Container Vessel Operations

Introduction – Industry Beginnings

- **Container Shipping is relatively young industry.**

- **Up until 1956 all cargo was carried on General Cargo Ships:**

Issues with General Cargo Handling

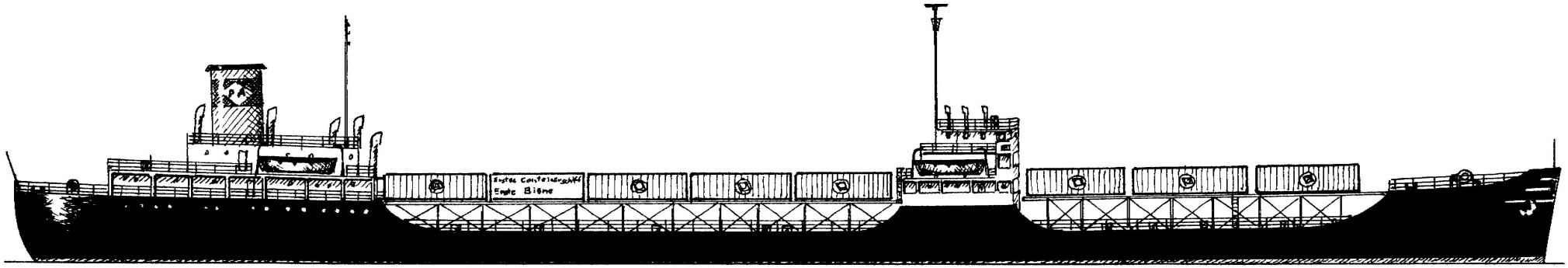
- **Cargo Operations were very slow**
- **Vessels port for days or weeks**
- **Very labour intensive**
- **Cargo easily stolen/damaged**
- **Still has to be handled to final destination**

So what was the solution?

Containerisation - 1956

- **In 1956, Malcolm McClean conceived the idea of Containers.**

- **The first vessel was the converted tanker Ideal-X:**



- **Now cargo could be “commoditized” into standard sized, steel boxes.**

- **Result: Faster Operations, Less Theft of Cargo, Cargo ”door to door”**

Basic Concepts

The two basic types of container are 20ft and 40ft.

20ft = 1 TEU

40ft = 2 TEU

TEU = Twenty Foot Equivalent Unit

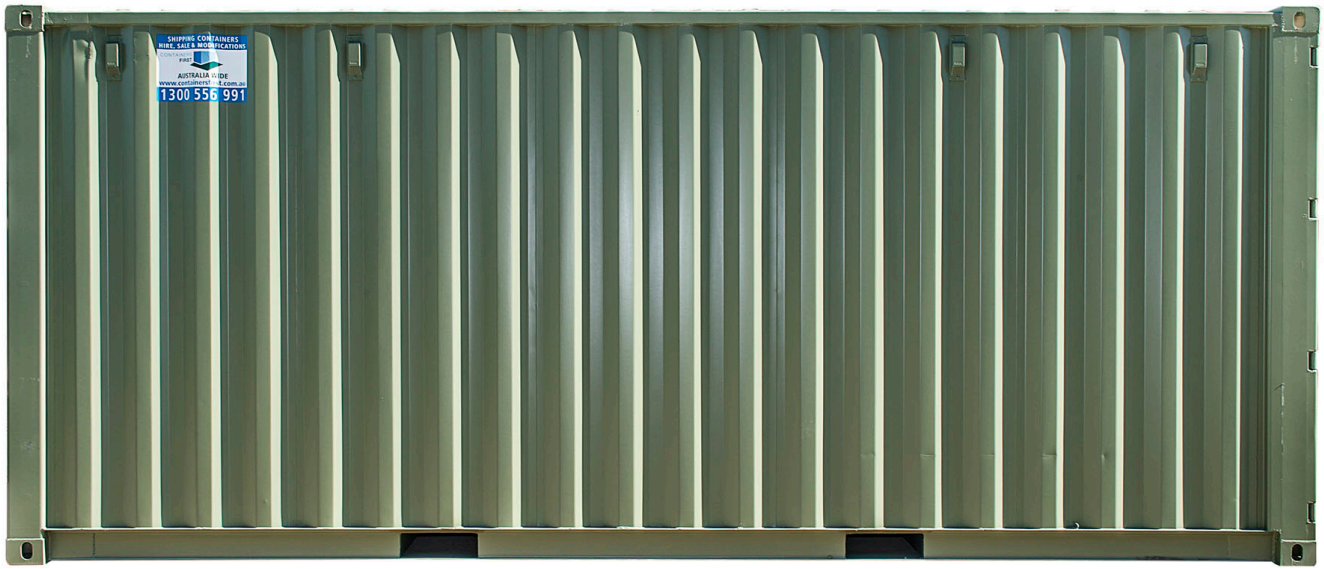
There are many different types of container other than the two basic designs:

45ft Containers
40ft High Cube
20ft Reefer
40ft Reefer
40ft HC Reefer
40ft FlatRack
40ft Platform
20ft Tanks
40ft Tanks
53ft Containers
20ft Open Top
40ft Open Top

These are just some examples.

Containerisation - 2018

Just to put things into perspective……



Standard 20 foot container

You

Containerisation - 2018

Just to put things into perspective……

Standard 20 foot container

You

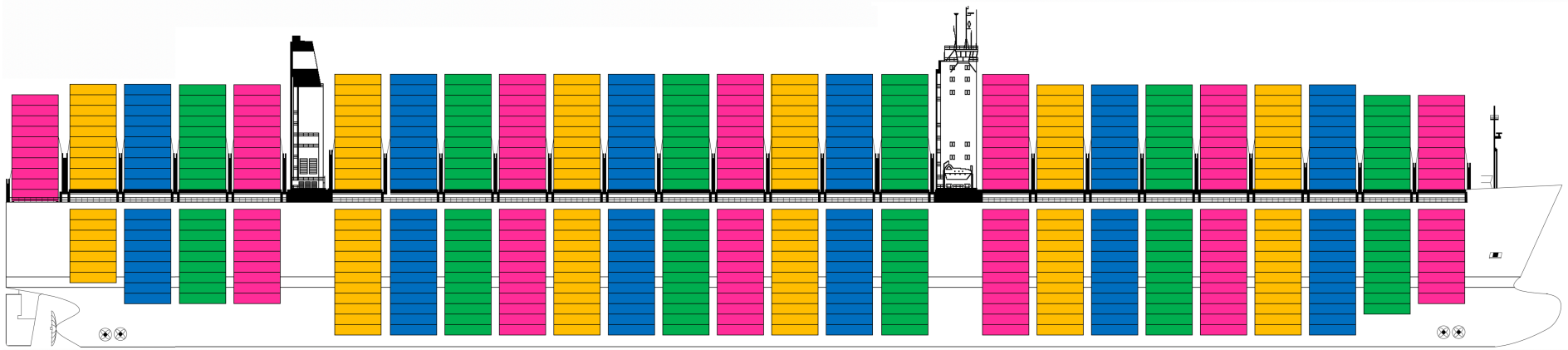
Ideal-X

21,000 TEU Vessel – 400m Length

Containerisation

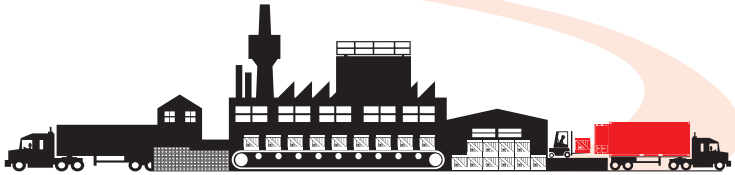
What a vessel looks like to you….

