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| IALA Guideline |

Gnnnn

the marking of breakwaters

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Revisions to this document are to be noted in the table prior to the issue of a revised document.

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# Introduction

This guideline provides guidance for the marking of exposed (‘above water’) and submerged (partially or wholly) 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 1078** The Use of AtoN in the Design of Fairways.

### INFORMATION AND PROMULGATION

Competent Authorities (AtoN) must ensure that all stakeholders are informed of installed 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).

### CATEGORISATION AND AVAILABILTY

AtoN for breakwaters are to be categorised and maintained to the availability level as specified by the Competent Authority (AtoN) further to IALA Recommendation 0130

# marking of breakwaters

## exposed breakwaters

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 for marking the breakwaters at Wyndham Harbour, Victoria, Australia.

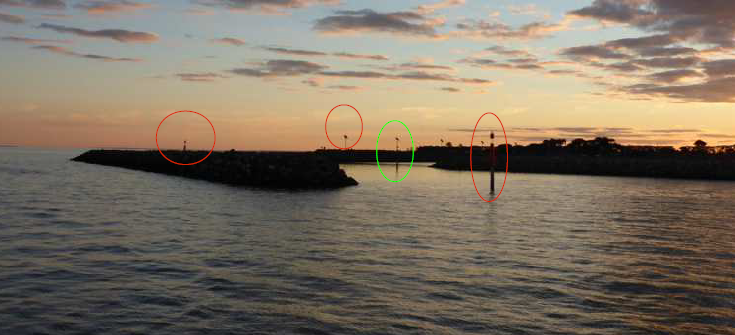




Figure 1 Wyndham Harbour, Victoria. (Photo Courtesy: Sail Escapade)

The unlit portion of the breakwater (in between AtoN) can presents 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 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]](#footnote-1)

Where the breakwater is parallel to the navigable channel, the colour of the structures 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.

The spacing between consecutive aids to navigation 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:

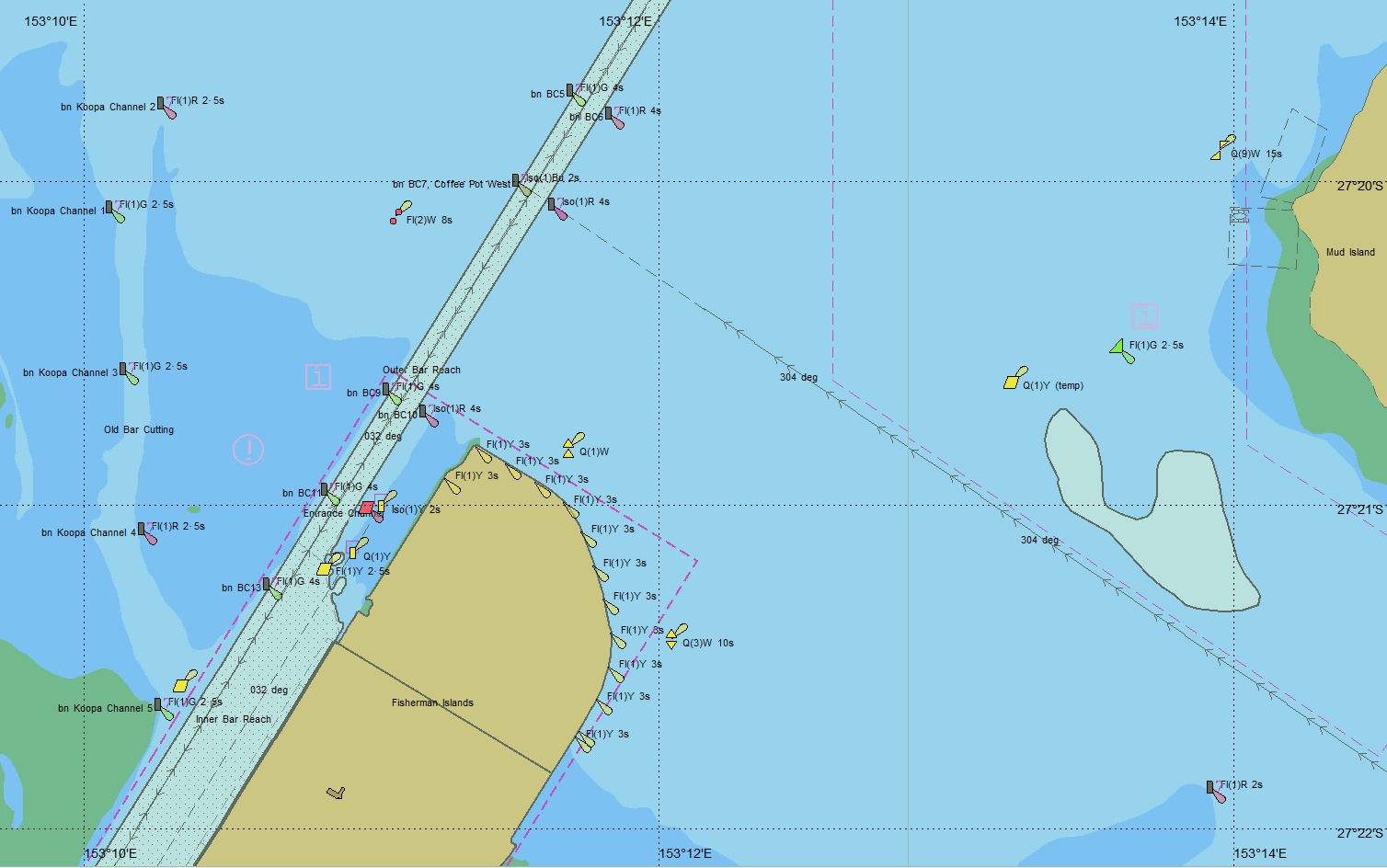


Figure 2 Fisherman's Island, Port of Brisbane, Australia

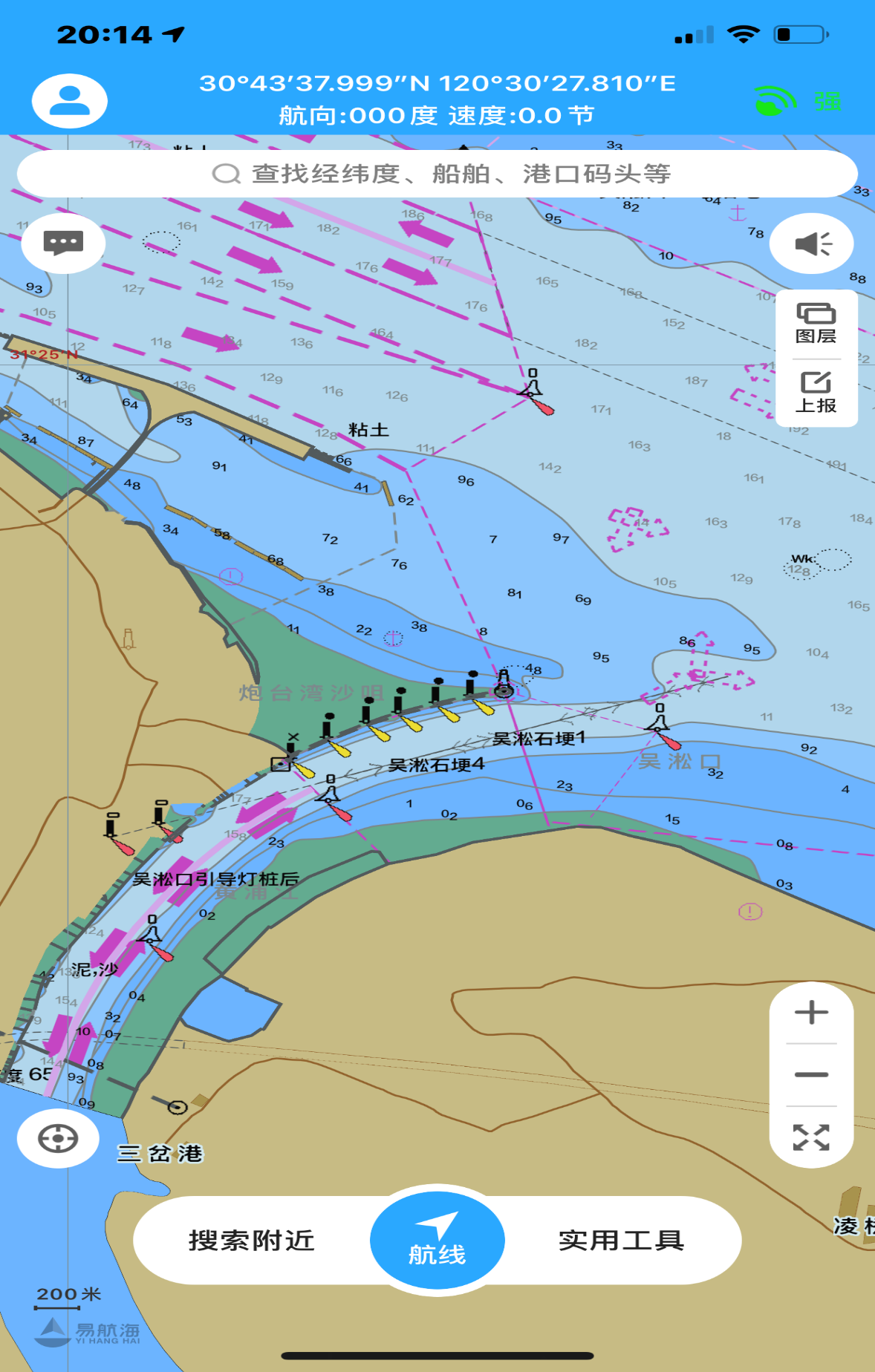


Figure 3 Wusong Estuary Submerged Barriers

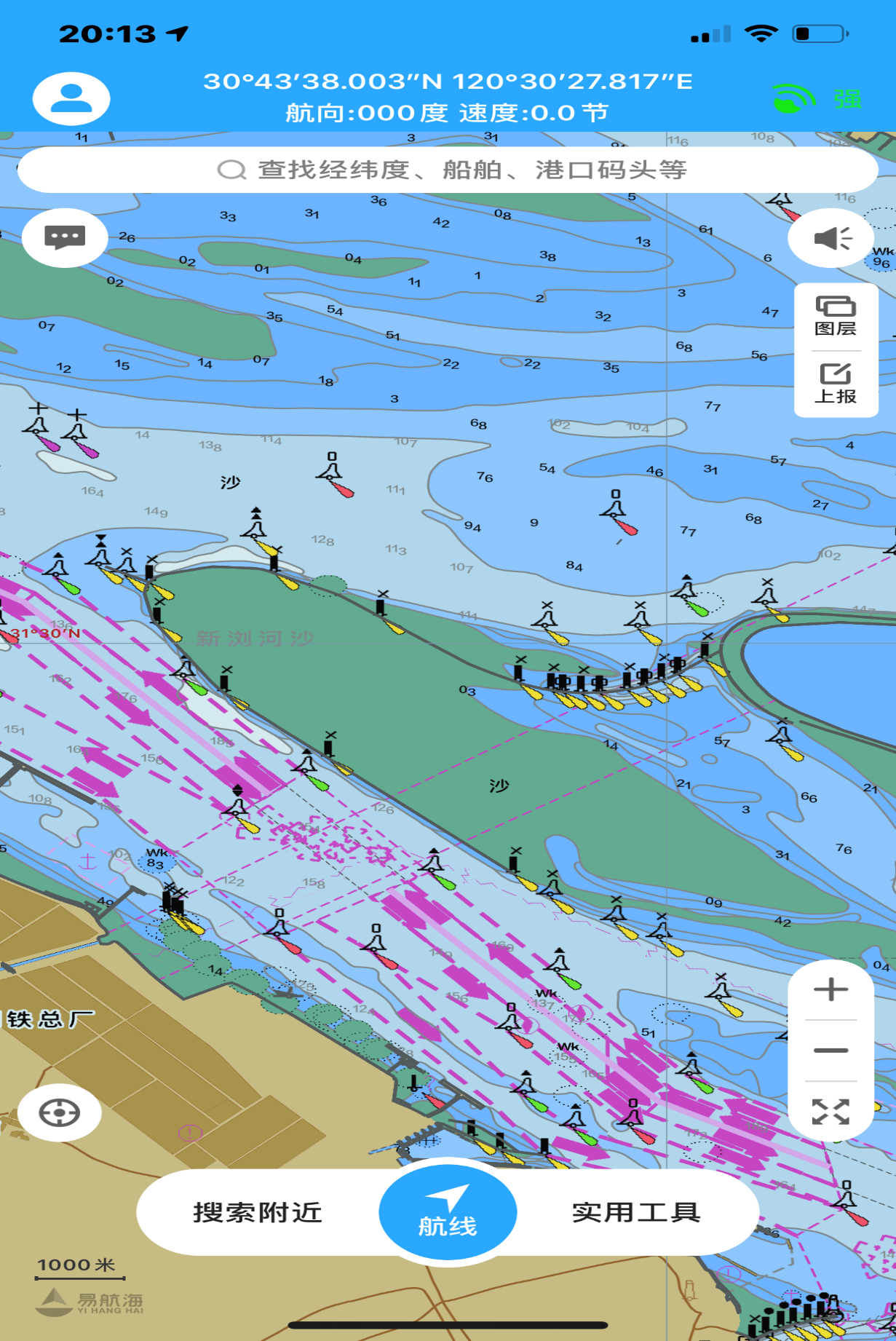


Figure 4 New Liuhe sand bar and Nanshatou Channel submerged breakwater (dikes), Yangtze River Estuary

## submerged breakwaters

Submerged breakwaters present a higher risk, as they are underwater at high tide, and only partially or wholly above water at low tide. Usually, vessels that transit in the proximity of