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## Horizontal and vertical channel dimensions

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# HORIZONTAL AND VERTICAL CHANNEL DIMENSIONS

by

by *Dr Mark McBride*<sup>1</sup>, *Dr Hans Moes*<sup>2</sup> and *Dr Mike Briggs*<sup>3</sup>

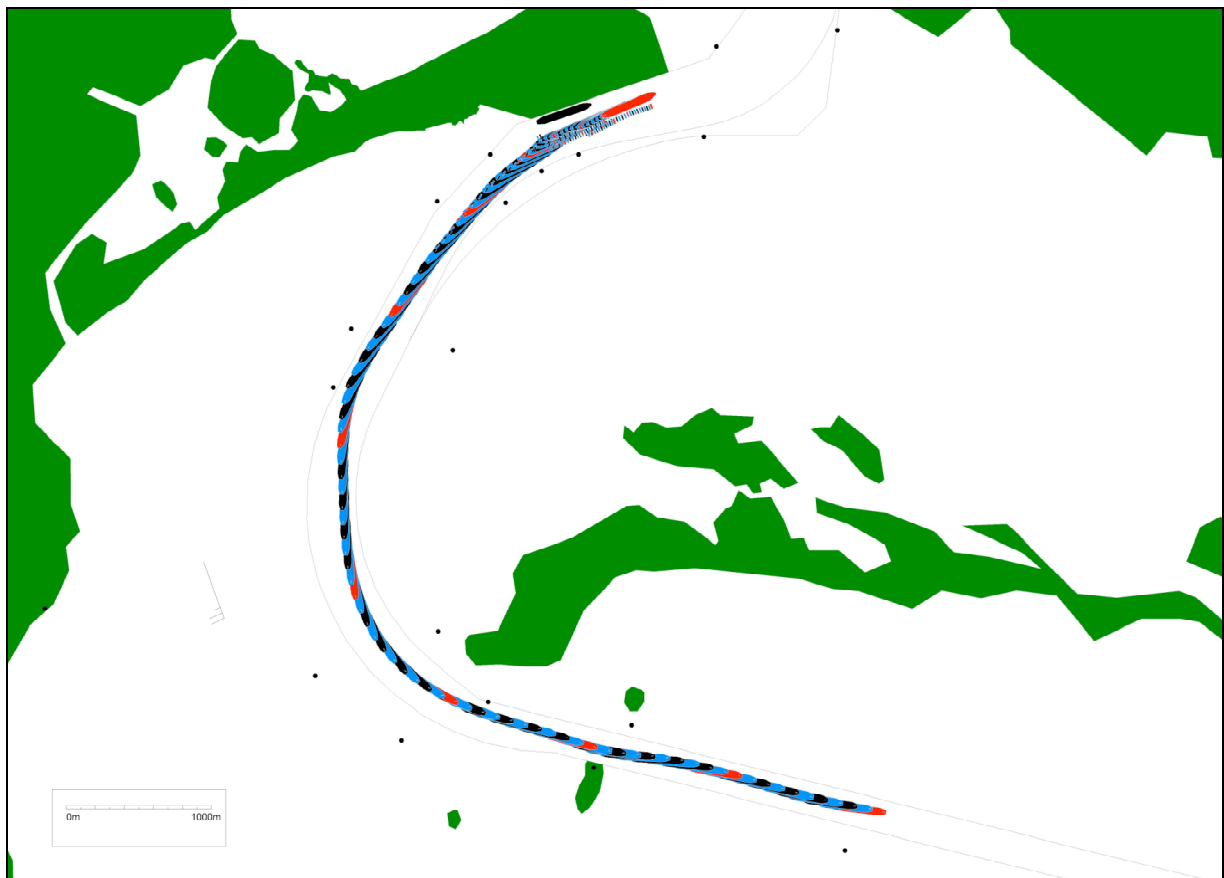
## ABSTRACT

PIANC MarCom Working Group 49 has been working for the past three years on reviewing, updating and expanding the PIANC (1997) report "Approach Channels – A guide for design". This paper will present the key aspects that have been updated and will describe the format for the new Working Group report, which is now nearing completion.

