

# IALA GUIDELINE

## GNNNN

# THE MARKING OF BRIDGES AND OTHER STRUCTURES OVER NAVIGABLE WATERS

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# DOCUMENT REVISION

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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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## 1. INTRODUCTION

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This Guideline replaces the previous IALA Recommendation R0113 (O-113) *The Marking of Bridges and Other Structures over Navigable Waters*.

The following guidelines should be read in conjunction with Recommendation *R1001 IALA Maritime Buoyage System (MBS)* and other IALA guidance. Bridges and other structures, due to their unique construction and location, may need marking to ensure their safety and that of vessels navigating beneath them. Navigation challenges at these structures include limited vertical clearance, width of navigable span, water depth, the possibility of allision with the structure and collision with other vessels.

Where sea and inland navigation meet, authorities should ensure that the marking of bridges does not conflict with the signs and signals of inland waterway systems.

## 2. SCOPE

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This Guideline applies to bridges and other structures, including floating bridges, opening bridges, overhead pipelines, cables with supporting structure in the waterways, as well as structures under construction that cross navigable waterways or channels.

## 3. GENERAL MARKING

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### 3.1. GENERAL PRINCIPLES

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This Guideline is to provide advice for the marking of safe passages under, between, or through obstacles protruding into or over navigable waterways.

### 3.2. BEST POINT(S) OF PASSAGE

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In some cases, it may be necessary or desirable to indicate to vessels the most appropriate point(s) to pass under a bridge. These are referred to in this Guideline as “best point(s) of passage”. This Guideline provides suitable day and night signals for this purpose.

The “best point(s) of passage” will be determined by the Competent Authority taking into account all relevant factors, such as:

- maximum available horizontal and vertical clearance;
- water depth under the bridge, particularly where it is not uniform;
- protection of the bridge piers and other obstructions; and
- traffic patterns including one or two directional transits and traffic separation schemes under individual or multiple spans.

Where there are multiple navigable spans of the bridge/structure those marking the structure should follow the same guidance for all navigable spans.

## 4. BASIC REQUIREMENTS

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The following section outlines the basic requirements on how to mark “the best point(s) of passage”. These requirements are illustrated in Figures 1 and 2 in section 5. Additional marking could be realized as described in Sections 6 and 7.

### 4.1. VISUAL MARKS

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Bridge marking should be in accordance with the direction of buoyage and the MBS.

### 4.2. COLOURS

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For countries in Buoyage Region A:

- Green to starboard
- Red to port.

For countries in Buoyage Region B:

- Red to starboard
- Green to port.

#### 4.2.1. MARKING BY DAY

If navigation is possible in the full passage span, the marks should be located on the bridge piers. If navigation is possible only in part of the span, the marks should be located on or under the span, indicating the limits of the navigable channel.

- For countries in Buoyage Region A (in the direction of buoyage):
  - to starboard: a panel showing a solid green equilateral triangle point upwards; and
  - to port: a panel showing a solid red square.
- For countries in Buoyage Region B (in the direction of buoyage):
  - to starboard: a panel showing a solid red equilateral triangle point upwards; and
  - to port: a panel showing a solid green square.

The “best point(s) of passage” may be indicated by a circular panel with red and white vertical stripes.

To ensure positive recognition, the competent authority should be satisfied that there is a good contrast between the coloured panels and the colour of the bridge structure. Such a contrast may be achieved by mounting the panels against a white background.

If there is more than one navigable channel under the bridge, the same system should be used for each channel.

Bridge spans other than those marked by red and green lateral marks, such as spans to be used by small craft, may be indicated by special yellow marks in accordance with the *IALA MBS*.

Consideration could be given to the placement of “No Entry” signage where appropriate.

#### 4.2.2. MARKING BY NIGHT

Red or green lights may be used to mark the navigable limits of the channel in accordance with the *IALA MBS*.

If navigation is possible in the full passage span, the lights should be located on the bridge piers. If navigation is possible only in a part of the span, the lights should be located under the span, or on buoy and beacons in the water so placed as to indicate the limits of the navigable channel. Synchronized lights may be used to increase conspicuity.

The “best point(s) of passage” may be indicated by a flashing white light or lights located under the span and exhibiting a safe water mark character.

