



# PIANC

The World Association for  
Waterborne Transport Infrastructure

PIANC MarCom WG 186

## Mooring of Large Ships at Quay Walls

### Terms of Reference

#### 1 Background

Ever larger container ships, cruise ships and dry bulk carriers are being developed, and these are frequently required to moor at quay walls where mooring bollards are all very close to the berthing line along the face of a quay. This leads to situations where mooring lines cannot provide adequate restraint perpendicular to the quay line, particularly in adverse wind conditions.

Oil and gas tankers and dry bulk carriers generally use island berths with arrangements of mooring and breasting dolphins for which design guidance already exists. These are designed to provide safe mooring in all necessary conditions of wind, waves and currents, and are outside the scope of this Working Group (WG).

#### 2 Objectives

The objectives of the proposed Working Group are to gather existing technical information on safe mooring of large ships in situations where mooring bollards are all very close to the berthing line along the face of a quay wall, and to develop practical guidelines to allow designers to provide safe mooring facilities and to allow ship operators to moor large ships safely at quay walls.

#### 3 Scope

The WG should consider container ships, cruise ships, bulk carriers, and any other ships other than oil and gas tankers (which tend to use island berths and are already covered by OCIMF, SIGTTO and PIANC). The situation where mooring bollards are all very close to the berthing line along the face of a quay can stretch the capability of standard systems for large ships. Such situations can result in the possible horizontal and vertical arrangements of mooring lines being incapable of providing adequate restraint to the ship particularly when considering forces perpendicular to the line of the quay.

The objective of the WG is to carry out a targeted study of this topic, to identify relevant questions and to provide practical answers for port authorities, designers and operators. A particular objective will be to identify combinations of environmental conditions (i.e. wind, current and waves) where provision of bollards only along the quay line cannot by themselves provide safe mooring facilities.

Quay walls generally exist inside harbours and estuaries, where wind and currents are the main environmental forces acting on moored ships. Nevertheless wave forces can also be significant in some locations, and should be considered by the Working Group. The impact of tidal height variations should also be included.

Quay walls can be solid structures or open-piled structures supporting a concrete deck, and the WG should consider whether any different mooring facilities are required at these two types of berth.

The influence of passing vessels on moored ships is also relevant.

The limitations of mooring equipment fitted to ships should also be considered, noting that the ship's mooring equipment, including winches and mooring lines, will normally set an upper limit to the number and strength of mooring lines than can be used.

The WG should consider where sub-optimal mooring layouts will result in reduced output or even stoppage of cargo handling operations, and more extreme conditions when it might no longer be safe for a ship to remain moored at the berth. They should differentiate between ports where ships must stay in all conditions and those where ships will leave the port when extreme conditions are forecast.

Guidance on emergency moorings (bollards set well back behind quay line) under extreme conditions, e.g. in conditions when the container cranes would be "locked down" and not in use, should be included.

The WG should review rope-free methods of mooring such as vacuum and magnetic mooring. The WG can also include multiple alongside berthing such as occurs for ship-to-ship cargo transfer operations.

The recommendations of the report will necessarily not be definitive due to the many varying environmental conditions and constraints that can exist at different ports, but should be sufficient to allow informed decisions on planning, design and construction to be made.

#### **4 Existing documents to be reviewed**

The WG should review relevant publications including PIANC reports (particularly PIANC Report PTCII WG No. 24 Criteria for Movements of Moored Ships in Harbours, 1995), OCIMF and SIGTTO reports, national and international standards, IMO publications, and standards for ships' mooring equipment such as the rules of classification societies.

#### **5 Intended product**

The report will list current national and international standards where they exist. It will also list standards and guidance for representative utility organisations.

An examination of the factors influencing the choice of installation should be included thereby providing a framework for considering the design and operational requirements for any proposed installation or for any retrofitting of protection where increased standards are required either by the utility owner or the harbour authority.

#### **6 Working Group membership**

Membership of the WG should include representatives from stakeholders and target users such as harbour authorities, container ship operators, cruise ship operators, port designers and naval architects. The range of expertise should cover practical design and construction knowledge in terms of planning, design, ship mooring and related port operations. Also sister Associations as IAPH or IHMA should be invited to the Working Group.

## **7 Relevance to Countries in Transition**

The report will be of value in protecting the interests of both developed countries and countries in transition, and will particularly assist decision makers in the commissioning and installation of cruise terminals.

## **8 Climate Change**

The report must consider the impact of climate change on the design of new and existing quay walls, including possible changes in sea level, and increasing intensity and frequency of storms. Mooring facilities at existing berths may need to be improved to provide adequate levels of security in present conditions and in more severe conditions that might exist in the future.