

Applying PIANC Fender Design Guidance to US Design Codes

Proposed Rational Approach to Implementing the PIANC Fender Design Guidance in US Designs

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EXTENDED ABSTRACT

PIANC guidelines for fender design (Report of PIANC MarCom Working Group 33—Guidelines for the Design of Fender Systems) was published in 2002. The PIANC document is a guidance and not a design code, while many designers worldwide utilize it as such. The PIANC document itself covers many factors related to calculating berthing energies, selecting a marine fender, and determining reaction loads on the supporting marine structure. Where the PIANC guidance could use some additional discussion is in the application with current design codes. In addition, since its publication in 2002 a number of items discussed within the PIANC fender design guidance have been researched further, including berthing velocities, the added mass coefficient, and the consideration of a more rational approach to developing factors of safety associated with fender selection.

Safety factors can be applied at several levels in the fender design process, starting with selection of berthing velocities for fender selection, manufacturer's tolerance in performance data, factors to account for abnormal berthing scenarios, to use of load factors in design of the supporting structures. It is important that all these factors are considered together as a whole to ensure both that enough residual capacity is built into the system, but also to avoid designs that are overly conservative.

It is widely accepted that the berthing velocity is the most important factor in the fender selection process. Up until now the velocities used for design have been based on old data, and in most cases the velocities have been presented as prescriptive values based on environmental conditions and ease of navigation. Efforts are currently underway to update the berthing velocity data supporting design guidelines, and once this effort is complete it is important that the recommended velocities are applied in a manner consistent with the selection of fenders and the design of the supporting structures. In addition, several terminals now use berthing velocity monitoring software to aid in berthing operations and for these terminals it might be possible to use site specific berthing velocities for fender design. In addition, current or planned use of berthing velocity monitoring equipment might have an actual effect on the berthing velocities and the use of this type of equipment could possibly be used as a modifying factor in determining proper berthing velocities in the fender selection process.

In the US, most design is based on a Load and Resistance Factor Design (LRFD) where different combinations of load factors are applied based on what condition is being checked. The Unified Facilities Criteria used for facilities for the US Armed Forces specifies these factors for their facilities, and there is a particular check for a berthing condition. The Marine Oil Terminal and Maintenance Standards (MOTEMS) in California does the same thing, but in both cases it is not very clear what load from the fender should be used as a basis when applying the specified load factors. In an ultra-conservative scenario, a fender is selected based on a chosen berthing velocity with applied factors for abnormal berthing and manufacturer's tolerance in berthing energy, then the load applied to the structure is the rated reaction force from the fender manufacturer, modified using the manufacturer tolerance for reaction force and the load factors specified in the applicable code. This will cause several different safety factors to be applied at the same time and result in an overly conservative design.

The presentation will provide examples of a rational approach for marine terminal designers in the United States to accompany the PIANC document and apply the factors outlined within it to standard US design codes. In addition, the presentation will provide commentary on the various topics covered within the PIANC guidance to provide some additional clarity and updated information based on the latest information and research for various topics.