such submerged breakwaters are small vessels, such as fishing boats and leisure craft. Many such vessels have no electronic chart system or other electronic navigation aids. 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.

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

1. Marking for the prevention of collision are generally special marks

2. If there is a passageway for craft around a submerged breakwater, mark the waters according to the IALA Maritime Buoyage System and Guideline 1078

3. 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.

4. 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.

5. If there are 2 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.

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| **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. |

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

## Examples of marking

### marking with fixed aton

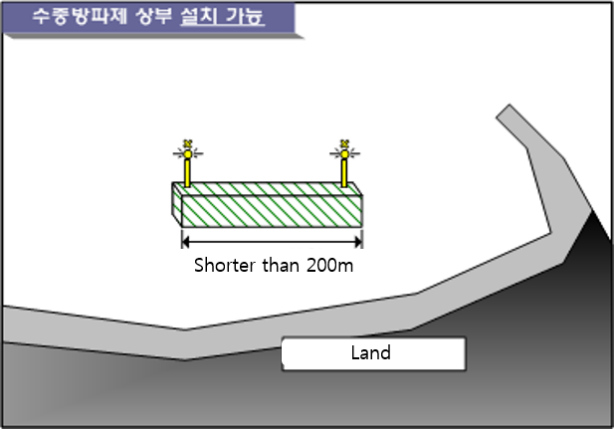
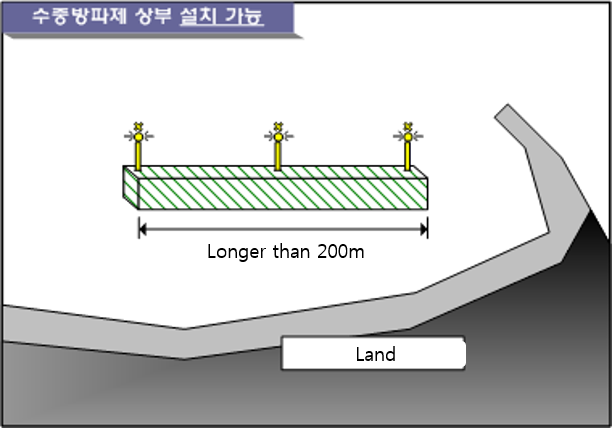
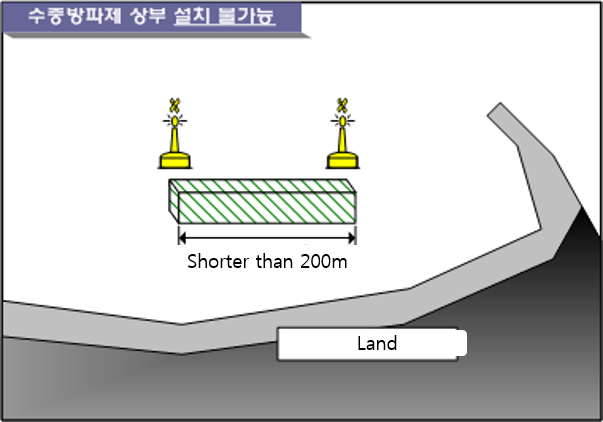
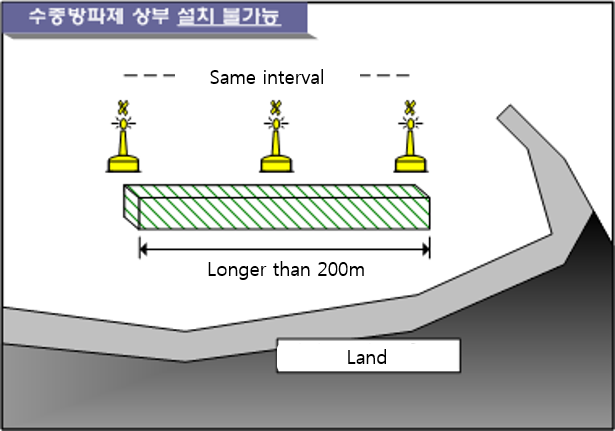
 