If there is more than one navigable channel under the bridge, the same marking principles should be used for each channel.

Care should be taken to ensure that all red and green lights have adequate ranges for the given circumstances, especially where background lighting makes identification difficult. The lights must be mounted so as to be visible over all relevant areas of the horizon, and not obstructed by parts of the bridge structure.

Bridge spans other than those marked by red and green lateral, such as spans to be used by small craft, may be indicated by special yellow lights in accordance with the MBS.

As an alternative or supplement to lights, the daymarks recommended in section 4.2.1 may be floodlit or displayed on an electronic panel.

Floodlighting of bridge piers may, in some cases, give a satisfactory indication of the navigable area and may be considered.


Retro-reflective material of appropriate colour may be used to enhance night-time recognition of daymark panels

### 4.2.3. BACKGROUND AND OTHER INTRUSIVE LIGHTING

When marking bridges the competent authority should consider the effects of background lighting and other lighting which could obscure the Marine Aids to Navigation (AtoN) and confuse the mariner.

## 5. EXAMPLES OF BRIDGE MARKING

The figures below are based on IALA MBS Region B. Daymarks are shown for illustration purposes only.

The  symbol identifies the conventional direction of buoyage.

### 5.1. ONE WAY TRAFFIC (REGION B)

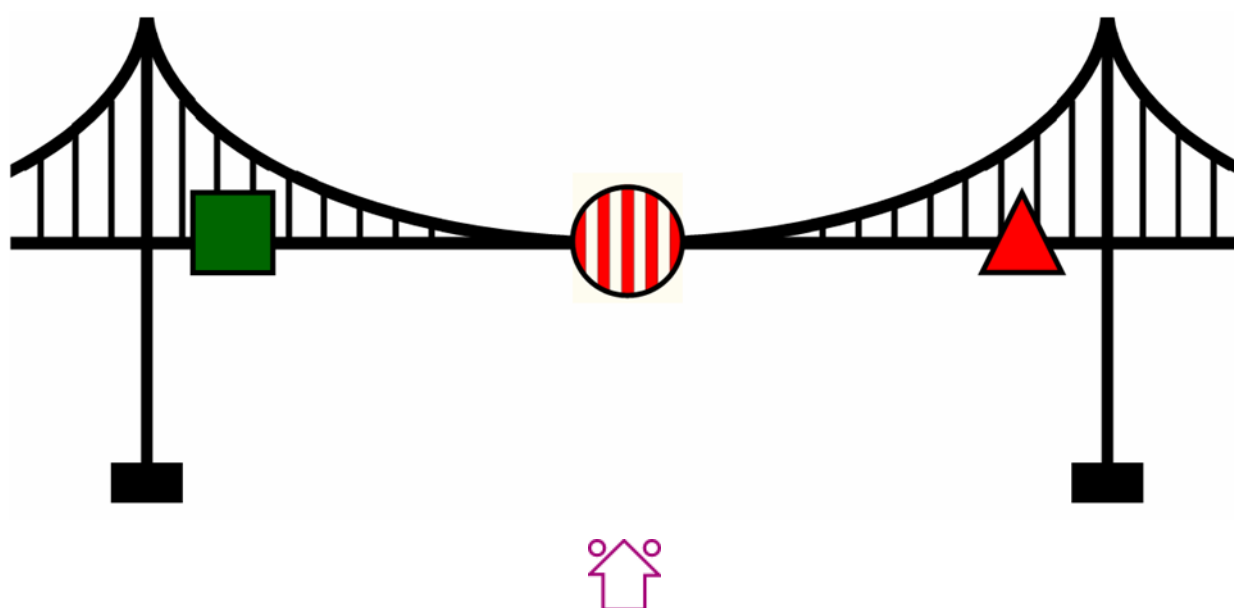


Figure 1 One way traffic - Elevation view

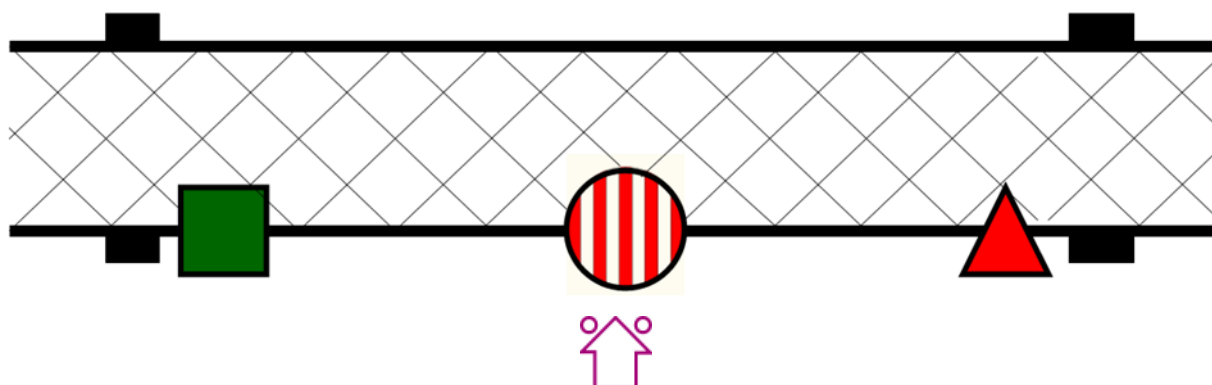


Figure 2 One way traffic - Plan view

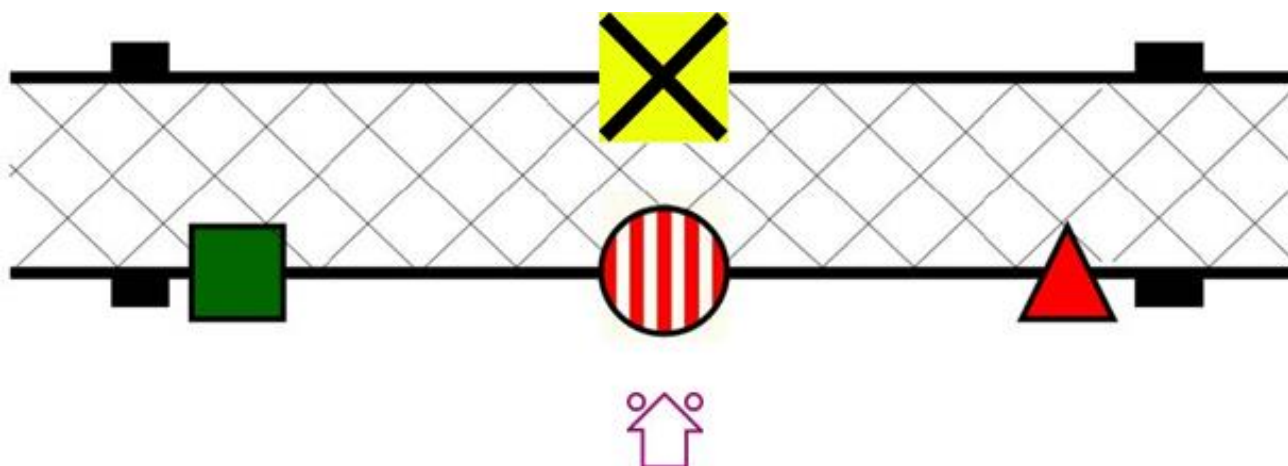


Figure 3 One way traffic – Example of plan view showing "No Entry" as found in China

