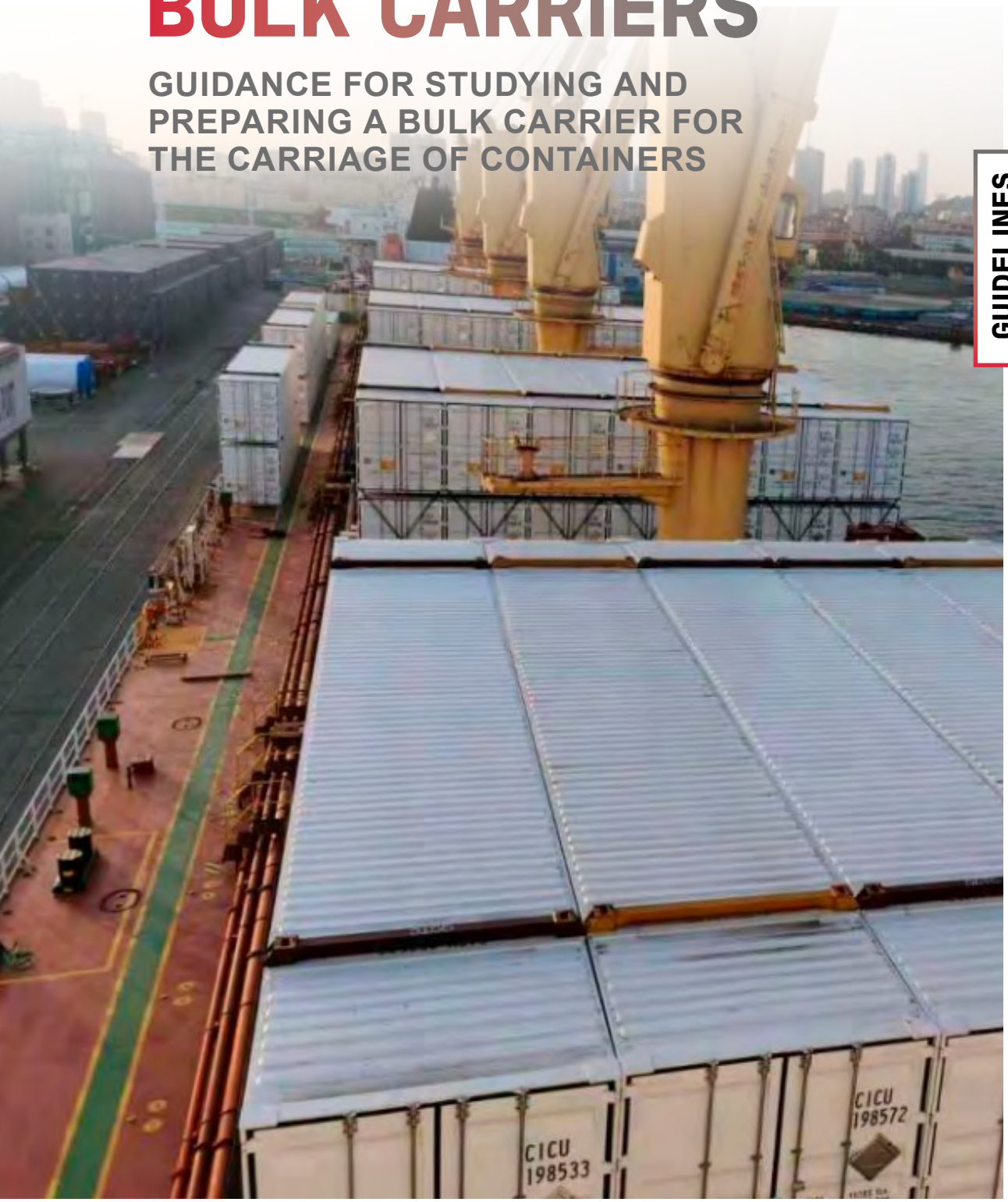
SEPTEMBER, 2021

LOADING CONTAINERS IN BULK CARRIERS

GUIDANCE FOR STUDYING AND PREPARING A BULK CARRIER FOR THE CARRIAGE OF CONTAINERS

GUIDELINES



BUREAU VERITAS

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1. INTRODUCTION

Unprecedented demand for the carriage of containers, exceeding the carriage supply in container ships has prompted charterers to explore the possibility of utilization of bulk carriers for that task. Bulk carriers, in general, are non-cellular vessels compared to container ships.