Figure 5 Example of Marking Breakwaters with Fixed AtoN

### marking with floating aton

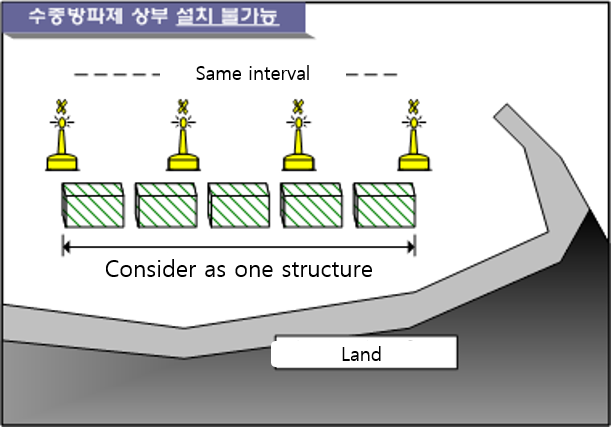
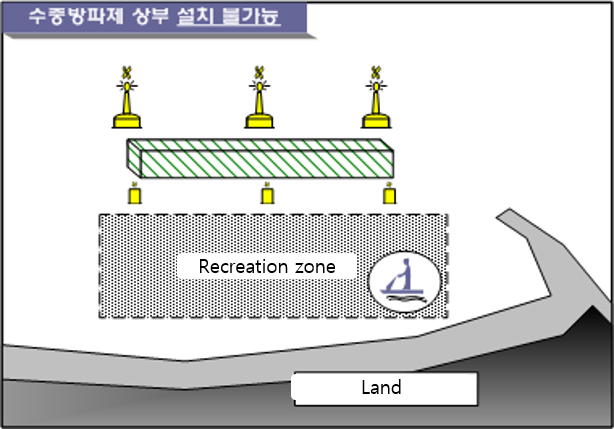
 

Figure 6 Examples of Marking Breakwaters with Floating AtoN

### 화면 캡처 2020-10-19 172748marking of passages at breakwaters

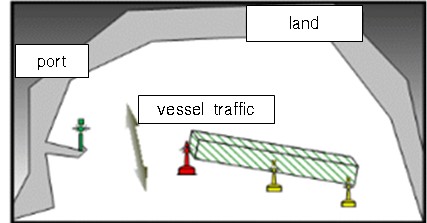




Figure 7 Example of Marking Passages between breakwaters or between breakwaters and the shore (IALA System B)

## 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 mariner users are aware of the activity.

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

# ADDITIONAL INFORMATION

IALA Standards

IALA R1001 IALA Maritime Buoyage System

IALA G1078 The use of AtoN in the design of fairways

IALA G1134 Surface colours used as visual signals on AtoN

IALA R0130 Categorisation and availability objectives for short range AtoN

IALA G1073 Conspicuity of AtoN lights at night

IALA G1121 Navigational safety within marine spatial planning

IALA G1090 Use of audible signals

IALA G1051 Provision of Aids to Navigation in built up areas

# 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.

# abbreviations or acronyms

|  |  |
| --- | --- |
| AtoN | Aid(s) to Navigation |
| MBS | IALA Maritime Buoyage System |
| MSI | Maritime Safety Information (e.g. NAVTEX, Notices to Mariners) |
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1. Local authorities are best placed to decide the characteristic of breakwater light/s. For example, synchronised and identical character lights may suit some situations, while a combination of differing characters may be required where enhanced spatial awareness in required (e.g. in areas of poor visibility). [↑](#footnote-ref-1)