

2021
INTERNATIONAL
BUILDING CODE®
ILLUSTRATED
HANDBOOK

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2021 INTERNATIONAL BUILDING CODE® ILLUSTRATED HANDBOOK

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Foreword

How often have you heard these questions when discussing building codes: “What is the intent of this section?” or, “How do I apply this provision?” This publication offers the code user a resource that addresses much of the intent and application principles of the major provisions of the *2021 International Building Code*® (IBC®).

It is impossible for building codes and similar regulatory documents to contain enough information, both prescriptive and explanatory narrative, to remove all doubt as to the intent of the various provisions. If such a document were possible, it would be so voluminous that it would be virtually useless.

Because the IBC must be reasonably brief and concise in its provisions, the user must have knowledge of the intent and background of these provisions to apply them appropriately. The IBC places great reliance on the judgment of the building official and design professional for the specific application of its provisions. Where the designer and official have knowledge of the rationale behind the provisions, the design of the building and enforcement of the code will be based on informed judgment rather than arbitrariness or rote procedure.

The information that this handbook provides, coupled with the design professional’s and building official’s experience and education, will result in better use of the IBC and more uniformity in its application. As lengthy as this document may seem, it still cannot provide all of the answers to questions of code intent; that is why the background, training, and experience of the reader must also be called on to properly apply, interpret, and enforce the code provisions.

The preparation of a document of this nature requires consulting a large number of publications, organizations, and individuals. Even so, the intent of many code provisions is not completely documented. Sometimes the discussion is subjective; therefore, individuals may disagree with the conclusions presented. It is, however, important to note that the explanatory narratives are based on many decades of experience by the authors and the other contributors to the manuscript.

Preface

Internationally, code officials and design professionals recognize the need for a modern, up-to-date building code addressing the design and installation of building systems through requirements emphasizing performance. The *International Building Code*® (IBC®) meets this need by providing model code regulations that safeguard the public health and safety in all communities, large and small. The *2021 IBC Illustrated Handbook* is a valuable resource for those who design, plan, review, inspect, or construct buildings or other structures regulated by the 2021 IBC.

The IBC is one of a family of codes published by the International Code Council® (ICC®) that establishes comprehensive minimum regulations for building systems using prescriptive and performance-related provisions. It is founded on broad-based principles that use new materials and new building designs. Additionally, the IBC is compatible with the entire family of *International Codes*® published by the ICC.

There are three major subdivisions to the IBC:

1. The text of the IBC
2. The referenced standards listed in Chapter 35
3. The appendices

The first 34 chapters of the IBC contain both prescriptive and performance provisions that are to be applied. Chapter 35 contains those referenced standards that, although promulgated and published by separate organizations, are considered part of the IBC as applicable. The provisions of the appendices do not apply unless specifically included in the adoption ordinance of the jurisdiction enforcing the code.

The *2021 IBC Illustrated Handbook* is designed to present commentary only for those portions of the code for which commentary is helpful in furthering the understanding of the provision and its intent. This handbook uses many drawings and figures to help clarify the application and intent of many code provisions.

The handbook examines the intent and application of many provisions for both the non-structural- and structural-related aspects of the IBC. It addresses in detail many requirements that are considered as “fire- and life-safety” provisions of the code. Found in IBC Chapters 3 through 10, these provisions focus on the important considerations of occupancy and type of construction classification, allowable building size, fire and smoke protection features, fire protection systems, interior finishes, and means of egress.

The discussion of the structural provisions in this handbook is intended to help code users understand and properly apply the requirements in Chapters 16 through 23 of the 2021 IBC. Although useful to a broad range of individuals, the discussion of the structural provisions was written primarily so that building officials, plans reviewers, architects, and engineers can get a general understanding of the IBC’s structural requirements and gain some insight into their underlying basis and intent. To that end, the numerous figures, tables, and examples are intended to illustrate and help clarify the proper application of many structural provisions of the IBC.

Because the IBC adopts many national standards by reference rather than transcribing the structural provisions of the standards into the code itself, in some cases the discussion in this handbook pertains to the provisions found in a referenced standard such as ASCE 7 or ACI 318

rather than the IBC. The structural provisions addressed focus on the general design requirements related to structural load effects; special inspection and verification, structural testing, and structural observation; foundations and soils; and specific structural materials design requirements for concrete, masonry, steel, and wood.

Questions or comments concerning this handbook are encouraged. Please direct any correspondence to handbook@icc-safe.org.

