
Design of Wood Structures —ASD/LRFD

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Preface

The purpose of this book is to introduce engineers, technologists, and architects to the design of wood structures. It is intended to serve either as a text for a course in timber design or as a reference for systematic self-study of the subject.

The book will lead the reader through the complete design of a wood structure (except for the foundation). The sequence of the material follows the same general order that it would in actual design:

1. Vertical design loads and lateral forces
2. Design for vertical loads (beams and columns)
3. Design for lateral forces (horizontal diaphragms and shearwalls)
4. Connection design (including the overall tying together of the vertical- and lateral-force-resisting systems)

The need for such an overall approach to the subject became clear from experience gained in teaching timber design at the undergraduate and graduate levels.

This text pulls together the design of the various elements into a single reference. A large number of practical design examples are provided throughout the text. Because of their widespread usage, buildings naturally form the basis of the majority of these examples. However, the principles of member design and diaphragm design have application to other structures (such as concrete formwork and falsework).

This book relies on practical, current industry literature as the basis for structural design. This includes publications of the American Wood Council (AWC), the International Code Council (ICC), the American Society of Civil Engineers (ASCE), APA—The Engineered Wood Association, and the American Institute of Timber Construction (AITC).

In the writing of this text, an effort has been made to conform to the spirit and intent of the reference documents. The interpretations are those of the authors and are intended to reflect current structural design practice. The material presented is suggested as a guide only, and final design responsibility lies with the structural engineer.

The seventh edition of this book was prompted by four major developments:

1. Publication of the 2012 *National Design Specification for Wood Construction* (NDS).
2. Publication of the 2008 *Special Design Provisions for Wind and Seismic* (SDPWS) Supplement to the NDS.
3. Publication and adoption nationally of the 2012 *International Building Code*.
4. Publication of updated load standards in the 2010 edition of *Minimum Design Loads for Buildings and Other Structures* (ASCE 7-10).

The *National Design Specification* (NDS) is published by the American Wood Council (AWC) and represents the latest structural design recommendations by the wood industry. The 2012 NDS presents both traditional allowable stress design (ASD) provisions as well as new load and resistance factor design (LRFD) provisions. LRFD provisions were first introduced to the NDS in the 2005 edition. As such, the NDS is considered a dual-format design specification. While ASD has been and may continue to be the method of choice for many designers of wood buildings, the acceptance and use of LRFD for wood design is increasing.

The 2012 *ASD/LRFD Manual for Engineered Wood Construction* includes guidelines and provisions helpful for wood engineering design. It includes design information for sawn lumber, structural glued laminated timber, structural-use panels, shearwalls and diaphragms, poles and piles, I-joists, structural composite lumber, and structural connections (nails, bolts, screws, timber rivets, shear plate and split ring connectors). The Manual was first introduced in 1999 for the 1997 NDS, and has evolved into a useful design support document.

The *International Building Code* (IBC) is a product of the International Code Council (ICC). The ICC brought together the three regional model building code organizations to develop and administer a single national building code. The first edition of the IBC was published in 2000, and now nearly all regions of the United States have adopted all or part of the IBC at either the state or local level.

Traditionally, the NDS has been based on the principles of what is termed *allowable stress design* (ASD). In ASD, *allowable stresses* of a material are compared to calculated *working stresses* resulting from *service loads*. In the 1990s, the wood industry and design community completed the development of a *load and resistance factor design* (LRFD) specification for wood construction. In LRFD, *adjusted nominal capacities* (resistance) are compared to the effect of *factored loads*. The factors are developed for both resistance and loads such that uncertainty and consequence of failure are explicitly recognized. The LRFD approach to wood design is now included in the NDS. This seventh edition of *Design of Wood Structures* presents both ASD and LRFD guidelines as provided in the NDS. In many examples, both ASD and LRFD approaches are presented to allow the reader a direct, side-by-side comparison of the two methods.

Questions or comments about the text or examples may be addressed to any of the authors. Direct any correspondence to:

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Dedication

To our families:

Matthew, Kerry, Daniel, and Sarah

Matthew

Paula, Justin, Connor, and Alison

Lynn, Sarah, and Will

Donald E. Breyer, P.E.
Kelly E. Cobeen, S.E.
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