



WORKING DOCUMENT



Introducing advanced ICT
and Mass Evacuation Vessel design
to ship evacuation and rescue systems

D4.5 MEV-II naval architecture and structural design (V2)

A holistic passenger ship evacuation and rescue ecosystem

MG-2-2-2018

Marine Accident Response

Grant Agreement Number	814962	Acronym	PALAEMON	
Full Title	A holistic passenger ship evacuation and rescue ecosystem			
Topic	MG-2-2-2018: Marine Accident Response			
Funding scheme	RIA - Research and Innovation Action			
Start Date	1 st JUNE 2019	Duration	44 months	
Project URL	https://www.palaemonproject.eu			
EU Project Officer	Georgios CHARALAMPOUS			
Project Coordinator	AIRBUS DEFENCE AND SPACE SAS			
Deliverable	D4.5 MEV-II naval architecture and structural design (V2)			
Work Package	WP4 – PALAEMON Mass Evacuation Vessel			
Date of Delivery	Contractual	M28	Actual	M44
Nature	R - Report	Dissemination Level	PU-PUBLIC	
Lead Beneficiary	ESI			
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Reviewer(s):				
Keywords				

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Revision History

Version	Date	Responsible	Description/Remarks/Reason for changes
0.1	2022/01/04	Alexandros Koimtzoglou	First draft
0.2	2022/09/02	Elias Chatzidouros	Change of inflatable design
0.3	2022/11/02	Alexandros Chatzidouros	New calculations
0.4	2022/12/19	Elias Chatzidouros	Reviewed-Final Draft

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Abbreviations

AP	After Peak
BL	Base Line
BM _L	Longitudinal Metacentric Radius
BM _T	Transverse Metacentric Radius
CL	Center Line
Disp (Δ)	Displacement
FP	Fore Peak
FSC	Free Surface moment Correction
GM	Metacentric height
GZ	Righting Arm
KM _L	Longitudinal Metacentric Height
KM _T	Transverse Metacentric Height
KN	Righting lever measured from BL
LCB	Longitudinal Center of Buoyancy
LCF	Longitudinal Center of Floatation
LCG	Longitudinal Center of Gravity
LSA	International Life-Saving Appliance Code
MTC	Moment to change Trim for 1cm
TCB	Transverse Center of Buoyancy
TCF	Transverse Center of Floatation
TCG	Transverse Center of Gravity
TPC	Tonnes per cm Immersion
VCB (or KB)	Vertical Center of Buoyancy
VCF	Vertical Center of Floatation
VCG (or KG)	Vertical Center of Gravity
VCG _{Corr} (or KG _{Corr})	The VCG including the FSC
WSA	Water Surface Area
WPA	Water Plane Area

1 Summary

In this deliverable the hydrostatics and the stability calculations for the MEV-II concept are evaluated and presented.

2 Introduction

The PALAEMON project's premise is the creation of mass evacuation vessels (MEVs) that can carry a lot more people than standard lifeboats while taking up about the same space and volume. It also shows how the MEVs can carry individuals with different types of mobility issues and demographics. In this sense there are two designs that are being developed, one is the MEV I which applies to existing ships and current ship designs, presented in D4.1 through to D4.3 and the MEV II which is a conceptual design for future ship designs. The advantage of the MEV II is that they are integrated designs to the ships structure and operation, able to accommodate 200% of the people onboard the ship (in MEV II existing both in port and stbd sides). Lastly the MEV II is also being designed having in mind the aesthetic view of the ship, since today's Passenger and Cruise ships are designed also with aesthetics in mind. In deliverable D4.4 the design, integration on the ship and structural analysis were accomplished and in this deliverable the stability analysis and hydrostatics are calculated.



3 MEV-II

The main particulars of MEV-II model are shown in the following table.

General Particulars	
L	25.30 m
B	7.00 m
D	5.20 m

Notes:

1. As for L.C.B., L.C.F. and L.C.G. the center of axis is considered to be the AP.
2. The specific gravity of sea water is assumed to be 1.025 t/m³.

3.1 Hydrostatics

This section presents the Hydrostatic Table and the Cross Curves for the MEV-II.

3.1.1 Hydrostatic Table

The Table below provides the main hydrostatic particulars for each draft.

