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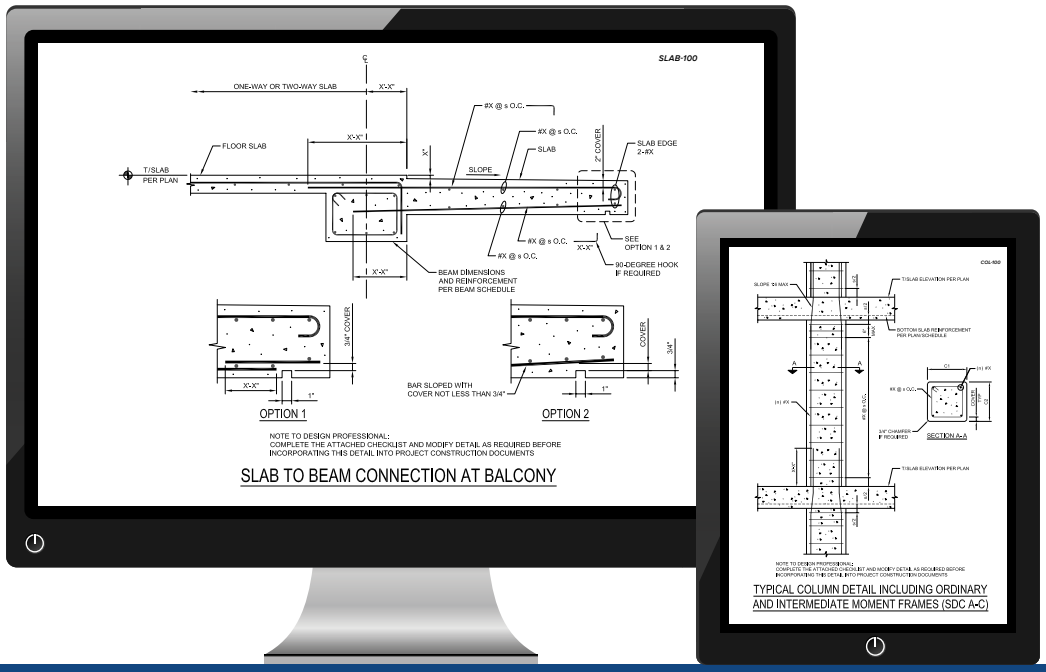

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ABOUT THIS BOOK

The 2020 edition of the *ACI Detailing Manual*, MNL-66, provides answers to many detailing questions asked by design engineers, architects, contractors, detailers, and engineering students. The Manual is divided in three sections: Section 1 includes a copy of ACI 315R-18, *Guide to Presenting Reinforcing Steel Design Details*; Section 2 includes individual details with corresponding checklists; and Section 3 includes a compilation of *Concrete International* articles chosen for their relevance to detailing reinforced concrete. Appendix A has tables to help the engineer in the detailing effort.

Section 1 guides designers of concrete structures in determining information and design details that are required to prepare reinforcing steel fabrication and placing drawings. The guide stresses the importance of this information to ensure that the reinforcing steel detailer effectively and accurately captures the intent of the designer, presenting it in a manner that is clear and unambiguous to the reinforcing steel fabricator and placer.

Section 2 illustrates methods for presenting necessary design information through over 100 individual details that provide examples of ways to communicate design information effectively and completely to the contractor. The details conform to "Building Code Requirements for Structural Concrete (ACI 318-19)" and were prepared with the assistance of a task group consisting of detailers, contractors, and practicing engineers. Each detail is placed on one page with dimensions and bar sizes left to be completed by the user. Alongside each detail, notes to the user are listed as a reminder of the main code requirements that need to be satisfied for that particular detail. This section is planned to be interactive with the engineering community. It is anticipated that engineers, architects, contractors, and detailers will not only submit comments to improve the details shown in this edition of the manual, but also submit other relevant details to be added to future editions at techinq@concrete.org.

Section 3 includes a collection of 37 articles published in *Concrete International* related to concrete detailing that were authored by detailers and practicing engineers. The articles identify constructability issues specific to reinforcing steel. Common problems found on engineering drawings are discussed along with solutions drawn from the experiences of knowledgeable practitioners in the industry. The article topics vary from describing the tolerance cloud to addressing constraints in reinforcing bar modeling to avoiding ambiguous callouts, among other topics. These solutions are not offered as official ACI-recommended practice.

Supporting reference data in Section 4 includes specific chapters on reinforcing bars, wires, bar supports, spirals, mathematical formulas and tables, and common symbols and abbreviations.

This guide is intended to provide examples and guidance for how licensed design professionals may satisfy the prescribed provisions of ACI 318-19, *Building Code Requirements for Structural Concrete*. It does not, however, purport to represent the only suitable way to satisfy the requirements for every project. Engineering judgment must be applied to the unique requirements of individual projects and the details should be modified accordingly before applying to a project.

