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**Input paper for the following Committee(s):** **Purpose of paper:**

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ARM  ENG  PAP  Input

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**Agenda item** [[1]](#footnote-1) 7.7

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Proposal to amend Guideline G1172 on the Marking of Bridges and Other Structures Over Navigable Waters

# Summary

In recent times, there were multiple collision incidents involving ships and bridges,with these incidents arising from diverse contributing factors. It is important for the safety of navigation that ships are well informed with the precise overhead clearance information.

To effectively mitigate the risk of collisions between ships and overhead structures, it is imperative to calculate Dynamic OverHead Clearance (DOHC). This calculation must include dynamic factors, specifically the characteristics of the vessel and the highest water level at the time, to ensure a thorough and accurate assessment of clearance for safe navigation.

## purpose of the document

In response to these requirements, this paper proposes several amendments to the Guideline G1172 on the Marking of Bridges and Other Structures Over Navigable Waters.

## Related documents

1. IALA Guideline G1172 on the Marking of Bridges and Other Structures Over Navigable Waters

# Background

A research project supported by the Korean government is currently being conducted in the Republic of Korea to develop hydrographic information standards for smart ships installed in autonomous systems. This initiative aims to create new and enhanced hydrographic information models coinciding with the rollout of autonomous shipping. The project has made advancements in developing models for Dynamic OverHead Clearance (DOHC), maritime traffic information based on the analysis of the S-100 hydrographic information model requirements.

This research has underscored the need for diverse services to address the requirements of both current vessels and the advent of autonomous shipping. A significant discovery is the critical role of dynamic data in ensuring maritime safety. Consequently, the necessity for new services facilitating bridge transits, which consider such dynamic data, has been established. Accordingly, we are submitting input data to propose revisions that incorporate these critical findings.

This paper will specifically address the DOHC component of the project, highlighting the critical need for dynamic calculations that factor in both the dimensions of the vessel and tidal changes to accurately assess the clearance height available under bridges and other navigational obstacles for both crewed and autonomous vessels. This calculation must take into account the vessel's specifications dynamically and include adjustments for tidal changes. Based on the outcomes of DOHC calculations, information categorizing the navigability of bridges and other obstacles into three levels should be provided. This categorization will enable both crewed and autonomous vessels to use this information, thereby preventing potential collisions.

Guideline G1172 provides a framework for marking bridges and other structures, with a focus on static information. The importance of coastal states supplying ships with accurate and timely dynamic information has been underscored, facilitating a safer navigation process by enabling ships to allocate attention to additional navigational concerns when traversing bridges. In light of this, the paper proposes minor modifications to G1172, aimed at improving the sharing of dynamic information. These proposed revisions are designed to bridge the gap between current practices and the evolving needs of the safety of navigation.

# Discussion

## cALCULATION OF DYNAMIC OVERHEAD CLEARANCE

DOHC is determined using three variables: Overall height of the bridge, Real-time water level, and Air draft. DOHC is calculated by subtracting Real-time water level and Air draft from Overall height of the bridge. Overall height of the bridge is the height from the seabed to the bottom of the bridge. Thus, it is calculated by adding Vertical Datum for Charted Vertical Clearance (CVC) to CVC as Equation 2. CVC is the height between verticl datum for CVC and the bottom of the brdige. Vertical Datum for CVC is differently defined by each contry. For example, USA and Canada use different Vertial Datum for CVC as Mean High Water(MHW) and High Astronomical Tide(HAT) respectively as shown in Figure 1.



Figure 1. Examples of different ways of calculating the Vertical Datum for CVC

Real-time water level is the depth from the seabed to sea level in real-time. Air draft is calculated by subtracting the ship's draft from its overall height as Equation 3. Figure 2 explains the variables of the equations



Figure 2. Concept of the calculation of DOHC

|  |  |
| --- | --- |
|  | (1) |
|  | (2) |
|  | (3) |

## ADD THE MARKING OF DYNAMIC OVERHEAD CLEARANCE

The results from DOHC calculations are used to mark the navigability of bridges and other obstacles through a three-tier system: safe, warning, and danger on the electoric chart. Figure 3 shows symbols for marking the three-tier system to describe on ENC. The calculated DOHC is displayed between arrow symbols, and the navigability status is indicated by color: green for safe, yellow for marginal warning, and red for danger on ENC.

 A screenshot of a video game

Description automatically generated A yellow line with a black and white circle on it

Description automatically generated A blue and red background with a red line

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Figure 3. MARKING OF DYNAMIC OVERHEAD CLEARANCE

# proposal

It is recommended that the ARM adopt the aforementioned content, which including the appendices, as base document for updating G1172.

# Action requested of the Committee

The Committee is invited to consider the proposal of amending G1172, and take action as appropriate.

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# Annex 1 Amendment proposal to G1172: inclusion of a new chapter 6.3

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# Supplementary Marking

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

## 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.

## 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.

## Dynamic OverHead Clearance (DOHC)

As the requirment of the calculation of Dynamic OverHead Clearance (DOHC) to avoid the risk of the collision between ships and bridges or other obstacles, marking to describe the navigability through a three-tier system: safe, warning, and danger on ENC is reruired. Additonally, The calculated DOHC is displayed between arrow symbols, and the navigability status is indicated by color: green for safe, yellow for marginal warning, and red for danger on ENC.

## Radar marking

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

### 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.

### Racons

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1. Leave open if uncertain [↑](#footnote-ref-1)