Carriage of containers in bulk carriers is possible but only after extensive planning, assessment and scrutiny. Operators must liaise with their insurance carriers, Class society of their vessel(s) and corresponding Flag Administration for advice and guidance on the necessary modifications and/or additions to satisfy relevant requirements.

From the regulatory point of view such an operation is acceptable under the IMO Code of Safe Practice for Cargo Stowage and Securing (CSS Code) for ships that are equipped with a Cargo Securing Manual, containing the Annex 1 “Safe stowage and securing of containers on deck of ships which are not specially designed and fitted for the purpose of carrying containers” as well as the calculation methods for forces acting on cargo units and the efficiency of securing arrangements.

However, the fact that bulk carriers are indeed “not specially designed and fitted for the purpose of carrying containers” combined with the potential need to maximize the intake of containers, creates issues of concern related to the integrity of the vessel’s structure and the cargo itself as well as the safety of the crew and the stevedores.

ABOUT THIS DOCUMENT

This document, divided in two parts, is compiled based on the recent experience of Bureau Veritas in handling such requests as well as on assisting in the successful completion of such operations. The first part summarizes the answers to frequently-asked questions that are posed by owners on the subject. The second part describes in more detail the two major options available to owners in order to successfully perform the operation as well as the relevant involvement of Class and the documentation that needs to be provided in each case.

BUREAU VERITAS’ ROLE

Bureau Veritas has a central role to play in helping the shipping industry understand new technologies. Our mission is to shape a world of trust by reducing clients’ risks, improving their performance, and helping them innovate to meet the challenges of quality, health and safety, environmental protection, and social responsibility.

The Bureau Veritas team is, of course, available to clarify technical details. We remain our clients’ trusted partner and look forward to helping you ensure compliance and developing the future together.

We have significant experience and knowledge of bulk carrier design, classification and operations across BV and we have numerous clients in the dry cargo market. Additionally, our class rules for container lashing and our own associated lashing software are highly sophisticated. The combination of bulker and boxship capability and understanding has enabled our teams to rapidly provide a framework to meet market requirements as demand emerges for bulkers to be able to carry boxes.

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2. FREQUENTLY ASKED QUESTIONS

2.1. HOW TO SELECT THE BULK CARRIER TO BE ENGAGED IN THE CARRIAGE OF CONTAINERS?

- **Type of Hath Covers and size of hatch way opening.**

Normally, folding type hatch covers are providing a bigger length of hatchway opening in respect to side rolling type. The length of the hatch way is important.

The optimum goal will be to have big enough hatchway length to facilitate the loading/unloading and enough (clear) space in holds (bhd stool) in order to load 2 bays of FEU (or 4 bays of TEU). Attention to the additional space (length) needed for lashing equipment and working space for stevedores.

Side rolling Hatch Covers railways extending transversally at deck side, may complicate the container deck arrangement.

- **Containers in Holds and SOLAS requirement for Fixed Fire Extinguishing system.**

Attention is drawn to SOLAS II.2/10.7.1, whereby, as required and for ships > 2000 GT, with or without Dangerous Goods, cargo holds shall be protected by a Fixed Fire extinguishing system.

