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Mooring of Ships *to* Piers and Wharves



Mooring Analysis Task Committee

Edited by
John W. Gaythwaite, P.E.

ASCE

COPRI
COASTS, OCEANS, PORTS AND RIVERS INSTITUTE

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Prepared by
the Mooring Analysis Task Committee
of the Technical Committee on Ports and Harbors of
the Coasts, Oceans, Ports, and Rivers Institute of
the American Society of Civil Engineers

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In February 1962 (and revised in April 1982), the Board of Direction voted to establish a series titled "Manuals and Reports on Engineering Practice," to include the Manuals published and authorized to date, future Manuals of Professional Practice, and Reports on Engineering Practice. All such Manual or Report material of the Society would have been refereed in a manner approved by the Board Committee on Publications and would be bound, with applicable discussion, in books similar to past Manuals. Numbering would be consecutive and would be a continuation of present Manual numbers. In some cases of joint committee reports, bypassing of Journal publications may be authorized.

A list of available Manuals of Practice can be found at http://www.asce.org/bookstore.

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PREFACE

At the fall 2001 meeting of the ASCE Technical Committee on Ports and Harbors of the Coasts, Oceans, Ports, and Rivers Institute (COPRI), Robert N. Robertson recommended that a task committee be established to prepare a document on mooring analysis for fixed piers and wharves. A new committee proposal was submitted in December 2001, and the first meeting of the mooring analysis task committee was held in March 2002. Robert Robertson was selected as chairman and Martin Eskijian as secretary. The committee discussed many topics and issues and added much since the original series of meetings. In April 2007 the chairmanship passed to John W. Gaythwaite at the direction of the Ports and Harbor Committee of COPRI, and the focus of the group subsequently became the development of an ASCE Manual of Practice (MOP) for the mooring of ships at fixed harbor facilities.

The purpose of this MOP is to provide designers of piers and wharves and other fixed marine facility structures with the necessary background and resource information to ensure that their structure designs are sound and adequate and provide a safe berth for the types of vessels to be accommodated. This is necessary because currently no single building code or standard specifically addresses the design of berthing and mooring facilities in general, and the guideline documents that do exist have varying requirements for specific facility types. In addition, many costly mooring incidents have occurred, emphasizing the need for a better understanding of mooring design principles. The chairman wishes to thank all of those involved in this process and trusts that the guidance provided herein will provide useful and timely information to the port engineering community.

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CHAPTER 1
INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this manual is to provide general guidance to determine forces acting upon piers, wharves, and other fixed structures such as berthing and mooring dolphins due to berthed vessels and to provide background for safe and efficient fixed mooring design practice. The ultimate goal is to provide vessels with a "safe berth" with adequate and sound mooring structures and arrangements. This manual is not, however, intended to be a complete, standalone mooring analysis and pier design document, because the subject matter is too complex and the variety of vessel and facility types with specific requirements is too wide. The reader is directed to the various important documents that cover these areas as introduced in the last section of this chapter and referred to throughout this manual.

Ships were once much smaller than they are today. Ports provided mooring accessories on wharves and piers based on a local standard, which proved adequate through many years of experience. Ship captains and pilots could direct the line handlers to tie up a ship in accordance with years of experience as mariners and based on tradition. However, ships built today are increasingly larger and more complex such as tankers, container ships, roll on-roll off (RO-RO), ships, bulk carriers, cruise ships, military vessels, etc. These ships typically have a larger area exposed to wind and deeper draft hulls exposed to current and passing ship effects. Old standards and methods are often inadequate, and analytical methods have been developed to determine mooring forces and optimize the arrangement of mooring lines. Safe mooring also includes