What a vessel looks like to a stowage planner….



Current Logistics Flow

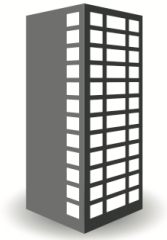
Container Depot



Shipper

Freight Forwarder

Shipping Agent

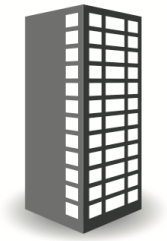


Stowage Planning

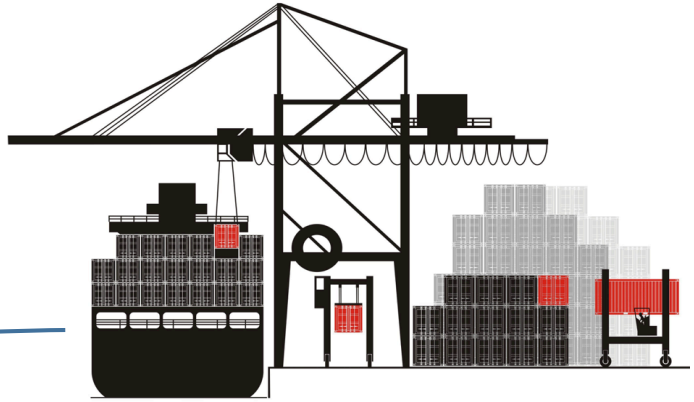
Terminal Planning

Vessel Operations

Vessel Operations At Sea

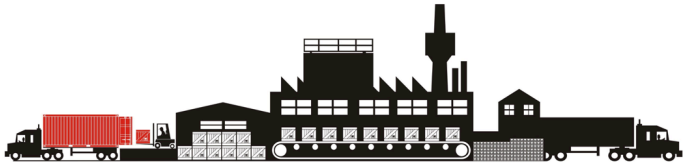


Stowage Planning



Vessel Operations

Terminal Planning

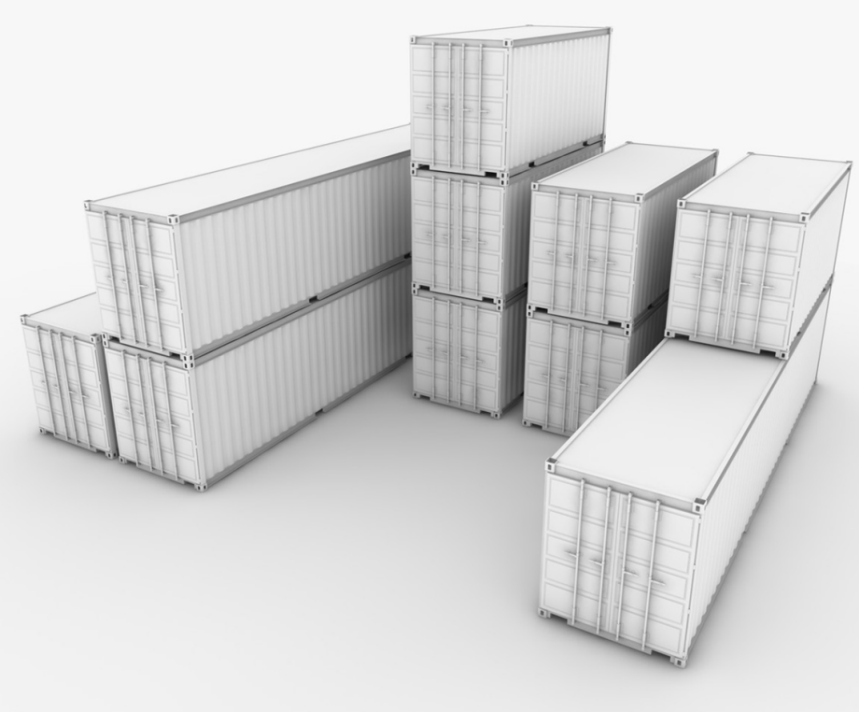


Shipping Agent

Cargo Recipient

So, what is Container Stowage?

Very Simply…



&

Lots of these…….

on one of these!

What is Stowage?

Stowage is like a jigsaw puzzle – except there is no single end result

There are many considerations when stowing a vessel, there are also many possible stowage outcomes. None of them are either totally right or wrong, good or bad. It's all about keeping options open and retaining flexibility……

Stowage Priorities

Safety

- **Vessel Stability**
  - GM, Torsion, Bending Moments, Shear Force
- **Cargo**
  - lashing forces, windstacks, stackweights
- **Special cargo stowage**
  - safely stowed, accessible by ships staff (IMO, Reefer, BBLK, OOG)
- **Ballast and draft considerations**
  - seaworthy sailing condition, within port draft limits, air draft considerations

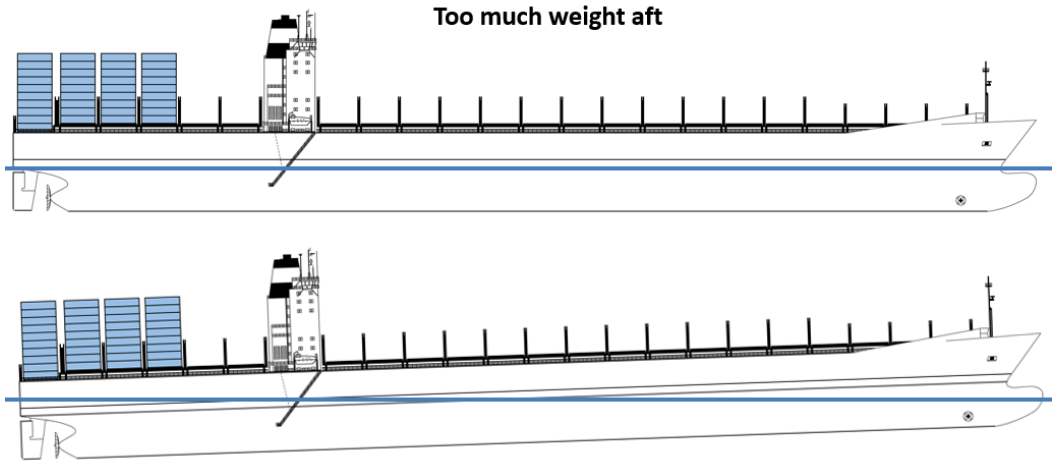
Flexibility

- **CraneSplit**
  - in current and future ports
- **Ports**
  - requirements and restrictions
- **Service**
  - requirements and restrictions
- **Vessel**
  - requirements and restrictions

