



**RecCom WG 222**

**DESIGN GUIDELINES FOR FLOATING BREAKWATERS IN  
MARINAS**

**TERMS OF REFERENCE**

**1. Historical background - Definition of the problem**

Floating breakwaters, also known as wave attenuators, are wave protection structures with specific characteristics for specific wave environments, which require specialized design guidelines. Small craft harbours are often exposed to waves and require structures to protect docking facilities, boats and users from excessive wave-induced motions or wave damage. Among the several wave protection structures available, floating breakwaters are often considered at locations where vessel wake, or wave conditions are relatively mild but still conducive to unacceptable levels of agitation within a marina or small craft harbour.

As opposed to breakwaters that are fixed and founded on the seabed, floating breakwaters anchored either with piles or mooring lines are dynamic. Consequently, they can only attenuate and not completely block incoming waves. Furthermore, to minimize footprint and reduce cost for most commercial applications, their size is constrained in a way that make them effective within a narrow range of wave periods of approximately up to 4 seconds

The wave protection performance of a floating breakwater is closely related to its geometry, mass properties, mooring system and how these relate with the design wave conditions. Therefore, a good understanding of these relationships is critical for adequate design.

Historically, floating breakwater design has been based on limited field and physical model experiments and empirical formulae derived from these. At times, the experimental data and empirical formulae have been used outside their range

of validity and this has led to designs of poor performance and structures that have suffered catastrophic failure.

Recent advances in applied research, materials, construction technologies and analytical tools and methods can significantly improve the understanding of floating breakwater performance and assist in the development of efficient and safe designs.

PIANC PTC2 Working Group No. 13, Floating Breakwaters - A Practical Guide for Design and Construction, 1994, is the only guideline currently available and, in the light of recent advances, it is need of review and update.

## **2. Objectives**

The objectives of the proposed WG are to:

1. collect and review existing technical information on floating breakwater applied research, analysis, design, construction, installation, inspection and maintenance;
2. identify the existing best practices and design guidelines;
3. develop state-of-the-art practical guidelines for the design of efficient and safe floating breakwaters.

## **3. Earlier reports to be reviewed**

The WG shall review PIANC's relevant publications including PIANC PTC2 Working Group No. 13, Floating Breakwaters - A Practical Guide for Design and Construction, 1994; and academic literature, reports, national and international standards, codes and guidelines.

## **4. Scope**

The expected scope of work necessary to achieve the objectives of the WG is the following:

- Literature collection and review
- Description of design principles (including functionality, operational, environmental and regulatory aspects) and guidelines
- Description of floating breakwater design process and outcomes
  - a. concepts (including historical developments)
  - b. components

- c. design (including site characterization and performance prediction)
- d. construction
- e. installation
- f. inspection and maintenance
- Case Studies

## **5. Intended product**

Aid for the assessment and design of floating breakwaters.

## **6. Working Group Membership**

Membership of the WG shall include representatives from stakeholders and target users such as: engineers, port authorities, harbour masters, marina operators, fabricators and developers of marine products, marina design-build contractors and designers, and researchers.

The range of WG expertise should cover practical knowledge in aspects such as planning, analysis, design, construction, installation, inspection and maintenance, as well as research focused on design performance and optimization.

## **7. Target Audience**

The target audience for the guidelines will be general maritime engineers and designers, marine product designers and fabricators, harbour masters, project managers, construction managers, and administrators.

## **8. Relevance**

### **8.1. Relevance to countries in transition**

The guidelines can assist countries in transition with the growth of recreational navigation by providing information for the evaluation and adequate implementation of efficient, safe and low-cost floating breakwater designs for wave protection. Conversely, inappropriate construction of these types of works can result in costly damage during extreme events, poor operational performance, and generally discourage boating infrastructure development.

## **8.2. Climate Change and Adaptation Implications**

Depending on site conditions, floating breakwaters constitute an alternative to mitigate the effects and adapt to sea level rise given their modular and reconfigurable nature.

## **8.3. Relevance to Implementation of WwN Philosophy**

Floating breakwaters, in the right conditions, could provide wave protection with minimal impact on benthic resources. Early feasibility evaluation of adequate wave attenuator solutions can be a valuable technical tool for the implementation of WwN philosophy.

## **8.4. Relevance to UN Sustainable Development Goals**

This report is intended to directly contribute to the following SDG's:

- Goal 9: Develop quality, reliable, sustainable and resilient infrastructure
- Goal 13: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters

## **8.5. Relevance to UN Small Island Development States (SIDS)**

Technically appropriate and cost-efficient solutions for sustainable coastal and boating infrastructure development supports SIDS.