IMO Circular MSC.1/Circ. 1228 dated 11 January 2007, *Revised guidance to the master for avoiding dangerous situations in adverse weather and sea conditions*

INTERNATIONAL MARITIME ORGANIZATION
4 ALBERT EMBANKMENT
LONDON SE1 7SR

Telephone: 020 7735 7611
Fax: 020 7587 3210

IMO

E

Ref. T1/2.04

MSC.1/Circ.1228
11 January 2007

REVISED GUIDANCE TO THE MASTER FOR AVOIDING DANGEROUS SITUATIONS IN ADVERSE WEATHER AND SEA CONDITIONS

1 The Maritime Safety Committee, at its eighty-second session (29 November to 8 December 2006), approved the Revised Guidance to the master for avoiding dangerous situations in adverse weather and sea conditions, set out in the annex, with a view to providing masters with a basis for decision making on ship handling in adverse weather and sea conditions, thus assisting them to avoid dangerous phenomena that they may encounter in such circumstances.

2 Member Governments are invited to bring the annexed Revised Guidance to the attention of interested parties as they deem appropriate.

3 This Revised Guidance supersedes the Guidance to the master for avoiding dangerous situations in following and quartering seas (MSC/Circ.707).

***

ANNEX

REVISED GUIDANCE TO THE MASTER FOR AVOIDING DANGEROUS SITUATIONS IN ADVERSE WEATHER AND SEA CONDITIONS

1 GENERAL

1.1 Adverse weather conditions, for the purpose of the following guidelines, include wind induced waves or heavy swell. Some combinations of wave length and wave height under certain operation conditions may lead to dangerous situations for ships complying with the IS Code. However, description of adverse weather conditions below shall not preclude a ship master from taking reasonable action in less severe conditions if it appears necessary.

1.2 When sailing in adverse weather conditions, a ship is likely to encounter various kinds of dangerous phenomena, which may lead to capsizing or severe roll motions causing damage to cargo, equipment and persons on board. The sensitivity of a ship to dangerous phenomena will depend on the actual stability parameters, hull geometry, ship size and ship speed. This implies that the vulnerability to dangerous responses, including capsizing, and its probability of occurrence in a particular sea state may differ for each ship.

1.3 On ships which are equipped with an on-board computer for stability evaluations, and which use specially developed software which takes into account the main particulars, actual stability and dynamic characteristics of the individual ship in the real voyage conditions, such software should be approved by the Administration. Results derived from such calculations should only be regarded as a supporting tool during the decision making process.

1.4 Waves should be observed regularly. In particular, the wave period T_W should be measured by means of a stop watch as the time span between the generation of a foam patch by a breaking wave and its reappearance after passing the wave trough. The wave length λ is determined either by visual observation in comparison with the ship length or by reading the mean distance between successive wave crests on the radar images of waves.

1.5 The wave period and the wave length λ are related as follows:

$$\lambda = 1.56 \cdot T_W^2 \text{ [m] or } T_W = 0.8\sqrt{\lambda} \text{ [s]}$$

1.6 The period of encounter T_E could be either measured as the period of pitching by using stop watch or calculated by the formula:

$$T_E = \frac{3T_W^2}{3T_W + V\cos(\alpha)} \text{ [s]}$$

where V = ship's speed [knots]; and
α = angle between keel direction and wave direction (α = 0° means head sea)

1.7 The diagram in figure 1 may as well be used for the determination of the period of encounter.

1.8 The height of significant waves should also be estimated.

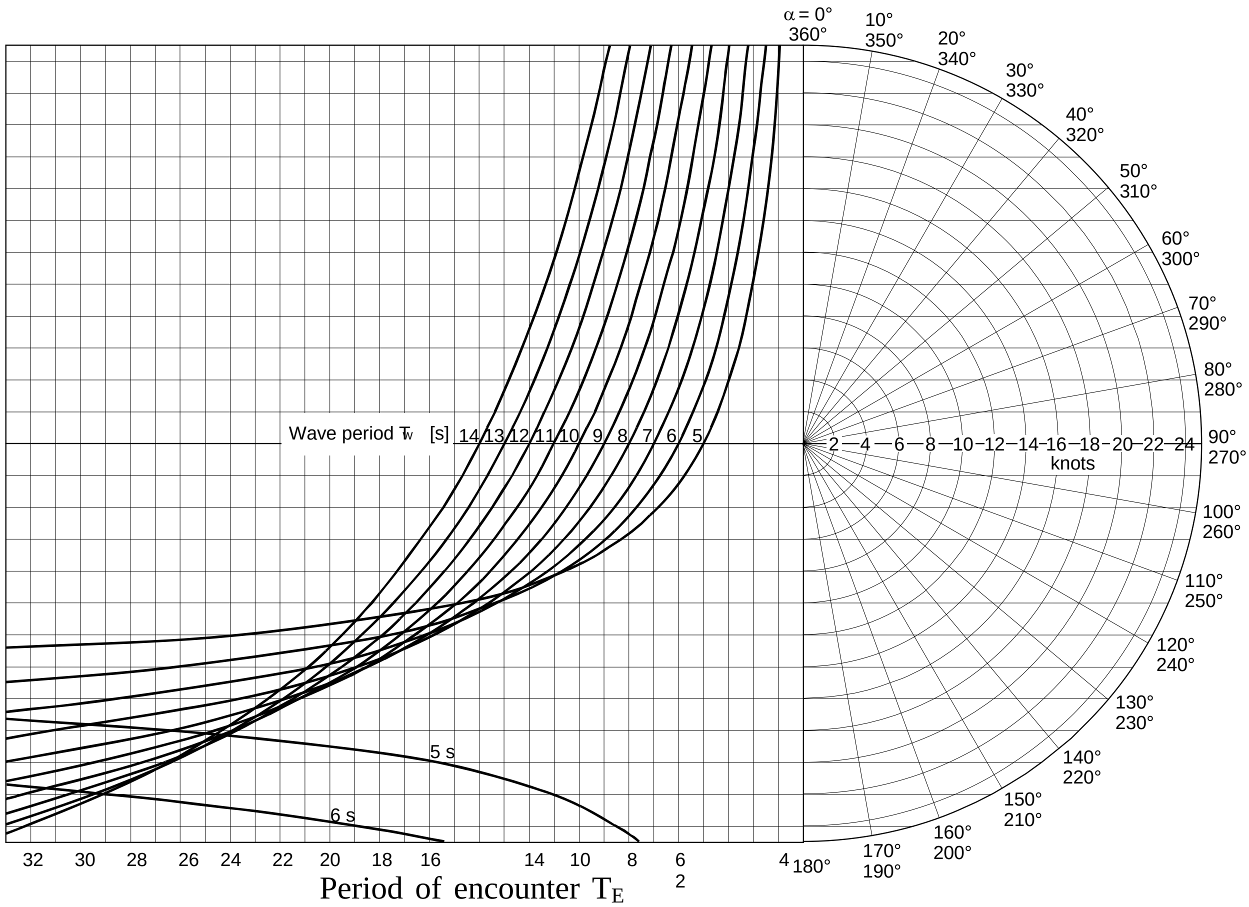


Figure 1: Determination of the period of encounter T_E

2 CAUTIONS

2.1 It should be noted that this guidance to the master has been designed to accommodate for all types of merchant ships. Therefore, being of a general nature, the guidance may be too restrictive for certain ships with more favourable dynamic properties, or too generous for certain other ships. A ship could be unsafe even outside the dangerous zones defined in this guidance if the stability of the ship is insufficient. Masters are requested to use this guidance with fair observation of the particular features of the ship and her behaviour in heavy weather.

2.2 It should further be noted that this guidance is restricted to hazards in adverse weather conditions that may cause capsizing of the vessel or heavy rolling with a risk of damage. Other hazards and risks in adverse weather conditions, like damage through slamming, longitudinal or torsional stresses, special effects of waves in shallow water or current, risk of collision or stranding, are not addressed in this guidance and must be additionally considered when deciding on an appropriate course and speed in adverse weather conditions.

2.3 The master should ascertain that his ship complies with the stability criteria specified in the IS Code or an equivalent thereto. Appropriate measures should be taken to assure the ship's watertight integrity. Securing of cargo and equipment should be re-checked. The ship's natural period of roll T_R should be estimated by observing roll motions in calm sea.

3 DANGEROUS PHENOMENA

3.1 Phenomena occurring in following and quartering seas

A ship sailing in following or stern quartering seas encounters the waves with a longer period than in beam, head or bow waves, and principal dangers caused in such situation are as follows:

3.1.1 Surf-riding and broaching-to

When a ship is situated on the steep forefront of a high wave in following or quartering sea conditions, the ship can be accelerated to ride on the wave. This is known as surf-riding. In this situation the so-called broaching-to phenomenon may occur, which endangers the ship to capsizing as a result of a sudden change of the ship's heading and unexpected large heeling.

3.1.2 Reduction of intact stability when riding a wave crest amidships

When a ship is riding on the wave crest, the intact stability can be decreased substantially according to changes of the submerged hull form. This stability reduction may become critical for wave lengths within the range of 0.6 L up to 2.3 L, where L is the ship's length in metres. Within this range the amount of stability reduction is nearly proportional to the wave height. This situation is particularly dangerous in following and quartering seas, because the duration of riding on the wave crest, which corresponds to the time interval of reduced stability, becomes longer.

3.2 Synchronous rolling motion

Large rolling motions may be excited when the natural rolling period of a ship coincides with the encounter wave period. In case of navigation in following and quartering seas this may happen when the transverse stability of the ship is marginal and therefore the natural roll period becomes longer.

3.3 Parametric roll motions

3.3.1 Parametric roll motions with large and dangerous roll amplitudes in waves are due to the variation of stability between the position on the wave crest and the position in the wave trough. Parametric rolling may occur in two different situations:

.1 The stability varies with an encounter period T_E that is about equal to the roll period T_R of the ship (encounter ratio 1:1). The stability attains a minimum once during each roll period. This situation is characterized by asymmetric rolling, i.e. the amplitude with the wave crest amidships is much greater than the amplitude to the other side. Due to the tendency of retarded up-righting from the large amplitude, the roll period T_R may adapt to the encounter period to a certain extent, so that this kind of parametric rolling may occur with a wide bandwidth of encounter periods. In quartering seas a transition to harmonic resonance may become noticeable.

.2 The stability varies with an encounter period T_E that is approximately equal to half the roll period T_R of the ship (encounter ratio 1:0.5). The stability attains a minimum twice during each roll period. In following or quartering seas, where the encounter period becomes larger than the wave period, this may only occur with very large roll periods T_R, indicating a marginal intact stability. The result is symmetric rolling with large amplitudes, again with the tendency of adapting the ship response to the period of encounter due to reduction of stability on the wave crest. Parametric rolling with encounter ratio 1:0.5 may also occur in head and bow seas.

3.3.2 Other than in following or quartering seas, where the variation of stability is solely effected by the waves passing along the vessel, the frequently heavy heaving and/or pitching in head or bow seas may contribute to the magnitude of the stability variation, in particular due to the periodical immersion and emersion of the flared stern frames and bow flare of modern ships. This may lead to severe parametric roll motions even with small wave induced stability variations.

3.3.3 The ship's pitching and heaving periods usually equals the encounter period with the waves. How much the pitching motion contributes to the parametric roll motion depends on the timing (coupling) between the pitching and rolling motion.

3.4 Combination of various dangerous phenomena

The dynamic behaviour of a ship in following and quartering seas is very complex. Ship motion is three-dimensional and various detrimental factors or dangerous phenomena like additional heeling moments due to deck-edge submerging, water shipping and trapping on deck or cargo shift due to large roll motions may occur in combination with the above mentioned phenomena, simultaneously or consecutively. This may create extremely dangerous combinations, which may cause ship capsize.

4 OPERATIONAL GUIDANCE

The shipmaster is recommended to take the following procedures of ship handling to avoid the dangerous situations when navigating in severe weather conditions.

4.1 Ship condition

This guidance is applicable to all types of conventional ships navigating in rough seas, provided the stability criteria specified in resolution A.749(18), as amended by resolution MSC.75(69), are satisfied.

4.2 How to avoid dangerous conditions

4.2.1 For surf-riding and broaching-to

Surf-riding and broaching-to may occur when the angle of encounter is in the range 135°<α<225° and the ship speed is higher than $\left(1.8\sqrt{L}\right)/\cos\left(180-\alpha\right)$ (knots). To avoid surf riding, and possible broaching the ship speed, the course or both should be taken outside the dangerous region reported in figure 2.

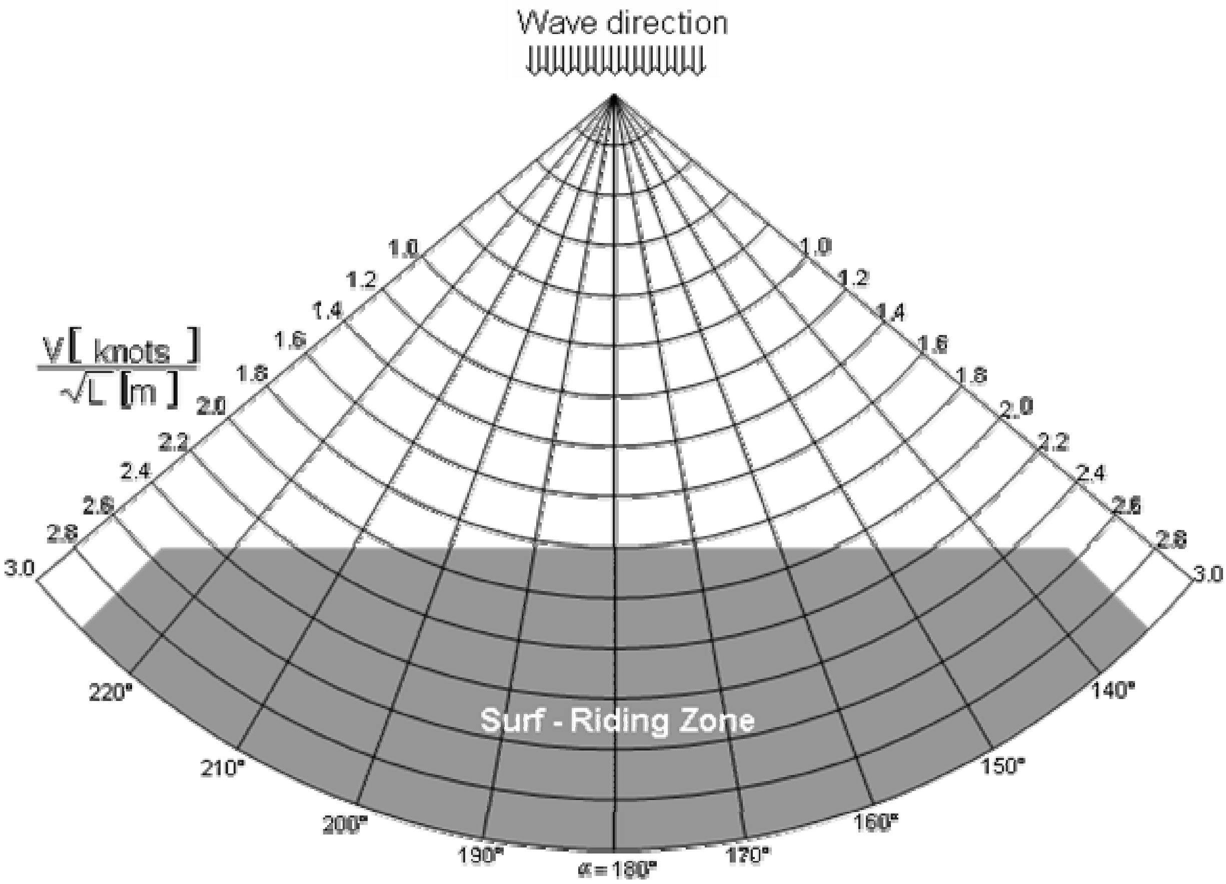


Figure 2: Risk of surf-riding in following or quartering seas

4.2.2 For successive high-wave attack

4.2.2.1 When the average wave length is larger than 0.8 L and the significant wave height is larger than 0.04 L, and at the same time some indices of dangerous behaviour of the ship can be clearly seen, the master should pay attention not to enter in the dangerous zone as indicated in figure 3. When the ship is situated in this dangerous zone, the ship speed should be reduced or the ship course should be changed to prevent successive attack of high waves, which could induce the danger due to the reduction of intact stability, synchronous rolling motions, parametric rolling motions or combination of various phenomena.

4.2.2.2 The dangerous zone indicated in figure 3 corresponds to such conditions for which the encounter wave period (T_E) is nearly equal to double (i.e., about 1.8-3.0 times) of the wave period (T_W) (according to figure 1 or paragraph 1.4).

4.2.3 For synchronous rolling and parametric rolling motions

4.2.3.1 The master should prevent a synchronous rolling motion which will occur when the encounter wave period T_E is nearly equal to the natural rolling period of ship T_R.

4.2.3.2 For avoiding parametric rolling in following, quartering, head, bow or beam seas the course and speed of the ship should be selected in a way to avoid conditions for which the encounter period is close to the ship roll period ($T_E \approx T_R$) or the encounter period is close to one half of the ship roll period ($T_E \approx 0.5 \cdot T_R$).

4.2.3.3 The period of encounter T_E may be determined from figure 1 by entering with the ship's speed in knots, the encounter angle α and the wave period T_W.

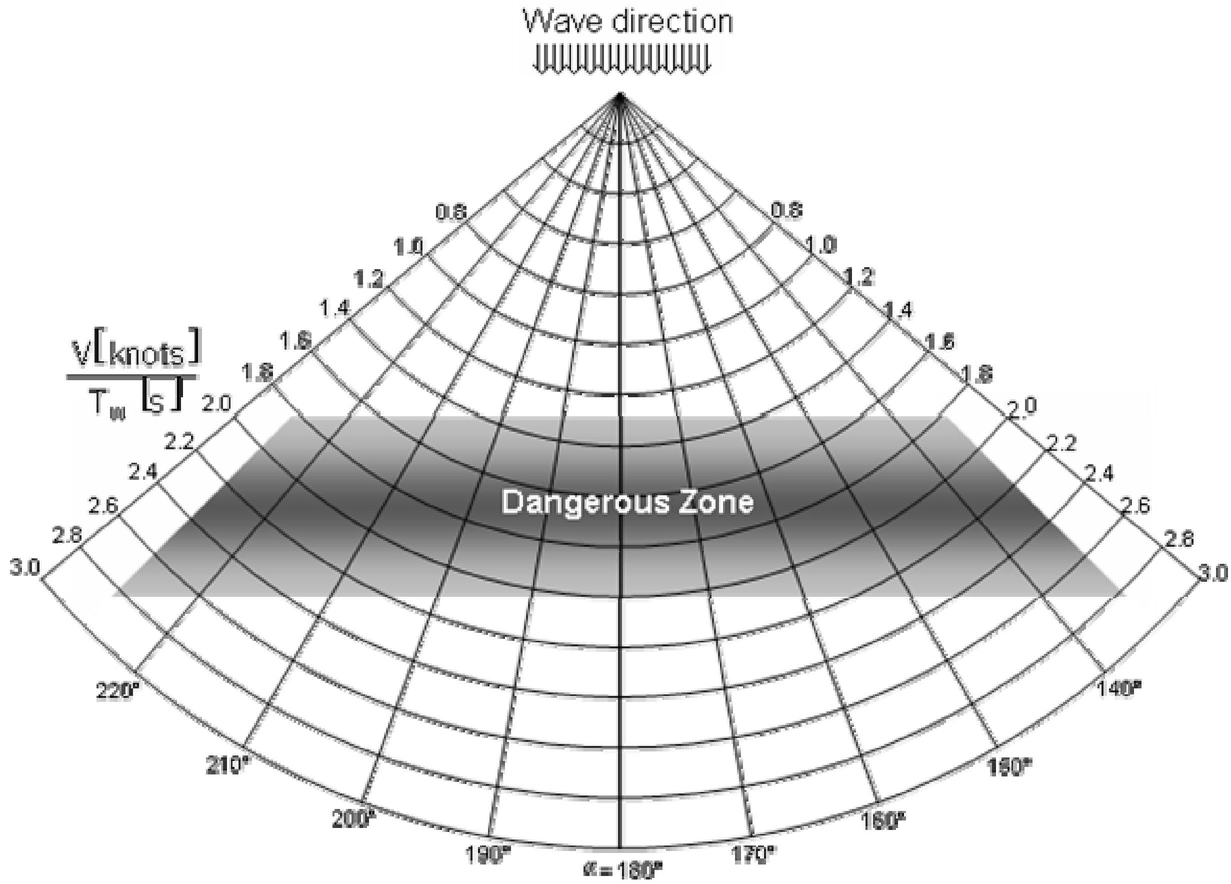


Figure 3: Risk of successive high wave attack in following and quartering seas

Abbreviations and symbols

Symbols	Explanation	Units
T_W	wave period	s
λ	wave length	m
T_E	encounter period with waves	s
α	angle of encounter (α = 0° in head sea, α = 90° for sea from starboard side)	degrees
V	ship's speed	knots
T_R	natural period of roll of ship	s
L	length of ship (between perpendiculars)	m

____

BV VeriSTAR calculations of the forces within the collapsed bays

BV n° 29663U – CMA CGM G. WASHINGTON 15 février 2018

BV/HO/Paris-La Défense

Dép DA-HULL/François AUBERT

Objet : CMA CGM G. WASHINGTON

A la demande de l'armateur, l'étude des séquences verticales de chargement en pontée du porte-conteneurs CMA CGM G. WASHINGTON pour les BAY 18/42/54/58/78 a été réalisée.

Cette demande fait suite à l'avarie constatée lors d'un voyage Trans pacifique, au début de l'année 2018.

Les résultats de calcul présentés ont été réalisés à l'aide du logiciel **VERISTARLashing** en version **2.2** et correspondant au règlement NR467.

