Subject: **QITAPI-LP-11-2019 (The Science behind the Dragging of an Anchor)**

Ref : DMA/AIFI/98/**C 1028**
Date: 26/06/2019

Dear Captain
Good Day,

Kindly find the attached informative document titled
" QITAPI-LP-11-2019 (The Science behind the Dragging of an Anchor) "
for your kind attention and necessary precaution measures.

You are requested to confirm receipt, discuss the contents in the next consolidated meeting on board & keep a copy in the file DA-11 .

Best Regards,
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(Note: This e-mail has been sent as BCC <blind carbon copy to : All R.O.D.-SMC Vessels, to eliminate the lengthy list that would result if this e-mail is printed)

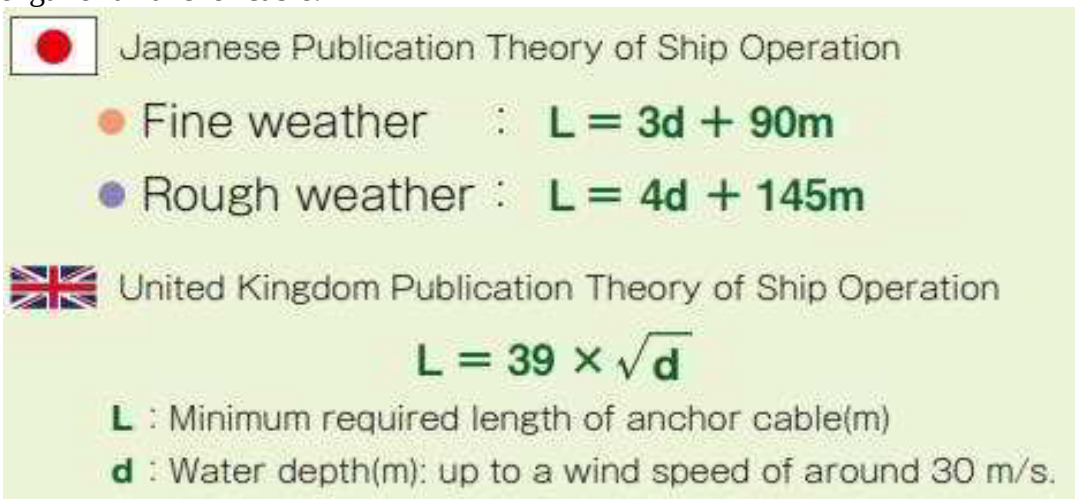
QITA MUTUAL CLUB
Qeshm International Trust Alliance

Loss Prevention Circular QITAPI-LP-11-2019
(The Science behind the Dragging of an Anchor)

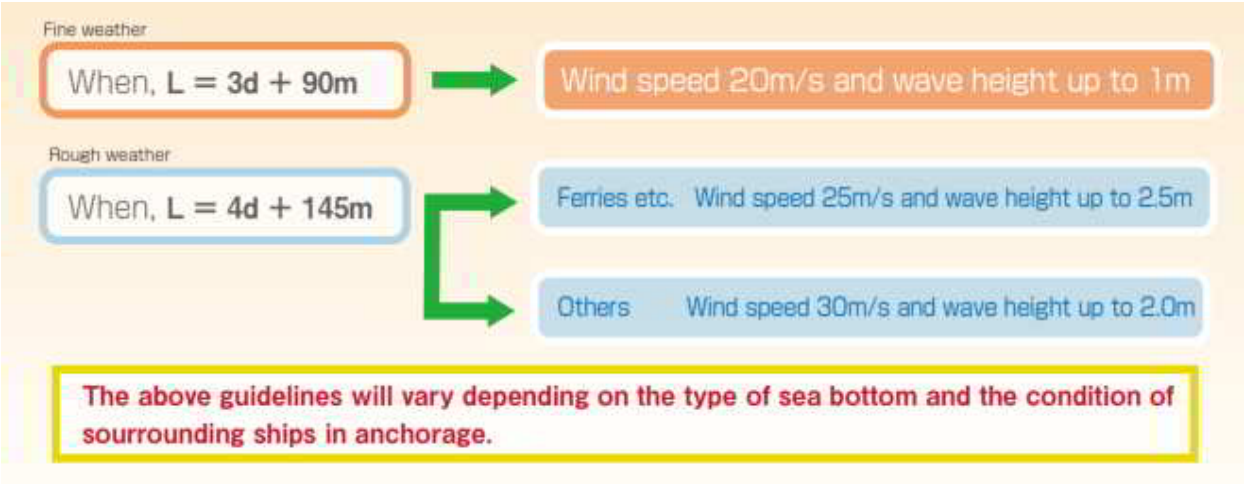
The following points are extracted and collected out of various available studies & academic researches to inspire a more scientific approach & in-depth understanding of factors affecting "Dragging" of an anchor & how to control it. The masters & navigating officers are urged to study & take note of these information.