Participation in ICC Code Development Process. Architects, engineers, designers, builders, and other professionals can freely participate in the ICC Code Development Process by submitting proposed code changes, collaborating with colleagues in developing code language and submitting changes, participating in giving testimony, and becoming ICC members to have voting opportunities in person or online at Committee Action Hearings. The Code Development Process is conducted via the ICC's state-of-the-art, cloud-based cdpACCESS system. Committee Action Hearings and Public Comment Hearings are broadcast live so anyone can follow the testimonies and actions taken. All building design and construction professionals are encouraged to participate in the ICC Code Development Process and have a say in the outcome of future editions of the *International Building Code* or any other of the ICC *International Codes*. Because architects, engineers, and other design and construction professionals apply the code to actual buildings and experience first-hand the effectiveness of code provisions, it is very critical for them to participate in the Code Development Process and improve the code each cycle.

Acknowledgments

The publication of this handbook is based on many decades of experience by the authors and the other contributors. Since its initial publication, the handbook has become a living document subject to changes and refinements as newer code regulations are released. This latest edition reflects extensive modifications based on the requirements found in the *2021 International Building Code*[®] (IBC[®]).

The initial handbook, on which the nonstructural portions of this document are based, was published in 1988. It was authored by Vincent R. Bush. In developing the discussions of intent, Mr. Bush drew heavily on his 25 years of experience in building safety regulation. Mr. Bush, a structural engineer, was intimately involved in code development work for many years.

In addition to the expertise of Mr. Bush, major contributions were made by John F. Behrens. Mr. Behrens's qualifications were as impressive as the original author's. He had vast experience as a building official, code consultant, and seminar instructor. Mr. Behrens provided the original manuscript of the means of egress chapter and assisted in the preparation of many other chapters.

Revisions to the handbook occurred regularly over the years, with nonstructural content based on the provisions of the *International Building Code* authored by Doug Thornburg, AIA, CBO. Mr. Thornburg, a certified building official and registered architect, has over 40 years of experience in the building regulatory profession. Previously a building inspector, plans reviewer, building code administrator, seminar instructor, and code consultant, he is currently the Vice President and Technical Director of Products and Services at the International Code Council[®] (ICC[®]). In his present role, Mr. Thornburg develops and reviews technical publications, reference books, resource materials, and educational programs relating to the *International Codes*[®]. He continues to present building code seminars nationally and has developed numerous educational texts, including *Significant Changes to the IBC, 2021 Edition*. Mr. Thornburg was presented with the ICC's inaugural Educator of the Year Award in 2008, recognizing his outstanding contributions in education and training.

The basis of the discussion on the structural provisions in the *2021 IBC Illustrated Handbook* is the *2000 IBC Handbook—Structural Provisions*, authored by S. K. Ghosh, Ph.D., and Robert Chittenden, SE. Dr. Ghosh initially authored Chapters 16 and 19, and Mr. Chittenden authored Chapters 17, 18, 20, 21, 22, and 23. John Henry, PE, former ICC principal staff engineer, then authored the commentary addressing IBC Chapters 16 through 23 for several editions. Mr. Henry was presented with the ICC's John Nosse Award for Technical Excellence in 2011, recognizing his outstanding contributions and technical expertise. William Bracken, PE, a registered civil and structural engineer with over 30 years of related experience, authored a portion of the commentary in the 2018 edition.

The structural provisions in relation to Chapters 16 through 23 in this edition have been updated by Chris Kimball, SE. Mr. Kimball is a licensed structural engineer, civil engineer, and ICC master code professional. He is also certified by the ICC in many other disciplines, including building official and fire code official. Mr. Kimball earned a master's degree with an emphasis in structural engineering and currently serves as the Vice President of West Coast Code Consultants, Inc. (WC³), a third-party plan review and inspection company. He has performed plan reviews for thousands of complex projects throughout the United States, is an ICC-approved instructor, and has authored several publications, including the *2018 International Existing Building Code Handbook*. Mr. Kimball has provided code training classes to building official, design professional, and contractor organizations throughout the United States.

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The information and opinions expressed in this handbook are those of the present and past authors, as well as the many contributors, and do not necessarily represent the official position of the International Code Council. Additionally, the opinions may not represent the viewpoint of any enforcing agency. Opinions expressed in this handbook are only intended to be a resource in the application of the IBC, and the building official is not obligated to accept such opinions. The building official is the final authority in rendering interpretations of the code.