

Wood Design  
**FOCUS**

A JOURNAL OF  
CONTEMPORARY  
WOOD ENGINEERING

Volume 23, Number 2

Summer 2013

In This Issue:

Lateral Loads for Exterior Decks and Balconies

*Editorial* ..... 2

Wind Load Determination for Residential Decks

*Garrett H. Lyman, and Donald A. Bender, ..... 3*

Seismic Load Determination for Residential Decks

*Garret H. Lyman, Donald A. Bender, J. Daniel Dolan, ..... 9*

Deck and Porch Lateral Loading by Occupants

*Brian J. Parsons, Donald A. Bender, J. Daniel Dolan, Frank E. Woeste,  
..... 15*

Lateral Load Path and Capacity of Exterior Decks

*Brian J. Parsons, Donald A. Bender, J. Daniel Dolan, Robert J. Tichy,  
Frank E. Woeste, ..... 21*

In The Next Issue:

Energy Efficiency of Wood Buildings

## Editorial

---

Deck safety continues to be an important national problem. Engineered design has been hampered by knowledge gaps on structural deck loads – especially lateral loads. We believe this information is vital for registered design professionals to create safe and efficient engineered designs for decks and balconies.

In the first three articles, we explore lateral loads on a 12 ft x 12 ft deck for wind, seismic and occupancy. One motivation was to find out whether deck lateral loads were a significant concern for regions with high wind and earthquake risks. The results were surprising and should be of interest to all design professionals.

Wind and seismic loads can be calculated using the provisions of *ASCE 7-10 Minimum Design Loads for Building and Other Structures*. ASCE 7-10 procedures are complicated and require engineering judgment. In the first two articles, we demonstrate the ASCE 7-10 methodology through example calculations for a 12 ft x 12 ft deck. Of course, the results of the analyses would vary for decks with different sizes and aspect ratios. Within the specific constraints of our example deck, we found that while wind loads generally control over seismic, the wind loads would not pose much of a design challenge except for hurricane and special wind regions.

The building codes and ASCE 7-10 are silent on the subject of lateral loads due to occupant movement, with the exception of grandstands, bleachers, and stadium seating. The third article describes laboratory experiments on full-size decks with two types of occupant loadings: cyclic side-sway and impulse (run and jump stop). We found that lateral loading from occupants can exceed the worst-case design loads from either wind or seismic. The key point being that *occupant loading can occur on any deck, anywhere and have a structural impact as great or greater than that from wind or seismic design loads*.

Armed with a better understanding of lateral loads, we sought to improve our understanding of load transfer from decks to the house floor framing and diaphragm. Two 12 ft x 12 ft decks were laterally loaded to determine their ultimate strengths and stiffnesses. To measure load paths, the decks were connected to a portion of a light-frame wood diaphragm to simulate realistic support conditions. Decks were tested with and without tension hold-down connectors, and each lag screw in the deck ledger was instrumented to monitor loads. The study yielded counterintuitive results that will help guide new design solutions and products to resist lateral loads.

I hope you enjoy this issue of *Wood Design Focus*.

*Dr. Donald A. Bender, P.E.*

Weyerhaeuser Professor of Civil Engineering  
Washington State University

## WOOD DESIGN FOCUS

Published by the  
Forest Products Society

EDITORIAL BOARD CHAIR  
Daniel P. Hindman, Ph.D.

EDITORIAL COMMITTEE  
Larry Beineke, P.E., Ph.D.  
Don Bender, P.E., Ph.D.  
Chris Brandt, P.E.  
Robert Leichti, Ph.D.  
Joseph R. Loferski, Ph.D.  
Patrick M. McGuire, P.E., S.E.  
John "Buddy" Showalter, P.E.  
Thomas D. Skaggs, P.E., Ph.D.  
Frank Woeste, P.E., Ph.D.

Wood Design Focus  
(ISSN 1066-5757)

is published quarterly by:  
Forest Products Society  
2801 Marshall Court  
Madison, WI 53705-2295  
Telephone: (608) 231-1361  
Fax: (608) 231-2152  
[www.forestprod.org](http://www.forestprod.org)

The annual subscription rate is \$45USD to subscribers who are Forest Products Society members and \$60USD to non-members and \$125USD for institutions and libraries. The Forest Products Society and its agents are not responsible for the views expressed by the authors. Individual readers of this journal, and non-profit libraries acting for them, are permitted to make fair use of the material in it, such as copying an article for use in teaching or research. Permission is granted to quote from this journal with the customary acknowledgement of the source.

© 2013 Forest Products Society