►Why anchor drags:
A ship's anchor drags due to the impact of external forces on it which exceed the holding power of the anchor and cable. That is; dragging anchor occurs as a result of a relatively simple reason*: "When an external force exceeds that of the anchor's holding power, it will drag".*

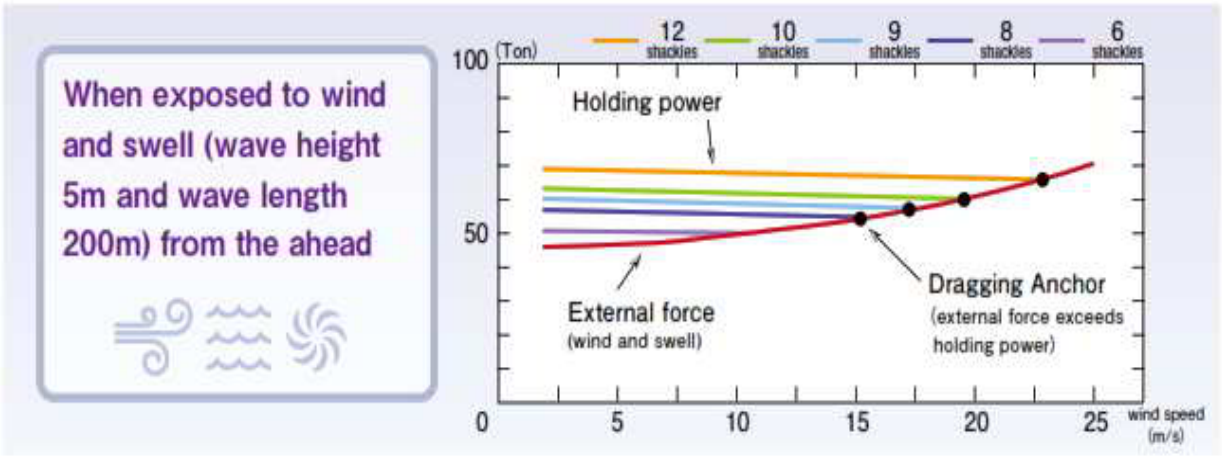
► Empirical or Rule of Thumb Methods:
The following are two well-known methods for assessing the Minimum Required Length of Anchor Cable, however factors related to ship type, actual wind speed etc. are not found in this method. It can be considered that those factors were consolidated in the process of formulating these methods for the minimum required length of an anchor cable.