Draft	Disp.	LCB	VCB	LCF	KM _L	KM _T	BM _L	BM _T	TPC	MTC	WSA	WPA
m	t	m	m	m	m	m	m	m	t/cm	t·m/cm	m ²	m ²
0.10	12.94	11.321	0.051	11.346	452.443	30.248	452.392	30.197	1.36	2.31	133.04	12.94
0.20	27.02	11.348	0.103	11.398	232.187	17.253	232.085	17.150	1.45	2.48	141.27	27.02
0.30	41.81	11.375	0.155	11.451	157.833	12.568	157.678	12.413	1.51	2.61	147.16	41.81
0.40	57.13	11.402	0.207	11.503	120.264	10.071	120.056	9.863	1.56	2.71	151.71	57.13
0.50	72.88	11.430	0.260	11.555	97.526	8.492	97.267	8.232	1.59	2.80	155.38	72.88
0.60	88.98	11.457	0.312	11.608	82.325	7.406	82.013	7.093	1.62	2.88	158.51	88.98
0.70	105.34	11.485	0.365	11.661	71.279	6.565	70.914	6.200	1.65	2.95	160.80	105.34
0.80	121.94	11.512	0.417	11.713	63.047	5.939	62.630	5.522	1.67	3.02	162.94	121.94
0.90	138.71	11.540	0.470	11.765	56.452	5.393	55.983	4.924	1.68	3.07	164.19	138.71
1.00	155.60	11.567	0.522	11.817	51.249	4.972	50.728	4.450	1.70	3.12	165.44	155.60
1.10	172.59	11.594	0.574	11.869	46.916	4.603	46.342	4.030	1.70	3.16	166.17	172.59
1.20	189.66	11.621	0.626	11.922	43.357	4.309	42.731	3.683	1.71	3.20	166.90	189.66
1.30	206.81	11.648	0.677	11.974	40.385	4.070	39.708	3.393	1.72	3.25	167.64	206.81
1.40	224.03	11.675	0.729	12.026	37.865	3.875	37.136	3.145	1.73	3.29	168.36	224.03
1.50	241.32	11.702	0.781	12.078	35.708	3.714	34.927	2.933	1.73	3.33	169.10	241.32



3.1.2 Cross Curves

The Table below provides the KN values for each draft and angle of heel respectively.

Heel	10°	20°	30°	40°	50°	60°	70°	80°	90°
Draft									
0.10	2.270	2.572	2.628	2.552	2.385	2.160	1.921	1.790	2.963
0.20	2.004	2.433	2.554	2.531	2.414	2.240	2.064	2.064	2.898
0.30	1.776	2.304	2.485	2.513	2.441	2.317	2.199	2.284	2.853
0.40	1.571	2.183	2.417	2.491	2.469	2.389	2.322	2.481	2.817
0.50	1.382	2.071	2.355	2.472	2.492	2.458	2.439	2.614	2.789
0.60	1.223	1.967	2.297	2.455	2.513	2.519	2.544	2.699	2.768
0.70	1.098	1.870	2.244	2.439	2.534	2.576	2.643	2.755	2.747
0.80	0.999	1.778	2.193	2.425	2.553	2.630	2.733	2.794	2.732
0.90	0.918	1.690	2.146	2.411	2.571	2.681	2.801	2.821	2.720
1.00	0.852	1.607	2.100	2.398	2.589	2.729	2.852	2.840	2.710
1.10	0.798	1.531	2.057	2.385	2.605	2.776	2.889	2.854	2.703
1.20	0.752	1.464	2.016	2.373	2.621	2.820	2.915	2.863	2.697
1.30	0.713	1.404	1.976	2.361	2.636	2.853	2.934	2.868	2.691
1.40	0.680	1.353	1.937	2.350	2.651	2.878	2.946	2.871	2.687
1.50	0.652	1.307	1.900	2.339	2.665	2.896	2.954	2.872	2.683

3.2 Weight Analysis

This section analyses the calculations that were conducted for the weight groups of MEV-II prototype to estimate the LCG, TCG and KG. Furthermore, the loading conditions are presented.

The weight groups that were calculated are the following:

- Lightweight
 - Structure
 - Inflatables
 - Outfitting
 - Engine
 - Equipment
- Deadweight
 - Passengers
 - Fuel
 - Provisions
 - Water
 - Food

Each weight group is analysed below.

3.2.1 Lightship

3.2.1.1 Structure

The weight of the structure is estimated at 34.5 tn. The MEV-II is symmetrical in regards to the center plane, therefore TCG will be located on the CL. The weight of the structure is assumed that will have more weight towards the stern as this part of the MEV-II will be more enhanced (despite the fact the effect of the shape of the bow), therefore the LCG is assumed that is located at 12.00 m from the stern. Finally, the VCG because of the windows and that the bottom of MEV-II will have more stiffeners compared to the top, VCG is assumed at 2.50 m from the BL.

