

Setting the standard

Shibata FenderTeam supplied a customised fender solution for a recent project in Malta

Fenders are an important asset to any port's infrastructure, the interface between the ship and the quay is vital to ensure smooth operations. So, why is it that there is still a lack of knowledge on their design and components? World Port Development reports...

Over the years, we have learnt that fendering systems should not be treated merely as an 'off-the-shelf' commodity but as a knowledge-based product. Whilst the rubber is a very important component within the system, the real craft is in the design of the panels, chains, mechanisms and anchorages, for the most part, fenders are a bespoke system and ship specific. "Clients, end users and even consultants often lack the knowledge of what constitutes a good fender system," said Rob Gabbitas, Engineering Director at QuayQuip, a Eurotech Benelux Company. "No two fender system designs will be the same for an oil terminal berth, or a ferry terminal, or a car carrier berth and a barge berth." Anna-Lena Georg, Marketing Manager at Germany-based Shibata FenderTeam supports such a statement. "Largely unnoticed, mostly overlooked and probably taken for granted in many ports, marine fenders are actually a thin but crucially important line between smooth operations and a substantial insurance claim," said Georg. "A customised fender design is crucial for the

successful operation of the fender system. Therefore, detailed and extensive design input should be delivered by the fender supplier at an early project stage." One example of a customised fender solution is given by ShibataFenderTeam's recent project in Malta. Their task was the design of fender systems for a liquefied natural gas (LNG) import and re-gasification facility based on a floating LNG storage vessel. The project had some important limitations which they solved with extensive consulting and excellent engineering work resulting in a customised fender design. The need for low hull pressure was met with large steel panels and softer rubber grades and the minimum standoff distance was achieved by customised steel spacers. Each of the delivered SPC 1800 Fender systems for the Regas LNG Plant, Delimara in Malta is able to absorb 3,153 kNm of energy which was crucial for a successful operation of the terminal. Richard Hepworth, Business Unit President for Trelleborg Marine Systems based in Dubai, adds that: "High quality fenders are an essential part of port infrastructure, providing protection for terminals and berthing vessels alike." Trelleborg has previously worked to raise awareness of the performance issues surrounding lower cost, lower quality fenders, manufactured using low quality rubber compound ingredients. To highlight this issue, two analytical tests were developed by Trelleborg, intended to help buyers determine

the quality of procured fenders. These tests require just a small sample from the fender body which has no impact on overall fender performance. However, prior to testing, there are a number of best practice parameters to consider in the manufacture of a high quality, engineered rubber fender. According to Hepworth: "A rubber compound, produced using a superior rubber formulation, doesn't guarantee a high quality fender - one that is capable of absorbing the correct amount of energy. If the mixing process uses inferior equipment or the process is poorly controlled, the rubber compound will not perform correctly." In addition, the modulus of rubber compounds, and the fatigue life of fenders, are dependent on carbon black dispersion, when all other factors are kept constant. This is why Trelleborg suggests the industry move from using 'hardness' to measure energy absorption, and instead evaluate the uniformity of carbon black dispersion in samples of rubber compounds and final fenders. (*World Port Development* will be looking at rubber compounds in greater detail in next month's issue). "It's important that designers, operators and owners of port infrastructure begin to recognise the importance of rubber compound composition, carbon black dispersion and modulus of rubber fenders. All these factors need to be taken into account during the design and procurement process," said Hepworth.

Buy cheap, buy twice...

Ports only create revenue when ships are berthing safely and regularly at their terminals; but if facilities are shut down for fender replacement or repair owing to premature fender failures, then the savings made via the 'cheap' fenders are often lost in a single day, since daily downtime can account for thousands of dollars in penalties and revenue loss.

"Therefore, it's important for ports to be involved in the selection of the fender supplier, or to pre-approve some high quality suppliers that can provide proven track records for several decades and at least 1,000 installations globally. In addition, another important issue for ports is that the fender supplier should have a product liability insurance as well as a claim-free record of at least five years," said Georg. "Once you have established a short list of high quality suppliers, testing of the rubber units has to be addressed. When it comes to testing of rubber units, there is a lot of discussion in the market about how and where to test rubber units. The common practice in the industry for decades has been testing at the point of manufacture, since all the needed equipment and test rigs as well as the trained in-house and independent technicians are available to make sure testing is performed according to the adapted standards and guidelines." Georg continued to support her statement; "As with most things in life, you get what you pay for. High quality and reliability are both important when choosing a fender supplier. When fenders fail or don't work properly due to low quality or incorrect designs, then there is a cost to the port in terms of repair, downtime or even accidents. However, the failure rate of poorly designed fenders systems should not be underestimated. Typically, whenever fender systems fail, the culprit is identified very swiftly - in a good number of cases the rubber unit is the main cause for the failure. Inexperienced suppliers often disregard the most obvious mistakes in fender system designs, like chain angles, especially the weight of the chains, and the position of the rubber unit on the steel panel and substructure. So-called propeller fenders where the rubber unit is placed almost at the top portion of the panel in combination with a long steel fender panel will lead to system failures no matter how good or well tested the rubber unit is." Shibata Fender-Team offers more than 10 different fender types such as cone, cell or element fenders and foam products. Each type has specific advantages, and depending on the

project, on-site conditions and preferences of the port or their consultants, determines as to which fender type is used. "Just to give an example, cone fenders with a deflection of 70% of its height have the most efficient energy absorption to fender weight ratio; and since clients are buying energy absorption, this fender type provides, generally speaking, the most value for money," said Georg. Clearly, different types of fenders are required for different site conditions and a range of marine environments and there is a good amount of overlap depending on the preference of the client. "Container terminals can be equipped with cone, cell, element or even foam fenders. However, foam fenders for example, are typically used for cruise terminals and naval bases because of the fenders ability to adapt to practically any ship shape and their low-friction and non-marking polyurethane outer skin. This is particularly important for cruise ships where operators don't appreciate black marks on a ship's paintwork [as you may get from a cylindrical rubber fender] for example," Georg added.