Les données de chargements ont été fournies par CMA CGM avec le courriel n° DNC/18/03620 en date du 9 février 2018.

Les résultats des BAY 18/42/58/78 se présentent de la façon suivante :

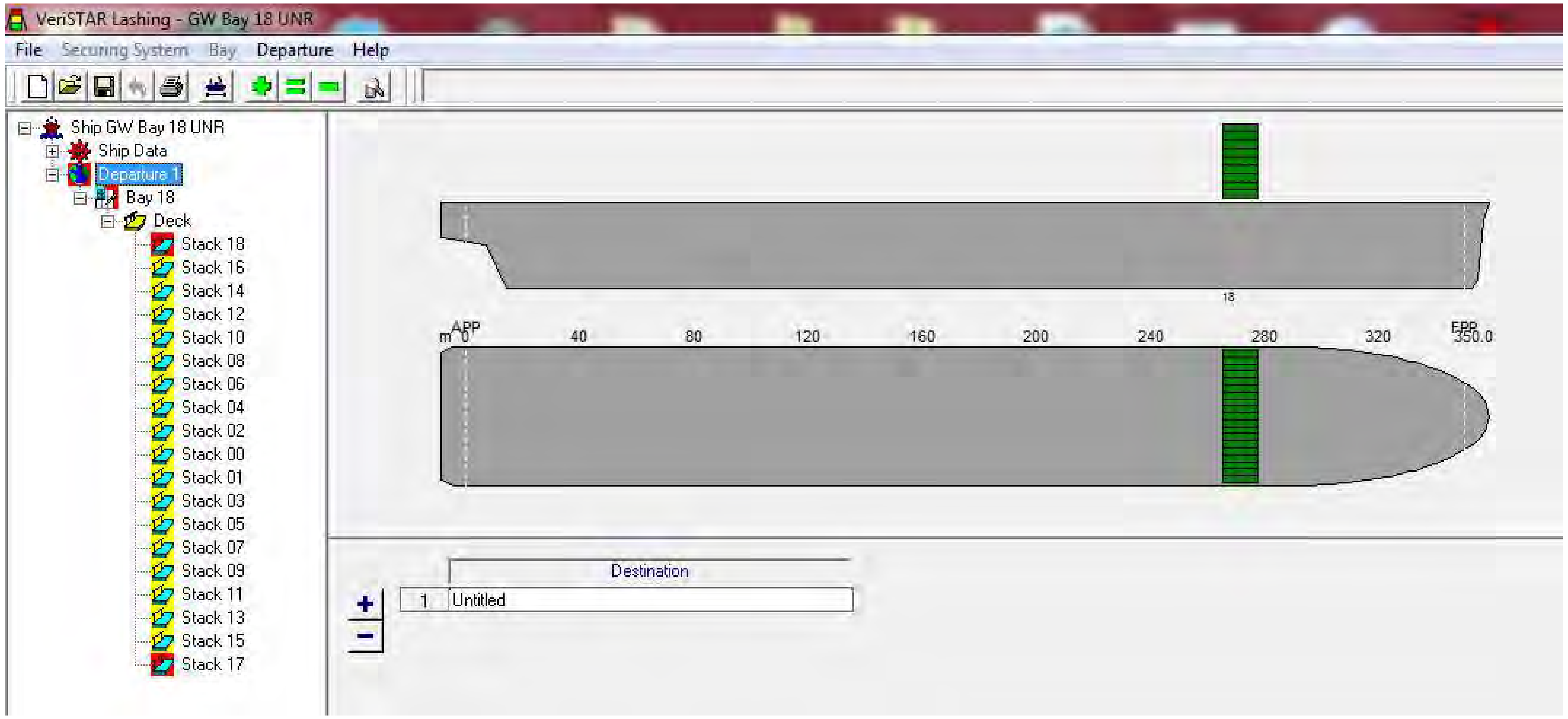
- Une page avec le résumé en couleur des calculs VERISTARLashing, soit en rouge au moins une valeur dépasse la CMU dans une pile et en jaune la pile est acceptable. Le croquis du haut représente le cas UNRESTRICTED et celui de bas, le cas WORLDWIDE.
- Une deuxième page avec les valeurs numériques maximales pour les twistlocks, les barres, le racking et la compression maximale sur le coin du conteneur.

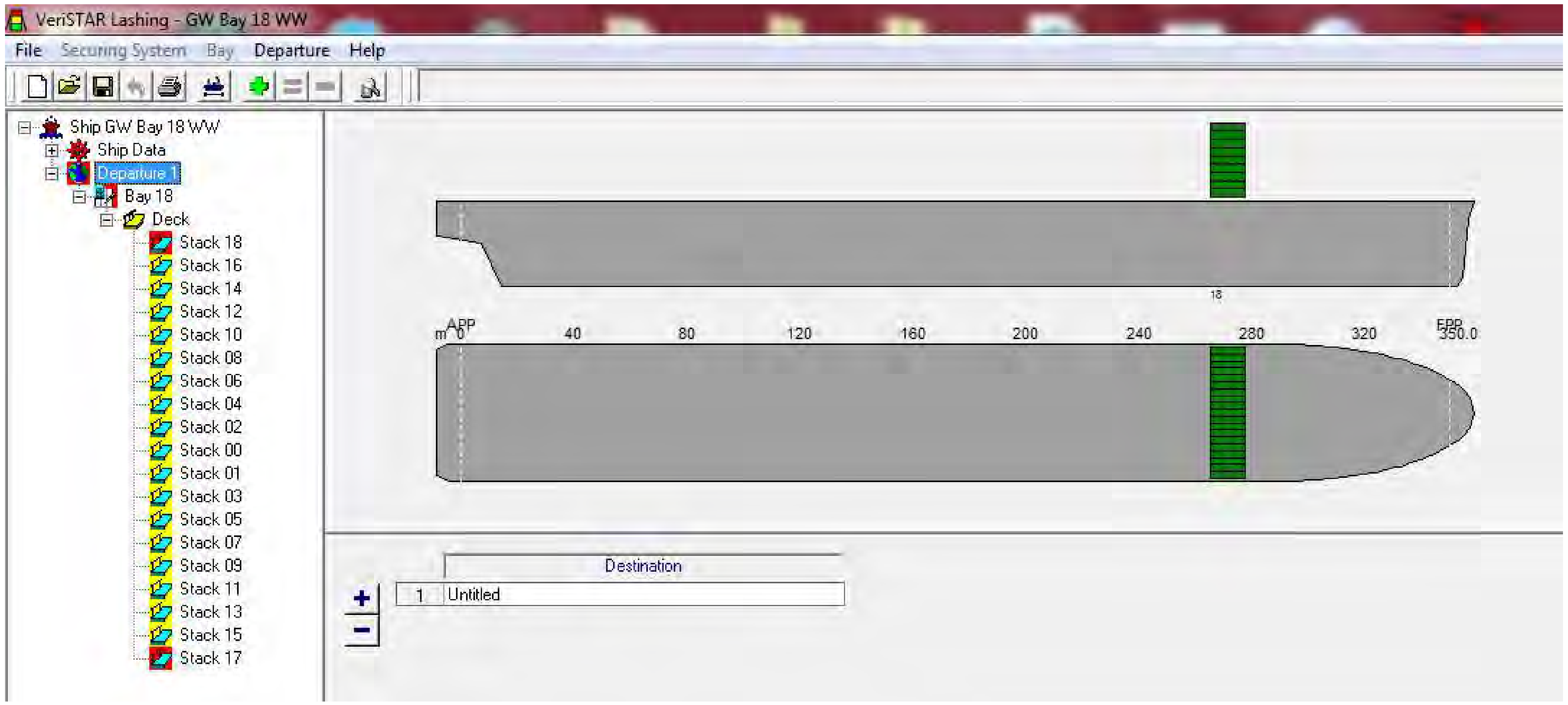
Pour la BAY 54, du fait des 53 Pieds, les résultats sont présentés différemment :

- Une page avec le tracé du haut résumant les résultats VL pour les piles complètes et le tracé du bas, les résultats VL pour des piles uniquement constituées de 53 pieds sur pont fictif, en configuration UNRESTRICTED.
- La page suivante : valeurs numériques maximales correspondant aux tracés et pour les pièces principales d'arrimage.
- Les deux pages suivantes répliquent les deux précédentes, mais en configuration WORLDWIDE.

Ce document comprend 13 pages en incluant la page de garde.

DA-HULL / François AUBERT


VeriSTAR Lashing - GW Bay 18 UNR
File
Securing System
Bay
Departure
Help
Ship GW Bay 18 UNR
Ship Data
Departure 1
Bay 18
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
18
m APP 0
40
80
120
160
200
240
280
320
FPP 350.0
Destination
1
Untitled

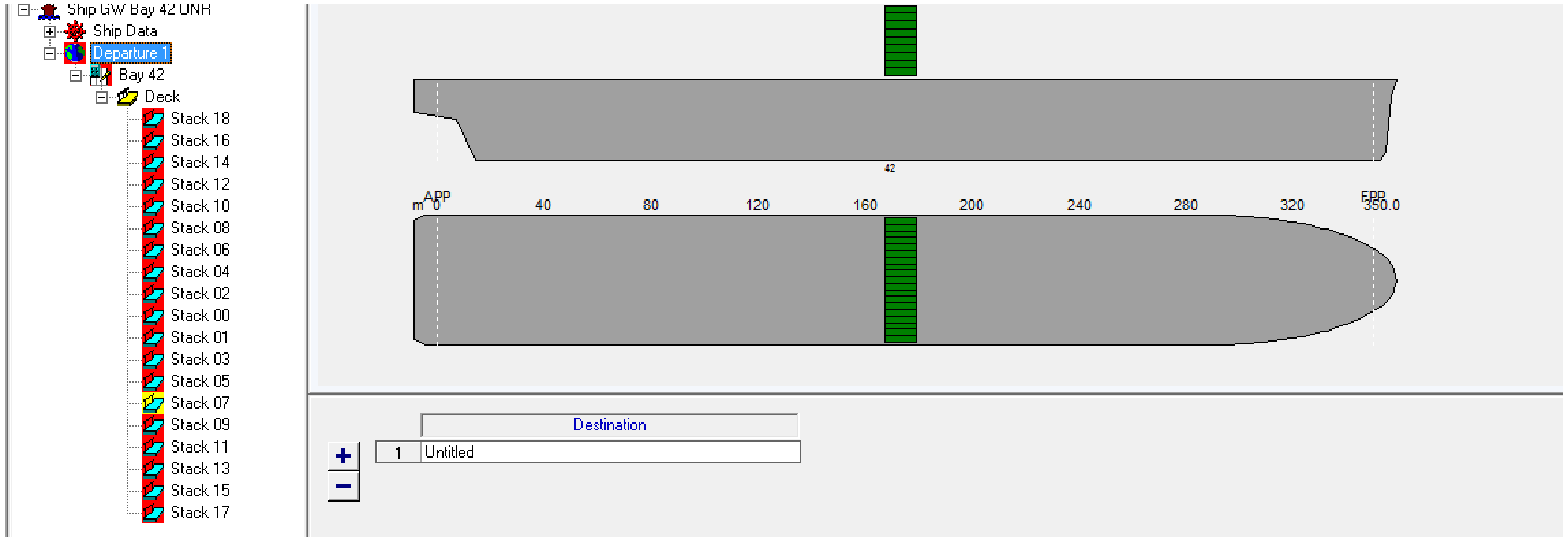

VeriSTAR Lashing - GW Bay 18 WW
File
Securing System
Bay
Departure
Help
Ship GW Bay 18 WW
Ship Data
Departure 1
Bay 18
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
18
m APP 0
40
80
120
160
200
240
280
320
FPP 350.0
Destination
1
Untitled

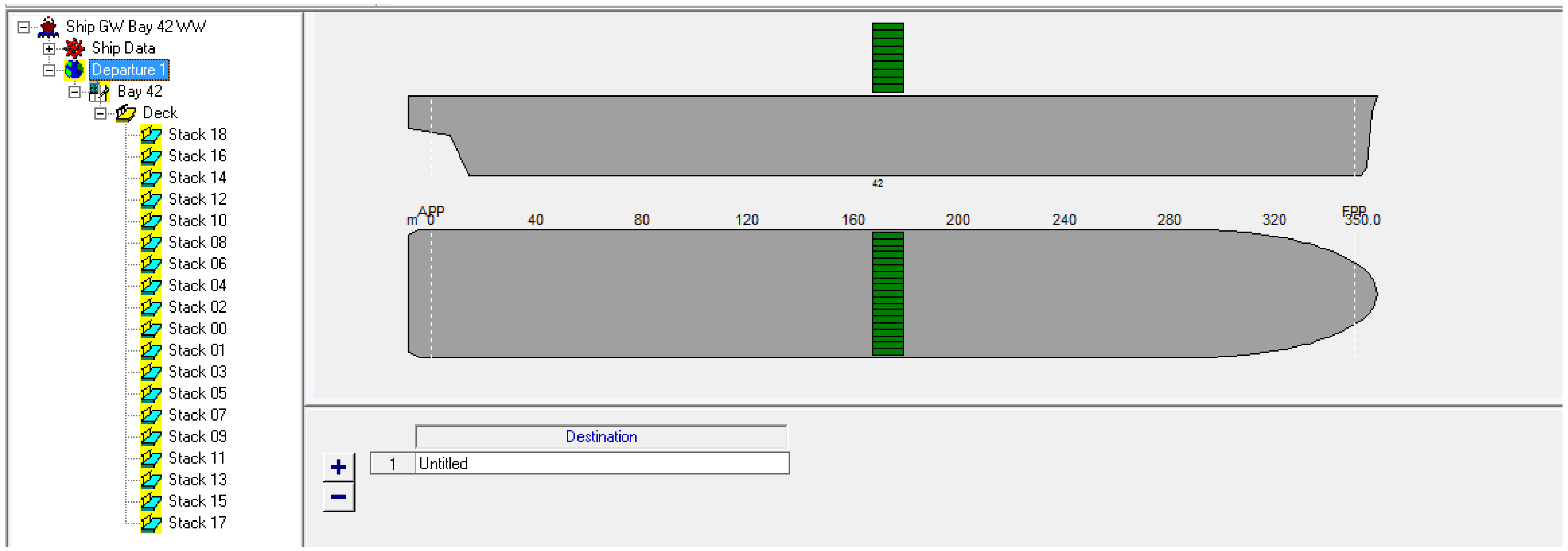
BAY 18 Unrestricted

	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
86			7.8	12.8	13.4	8.6	13	11.4	12.1	13.4	9.3	8.5		7.6					
84		10.8	10.2	11.3	9.1	11.9	606	11.3	11.8	12.3	14.7	14.1	9.1	9.6	12	9.3	8.9	8.6	
82	9.2	8.8	11	12.5	11.1	12.9	13.2	12.2	15.1	9.5	13.9	15.5	13.3	14.3	12.8	12.5	8.6	10.7	10
80	11.3	12	9.9	14.5	12.7	23.1	13.2	11.1	10.4	8.4	7.7	9.9	13.6	13.7	14.9	16.3	9.6	10.6	11.1
78	12	13.6	13.3	11.4	12.4	11	10.5	11	12.1	12.2	11.9	11.6	16.9	11.7	12.5	10.2	15.7	12.7	11.7
76	14.4	12.8	12.4	11.3	11.2	10.8	11.9	12.2	15.5	15.5	15.5	12.3	12.4	10.5	9.3	10.6	12.7	12.3	11.8
74	9.5	18.6	13.4	15.8	16.1	18.3	18.3	17.5	21.3	22.3	22	15.3	10.3	10.1	16	11.3	13.4	11.5	10.7
72	16.6	21.5	21.5	21.1	20.9	20.9	20.9	22.9	25.8	22.6	22.5	22.9	15.5	23.7	23	15.1	19.4	21	19.5
Sum	73	98.1	99.5	110.7	106.9	117.5	707	109.6	124.1	116.2	117.5	110.1	91.1	101.2	100.5	85.3	88.3	87.4	74.8
Twistlock max	**280.5**	106	189.8	148.4	128	121.6	123.3	133.6	146.1	152	140.4	124.2	40.4	214.5	50.3	38.3	38	101.3	**277.8**
Cornerpost load	727.5	627.2	771.4	794	746.5	811.7	728.3	739.6	812.4	764.1	770.6	757.3	569	805.5	586.7	542.1	474.3	582.1	722.3
Racking Max	119.3	113.4	130.6	136.5	126.1	149	123.1	123.7	133.2	119.4	123.9	129.3	106.8	143.8	110.4	103.8	84	108.3	121.5
Lashing rod max	177.4	150	157.9	161.2	153.9	172.4	152.9	154.2	172.9	161.8	164.7	157.5	137.3	161.5	138.9	126.3	122.5	137.2	175.8
Acc Horiz	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805

BAY 18 Worldwide

	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
86			7.8	12.8	13.4	8.6	13	11.4	12.1	13.4	9.3	8.5		7.6					
84		10.8	10.2	11.3	9.1	11.9	606	11.3	11.8	12.3	14.7	14.1	9.1	9.6	12	9.3	8.9	8.6	
82	9.2	8.8	11	12.5	11.1	12.9	13.2	12.2	15.1	9.5	13.9	15.5	13.3	14.3	12.8	12.5	8.6	10.7	10
80	11.3	12	9.9	14.5	12.7	23.1	13.2	11.1	10.4	8.4	7.7	9.9	13.6	13.7	14.9	16.3	9.6	10.6	11.1
78	12	13.6	13.3	11.4	12.4	11	10.5	11	12.1	12.2	11.9	11.6	16.9	11.7	12.5	10.2	15.7	12.7	11.7
76	14.4	12.8	12.4	11.3	11.2	10.8	11.9	12.2	15.5	15.5	15.5	12.3	12.4	10.5	9.3	10.6	12.7	12.3	11.8
74	9.5	18.6	13.4	15.8	16.1	18.3	18.3	17.5	21.3	22.3	22	15.3	10.3	10.1	16	11.3	13.4	11.5	10.7
72	16.6	21.5	21.5	21.1	20.9	20.9	20.9	22.9	25.8	22.6	22.5	22.9	15.5	23.7	23	15.1	19.4	21	19.5
Sum	73	98.1	99.5	110.7	106.9	117.5	707	109.6	124.1	116.2	117.5	110.1	91.1	101.2	100.5	85.3	88.3	87.4	74.8
Twistlock max	**285.7**	108.3	196.8	156.2	137.8	129.9	126.5	136.8	149.5	155.1	143.6	134.8	42.9	221.6	53.1	44.3	39.9	103.4	**283.1**
Cornerpost load	723.5	621.8	765.9	787.7	740.5	804.9	722.2	733.5	805.6	757.6	763.9	751.2	563.7	800.1	581.2	537.2	469.5	577.4	718.3
Racking Max	119.3	113.4	130.6	136.5	126.1	149	123.1	123.7	133.2	119.4	123.9	129.3	106.8	143.8	110.4	103.8	84	108.3	121.5
Lashing rod max	177.4	**150**	157.9	161.2	153.9	172.4	152.9	154.2	172.9	161.8	164.7	157.5	137.3	161.5	138.9	126.3	122.5	137.2	175.8
Acc Horiz	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805


Ship GW Bay 42 UNH
Ship Data
Departure 1
Bay 42
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
42
m
APP
0
40
80
120
160
200
240
280
320
FPP
350.0
Destination
1
Untitled


Ship GW Bay 42 WW
Ship Data
Departure 1
Bay 42
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
42
m
APP
0
40
80
120
160
200
240
280
320
FPP
350.0
Destination
1
Untitled