• **Containers on deck & hatch covers**

The selected bulk carrier to have Loading Conditions with “Deck/Hatch Covers cargo” in the Loading Manual. If there are not such loading conditions, additional intact and damage stability requirements are applicable. Two cases exist as follows:

• Vessels with type B freeboard: Such vessels will already have a probabilistic damage stability calculation as per SOLAS II-1 Part B requirements and a “Minimum GM Curve” established and included in the vessel’s stability documentation. For these vessels the extra windage area due to the deck stowed containers is to be taken into account in the intact stability calculations

• Vessels with type B-60 freeboard: Such vessels will need to develop the Minimum GM Curve as per SOLAS II-1 Part B probabilistic damage stability requirements. This curve is to be applicable when the vessel will be carrying deck cargo. In addition, as per the above case, the deck containers windage area is to be taken into account in the intact stability calculations.

A consulting office will have to prepare all needed files as above and submit them to BV for review.

In addition, as per SOLAS II.2/10.7.3 (formally applicable to ships > 01.01.2016), the following are also to be provided:

a) Water mist lance

b) possibly mobile water monitors (for 5 tiers or above – it will not be the case for a bulk carrier)

2.2. HOW MANY CONTAINERS CAN BE LOADED?

This greatly depends on the vessel’s cargo hold and hatch geometry, as well as on the scantlings of the inner bottom, deck and hatch covers. Based on Bureau Veritas experience the following guidance figures can be used for an initial estimate:

Number of 20’ or 40’ bays in holds: Depending on hatch and hold length

Number of stacks in holds: Stacks consisting of 4-6 tiers may be possible

Number of stacks on decks: Stacks consisting of 3 tiers may be possible

Number of stacks on hatch covers: Stacks consisting of 2 tiers may be possible

Above figures are indicative for loading option 2[1] and depend on the design options, stack weight, stack VCG, loading condition GM, loading condition Hull Girder Stresses. For the number of bays, sufficient space to be considered for the lashing arrangement and stevedores working space. For the number of tiers on decks and hatch covers, the IMO visibility requirements are to be taken into account.

ATTENTION – HIGH GM VALUES AND IMPACT

Loading of containers in bulkers will result in a Loading Condition with smaller DWT compared to the maximum one. Therefore the loading condition will have a draught similar to the ballast condition draught (ballast water will be needed too). This will result in a high GM value. The higher GM value, the bigger acceleration in CSM/IMO tables in Roll motion -> caution to cargo tipping.

It is advised that prior any lashing/securing calculation, to simulate the intended voyage for assessing the loading condition GM value. GM can be > 6m for a bulker (even abt 13m for cape size bulker in ballast draught). A quick and first approach will be to consider the GM value of the light ballast condition

1 see page 9

2.3. WHAT ABOUT DANGEROUS GOODS INSIDE THE CONTAINERS?

ATTENTION

According to SOLAS II.2/10.7.1, whereby, as required and for ships > 2000 GT, with or without Dangerous Goods, for carrying packaged cargo inside cargo holds, cargo holds shall be protected by a Fixed fire-extinguishing system.

For carriage of packaged Dangerous Goods, we address the following:

1. For studying your Bulk Carrier (and available equipment), refer to SOLAS II-2, Reg.19 that shall be satisfied (same in BV Rules NR467, Part C, Ch 4, Sect 12). More particular, refer to Tables 19.1 and 19.3 of SOLAS (i.e. containers shall be considered as “packaged goods”),

2. For stowage / exact location of the Dangerous Goods on board the ship, IMDG code applies (out of Class scope)

3. Attention to be paid to dangerous goods segregation requirements, IMDG code applies (out of Class scope)

Assuming that the bulk carrier has a Document of Compliance (DoC) for carrying Dangerous Goods, then this carriage of Dangerous Goods shall be in compliance with the available/allowed list of dangerous goods (for packaged goods).

In the case the ship does not have a DoC for carrying Dangerous Goods, then a BV Surveyor should verify on board the relevant vessel characteristics, to process the data in the BV Software for Dangerous goods and issue the relevant DoC and associated list of dangerous goods (packaged goods).

Even with ships equipped with a DoC, BV Surveyor attendance and verification will be needed if new equipment is to be installed in order to include new classes of dangerous goods (packaged goods) in the available ones.