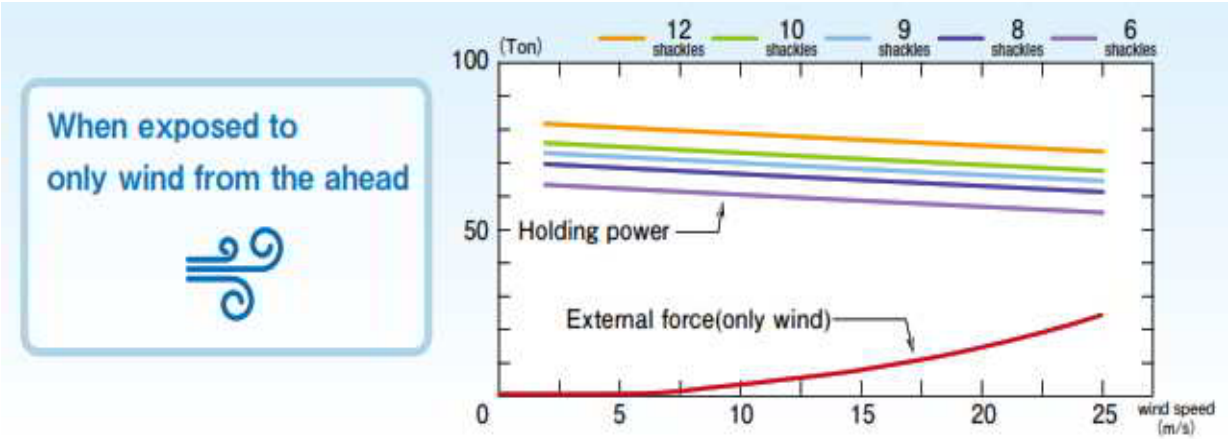
According to the Japanese Marine Accident Inquiry Agency (MAIA), at that time the wind speed and wave height which corresponds to the Japanese theory are introduced as simulation results and actual statistical data regarding the anchoring situation of 700 coastal vessels, when the landed typhoons (10 typhoons) passed during one year, are documented. The findings are depicted below. Naturally, because this theory or guideline will vary depending upon the type of sea bottom and anchorage conditions regarding one's ship and the other ships, actual minimum required length of anchor cable is to be determined, with safety being the priority.



In addition, in the publication of the Maritime Casualty Analysis Report, the simulation results are introduced and attempt to answer question regarding the difference in the anchoring limit between "being exposed to wind only" and "being exposed to wind and swell"



As can be seen from the anchor holding power of the anchor and anchor chain, which will be referred to later, because the bottom part of the anchor chain decreases when wind pressure increases, it was found that the anchor does not drag until the wind speed is 25m/s and when the minimum required length of anchor chain in the water is more than 6 shackles, although anchor holding power does decrease.



In the event that a swell is added, due to Wind pressure force + Wave drift force (the force at which a wave moves a floating object), the anchor chain tension reaches approximately 50 tons at a wind speed of 10m/s and exceeds its holding power at 6 shackles at this point in time. Also, it was revealed that the anchor drags at 8 shackles at a wind speed of 15 m/s and at 12 shackles at a wind speed of 25m/s.

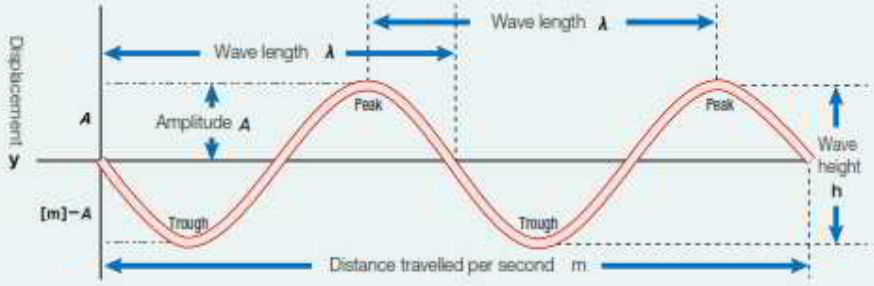
Don' t underestimate "swell" and "wave height" which may cause ship motion during anchoring.

Watch out for wind and for waves ! !

- Be careful regarding changes in wind direction, when a typhoon or windy atmospheric depression approaches.
- At sea, where there are few structures against wind, it is estimated that the maximum wind speed will be be1.5-2 times stronger than the average wind speed.
- The higher the swell becomes, the greater the danger of dragging anchor will be, remarkably. Anchor at a position where the encroachment of a swell is expected is to be avoided. Occasionally, the maximum wave height may be 1.5-2 times of that of the significant wave height (*1).

*1) Significant wave height (from the Japan Meteorological Agency website)

Choose 1/3 of the wave observations (within a timeframe of 20 mins.) in descending order from the top. Of those, the average wave height and period becomes the significant wave. According to this definition, this is also referred to as the "1/3 maximum wave".



Graph expressing waves: in the event that two waves are generated per second