BAY 42 Unrestricted

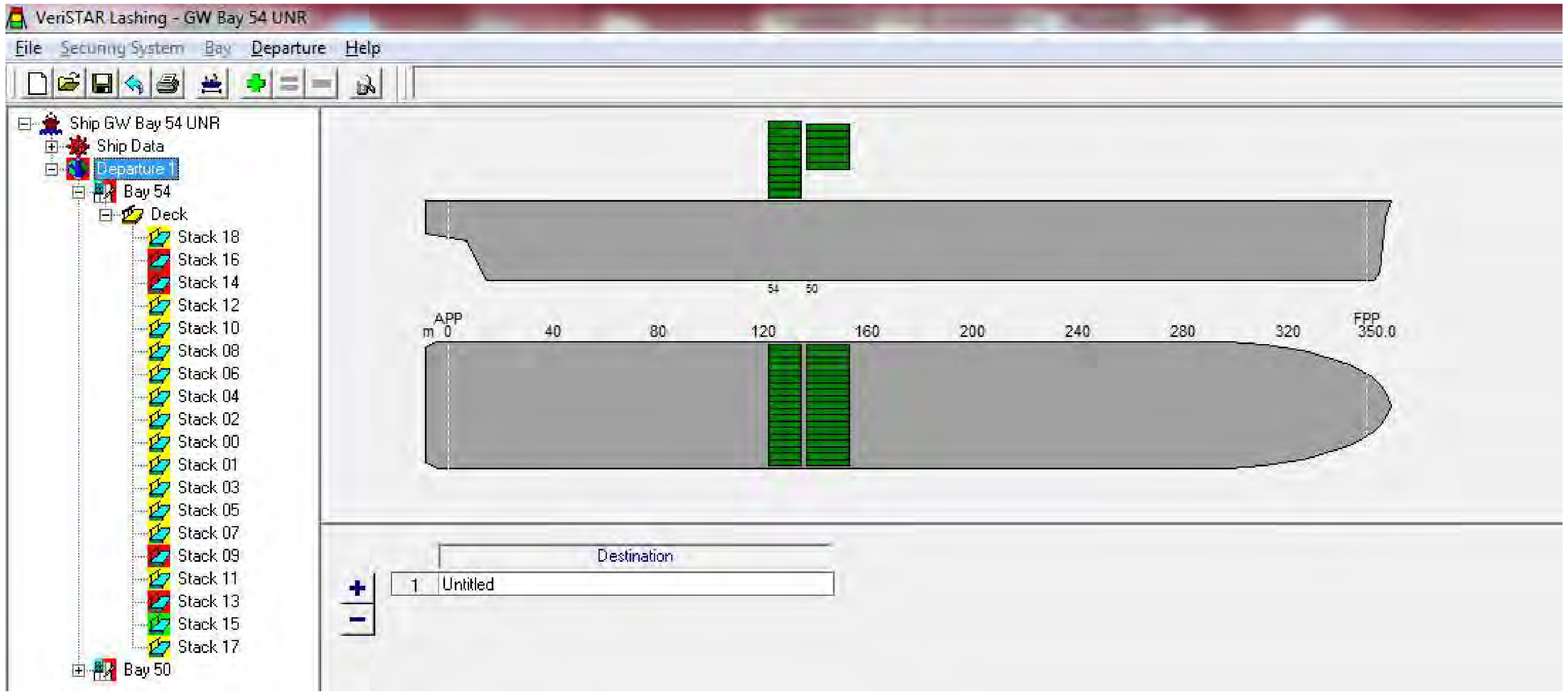
	18	16	14	12	10	8	6	4	2	0	1	3	5	7	9	11	13	15	17
88			11.5	12	11.6	12.2	10.4	12	11	10.9	11.7	9.9	12	9.2	11.2	11.2	7.6		
86		11.2	11.4	12.1	11.9	13.3	11.9	12.1	12.4	11	12.1	12.2	12.9	9.5	11	11.1	11	8.6	
84	5.8	11.2	11.5	12.3	12.8	12.6	13.4	12.4	12.8	11.9	12.6	11.7	12.7	9.8	12.5	12.3	12.6	11.1	8.3
82	6.3	12.2	13.1	13	11.9	14	12.8	12.3	12.9	13.1	12.3	12.5	13.2	10.4	12.1	13.3	12.6	12.6	7.3
80	12.4	12.2	13.4	14.2	13.6	14.1	13.7	12.7	13.9	12.5	13.7	12.6	14.6	10.6	12.9	13	13	14.1	14
78	12.3	13.1	13.3	13.3	14.1	13.6	14.7	14.2	13.9	14.4	12.7	15.3	15.6	15.2	13	14.1	14.9	13.7	13.8
76	14.1	14	15.9	15.4	15.4	16	15.5	16.1	15.5	15.2	12.7	15.1	15.9	15	15	13.9	14.9	14.9	15.2
74	15.4	17.2	16.1	17.2	16.6	16.1	15.6	15.8	16.7	16.9	17.3	16.5	17.1	17	17.1	18.8	15.1	15.6	15.1
72	17.3	24.7	24.7	8.3	29.1	25.6	27.8	26	28.9	27.3	25.6	25.6	26.5	26.5	27.3	26.5	29.3	20.9	18.6
Sum	83.6	115.8	130.9	117.8	137	137.5	135.8	133.6	138	133.2	130.7	131.4	140.5	123.2	132.1	134.2	131	111.5	92.3

Twistlock max	309.5	111	250.5	187.1	137.1	155.8	128.4	140	133.9	125.5	144	124.1	142.7	107.4	129.9	128.3	197.4	99.1	336.3
Cornerpost load	845	785	1056.4	964	931.5	988.7	929	937.9	940.2	899	926.5	896	986.3	778.4	898.1	916	982.3	766	929.5
Racking Max	137.4	111.9	151.4	135.8	132.1	142.1	133	132.5	134.7	127.7	133.5	126.4	139.6	112	127.9	130.7	142	115.7	143.8
Lashing rod max	234.1	220	264	242.8	242.4	254.3	244.1	241.3	245.7	235.4	238.7	235.2	256.5	207	233.4	239	254.3	219.3	253.6
Acc Horiz	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805

BAY 42 Worldwide

	18	16	14	12	10	8	6	4	2	0	1	3	5	7	9	11	13	15	17
88			11.5	12	11.6	12.2	10.4	12	11	10.9	11.7	9.9	12	9.2	11.2	11.2	7.6		
86		11.2	11.4	12.1	11.9	13.3	11.9	12.1	12.4	11	12.1	12.2	12.9	9.5	11	11.1	11	8.6	
84	5.8	11.2	11.5	12.3	12.8	12.6	13.4	12.4	12.8	11.9	12.6	11.7	12.7	9.8	12.5	12.3	12.6	11.1	8.3
82	6.3	12.2	13.1	13	11.9	14	12.8	12.3	12.9	13.1	12.3	12.5	13.2	10.4	12.1	13.3	12.6	12.6	7.3
80	12.4	12.2	13.4	14.2	13.6	14.1	13.7	12.7	13.9	12.5	13.7	12.6	14.6	10.6	12.9	13	13	14.1	14
78	12.3	13.1	13.3	13.3	14.1	13.6	14.7	14.2	13.9	14.4	12.7	15.3	15.6	15.2	13	14.1	14.9	13.7	13.8
76	14.1	14	15.9	15.4	15.4	16	15.5	16.1	15.5	15.2	12.7	15.1	15.9	15	15	13.9	14.9	14.9	15.2
74	15.4	17.2	16.1	17.2	16.6	16.1	15.6	15.8	16.7	16.9	17.3	16.5	17.1	17	17.1	18.8	15.1	15.6	15.1
72	17.3	24.7	24.7	8.3	29.1	25.6	27.8	26	28.9	27.3	25.6	25.6	26.5	26.5	27.3	26.5	29.3	20.9	18.6
Sum	83.6	115.8	130.9	117.8	137	137.5	135.8	133.6	138	133.2	130.7	131.4	140.5	123.2	132.1	134.2	131	111.5	92.3

Twistlock max	215.6	60.1	125.6	49	41.1	41.9	35.1	42.2	38	34.8	41.1	34.4	41.9	30.9	37.6	35.6	111.8	54.8	224.1
Cornerpost load	720.2	626.5	822.9	715.9	693.8	733.8	692.2	697.5	700.4	671.2	637.8	669.2	734.3	586	669.6	683.7	771.6	614	780.7
Racking Max	107.3	83	103.8	86.1	83.8	90.1	84.3	84	85.4	81	73.3	80.1	88.5	71	81.1	82.9	97.8	81	111.3
Lashing rod max	188.9	148.9	177.1	154	153.7	161.2	154.8	153	155.8	149.3	151.4	149.1	162.7	131.2	148	151.6	171	148.5	201.2
Acc Horiz	3.031	3.039	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.039	3.031


VeriSTAR Lashing - GW Bay 54 UNR
File Securing System Bay Departure Help
Ship GW Bay 54 UNR
Ship Data
Departure 1
Bay 54
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
Bay 50
54 50
APP
m 0
40
80
120
160
200
240
280
320
FPP
350.0
Destination
1 Untitled


VeriSTAR Lashing - GW Bay 54 UNR
File Securing System Bay Departure Help
Ship GW Bay 54 UNR
Ship Data
Departure 1
Bay 54
Bay 50
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
54 50
APP
m 0
40
80
120
160
200
240
280
320
FPP
350.0
Destination
1 Untitled

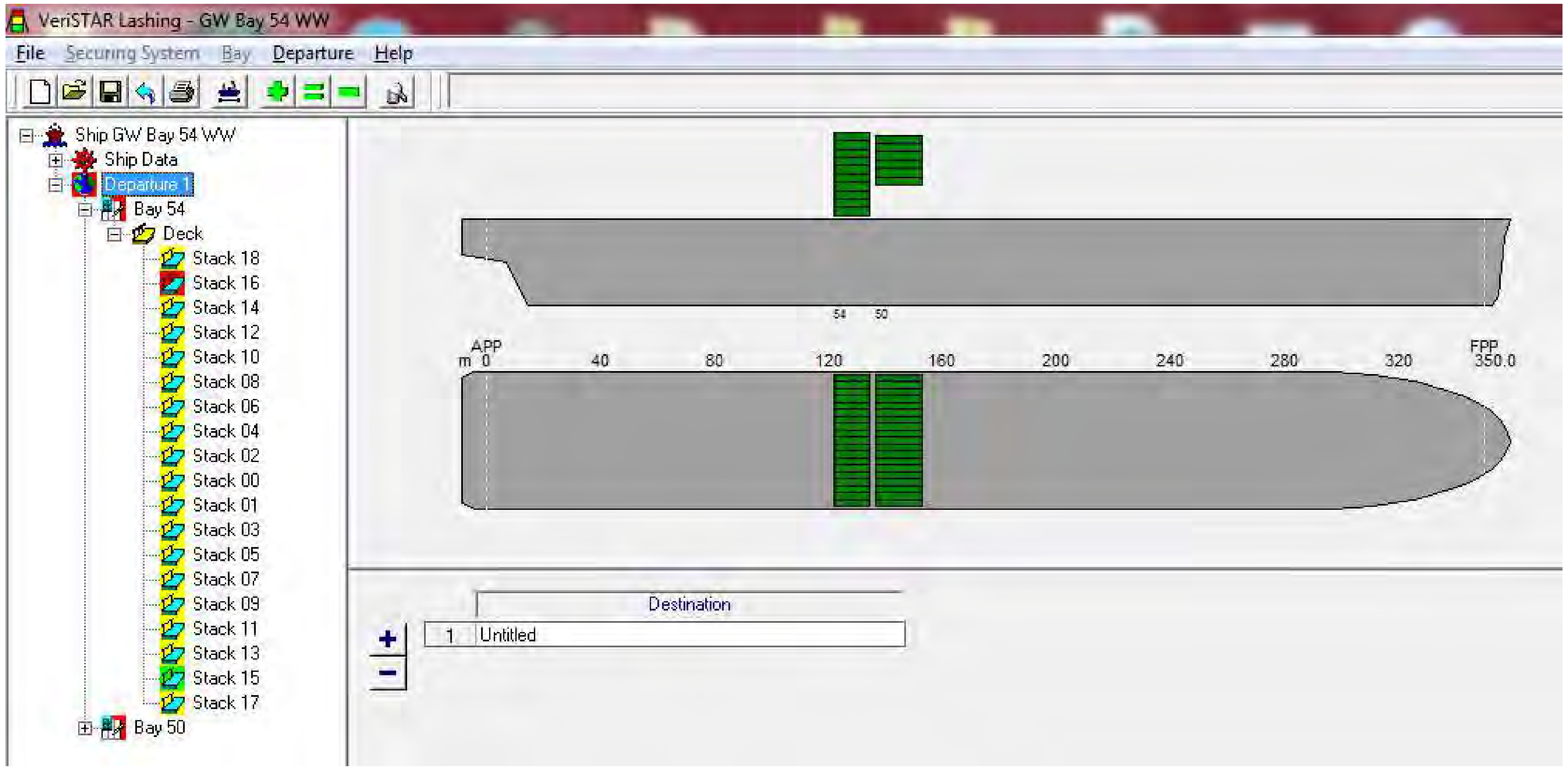
Bay 54 Unrestricted

	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
90			3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5				
88		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		
86		11.2	12.1	11.5	12.7	12.4	11.7	12.3	11.9	11.1	12.5	12	10	12.2	11.6	9.7	12		
84	4.5	13.2	13.1	13	13.1	11.9	13.1	13.2	13.1	12.1	12	13.6	12	11.8	11.9	12.8	13		7.1
82	6.8	13.5	13.9	19.1	16	14.5	20.5	20.6	14.9	13	13.4	18.6	21.2	13.2	19.3	14.1	19.1		7.1
80	**6.9**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**7.5**
78	**7.6**	**8.5**	**8.9**	**8.1**	**8.6**	**9.3**	**8.3**	**9.6**	**9.5**	**9.6**	**9.7**	**8.6**	**9.1**	**8.2**	**9**	**8.6**	**8.6**	**9.4**	**9.3**
76	**10.5**	**10.1**	**11.6**	**10.3**	**10.1**	**10.7**	**10.9**	**10.6**	**9.8**	**9.6**	**9.8**	**10.2**	**10.6**	**11.1**	**11.3**	**11.5**	**12.3**	**9.8**	**9.5**
74	**10.6**	**12.4**	**12.2**	**11**	**11.2**	**11.7**	**11**	**12.5**	**4.6**	**8.8**	**15**	**11**	**13.1**	**12.4**	**12**	**12.6**	**13.5**	**11.2**	**12.6**
72	**12.2**	**12.5**	**13.2**	**13.9**	**17.3**	**14.6**	**15.4**	**14.8**	**12.1**	**18.5**	**20.2**	**15.2**	**15.4**	**16**	**14.7**	**13.5**	**19**	**13.8**	**14.4**
Sum	59.1	88.9	96	97.9	100	96.1	101.9	104.6	86.9	93.7	103.6	100.2	102.4	95.9	100.8	90.3	105	48.2	67.5

Twistlock max	173	**277**	**265.2**	104	113.7	111.3	103.2	104.5	111.8	109.4	114.8	107.7	104.3	113.4	**253.9**	67.4	235.5	No tilting	181.1
Cornerpost load	559	783.2	783.5	618.1	611.9	600.4	632.6	640.7	588.8	558.2	588.7	618.1	652.4	577.7	800.9	502.7	726.2	190.3	614.3
Racking Max	87.8	**160.7**	143.8	126.4	122.1	117.3	130.5	130.2	117.5	108.6	112.7	125.2	103.8	111	**152.6**	101.2	**155.1**	44.7	95
Lashing rod max	166.4	214.5	197	174.8	171.1	167.1	180.3	182.6	164.2	156.5	163.9	174.4	186.3	158.8	207.2	148.3	211	57.8	179.3
Acc Horiz	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805

	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
90			3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5				
88		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		
86		11.2	12.1	11.5	12.7	12.4	11.7	12.3	11.9	11.1	12.5	12	10	12.2	11.6	9.7	12		
84	4.5	13.2	13.1	13	13.1	11.9	13.1	13.2	13.1	12.1	12	13.6	12	11.8	11.9	12.8	13		7.1
82	6.8	13.5	13.9	19.1	16	14.5	20.5	20.6	14.9	13	13.4	18.6	21.2	13.2	19.3	14.1	19.1		7.1
80	**6.9**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**7.5**
78																			
76																			
74																			
72																			
sum	18.2	45.4	50.1	54.6	52.8	49.8	56.3	57.1	50.9	47.2	48.9	55.2	54.2	48.2	53.8	44.1	51.6	4	21.7

Twistlock max	133.2	**311.3**	**298.9**	130.2	140.6	137.3	132.8	136	137.3	132.1	138.8	136.6	121.2	136.9	**290.9**	87.8	**316.2**	No tilting	144
Cornerpost load	111	494.4	523.7	383.8	387.3	369.4	396.3	403.4	374.6	351.4	366.4	394.8	374.5	361.2	533.1	292.3	539.6	NA	130.7
Racking Max	88.4	155.6	143.8	125.4	122.1	114.8	130.5	132.4	117.5	108.6	112.7	127.8	125.4	111	**152.6**	101.2	**175.6**	4.8	96.1
Lashing rod max	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acc Horiz	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805

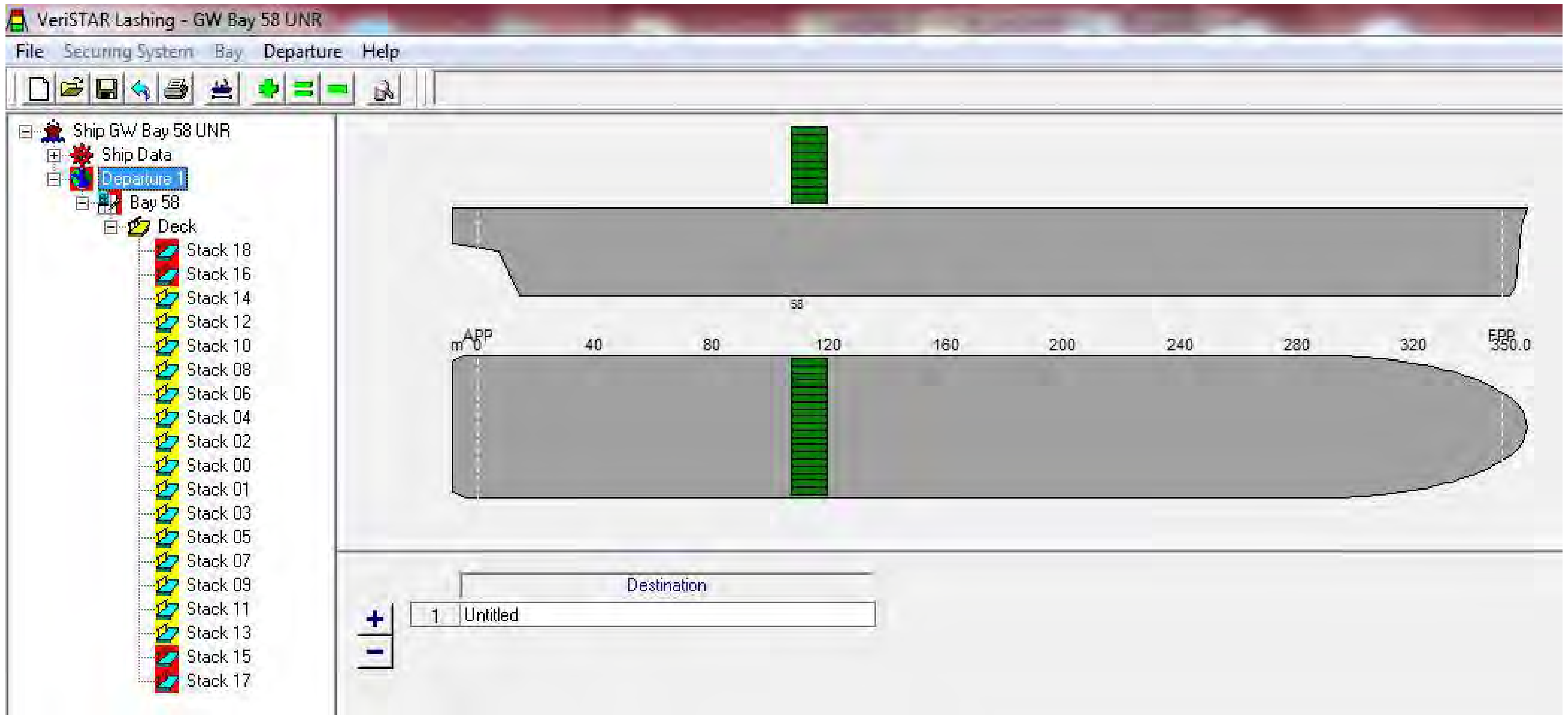

VeriSTAR Lashing - GW Bay 54 WW
File Securing System Bay Departure Help
Ship GW Bay 54 WW
Ship Data
Departure 1
Bay 54
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
Bay 50
54 50
APP
m 0 40 80 120 160 200 240 280 320
FPP
350.0
Destination
1 Untitled


VeriSTAR Lashing - GW Bay 54 WW
File Securing System Bay Departure Help
Ship GW Bay 54 WW
Ship Data
Departure 1
Bay 54
Bay 50
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
54 50
APP
m 0 40 80 120 160 200 240 280 320
FPP
350.0
Destination
1 Untitled

Bay 54 Worldwide

	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
90			3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5				
88		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		
86		11.2	12.1	11.5	12.7	12.4	11.7	12.3	11.9	11.1	12.5	12	10	12.2	11.6	9.7	12		
84	4.5	13.2	13.1	13	13.1	11.9	13.1	13.2	13.1	12.1	12	13.6	12	11.8	11.9	12.8	13		7.1
82	6.8	13.5	13.9	19.1	16	14.5	20.5	20.6	14.9	13	13.4	18.6	21.2	13.2	19.3	14.1	19.1		7.1
80	6.9	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	7.5
78	7.6	8.5	8.9	8.1	8.6	9.3	8.3	9.6	9.5	9.6	9.7	8.6	9.1	8.2	9	8.6	8.6	9.4	9.3
76	10.5	10.1	11.6	10.3	10.1	10.7	10.9	10.6	9.8	9.6	9.8	10.2	10.6	11.1	11.3	11.5	12.3	9.8	9.5
74	10.6	12.4	12.2	11	11.2	11.7	11	12.5	4.6	8.8	15	11	13.1	12.4	12	12.6	13.5	11.2	12.6
72	12.2	12.5	13.2	13.9	17.3	14.6	15.4	14.8	12.1	18.5	20.2	15.2	15.4	16	14.7	13.5	19	13.8	14.4
Sum	59.1	88.9	96	97.9	100	96.1	101.9	104.6	86.9	93.7	103.6	100.2	102.4	95.9	100.8	90.3	105	48.2	67.5
Twistlock max	124	209.5	179.4	17.5	25.4	25.8	15.4	16.3	26	28	29.7	20.3	14.7	29.6	168.7	4.1	185.5	No tilting	120.9
Cornerpost load	489.2	666.2	642.9	472.1	467	459.4	483.7	491.1	444.7	425.7	452.7	472	500.2	442.6	657	391.6	631.2	152.8	530.1
Racking Max	70.2	122.3	101.4	80.1	77.4	74.3	82.7	82.5	74.5	68.8	71.4	79.3	85	70.4	107.1	63.9	118	28	79
Lashing rod max	138.8	159.1	136.6	110.8	108.4	105.9	114.3	115.7	104.1	99.2	103.8	110.5	118.1	100.6	143	93.8	156.8	36.2	147
Acc Horiz	3.027	3.038	3.046	3.046	3.046	3.046	3.046	3.046	3.046	3.046	3.043	3.046	3.046	3.046	3.046	3.038	3.037	3.006	3.027