We would suggest owner to run a simulation for issuance of a DOC Dangerous Good within BV VDGB Software in order to see which categories of cargo can be loaded and which equipment is missing.

4. Medicines and equipment according to the MFAG (Medical First Aid Guide for Use in Accidents Involving Dangerous Goods) are to be available onboard, in accordance with SOLAS Regulation VII/2.4.

5. The latest edition of the IMDG Code and the MFAG are to be available onboard.

2.4. IS THERE ANY BV NOTATION TO REFLECT THIS OPERATION?

In case of following the option 2 (detailed hereafter), then it is possible your bulk carrier to be assigned with BV additional service feature “equipped for carriage of containers”.

In many ways, we are going back to the future, as general cargo and multi-purpose ships have always been able to carry containers. In the context of today’s market demands, the capacity to move containers in bulk carriers is a key advantage. With our guidance, we wish to ensure that modern analysis tools and techniques can be applied to support safety as well as modern operational efficiency.

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CU. CAP.
30.480 KG
67.200 LB
2.220 KG
4.890 LB
28.260 KG
62.310 LB

3. TWO OPTIONS – LOADING OF CONTAINERS ON CARGO HOLDS/DECKS/HATCH COVERS

3.1. OPTION 1

3.1.1. Containers bay to be handled as a solid piece of cargo – CSS code

The first option is considering containers as solid piece of cargo (i.e. this option is only valid for containers in cargo holds, as opposed to containers on deck or hatch covers). In general, ship's officers are to follow the instructions in the approved Cargo Securing Manual and perform the operation under the Master's responsibility. Class involvement is needed only if new fixed securing devices are added on the vessel's structure. The following are the main points to be considered for this operation:

1. Ship shall be equipped with an appropriate & approved Cargo Securing Manual (CSM - including Annex 1). Master and person in charge of cargo operations must be familiar with the CSM.

2. Appropriate lashing and contact elements/spacers in between containers stacks to "ensure" that the container bay is to behave as a solid piece of cargo i.e. no relative motion between containers stacks.

3. Uniform strength of inner bottom/deck/hatch covers to be respected (e.g. placing wooden dunnage below containers of appropriate hardness to generate uniform load distribution).

4. "Cargo" securing/lashing to be calculated/ assessed by ship's officers' as per the guidelines and methodology of the approved CSM.

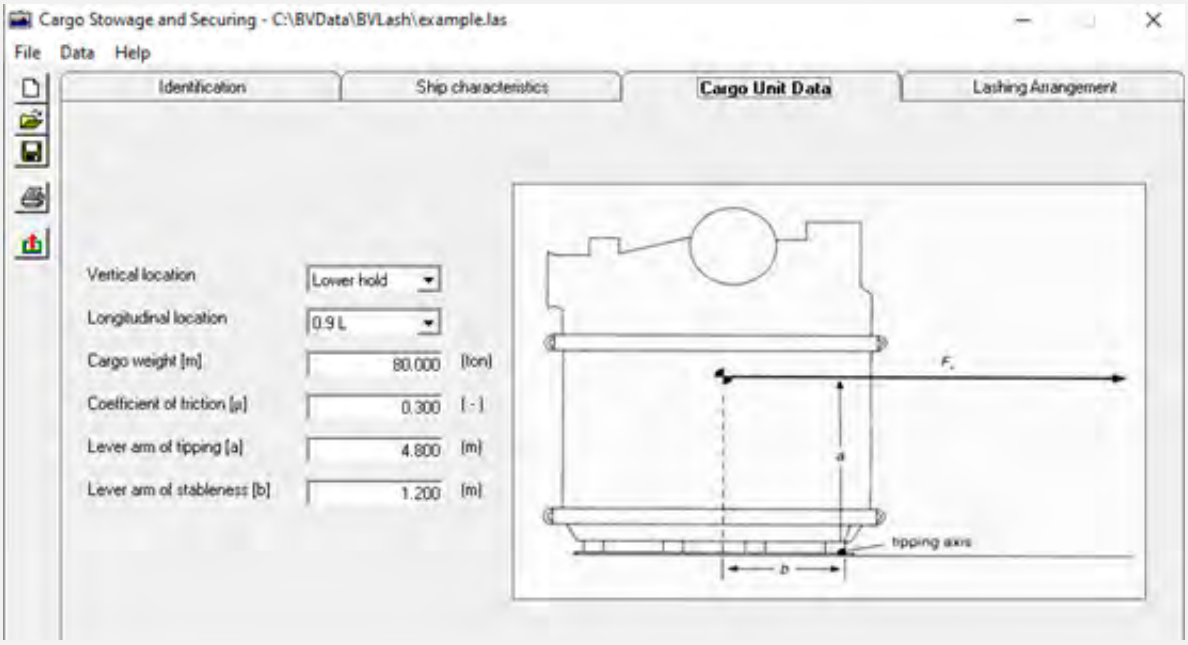
5. Fixed securing devices (pad eyes) will have to be fitted in Cargo holds/deck/hatch covers.