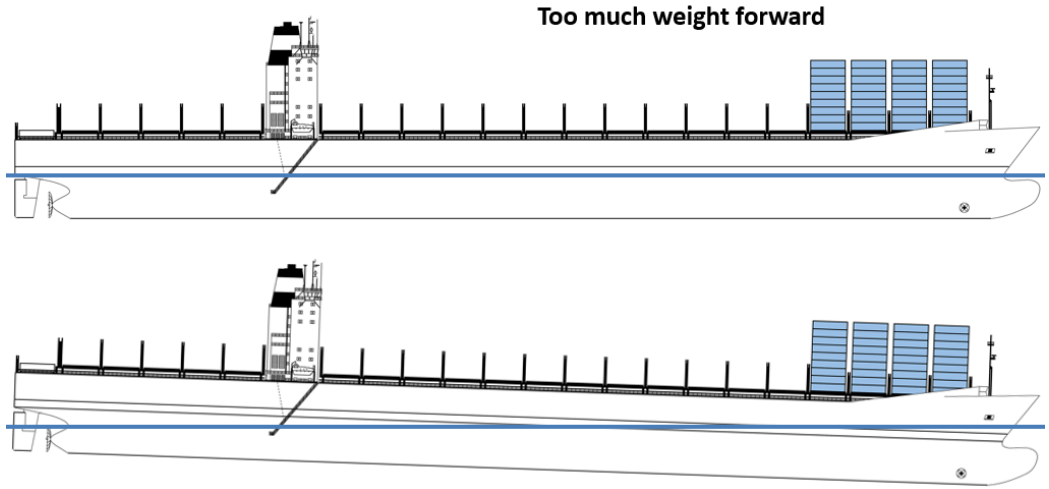
Productivity

- **Terminal**
  - restrictions, requirements and capabilities
- **Learning's**
  - from Terminal Partnering Project
- **Reductions**
  - in restows, low moves bays, hatch cover moves
- **Increase**
  - in CraneSplit, Twinlifting and Dual Cycling

Basic Concepts – Stability (Weight Distribution)

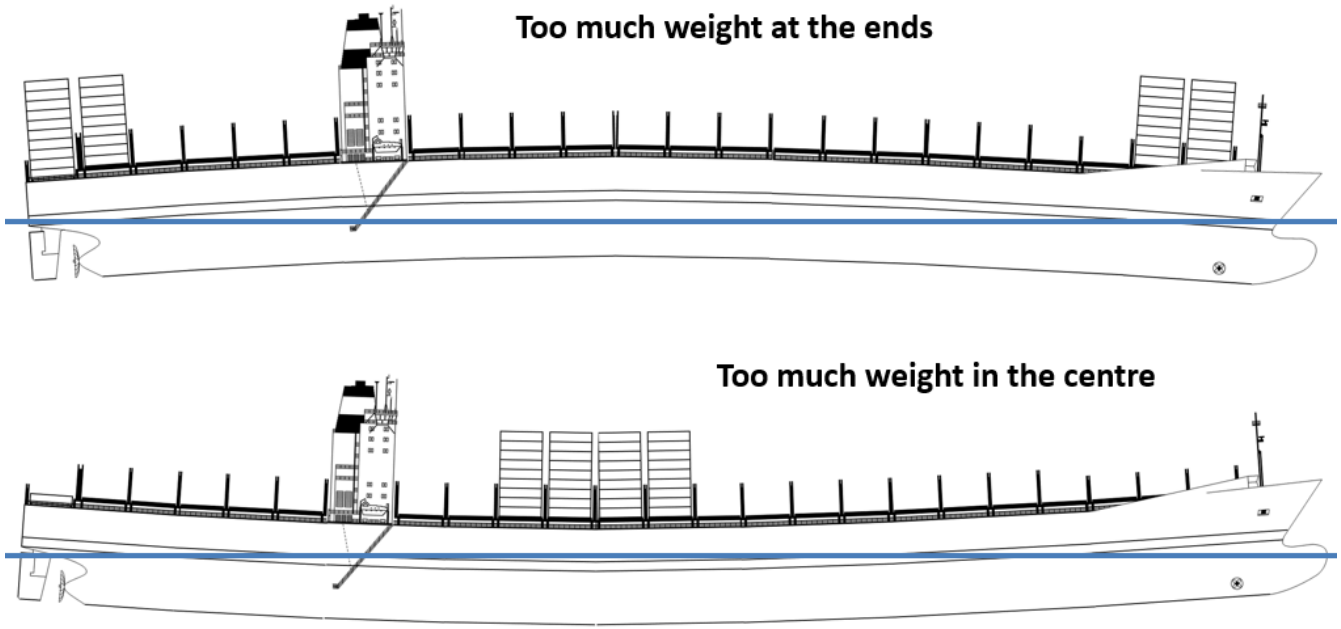


Too much aft trim will increase the friction on the vessel caused by the stern being in the water. This will increase fuel consumption.



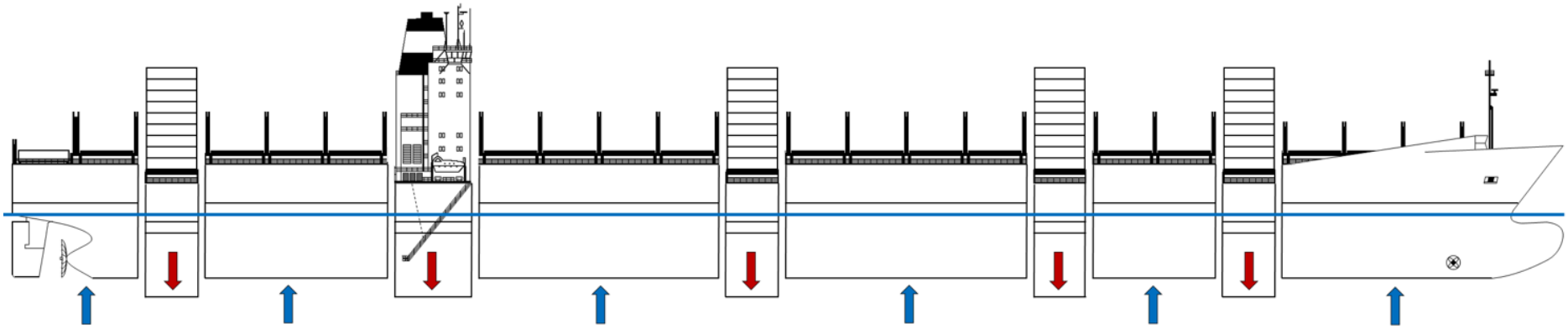
When there is too much trim forward, the rudder and propeller may not be sufficiently submerged. Particularly at low speeds, it will be difficult to control the vessel.

Basic Concepts – Stability (Weight Distribution)



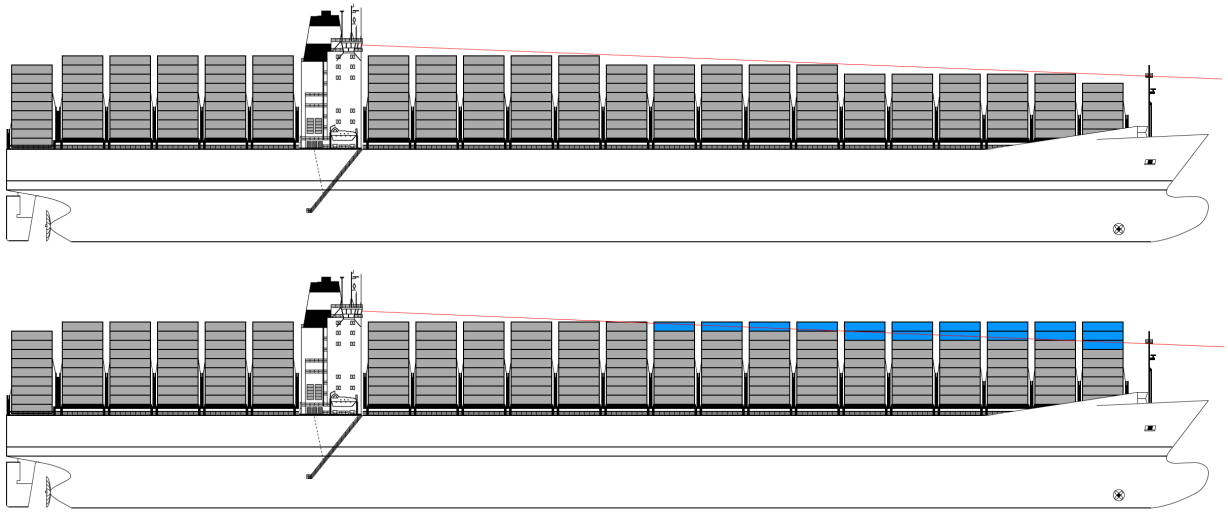
Bending or hogging the vessel will, over time, reduce the structural integrity of the vessel. Evenly balanced weights from forward to aft will avoid this issue.