## 5.2. TWO WAY TRAFFIC (REGION B)

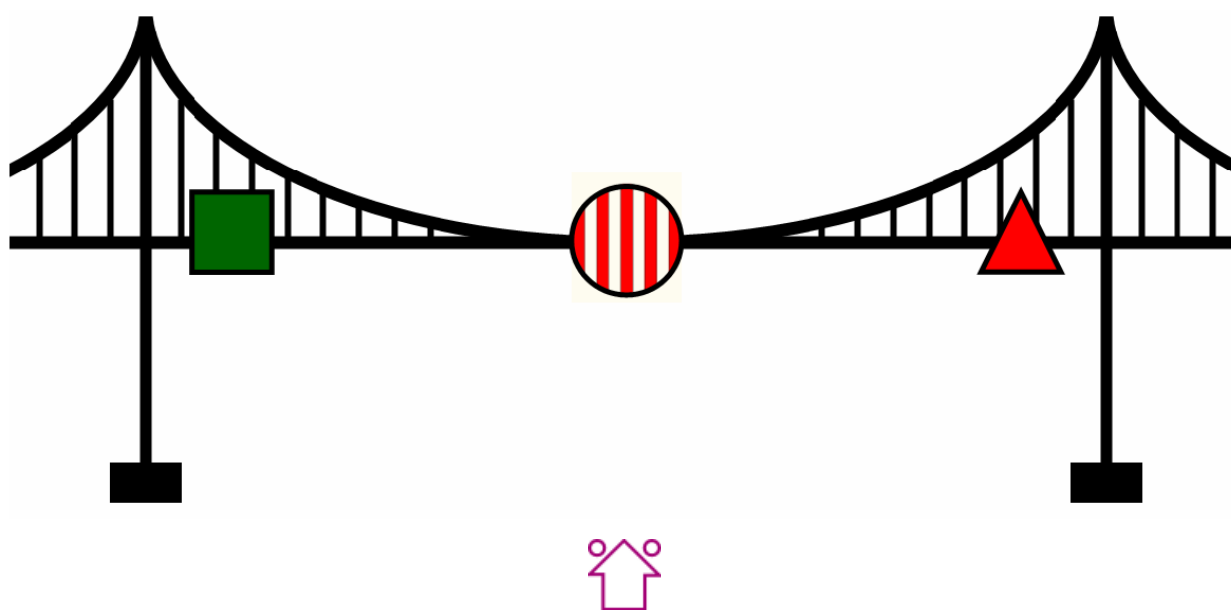


Figure 4 Two way traffic - Elevation view



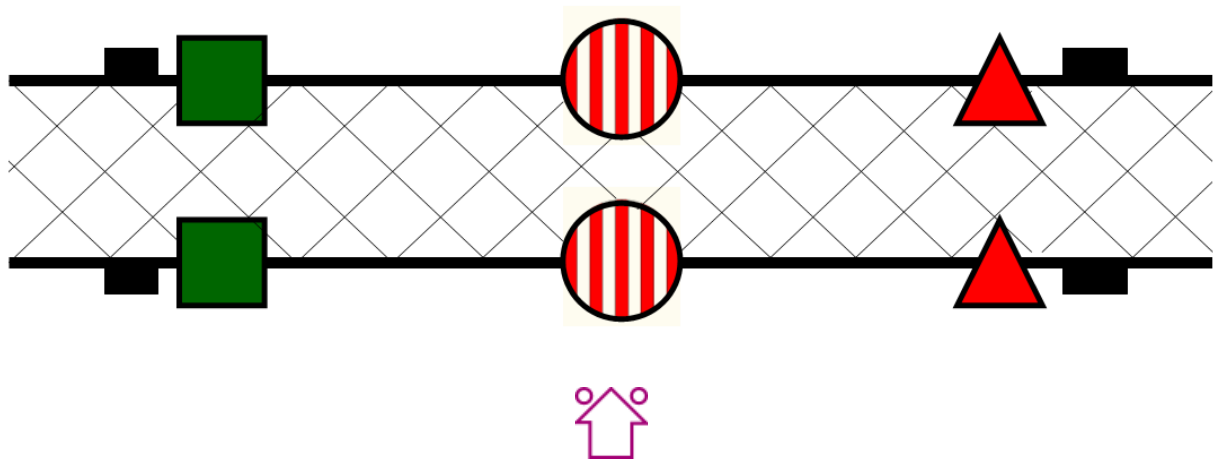


Figure 5 Two way traffic - Plan View

## 6. SUPPLEMENTARY MARKING

The systems described in this section are intended to amplify the lighting and marking described in section 4.

### 6.1. SOUND SIGNALS

One or more sound signals may be used to warn the navigator of the presence of a bridge. Any type of sound signal may be used for this purpose.

### 6.2. AIS ATON

AIS AtoN may be used to mark a bridge or other structure in accordance with related recommendations or guidelines.

AIS AtoN may be used to mark piers, “best point(s) of passage”, or the navigable channel beneath a span.

AIS AtoN may support the use of additional sensors such as air draft gauging, current meters, and current status of movable bridges.

AIS AtoN may also support the provision of maritime safety information (MSI) for the operation of the bridge and relevant navigable channel.

Further technical information on the use of AIS AtoN can be found in other IALA documentation.

