



IALA GUIDELINE

GNNNN THE MARKING OF BREAKWATERS AND BARRIERS

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1. INTRODUCTION

This Guideline provides guidance for the marking of exposed (“above water”) and submerged (partially or wholly/fully) breakwaters.

Breakwaters are typically large artificial offshore structures, designed to serve as a barrier that protects a coast, a port and/or its facilities (e.g., a marina).

Breakwaters can present a challenge to the safety of navigation if not marked appropriately. A lack of lighting (or ambiguous lighting) can create confusion for ships, particularly at night.

Various factors will need to be considered when deciding how breakwaters are to be marked. These include the structure of breakwater itself, stakeholder needs, bathymetry and available depths, traffic density and background lighting, if any.

This guideline must be read in conjunction with IALA Guideline *G1078 The Use of AtoN in the Design of Fairways*.

2. INFORMATION AND PROMULGATION

Competent authorities (AtoN) must ensure that all stakeholders are informed of installed Marine Aids to Navigation (AtoN) and markings in accordance with these guidelines. These must be published on nautical charts, in relevant publications and by promulgation of Maritime Safety Information (MSI).

2.1. CATEGORIZATION AND AVAILABILITY

AtoN for breakwaters are to be categorized and maintained to the availability level as specified by the Competent Authority (AtoN) further to IALA Recommendation *R0130*.

3. MARKING OF BREAKWATERS

3.1. EXPOSED BREAKWATERS (FIXED OR FLOATING)

Often, breakwaters are exposed or “above water”. These can be associated with smaller, regional ports, used by domestic and recreational craft. These breakwaters can be marked using a combination of lateral marks. In many cases, a set of lead and/or sector lights, or port entry lights, are installed to assist vessel entry and departure.

Small ports

The following example illustrates the layout of AtoN, namely lateral marks, for marking the breakwaters at Wyndham Harbour, Victoria, Australia.



Figure 1 Wyndham Harbour, Victoria. (Photo Courtesy: Sail Escapade)

The unlit portion of the breakwater (in between AtoN) can present a hazard to navigation. Where pedestrian access is permitted, pathway or street lighting is sometimes (but not always) provided. Pathway or street lighting could be considered a non-conventional means to maximize the illuminated portion of a breakwater, thus increasing maritime safety. These supplemental lights should be designed to not distract from, interfere with or obscure the main AtoN.

Large ports

Some larger ports incorporate a combination of Special marks, spaced at an equal distance apart, in a similar fashion to that illustrated in figure 3. Examples of where Special marks have been used extensively to mark breakwaters include the ports of Brisbane and Townsville, Australia (200m apart) and the Yangtze River Estuary of the port of Shanghai, People's Republic of China (1000m apart).¹

Where the breakwater is parallel to the navigable channel, the colour of the structures of the breakwater and the lateral edge of the channel should be the same. However, the light characteristics should be different from each other. The use of port entry lights may also be considered.

In order to increase conspicuity of the breakwater, the AtoN lights may be set to flash synchronously.

¹ Local authorities are best placed to decide the characteristic of breakwater light/s. For example, synchronized and identical character lights may suit some situations, while a combination of differing characters may be required where enhanced spatial awareness is required (e.g., in areas of poor visibility).

The spacing between consecutive AtoN and their flash characteristics should be decided based on traffic density, the results of any risk assessment and stakeholder feedback. The hazard warning arrangement may be strengthened using signs with plain text.

Some examples of marking arrangements are below:

