Devon & Cornwall Joint Branch

A Joint Branch of the RINA and the IMarEST
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The Royal Institution of Naval Architects

Institute of Marine Engineering, Science & Technology

IMAREST

Lecture

Date: Tuesday 10 April 2018
Time: 1900
Venue: RPCYC, The Hoe, Plymouth

Stability of Car Carriers
A Nautical Institute presentation given by Mr John Waite

There have been many casualties and losses involving dedicated car carriers. The MAIB report on the incident of the Hoegh Osaka raised interesting, but unanswered, questions

The management of ballast water also warrants more attention during the operation of car carrier tonnage. In the case of the Hoegh Osaka investigators claim that the 180m car carrier had overestimated its ballast by 635 tonnes and underestimated the weight of its cargo by 265 tonnes prior to leaving port.
The IMO recommended centre of gravity below the metacentre is a minimum of 1.34m.but the measurements and simulations carried out by the MAIB put this figure at close to 0.7m.

Mr John Waite gave an interesting and useful presentation to a select gathering at RPCYC premises overlooking the Hoe. The gathered professionals were mainly ships masters, pilots, engineers and deck officers. Members of RINA, IMAREST, RIN and NI all attending.

After his introduction and precis of his career, the first bomb shell that Mr Waite delivered is that the vessel stability booklet is often made up of incorrect or erroneous information. This is important for any type of vessel, but especially important for PCC car carrier type ships, ROROs and multi cargo vessels. The master should familiarise himself with the stability booklet and confirm the accuracy of the data and where it has originated from. Indeed, if the data is correct. If it is not correct now, was it once correct and changes been made.

Particular attention should be made to the hydrostatics to confirm the CB and LCB.

Car carriers and RoRo vessels are designed and built with fine hull forms (block coefficients in the region of 0.5-ish) due to the need to have large volume and low weight. This makes the hull more fuel efficient but requires the aft sections of the hull to be sunk lower, in order to submerge the propeller to make it efficient.

The unusual intact GZ curve of the Hoag Osaka was then shown from the MAIB report, and the upward end of the blue curve pointed out.

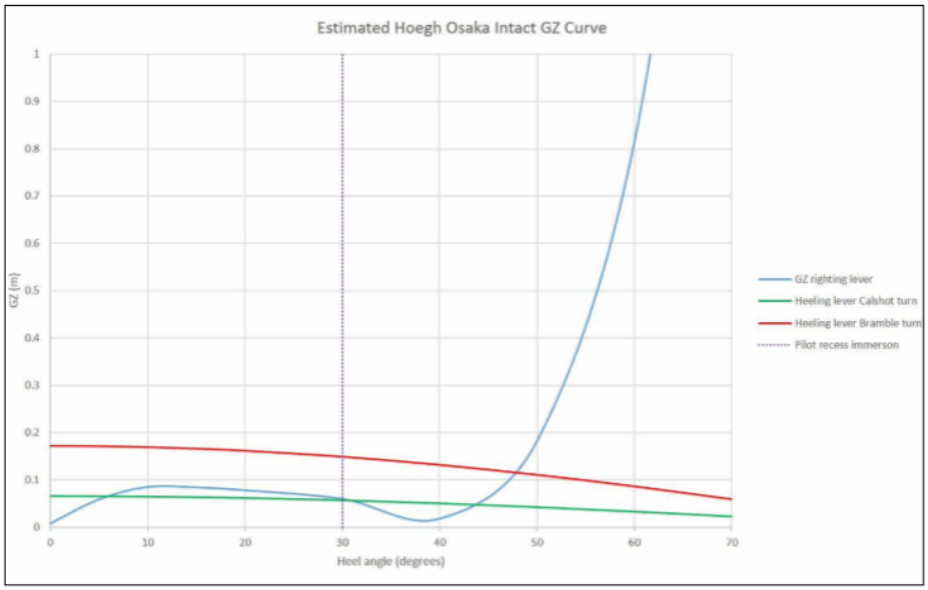

Figure 30: Estimated *Hoegh Osaka* intact GZ curve

PCCs are susceptible to lowered stability due to forward trim. This is due to less wetted surface area at the bow than the stern.

Stability of a vessel changes greatly with 1) trim and 2) heel. Mr Waite then went on to discuss the likelihood of Parametric Rolling and how it affects PCCs and similar ship designs.

Synchronized rolling

is a special kind of rolling experienced when time period of encounter (Te) becomes equal to or almost equal to time period of roll (Tr) of the ship.

Te = Tr

It causes the vessel to roll at an angle which increases succesively till GZ values are sufficient to dampen the roll.

Before damping occurs , vessel may reach angle of flooding or capsizing.

Any type of ship can be affected by synchronized rolling in any sea condition (head, beam, following)

Parametric rolling

is observed when change of parameter (GZ oscillating for some angle as crest and trough are passing by) synchronising with the rolling period of ship.

It can be visualised as a large single crest passing on port side of vessel , then the vessel rolls and again the crest comes on stbd. side or when vessel is pitching with maximum roll angle

Only experienced in head and following seas , not beam seas.

Unlike Synchronised , it is sudden increase of roll without any warning roll may change from 5 degree to 40 degree suddenly.

Ships likjely to experience parametric rolling are those ships having large flare and 1 or more broad overhanging stern.