Group	Weight	LCG	TCG	VCG	AFT ext.	FOR. ext.
	(tn)	(m)	(m)	(m)	(m from AP)	
Structure	34.500	12.000	0.000	2.500	0.000	25.300

3.2.1.2 Inflatables

The weight of the inflatables is estimated at 0.300 tn (i.e. 0.150 Kg per side). Regarding the center of gravity, LCG was assumed at 12.00 m from the stern, TCG on the CL and VCG at 1.80 form the BL.

Group	Weight	LCG	TCG	VCG	AFT ext.	FOR. ext.
	(tn)	(m)	(m)	(m)	(m from AP)	
Inflatables	0.300	12.000	0.000	1.800	0.000	24.000

3.2.1.3 Outfitting

This weight group includes all the equipment (i.e. navigational, electrical, etc.), pipping (fuel, cooling water, air conditioning, etc.), appendages (e.g. propeller, etc.), air conditioning pumps, lights and the respective cables, that will be installed on the MEV-II.

The weight is estimated at 4.00 tn. The center of gravity is estimated at LCG 10.00 m from the stern (because the propeller most of the of the appendages regarding the engine as well as the pipping will be located towards the stern), TCG on the CL and VCG at 2.20 m above BL.

Group	Weight	LCG	TCG	VCG	AFT ext.	FOR. ext.
	(tn)	(m)	(m)	(m)	(m from AP)	
Outfitting	4.000	10.000	0.000	2.200	0.000	25.300



3.2.2 Engine

The weight of the main engine is estimated 1.00 tn. The center of gravity for the main engine is located on the geometric center of the respective space, due to the fact that the engine will be located on the CL. Therefore, the LCG is located at 0.60 m from the stern, TCG on the CL, and VCG 0.50 m from the BL.

Group	Weight	LCG	TCG	VCG	AFT ext.	FOR. ext.
	(tn)	(m)	(m)	(m)	(m from AP)	
Engine	1.000	0.600	0.000	0.500	0.000	1.200

3.2.3 Equipment

This weight includes all the equipment required by LSA Code¹, excluding the food and water supplies. The weight of the equipment is estimated 1.00 tn, and it will be stored in the forward area of the MEV-II for Deck I and in the rear area for Deck II.

Group	Weight	LCG	TCG	VCG	AFT ext.	FOR. ext.
	(tn)	(m)	(m)	(m)	(m from AP)	
Equipment	1.000	11.500	0.000	2.000	0.000	23.000

3.2.4 Deadweight

3.2.4.1 Persons on-board

MEV-II is designed to have on-board 682 persons on-board. In particular, the persons will be seated in two decks, 310 persons will be on-board on Deck I and 372 persons on Deck II. The average weight of each person is assumed 100 kg (i.e. 0.10 tn), therefore 68.00 tn in total, i.e. 31.00 tn for Deck I and 37.20 for Deck II. According to the seating arrangement the weight is equally distributed and the passengers are seated symmetrically from the CL, therefore the LCG is located at 11.500 m from the stern and the TCG on the CL. Regarding the VCG, it is assumed an average height of 1.70 m and that the center of gravity of a seating person is located at half of this height. Hence the VCG for the persons on Deck I is located at 0.85 m above BL, and for Deck II m 3.45 m above BL, as Deck II is located 2.60 m from the BL.

Group	Weight	LCG	TCG	VCG	AFT ext.	FOR. ext.
	(tn)	(m)	(m)	(m)	(m from AP)	
Deck I (310 per.)	31.000	11.500	0.000	0.850	1.500	21.500
Deck II (372 per.)	37.200	11.500	0.000	3.450	1.500	21.500
Persons on board	68.200	11.500	0.000	2.268	1.500	21.500

3.2.4.2 Fuel

The fuel tanks will be located at the stern of the MEV-II. They will be two symmetric tanks (one port and one starboard).

Group	Weight	LCG	TCG	VCG	AFT ext.	FOR. ext.
	(tn)	(m)	(m)	(m)	(m from AP)	
Total Fuel	0.800	0.500	0.000	0.450	0.000	1.000

For each condition FLD (Full Load Departure) and FLA (Full Load Arrival) it is assumed that 100% of the group is on the MEV-II for the FLD and 10% will remain on the FLA.

¹ Ch. IV, § 4.4.8

3.2.4.3 Provisions

This weight group includes the water and food supplies that MEV-II should carry according to the maximum capacity of the persons on-board. Base on the LSA Code, for a person on-board it is required 3 lt of water² and food that provides 10000 kJ (i.e. 2400 kCal) per day³.

To calculate the required weight of the water supplies for the 682 persons on-board it is estimated that each person will consume 3 lt for two days (1.5lt per day). By applying a safety factor of 25%, the water weight is 1.163 tn for Deck I and 1.395 tn for Deck II.