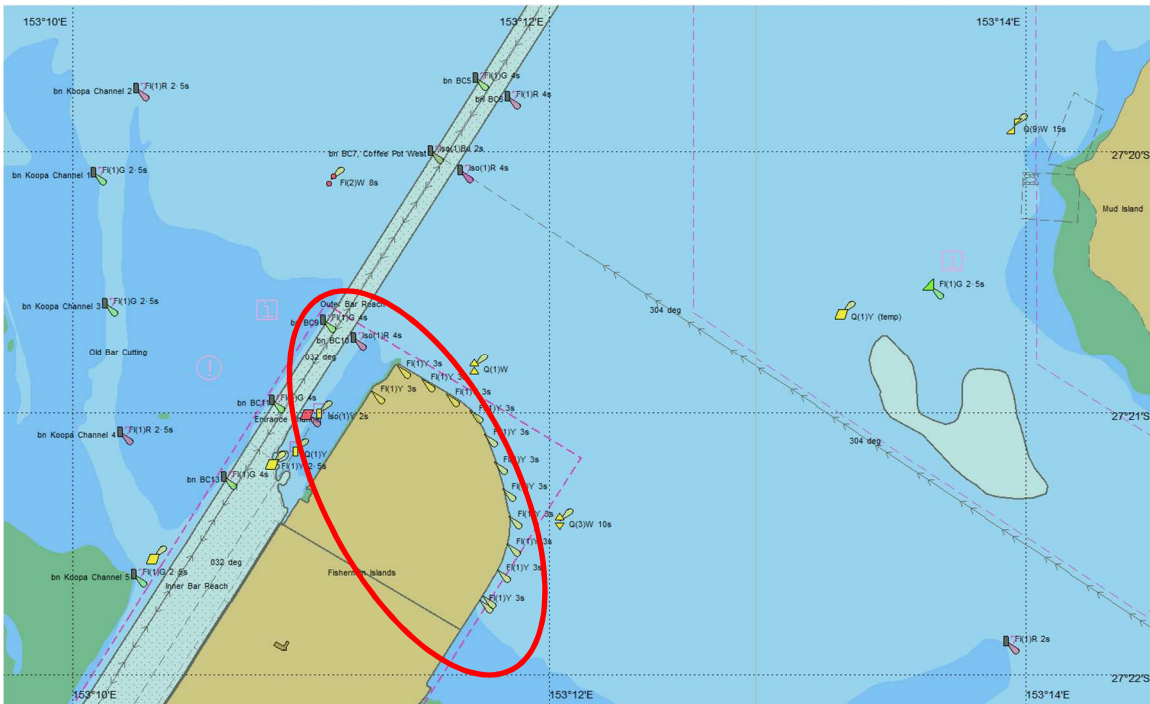


Figure 2 Fisherman's Island, Port of Brisbane, Australia

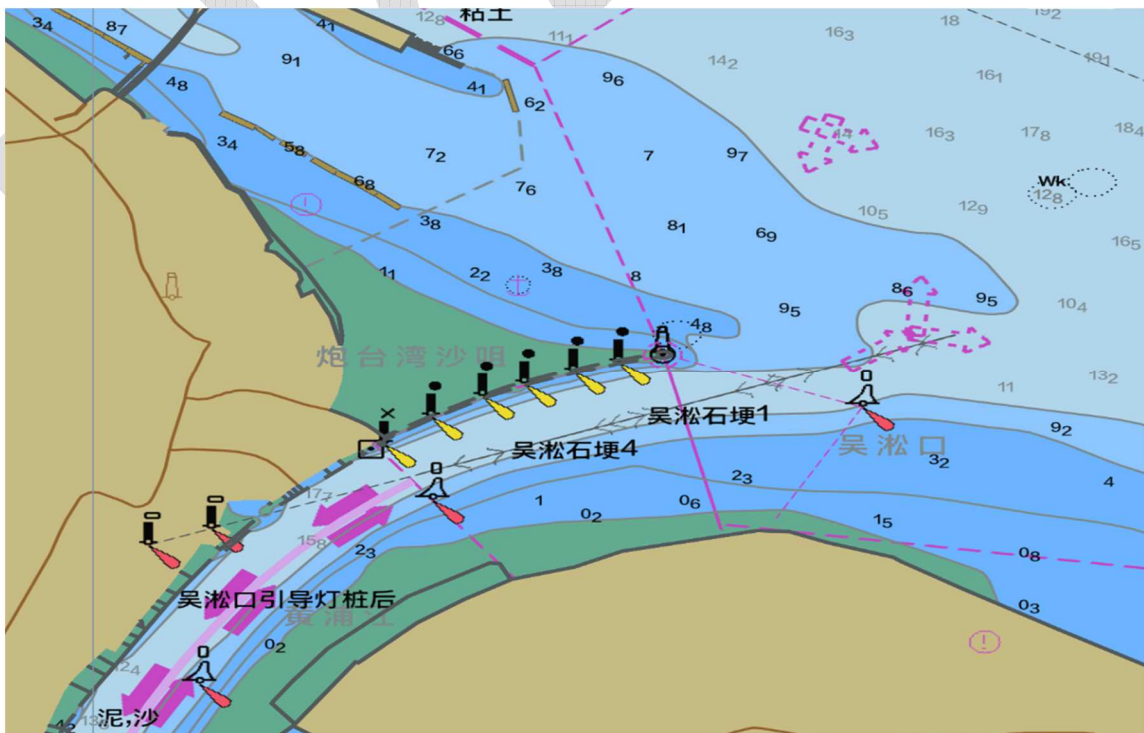


Figure 3 Wusong Estuary Submerged Barriers

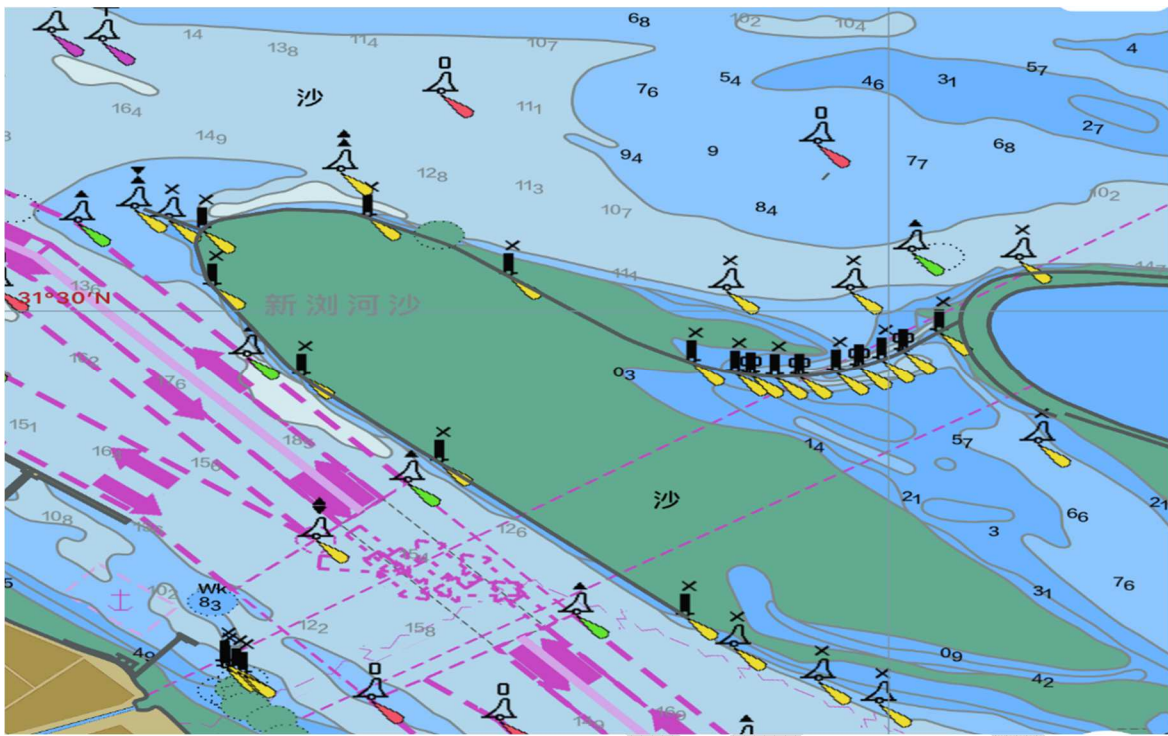


Figure 4 New Liuhe sand bar and Nanshatou Channel submerged breakwater (dikes), Yangtze River Estuary

3.2. SUBMERGED BREAKWATERS OR BARRIERS

Submerged breakwaters or barriers have numerous uses and titles internationally. Titles such as training walls, submarine barriers, booms, and dikes (See Figure 4 Above) are examples of some terminology used.

Submerged breakwaters present a higher risk, as they are fully underwater, and may only be partially or wholly/fully visible above water at other states of the tide. Vessels that transit in the proximity of such submerged breakwaters include small vessels such as fishing boats and leisure craft. Many such vessels have no electronic chart system or other electronic navigation aids and still navigate using visual means and paper charts. If a submerged breakwater is not visible to the mariner it can be a danger to navigation.

The criteria for the marking of submerged breakwaters should be considered on a case by case basis after close consultation with all stakeholders, supported by a risk assessment. Factors to consider include the structure of submerged breakwater itself, traffic density, bathymetry and available depths of water when considered with typical vessel draught in the area.