	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
90			3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5				
88		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		
86		11.2	12.1	11.5	12.7	12.4	11.7	12.3	11.9	11.1	12.5	12	10	12.2	11.6	9.7	12		
84	4.5	13.2	13.1	13	13.1	11.9	13.1	13.2	13.1	12.1	12	13.6	12	11.8	11.9	12.8	13		7.1
82	6.8	13.5	13.9	19.1	16	14.5	20.5	20.6	14.9	13	13.4	18.6	21.2	13.2	19.3	14.1	19.1		7.1
80	6.9	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	7.5
78																			
76																			
74																			
72																			
Sum	18.2	45.4	50.1	54.6	52.8	49.8	56.3	57.1	50.9	47.2	48.9	55.2	54.2	48.2	53.8	44.1	51.6	4	21.7
Twistlock max	108.8	237.8	202.5	33	41.1	41.8	32.6	34	40.7	40.9	43.6	36.2	27.1	43	193.5	15.1	233.1	No tilting	112.5
Cornerpost load	99.7	426.2	433.6	293.2	294.2	280	303.2	308.5	284.3	266	277.2	301.2	287.2	273.2	442.8	224.9	462.9	NA	115.1
Racking Max	75.6	120	102.4	80.5	78.4	73.8	83.7	85	75.5	69.8	72.4	82.1	80.5	71.3	108.1	64.9	132.8	3.1	80.5
Lashing rod max	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acc Horiz	3.072	3.082	3.087	3.085	3.086	3.087	3.084	3.084	3.087	3.0387	3.088	3.085	3.083	3.088	3.085	3.082	3.081	3.05	3.072



VeriSTAR Lashing - GW Bay 58 UNR
File
Securing System
Bay
Departure
Help
Ship GW Bay 58 UNR
Ship Data
Departure 1
Bay 58
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
58
m
APP
0
40
80
120
160
200
240
280
320
FPP
350.0
Destination
1
Untitled

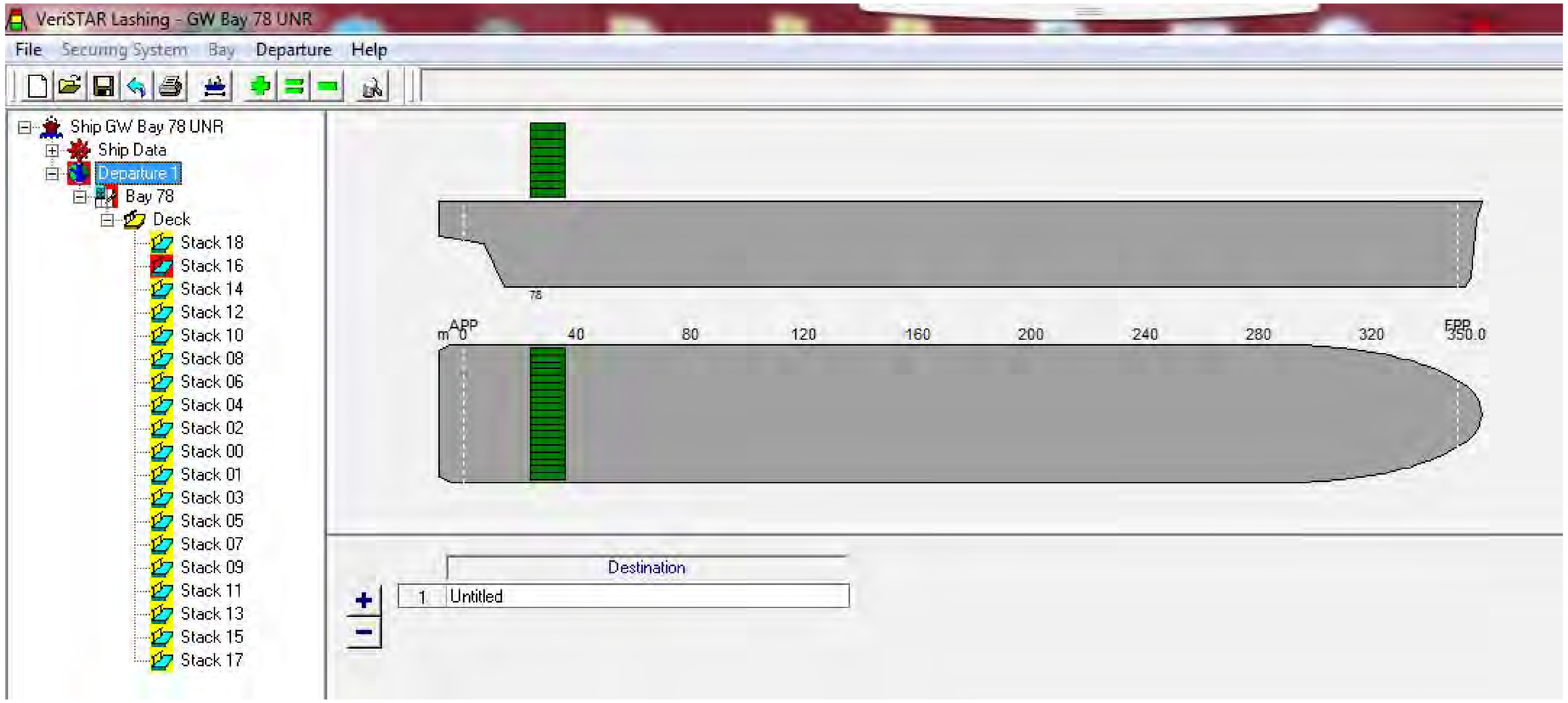
VeriSTAR Lashing - GW Bay 58 WW
File
Securing System
Bay
Departure
Help
Ship GW Bay 58 WW
Ship Data
Departure 1
Bay 58
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
58
m
APP
0
40
80
120
160
200
240
280
320
FPP
350.0
Destination
1
Untitled

BAY 58 Unrestricted

	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
88		6.5	8.9	9.3	7.9	9.1	9.2	8.7	8.3	8.6	8.2	9.2	9.5	8.4	9.3	9.3	6.5	8.4	
86		8.8	9.3	9.3	11.2	9.3	11.1	9.6	10.8	9.9	10.7	10.2	11.7	10.1	9.7	10.2	9.5	8.7	
84	6.5	9.3	11.2	10.7	11.1	10.6	10.2	9.9	11.1	10.7	12.6	8.7	9.9	10.7	10.7	9.9	9.2	11.2	9.4
82	8.7	9.3	10.3	9.6	9.2	10.7	10.5	11.4	9.9	10.6	9.8	10.7	10.2	10.2	10.3	9.3	9	10.9	8.4
80	9.4	9.6	9.8	10.1	9.8	8.5	9.6	9.4	9.6	9.2	10.3	9.3	11.2	12	11.8	10.1	10.1	10.6	9.1
78	10.7	11.1	9.5	11	10.1	10.3	10.8	10.9	12.5	11.2	12.3	11.3	11.2	10.5	9.6	11.8	10.1	9.9	10
76	10.3	10.7	10.8	9.6	9.9	8.6	12.3	11.6	11.3	10.9	11.3	10	10.4	10.8	9.7	9.4	10.7	10.8	9.1
74	10.4	9.9	9.9	10.8	9.6	10.7	9.9	10.9	9.8	9.9	10.3	11.2	10.3	10.7	10.9	10	9.6	9.8	10.3
72	10.3	11.7	11.3	11.9	12.4	14.1	12.6	12	12.3	12.2	12.4	12.2	12.5	14.1	11.6	11.3	6.5	10.1	9.9
Sum	66.3	86.9	91	92.3	91.2	91.9	96.2	94.4	95.6	93.2	97.9	92.8	96.9	97.5	93.6	91.3	81.2	90.4	66.2
Twistlock max	**348.9**	**324.1**	151	146.7	151.3	145.8	153.7	137	144.7	144.4	149.3	139.2	163	136.3	155	151.7	114.1	**366.2**	**372.5**
Cornerpost load	810.6	**909.6**	735.2	736	732.6	721.6	767.5	738.5	756.5	739.2	776.7	733.7	783.9	751.6	755.7	739	659	**987.6**	837.6
Racking Max	117.4	135.3	107.2	105.6	106.4	105.6	110	106.4	107.9	106.7	111.6	104.4	112.7	109.1	110.3	105.1	94.3	149.3	116.5
Lashing rod max	**223.9**	**223.5**	185.2	186.3	184.8	181.9	192.7	187.9	192.5	187.4	198.1	185.5	197.8	193.9	191.9	186.6	170.3	**239.7**	**228.3**
Acc Horiz	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805

BAY 58 Worldwide

	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
88		6.5	8.9	9.3	7.9	9.1	9.2	8.7	8.3	8.6	8.2	9.2	9.5	8.4	9.3	9.3	6.5	8.4	
86		8.8	9.3	9.3	11.2	9.3	11.1	9.6	10.8	9.9	10.7	10.2	11.7	10.1	9.7	10.2	9.5	8.7	
84	6.5	9.3	11.2	10.7	11.1	10.6	10.2	9.9	11.1	10.7	12.6	8.7	9.9	10.7	10.7	9.9	9.2	11.2	9.4
82	8.7	9.3	10.3	9.6	9.2	10.7	10.5	11.4	9.9	10.6	9.8	10.7	10.2	10.2	10.3	9.3	9	10.9	8.4
80	9.4	9.6	9.8	10.1	9.8	8.5	9.6	9.4	9.6	9.2	10.3	9.3	11.2	12	11.8	10.1	10.1	10.6	9.1
78	10.7	11.1	9.5	11	10.1	10.3	10.8	10.9	12.5	11.2	12.3	11.3	11.2	10.5	9.6	11.8	10.1	9.9	10
76	10.3	10.7	10.8	9.6	9.9	8.6	12.3	11.6	11.3	10.9	11.3	10	10.4	10.8	9.7	9.4	10.7	10.8	9.1
74	10.4	9.9	9.9	10.8	9.6	10.7	9.9	10.9	9.8	9.9	10.3	11.2	10.3	10.7	10.9	10	9.6	9.8	10.3
72	10.3	11.7	11.3	11.9	12.4	14.1	12.6	12	12.3	12.2	12.4	12.2	12.5	14.1	11.6	11.3	6.5	10.1	9.9
Sum	66.3	86.9	91	92.3	91.2	91.9	96.2	94.4	95.6	93.2	97.9	92.8	96.9	97.5	93.6	91.3	81.2	90.4	66.2
Twistlock max	**257.2**	203.6	29.6	32.3	31.4	29.7	33.6	27.5	30.9	29.1	30.6	31.7	36.3	29.5	31.8	34.5	23.7	227	**272.1**
Cornerpost load	688.6	742.5	542.3	543.5	539.8	531.9	566.5	547	559.3	546.1	574.2	543	577.7	556.3	557.5	545	489.2	796.9	705.9
Racking Max	94.7	101.3	67.9	67	67.5	67	69.8	67.5	68.4	67.6	70.8	66.2	71.5	69.2	69.9	66.7	59.8	110.2	94.1
Lashing rod max	182.5	161.1	117.4	118.1	117.2	115.3	122.2	119.1	122	118.8	125.6	117.6	125.4	122.9	121.7	118.3	108	171.4	185.2
Acc Horiz	3.031	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.047	3.031


VeriSTAR Lashing - GW Bay 78 UNR
File Securing System Bay Departure Help
Ship GW Bay 78 UNR
Ship Data
Departure 1
Bay 78
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
78
m APP 0
40
80
120
160
200
240
280
320
FPP 350.0
Destination
1 Untitled


VeriSTAR Lashing - GW Bay 78 WW
File Securing System Bay Departure Help
Ship GW Bay 78 WW
Ship Data
Departure 1
Bay 78
Deck
Stack 18
Stack 16
Stack 14
Stack 12
Stack 10
Stack 08
Stack 06
Stack 04
Stack 02
Stack 00
Stack 01
Stack 03
Stack 05
Stack 07
Stack 09
Stack 11
Stack 13
Stack 15
Stack 17
78
m APP 0
40
80
120
160
200
240
280
320
FPP 350.0
Destination
1 Untitled

BAY 78 Unrestricted

	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
88			6.3	6.9	6.2	9.3	5.9	7.8	5.9	7.7	6.2	6.7	7.2	6.3	7.6	6	5.8		
86		6	6.7	7.4	8.3	9.4	9.7	7.5	7.5	7.8	8.5	7.9	8.6	8.2	9.4	9.2	6.4	6	
84		11.5	11	10.5	12.3	10.9	10.2	8.7	8.7	8.9	8.4	9.5	9.2	10.6	11.2	10.4	10.5	11.4	
82	12	12.1	11.9	12.4	12.9	10.7	10.6	7	7.9	8.2	6.9	6.3	10.6	11.5	13.3	12.1	13.1	11.6	11.8
80	10.9	11.3	10.9	11.2	11.2	10.4	9.8	8.2	6.3	5.8	5.8	6.3	10.4	9.9	9.9	10.4	9.9	9.1	8.8
78	8.5	10.5	10.1	8	9.9	8.7	8.7	6.8	5.6	6.9	6.8	8.1	10.4	10.3	10.3	10	9.4	10.2	9.4
76	8.7	7.9	7.6	8.9	6.9	9.1	6.6	9.8	6.5	6.8	6.7	7.4	10.5	10.2	10.5	10.3	10.4	10.5	8.9
74	8.1	8.8	10.3	10.3	10.1	9.7	10	8.8	6.8	9	9.7	9.5	9.9	10	9.6	10.1	9.8	9.8	9.8
72	10	9.9	10.3	10.3	9.4	10.4	9.6	9.9	9.9	9.6	9.9	9.9	9.9	10.5	10.2	10.2	9.2	9.9	9.9
Sum	58.2	78	85.1	85.9	87.2	88.6	81.1	74.5	65.1	70.7	68.9	71.6	86.7	87.5	92	88.7	84.5	78.5	58.6

Twistlock max	225.1	214.4	236.1	124.8	140.3	165.6	134.7	117.9	117.3	132.7	113.2	113.8	118.8	114.6	148.3	120.8	226.6	203.3	216.2
Cornerpost load	618.5	749.1	801.3	677.5	710.3	739.2	658.2	589.4	527.6	580.4	543.9	564.2	677.8	676.6	746.9	693.5	791.3	735.9	608.1
Racking Max	103.3	127.1	120.5	102.8	108.8	109.3	99.2	84.3	79.7	85.3	79	80.6	98	99.8	111.6	103.1	119.1	123	105.4
Lashing rod max	185.1	211	202	177.2	186.6	185.4	169.7	147	131.8	142.2	134.5	140.3	176	177.2	191.9	181.5	199.3	204.8	181.1
Acc Horiz	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805

BAY 78 Worldwide

	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
88			6.3	6.9	6.2	9.3	5.9	7.8	5.9	7.7	6.2	6.7	7.2	6.3	7.6	6	5.8		
86		6	6.7	7.4	8.3	9.4	9.7	7.5	7.5	7.8	8.5	7.9	8.6	8.2	9.4	9.2	6.4	6	
84		11.5	11	10.5	12.3	10.9	10.2	8.7	8.7	8.9	8.4	9.5	9.2	10.6	11.2	10.4	10.5	11.4	
82	12	12.1	11.9	12.4	12.9	10.7	10.6	7	7.9	8.2	6.9	6.3	10.6	11.5	13.3	12.1	13.1	11.6	11.8
80	10.9	11.3	10.9	11.2	11.2	10.4	9.8	8.2	6.3	5.8	5.8	6.3	10.4	9.9	9.9	10.4	9.9	9.1	8.8
78	8.5	10.5	10.1	8	9.9	8.7	8.7	6.8	5.6	6.9	6.8	8.1	10.4	10.3	10.3	10	9.4	10.2	9.4
76	8.7	7.9	7.6	8.9	6.9	9.1	6.6	9.8	6.5	6.8	6.7	7.4	10.5	10.2	10.5	10.3	10.4	10.5	8.9
74	8.1	8.8	10.3	10.3	10.1	9.7	10	8.8	6.8	9	9.7	9.5	9.9	10	9.6	10.1	9.8	9.8	9.8
72	10	9.9	10.3	10.3	9.4	10.4	9.6	9.9	9.9	9.6	9.9	9.9	9.9	10.5	10.2	10.2	9.2	9.9	9.9
Sum	58.2	78	85.1	85.9	87.2	88.6	81.1	74.5	65.1	70.7	68.9	71.6	86.7	87.5	92	88.7	84.5	78.5	58.6

Twistlock max	229.3	219.9	242.1	130.8	146.4	171.8	140.4	123.1	121.9	137.7	118.1	118.8	124.8	120.7	154.8	127.1	232.6	208.9	220.4
Cornerpost load	615.1	744.3	796.1	672.2	704.8	733.7	653.2	584.8	523.8	576.1	539.8	559.8	672.4	671.2	741.1	687.9	786	731	604.7
Racking Max	103.3	127.1	120.5	102.8	108.8	109.3	99.2	84.3	79.7	85.3	79	80.6	98	99.8	111.6	103.1	119.1	123	105.4
Lashing rod max	185.1	211	202	177.2	186.6	185.4	169.7	147	131.8	142.2	134.5	140.3	176	177.2	191.9	181.5	199.3	204.8	181.1
Acc Horiz	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805	4.805

Annex C

IMO Circular MSC.1/Circ. 1475 dated 9 June 2014, *Guidelines regarding the verified gross mass of a con-tainer carrying cargo*

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

E

MSC.1/Circ.1475
9 June 2014

GUIDELINES REGARDING THE VERIFIED GROSS MASS OF A CONTAINER CARRYING CARGO

1 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), having considered the proposal by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers, at its eighteenth session (16 to 20 September 2013), approved the *Guidelines regarding the verified gross mass of a container carrying cargo*, as set out in the annex.

2 The Guidelines are intended to establish a common approach for the implementation and enforcement of the SOLAS requirements regarding the verification of the gross mass of packed containers.

3 Member Governments are invited to bring the annexed Guidelines to the attention of all parties concerned.

***

ANNEX

GUIDELINES REGARDING THE VERIFIED GROSS MASS OF A CONTAINER CARRYING CARGO

1 Introduction

1.1 To ensure the safety of the ship, the safety of workers both aboard ships and ashore, the safety of cargo and overall safety at sea, the International Convention for the Safety of Life at Sea (SOLAS), as amended, requires in chapter VI, part A, regulation 2 that packed containers' gross mass are verified prior to stowage aboard ship. The shipper is responsible for the verification of the gross mass of a container carrying cargo (hereinafter "a packed container"). The shipper is also responsible for ensuring that the verified gross mass is communicated in the shipping documents sufficiently in advance to be used by the ship's master or his representative and the terminal representative in the preparation of the ship stowage plan. In the absence of the shipper providing the verified gross mass of the packed container, the container should not be loaded on to the ship unless the master or his representative and the terminal representative have obtained the verified gross mass through other means.

1.2 The purpose of these Guidelines is to establish a common approach for the implementation and enforcement of the SOLAS requirements regarding the verification of the gross mass of packed containers. The Guidelines provide recommendations on how to interpret and apply the provisions of the SOLAS requirements. They also identify issues that may arise from the application of these requirements and provide guidance for how such issues should be resolved. Adherence to these Guidelines will facilitate compliance with the SOLAS requirements by shippers of containerized shipments, and they will assist other parties in international containerized supply chains, including shipping companies and port terminal facilities and their employees, in understanding their respective roles in accomplishing the enhancement of the safe handling, stowage and transport of containers.

2 Definitions

2.1 For the purpose of these Guidelines:

2.1.1 *Administration* means the Government of the State whose flag the ship is entitled to fly.

2.1.2 *Calibrated and certified equipment* means a scale, weighbridge, lifting equipment or any other device, capable of determining the actual gross mass of a packed container or of packages and cargo items, pallets, dunnage and other packing and securing material, that meets the accuracy standards and requirements of the State in which the equipment is being used.

2.1.3 *Cargo items* has the same general meaning as the term "cargo" in the International Convention for Safe Containers, 1972, as amended (hereinafter referred to as "the CSC"), and means any goods, wares, merchandise, liquids, gases, solids and articles of every kind whatsoever carried in containers pursuant to a contract of carriage. However, ship's equipment and ship's supplies[1], including ship's spare parts and stores, carried in containers are not regarded as cargo.

[1] Refer to the *Revised recommendations on the safe transport of dangerous cargoes and related activities in port areas* (MSC.1/Circ.1216).

2.1.4 *Container* has the same meaning as the term "container" in the CSC and means an article of transport equipment:

(a) of a permanent character and accordingly strong enough to be suitable for repeated use;

(b) specially designed to facilitate the transport of goods, by one or more modes of transport, without intermediate reloading;

(c) designed to be secured and/or readily handled, having corner fittings for these purposes; and

(d) of a size such that the area enclosed by the four outer bottom corners is either:

(i) at least 14 m^2 (150 sq. ft.); or

(ii) at least 7 m^2 (75 sq. ft.) if it is fitted with top corner fittings.

2.1.5 *Contract of carriage* means a contract in which a shipping company, against the payment of freight, undertakes to carry goods from one place to another. The contract may take the form of, or be evidenced by a document such as sea waybill, a bill of lading, or multi-modal transport document.

2.1.6 *Gross mass* means the combined mass of a container's tare mass and the masses of all packages and cargo items, including pallets, dunnage and other packing material and securing materials packed into the container (see also *"Verified gross mass"*).

2.1.7 *Package* means one or more cargo items that are tied together, packed, wrapped, boxed or parcelled for transportation. Examples of packages include, but are not limited to, parcels, boxes, packets and cartons.

2.1.8 *Packed container* means a container, as previously defined, loaded ("stuffed" or "filled") with liquids, gases, solids, packages and cargo items, including pallets, dunnage, and other packing material and securing materials.

2.1.9 *Packing material* means any material used or for use with packages and cargo items to prevent damage, including, but not limited to, crates, packing blocks, drums, cases, boxes, barrels, and skids. Excluded from the definition is any material within individual sealed packages to protect the cargo item(s) inside the package.

2.1.10 *Securing material* means all dunnage, lashing and other equipment used to block, brace, and secure packed cargo items in a container.

