



PIANC
The World Association for
Waterborne Transport Infrastructure

MarCom WG 211

UPDATING OF WG33 – GUIDELINES FOR THE DESIGN OF FENDER SYSTEMS

Terms of Reference

1. Background

Marine fenders are a critical component in maritime infrastructure, absorbing the energy of vessels during berthing and while moored, and protecting both vessels and berth structures from damage.

In 1984 PIANC published a Supplement to Bulletin No. 45, containing improved design methods for fender systems.

This guideline was followed in 2002 by PIANC WG33, which included more advanced fender design and testing methods, taking into account performance modification factors for manufacturing tolerances, temperature and velocity.

Since the WG33 guideline was published:

- there have been further advances in design methods for fender systems
- vessel dimensions and hull shapes have further evolved
- WG145 (being finalised) has collected and analysed berthing velocities and angles
- WG145 has also addressed reliability design, vessel dimensions and container vessel flare angles
- WG186 (in progress) is considering mooring requirements for large ships at quay walls
- an update of WG24 is proposed (Criteria for Movement of Moored Ships in Harbours)

- manufacturers have undertaken further research into fender materials, performance, durability and impacts of aging
- improvements to WG33 guidelines have been suggested by users, including improved fender testing and verification procedures, performance requirements for fender system elements and the addition of maintenance and repair guidelines
- automated mooring systems are increasingly being used in conjunction with conventional fender systems.

Under these circumstances it is proposed to update WG33.

2. Objectives and Scope

Prepare a general update of WG33, including:

- update the basis of design and design guidance in relation to:
 - alignment with current practice including reliability design methods
 - latest simulation software for evaluation of fender/vessel interaction
 - recent vessel trends including increases in vessel sizes, developments in hull shapes and the implications for fender engagement
 - vertical and horizontal forces on fenders
 - hull pressures
 - outline consideration of special issues applying to wheel fenders and foam filled fenders
- consider and incorporate relevant outcomes of other working groups including:
 - WG145 in relation to analysis of berthing velocities and angles
 - WG145 in relation to reliability design
 - WG145 in relation to the problem of hull flare angles on large container vessels
 - WG186 in relation to mooring requirements of large vessels at quay walls
 - WG24 (update proposed) in relation to acceptable movements of vessels at berth
- review recent research by fender manufacturers and update guidance in relation to durability and performance, including:

- fender materials composition and influence on performance factors
- fender durability and causes of failure
- impact of aging on fender performance and reactions
- review the WG33 guidance in relation to testing procedures for fender materials and fender performance, with specific reference to:
 - representative scope of testing,
 - consistency of test procedures and compliance in testing facilities,
 - representative quality and quantity of samples to be tested,
 - independence of testing and verification of fender materials and performance
- clarify that PIANC is not a fender certifying body and cannot endorse certification of compliance by third parties using the guidelines
- provide guidance on design of other fender system components including facing panels, chains and fixings
- provide guidance on durability, maintenance and repair of fender system components
- provide guidance on the implications of automated mooring systems used in conjunction with fender systems.

3. Documents to be Reviewed

Documents to be reviewed include, but are not limited to, the following:

- Report of the International Commission for Improving the Design of Fender Systems, Supplement to PIANC Bulletin No. 45, 1984
- Guidelines for the Design of Fender Systems, PIANC MarCom Working Group 33, 2002
- EAU Recommendations of the Committee for Waterfront Structures, Harbours and Waterways, 2004
- Technical Standards and Commentaries for Port and Harbour Facilities in Japan, 2009
- Spanish ROM 0.2-11, Recommendations for the Planning and Execution of Berthing and Mooring Works, 2011

- Code of Practice for Design of Fendering and Mooring Systems, Maritime Structures Part 4, BS6349, 2014.
- Berthing Velocities and Fender Design, PIANC MarCom Working Group 145 (in preparation)
- Criteria for Movement of Moored Ships in Harbours, PIANC MarCom Working Group 24, 1995 (update proposed)
- Mooring of Large Ships at Quay Walls, PIANC MarCom Working Group 186 (in preparation)
- Maintenance Guideline for Rubber Marine Fenders: Coastal Development Institute of Technology Library, No.40, 2013
- Recent technical papers and presentations including the following presented at the PIANC Australia Fender Workshop and PIANC/IEAust Ports and Coasts Conference, 2017:
 - Approaches to Life Evaluation of Rubber Marine Fender, by H Akiyama, T Shiomi, K Shimizu, S Yamamoto, S Ueda, and T Kamada
 - Life Evaluation of Fenders including Effect of Compounding Fillers, presentation by Hitoshi Akiyama, Bridgestone Corporation
 - Large Vessel Profile and Fender System Design Study, presentation by Hitoshi Akiyama, Bridgestone Corporation
 - Ensuring Fender Performance through Compression and Material Testing, presentation by Mishra Kumar, Trelleborg Marine Systems
 - Fender Compression and Durability Testing – First Hand Experience and Room for Improvement, presentation by Harvinder Singh, CH2M.

4. Intended Product

The intended product is an update of WG33 providing concise and clear design guidance for fender systems, in alignment with current practice, together with updated guidance in relation to fender materials, performance, testing, durability and maintenance.

5. Working Group Membership

Working Group members should be drawn from:

- Marine terminal owners/operators

- Marine infrastructure designers
- Marine fender and mooring system manufacturers
- Relevant research organizations.

6. Relevance to Countries in Transition

The updated guideline will be of value to countries in transition by providing practical guidance on fender system selection, procurement and maintenance, and on the impact of aging on fender performance.

7. Relevance of Climate Change

The activities of this working group will not be related directly to climate change.