Regarding the food weight, 2 packs per person (one per day) is required. According to LSA and indicatively the weight of each pack is 0.55 gr. By applying a safety factor of 25%, therefore the food weight is calculated 0.426 tn for Deck I and 0.512 tn for Deck II.

The water and food supplies is assumed to be located beneath the seats. Therefore, the LCG for both supplies will be the same. LCG is 11.500 m from the stern, TCG is located on the CL and the VCG is 0.400 m above the BL for Deck I and 3.000 m for Deck II.

It is noted that the free surface moment effect from the water supplies is neglected because it should be in specific packs according to LSA Code.

Group	Weight	LCG	TCG	VCG	AFT ext.	FOR. ext.
	(tn)	(m)	(m)	(m)	(m from AP)	
Deck I Water	1.163	11.500	0.000	0.400	1.500	21.500
Deck I Food	0.426	11.500	0.000	0.400	1.500	21.500
Deck I provisions	1.589	11.500	0.000	0.400	1.500	21.500
Deck II Water	1.395	11.500	0.000	3.000	1.500	21.500
Deck II Food	0.512	11.500	0.000	3.000	1.500	21.500
Deck II provisions	1.907	11.500	0.000	3.000	1.500	21.500
Total Water	2.558	11.500	0.000	1.818	1.500	21.500
Total Food	0.938	11.500	0.000	1.818	1.500	21.500
Total provisions	3.496	11.500	0.000	1.818	1.500	21.500

For each condition FLD (Full Load Departure) and FLA (Full Load Arrival) it is assumed that 100% of the group is on the MEV-II for the FLD and 10% will remain on the FLA.

3.2.5 Total weights groups

Main group	Group	Weight	LCG	TCG	VCG	AFT ext.	FOR. ext.
		(tn)	(m)	(m)	(m)	(m from AP)	
Lightship	Structure	34.500	12.000	0.000	2.500	0.000	25.300
	Inflatables	0.300	12.000	0.000	1.800	0.000	24.000
	Outfitting	4.000	10.000	0.000	2.200	0.000	25.300
	Engine	1.000	0.600	0.000	0.500	0.000	1.200
	Equipment	1.000	11.500	0.000	2.000	0.000	23.000
	Total (LS)	40.800	11.512	0.000	2.404	0.000	25.300

² Ch. IV, § 4.4.8.9

³ Ch. IV, § 4.4.8.12



Main group	Group	Weight	LCG	TCG	VCG	AFT ext.	FOR. ext.
		(tn)	(m)	(m)	(m)	(m from AP)	
Load	Persons	68.200	11.500	0.000	2.268	1.500	21.500
	Fuel FLD	0.800	0.500	0.000	0.408	0.000	1.000
	Fuel FLA	0.080	0.500	0.000	0.450	0.000	1.000
	Provisions FLD	3.496	11.500	0.000	1.818	1.500	21.500
	Provisions FLA	0.349	11.500	0.000	1.818	1.500	21.500

3.3 Loading Conditions

According to LSA Code (CH.IV §4.4.2.1) the maximum allowable number of persons for a lifeboat to accommodate is 150 persons. Due to the fact that MEV-II has a considerable larger maximum capacity (i.e. 682, refer to section 1.2.4.1), it can be characterised as alternative design and can be designed and built based on the IMO MSC.1 Circ. 1212/Rev.1 "*Revised Guidelines on Alternative Design and Arrangements for SOLAS Chapters II-1 and III*".

However, as MEV-II is at conceptual level (i.e., its feasibility is examined and presented) the stability calculations will be provided for the main loading conditions:

- Lightship (LS)
- Full Load Departure (FLD)
- Full Load Arrival (FLA)

Additionally, in order to cover the extra loading conditions required from the LSA for the lifeboats (CH.IV §4.4.5), on studying the stability of the lifeboat for having only half passengers from the one side of the CL, two additional loading conditions will be studied for departure and arrival:

- FLD Half Passenger
- FLA Half Passenger

In particular, MEV-II stability will be studied for having half of the passengers on-board (i.e. 341) but, because MEV-II has two decks, Deck-I will be considered full of passengers and the remaining passengers will be on Deck-II at the one side of CL.

This is proposed, as in case the MEV-II is required to be loaded with half capacity the passenger will first be seated on Deck-I and then on Deck-II.