6. All fixed and portable securing devices to be of appropriate capacity as concluded by calculations to be done according to the approved CSM guidelines. . Sufficient quantity of reserve fittings to be available on-board.

7. It is always good practice to place the heaviest containers of a stack at lower positions & light containers at higher/top positions.

8. Cargo holds «cargo mass curves» to be respected – normally will be ok.

EXAMPLE OF CARGO STORAGE AND SECURING



The “BVLash” software is available and can be used to calculate lashing as per CSS code.

3.1.2. Bureau Veritas involvement

If new fixed pad eyes are to be fitted onboard for securing this cargo, class review is needed to check the supporting structure under the SWL of these fittings. Relevant drawings to be submitted to BV for review.

3.2. OPTION 2

3.2.1. Containers bay to be secured in Cargo Holds/Deck/Hatch Covers by using appropriate (new) arrangement of fixed & portable containers’ securing equipment.

For cases where the container intake needs to be maximized, owners may consider installing specialized container securing equipment that will be able to handle higher stacks and container “blocks”. In such cases, the arrangement will resemble more the relevant arrangements existing in specialized containerships or General cargo vessels and several issues need to be addressed as follows:

1. Containers bottom pockets and pad eyes will have to be fitted in cargo holds/deck/HCs.

2. By not having the contribution of Cell Guides in holds (as it is the case for container ships), the containers stacks “behave” independently and only under the stack lashing effect.

The max stack weight inside cargo holds depends on

a) The strength of the supporting (existing & new) structure of the new fixed container equipment. The use of appropriate steel structure (H-Beams) on top of inner bottom may be an option for integrating the fixed securing equipment.

b) Strength of lashing and securing equipment.

c) Own strength/capacity of containers (under racking forces, corner loads etc).

3. The maximum stack weight on H/C depends mainly on the local strength of Hatch Covers. New structure integrating the fixed securing equipment will be needed on top of Hatch Covers. The number of tiers is restricted by the IMO visibility requirements.

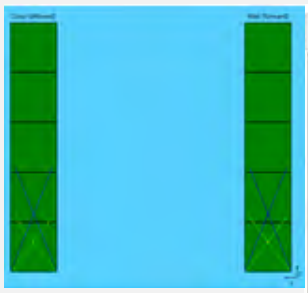
4. The maximum stack weight on the main deck depends on its local strength. When designing the new arrangement for the fixed equipment attention is to be paid to the high Hull Girder Stresses (HGS) that are superimposed to the stress due to local loads (deck area is highly stressed by HGS).

3.2.2. How to start analysis for points 2,3 and 4?

1. It is advised to simulate the intended voyage for GM assessment prior to any lashing/securing calculation. GM can be > 6m (even abt 13m for cape size bulker in ballast draught)

2. BV rules NR 625 and VeriSTAR LASHING software are the optimum tools to assess the maximum stack weight based on B.1.2 & B1.3 & B1.4. After defining the max stack weight the resultant reaction forces will be the input to design the supporting structure (new and existing) of the fixed equipment.