2.1.11 *Ship* means any vessel to which SOLAS chapter VI applies. Excluded from this definition are roll-on/roll-off (ro-ro) ships engaged on short international voyages[2] where the containers are carried on a chassis or trailer and are loaded and unloaded by being driven on and off such a ship.

---

[2] SOLAS regulation III/2 defines "short international voyage" as an international voyage in the course of which a ship is not more than 200 miles from a port or place in which the passengers and crew could be placed in safety, and which does not exceed 600 miles in length between the last port of call in the country in which the voyage begins and the final port of destination.

2.1.12 *Shipper* means a legal entity or person named on the bill of lading or sea waybill or equivalent multimodal transport document (e.g. "through" bill of lading) as shipper and/or who (or in whose name or on whose behalf) a contract of carriage has been concluded with a shipping company.

2.1.13 *Shipping document* means a document used by the shipper to communicate the verified gross mass of the packed container. This document can be part of the shipping instructions to the shipping company or a separate communication (e.g. a declaration including a weight certificate produced by a weigh station).

2.1.14 *Tare mass* means the mass of an empty container that does not contain any packages, cargo items, pallets, dunnage, or any other packing material or securing material.

2.1.15 *Terminal representative* means a person acting on behalf of a legal entity or person engaged in the business of providing wharfage, dock, stowage, warehouse, or other cargo handling services in connection with a ship.

2.1.16 *Verified gross mass* means the total gross mass of a packed container as obtained by one of the methods described in paragraph 5.1 of these Guidelines. (see also *"gross mass").*

3 Scope of applicability

3.1 The SOLAS requirements to verify the gross mass of a packed container apply to all containers to which the CSC applies, and which are to be stowed onto a ship determined by the Administration to be subject to SOLAS chapter VI.

3.2 For example (but not limited to), a packed container on a chassis or trailer to be driven on a ro-ro ship is subject to the SOLAS requirements, if the ship has been determined by the Administration to be subject to SOLAS chapter VI and is not engaged on short international voyages. However, cargo items tendered by a shipper to the master for packing into a container already on board the ship are not subject to these SOLAS requirements.

3.3 The term container includes tank-containers, flat-racks, bulk containers etc. Also included are containers carried on a chassis or a trailer except when such containers are driven on or off a ro-ro ship engaged in short international voyages (see definition of ship). Excluded from the definition is any type of vehicle[3]. Also excluded from the definition are "offshore containers" to which the CSC, according to the *Guidelines for the approval of offshore containers handled in open seas* (MSC/Circ.860) and the *Revised recommendations on harmonized interpretation and implementation of the International Convention for Safe Containers, 1972, as amended* (CSC.1/Circ.138/Rev.1), does not apply.

4 Main principles

4.1 The responsibility for obtaining and documenting the verified gross mass of a packed container lies with the shipper.

4.2 A container packed with packages and cargo items should not be loaded onto a ship to which the SOLAS regulations apply unless the master or his representative and the terminal representative have obtained, in advance of vessel loading, the verified actual gross mass of the container.

[3] Refer to the *Revised recommendations on harmonized interpretation and implementation of the International Convention for Safe Containers, 1972, as amended* (CSC.1/Circ.138/Rev.1).

5 Methods for obtaining the verified gross mass of a packed container

5.1 The SOLAS regulations prescribe two methods by which the shipper may obtain the verified gross mass of a packed container:

5.1.1 Method No.1: Upon the conclusion of packing and sealing a container, the shipper may weigh, or have arranged that a third party weighs, the packed container.

5.1.2 Method No.2: The shipper (*or, by arrangement of the shipper, a third party*), may weigh all packages and cargo items, including the mass of pallets, dunnage and other packing and securing material to be packed in the container, and add the tare mass of the container to the sum of the single masses using a certified method as described in paragraphs 5.1.2.3 and 5.1.2.3.1. Any third party that has performed some or all of the packing of the container should inform the shipper of the mass of the cargo items and packing and securing material that the party has packed into the container in order to facilitate the shipper's verification of the gross mass of the packed container under Method No.2. As required by SOLAS VI/2 and paragraph 5, the shipper should ensure that the verified gross mass of the container is provided sufficiently in advance of vessel loading. How such information is to be communicated between the shipper and any third party should be agreed between the commercial parties involved.

5.1.2.1 Individual, original sealed packages that have the accurate mass of the packages and cargo items (including any other material such as packing material and refrigerants inside the packages) clearly and permanently marked on their surfaces, do not need to be weighed again when they are packed into the container.

5.1.2.2 Certain types of cargo items (e.g. scrap metal, unbagged grain and other cargo in bulk) do not easily lend themselves to individual weighing of the items to be packed in the container. In such cases, usage of Method No.2 would be inappropriate and impractical, and Method No.1 should be used instead.

5.1.2.3 The method used for weighing the container's contents under Method No.2 is subject to certification and approval as determined by the competent authority of the State in which the packing and sealing of the container was completed.[4]

5.1.2.3.1 How the certification is to be done will be up to the State concerned, and could pertain to either the procedure for the weighing or to the party performing the weighing or both.

5.1.3 If a container is packed by multiple parties or contains cargo from multiple parties, the shipper as defined in paragraph 2.1 is responsible for obtaining and documenting the verified gross mass of the packed container. If the shipper chooses Method No.2 to obtain the verified gross mass, the shipper is then subject to all the conditions given in paragraphs 5.1.2, 5.1.2.1, 5.1.2.2, and 5.1.2.3.

6 Documentation

6.1 The SOLAS regulations require the shipper to verify the gross mass of the packed container using Method No.1 or Method No.2 and to communicate the verified gross mass in a shipping document. This document can be part of the shipping instructions to the shipping company or a separate communication (e.g. a declaration including a weight certificate produced by a weigh station utilizing calibrated and certified equipment on the route between the shipper's origin and the port terminal). In either case, the document should clearly highlight that the gross mass provided is the "verified gross mass" as defined in paragraph 2.1.

---

[4] Reference to the relevant MSC Circular regarding contact information for the competent authority.

6.2 Irrespective of its form, the document declaring the verified gross mass of the packed container should be signed by a person duly authorized by the shipper. The signature may be an electronic signature or may be replaced by the name in capitals of the person authorized to sign it.

6.3 It is a condition for loading onto a ship to which the SOLAS regulations apply that the verified gross mass of a packed container be provided, preferably by electronic means such as Electronic Data Interchange (EDI) or Electronic Data Processing (EDP), to the ship's master or his representative and to the terminal representative sufficiently in advance of ship loading to be used in the preparation and implementation of the ship stowage plan.

6.3.1 Because the contract of carriage is between the shipper and the shipping company, not between the shipper and the port terminal facility, the shipper may meet its obligation under the SOLAS regulations by submitting the verified gross mass to the shipping company. It is then the responsibility of the shipping company to provide information regarding the verified gross mass of the packed container to the terminal representative in advance of ship loading. Similarly, the shipper may also submit the verified gross mass to the port terminal facility representative upon delivery of the container to the port facility in advance of loading.

6.3.1.1 The master or his representative and the terminal representative should enter into arrangements to ensure the prompt sharing of verified container gross mass information provided by shippers. Existing communication systems may be used for the transmission and sharing of such verified container gross mass information.

6.3.1.2 At the time a packed container is delivered to a port terminal facility, the terminal representative should have been informed by the shipping company whether the shipper has provided the verified gross mass of the packed container and what that gross mass is.

6.3.2 There is no SOLAS prescribed time deadline for the shipper's submission of the verified gross mass other than such information is to be received in time to be used by the master and the terminal representative in the ship stowage plan. The finalization of the ship stowage plan will depend on ship type and size, local port loading procedures, trade lane and other operational factors. It is the responsibility of the shipping company with whom the shipper enters into a contract of carriage to inform the shipper, following prior discussions with the port terminal, of any specific time deadline for submitting the information.

7 Equipment

7.1 The scale, weighbridge, lifting equipment or other devices used to verify the gross mass of the container, in accordance with either Method No.1 or Method No.2 discussed above, should meet the applicable accuracy standards and requirements of the State in which the equipment is being used.

8 Intermodal container movements and transhipments

8.1 The verified gross mass of a packed container should be provided to the next party taking custody of the container.

8.1.1 If a packed container is transported by road, rail or a vessel to which the SOLAS regulations do not apply and delivered to a port terminal facility without its verified gross mass, it may not be loaded onto a ship to which the SOLAS regulations apply unless the master or his representative and the terminal representative have obtained the verified gross mass of the container on behalf of the shipper (see also paragraph 13.1).

8.1.2 If a packed container is delivered to a port terminal facility by a ship to which the SOLAS regulations apply for transhipment onto a ship to which the SOLAS regulations also apply, each container being delivered is required by the SOLAS regulations to have had a verified gross mass before loading onto the delivering ship. All packed containers discharged in the transhipment port should therefore already have a verified gross mass and further weighing in the transhipment port facility is not required. The delivering ship should inform the port terminal facility in the transhipment port of the verified gross mass of each delivered packed container. The master of the ship onto which the transhipped, packed containers are to be loaded and the port terminal facility in the transhipment port may rely on the information provided by the delivering vessel. Existing ship-port communication systems may be used for the provision of such information in agreement between the commercial parties involved.

9 Discrepancies in gross mass

9.1 Any discrepancy between a packed container's gross mass declared prior to the verification of its gross mass and its verified gross mass should be resolved by use of the verified gross mass.

9.2 Any discrepancy between a verified gross mass of a packed container obtained prior to the container's delivery to the port terminal facility and a verified gross mass of that container obtained by that port facility's weighing of the container should be resolved by use of the latter verified gross mass obtained by the port terminal facility.

10 Containers exceeding their maximum gross mass

10.1 SOLAS regulation VI/5 requires that a container not be packed to more than the maximum gross mass indicated on the Safety Approval Plate under the International Convention for Safe Containers (CSC), as amended. A container with a gross mass exceeding its maximum permitted gross mass may not be loaded onto a ship.

11 Containers on road vehicles

11.1 If the verified gross mass of a packed container is obtained by weighing the container while it is on a road vehicle, (e.g. chassis or trailer), the tare mass of the road vehicle (and, where applicable, the tractor) should be subtracted to obtain the verified gross mass of the packed container. The subtraction should reflect the tare mass of the road vehicle (and, where applicable, the tractor) as indicated in their registration documents as issued by the competent authority of the State where these assets are registered. The mass of any fuel in the tank of the tractor should also be subtracted.

11.2 If two packed containers on a road vehicle are to be weighed, their gross mass should be determined by weighing each container separately. Simply dividing the total gross mass of the two containers by two after subtracting the mass of the road vehicle and the tractor, where applicable, would not produce an accurate verified gross mass for each container, and should not be allowed.

12 Empty containers

12.1 Shippers of empty containers and operators of empty containers are encouraged to have practices and arrangements in place to ensure that they are empty. The tare weight will visually appear on the container in accordance with the International Organization for Standardization (ISO) standard for container marking and identification[5]) and should be used.

[5] Refer to standard ISO 6346 – Freight containers – Coding, identification and marking.

13 Contingencies for containers received without a verified gross mass

13.1 Notwithstanding that the shipper is responsible for obtaining and documenting the verified gross mass of a packed container, situations may occur where a packed container is delivered to a port terminal facility without the shipper having provided the required verified gross mass of the container. Such a container should not be loaded onto the ship until its verified gross mass has been obtained. In order to allow the continued efficient onward movement of such containers, the master or his representative and the terminal representative may obtain the verified gross mass of the packed container on behalf of the shipper. This may be done by weighing the packed container in the terminal or elsewhere. The verified gross mass so obtained should be used in the preparation of the ship loading plan. Whether and how to do this should be agreed between the commercial parties, including the apportionment of the costs involved.

14 Master's ultimate decision whether to stow a packed container

14.1 Ultimately, and in conformance with the Code of Safe Practice for Cargo Stowage and Securing[6], the ship's master should accept the cargo on board his ship only if he is satisfied that it can be safely transported. Nothing in the SOLAS regulations limit the principle that the master retains ultimate discretion in deciding whether to accept a packed container for loading onto his ship. Availability to both the terminal representative and to the master or his representative of the verified gross mass of a packed container sufficiently in advance to be used in the ship stowage plan is a prerequisite for the container to be loaded onto a ship to which the SOLAS regulations apply. It does, however, not constitute an entitlement for loading.

15 Enforcement

15.1 Like other SOLAS provisions, the enforcement of the SOLAS requirements regarding the verified gross mass of packed containers falls within the competence and is the responsibility of the SOLAS Contracting Governments. Contracting Governments acting as port States should verify compliance with these SOLAS requirements. Any incidence of non-compliance with the SOLAS requirements is enforceable according to national legislation.

15.2 The ultimate effectiveness and enforcement of the SOLAS container gross mass verification requirement is that a packed container, for which the verified gross mass has not been obtained sufficiently in advance to be used in the ship stowage plan, will be denied loading onto a ship to which the SOLAS regulations apply. Any costs associated with the non-loading, storage, demurrage or eventual return of the container to the tendering shipper of the container should be subject to contractual arrangements between the commercial parties.

16 Effective date of the SOLAS requirements regarding verified gross mass of a container carrying cargo

16.1 The SOLAS requirements regarding verified gross mass of a container carrying cargo (SOLAS regulation VI/2) are expected to enter into force in July 2016.

___

[6] Refer to the *Code of Safe Practice for Cargo Stowage and Securing* (resolution A.714(17)) and subsequent amendments.

CMA CGM G. Washington loading computer lashing calculation

Lashing main parameters

Lashing Input Parameters

Service Speed	22.0	Kn
Design Draught	14.500	m
Draught for Lashing Calculations	13.324	m
GM for Lashing Calculations	1.277	m
GM for 20\' Perm.Weight Calculation in Hold	3.374	m

Lashing Limits

Permissible racking load (transverse force)	150.0	kN
Permissible racking load (longitudinal force)	100.0	kN
Permissible tension for non-bottom layer	250.0	kN
Permissible CornerPost	848.000	kN

Lashing Parameters

Thickness of fitting between tiers (on-deck bays)	30	mm
Thickness of fitting between tiers (in-hold bays)	0	mm
Thickness of bottom fitting (on-deck bays)	0	mm
Thickness of bottom fitting (in-hold bays)	0	mm
Twistlock bottom clearance	7	mm
Twistlock clearance between tiers	10	mm
Resilience of 8'6" container door side	3.764	kN/mm
Resilience of 8'6" container front side	15.058	kN/mm
Basic lashing diameter	22.0	mm

Lashing Calculation Constants

Wave parameter	hw	10.690	m	(Pt B, Ch 5, Sec 3)
Block Coefficient	Cb	0.690		(Pt B, Ch 5, Sec 3)
Navigation Coefficient	n	1.000		(Pt B, Ch 5, Sec 1, 2.6.1)
Froud's number	F	0.193		(Pt B, Ch 5, Symbols)
Motion and acceleration parameter	ab	0.204		(Pt B, Ch 5, Sec 3)
Surge acceleration	asu	0.500	m/s2	(Pt B, Ch 5, Sec 3, 2.1.1)
Sway acceleration	asw	1.550	m/s2	(Pt B, Ch 5, Sec 3, 2.2.1)
Sway period	Tsw	12.116	s	(Pt B, Ch 5, Sec 3, 2.2.1)
Heave acceleration	ah	2.000	m/s2	(Pt B, Ch 5, Sec 3, 2.3.1)
Roll parameter E used for calculation	E	1.000		(Pt B, Ch 5, Sec 3, 2.4.1)
Roll parameter E (original)	Eorig	0.301		(Pt B, Ch 5, Sec 3, 2.4.1)
Roll radius of gyration	Delta	16.870	m	(Pt B, Ch 5, Sec 3, 2.4.1)
Roll angle amplitude	ar	0.203841	rad	(Pt B, Ch 5, Sec 3, 2.4.1)
Roll angle amplitude	ar	11.679	deg	(Pt B, Ch 5, Sec 3, 2.4.1)
Roll period	Tr	32.841	s	(Pt B, Ch 5, Sec 3, 2.4.1)
Roll acceleration	alphaR	0.007462	rad/s2	(Pt B, Ch 5, Sec 3, 2.4.1)

Pitch angle amplitude	ap	0.077633	rad	(Pt B, Ch 5, Sec 3, 2.5.1)
Pitch angle amplitude	ap	4.448	deg	(Pt B, Ch 5, Sec 3, 2.5.1)
Pitch Period	Tp	10.757	s	(Pt B, Ch 5, Sec 3, 2.5.1)
Pitch acceleration	alphaP	0.026485	rad/s2	(Pt B, Ch 5, Sec 3, 2.5.1)
Yaw acceleration	ay	0.009033	rad/s2	(Pt B, Ch 5, Sec 3, 2.6.1)
nw1	nw1	0.870		
nw2	nw2	0.800		

"CMA CGM G. WASHINGTON" HYUN2855 LASHING TEST CASES

BV Lashing parameters

Yard	Hyundai Heavy Industries & Construction Co. Ltd.
Hull No.	HYUN2855
IMO No.	9780847
Lash Classification	BV, Bureau Veritas [BV 2014]
Lash Classification Number	29663U
Length over all	365.960 m
Length between perpendiculars	350.000 m
Moulded Breadth	48.200 m
Moulded depth to main deck	29.850 m
Service Speed	22.0 Kn
Design Draught	14.500 m
Draught for Lashing Calculations	13.324 m

Lashing Limits

Permissible racking load (transverse force)	150.0 kN
Permissible racking load (longitudinal force)	100.0 kN
Permissible tension for non-bottom layer	250.0 kN
Permissible CornerPost	848.000 kN

Bay 01 (GM=1.28 m) (aft)

2/207

Row	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13
RemWeight	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Weight															
% Forces	F82 Lif	F96 Rac	F77 Rac	F86 Rac	F94 Rac	F90 Pre	F98 Pre	F77 Pre	F77 Pre	F80 Pre	F88 Rac	F87 Rac	F67 Rac	F77 Rac	F83 Lif
LW wind	-	-	-	-	-	-	-	-	-	-	-	-	6.9	-	-
LW no wind		12.2	14.5	8.7	3.6	-	-	7.8	8.0	7.0	7.7	8.2	19.4	20.0	

14	12	10	08	06	04	02	00	01	03	05	07	09	11	13
	12.5 LAX 9510 EMCU 8015982 021282	14.2 LAX 9510 OOLU 9035900 021082	12.6 LAX 9510 OOLU 9068539 020882	12.9 LAX 9510 DFSU 3512616 020682	9.8 LAX 9510 WHSU 9006120 020482	12.1 LAX 9510 EMCU 8027704 020282	9.7 LAX 9510 OOLU 5380322 020082	12.4 LAX 9510 CXDU 2234415 020182	9.5 LAX 9510 OOLU 9069659 020382	15.8 LAX 9510 TEMU 8035420 020582	13.8 LAX 9510 OOLU 9007127 020782	10.9 LAX 9510 ECMU 8168298 020982	9.7 LAX 9510 EMCU 8036012 021182	
14.9 LAX 9510 ECMU 8081768 021480	12.1 LAX 9510 OOLU 9022203 021280	16.6 LAX 9510 WHSU 9000477 021080	22.5 LAX L5G1 TCNU 9987246 020880	25.7 LAX L5G1 OOLU 9005783 020680	16.0 LAX 9510 WHSU 9011276 020480	15.8 LAX 9510 ECMU 8012427 020280	18.7 LAX 9510 TCNU 9980431 020080	9.4 LAX 9510 OOLU 9018060 020180	12.1 LAX 9510 TRIU 9973126 020380	20.6 LAX L5G1 APHU 4657047 020580	23.2 LAX L5G1 APHU 4616177 020780	8.7 LAX 9510 APHU 4672020 020980	10.0 LAX 9510 DRYU 4511932 021180	11.7 LAX 9510 OOLU 9071260 021380
11.0 LAX 9510 CXDU 2214825 021478	19.4 LAX 9510 CCLU 9945294 021278	11.1 LAX 9510 APHU 4660380 021078	13.0 LAX L5G1 TCNU 9991251 020878	14.4 LAX L5G1 TEMU 8034960 020678	18.1 LAX 9510 EMCU 8040049 020478	19.7 LAX 9510 OOLU 9082373 020278	9.5 LAX 9510 ECMU 8168261 020078	14.2 LAX 9510 OOLU 9051942 020178	13.8 LAX 9510 APHU 4620794 020378	12.3 LAX L5G1 DFSU 3511219 020578	11.1 LAX L5G1 WHSU 9006053 020778	16.4 LAX 9510 ECMU 8012915 020978	12.5 LAX 9510 DRYU 4530758 021178	15.1 LAX 9510 DRYU 4542276 021378
10.6 LAX 45G1 APHU 7321499 021476	12.2 LAX 45G1 EITU 1594580 021276	11.9 LAX 45G1 EGSU 9081273 021076	11.2 LAX 45G1 TCLU 7922341 020876	11.3 LAX 45G1 HMCU 9226215 020676	18.3 LAX 9510 EMCU 8043238 020476	18.6 LAX 9510 EISU 8055653 020276	10.2 LAX 9510 TCKU 9974120 020076	15.3 LAX 9510 OOLU 9013834 020176	22.0 LAX 9510 OOLU 9017038 020376	11.9 LAX 45G1 MAGU 5423993 020576	12.1 LAX 45G1 TCLU 8913874 020776	12.0 LAX 45G1 TCNU 4503610 020976	11.3 LAX 45G1 BMOU 4568562 021176	11.9 LAX 45G1 EGSU 9136524 021376
12.6 LAX 45G1 EITU 1799533 021474	15.8 LAX 45G1 EITU 1622532 021274	13.5 LAX 45G1 EGSU 9059367 021074	11.6 LAX 45G1 HMCU 9149546 020874	11.9 LAX 45G1 EISU 9338447 020674	16.9 LAX 4510 FSCU 8519809 020474	16.6 LAX 4510 FCIU 9588750 020274	15.8 LAX 4510 APHU 7032650 020074	15.6 LAX 4510 GLDU 7626086 020174	18.6 LAX 4510 OOCU 6553046 020374	14.2 LAX 45G1 TEMU 7141285 020574	11.9 LAX 45G1 TCNU 5450897 020774	11.9 LAX 45G1 EMCU 9752156 020974	12.0 LAX 45G1 EITU 1095112 021174	11.9 LAX 45G1 EISU 9183495 021374
15.3 LAX 45G1 TLLU 4028255 021472	16.2 LAX 45G1 TCLU 9327100 021272	14.2 LAX 45G1 TGBU 5106691 021072	13.8 LAX 45G1 EISU 9039174 020872	14.3 LAX 45G1 TEMU 7118114 020672	18.2 LAX 4510 OOLU 8289469 020472	19.0 LAX 4510 SEGU 4685885 020272	16.0 LAX 4510 CSLU 6164010 020072	15.8 LAX 4510 APHU 6786465 020172	17.4 LAX 4510 CCLU 7726390 020372	16.0 LAX 45G1 HMCU 9055534 020572	13.7 LAX 45G1 TEMU 6276666 020772	14.8 LAX 45G1 BMOU 4629668 020972	13.7 LAX 45G1 TEMU 8540377 021172	11.9 LAX 45G1 EITU 1407273 021372