For the Half Passenger conditions, the weights are shown below:

Group	Weight	LCG	TCG	VCG	AFT ext.	FOR. ext.
	(tn)	(m)	(m)	(m)	(m from AP)	
Deck I (310 per.)	31.000	11.500	0.000	0.850	1.500	21.500
Deck II (31 per.)	3.100	11.500	3.500	3.450	1.500	21.500
Persons on board	34.100	11.500	0.318	1.086	1.500	21.500

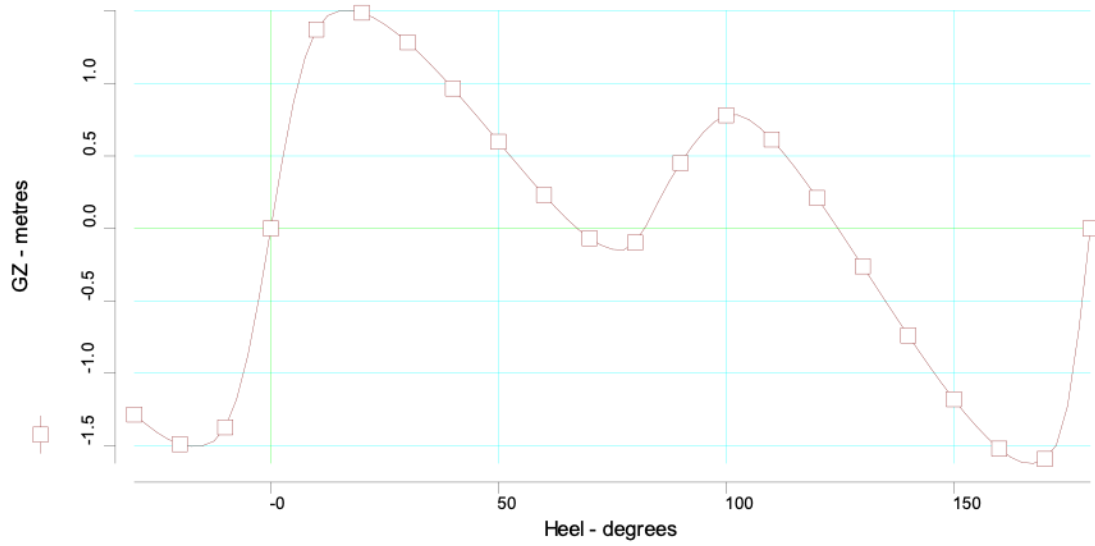
3.3.1 *Lightship*

The weights for this loading condition are shown below:

Group	Weight	LCG	TCG	VCG
	(tn)	(m)	(m)	(m)
Lightship	40.800	11.512	0.000	2.404

Drafts		
at LCF	0.294	m
at AP	0.284	m
at FP	0.306	m
mean at amidships	0.295	m

Heel	No heel	
Trim (by the bow)	0.022	m
VCG	2.404	m
FSC	0.000	m
VCG _{Corr}	2.404	m
GM	10.400	m
BM _T	12.635	m
BM _L	161.131	m
WPA	146.91	m ²
LCG	11.512	m
LCB	11.514	m
TCB	0.000	m
LCF	11.465	m
TCF	0.000	m
TPC	1.506	tn/cm
MTC	2.595	tn·m/cm



IMO A167 Intact Stability criteria			
#	Criterion	Actual Value	Required Value
1	Area under GZ curve up to 30° > 0.055	0.644	0.055
2	Area under GZ curve from 30° to 40° or downflood > 0.03	0.198	0.030
3	Area under GZ curve up to 40° or downflood > 0.09	0.841	0.090
4	Maximum GZ to be at least 0.20 m at 30° above	1.508	0.200
5	Maximum GZ to be at an angle > 25°	16.800	25.000
6	Initial GM to be at least 0.15 m	10.400	0.150



3.3.2 Full Load Departure

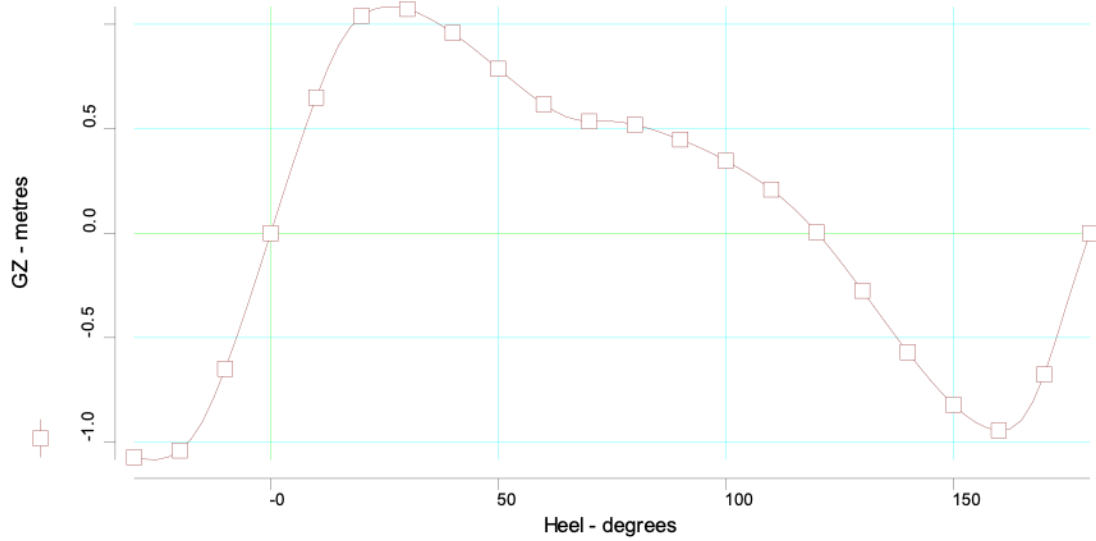
The weights for this loading condition are shown below:

Group	Weight	LCG	TCG	VCG
	(tn)	(m)	(m)	(m)
Persons	68.200	11.500	0.000	2.268
Fuel FLD	0.800	0.500	0.000	0.408
Provisions FLD	3.496	11.500	0.000	1.818
Deadweight	72.496	11.379	0.000	2.226
Lightship	40.800	11.512	0.000	2.404
Δ	113.300	11.427	0.000	2.290

Drafts		
at LCF	0.748	m
at AP	0.765	m
at FP	0.733	m
mean at amidships	0.747	m

Heel	No heel	
Trim (by the stern)	0.028	m
VCG	2.290	m
FSC	0.000	m
VCG _{Corr}	2.290	m
GM	3.955	m
BM _T	5.855	m
BM _L	66.56	m
WPA	161.82	m ²
LCG	11.427	m
LCB	11.425	m
TCB	0.000	m
LCF	11.673	m
TCF	0.000	m
TPC	1.659	tn/cm
MTC	2.981	tn-m/cm





IMO A167 Intact Stability criteria			
#	Criterion	Actual Value	Required Value
1	Area under GZ curve up to 30° > 0.055	0.400	0.055
2	Area under GZ curve from 30° to 40° or downflood > 0.03	0.179	0.030
3	Area under GZ curve up to 40° or downflood > 0.09	0.578	0.090
4	Maximum GZ to be at least 0.20 m at 30° above	1.085	0.200
5	Maximum GZ to be at an angle > 25°	26.171	25.000
6	Initial GM to be at least 0.15 m	3.955	0.150



3.3.3 Full Load Arrival

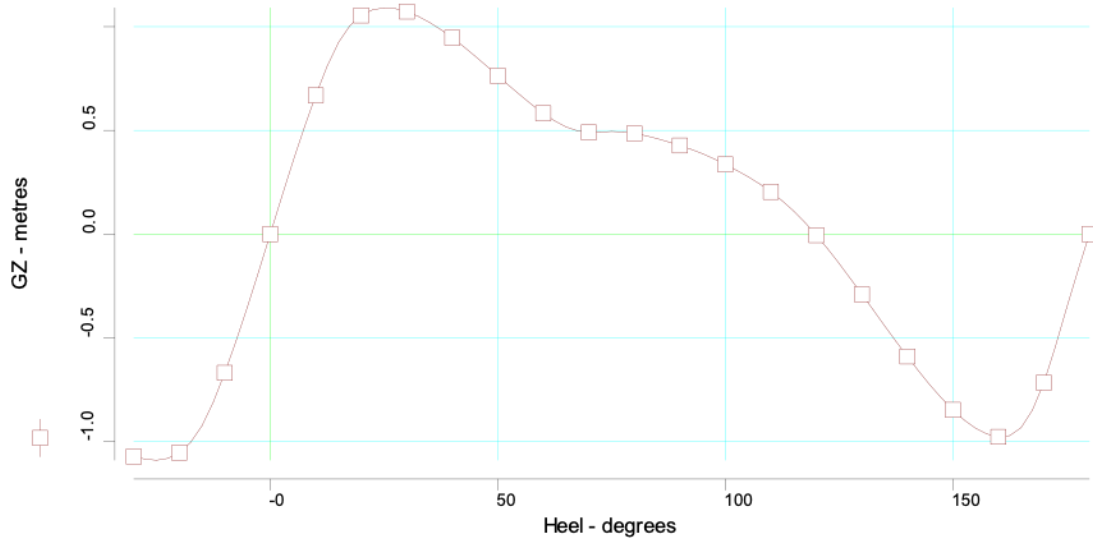
The weights for this loading condition are shown below:

Group	Weight	LCG	TCG	VCG
	(tn)	(m)	(m)	(m)
Persons	68.200	11.500	0.000	2.268
Fuel FLA	0.080	0.500	0.000	0.408
Provisions FLA	0.350	11.500	0.000	1.818
Deadweight	68.630	11.487	0.000	2.263
Lightship	40.800	11.512	0.000	2.404
Δ	109.400	11.497	0.000	2.316

Drafts		
at LCF	0.725	m
at AP	0.724	m
at FP	0.726	m
mean at amidships	0.725	m

Heel	No heel	
Trim	No trim	m
VCG	2.316	m
FSC	0.000	m
VCG _{Corr}	2.316	m
GM	4.080	m
BM _T	6.018	m
BM _L	68.666	m
WPA	161.38	m ²
LCG	11.497	m
LCB	11.497	m
TCB	0.000	m
LCF	11.674	m
TCF	0.000	m
TPC	1.654	tn/cm
MTC	2.970	tn·m/cm





IMO A167 Intact Stability criteria			
#	Criterion	Actual Value	Required Value
1	Area under GZ curve up to 30° > 0.055	0.407	0.055
2	Area under GZ curve from 30° to 40° or downflood > 0.03	0.178	0.030
3	Area under GZ curve up to 40° or downflood > 0.09	0.584	0.090
4	Maximum GZ to be at least 0.20 m at 30° above	1.091	0.200
5	Maximum GZ to be at an angle > 25°	25.514	25.000
6	Initial GM to be at least 0.15 m	4.080	0.150



3.3.4 FLD Half Passengers

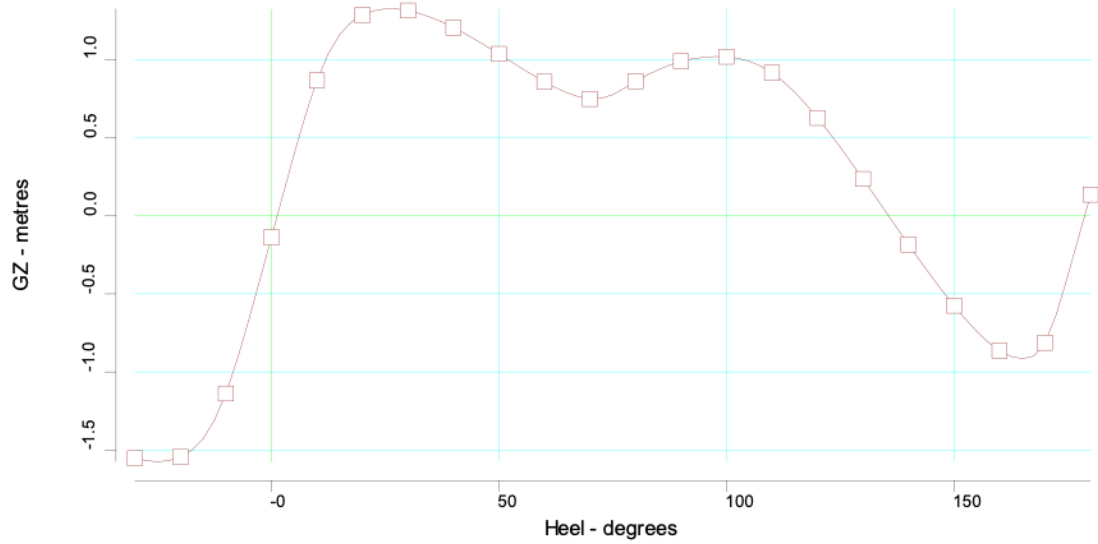
The weights for this loading condition are shown below:

Group	Weight	LCG	TCG	VCG
	(tn)	(m)	(m)	(m)
Persons (half capacity)	34.100	11.500	0.318	1.086
Fuel FLD	0.800	0.500	0.000	0.408
Provisions FLD	3.496	11.500	0.000	1.818
Deadweight	38.496	11.271	0.283	1.139
Lightship	40.800	11.512	0.000	2.404
Δ	79.296	11.395	0.137	1.791

Drafts		
at LCF	0.539	m
at AP	0.545	m
at FP	0.532	m
mean at amidships	0.538	m

Heel (to starboard)	1.26	deg.
Trim (by the stern)	0.013	m
VCG	1.791	m
FSC	0.000	m
VCG _{Corr}	1.791	m
GM	6.213	m
BM _T	7.719	m
BM _L	90.442	m
WPA	156.510	m ²
LCG	11.395	m
LCB	11.394	m
TCB	0.170	m
LCF	11.570	m
TCF	0.054	m
TPC	1.604	tn/cm
MTC	2.831	tn·m/cm