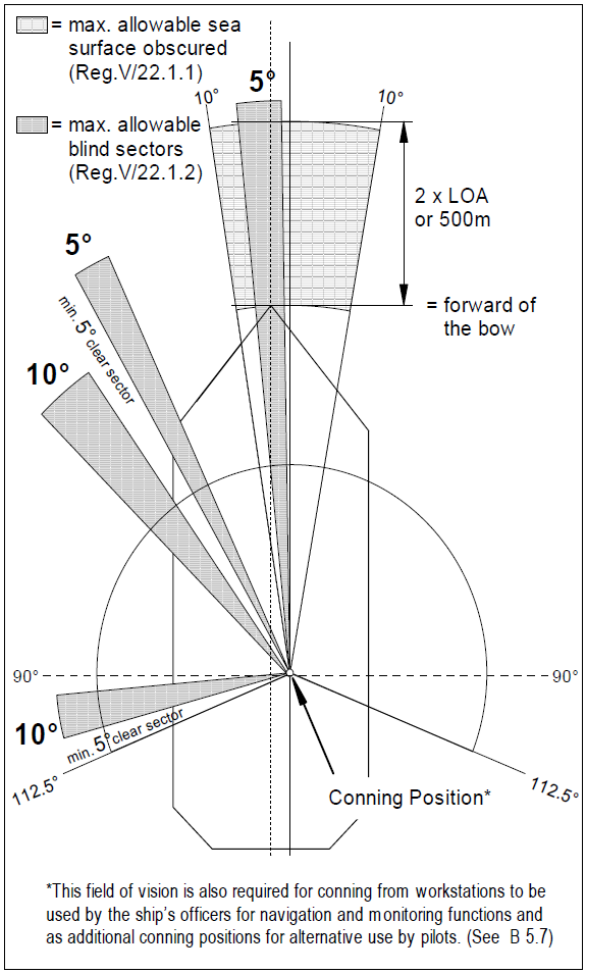
Basic Concepts – Stability (Shear Force)



Shear force is caused by the weight of the cargo pushing down and the buoyancy of the vessel pushing up in the empty bays of the vessel. This is similar to the problem of bending but it is calculated over more specific areas of the vessel length (at each frame).

Basic Concepts – Line of Sight



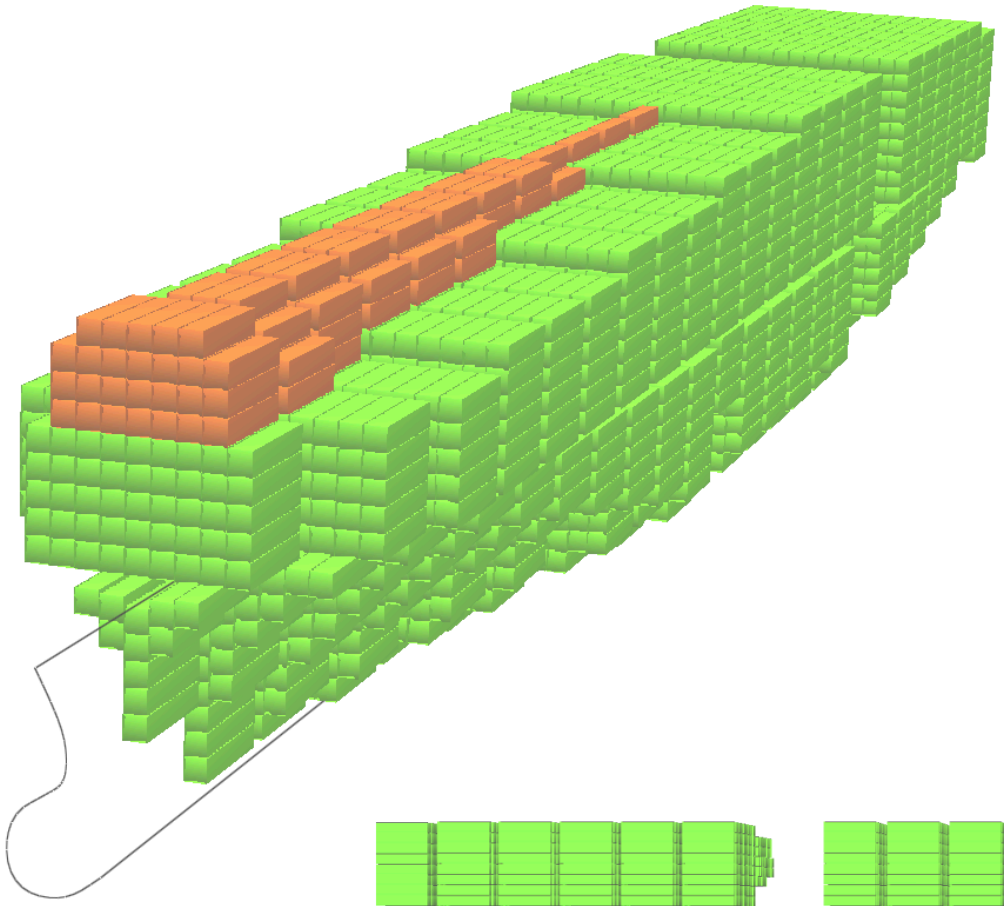


The SOLAS line of sight rules state that:

"The view of the sea surface from the bridge shall not be obscured by more than two ship lengths, or 500m, whichever is less"

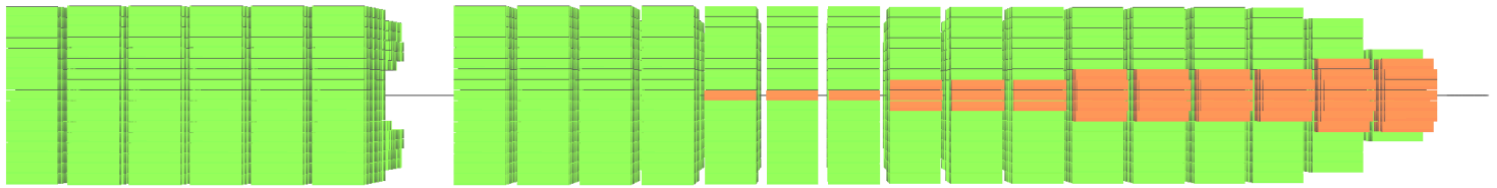
These rules were written at a time when vessels were much smaller than today. For the majority of vessels that are stowed on the Asia – Europe trade today, the 500m rule applies.

