An ACI Manual

Formwork for Concrete

8th Edition

SP-4 (14)

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FORMWORK FOR CONCRETE

FORMWORK FOR CONCRETE

Eighth Edition

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This eighth edition has been revised to agree with "Guide to Formwork for Concrete (ACI 347R-14)," which is reprinted in full in the appendix. Other revisions have been made for consistency with ACI documents undergoing revision since previous editions of this manual were issued. Wood design stresses and procedures have been updated to agree with the 2012 National Design Specification® issued by the American Wood Council. "

The drawings and examples in this book are based on typical designs and should not be used as working drawings or in place of making calculations for a particular project. They are intended to be helpful in the preparation of complete formwork plans that should be adapted to local conditions and comply with all applicable legal requirements. In no way is this book able to, or intended to, supplant the qualified designer or engineer to whom formwork should be entrusted.

Limitations of space and time make it impossible to show all of the methods, materials, and products available for formwork construction. Omission of any item therefore should not be regarded as a judgment that it is inferior or unsuitable.

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DEDICATION

The eighth edition of *Formwork for Concrete* is dedicated to the memory and achievements of M. K. Hurd, author of the first seven editions and constant advocate for safety, economy, and quality of formwork. Mary Hurd (1926-2013), a civil engineering graduate of Iowa State University, began her career as a staff engineer with the American Concrete Institute in 1947. In the early 1960s, she was asked by ACI to work with the committee on Formwork for Concrete to develop a major publication on formwork that had been identified as an industry need. Over the years, as she moved at various times from ACI staff engineer to private consultant or editor of concrete industry publications, she was repeatedly engaged by ACI to update *Formwork for Concrete*. Well known and respected as an engineering writer and editor on concrete construction, formwork, and concrete aesthetics, she published over 230 articles on always-timely topics.

In the five decades since *Formwork for Concrete* made its first appearance, more than 130,000 copies have been printed and the book has become recognized as the "green bible" of the formwork industry. *Formwork for Concrete* has been and continues to be a cooperative effort supported by individuals, companies, public agencies, and industry and professional associations in large measure due to the groundwork laid and respect for *Formwork for Concrete* garnered through the pioneering efforts of Mary Hurd.

Mary K. Hurd in 1969

ACKNOWLEDGMENTS

The American Concrete Institute would like to acknowledge the hard work and support of several groups and individuals without whom the production of a document of this caliber would not be possible.

Without the vision and effort put forth by Mary K. Hurd and the members of ACI Committee 347 over the last 50 years, much of the basis for this document would not exist. Their work has established *Formwork for Concrete* as a well-known and respected reference in the concrete formwork industry and as an excellent teaching resource in classrooms across the United States.

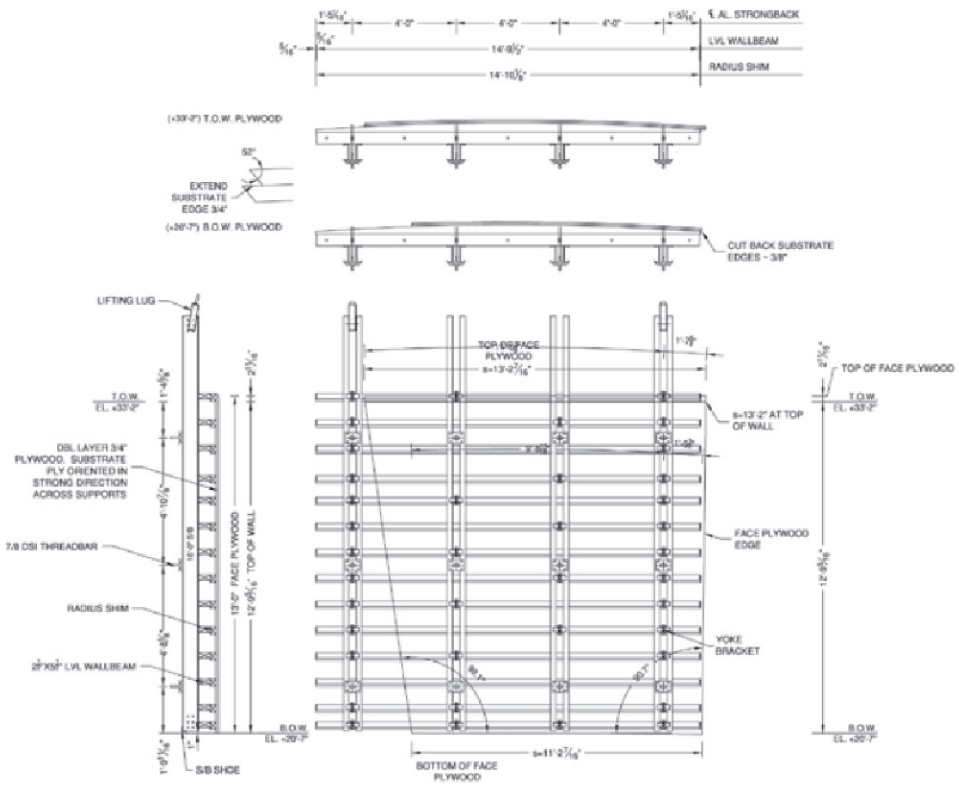
David W. Johnston, Ph.D., P.E., took on the task of revising and bringing an iconic document up-to-date by including the latest design standards, design methods, procedures, products, and several new worked examples. In addition, he coordinated the selection of nearly 500 modern color photographs to enable the eighth edition of *Formwork for Concrete* to be the first edition in full color. Photos in this manual without photo credit were provided by Dr. Johnston. The assistance of Matthew Poisel in revising the document is also gratefully acknowledged.