IMO A167 Intact Stability criteria			
#	Criterion	Actual Value	Required Value
1	Area under GZ curve up to 30° > 0.055	0.497	0.055
2	Area under GZ curve from 30° to 40° or downflood > 0.03	0.222	0.030
3	Area under GZ curve up to 40° or downflood > 0.09	0.719	0.090
4	Maximum GZ to be at least 0.20 m at 30° above	1.328	0.200
5	Maximum GZ to be at an angle > 25°	26.168	25.000
6	Initial GM to be at least 0.15 m	6.213	0.150



3.3.5 FLA Half Passengers

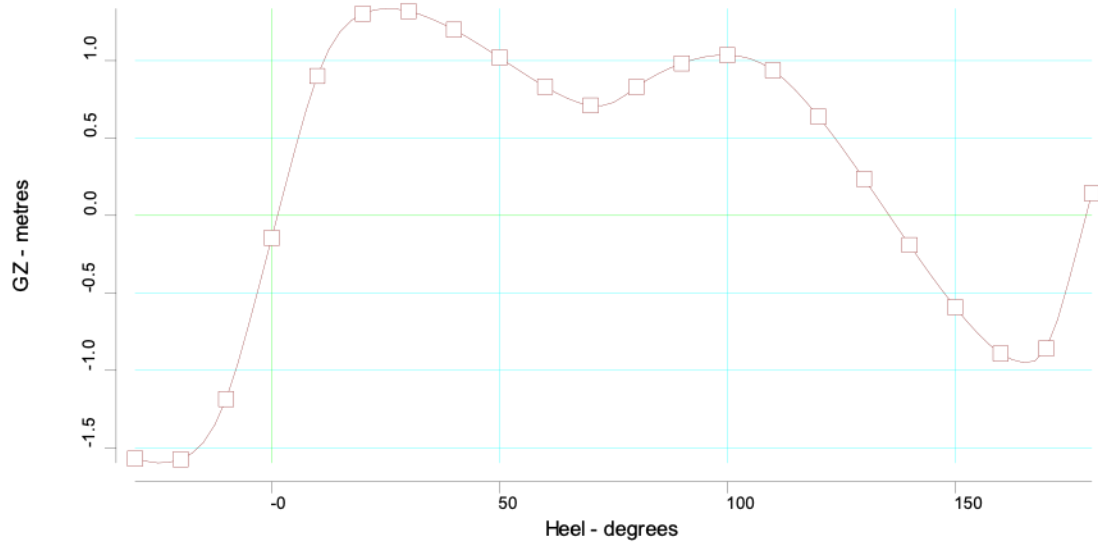
The weights for this loading condition are shown below:

Group	Weight	LCG	TCG	VCG
	(tn)	(m)	(m)	(m)
Persons (half capacity)	34.100	11.500	0.318	1.086
Fuel	0.080	0.500	0.000	0.408
Provisions FLA	0.350	11.500	0.000	1.818
Deadweight	34.530	11.475	0.314	1.091
Lightship	40.800	11.512	0.000	2.404
Δ	70.330	11.495	0.144	1.802

Drafts		
at LCF	0.515	m
at AP	0.507	m
at FP	0.525	m
mean at amidships	0.516	m

Heel (to starboard)	1.27	deg.
Trim (by the bow)	0.016	m
VCG	1.802	m
FSC	0.000	m
VCG _{Corr}	1.803	m
GM	6.485	m
BM _T	8.032	m
BM _L	94.635	m
WPA	155.930	m ²
LCG	11.495	m
LCB	11.496	m
TCB	0.178	m
LCF	11.572	m
TCF	0.057	m
TPC	1.598	tn/cm
MTC	2.818	tn·m/cm





IMO A167 Intact Stability criteria			
#	Criterion	Actual Value	Required Value
1	Area under GZ curve up to 30° > 0.055	0.506	0.055
2	Area under GZ curve from 30° to 40° or downflood > 0.03	0.221	0.030
3	Area under GZ curve up to 40° or downflood > 0.09	0.727	0.090
4	Maximum GZ to be at least 0.20 m at 30° above	1.336	0.200
5	Maximum GZ to be at an angle > 25°	25.499	25.000
6	Initial GM to be at least 0.15 m	6.485	0.150

4 Conclusions

The stability calculations for the MEV II, show that for all the IMO A167 Intact Stability criteria are satisfied for all loading cases. The MEV II concept design with respect to structural, launching, aesthetics, ease of access (D4.3) and stability calculations, offer a sound and innovative design for future High passenger capacity Passenger and Cruise ships.

