FEMAS

The Federation of European Maritime Associations of Surveyors and Consultants

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Ladies and Gentlemen

Allow me to introduce myself; I am Carl van der Avoirt, president of FEMAS (slide 1) The Federation of European Associations of marine surveyors and consultants.

I have the honour and the pleasure of having been invited to take part in a panel about :

Containers Lost at Sea (slide 2)

Parties involved :

- The vessel, its equipment and its crew
- The owners, charterers, freighters and shippers
- The cargo and the suppliers
- The stevedores

slide 3

The subject involves the following issues :

- Sea transport and loads involved
- Securing the cargo in the container
- Securing the container on board
- Rules and regulations

Before you start losing containers you first have to put cargo in the container and than load and secure the container on board the ship.

Already this first action requires giving you a little theory about inertia and accelerations.

So please allow me :

If you accelerate in a car from 0 to 100 km / H in 10 seconds (slide 4 car) your body will be pressed against the back of your seat with a force equal to 28 % of your weight, or 0,28 “g”.

Any transported cargo, will be subjected to various motions caused by the means of transportation, and so will the containers.

Any change in motion of a body, will apply a force on it.

Such loads are expressed as multiples or fractions of “g” (being the earth gravity or gravitation) or in % of the body weight.

This means that an object submitted to 1 “g” is submitted to a force equal to its own weight.

The forces acting on the cargo during sea transport are as follows :

(Slide 5) forces vessel

These forces depend on the position of the cargo on board the ship, and can reach as much as 1 g or 100% of the weight, even in upward direction.

The only force preventing unsecured cargo from moving within the container, is the friction between the cargo and the floor of the container. (f.i. between wood / wood :f =0,4).
So if the force acting on the cargo is 0,8 “g” you must shore an equivalent of 0,4 “g”.
Do not forget that the friction coefficient is a dimensionless figure and thus not influenced by the weight of the cargo itself (otherwise all ski champions would be fat guys)

Slide 6 (sketch forces F & G)

To secure cargo one has to consider the nature and shape of the cargo itself (slide 7).

Securing cargo is however not the theme of this conference. I just wanted to draw your attention to this point, as on loading a ship one has no information on how the cargo has been secured in the container.

SECURING THE CONTAINERS ON BOARD :

TYPES OF VESSELS : (slide 8)

- General cargo ship carrying containers
- Standard open container ship with container cells

The following photo’s of the GOLDEN ISLE are the illustration of a recent multipurpose container vessel of the MACS fleet. She was built in 2003 TDW 30.500 carrying 1900 TEU’s.
Slides 9 & 10

Whatever the type of vessel, only containers on deck and above cells are subject to the risk of falling over board.
In both cases securing means and conditions are identical.

POSSIBLE FAILURES :

There are three possible causes for loss of containers :

slide 11

1. The tilting of the stack
2. Collapsing of the lower container due to corner post overload
3. Racking force on the side of the doors.

sketch slide 12

Tilting :

Under the influence of wind and the rolling of the vessel, a column is subject to tilting. The total force depends on the height of the column, and on the position of the centre of gravity of the total column.
The maximum allowed lifting force on a twistlock is 25 tons, for a breaking load of 50 tons.
Placing “Bridges” on top between 2 adjacent racks can prevent tilting.
The OSHA (occupational safety & health administration) suggests not allowing people to go on top of the containers. This makes the use of bridges impossible.

Collapsing :

The maximum admissible load on the corner post limits the load on top of a container.
A 40’ container is not stronger than a 20’, both having the same corner posts.
The maximum post load is 848 KN. Figure not to be multiplied by 4 as the load is never equally divided over the 4 posts.

Racking :

The weakest part of a container is the rear end fitted with doors, which can lead to racking.
To prevent same one places lashing rods across from corner to corner.
They exist in all shapes and forms.

The next photo is an illustration to show that securing containers is not a job without risks.
photo guy climbing on containers slide 13

I already mentioned wind as a force working on the containers.
Just for information, but GL gives an indication about the wind loads to be taken into consideration (slide .14.)

In a cargo securing manual the calculations are made with winds up to 40 m/sec equals 144 km/h = force 12 Beaufort. (above 117 km/h)

MEANS OF SECURING :

In order to avoid shifting of the containers in a column or stack, twistlocks are placed between each row of containers.