The final report of the Working Group will provide guidelines and recommendations on the horizontal and vertical dimensions of approach channels for harbours and marine terminals, along with the manoeuvring areas within harbours, for the purpose of assisting in the design process. This paper presents an overview of the updated report and describes key aspects of the review and revision process.

## 1. INTRODUCTION

Ensuring the continued safety and efficiency of ships transiting dredged channels in the years ahead will require channel designers and naval architects alike to better understand the handling and manoeuvrability of both existing and new generation ships in shallow and restricted waters. In particular, PIANC has a desire to address the issues of horizontal and vertical dimensions relating to ship channel and manoeuvring area design.



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The design of approach channels and fairways was first considered by PIANC in a report published by Working Group 2 of the PIANC International Oil Tankers Commission (IOTC) in 1972. Some years later, this work was reviewed by Working Group 4 of the PIANC International Commission for the Reception of Large Ships (ICORELS) in a report published in 1980. The subject was most recently considered by the joint PIANC-IAHP Working Group PTC II-30 in co-operation with IMPA and IALA. Their findings were published, first as a preliminary set of concept design guidelines in 1995, followed by the 1997 final report "Approach Channels – A guide for design".

The objectives of MarCom Working Group 49 were to examine the horizontal and vertical dimensions of channels and to review, update and, where appropriate, expand on the design recommendations as presented in the Working Group 30 report of 1997. In doing so, the Working Group considered recent developments in simulation and other design tools and the sizes and handling characteristics of new generation vessels. In addition, further attention was given the design of the vertical dimensions of channels than had previously been provided.

The overall report has been completely restructured to present the vertical and horizontal aspects.

## **1. METHODOLOGY**

### **1.1 General**

In 2004, PIANC MarCom decided that it was time to update this guideline based on recent developments in ship sizes and port design technology. As a consequence PIANC Working Group 49 (WG49) was established in 2005, again in conjunction with IAPH and IMPA. WG49 contains three of the original members of WG30 and again has participation from IALA representatives.

### **1.2 Aims and objectives**

The aim of this updated Guideline is to provide best international practice for the design of approach channels available to the port engineering community. The goal is to produce a practical set of guidelines, which will be easy to understand and apply. The use of this Guideline will not be obligatory and will still require proper engineering judgement.

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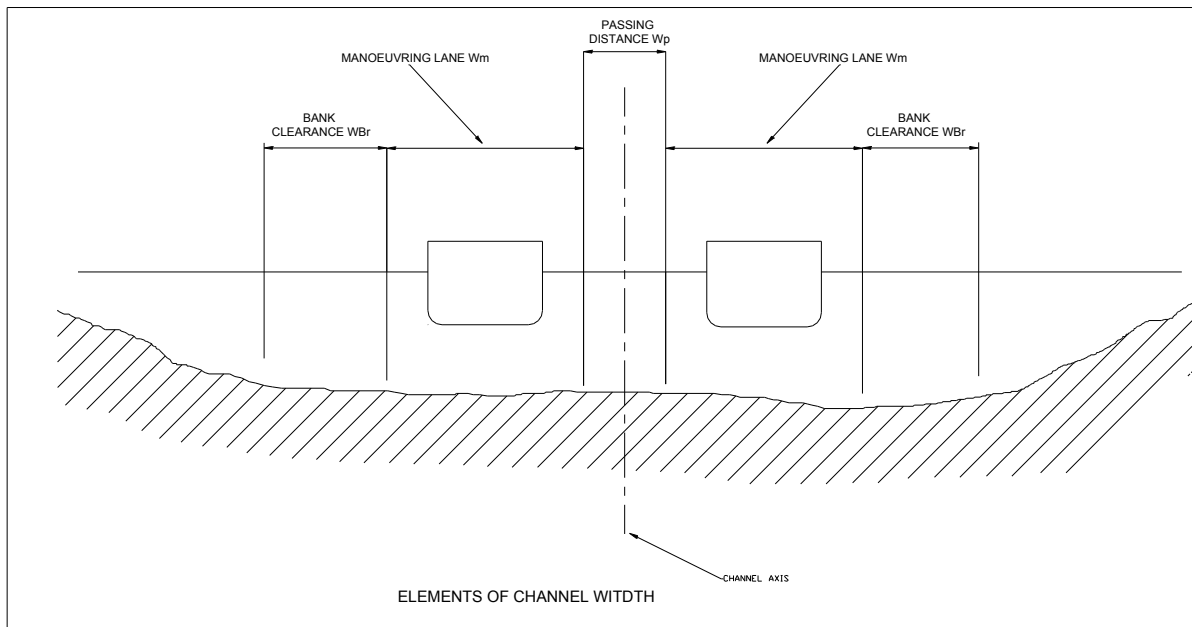
### **1.3 Revised report**

