olması durumu:

Geminin söz konusu balast durumunda stabilite kriterlerinin büyük bir kısmının IMO kriterlerini sağlamadığı aşağıdaki tablolarda görülmektedir.

Geminin limandan çıkış manevrası sırasında gerek manevra gerek rüzgar nedeniyle oluşan meyil 14 dereceye kadar meyil yapacağı görülmektedir. Bu meyil sonucu yük kayması oluşacak, geminin ana güvertesi üzerindeki açıklıkların suya girecek açığa kadar yatmasına neden olacaktır.

Su alması sonucu doğrulma şansı kalmayan gemi hızla iskeleye doğru yatarak açık güvertedeki yüklerden denize düşerler olacak ve gemi iskele alabandasının üzerine alabora olacaktır.

Bu senaryo ile ilgili veriler aşağıda gösterilmiştir:



Key

Key	Name	Density (t/m3)
	WB	1.0250

Intact State

Intact State

Title	Frames	Cargo	% full	SG (t/m3)	Weight (t)	LCG (m)	TCG (m)	VCG (m)	FSM (t-m)	S M
<i>WATER BALAST</i>										
ANTIH10P: ANTIH10P	61-89	WB	50.2	1.025	75.0	51.63	- 7.92	3.20	7.5	
ANTIH10S: ANTIH10S	61-89	WB	50.1	1.025	75.0	51.63	7.92	3.20	7.5	
WB11P: WATER BALAST 11P	56-75	WB	90.0	1.025	72.6	45.05	- 2.54	0.89	53.0	
WB11S: WB11S	56-75	WB	90.0	1.025	72.6	45.05	2.54	0.89	53.0	
WB12P: WATER BALAST 12P	56-75	WB	90.0	1.025	58.7	45.14	- 6.11	1.09	69.3	
WB12S: WB12S	56-75	WB	90.0	1.025	58.7	45.14	6.11	1.09	69.3	
WB14P: WATER BALAST 14P	38-56	WB	90.0	1.025	68.6	32.09	- 2.54	0.90	50.2	
WB14S: WB14S	38-56	WB	90.0	1.025	68.6	32.09	2.54	0.90	50.2	
WB15P: WATER BALAST 15P	38-56	WB	90.0	1.025	43.0	32.63	- 5.76	1.12	41.6	
WB15S: WB15S	38-56	WB	90.0	1.025	43.0	32.63	5.76	1.12	41.6	
WB2C: WATER BALAST 2C	156- 167	WB	90.0	1.025	71.5	110.85	0.00	3.19	9.0	
WB3C: WATER BALAST 3C	147- 150	WB	90.0	1.025	65.9	103.11	0.00	3.81	141.3	
WB4P: WATER BALAST 4P	115- 139	WB	90.0	1.025	51.3	85.68	- 3.14	1.08	70.6	
WB4S: WB4S	115- 139	WB	90.0	1.025	51.3	85.68	3.14	1.08	70.6	
WB5P: WATER BALAST 5P	92-115	WB	90.0	1.025	88.4	71.63	- 2.54	0.89	64.2	
WB5S: WB5S	92-115	WB	90.0	1.025	88.4	71.63	2.54	0.89	64.2	
WB6P: WATER BALAST 6P	92-115	WB	90.0	1.025	56.2	70.62	- 5.82	1.12	57.1	
WB6S: WB6S	92-115	WB	90.0	1.025	56.2	70.62	5.82	1.12	57.1	
WB8P: WATER BALAST 8P	75-92	WB	90.0	1.025	65.3	57.64	- 2.54	0.89	47.4	
WB8S: WB8S	75-92	WB	90.0	1.025	65.3	57.64	2.54	0.89	47.4	
WB9P: WATER BALAST	75-92	WB	90.0	1.025	53.7	57.64	-	1.08	61.2	