Between stacks of containers there is always an accessible and an inaccessible side.
(slide 15)
On the inaccessible side one places either a stacking cone or better a so-called midlock (slide 16) on the accessible side a manual or semi-automatic twistlock.
(slides 17)

The lack of standardisation has unfortunately resulted in both left-hand and right-hand manual twistlocks. You will easily understand the risk of both types getting mixed on board.
As for the semi-automatic twistlocks the risk is the spring loosing its resilience. It has been found that the movement and flexing of a ship was sufficient to allow such twistlocks to unlock themselves if their spring action fails.

One is now developing a full automatic twistlock inside of which a steel ball will lock if the ship rolls and unlock if the vessel is horizontal.
This will avoid opening twistlocks on discharging of the vessel, thus a gain of time.
The idea itself is great, but I think that if not maintained in perfect condition they might become a source of income for surveyors.

In order to avoid racking, the lower rows are secured by means of lashing rods, also used to secure a second row to deck.
(slide 18) a view of different types of rods

These lashings are however creating pre-stressing, which has to be kept as low as possible.

On deck or on the hatch covers, one uses different types of fittings under which dovetail foundations. Here also standardisation is equal to zero. They make dovetails under an angle of 45° and 55°, large and small. It is easily understandable that mixing will again lead to container losses.
slide 19 sketch and picture

RULES AND REGULATIONS :

The cargo manual has already been mentioned and I only give you an example for two bays in connection with the Metacentric height of the vessel.
This is a general cargo ship also fitted out for carrying containers.

slide 20 = pages 1 & 2 loading manual

The maximum weight distribution is calculated for a minimum and a maximum GM.

GM is the metracentric height (slide 21) from which results the couple of forces bringing the ship upright.
Three important points are M metacentre, G centre of gravity, B centre of buoyancy.
If a vessel rolls the centre of buoyancy will shift from B to B1. The buoyancy force cuts the vertical line in M. GM is the metacentric height.

On the following picture the vessel must have had a negative GM, and as a ship is a lady she tries to show her bottoms !
slide 22 photo from sunk container technics

The GM influences the rolling period of the ship, and thus the forces on the containers.
slide 23 page 4 of the manual
The lower the GM value the longer the rolling period for the same amplitude.

The GM also influences the permissible weights and the number of containers to be loaded.
slides 24 and 25 pages 23 & 62 of manual

This is an example of calculation for bay 29, respectively for a GM = 1,19 m and GM = 5,8 m. You can see that with a high GM containers are not allowed to be stowed on top in the outer stack.

HOW CAN POSSIBLY ANYTHING GO WRONG ?

- Rogue securing equipment
- non respect of the prescriptions
  - influence of wind loads
  - effect of lashing rods
- The stowage plan made by the charterers
- Building ships with low GRT
- Time Pressure

slide 26

Following pictures are illustrating the facts that things do go wrong. It concerns a case of container losses on a French vessel in which three court surveyors were appointed.
M/V SHERBRO from Dunkerque.
During investigation it was noted that :

Only 10 % of the containers had the exact indicated weight
all the others were having overload up to 25 %.

And this is the result.
slide 27 photo's Pierre

Rogue equipment :

Apparently, the human nature of stevedores means that they will use the first item of equipment which comes to hand, be it “rogue” or damaged, without due consideration to its suitability. The following pictures show the situation on the above mentioned vessel.
(slides 28 photos pierre)

Non respect of prescriptions :

Wind loads
Lashing rod effect
Repartition of weights the heaviest containers below.

(slide 29 & 30 pages 122 & 124 of the manual)

A total stack of 50 tons does not necessarily mean 4 containers of 12,5 tons. So the commercial department must be aware of what the possibilities are.

The stowage plan

Mostly made by charterers or stevedores. However the master remains responsible over the stability of his ship.
He has to ensure that correct and safe procedures are followed.
Here the time pressure is very important.

The next photo gives you a view on a vessel leaving Antwerp and one could wonder about the stability of the starboard outer stacks.
(slide 31)

As a conclusion I would say :

QUALITY SURVEY gives you
QUALITY TRANSPORT.

Thank you .

(slides 32 & 33)

Carl van der Avoirt