### 6.3. RADAR MARKING

Limitations of radar often require additional signals to identify the bridge piers and navigable channel.

#### 6.3.1. RADAR REFLECTORS

Radar recognition of the bridge piers or channel boundaries may be made possible by radar reflectors located either on dolphins, buoys or poles fixed to the bridge structure. To ensure that the reflectors can be clearly distinguished from the bridge structure, practical trials should be carried out.

#### 6.3.2. RACONS

A racon may be used to mark the “best point(s) of passage” under a bridge. While it is not recommended that multiple racon are used to mark bridges. However, if an administration is contemplating the use of more than one racon to mark one or more spans must take into account technical limitations that may exist, such as the racon trace may unnecessarily obscure echoes from other targets.

Where two racon are used to mark a bridge span the preferred codes should be significantly different.

An example could be Starboard Morse code T(-) and Port Morse code B(----).

## 7. ADDITIONAL CONSIDERATIONS

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Buoys or beacons may be deployed to enhance the identification of the navigable channel and to mark any restricted areas in accordance with the MBS.

### 7.1. CLOSED SPAN MARKING

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When spans are closed to navigation these should be clearly marked so that they are easily identifiable to the mariner. These marks vary depending on the authority providing the AtoN. Local marking may apply in ports and harbours and differ from that provided by the national competent authority (AtoN).

“No Entry” marks, as defined by the competent authority, may be considered to inform mariners that passing under a span or one side of the span is forbidden.

### 7.2. PIER/SUPPORT MARKING

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It is recommended that the competent authority mark the extremities of the piers visible to vessels approaching the bridge so that they are easily identifiable by day and night.

It may also be necessary to mark the pier where it borders on, or encroaches into, the navigable channel. This could be by using lateral marks or indirect lighting such as floodlighting or strip lighting along the edge of the pier.

The competent authority (AtoN) should take into account sections of the bridge foundation or piers that could be submerged depending on the height of tide when marking the structure. This could be by using floodlighting, lateral or special marks.

## 8. OPENING BRIDGES

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Opening bridges such as vertical lifting (platform) bridges, swing bridges, cantilever bridges and bascule bridges may require individual marking solutions compliant with the MBS as specified by the competent authority (AtoN).

AtoN can be provided to mark the structure affecting the open waterway.

Consideration should be given to marking these structures in both the open and closed positions so that the bridge condition is apparent to the mariner.

Opening bridges may need to show different signals if they can be passed in both the open and closed state.

Traffic passing through open bridges may be controlled by visual signalling and/or vessel traffic services. Port traffic signals (IALA Recommendation *R0111 Port Traffic Signals*) should be referred to. Local signals can be used to indicate when the bridge is opening or closing and passage through the structure is prohibited or restricted by local regulations.

Bridge operational failures may require local marking solutions if some vessels can still transit the bridge area.

## 9. NAVIGABLE TUNNELS

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Navigable tunnels may require individual marking solutions compliant with the MBS as specified by the competent authority (AtoN).

Port traffic signals may be used to control vessels entering a tunnel.

Visual AtoN may be used to give the mariner situational awareness of where they are inside the tunnel.

## 10. DEFINITIONS

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The definitions of terms used in this Guideline can be found in the *International Dictionary of Marine Aids to Navigation* (IALA 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.

## 11. ABBREVIATIONS

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AIS	Automatic Identification System
AIS AtoN	AIS as a Marine Aid to Navigation
AtoN	Marine Aid(s) to Navigation
MBS	IALA Maritime Buoyage System

## 12. REFERENCES

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- [1] IALA. Standards
- [2] IALA. Navguide
- [3] IALA. Recommendation R1001 IALA Maritime Buoyage System
- [4] IALA. Recommendation R0130 Categorization and Availability objectives for Short Range AtoN
- [5] IALA. Recommendation R0111 Port Traffic Signals
- [6] IALA. Guideline G1134 Surface Colours used as Visual Signals on AtoN
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- [9] IALA. Guideline G1121 Navigational Safety within Marine Spatial Planning
- [10] IALA. Guideline G1090 Use of Audible Signals
- [11] IALA. Guideline G1078 The Use of AtoN in the Design of Fairways and Channels
- [12] IALA. Guideline G1051 Provision of Aids to Navigation in Built up Areas.