Basic Concepts – Line of Sight



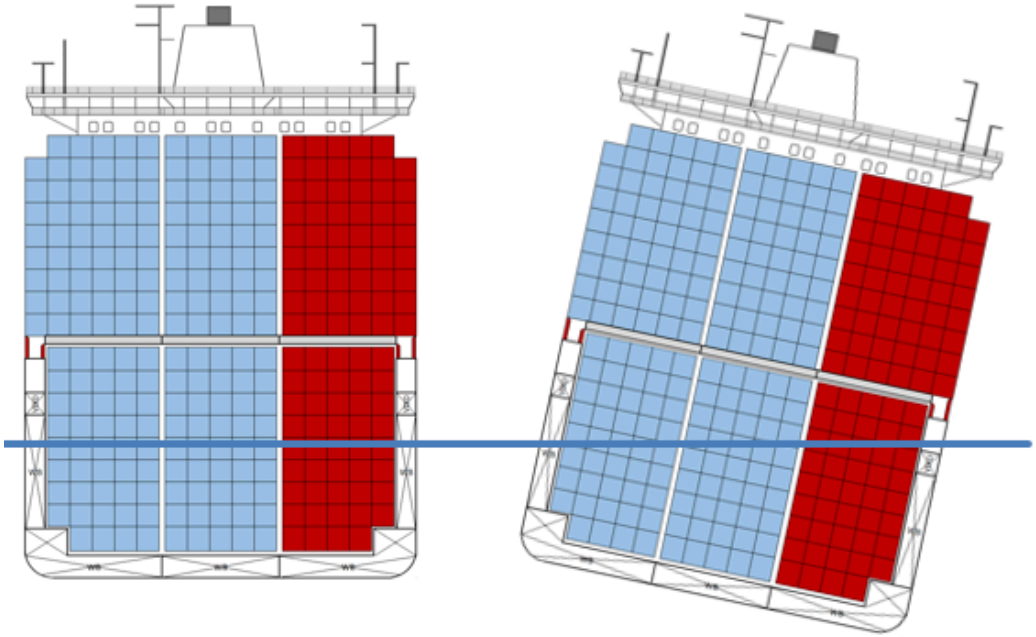
However, the rules are not as clear cut as they first appear. It is possible to load containers above the line of sight, without contravening the rules, so long as the total blind sector (when viewed from the bridge) does not exceed 10° within an arc of 10° either side of the centerline. Each individual blind sector within that arc must not exceed 5° and there must be a gap of 5° in between in the blind sectors.

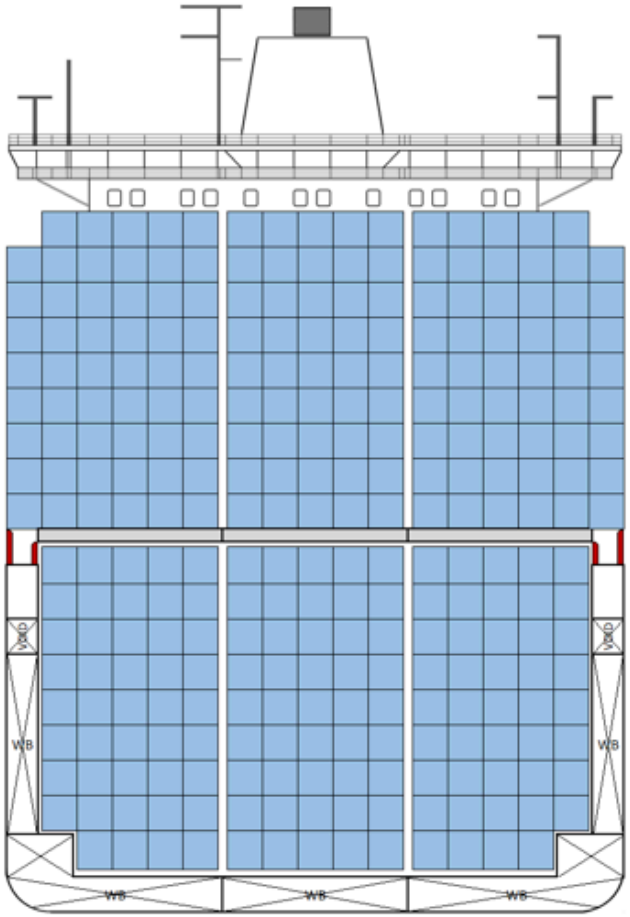
In practice, what this means for a line is that they can make use of so-called pyramid stowage on the forward bays. That is to load containers above the line of sight but within the allowable blind sectors.



Basic Concepts - Stability

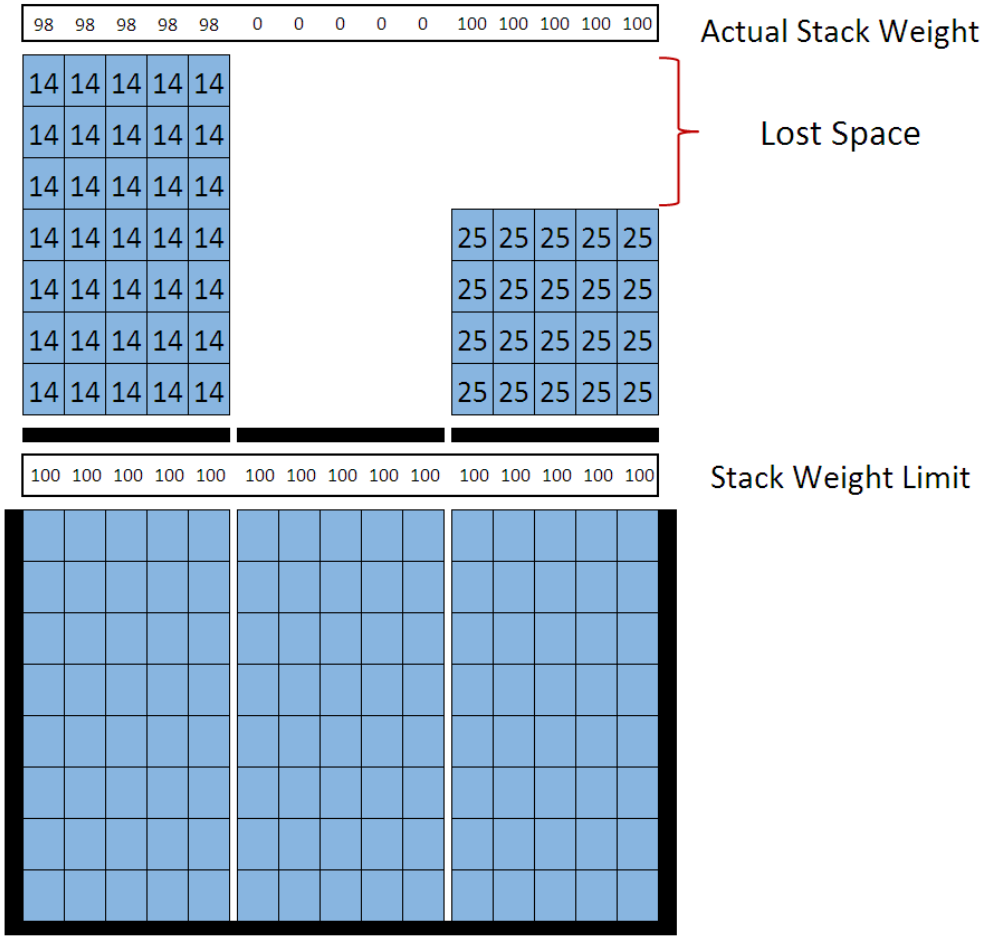
In an ideal world, all the containers would be of equal weight and spread evenly across the vessel





Basic Concepts – Stack Weight Limits

Vessel has 100mt stackweight limit on deck. Therefore, fewer heavy containers can be loaded before the stackweight limit is reached on deck.