The assistance of the many formwork and construction companies that permitted the use of their photographs and illustrations allows *Formwork for Concrete* to show a breadth of formwork application that would not be possible otherwise. Specific acknowledgments for their contributions are found in the figure captions.

Members of ACI Committee 347, *Formwork for Concrete*, were engaged by the author during the process of revising the document, as they have been during the development of previous editions. Their comments and insight have brought a balanced viewpoint to the document that is not found in other documents on the topic.

Members of the ACI Educational Activities Committee (EAC), with the assistance of outside reviewers selected from ACI Committee 347, provided final review comments for chapters of the document. Responses by the author to these comments were reviewed and approved by the EAC members who commented on the chapter. These comments provided a fresh perspective and helped ensure that people reading the document for the first time would be able to quickly and easily understand the content. These reviewers also made sure that the content of this work was consistent with other ACI documents. These suggestions have helped improve the document for the final end user.

Michael Tholen, Ph.D., P.E.
Managing Editor



'RA' OUTSIDE-4
RELIQUARY WALL PANEL ELEV.
1/4" = 1'-0"

FOREWORD

Following in the footsteps of Mary K. Hurd is a challenge. My respect for her knowledge of formwork included recent decades of interaction with her on ACI Committee 347, but also extended back to my days as a student specializing in construction engineering and structural engineering. In 1965, I encountered the first edition of *Formwork for Concrete* as a construction engineering undergraduate student at North Carolina State University. During my years in industry and later as a faculty member, my appreciation of her pioneering and dedicated work on *Formwork for Concrete* and her contributions to ACI Committee 347 continued to grow.

The eighth edition, as all previous editions, follows the most recent guidelines established by ACI Committee 347 and documented in the committee report, now ACI 347R-14, which is reprinted in full in the appendix. This new edition of *Formwork for Concrete* considers the updated lateral pressure provisions now provided by ACI 347. Expanded coverage is provided for wind loads, analysis of the shoring and reshoring process, evaluation of concrete and structure strength to withstand shoring loads, and design of shoring and bracing elements. This edition also reflects the latest changes in wood design recommendations of the American Wood Council and introduces LRFD in addition to the primary coverage based on ASD procedures. The recent recommendations of other ACI committees have also been considered in the manual revisions and some related provisions of ACI 318 and OSHA have been extracted for convenient reference in the appendix. The growing number of standards related to design of the construction process and design of temporary structures, as well as a number of formwork industry products and practices adopted since the last edition was published, have been considered during development of the revisions. For instructional use, a series of problems and review questions have been provided following the appendix.

Drafts of revisions have been submitted for review and comment by members of ACI Committee 347, whose suggestions and advice have been most constructive. I am very grateful to the many committee members who shared their expertise and counsel during the preparation of the eighth edition. My special thanks to colleague Matthew Poisel, for his development of the data for the span tables of Chapter 9. The author is also grateful to the many individuals and organizations who have contributed nearly 500 new illustrations, drawings, and photo images to this first edition to be printed in color and to the many contractors who have provided access to their construction sites for photographs by the author, particularly United Forming, Inc., and Clancy & Theys Construction Co.

David W. Johnston, Ph.D., P.E.
July 2014

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