Immovable objects v. irresistible forces

➔ The May presentation of the Hong Kong branch featured Mike Harrison MNI of Solis Marine speaking about jetty fendering. His talk was every bit as interesting as the conundrum of the title suggests.

Mike has been involved in designing port structures for safe berthing and mooring since 1985. He is a member of PIANC, a non-profit organisation which brings together international experts on ports and infrastructure. As co-Chairman of PIANC Working Group 145, he led a diverse team of 20 international specialists in a study of large ship berthing speeds. Their report is expected to become the new industry benchmark, so we could not have had a better speaker on a topic which affects all mariners but, all too often, is not given the attention it deserves.

Mike explained the berthing energy formulae, in particular the importance of ship course, speed over the ground and rate of turn. This was considered in the context of converting kinetic energy into potential energy during berthing, and the speaker tied these together using Newton's Three Laws of Motion. The engineers in the audience responded enthusiastically while the rest of us nodded wisely.

Everyone paid attention, though, when he pointed out that there have only been a handful of significant studies of ship berthing speeds since the Second World War. The most widely adopted study was from 1977, using data collected as early as 1963, and only covered tankers under one set of berthing conditions (easy approach, exposed). Worryingly, this single basic relationship between deadweight and speed was extrapolated for more sheltered and exposed berthing conditions and a variety of different approaches. Port design codes adopted these curves and then applied them to all vessel types, including ships which were much smaller and much larger than the study ever intended. These berthing speed curves are still in widespread use today. Although the berthing speeds are conservative in many cases, the extrapolations made mean that the Master of a ULCC might not sleep so easily in his bed if he knew how the fendering at his next berth had been designed.

Luca Ferrerio FNI (R) presents a memento to speaker Mike Harrison (L)

Thus it was that PIANC Working Group 145 was formed in late 2010 to investigate modern berthing requirements. To date, they have recorded over 2,300 berthings, mostly on ships of above 30,000 dwt, including container, bulk, oil and gas vessels. The study also covered a variety of berths including those in rivers, harbours and exposed locations, and in different tidal and current scenarios. Data was recorded at 13 different locations in Asia, Europe and North America.

Not surprisingly, the research has revealed many instances where design berthing speeds are being exceeded in practice, leading to a risk of structural overloads. Mike also reminded us again of Newton's Third Law which means that the same high forces exerted on the berth are also exerted on the ship's hull, usually in a concentrated area in way of the fender panel. We were also reminded that the rate of turn can amplify those forces.

The PIANC study found that berthing speeds do not change appreciably as a result of ship size, configuration, pilot experience or the number of tugs. On the other hand, underkeel clearance, strong currents, communication of the design operating limits and the use of berthing aids can have a pronounced effect.

Mike demonstrated a number of modern berthing aids, giving clear advice on their performance and cost benefit. He obviously felt they are an indispensable tool for the modern port and pilot. Pointing out that many Masters and pilots are still not given clear guidelines on safe berthing speeds, he told us that the working group is likely to recommend:

- Using 'reliability design' methods which define the probability of a berthing speed being exceeded (based on research data).
- Telling users the operating limits for the berth, information which commonly vanishes somewhere between the designer and the pilot.
- Reducing target (operational) berthing speeds below maximum design speeds to allow an extra safety margin.
- The routine monitoring and logging of berthing operations.
- Safety practices which rely on known safety margins and appropriate training, rather than luck or instinct.
- Witnessing the testing of all fenders before they are installed to make sure they perform according to the manufacturer's claims.
- Regular reviews of berths to consider changes in working practices, equipment and vessels, and how these can affect safety during berthing.

Finally, Mike cautioned that not all fender manufacturers actually test their products, while some test in an unsatisfactory way. He has seen cases where a small manufacturer has copied the fender designs of a well-known company and quoted the same performance, without ever testing or proving the fender. These inferior fenders can represent a real danger to visiting ships and the viability of a port if facilities get damaged, not to mention the lengthy and expensive claims that can ensue. This will hopefully be a future topic for a PIANC study and perhaps an opportunity for collaboration with members of The Nautical Institute.

The talk was carefully pitched to be accessible to mariners while also being stimulating for the engineers and scientists in the audience. The questions afterwards demonstrated how many people had enjoyed and benefited from the presentation, which can be accessed in full on the Branch website.

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