84
82
80
78
76
74
72

Tier	12	10	08	06	04	02	00	01	03	05	07	09	11
22	12.6 LAX 45G1 EITU 1400432 021222	12.0 LAX 45G1 TCLU 4931205 021022	13.6 LAX 45G1 EGSU 9106659 020822	13.6 LAX 45G1 IMTU 9036649 020622	12.6 LAX 4200 CCLU 4589884 020422	20.9 LAX 4200 ECMU 4472996 020222		21.8 LAX 4200 CCLU 4970479 020122	23.6 LAX 4200 CCLU 4995055 020322	11.9 LAX 45G1 EISU 9181996 020522	11.9 LAX 45G1 EISU 9340779 020722	13.5 LAX 45G1 EISU 9054461 020922	14.6 LAX 45G1 TEMU 6268254 021122
20			11.4 LAX 42G1 FSCU 5001462 020820	12.7 LAX 45G1 EISU 9359563 020620	20.7 LAX 4510 OOCU 6828740 020420	21.6 LAX 4200 MAGU 4886041 020220	22.9 LAX 4510 DRYU 9830275 020020	21.7 LAX 4200 CCLU 4514313 020120	21.1 LAX 4510 OOLU 9639448 020320	15.2 LAX 45G1 EISU 9330301 020520	7.2 LAX 42G1 APZU 4872504 020720		
18				8.7 LAX 42G1 CMAU 8213347 020618	17.0 LAX 4510 FCIU 9917080 020418	19.7 LAX 4510 UETU 5192274 020218	22.5 LAX 4510 CCLU 7977461 020018	19.1 LAX 4510 CCLU 7742786 020118	16.6 LAX 4510 BMOU 5070511 020318	9.6 LAX 42G1 OOLU 7339647 020518			
16						3.4 LAX 2200 CBHU 5719004 010216	9.9 LAX 45G1 TGHU 9699679 020016	5.5 LAX 2200 TTNU 3719655 010116					
14							7.6 LAX 45G1 GESU 6264113 020014						
12							10.9 LAX 45G1 TCLU 8768647 020012						

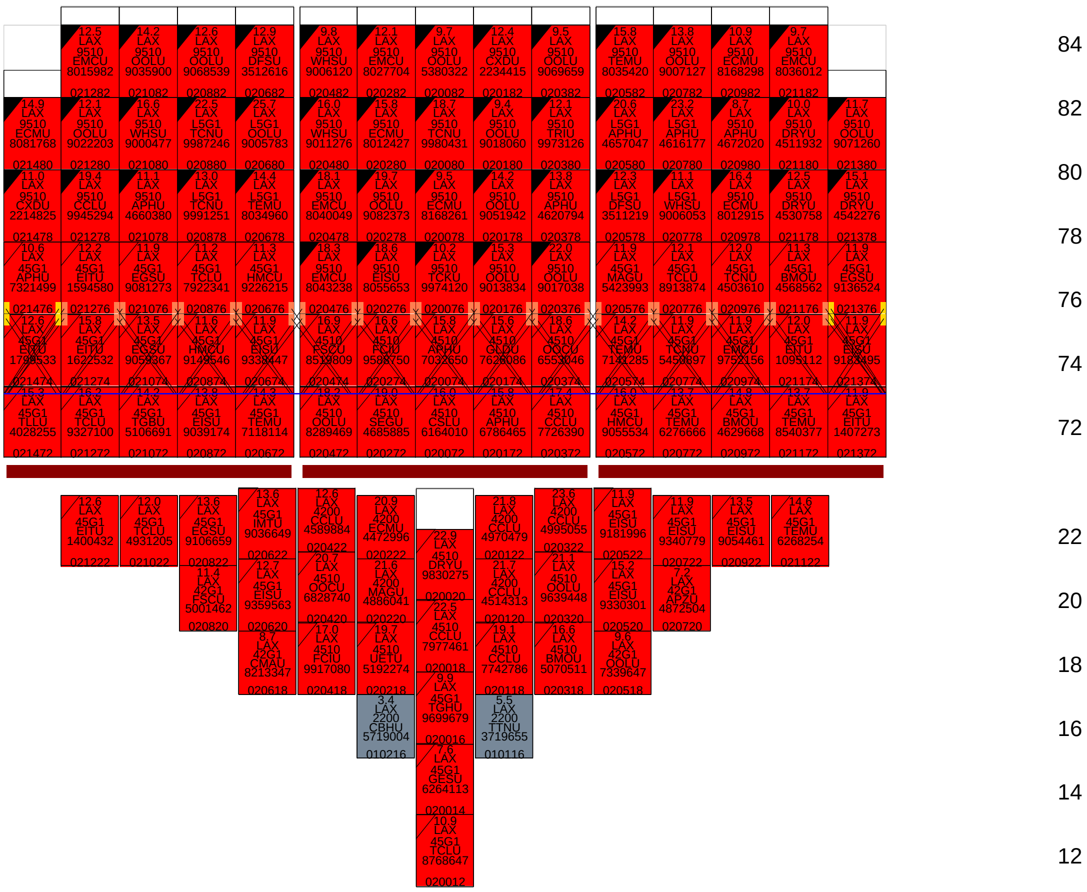
Weight
POD
Type
Serial
Number
IMDG-Class
Position

Row	12	10	08	06	04	02	00	01	03	05	07	09	11
perm.Weight	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5
Weight						3.4		5.5					
RemWeight	30	30	60	90	90	116.59	180	114.54	90	90	60	30	30

Bay 01 (GM=1.28 m) (fore)

2/207

Row	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13
RemWeight	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Weight															
% Forces	F82 Lif	F96 Rac	F77 Rac	F86 Rac	F94 Rac	F90 Pre	F98 Pre	F77 Pre	F77 Pre	F80 Pre	F88 Rac	F87 Rac	F67 Rac	F77 Rac	F83 Lif
LW wind	-	-	-	-	-	-	-	-	-	-	-	-	6.9	-	-
LW no wind		12.2	14.5	8.7	3.6	-	-	7.8	8.0	7.0	7.7	8.2	19.4	20.0	



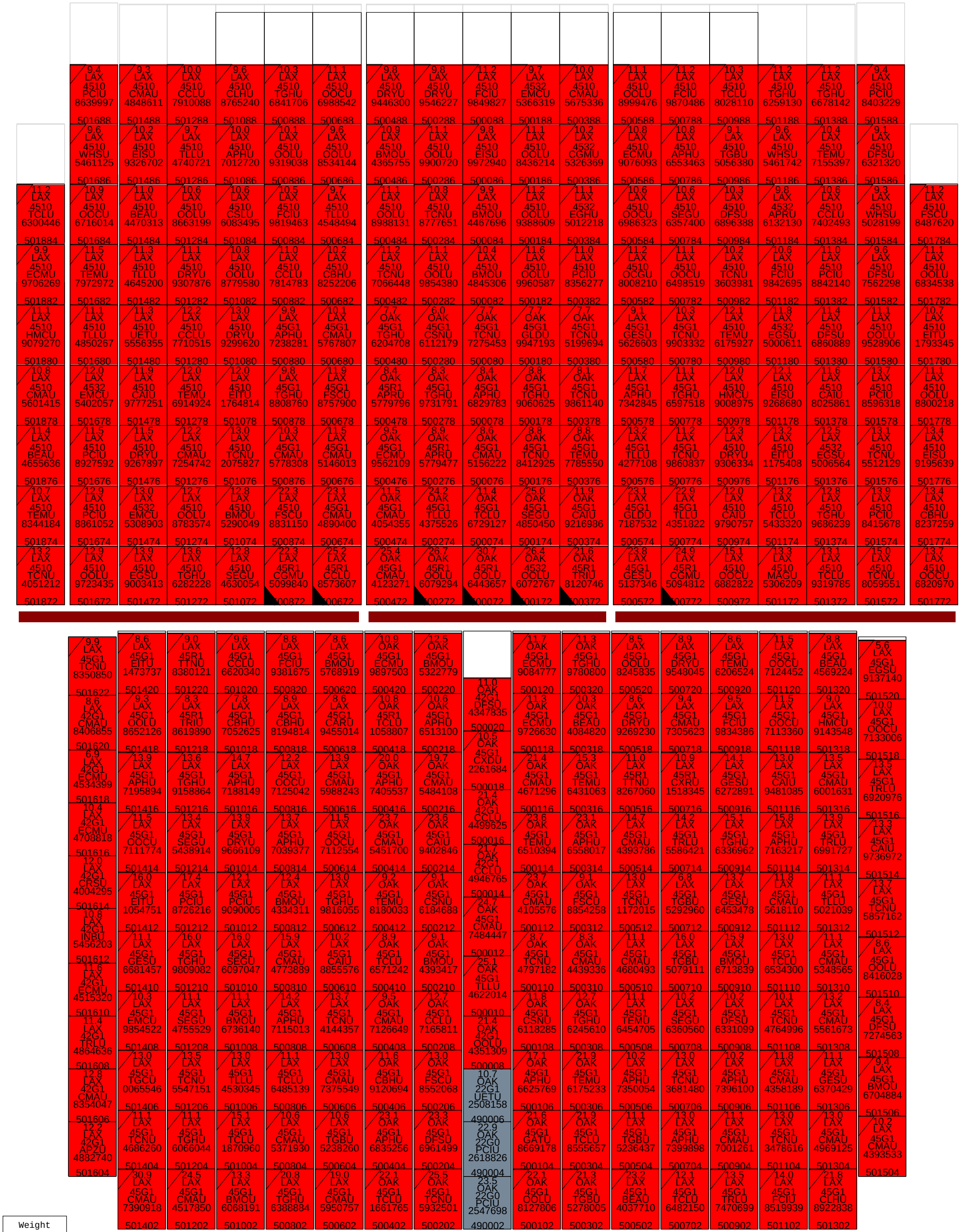
Weight
POD
Type
Serial
Number
IMDG-Class
Position

perm.Weight	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5
Weight						3.4		5.5					
RemWeight	30	30	60	90	90	116.59	180	114.54	90	90	60	30	30
Row	12	10	08	06	04	02	00	01	03	05	07	09	11

Bay 49 (GM=1.28 m) (aft)

3/333

18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17	Row
90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	RemWeight
																			Weight
F96 Lif	F94 Cor	F66 Cor	F71 Cor	F72 Cor	F61 Cor	F62 Lng	F63 Cor	F60 Cor	F56 Cor	F61 Lng	F58 Cor	F75 Cor	F64 Cor	F69 Cor	F72 Cor	F71 Cor	F98 Cor	F94 Cor	% Forces
-	-	9.1	5.1	4.8	11.3	10.8	11.2	12.5	14.6	11.2	13.5	-	9.1	6.1	4.7	6.0	-	-	LW wind
	19.4	19.3	16.3	16.1	20.3	21.1	19.8	19.8	21.2	19.7	20.0	14.3	20.1	17.3	16.0	17.2	18.5		LW no wind

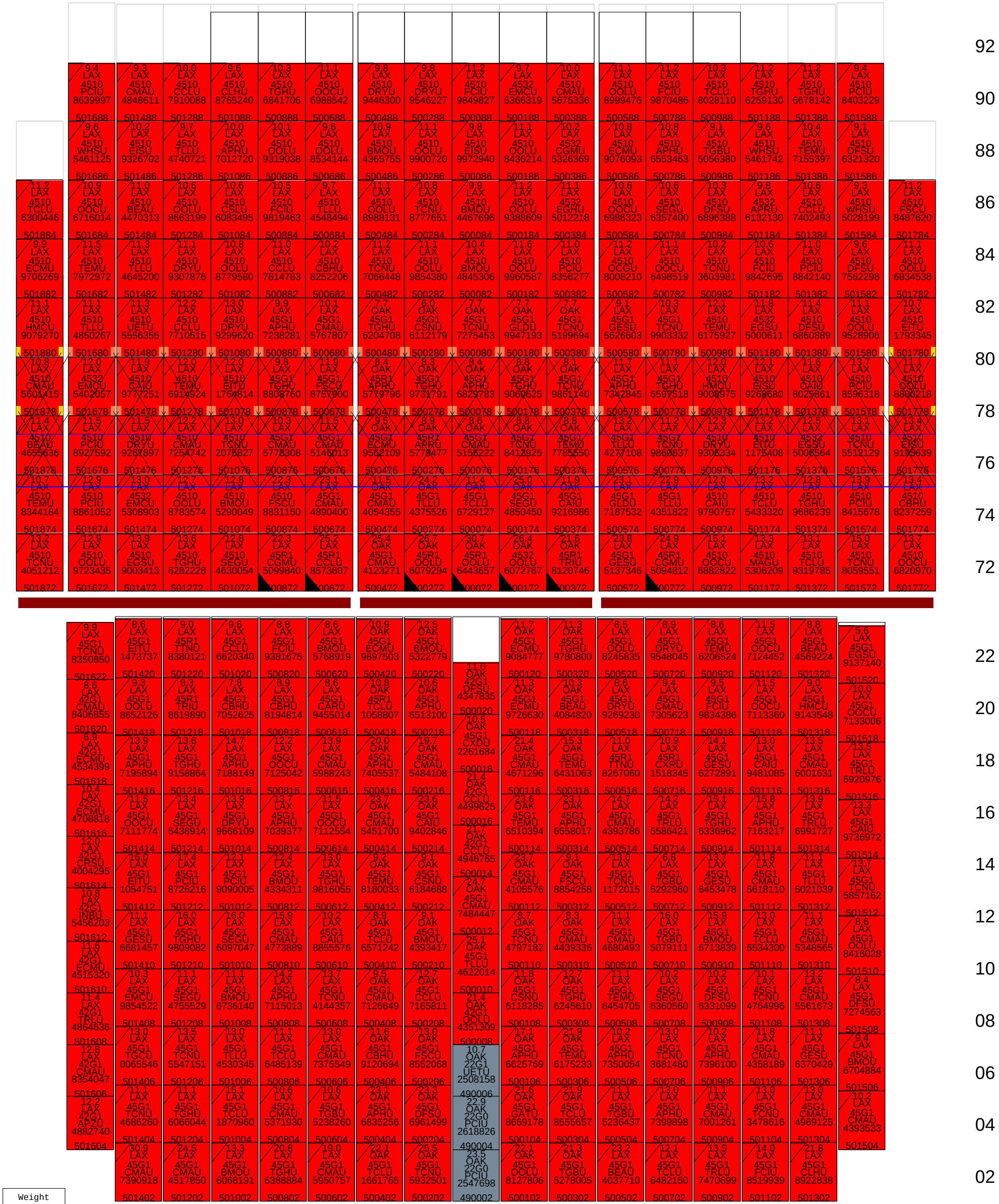


Weight / POD / Type / Serial / Number / IMDG-Class / Position	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	
	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	200.0	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	perm.Weight
									57.0									Weight
	210	210	210	210	210	210	210	210	152.99	210	210	210	210	210	210	210	210	RemWeight
	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	Row

Bay 49 (GM=1.28 m) (fore)

3/333

Row	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
RemWeight	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Weight																			
% Forces	F96 Lif	F94 Cor	F66 Cor	F71 Cor	F72 Cor	F61 Cor	F62 Lng	F63 Cor	F60 Cor	F56 Cor	F61 Lng	F58 Cor	F75 Cor	F64 Cor	F69 Cor	F72 Cor	F71 Cor	F98 Cor	F94 Cor
LW wind	-	-	9.1	5.1	4.8	11.3	10.8	11.2	12.5	14.6	11.2	13.5	-	9.1	6.1	4.7	6.0	-	-
LW no wind		19.4	19.3	16.3	16.1	20.3	21.1	19.8	19.8	21.2	19.7	20.0	14.3	20.1	17.3	16.0	17.2	18.5	



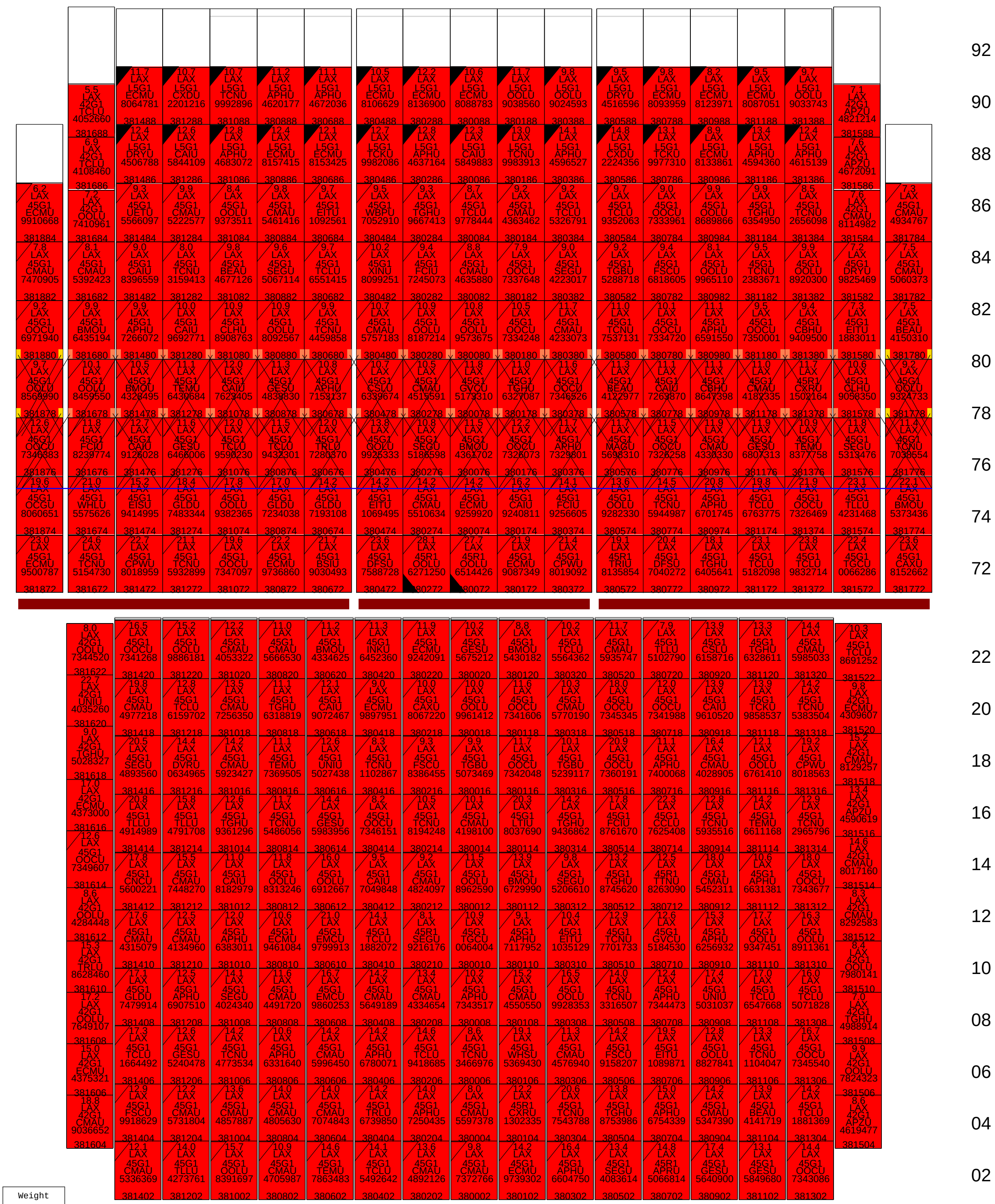
Weight
POD
Type
Serial
Number
IMDG-Class
Position

Row	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15
perm.Weight	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	200.0	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5
Weight									57.0								
RemWeight	210	210	210	210	210	210	210	210	152.99	210	210	210	210	210	210	210	210

Bay 38 (GM=1.28 m) (aft)

0/504

Row	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17
RemWeight	91.836	74.868	66.704	66.699	66.117	64.157	68.951	64.176	61.996	63.69	66.336	67.553	70.197	71.177	71.998	62.397	61.846	75.25	91.338
Weight	88.2	105.1	113.3	113.3	113.9	115.8	111.0	115.8	118.0	116.3	113.7	112.4	109.8	108.8	108.0	117.6	118.2	104.7	88.7
% Forces	A84 Las	F77 Cor	F81 Cor	F71 Cor	F73 Cor	F73 Cor	F71 Cor	F73 Cor	A66 Cor	A62 Cor	F73 Cor	F72 Cor	A65 Cor	F70 Cor	F65 Cor	F72 Cor	F75 Cor	F79 Cor	A83 Las
LW wind	-	3.5	-	3.5	-	-	3.6	-	8.5	10.5	-	-	8.1	4.4	7.5	-	-	-	-
LW no wind		15.5	15.8	16.2	15.4	15.0	16.2	15.4	21.1	20.6	15.5	15.7	19.5	17.0	18.2	15.8	19.7	17.1	