The new 2010 guidelines will update the Conceptual Design guidelines from the WG30 work for both horizontal and vertical dimensions. Horizontal dimension guidelines will include revised and updated allowances for channel width in straight sections, along with providing mention to Spanish ROM and Japanese MLIT methods. Vertical dimension sections will be revised and updated with additional methods and examples.

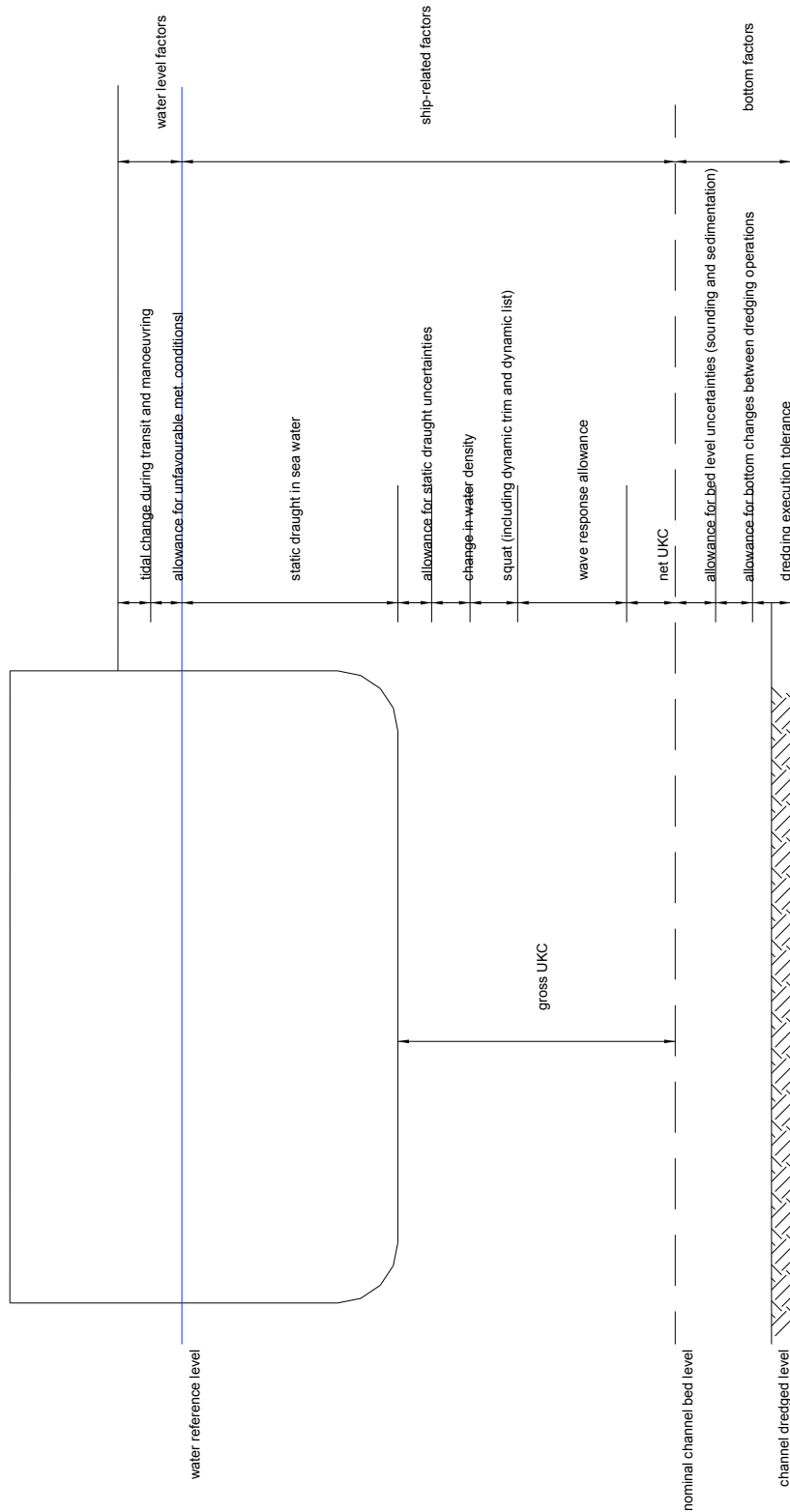
The main effort of WG49 was focused on Detailed Design guidelines, particularly probabilistic design and risk aspects. The vertical dimension guidelines include more discussion and examples for predicting vertical ship motions due to waves that include deterministic, statistical, and probabilistic methods. They also include sections on squat and muddy channel beds, which have been updated based on recent research and developments. In addition, with recent accurate (PDGPS) measurements of ship squat and calibrated theories, squat can now be predicted with more accuracy. This information will be incorporated in the new Guidelines.