Title	Frames	Cargo	% full	SG (t/m3)	Weight (t)	LCG (m)	TCG (m)	VCG (m)	FSM (t-m)	S M
9P							6.13			
WB9S: WB9S	75-92	WB	90.0	1.025	53.7	57.64	6.13	1.08	61.2	
Total WATER BALAST					1403.0	60.32	0.00	1.47	1194.5	
<i>Araçlar</i>										
35 Araç Üst Güverte					1117.0	52.00	0.03	16.07	0.0	
38 Araç Ana Güvertede					1214.0	52.00	0.03	9.18	0.0	
Total Araçlar					2331.0	52.00	0.03	12.48	0.0	
Lightweight					4424.0	49.10	0.00	9.00	0.0	
Deadweight					3734.1	55.13	0.02	8.34	1194.3	
Total Displacement					8158.1	51.86	0.01	8.70	1194.3	
Buoyancy					8158.1	51.84	0.31	3.24	47117.4	
Total Buoyancy					8158.1	51.84	0.31	3.24	47117.4	

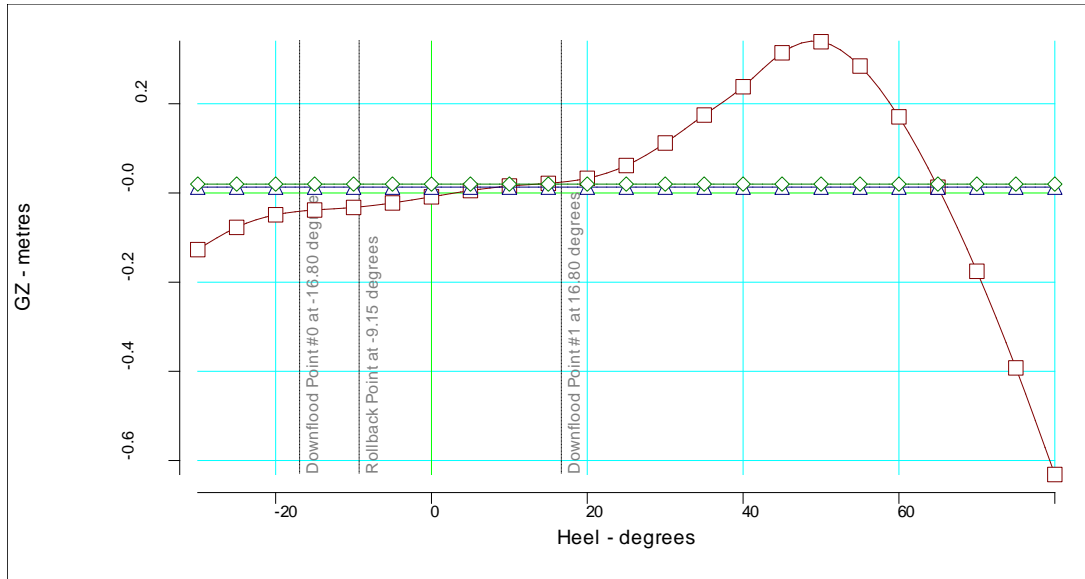
Intact State

Drafts at equilibrium angle

Draft at LCF	5.703	metres
Draft aft at marks	5.860	metres
Draft fwd at marks	5.503	metres
Draft at AP	5.860	metres
Draft at FP	5.503	metres
Mean draft at midships	5.681	metres

Hydrostatics at equilibrium angle

Density of water	1.0250	tonnes/cu.m
Heel to starboard	3.08	degrees
Trim by the stern	0.357	metres
KG	8.700	metres
FSC	0.146	metres
KGf	8.846	metres
GMt	0.159	metres