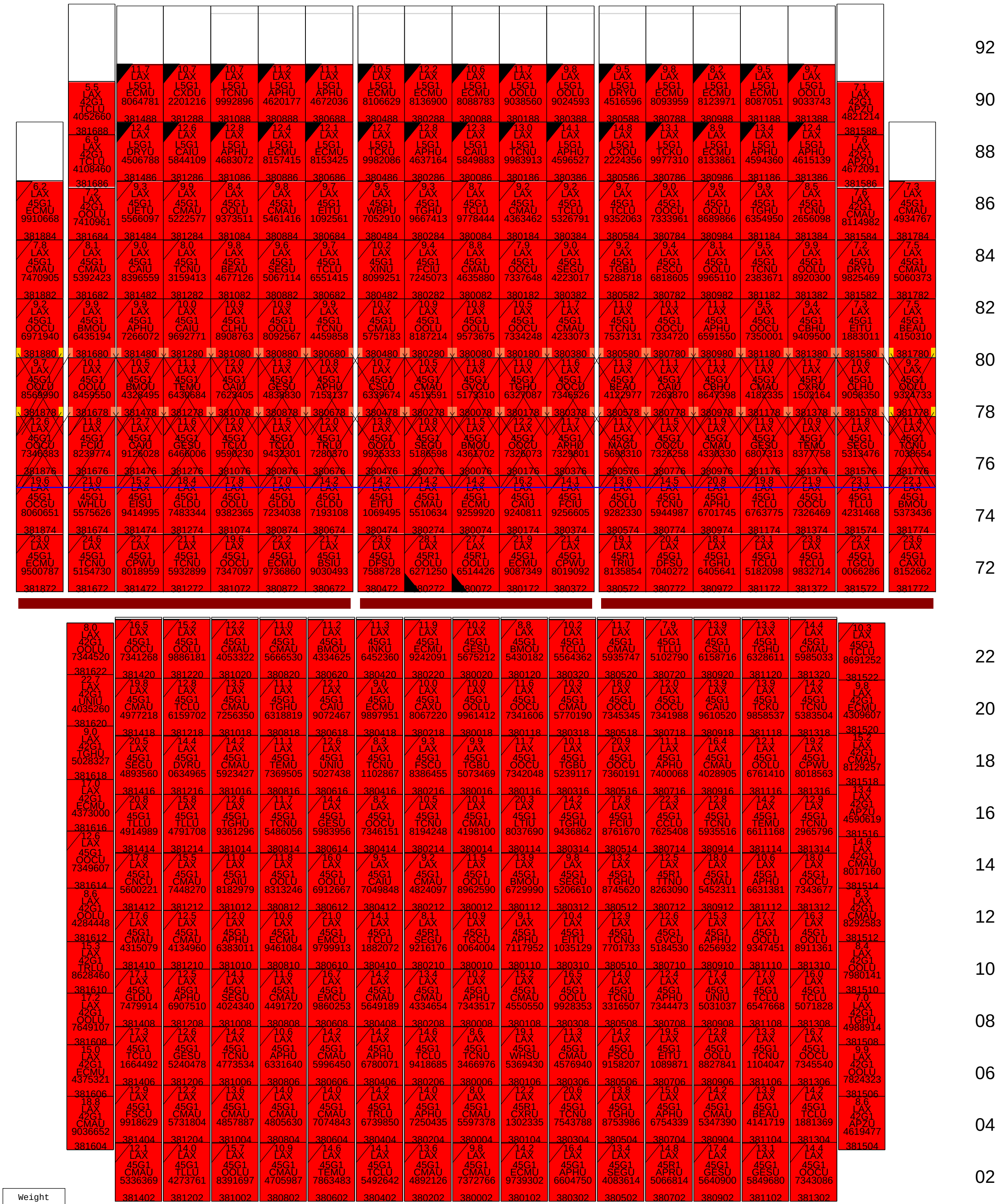
Weight
POD
Type
Serial
Number
IMDG-Class
Position

Row	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15
perm.Weight																	
Weight	144.2	172.5	137.5	133.1	114.3	146.7	117.1	114.6	99.2	136.1	129.8	150.0	140.0	152.1	139.1	156.1	105.5
RemWeight	160.85	163.01	197.96	202.36	221.24	188.79	218.43	220.94	236.33	199.39	205.70	185.49	195.54	183.38	196.37	179.36	199.51

Bay 38 (GM=1.28 m) (fore)

0/504

18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17	Row
91.836	74.868	66.704	66.699	66.117	64.157	68.951	64.176	61.996	63.69	66.33	67.553	70.19	71.177	71.998	62.397	61.846	75.25	91.338	RemWeight
88.2	105.1	113.3	113.3	113.9	115.8	111.0	115.8	118.0	116.3	113.7	112.4	109.8	108.8	108.0	117.6	118.2	104.7	88.7	Weight
A84 Las	F77 Cor	F81 Cor	F71 Cor	F73 Cor	F73 Cor	F71 Cor	F73 Cor	A66 Cor	A62 Cor	F73 Cor	F72 Cor	A65 Cor	F70 Cor	F65 Cor	F72 Cor	F75 Cor	F79 Cor	A83 Las	% Forces
-	3.5	-	3.5	-	-	3.6	-	8.5	10.5	-	-	8.1	4.4	7.5	-	-	-	-	LW wind
	15.5	15.8	16.2	15.4	15.0	16.2	15.4	21.1	20.6	15.5	15.7	19.5	17.0	18.2	15.8	19.7	17.1		LW no wind



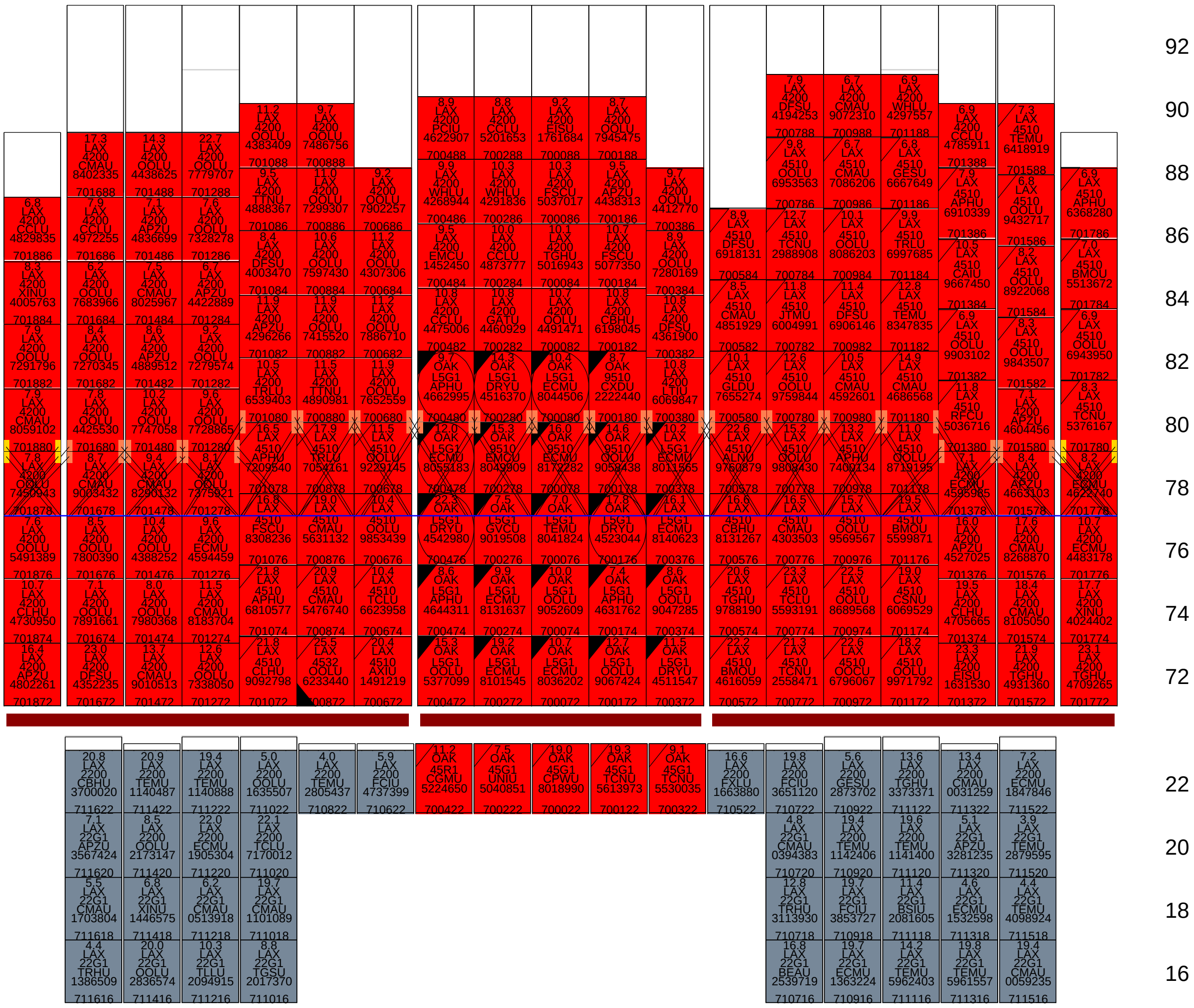
Weight
POD
Type
Serial
Number
IMDG-Class
Position

																	perm.Weight
144.2	172.5	137.5	133.1	114.3	146.7	117.1	114.6	99.2	136.1	129.8	150.0	140.0	152.1	139.1	156.1	105.5	Weight
160.85	163.01	197.96	202.36	221.24	188.79	218.43	220.94	236.33	199.39	205.70	185.49	195.54	183.38	196.37	179.36	199.51	RemWeight
16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	Row

Bay 70 (GM=1.28 m) (aft)

78/335

18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17	Row
106.48	85.177	90.889	82.394	51.58	42.091	33.703	73.054	73.78	85.583	79.12	93.34	70.563	48.977	60.758	61.053	70.081	76.02	91.24	RemWeight
73.5	94.8	89.1	97.6	128.4	137.9	96.3	106.9	106.2	94.4	100.9	86.7	109.4	131.0	119.2	118.9	109.9	104.0	88.8	Weight
F81 Lif	F67 Cor	F54 Cor	F65 Cor	F75 Cor	70 Lng	F49 Cor	88 Cor	89 Pre	88 Cor	86 Cor	88 Cor	54 Lng	F78 Cor	F61 Cor	F71 Cor	55 Lng	F62 Cor	89 Lif	% Forces
-	9.5	20.5	13.1	6.0	13.8	19.2	-	-	-	-	-	18.9	-	13.4	7.1	16.9	6.0	-	LW wind
	27.3	24.3	22.7	19.6	19.7	19.2	3.8	-	-	3.6	-	18.9	16.3	16.7	16.9	16.9	17.3		LW no wind

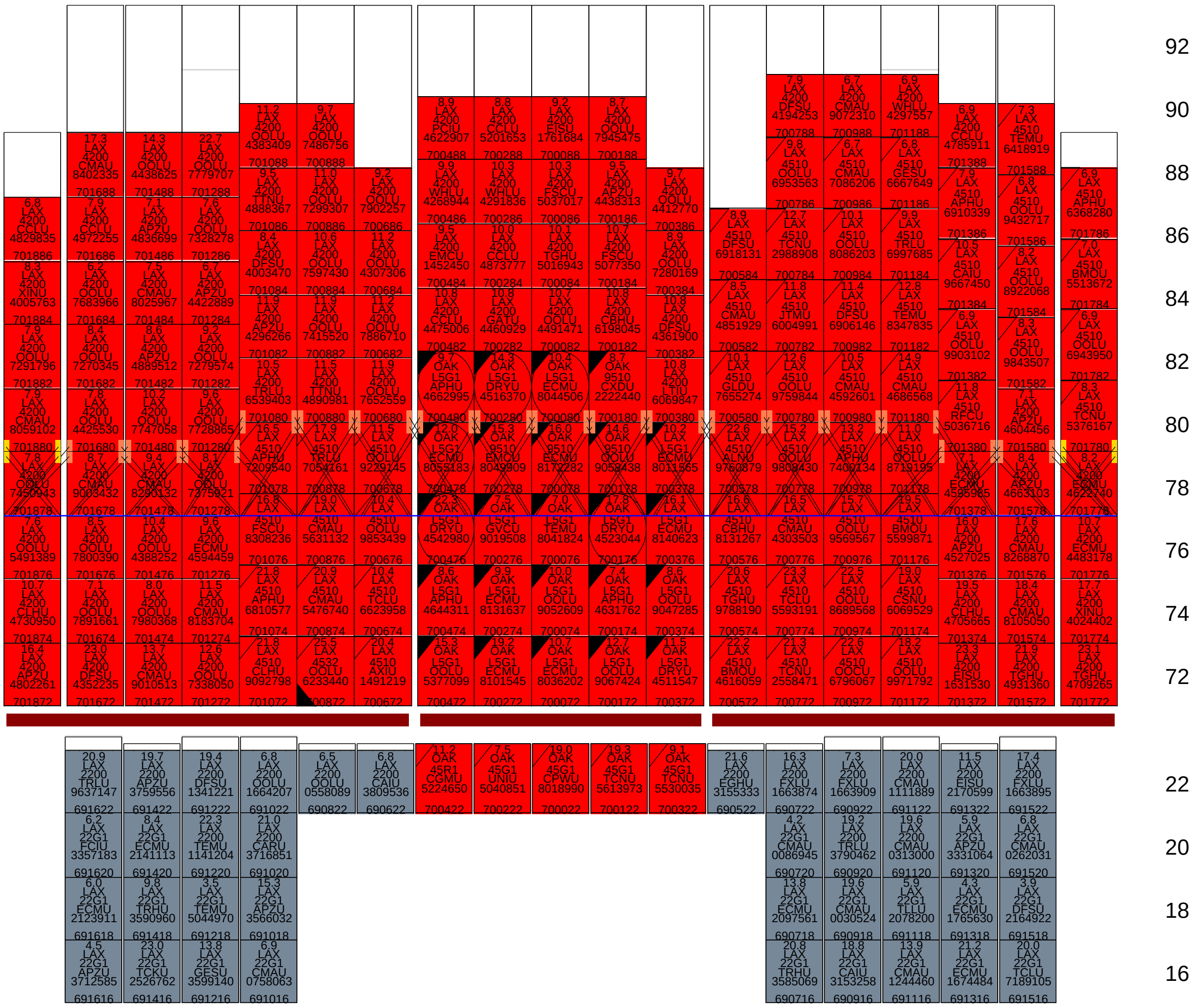


Weight POD Type Serial Number IMDG-Class Position																		
																		perm.Weight
	37.8	60.8	59.0	55.7	6.5	6.8	11.2	7.5	19.0	19.3	9.1	21.6	55.1	64.9	59.5	42.9	48.1	Weight
	84.218	61.2	63.028	66.282	24.022	23.71	19.3	23.041	11.481	11.24	21.39	8.86	66.9	57.113	62.534	79.056	73.916	RemWeight
	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	Row

Bay 70 (GM=1.28 m) (fore)

78/335

18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17	Row
106.48	85.17	90.88	82.39	51.58	42.09	83.70	73.05	73.78	85.58	79.12	93.34	70.56	48.97	60.75	61.05	70.08	76.02	91.24	RemWeight
73.5	94.8	89.1	97.6	128.4	137.9	96.3	106.9	106.2	94.4	100.9	86.7	109.4	131.0	119.2	118.9	109.9	104.0	88.8	Weight
F81 Lif	F67 Cor	F54 Cor	F65 Cor	F75 Cor	70 Lng	F49 Cor	88 Cor	89 Pre	88 Cor	86 Cor	88 Cor	54 Lng	F78 Cor	F61 Cor	F71 Cor	55 Lng	F62 Cor	89 Lif	% Forces
-	9.5	20.5	13.1	6.0	13.8	19.2	-	-	-	-	-	18.9	-	13.4	7.1	16.9	6.0	-	LW wind
	27.3	24.3	22.7	19.6	19.7	19.2	3.8	-	-	3.6	-	18.9	16.3	16.7	16.9	16.9	17.3		LW no wind



Weight / POD / Type / Serial Number / IMDG-Class / Position	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	
																		perm.Weight
	37.8	60.8	59.0	55.7	6.5	6.8	11.2	7.5	19.0	19.3	9.1	21.6	55.1	64.9	59.5	42.9	48.1	Weight
	84.218	61.2	63.028	66.282	24.022	23.71	19.3	23.041	11.481	11.24	21.39	8.86	66.9	57.113	62.534	79.056	73.916	RemWeight
	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	Row

Lashing forces for bay 01 with LCG=333.477 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->10	10<-
	Weight Aft [t]		
	Weight Fore [t]		
01	82	14.16	14.16
01	80	16.61	16.61
01	78	11.09	11.09
01	76	11.85	11.85
01	74	13.47	13.47
01	72	14.23	14.23
	AccLCG Aft [m]		
	AccLCG Fore [m]		
01	82	330.41	330.41
01	80	330.41	330.41
01	78	330.41	330.41
01	76	330.41	330.41
01	74	330.41	330.41
01	72	330.41	330.41
	AccTCG Aft [m]		
	AccTCG Fore [m]		
01	82	-12.61	-12.61
01	80	-12.61	-12.61
01	78	-12.61	-12.61
01	76	-12.61	-12.61
01	74	-12.61	-12.61
01	72	-12.61	-12.61
	AccVCG Aft [m]		
	AccVCG Fore [m]		
01	82	39.65	39.65
01	80	39.65	39.65
01	78	39.65	39.65
01	76	39.65	39.65
01	74	39.65	39.65
01	72	39.65	39.65
	Stack Aft		
01	Level, m	32.70	32.70
	Stack Fore		
01	Level, m	32.70	32.70
	Bridge Aft		
01	Level, m		
	Bridge Fore		
01	Level, m	35.29	35.29
	Wind Aft [kN]		
	Wind Fore [kN]		
01	82	0.00	0.00
01	80	0.00	0.00

Lashing forces for bay 01 with LCG=333.477 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->10	10<-
01	78	0.00	0.00
01	76	0.00	0.00
01	74	0.00	0.00
01	72	0.00	0.00
	RollAccHoriz Aft [m/s²]		
	RollAccHoriz Fore [m/s²]		
01	82	4.81	4.81
01	80	4.81	4.81
01	78	4.81	4.81
01	76	4.81	4.81
01	74	4.81	4.81
01	72	4.81	4.81
	RollAccVert Aft [m/s²]		
	RollAccVert Fore [m/s²]		
01	82	10.93	10.93
01	80	10.93	10.93
01	78	10.93	10.93
01	76	10.93	10.93
01	74	10.93	10.93
01	72	10.93	10.93
	Longitudinal Aft [kN]		
	Longitudinal Fore [kN]		
01	82	4.75	4.75
01	80	15.06	15.06
01	78	24.35	24.35
01	76	32.04	32.04
01	74	40.53	40.53
01	72	49.81	49.81
	Racking Aft [kN]		
	Racking Fore [kN]		
01	82	17.02	17.02
01	80	53.99	53.99
01	78	87.29	87.29
01	76	114.86	114.86
01	74	42.37	42.37
01	72	75.65	75.65
	Deformation Aft [mm]		
	Deformation Fore [mm]		
01	82	29.03	29.03
01	80	27.76	27.76
01	78	23.76	23.76
01	76	17.28	17.28
01	74	8.76	8.76
01	72	5.61	5.61

Lashing forces for bay 01 with LCG=333.477 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->10	10<-
	Pressure Aft [kN]		
	Pressure Fore [kN]		
01	82	58.89	58.89
01	80	168.37	168.37
01	78	302.25	302.25
01	76	470.93	470.93
01	74	558.02	558.02
01	72	686.67	686.67
	CornPost Aft [kN]		
	CornPost Fore [kN]		
01	80	58.89	58.89
01	78	168.37	168.37
01	76	302.25	302.25
01	74	470.93	470.93
01	72	558.02	558.02
	Lifting Aft [kN]		
	Lifting Fore [kN]		
01	82	18.52	18.52
01	80	-0.13	-0.13
01	78	-73.38	-73.38
01	76	-36.33	-36.33
01	74	-49.79	-49.79
01	72	-100.65	-100.65

Lashing forces for bay 38 with LCG=188.050 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->08	08<-
	Weight [t]		
38	88	11.17	11.17
38	86	12.36	12.36
38	84	9.81	9.81
38	82	9.65	9.65
38	80	10.87	10.87
38	78	11.29	11.29
38	76	11.53	11.53
38	74	17.02	17.02
38	72	22.15	22.15
	AccLCG [m]		
38	88	188.05	188.05
38	86	188.05	188.05
38	84	188.05	188.05
38	82	188.05	188.05
38	80	188.05	188.05
38	78	188.05	188.05

Lashing forces for bay 38 with LCG=188.050 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->08	08<-
38	76	188.05	188.05
38	74	188.05	188.05
38	72	188.05	188.05
	AccTCG [m]		
38	88	-10.13	-10.13
38	86	-10.13	-10.13
38	84	-10.13	-10.13
38	82	-10.13	-10.13
38	80	-10.13	-10.13
38	78	-10.13	-10.13
38	76	-10.13	-10.13
38	74	-10.13	-10.13
38	72	-10.13	-10.13
	AccVCG [m]		
38	88	43.12	43.12
38	86	43.12	43.12
38	84	43.12	43.12
38	82	43.12	43.12
38	80	43.12	43.12
38	78	43.12	43.12
38	76	43.12	43.12
38	74	43.12	43.12
38	72	43.12	43.12
	Stack Aft		
38	Level, m	32.70	32.70
	Stack Fore		
38	Level, m	32.70	32.70
	Bridge Aft		
38	Level, m	37.91	37.91
	Bridge Fore		
38	Level, m	37.91	37.91
	Wind [kN]		
38	88	0.00	0.00
38	86	0.00	0.00
38	84	0.00	0.00
38	82	0.00	0.00
38	80	0.00	0.00
38	78	0.00	0.00
38	76	0.00	0.00
38	74	0.00	0.00
38	72	0.00	0.00
	RollAccHoriz [m/s²]		
38	88	3.07	3.07
38	86	3.07	3.07

