



Mooring Bollards & Hooks: **Selection, maintenance and testing**

Terms of Reference

1. Background

Quayside bollards and quick release hooks (QRH) are critical parts of port infrastructure and are likely to continue to be so for the foreseeable future. They are essential equipment in maritime and inland ports and waterways, including quays, mooring dolphins, inland waterways, and when mooring in navigation locks.

With the steadily increasing freeboards and tonnages of ships using berths, a proactive approach is now necessary to accommodate the higher loads on existing equipment not designed for those extra loads. However, despite this criticality there is little in the way of industry-recognised specifications for materials, inspection and testing procedures during manufacturing, following installation or throughout the service life.

There is a need for PIANC to examine these important elements of infrastructure, including the foundations, fixings and the hooks / bollards themselves as a whole system. This will provide recognised criteria for use by port operators, consultants, designers and manufacturers enabling them to deliver cost-effective and safe moorings for the vessels visiting their ports.

Bollards are also used in recreational and tourism navigation infrastructure, especially in superyacht marinas. They can suffer the consequences of traditional approaches that lack technical details.

Some of the aspects of this topic are covered in part by reports from other PIANC Working Groups (WGs) such as WG 184 *Design Principles for Dry Bulk Terminals*, and the soon to be published report from WG 186 *Mooring of Large Ships at Quay Walls*, and a holistic review of these and associated international standards and references should be included.

Whilst there is a desire from port operators for reassurance on the integrity of their mooring points, there is little agreement as to what constitutes a valid test procedure, and the WG should incorporate a review of all available methods and their efficacy.

2. Objectives

The objective of the WG is to produce a benchmark document providing clear guidance and recommendations when specifying shoreside mooring equipment (from 200 kN upwards) including mooring bollards and quick release hooks, including a list of types and typical capacities for different ship sizes, and guidelines for the full scope of testing during the manufacturing process and subsequently after installation.

3. Scope

In these Terms of Reference, reference to bollards includes mooring hooks.

The WG shall consider, but not be limited to, the topics listed below.

- Load-case criteria to be used for specifying bollards;
- Loading of bollards relative to the number of mooring lines each bollard can be allowed to take;
- Factors of safety (FOS) and other criteria to be used for the safe operation of mooring equipment, including permitted vertical mooring angles and possible horizontal angles;
- Material specifications, non-destructive and proof load testing.
- Practical monitoring, inspection and maintenance of mooring equipment in service including recommendations for regular calibration of load monitoring systems and guidelines for replacement criteria.
- Realistic in-situ testing methodology that simulates real-world mooring operations.
- Consideration of how load monitoring can be incorporated into standard bollards as well as quick release hooks including ATEX (ATmosphères EXplosibles) requirements.
- Anchorage of mooring equipment to superstructure to safely transfer the forces from the mooring equipment into the main mooring structure

Calculation of loads (magnitude and direction) on mooring lines is outside the scope of this WG, being covered by other WGs, as well as by BS6349 Part 4.

The WG should consider, co-ordinate and incorporate the work produced and being carried out by other MarCom and InCom PIANC WGs including, but not limited to:-

- WG 134 *Design and Operational Guidelines for Superyacht Facilities* (2013)
- WG153 *Recommendations for the Design and Assessment of Marine Oil and Petrochemical Terminals* (2016)
- WG 155: *Ship Behaviour in Locks and Lock Approaches* (2014)
- WG 162 *Recommendations for Increased Durability and Service Life of New Marine Concrete Infrastructure* (2016)
- WG 184 *Design Principles for Dry Bulk Marine Terminals* (2019)
- WG 186 *Mooring of Large Ships at Quay Walls* (in preparation)
- WG 206 *Design of Navigation Locks* (in preparation)

- WG 211 *Guidelines for the Design of Fender Systems* (in preparation).

Vacuum mooring methods and other methods not using mooring lines, and also tension mooring systems, are outside the scope of this WG. Floating bollards, as used in some navigation locks, are considered in WG 206 and are outside the scope of this WG. Small bollards as used in marinas are not the focus of this WG although the report will be relevant for larger recreational vessels requiring bollards above 200 kN.

4. Documents to be reviewed

Documents to be reviewed by the WG shall include, but not be limited to, the following:

- *BS6349 Maritime Works Part 1-2– General – Code of Practice for assessment of actions*
- *BS6349 Maritime Works Part 1-4– General – Code of Practice for materials*
- *BS6349 Maritime Works Part 4 - Code of Practice for Design of Fendering and Mooring Systems*
- *OCIMF Mooring Equipment Guidelines 4th edition 2018*
- *Technical Standards and Commentaries for Port and Harbour facilities in Japan, OCDI, 2009*
- *EAU 2012 Recommendations of the Committee for Waterfront Structures Harbours and Waterways, 9th Edition.*
- *SIP 005 - Guidance on Mooring - Safety in Ports 005, March 2019 (UK Gov.).*
- *Port of Rotterdam presentation on Bollards 2018*
- *Ship/Shore Interface for LPG/Chemical Gas Carriers and Terminals, SIGTTO, 2018*
- *Jetty maintenance and inspection guide, SIGTTO/OCIMF, 2008*

5. Intended Product

It is intended that the WG report will become a globally referenced document used by all those specifying or responsible for shore-based mooring equipment in maritime and inland ports and other facilities (e.g. inland waterways and navigation locks) where bollards and mooring hooks are used. It will be intended to be used in conjunction with relevant country-specific standards.

6. Working Group Membership

The WG should at least include, manufacturers, designers, operators and owners of maritime and inland ports and waterways. This WG is to be a joint Marcom/InCom WG, managed by MarCom.

7. Relevance to Countries in Transition

The report will be of value in protecting the interests of developed countries and countries in transition, and will assist decision makers in the assessment of adequacy and safety of existing mooring equipment.

8. Climate Change

Relevant effects of climate change should be considered; these may include sea level rise, increasingly extreme weather, and effects on the magnitude of load applications.

9. Relevance to UN Sustainable Development Guidelines

This WG will be relevant to UN Goal 9 in particular, which refers to building resilient infrastructure.