BV VERISTAR LASHING SOFTWARE - COMPLEX CONTAINER LASHING



Summary | Displacements | Lashing forces | Twistlock forces | Corner loads | Rac

Load case	Door			Wall		
	Vertical reaction (kN)		Horizontal reaction (kN)	Vertical reaction (kN)		Horizontal reaction (kN)
	Left	Right		Left	Right	
LC1 Min	286	286	0	314	314	53
LC1 Max	81	81	0	54	54	-53
LC2 Min	592	-4	42	639	-32	87
LC2 Max	-31	577	48	-82	593	88
LC3 Min	587	-21	48	598	-73	87
LC3 Max	-4	596	45	-43	628	87
LC4 Min	183	7	9	185	5	9
LC4 Max	239	415	9	237	415	8

3. BV can assist in calculating the maximum stack weight and reaction forces that are needed for the design office to design the new structural elements and to evaluate the strength of the supporting structure (existing and new). This will be at intermediate stage of design, before the final submittal.

4. BV has simulated various scenarios for different sizes of bulkers. This exercise has shown that a stack of 4-6 containers could be possible inside cargo holds by applying internal lashing to bottom 2nd tier & bottom 3rd tier. These figures are for reference, since the design variables could change the final arrangement. Twist locks at every level are also fitted. As an example and in order to get an idea of the stack reaction forces' level, for an assumed 5tier stack of 75tons & GM=7.m, the max stack reactions (Roll motion) are of the level of 639 kN (see table above – VeriSTAR Lashing).

5. The local stresses from containers' reactions of deck & inner bottom longitudinal stiffeners are to be combined with the Hull Girder Stresses. Normally, the loading condition will be in Hogging Still Water Bending Moment.

3.2.3. What needs to be submitted for review?

- Container Stowage and Lashing Plan (for review)

- Structural drawings of new structural elements for the fixed securing equipment for Cargo Holds/Deck/Hatch Covers (for review)

- We recommend two Loading conditions with containers as cargo (departure & arrival) to be prepared and submitted for review in order to satisfy possible request for same by port authorities

- Addendum to CSM to include the arrangement of new fixed securing devices, and required information (CSS code) for all new fixed and portable securing devices.

- Loading Software – Shall be updated and submitted for review in the following two cases:

1. Bulk Carriers with reduced freeboard B-60, to be updated for including the new damage stability Minimum GM Curve as per SOLAS II-1 Part B probabilistic damage, and the new windage area.

2. Bulk Carriers with freeboard type B, to be updated for including the new (bigger) windage area, if this is the case.

In other than the above two cases (i.e. no containers and/or cargo on deck), the existing Loading Software could be kept and used as follows:

The weight of each container bay applies two forces on the ship at the fore and aft locations of each bay (cargo is not uniform). Then, an accurate simulation of this cargo/container bay would be:

Weight of container bay

Each bay is resting on 2 x-locations -> divide the static bay weight by two -> apply concentrated weight corresponding to half the bay weight at x-location of fore/aft of the bay.

Transverse center of gravity of Container Bay

If the bay weights are not symmetrical in terms of x-z plane (CL plane) – the above mentioned weight/force may have a TCG different than zero.

Vertical Center of Gravity of Container Bay

Proper VCG of the bay has also to be calculated and introduced in the Loading Instrument.

By using this way to introduce the container bays weights in holds/deck/hatch covers the following checks can be made using the Loading Instrument:

• Stability and Longitudinal Strength

A very accurate calculation of stability and longitudinal strength of the intended voyage can be performed.

• Longitudinal Strength after flooding

For longitudinal strength after damage calculation, since the containers weights will be represented in the loading instrument as concentrated weights (and no volume is occupied by them in cargo holds), the flooding water volume will enter in the cargo holds in this calculation will be more conservative and therefore this calculation will be on the "safe side".

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