



CONCRETE MANUAL

CONCRETE QUALITY AND FIELD PRACTICES

2021 IBC® AND ACI 318-19

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**Concrete Manual:
Based on the 2021 IBC® and
ACI 318-19**

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Preface

This content on concrete inspection will provide the inspector with an understanding of the scientific principles that underlie sound practices and will assist the inspector in making rational, rather than arbitrary, decisions. The *Concrete Manual* provides the guidance and information that inspectors and related professionals need to become more proficient and professional in relating to concrete field practices and inspection. The information provided will increase the technical capabilities of jurisdictional inspectors in the performance of their inspection duties.

The *International Building Code*® (IBC®), published by the International Code Council® (ICC®), presents a number of situations in which specially qualified inspectors are required to perform special inspection of construction. The special inspectors are individuals with highly developed and specialized skills who observe those critical building or structural features that they are qualified to inspect. The *Concrete Manual* serves as a valuable reference to assist the special inspector in performing the duties and responsibilities of special inspection for reinforced and prestressed concrete construction.

To perform inspection of any phase or part of construction, the inspector must be versed in the phase or part that they are inspecting. The inspector's knowledge of laws, codes and specifications will be of little value if they do not have an understanding of the construction to be inspected. This book provides the inspector with a source of that knowledge as applied to concrete construction.

The initial chapters of the book introduce the reader to concrete and explain what concrete is and why it behaves as it does. A brief history of portland cement and concrete is included. In the following chapters, materials are presented to the reader as a preparation for the final chapters, which cover construction. Conventional construction procedures as well as special techniques are covered in sufficient detail to enable the reader to understand and recognize them. Throughout all chapters the reader will find information about unsatisfactory materials and methods, as well as discussions of acceptable materials and methods. Actual control and inspection procedures are described and should be of immediate interest to the inspector.

The *Concrete Manual* provides basic information that can be related to the described inspection procedures. The descriptions are, by necessity, somewhat general, as the responsible building official will designate the

details of inspection. Codes, specifications and other requirements differ from job to job. For example, what are the conditions under which the inspector is authorized to order the work stopped or refuse to accept certain material or construction? These administrative decisions must be made by the building official. The statistical quality control methods, although of limited value to most inspectors, are included for completeness as concrete mixture proportioning and strength test evaluation and acceptance are based on statistical methods of analysis and the mathematics of probability. The inspector should at least be aware of the basic concepts of statistical quality control and its applications to concrete construction. A “Resource References” list of the concrete industry and technical organizations is included at the back of this book. The reader is encouraged to contact a listed organization for additional information or a publication on a specific concrete subject, or both.

Of special note, the International Code Council, in cooperation with the American Concrete Institute (ACI), offers an examination for reinforced concrete special inspectors with national certification opportunities. The International Code Council offers the examination dealing with the codes and standards involved with reinforced concrete inspection; ACI offers certification of field technicians. When combined, they provide a national certification for Reinforced Concrete Special Inspector. For more information on the “Reinforced Concrete Special Inspector Certification” the reader should contact ACI or the International Code Council.

In addition to the reinforced concrete special inspector certification, ICC offers a “Prestressed Concrete Special Inspector Certification.” The reinforced concrete certification is a prerequisite for obtaining a prestressed concrete certification.



Acknowledgments

The initial author of the *Concrete Manual* was Joseph J. Waddell, noted concrete consultant. Special thanks are due to Mr. Waddell for his outstanding contribution to this unique publication addressing the special needs of the concrete field and laboratory inspector/technician. From 1988 to 2015 the document was updated by Gerald B. Neville, P.E., formerly of the ICBO/ICC technical staff, along with assistance from Steven H. Kosmatka, formerly of the Portland Cement Association (PCA).

For three decades, the publication has been continuously updated to address new developments in concrete technology and construction practice. In addition, the text is revised on a regular basis to reflect ongoing changes in the *International Building Code*® (IBC®) and corresponding referenced standards. This edition has been updated to reflect changes in the 2021 IBC and referenced standard ACI 318-19.

Primary responsibility for the text of this publication is with Steven H. Kosmatka, P.E., of the University of Wisconsin—Milwaukee. Special thanks go to Amy Trygestad of the Concrete Reinforcing Steel Institute (CRSI), Tim D. Christle of the Post-Tensioning Institute (PTI), Paul Aubee of the Wire Reinforcement Institute (WRI) and Jared E. Brewe of the Precast/Prestressed Concrete Institute (PCI).

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The International Code Council is the leading global source of model codes and standards and building safety solutions that include product evaluation, accreditation, technology, codification, training and certification. The Code Council's codes, standards and solutions are used to ensure safe, affordable and sustainable communities and buildings worldwide. The International Code Council family of solutions includes the ICC Evaluation Service, the International Accreditation Service, General Code, S. K. Ghosh Associates, NTA Inc., Progressive Engineering Inc., ICC Community Development Solutions and the Alliance for National & Community Resilience. The Code Council is the largest international association of building safety professionals and is the trusted source of model codes and standards, establishing the baseline for building safety globally and creating a level playing field for designers, builders and manufacturers.

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