Another aspect that has motivated an update of the Guidelines is the recent development of Post and Ultra-Post-Panamax container vessels (with present capacities of up to 14 000 TEU), car carriers, and LNG carriers. These vessels have specific characteristics (high windage, larger bulbous bows, wider

transom sterns, minimal parallel mid body/flat of side, etc.) and may require specific risk mitigation measures which can have an impact on access channel design and operation. The new Guidelines will take these new design changes into consideration. Furthermore, numerical models of wave propagation and ship response to waves and ship manoeuvring simulator packages have become common practice in port engineering design. The new guidance will include more details and examples with numerical models.



Methods have also been developed and applied for determining minimum safe channel bed widths on the basis of an accepted percentage of exceedence of the ship's swept path, which is determined from ship manoeuvring simulation. Capacity simulation models can also be used to evaluate the safety of port infrastructure and are described with an example for the Port of Rotterdam. Today, there is a more continuous range of tools available, so that each type of simulator/simulation can be used in different stages and detail of channel design.



Recent developments have also led to a more integrated approach of environmental aspects for access channel design. In the older approach, the Conceptual Design was first completed. This was then used as the basis for the Environmental Impact Assessment (EIA). After completion of the EIA, the Detailed Design was undertaken. This has led to very long and interrupted design periods. In more recent studies, the EIA study is integrated in the continuous Conceptual and Detailed Design process. This leads to a faster design process, but also has consequences for the engineering design approach.

In summary, the WG49 report recommends that channel horizontal and vertical dimension design should include consideration of many factors including design vessels, operational limits, economic and environmental considerations, support craft requirements, and aids to navigation.

Operational Rules can be established from the basic design that will be useful in evaluating safety conditions for different design vessels in the future.

## **2. CONCLUSION**

The final report of the Working Group will provide guidelines and recommendations on the conceptual and detailed design requirements for horizontal and vertical dimensions of approach channels, for harbours and marine terminals. This will also include guidelines for the design of manoeuvring area dimensions within harbours, for the purpose of assisting in the design process.



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