The marking of submerged breakwaters should be in accordance with the following criteria.

- Marking to show the location and alignment of the structure will generally be Special marks as shown in Figure 4.
- If there is a passageway for a craft around, or through, a submerged breakwater, mark the waters according to the IALA *Maritime Buoyage System* and *Guideline G1078*.
- If possible, the preferred option is to attach marks to the top of submerged breakwater. If not, mark the waters near the submerged breakwater on the side which craft navigate.
- For a single submerged breakwater, deploy the mark at the regular intervals along and at the end of a submerged breakwater, depending on the sea and other conditions.

- If there are two or more units forming the submerged breakwater, consider the entire submerged breakwater arrangement as one. Deploy marks at both ends of the submerged breakwater at regular intervals, depending on the sea and other conditions.

Table 1 Recommended criteria for the AtoN arrangement of exposed or submerged breakwaters

Type of Marking	Length of Breakwater	The criteria for the AtoN arrangement of exposed or submerged breakwaters
Marking with fixed AtoN	Single/composite structure (shorter than 200m)	Mark both ends
	Single/composite structure (longer than 200m)	Mark at the both ends and at regular intervals along the structure
	Passages between breakwaters or between breakwaters and the shore.	Use Lateral Marks, Fixed Lights or Beacons, at the passage and marking along the breakwater as described above.
Marking with floating AtoN	Single/composite structure (shorter than 200m)	Mark at the both ends of the outer sea area (vessel traffic area)
	Single/composite structure (longer than 200m)	Mark at the both ends and at regular intervals along the outer sea area (vessel traffic area)
	Passages between breakwaters or between breakwaters and the shore.	Use Lateral Marks at the passage and marking along the breakwater as described above.

