ASCE Manuals and Reports on
Engineering Practice No. 129

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

ASCE Manuals and Reports on Engineering Practice No. 129

Mooring of Ships to Piers and Wharves

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

Edited by
John W. Gaythwaite, P.E.

ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS

COPRI COASTS, OCEANS, PORTS & RIVERS INSTITUTE

Library of Congress Cataloging-in-Publication Data

Coasts, Oceans, Ports and Rivers Institute (American Society of Civil Engineers). Technical Committee on Ports and Harbors. Mooring Analysis Task Committee.

Mooring of ships to piers and wharves / 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 ; edited by John W. Gaythwaite, P.E.

pages cm. — (ASCE manuals and reports on engineering practice ; no. 129)

Includes bibliographical references and index.

ISBN 978-0-7844-1355-5 (soft cover : alk. paper) — ISBN 978-0-7844-7842-4 (e-book pdf)

1. Mooring of ships. 2. Piers. 3. Wharves. I. Gaythwaite, John, editor. II. Title.

VK361.C63 2014

627′.3–dc23

2014014378

Published by American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, Virginia, 20191-4382
www.asce.org/bookstore | ascelibrary.org

Errata: Errata, if any, can be found at http://dx.doi.org/10.1061/9780784413555

ISBN 978-0-7844-1355-5 (paper)
ISBN 978-0-7844-7842-4 (PDF)
Manufactured in the United States of America.

21 20 19 18 17 16 15 14 1 2 3 4 5

Cover photo credit: Appledore Marine Engineering, LLC.

MANUALS AND REPORTS ON ENGINEERING PRACTICE

(As developed by the ASCE Technical Procedures Committee, July 1930, and revised March 1935, February 1962, and April 1982)

A manual or report in this series consists of an orderly presentation of facts on a particular subject, supplemented by an analysis of limitations and applications of these facts. It contains information useful to the average engineer in his or her everyday work, rather than findings that may be useful only occasionally or rarely. It is not in any sense a "standard," however; nor is it so elementary or so conclusive as to provide a "rule of thumb" for nonengineers.

Furthermore, material in this series, in distinction from a paper (which expresses only one person's observations or opinions), is the work of a committee or group selected to assemble and express information on a specific topic. As often as practicable the committee is under the direction of one or more of the Technical Divisions and Councils, and the product evolved has been subjected to review by the Executive Committee of the Division or Council. As a step in the process of this review, proposed manuscripts are often brought before the members of the Technical Divisions and Councils for comment, which may serve as the basis for improvement. When published, each work shows the names of the committees by which it was compiled and indicates clearly the several processes through which it has passed in review, so that its merit may be definitely understood.

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.

This page intentionally left blank

CONTENTS

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.

This page intentionally left blank

CONTRIBUTORS

Woosuk "Willy" Ahn, Ph.D., P.E.
Ronald Byres, P.E., P.Eng.
Martin L. Eskijian, P.E., D.PE
Scott Fenical, P.E.
John Flory, P.E.
John W. Gaythwaite, P.E., D.PE, D.CE, *Chair and Editor*
John R. Headland, P.E.
Robert N. Robertson, P.E., *Past Chair*
Eric Smith, Ph.D., P.E.
Stanley M. White, P.E., P.Eng., D.PE, D.CE

Blue Ribbon Panel
Gary Greene, P.E., Gary Greene Engineers
Mads Jorgensen, P.E., Moffatt Nichol, Inc.
Sandra D. Rice, P.E., *SDR Analytics and Maritime, LLC*