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The Structural Engineers Association of California (SEAOC) is a professional association of four regional member organizations (Southern California, Northern California, San Diego, and Central California). SEAOC represents the structural engineering community in California. This document is published in keeping with SEAOC's stated mission:

> Empower our members and Member Organizations to advance the people, practice, and position of structural engineering.

Editor

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Suggestions for Improvement

Comments and suggestions for improvements are welcome and should be sent to the following:

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Errata Notification

SEAOC has made a substantial effort to ensure that the information in this document is accurate. In the event that corrections or clarifications are needed, these will be posted on the SEAOC website at www.seaoc.org and on the ICC website at www.iccsafe.org.
SEAOC, at its sole discretion, may issue written errata.

Contents

2024 *IBC® SEAOC Structural/Seismic Design Manual*

The *IBC® SEAOC Structural/Seismic Design Manual*, throughout its many editions, has served the purpose of illustrating good seismic design and the correct application of building code provisions. The manual has bridged the gap between the discursive treatment of topics in the *SEAOC Blue Book (Recommended Lateral Force Requirements and Commentary)* and real-world decisions that designers and engineers face in their practice.

The examples illustrate code-compliant designs engineered to achieve good performance under severe seismic loading. In some cases, simply complying with building code requirements may not ensure good seismic response. This manual presents various methods and procedures that extend beyond what one might use to comply with minimum code requirements and discussion of the reasons for using a specific method or procedure.

This manual comprises four volumes:

- Volume 1: Code Application Examples
- Volume 2: Examples for Light-Frame, Tilt-Up, and Masonry Buildings
- Volume 3: Examples for Concrete Buildings
- Volume 4: Examples for Steel-Framed Buildings

In general, the provisions for developing the design base shear, distributing the base-shear forces vertically and horizontally, checking for irregularities, and so on are illustrated in Volume 1. The other volumes contain more extensive design examples that address the requirements of the material standards (for example, ACI 318 and AISC 341) that are adopted by the IBC. Building design examples in material-focused volumes intentionally omit repeating items addressed in Volume 1.

Each volume has been produced by a small group of authors under the direction of a manager. The managers have assembled reviewers to ensure numerical accuracy and coordination with other SEAOC work and publications, most notably the *Blue Book*.

This manual is a valuable tool for engineers seeking to design buildings for good seismic response.

Kevin S. Moore, S.E.
Project Manager

Preface to Volume 1

Volume 1 of the 2024 *IBC SEAOC Structural/Seismic Design Manual* addresses the application and interpretation of the seismic provisions of the 2024 *International Building Code*. More specifically, Chapter 16 of the 2024 IBC requires compliance with the provisions of ASCE/SEI 7-22 *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*.

ASCE 7 generally prescribes the loading and methodology to be used in the analysis of a structure or an element. In order to determine strength to resist the load demands from ASCE 7, the IBC adopts national material design standards (such as ACI, AISC, and NDS) to be used for the design of an element of a particular material. The Volume 1 examples focus on the application of the provisions of ASCE 7, while the examples in Volumes 2, 3, and 4 focus more on the application of the material design standards. The Manual is not intended to serve as a building code or to be an exhaustive catalogue of all valid approaches.

Volume 1 presents 62 examples covering most of the key code provisions within ASCE 7 Chapters 2, 11, 12, 13, and 15. Of the 62 design examples, 58 have been updated and revised to reflect applicable changes to codes and standards since the 2021 edition of the Manual to provide additional clarification and commentary for the more complex or nuanced provisions and to incorporate input from the SEAOC Seismology Committee and other practicing engineers regarding the latest SEAOC interpretations and recommended practices. Example 62 has been added to Volume 1; this new example covers the design of shallow foundations on liquefiable soil in compliance with ASCE 7 Section 12.10.3.

Wherever possible, the authors have incorporated lessons learned from actual projects into the examples. Readers are welcome to submit other conditions or provisions not addressed in this edition for consideration in future editions.

Emily Guglielmo, S.E.
Volume 1 Manager

Acknowledgments

SEAOC is the author of the *IBC SEAOC Structural/Seismic Design Manual*. Each edition comes about through the effort of highly qualified structural engineers who contribute their expertise to writing, reviewing, and updating design examples to be consistent with best practices for seismic design. Each edition contains new examples as well as revisions to previous examples. As such, it is impractical to consistently assign authorship of examples, as most are the work, in varying degrees, of the original author and multiple later reviewers and revisers. Nevertheless, SEAOC gratefully acknowledges the contributions of these members to this volume over several editions.

Ryan A. Kersting, S.E.
Kevin S. Moore, S.E.
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Michael Comaroto, S.E.
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How to Use This Document

The examples in Volume 1 are written to illustrate the application of a specific section or provision within ASCE 7. Each example is a separate problem (or group of problems) for a unique condition chosen to best address the particular referenced code provision. Examples are stand-alone and do not rely on results from another example.

Each example contains a problem statement with a detailed listing of "given" information and a clear list of items to be determined in order to arrive at the solution. The problem is solved through a logical sequence of steps. Appropriate code references are provided in the right-hand margin of the page. Most examples include an introductory overview to the particular code provision and/or additional commentary following the solution. Readers are referred to applicable *SEAOC Blue Book* articles for additional information when appropriate.

For all examples, ASCE 7 is the default source document for the references, unless another document is specifically included in the reference. The following abbreviations are used within the references:

§—Section T—Table

F—Figure Eq—Equation