PERFORMANCE-BASED PLASTIC DESIGN

EARTHQUAKE-RESISTANT STEEL STRUCTURES

Subhash C. Goel
Shih-Ho Chao

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Project coordinator:	Cindy Rodriguez
Cover design:	Lindsay Seligman
Publications Manager:	Mary Lou Luif
Project editor:	Greg Dickson
Illustrator:	Mike Tamai
Interior design and typesetting:	Yolanda Nickoley

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Foreword

There is no doubt that Performance-Based Seismic Design (PBSD) is an integral and important component of the future of earthquake engineering. PBSD, which started as a trend for the rehabilitation of existing structures in 1990s by the publication of Vision 2000 and FEMA-356 documents, has been extended to a viable and rational approach to the design of new structures. Many tall buildings in Los Angeles, San Francisco, and elsewhere have been or are being designed using PBSD methodology. A new generation of PBSD methodologies is currently under development by the Applied Technology Council under its ATC-58 project. Organizations such as the Los Angeles Tall Buildings Structural Design Council and the Pacific Earthquake Engineering Research Center are actively pursuing new developments and guidelines for the application of PBSD methodology for the design and evaluation of major structures.

One shortcoming of all existing PBSD approaches is that they are all basically more of an evaluation methodology than a design strategy. In other words, existing PBSD methodologies provide guidance and tools for the evaluation of seismic performance of a building that has already been designed. They do not provide clear guidance on how to design a building to achieve a desired performance. This is precisely what this book does. It provides a clear step-by-step approach that can be followed to design a building that would satisfy the desired performance given a level of seismic excitation.

The methodology presented in this book relieves the structural engineer from performing elaborate nonlinear time-history analyses during the design phase of the project and limits the application of nonlinear time-history analysis to its proper place: verification of adequate performance of an already-designed building. This is achieved by the application of simple rules of plastic design in steel, capacity-design principles, and the application of a simple static lateral force profile, which is similar to, yet somewhat different from, the static lateral force profile specified by the current prescriptive codes. The result is a building that is designed using basic engineering analysis and design techniques that performs as intended when subjected to earthquakes of specified intensity.

What makes this book exceptional is not only the fact that it explains the elegant design methodology discussed earlier, but that it applies the methodology to various structural systems via clear explanations and numerous design examples, where every step of the process is clearly defined and demonstrated.

I have no doubt that every serious practitioner of seismic design of steel structures will find this book immensely useful and practical. Teachers and students of university courses on plastic design will find this book to be a valuable teaching and learning tool. The authors should be congratulated for their significant contribution to the art and practice of structural engineering. This is a job well done!

Farzad Naeim, Ph.D., S.E., Esq.
Vice President and General Counsel
John A. Martin & Associates, Inc.
Los Angeles, CA

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Abolhassan Astaneh-Asl	University of California, Berkeley
Scott Campbell	Structural Analysis Consulting Group, Louisville, KY
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Nabih Youssef	Nabih Youssef & Associates, Los Angeles, CA