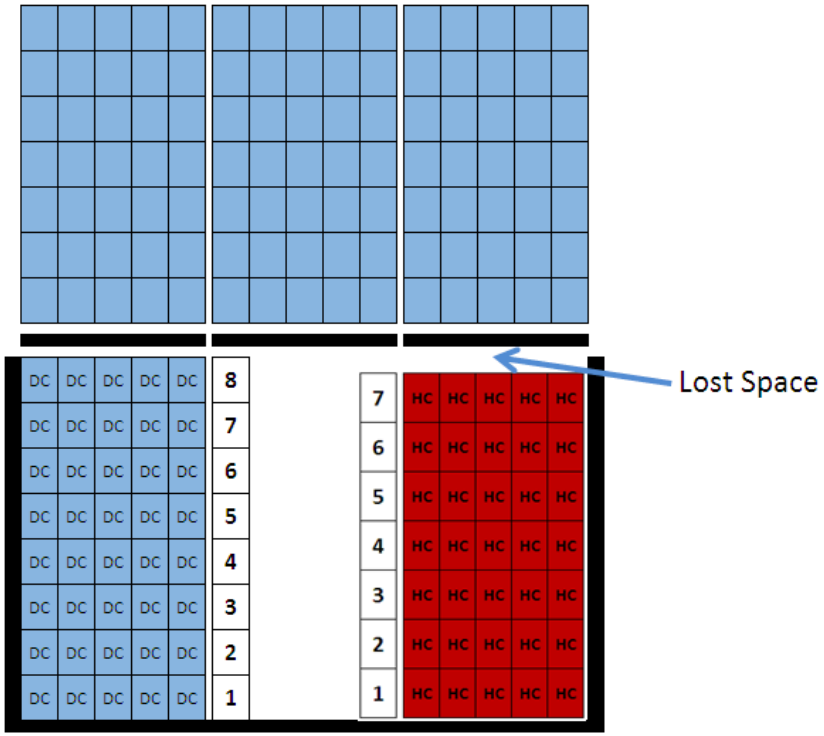
When looking at ways to maximise the vessel intake, it is also important to make best use of the individual stackweights. Underdeck stackweights are generally higher than on deck due to the additional strength that the tank-top is designed with.

Hatch-covers generally have lower stackweight limits as they lack this additional structural strength. The reason for this is that although hatch-covers have to be strong enough to support the weight of the containers loaded on to them, they also have to be light enough for a gantry crane to lift them.

Heavy units are usually preferred below deck. Firstly to take advantage of the stackweight but also because heavy units underdeck will help maintain the vessel GM.

Basic Concepts – Stack Weight Limits

When loading high cubes underdeck, vessel can only go 7 tiers high. When loading only DC's, vessel can go 8 high. In this example, 10 TEU lost due to high cubes.



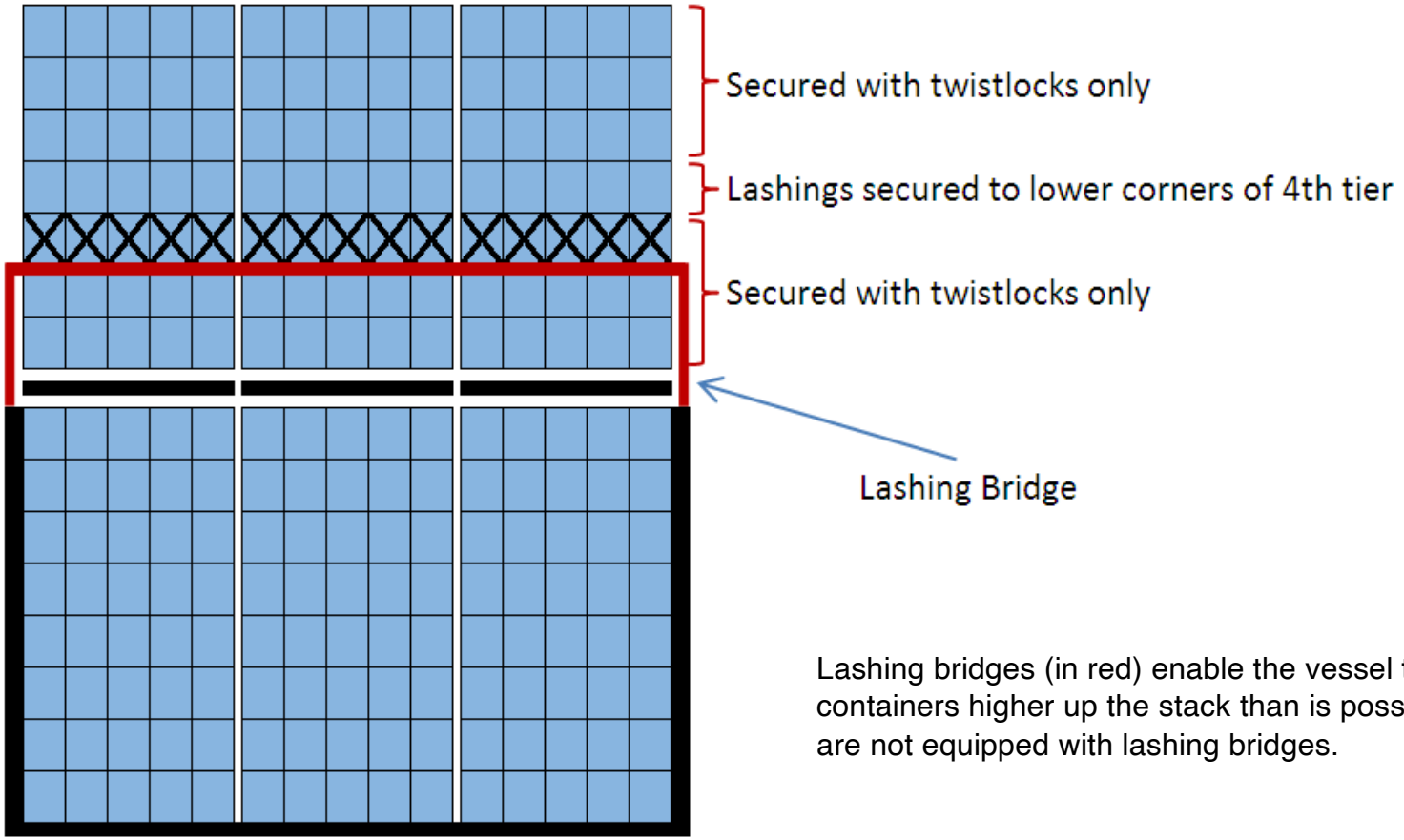
In the same way that stackweight can affect a vessel intake, stack height also plays an important role. When loading high cubes in a bay, most vessels will lose the top tier because they are generally designed around a container height of 8' 6". Some vessels are capable of taking a specific number of high cubes underdeck without slot loss.

When stowing HC's below deck, it is preferable to only stow a number of them per stack that will not result in loss of slots. Due to the nature of the cargo mix, this is not always possible.

On deck, the issue of stack height still plays a part, especially on the forward bays of the vessel. Too many high cubes in a forward stack can result in lost slots due to exceeding the SOLAS Line of Sight regulations.

