

Concrete Construction Engineering Handbook

Second Edition

Concrete Construction Engineering Handbook

Second Edition

Editor-in-Chief

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Cover Image: Veterans' 1-280 Glass City Skyway, Toledo, Ohio, 612-ft twin cable-stayed spans with 403-ft pylon. The top 196 ft of the pylon features four sides of glass enveloping LED light fixtures that allow an array of as many as 16.7 million color combinations at night. The bridge construction involved 185,000 cubic yards of concrete, 1.9 million lb of post-tensioning strands, and 32.6 million lb of mild steel reinforcement. The bridge was opened in June 2007. (Photos courtesy of Ms. Linda Figg, President and CEO, FIGG, Tallahassee, Florida. Owner: Ohio Department of Transportation. Designer: FIGG. Contractor: Fru-Con.)

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Preface

A great need has existed for an in-depth handbook on concrete construction engineering and technology that can assist the constructor in making correct technical judgments in the various areas of constructed systems. This *Handbook* is intended to fill this very need. This edition is completely updated and includes ten new chapters written by leading experts on various topics dealing with the state of the art in several newly developed areas of concrete construction and design engineering. All chapters treat their particular subjects with extensive detail and depth of discussion, a feature that is lacking in any comparable texts. Also, each chapter provides selected references for the user to consult for further research beyond the scope of the *Handbook*. The topics covered here are state-of-the-art statements regarding what the design engineer and the constructor should know about concrete, the most versatile material of the 21st century. These topics can be grouped into five categories:

1. *Latest advances in engineered concrete materials*, including concrete constituents, high-performance concretes, the design of mixtures for both normal- and high-strength concretes, and special concrete applications such as architectural concrete
2. *Reinforced concrete construction*, including recommendations on the vast array of types of constructed facilities, long-term effects on behavior and performance such as creep and shrinkage, construction loading effects, formwork and falsework proportioning, and automation in construction
3. *Specialized construction*, such as prestressed concrete construction in buildings and transportation facilities; construction and proportioning of structures in seismic zones (including the latest provisions of the 2006 International Building Code on the design of structures in high-seismicity zones); masonry construction; heavy concrete construction, such as roller-compacted concrete; and concrete marine structures, such as offshore platforms concrete
4. *Design recommendations for high performance*, including deflection reduction in buildings, proportioning of concrete structural elements by the latest ACI 318-08 Building Code, prefabricated precasting, geotechnical and foundation engineering, nondestructive evaluation of long-term structural performance, and structural concrete repair, retrofit, and rehabilitation
5. *Specialized topics on new materials*, such as engineered concrete composites, geopolymer concrete, equipment for concrete building construction, joints in concrete structures, design of precast seismic bracing systems, detailed design of fiber-reinforced polymers (FRP), and aesthetics in long-span bridge construction

The 37 contributors to this new edition of the *Handbook* are leading authorities in the field, with a combined professional practice of at least 1200 years. All of them are national or international leaders in research, design, and construction. This *Handbook* is the only publication in this category that has in a single chapter a summary of all concrete design expressions in accordance with the latest ACI 318-08 Building Code for flexure, shear, torsion, strut-and-tie design of corbels and deep beams, compression, long-term effects, slender columns, and development of reinforcement. Both PI (in.-lb) and SI formats are provided. A design office will be able to quickly review all of the latest requirements for structural concrete. This *Handbook* should enable designers, constructors, educators, and field personnel to produce the best and most durably engineered constructed facilities. It is for these professionals that this *Handbook* was written in the hope that the wealth of the most up-to-date knowledge embodied in this comprehensive work will provide, in this dynamic century, vastly better, more efficient, and longer enduring constructed concrete.

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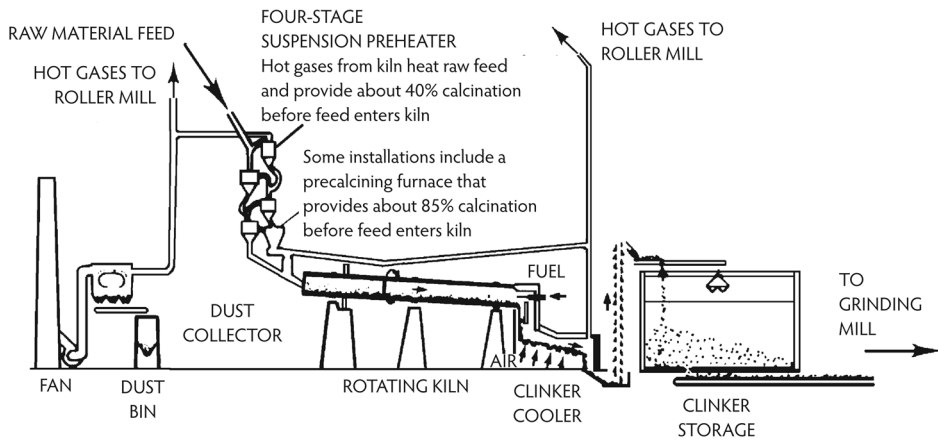
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Schematic of Portland cement manufacturing process. (From Nawy, E.G., *Reinforced Concrete: A Fundamental Approach*, 6th ed., Prentice Hall, Upper Saddle River, NJ, 2008.)