Lashing forces for bay 38 with LCG=188.050 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->08	08<-
38	84	3.07	3.07
38	82	3.07	3.07
38	80	3.07	3.07
38	78	3.07	3.07
38	76	3.07	3.07
38	74	3.07	3.07
38	72	3.07	3.07
	RollAccVert [m/s²]		
38	88	10.93	10.93
38	86	10.93	10.93
38	84	10.93	10.93
38	82	10.93	10.93
38	80	10.93	10.93
38	78	10.93	10.93
38	76	10.93	10.93
38	74	10.93	10.93
38	72	10.93	10.93
	Longitudinal [kN]		
38	88	3.96	3.96
38	86	12.29	12.29
38	84	20.14	20.14
38	82	27.03	27.03
38	80	34.29	34.29
38	78	42.14	42.14
38	76	50.23	50.23
38	74	60.34	60.34
38	72	74.21	74.21
	Racking Aft [kN]		
38	88	8.57	8.57
38	86	26.63	26.63
38	84	43.65	43.65
38	82	58.59	58.59
38	80	74.34	74.34
38	78	21.96	21.96
38	76	-12.32	-12.32
38	74	9.60	9.60
38	72	39.68	39.68
	Racking Fore [kN]		
38	88	8.57	8.57
38	86	26.63	26.63
38	84	43.65	43.65
38	82	58.59	58.59
38	80	74.34	74.34
38	78	42.44	42.44

Lashing forces for bay 38 with LCG=188.050 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->08	08<-
38	76	16.60	16.60
38	74	38.52	38.52
38	72	68.60	68.60
	Deformation Aft [mm]		
38	88	80.35	80.35
38	86	77.81	77.81
38	84	69.90	69.90
38	82	56.95	56.95
38	80	39.56	39.56
38	78	17.49	17.49
38	76	10.97	10.97
38	74	14.63	14.63
38	72	11.78	11.78
	Deformation Fore [mm]		
38	88	28.05	28.05
38	86	27.41	27.41
38	84	25.43	25.43
38	82	22.19	22.19
38	80	17.85	17.85
38	78	12.33	12.33
38	76	9.18	9.18
38	74	7.95	7.95
38	72	5.09	5.09
	Pressure Aft [kN]		
38	88	40.70	40.70
38	86	106.07	106.07
38	84	184.68	184.68
38	82	280.56	280.56
38	80	398.47	398.47
38	78	455.40	455.40
38	76	472.30	472.30
38	74	530.21	530.21
38	72	637.83	637.83
	Pressure Fore [kN]		
38	88	40.70	40.70
38	86	106.07	106.07
38	84	184.68	184.68
38	82	280.56	280.56
38	80	398.47	398.47
38	78	479.69	479.69
38	76	530.90	530.90
38	74	623.13	623.13
38	72	765.07	765.07
	CornPost Aft [kN]		

Lashing forces for bay 38 with LCG=188.050 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->08	08<-
38	86	40.70	40.70
38	84	106.07	106.07
38	82	184.68	184.68
38	80	280.56	280.56
38	78	398.47	398.47
38	76	455.40	455.40
38	74	472.30	472.30
38	72	530.21	530.21
	CornPost Fore [kN]		
38	86	40.70	40.70
38	84	106.07	106.07
38	82	184.68	184.68
38	80	280.56	280.56
38	78	398.47	398.47
38	76	479.69	479.69
38	74	530.90	530.90
38	72	623.13	623.13
	Lifting Aft [kN]		
38	88	20.35	20.35
38	86	22.52	22.52
38	84	-2.46	-2.46
38	82	-45.61	-45.61
38	80	10.77	10.77
38	78	94.67	94.67
38	76	140.80	140.80
38	74	175.93	175.93
38	72	189.40	189.40
	Lifting Fore [kN]		
38	88	20.35	20.35
38	86	22.52	22.52
38	84	-2.46	-2.46
38	82	-45.61	-45.61
38	80	-23.12	-23.12
38	78	23.59	23.59
38	76	35.40	35.40
38	74	36.22	36.22
38	72	15.37	15.37

Lashing forces for bay 49 with LCG=147.467 m [BV 2014, GM(Hold)=3.37 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->01	01<-
	Weight Aft [t]		
	Weight Fore [t]		
49	20	11.70	11.70

Lashing forces for bay 49 with LCG=147.467 m [BV 2014, GM(Hold)=3.37 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->01	01<-
49	18	11.28	11.28
49	16	21.40	21.40
49	14	23.62	23.62
49	12	23.70	23.70
49	10	8.75	8.75
49	8	11.77	11.77
49	6	17.11	17.11
49	4	21.55	21.55
49	2	22.07	22.07
	AccLCG Aft [m]		
	AccLCG Fore [m]		
49	20	144.40	144.40
49	18	144.40	144.40
49	16	144.40	144.40
49	14	144.40	144.40
49	12	144.40	144.40
49	10	144.40	144.40
49	8	144.40	144.40
49	6	144.40	144.40
49	4	144.40	144.40
49	2	144.40	144.40
	AccTCG Aft [m]		
	AccTCG Fore [m]		
49	20	2.52	2.52
49	18	2.52	2.52
49	16	2.52	2.52
49	14	2.52	2.52
49	12	2.52	2.52
49	10	2.52	2.52
49	8	2.52	2.52
49	6	2.52	2.52
49	4	2.52	2.52
49	2	2.52	2.52
	AccVCG Aft [m]		
	AccVCG Fore [m]		
49	20	15.91	15.91
49	18	15.91	15.91
49	16	15.91	15.91
49	14	15.91	15.91
49	12	15.91	15.91
49	10	15.91	15.91
49	8	15.91	15.91
49	6	15.91	15.91
49	4	15.91	15.91

Lashing forces for bay 49 with LCG=147.467 m [BV 2014, GM(Hold)=3.37 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->01	01<-
49	2	15.91	15.91
	Stack Aft		
49	Level, m	2.36	2.36
	Stack Fore		
49	Level, m	2.36	2.36
	Bridge Aft		
49	Level, m		
	Bridge Fore		
49	Level, m	37.91	37.91
	RollAccHoriz Aft [m/s²]		
	RollAccHoriz Fore [m/s²]		
49	20	2.99	2.99
49	18	2.99	2.99
49	16	2.99	2.99
49	14	2.99	2.99
49	12	2.99	2.99
49	10	2.99	2.99
49	8	2.99	2.99
49	6	2.99	2.99
49	4	2.99	2.99
49	2	2.99	2.99
	RollAccVert Aft [m/s²]		
	RollAccVert Fore [m/s²]		
49	20	10.96	10.96
49	18	10.96	10.96
49	16	10.96	10.96
49	14	10.96	10.96
49	12	10.96	10.96
49	10	10.96	10.96
49	8	10.96	10.96
49	6	10.96	10.96
49	4	10.96	10.96
49	2	10.96	10.96
	20'Perm.St.W,t		
49		590/2.985	590/2.985
	20'Perm.St.W.,t		
49		30.5	30.5
	Stack Weight,t		
49		0.0	0.0
	20'St.W.Compare		
49		0.0<30.5	0.0<30.5
	20'St.W.Result		
49		OK	OK

Lashing forces for bay 70 with LCG=71.650 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->18	18<-
	Weight [t]		
70	86	6.80	6.80
70	84	8.27	8.27
70	82	7.87	7.87
70	80	7.92	7.92
70	78	7.85	7.85
70	76	7.63	7.63
70	74	10.74	10.74
70	72	16.43	16.43
	AccLCG [m]		
70	86	71.65	71.65
70	84	71.65	71.65
70	82	71.65	71.65
70	80	71.65	71.65
70	78	71.65	71.65
70	76	71.65	71.65
70	74	71.65	71.65
70	72	71.65	71.65
	AccTCG [m]		
70	86	-22.80	-22.80
70	84	-22.80	-22.80
70	82	-22.80	-22.80
70	80	-22.80	-22.80
70	78	-22.80	-22.80
70	76	-22.80	-22.80
70	74	-22.80	-22.80
70	72	-22.80	-22.80
	AccVCG [m]		
70	86	40.99	40.99
70	84	40.99	40.99
70	82	40.99	40.99
70	80	40.99	40.99
70	78	40.99	40.99
70	76	40.99	40.99
70	74	40.99	40.99
70	72	40.99	40.99
	Stack Aft		
70	Level, m	32.70	32.70
	Stack Fore		
70	Level, m	32.70	32.70
	Bridge Aft		
70	Level, m	40.53	40.53
	Bridge Fore		
70	Level, m	40.53	40.53

Lashing forces for bay 70 with LCG=71.650 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->18	18<-
	Wind [kN]		
70	86	37.91	0.00
70	84	37.91	0.00
70	82	37.91	0.00
70	80	37.91	0.00
70	78	37.91	0.00
70	76	37.91	0.00
70	74	37.91	0.00
70	72	37.91	0.00
	RollAccHoriz [m/s²]		
70	86	3.07	3.07
70	84	3.07	3.07
70	82	3.07	3.07
70	80	3.07	3.07
70	78	3.07	3.07
70	76	3.07	3.07
70	74	3.07	3.07
70	72	3.07	3.07
	RollAccVert [m/s²]		
70	86	10.95	10.95
70	84	10.95	10.95
70	82	10.95	10.95
70	80	10.95	10.95
70	78	10.95	10.95
70	76	10.95	10.95
70	74	10.95	10.95
70	72	10.95	10.95
	Longitudinal [kN]		
70	86	2.33	2.33
70	84	7.49	7.49
70	82	13.02	13.02
70	80	18.43	18.43
70	78	23.83	23.83
70	76	29.14	29.14
70	74	35.43	35.43
70	72	44.74	44.74
	Racking Aft [kN]		
70	86	14.70	5.22
70	84	45.23	16.80
70	82	76.58	29.19
70	80	107.66	41.32
70	78	-39.81	-17.30
70	76	-8.97	-5.41
70	74	24.09	8.69

Lashing forces for bay 70 with LCG=71.650 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->18	18<-
70	72	63.90	29.55
	Racking Fore [kN]		
70	86	14.70	5.22
70	84	45.23	16.80
70	82	76.58	29.19
70	80	107.66	41.32
70	78	-15.71	-7.75
70	76	15.13	4.14
70	74	48.19	18.24
70	72	88.01	39.10
	Deformation Aft [mm]		
70	86	75.27	28.71
70	84	71.37	27.32
70	82	59.35	22.86
70	80	39.01	15.10
70	78	10.41	4.13
70	76	20.99	8.72
70	74	23.37	10.16
70	72	16.98	7.85
	Deformation Fore [mm]		
70	86	25.22	9.71
70	84	24.25	9.37
70	82	21.24	8.25
70	80	16.16	6.31
70	78	9.01	3.57
70	76	10.05	4.08
70	74	9.05	3.81
70	72	5.84	2.60
	Pressure Aft [kN]		
70	86	34.23	24.17
70	84	104.89	64.63
70	82	207.75	117.18
70	80	542.21	261.36
70	78	521.40	264.46
70	76	532.76	279.60
70	74	587.73	318.22
70	72	700.54	394.56
	Pressure Fore [kN]		
70	86	34.23	24.17
70	84	104.89	64.63
70	82	207.75	117.18
70	80	515.41	250.74
70	78	520.20	263.98
70	76	557.16	289.26

Lashing forces for bay 70 with LCG=71.650 m [BV 2014, GM=1.28 m , D=13.32 m , V=22.0 knots , R=Worldwide, UseRealLength]

Bay	Name/Layer	->18	18<-
70	74	637.72	338.02
70	72	776.14	424.51
	CornPost Aft [kN]		
70	84	34.23	24.17
70	82	104.89	64.63
70	80	207.75	117.18
70	78	542.21	261.36
70	76	521.40	264.46
70	74	532.76	279.60
70	72	587.73	318.22
	CornPost Fore [kN]		
70	84	34.23	24.17
70	82	104.89	64.63
70	80	207.75	117.18
70	78	515.41	250.74
70	76	520.20	263.98
70	74	557.16	289.26
70	72	637.72	338.02
	Lifting Aft [kN]		
70	86	3.01	13.07
70	84	-22.39	17.86
70	82	-82.16	8.41
70	80	-174.81	-13.79
70	78	-111.05	26.05
70	76	-80.63	52.69
70	74	-76.82	72.85
70	72	-99.72	86.43
	Lifting Fore [kN]		
70	86	3.01	13.07
70	84	-22.39	17.86
70	82	-82.16	8.41
70	80	-174.81	-13.79
70	78	-136.65	15.91
70	76	-131.83	32.41
70	74	-153.62	42.43
70	72	-202.11	45.87

Annex E

World Shipping Council, Containers Lost at Sea – 2017 update

Containers Lost At Sea – 2017 Update

In 2016, the international liner shipping industry transported approximately 130 million containers packed with cargo, with an estimated value of more than $4 trillion. Proper packing, stowage and securing of containers and reporting of correct weight is very important to the safety of a container ship, its crew and its cargo, to shore-based workers and equipment, and to the environment. However, even with proper packing of the cargo into the container, correct container weight declaration, and proper stowage and securing aboard ship, a number of factors ranging from severe weather and rough seas to more catastrophic and rare events like ship groundings, structural failures, and collisions can result in containers being lost at sea.

In the past, obtaining an accurate assessment of how many containers actually are lost at sea was a highly speculative process. For many years, there were widely circulated, but unsupported and grossly inaccurate claims that the industry might lose as many as 10,000 containers a year at sea.

Ocean carriers operating the containerships, which the World Shipping Council (WSC) represents, remain the best sources for accurate information on this subject. [1] Therefore, in an effort to provide greater clarity and a more accurate assessment of the number of containers lost at sea on an annual basis, WSC undertook the first survey of its member companies in 2011, with updates in 2014 and 2017, and has published the results to make the information readily available to all interested parties.

[1] The WSC's member companies operate 80 percent of the global containership capacity; thus, a survey of their losses should provide a valid estimate of the number of containers lost at sea. More information about WSC and the liner shipping industry can be obtained at: www.worldshipping.org

Methodology of the Surveys

In each of the surveys conducted in 2011, 2014 and 2017, the WSC member companies were asked to report the number of containers lost overboard for the preceding three years. For the 2017 report, all WSC member companies responded and together, they represent 80% of the total global vessel container capacity. WSC assumes for the purpose of its analysis that the container losses for the 20% of the industry's capacity that is operated by carriers that did not participate in the survey would be roughly the same as those of the 80% of the industry that responded.

The total annual figure reported by WSC members is adjusted upward to provide an estimated loss figure for all carriers, both WSC members and non-members, and arrive at a total industry figure. As expected, some carriers lost no containers during the period, while others noted a catastrophic loss, which for the purposes of this analysis is defined as a loss overboard of 50 or more containers in a single incident. Catastrophic losses are rare, but the total number of containers lost in such events represents more than half of all containers lost.

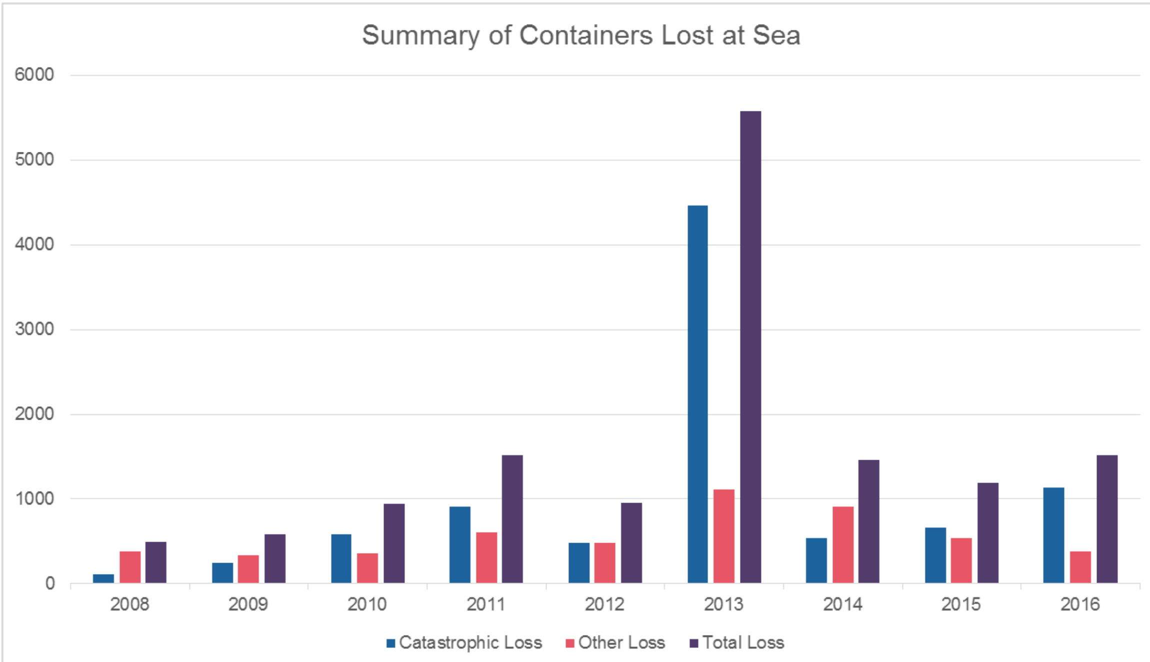
Based on the 2011 survey results, the World Shipping Council estimated that on average there were approximately 350 containers lost at sea each year during the 2008-2010 time frame, not counting catastrophic events. When one counted the catastrophic losses, an average annual total loss per year of approximately 675 containers was estimated for this three year period.

In the 2014 survey, WSC received reports from carriers on losses during 2011, 2012 and 2013. From those results, WSC estimated that there were approximately 733 containers lost at sea on average for each of these three years, not counting catastrophic events. When one includes catastrophic losses (as defined above) during these years, the average annual loss for the period was approximately 2,683 containers.

This larger number in 2014 is due primarily to two factors: the complete loss in 2013 of the *MOL Comfort* in the Indian Ocean and all of the 4,293 containers on board – which remains the worst containership loss in history; and, in 2011, the grounding and loss of the *M/V Rena* off New Zealand, which resulted in a loss overboard of roughly 900 containers. Both of these incidents involved complete and total vessel losses.

The most recent 2017 survey gathered input for 2014, 2015 and 2016. All WSC member companies responded, and additional information was made available on certain non-member catastrophic events. For each of the three years surveyed, the average number of containers lost at sea excluding catastrophic events was 612, which is about 16% less than the average of 733 units lost each year for the previous three year period. When catastrophic losses are included, the total containers lost at sea averaged 1,390 with 56% of those lost being attributed to catastrophic events. This is a 48% reduction from the average annual total losses of 2,683 estimated in 2014.

Analysis of the Nine Year Trends



Upon review of the results of the nine year period (2008-2016) surveyed, the WSC estimates that there were on average 568 containers lost at sea each year, not counting catastrophic events, and on average a total of 1,582 containers lost at sea each year including catastrophic events. On average, 64% of containers lost during the last decade were attributed to a catastrophic event.

The data consistently demonstrates that container losses in any particular year can vary quite substantially based on differences in weather and other unusual events. The data also consistently shows that the majority of containers lost at sea result from catastrophic events. For example, in 2013, there was a total loss of 5,578 containers – 77% of which occurred with the sinking of the *MOL Comfort* in the Indian Ocean. The tragic total loss of vessel *El Faro* occurred two years later in 2015. All containers on the *El Faro* were lost and this event alone accounted for almost 43% of the total containers lost into the sea in 2015.

Active Safety Improvement Initiatives

While containers lost overboard represent about one thousandth of 1% of the roughly 130 million container loads shipped each year, the industry has been actively supporting a number of efforts to enhance container safety that should help reduce the number of containers lost at sea, including:

- **Amendments to the Safety of Life at Sea (SOLAS) Convention:** In November 2014, the International Maritime Organization (IMO) adopted changes to the Safety of Life at Sea (SOLAS) convention requiring verification of container weights before packed containers may be loaded aboard ships. This is an effort WSC advocated in support of for many years. The requirement making container weight verification a condition for vessel loading became legally binding internationally on July 1, 2016. Misdeclared container weights have contributed to the loss of containers at sea, as well as to other safety and operational problems. For more information about this issue, visit: http://www.worldshipping.org/industry-issues/safety/cargo-weight

- **Code of Practice for Packing of Cargo Transport Units (CTU):** The IMO, the International Labour Organization (ILO), and the United Nations Economic Commission for Europe (UNECE), with industry support, have produced a code of practice for the packing of CTU, including containers, outlining specific procedures and techniques to improve safety, such as how to ensure correct distribution of the weight inside the container, proper positioning, blocking and bracing according to the type of cargo, and other safety considerations. The code was approved in 2014. For more information about this and other initiatives related to the improved safety of handling containers, visit: http://www.worldshipping.org/industry-issues/safety/containers

- **Revised ISO standards for container lashing equipment and corner castings:** In support of the IMO's efforts to enhance container safety, the International Organization for Standardization (ISO), with the industry's active participation, has revised its standards regarding lashing equipment and corner castings. For more information about this issue visit: http://www.worldshipping.org/industry-issues/safety/containers

At any point in time, there are about 6,000 containerships active on the world's seas and waterways linking continents and communities through trade. The container shipping industry's goal remains to keep the loss of containers carried on those ships as close to zero as possible. Carriers will continue to explore and implement preventative and realistic measures to achieve that goal.