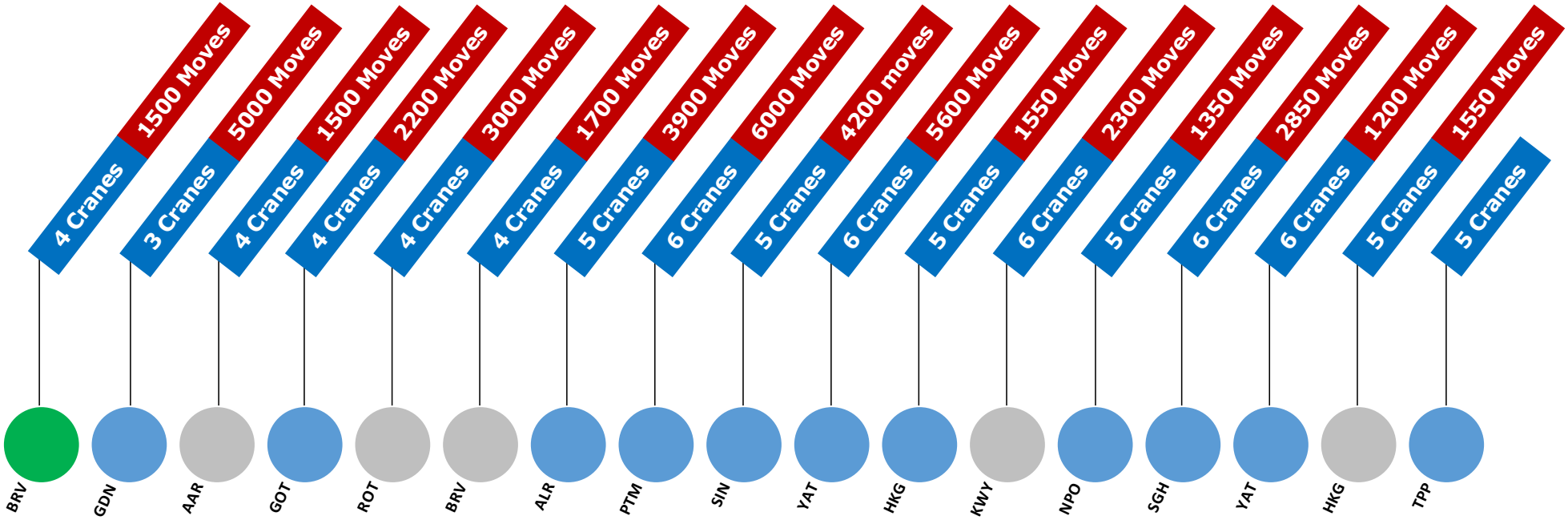
Basic Concepts – Container Lashing

Only the 4th Tier containers have lashing bars attached. All other tiers are using twistlocks only. The height of the lashings is dependent on the height of the lashing bridge.



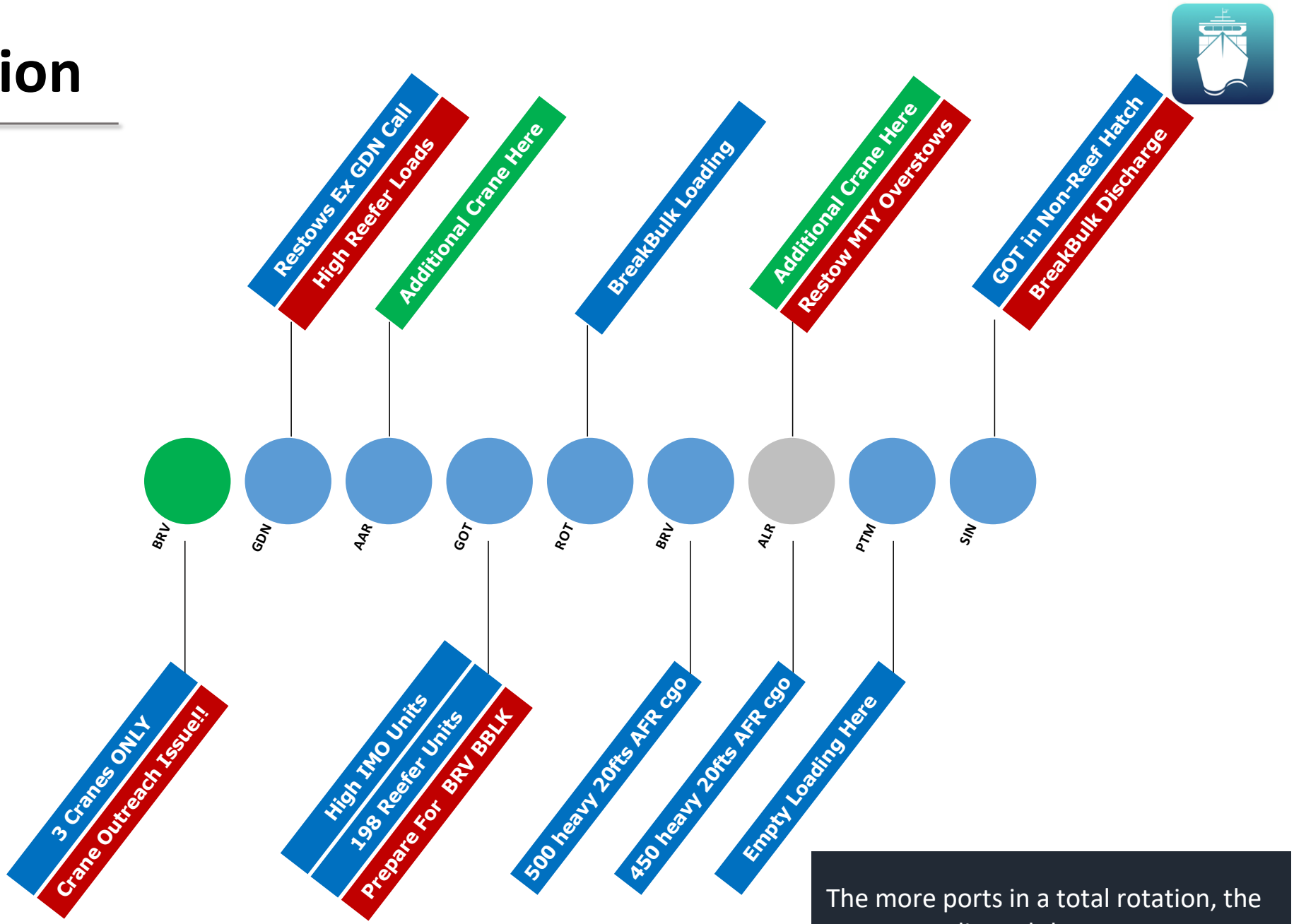
Lashing bridges (in red) enable the vessel to fix lashing bars to containers higher up the stack than is possible on older vessels that are not equipped with lashing bridges.