Fender standards

Our research for this article confirmed that all fender manufacturers agree on the need for fender standardisation. However, this begs the question: how can you have standardisation when each project needs a tailor-made system? "Long overdue is the appropriate application of rubber technology principles and standards in fender systems, using the same intensity as those applied in steel fabrication," said Hepworth. When it comes down to fender testing Gabbitas told *World Port Development* that the latest version of BS6349-4:2014 for fenders has introduced a considerable amount of useful guides to consider, but it stops short

of recommendations on testing, as it is essentially only intended for UK use. "The testing requirements in PIANC 2002 are full of inconsistencies, errors, and unclear procedures which make it unclear to follow, yet it is generally perceived in the market to be a 'type testing' standard, which it is not! It is after all just a guideline!" states Gabbitas. So, with the lack of a 'proper' fender standard, perhaps the time has come for each fender manufacturer to be equipped with their own testing facilities. "It's essential that the industry works towards a deeper understanding of the impact of the manufacturing process while ensuring that the mixing quality does not impact product performance," said Hepworth. "Port owners, operators, contractors and consultants need comprehensive specifications/testing methods covering ingredient selection, mixing procedure and production process to stipulate the performance of finished products. It is Trelleborg's mission to ensure these are made available, to drive up standards across the whole industry."

Testing facilities

Although fender manufacturers agree that the industry needs to set a much higher benchmark, and collaborate to produce its own set of standards for testing and design to prevent 'pop-up' trading companies delving into a market and science they know little about, it seems that most still 'go their own way' in order to assure their customers of good quality products. Quayquip have pioneered their own durability testing machine and have now completed several orders with 3000 cycle compression tests which have been performed on actual full size fender units (which may be selected at random by the



Quayquip installed fenders at Stewart World Port - a bulk handling jetty in British Columbia



Quayquip donut fenders at Wheatstone LNG



Shibata FenderTeam has state-of-the-art test equipment

client to undergo the most arduous of duties). “We have also invested in the development of our range of donut and quayguard foam fenders with the introduction and testing of new materials and production techniques which improve the life cycle of the products,” said Gabbitas. For the last six months, Quayquip has been involved in some interesting projects including the installation of fenders at Stewart World Port - a bulk handling jetty in British Columbia, Canada, which borders Alaska and is ideally located at the end of the deep-water Portland Canal - within miles of the most resource rich areas of North America. In Australia, the company delivered 12 sets of 2.8m donuts for a novel application of floating pontoon corner protection-cum-pontoon restraint guides at Wheatstone LNG. All units were designed, manufactured and model tested in-house by Quayquip to exacting requirements. Their latest project was for Seaspan Ferries, again in British Columbia, for four ferry terminals with the latest generation of Parallel Motion Fenders. Shibata FenderTeam also has the latest and state-of-the-art test equipment on offer and claims to be the only manufacturer that does combined shear and compression testing for full size and large rubber units, and is fully supporting testing at the point of manufacture under the supervision of an independent and qualified third party. “Any other test set-ups often lack the availability of correct equipment meeting the stringent PIANC guidelines, trained and experienced personnel, etc.,” said Georg. “This is particularly the case for the requirement of domestic testing in certain

countries pushed by some stakeholders. The interesting part is that domestic testing is promoted to ensure performance verification is done correctly and corresponding test results can be trusted. However, that implies vice versa that all fenders delivered outside of that market cannot be trusted in terms of performance which is not only discrediting suppliers, but also independent test agencies.” Trelleborg has recently undertaken a large-scale study to improve understanding on the impact of curing on the performance of rubber fenders, which will be published in due course. “The primary purpose of this research has been to develop guidelines that will enable the use of optimum fenders in different application areas, and to improve knowledge-sharing and best-practice across the industry;” said Hepworth. Trelleborg’s on-going research into materials best practice is part of the company’s ‘Smarter Approach’ initiative, which is designed to elicit excellence across all product ranges and technology

development. Whilst Trelleborg is refocusing its business model towards smart, data-driven technologies, the company is also keeping a keen eye on the evolution of its current fender offering to add the most value to specifiers. The next step in this journey will be deep research into testing for specification. Trelleborg is working on a process for ensuring that performance testing can never be falsified, with a testing procedure taking specifiers and buyers through multiple considerations to ensure that the finished fenders they procure adhere precisely to specification. With so many manufacturers pulling in different directions and not putting their efforts in to collaboration to establish the right fender standard, it seems that end-users will have to continue to scrutinise their options prior to any fender purchase and as one particular quote from Georg highlights: “Choose wisely and don’t fall for the cheapest option - it will cost more over the long haul.” 



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