Righting Lever (GZ) Curve

Heel to Stbd (deg)	GZ (m)	Slope (m/rad)	Trim (m)	WLRad (m)	Freeboard (m)	Unprotected (m)	Turning (m)	Wind (m)
-30.00	-0.1270	0.6895	-0.045	4.576	2.44[1]	-1.83[0]	0.0130	0.0199
-25.00	-0.0770	0.4675	-0.132	4.910	3.36[1]	-1.17[0]	0.0130	0.0199
-20.00	-0.0490	0.2178	-0.215	5.183	4.27[1]	-0.47[0]	0.0130	0.0199
-15.00	-0.0382	0.0815	-0.285	5.398	5.17[1]	0.26[0]	0.0130	0.0199
-10.00	-0.0324	0.0770	-0.333	5.555	6.05[1]	1.01[0]	0.0130	0.0199
-5.00	-0.0224	0.1560	-0.353	5.652	6.90[1]	1.77[0]	0.0130	0.0199
0.00	-0.0086	0.1606	-0.358	5.686	7.71[0]	2.56[0]	0.0130	0.0199
5.00	0.0053	0.1575	-0.353	5.652	6.90[0]	1.77[1]	0.0130	0.0199
10.00	0.0156	0.0800	-0.333	5.555	6.05[0]	1.01[1]	0.0130	0.0199
15.00	0.0216	0.0860	-0.285	5.398	5.17[0]	0.26[1]	0.0130	0.0199
20.00	0.0329	0.2237	-0.215	5.183	4.27[0]	-0.47[1]	0.0130	0.0199
25.00	0.0615	0.4747	-0.132	4.910	3.36[0]	-1.17[1]	0.0130	0.0199
30.00	0.1121	0.6981	-0.045	4.576	2.44[0]	-1.83[1]	0.0130	0.0199
35.00	0.1748	0.7345	0.038	4.173	1.54[0]	-2.45[1]	0.0130	0.0199
40.00	0.2383	0.7762	0.113	3.689	0.68[0]	-3.00[1]	0.0130	0.0199
45.00	0.3143	0.8245	0.179	3.124	-0.14[0]	-3.48[1]	0.0130	0.0199
50.00	0.3392	-0.1991	0.252	2.520	-0.94[0]	-3.92[1]	0.0130	0.0199
55.00	0.2845	-0.9891	0.323	1.905	-1.74[0]	-4.34[1]	0.0130	0.0199
60.00	0.1707	-1.5637	0.392	1.284	-2.53[0]	-4.72[1]	0.0130	0.0199
65.00	0.0129	-1.9826	0.463	0.659	-3.31[0]	-5.08[1]	0.0130	0.0199
70.00	-0.1756	-2.3297	0.537	0.032	-4.07[0]	-5.40[1]	0.0130	0.0199
75.00	-0.3924	-2.6066	0.609	-0.598	-4.80[0]	-5.68[1]	0.0130	0.0199
80.00	-0.6315	-2.8568	0.656	-1.231	-5.48[0]	-5.91[1]	0.0130	0.0199

#	Criterion	Actual Value	Critical Value

#	Criterion	Actual Value	Critical Value	
1	Area under GZ curve up to 30 degrees > 0.055	0.003	0.055	F
2	Area under GZ curve from 30 to 40 deg. or downflood > 0.03	0.000	0.030	F
3	Area under GZ curve up to 40 deg. or downflood > 0.09	0.003	0.090	F
4	Initial GM to be at least 0.15 metres	Not Appl.	0.150	
5	GZ to be at least 0.20m at an angle > 30 degrees	0.112	0.200	F
6	Max GZ to be at an angle > 30 degrees	48.889	30.000	
7	Angle of heel for turning < 10 degrees	8.415	10.000	
8	IMO Weather Criterion (Maximum Initial Angle Of Heel)	8.528	16.000	

Unprotected Openings

Point #	X position (m)	Y position (m)	Z position (m)	Ht. above WL (m)	Flood Angle (deg)	Downflood Compartment
0	7.000	-9.021	8.400	3.051	-16.798	
1	7.000	9.021	8.400	2.083	16.798	

Deck Edge

Point #	X position (m)	Y position (m)	Z position (m)	Ht. above WL (m)	Flood Angle (deg)
0	56.400	9.175	13.400	7.223	44.175
1	56.400	-9.175	13.400	8.208	Not immersed

Senaryo 4:

Geminin yara alması:

Geminin alt güverte üzerinden saç atması veya çarparak yara alması geminin tek ambarlı olması nedeniyle kısa sürede bir alabandan alabora olmasını sağlayacaktır. Bu senaryonun geçerli olabilmesi için geminin çıkarılma sürecinde inceleme yapılması gerekmektedir.