Basic Concepts – Service



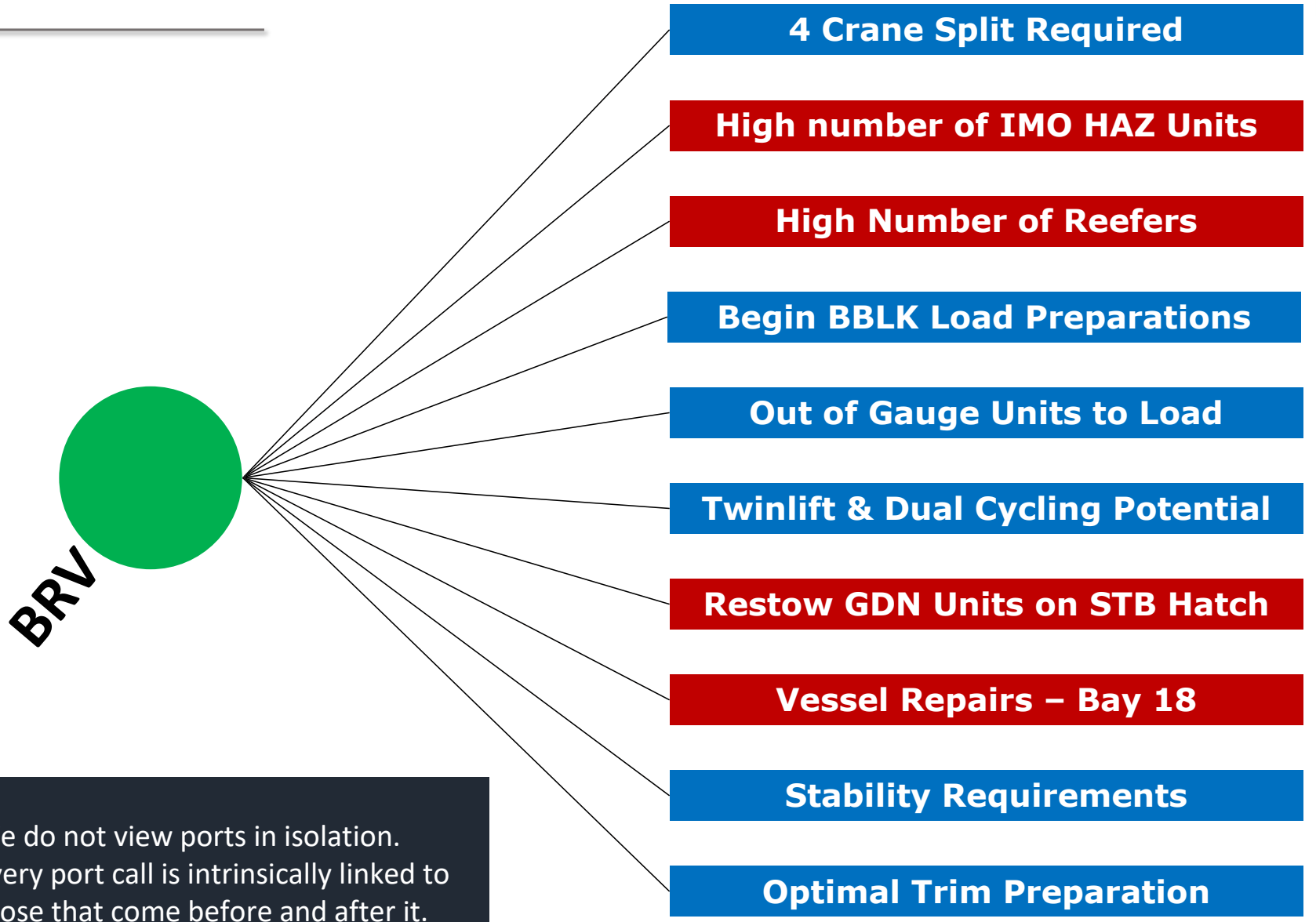
What may not make sense from a vessel perspective can make perfect sense from an overall service perspective

Region



The more ports in a total rotation, the more complicated the stowage gets.

Port Level

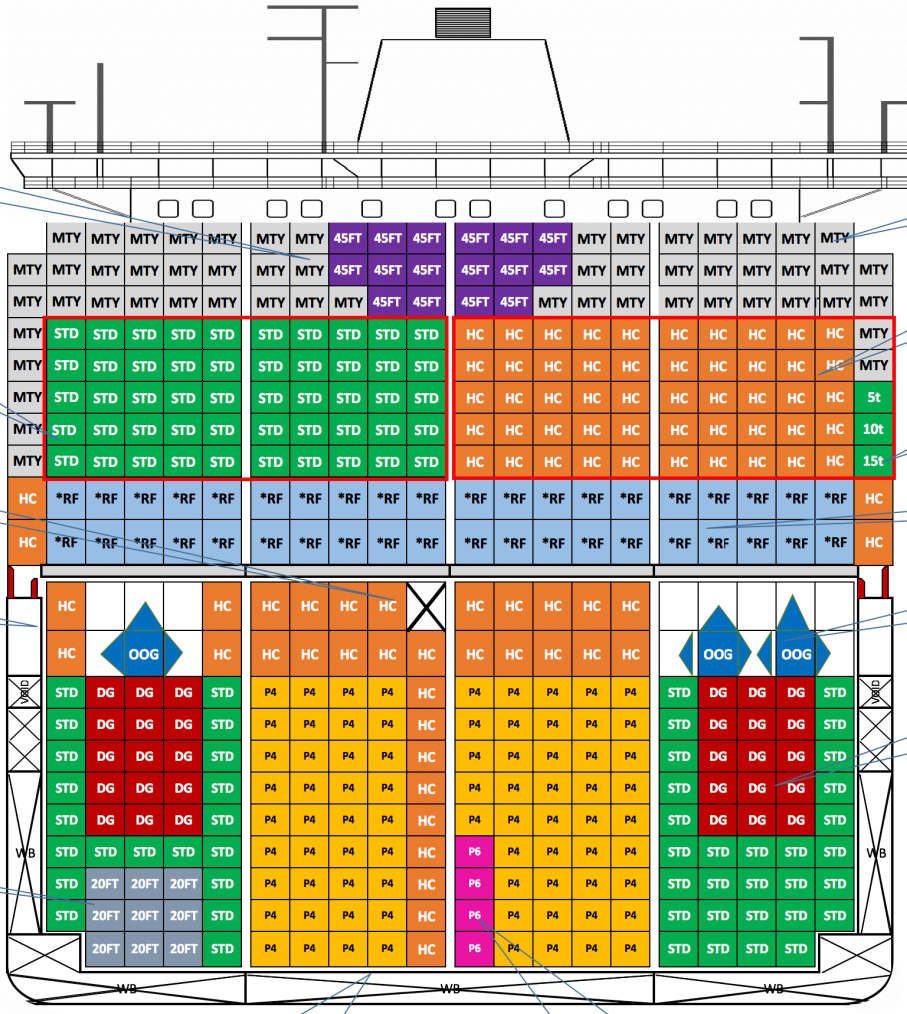


We do not view ports in isolation. Every port call is intrinsically linked to those that come before and after it.

Stowage Considerations

General	Terminal	Vessel	Cargo	Cargo Cont'd	Stability
• Crane Intensity • Restows • Restow costs per port • Overstows • Port of loading • Port(s) of discharge • Change of destinations • Reefer allocation	• Crane height limits • Crane reach ability • Crane lift capacities • Twin lift capability • Dual cycling ability • Tandem hoisting • Dual hoist capability • Gantrying of cranes • Crane repairs • Crane breakdowns • Boom up/down over accommodation • Crane productities (Single, TL, DC etc) • Manhattan Towers • Low move bays • Hatchcover moves	• Russian stowage • Reefer bays • Document of compliance • Vessel restrictions (temp. or permanent) • Vessel repairs • Stack weight limits • Stack height limits • Onboard cranes • Bottom space availability	**IMO -** • 9 UN Classes • 3468 UN Numbers • Class 1 – Explosives • Class 2 – Gases (2.1 flammable, 2.2 non-flammable, non-toxic, 2.3 toxic) • Class 3 – Flammable Liquids • Class 4 – Flammable Solids (4.1, 4.2, 4.3) • Class 5 – Oxidizing substances and organic peroxides • Class 6 – Toxic and infectious substances • Class 7 – Radioactive substances • Class 8 – Corrosive substances • Class 9 – Miscellaneous substances • Specific segregation requirements • Maersk Line in-house rules	**OOG –** • Over height • Over width • Over length • Weight • Lifting requirements • Protection required • Stowage restrictions **BBLK –** • Vessel restrictions • Gantry or floating crane • Size and weight restrictions • POL and POD restrictions • Floating crane costs • Impact on cranesplit • BBLK should never be restowed • BBLK should never be on top of live reefers	• GM (vessel stability) • Shear Force • Torsion • Bending Moment • Visibility rules • Line of Sight • Windstacks • Lashing forces

Stowage Overview



Questions

Q&A?

Further Reading

www.container-logic.com