3.3. EXAMPLES OF MARKING

3.3.1. MARKING WITH FIXED ATO N

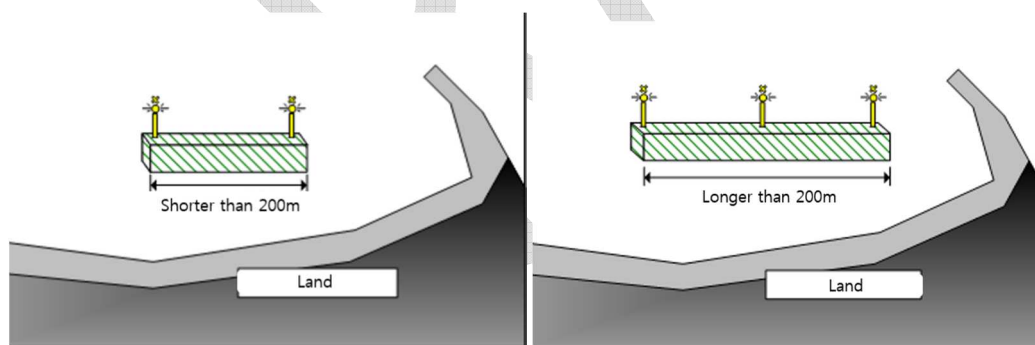


Figure 5 Example of marking breakwaters with fixed AtoN

3.3.2. MARKING WITH FLOATING ATO N

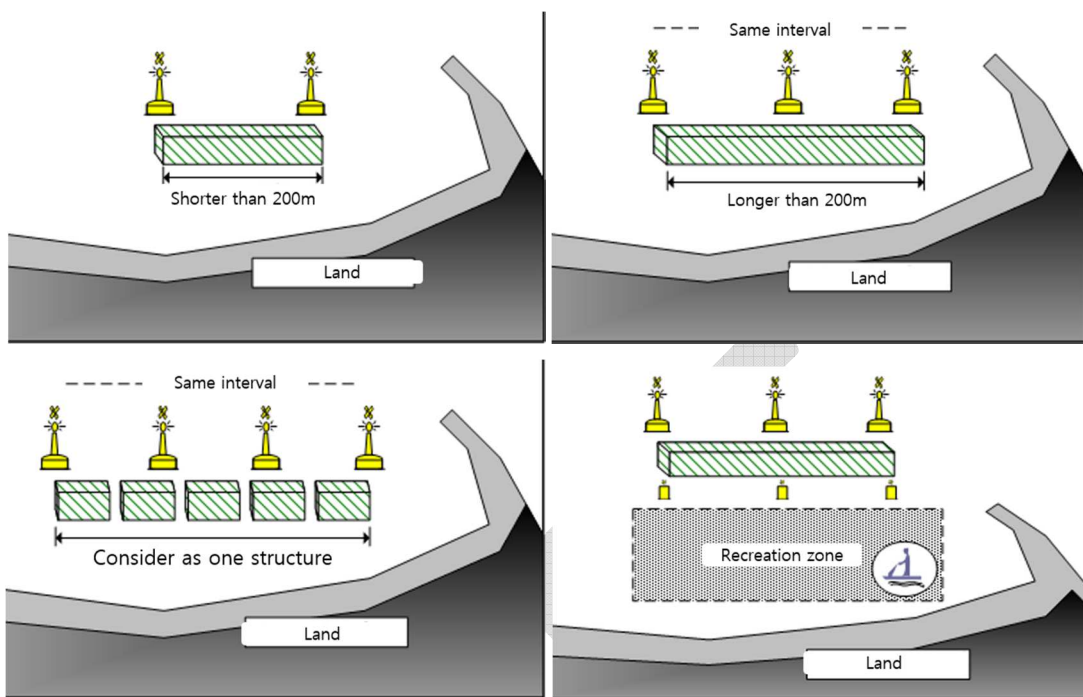


Figure 6 Examples of marking breakwaters with floating AtoN

3.3.3. MARKING OF PASSAGES AT BREAKWATERS

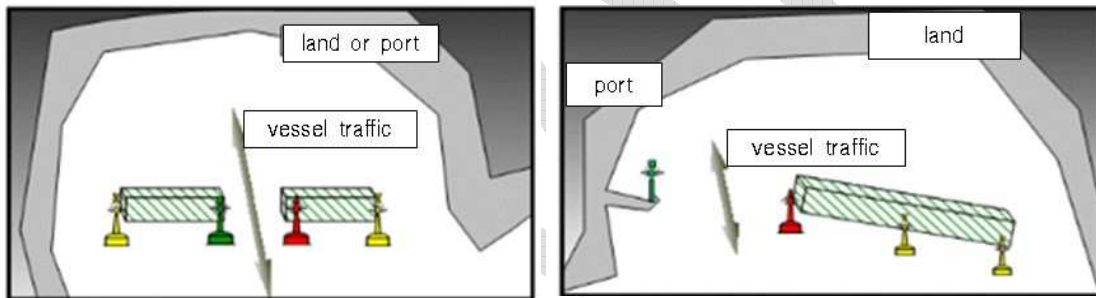


Figure 7 Example of marking passages between breakwaters or between breakwaters and the shore (IALA System B)

3.4. CONSIDERATIONS DURING CONSTRUCTION OF BREAKWATERS

During the construction phase of any breakwater, special consideration should be given to promulgation of the relevant MSI so that all maritime users are aware of the ongoing activity.

Construction zones should be marked with temporary AtoN to increase awareness of the building of the breakwater.

4. DEFINITIONS

The definitions of terms used in this Guideline can be found in the *International Dictionary of Marine Aids to Navigation* (IALA Dictionary) at <http://www.iala-aism.org/wiki/dictionary> and were checked as correct at the time of going to print. Where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.

In addition, for this document:

Competent authority (AtoN) – the regulatory body for AtoN marking of offshore structures.

5. ABBREVIATIONS

AtoN	Marine Aid(s) to Navigation
MBS	IALA Maritime Buoyage System
MSI	Maritime Safety Information (e.g., NAVTEX, Notices to Mariners)

6. REFERENCES

- [1] IALA. Standards S1010 AtoN planning and service requirements
- [2] IALA. NAVGUIDE
- [3] IALA. Recommendation R1001 IALA Maritime Buoyage System
- [4] IALA. Guideline G1078 The Use of AtoN in the Design of Fairways
- [5] IALA. Guideline G1134 Surface Colours used as Visual Signals on AtoN
- [6] IALA. Recommendation R0130 Categorization and Availability Objectives for Short Range AtoN
- [7] IALA. Guideline G1073 Conspicuity of AtoN Lights at Night
- [8] IALA. Guideline G1121 Navigational Safety within Marine Spatial Planning
- [9] IALA. Guideline G1090 Use of Audible Signals
- [10] IALA. Guideline G1051 Provision of Aids to Navigation in Built-up Areas