ACKNOWLEDGMENTS

The development of MNL-66(20), "ACI Detailing Manual," is a must-have resource that provides answers to many detailing questions asked by design engineers, architects, contractors, detailers, and engineering students. The structural drawings conform to the "Building Code Requirements for Structural Concrete (ACI 318-19)."

ACI would like to thank the review group for this manual consisting of Chair Richard Birley, James Cornell, Jason Draper, John Hausfeld, Christopher Perry, and Tom Schaeffer. Their careful review and dedication to the project on top of all their other volunteer time made it possible to develop and revise this guide in a timely manner while maintaining the quality expected by the industry.

ACI would also like to thank Burns & McDonnell for providing examples of typical details that were used to develop the drawing in this detailing manual.

Khaled Nahlawi
Managing Editor

CONTENTS

SECTION 1
ACI 315R-18

ACI 315R-18

Guide to Presenting Reinforcing Steel Design Details

Reported by Joint ACI-CRSI Committee 315

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*The Committee acknowledges P. Brienen, D. Fontenot, and C. Yokoyama for their contributions to this guide.

This document guides designers of concrete structures how to determine information and design details that are required to prepare reinforcing steel fabrication details and placing drawings. The guide stresses the importance of this information to ensure that the reinforcing steel detailer effectively and accurately captures the intent of the designer, presenting it in a manner that is clear and unambiguous to the reinforcing steel fabricator and placer. Recommendations are also provided concerning the review of placing drawings.

Keywords: concrete structures; design details; detailing; engineering drawings; fabrication details; placing drawings; reinforcement; reinforcing steel; tolerances.

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ACI 315R-18 supersedes ACI 315-99 and was adopted and published January 2018.

CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

The purpose of this document is to guide the licensed design professional (LDP) in determining the information a reinforcing steel detailer requires to properly prepare reinforcing steel fabrication details and placing drawings. Guidance to the LDP is provided on how to present that information on their structural drawings so that the design intent is effectively and accurately conveyed.

The intent of this guide is to encourage clarity and consistency in reinforcing steel design details to help improve the quality and uniformity of steel reinforcement detailing, fabrication, and installation. It is intended to facilitate clear communication between LDPs, reinforcing steel detailers, fabricators, and placers by encouraging clear presentation of design details and information. Information presented is consistent with the requirements and recommendations of several ACI documents, including ACI 318, ACI 301, ACI 117, ACI 131.1R, and ACI 132R.

1.2—Scope

This guide provides general and specific information, as well as illustrative design details that are required for steel-reinforced concrete members such as slabs, beams, and columns. The importance of this information is emphasized to ensure that the reinforcing steel detailer effectively and accurately captures the intent of the LDP, and presents it in a manner that is clear and unambiguous to the reinforcing steel fabricator and placer. Recommendations are also provided concerning the review of placing drawings by the LDP.

CHAPTER 2—NOTATION AND DEFINITIONS

2.1—Notation

A_g = gross area of concrete section, in.^{2} (mm^2) where for a hollow section, A_g is the area of the concrete only and does not include the area of the void(s)
A_{st} = total area of nonprestressed longitudinal reinforcement, including bars or steel shapes and excluding prestressing reinforcement, in.^{2} (mm^2)
b = width of member, in. (mm)
d = distance from extreme compression fiber to centroid of tension reinforcement, in. (mm)
d_{agg} = nominal maximum size of coarse aggregate, in. (mm)
d_b = nominal diameter of bar or wire, in. (mm)
f_c' = specified compressive strength of concrete, psi (MPa)
f_y = specified yield strength for nonprestressed reinforcement, psi (MPa)
h = overall thickness, height, or depth of member, in. (mm)
ℓ_d = development length in tension of deformed bar, deformed wire, or plain and deformed welded wire reinforcement, in. (mm)
ℓ_{dh} = development length in tension of deformed bar or deformed wire with a standard hook, measured from outside end of hook, point of tangency, toward critical section, in. (mm)
ℓ_{ext} = straight extension at the end of a standard hook, in. (mm)
V_u = factored shear force

2.2—Definitions

ACI provides a comprehensive list of definitions through an online resource, ACI Concrete Terminology. The definitions provided herein complement that resource.

design details—drawings or other information presented by the licensed design professional (LDP) defining steel reinforcement sizes, locations, clearances, splices, geometry, points of termination, relationships, and tolerances.

detailer—person, firm, or corporation producing the reinforcing steel fabrication details and placing drawings based on the design drawings and design details for the structure.

detailing—the process of determining fabrication details based on design details.

fabrication details—dimensions and geometry of steel reinforcement determined for fabrication.

fabricator—person, firm, or corporation producing the reinforcing steel cut and bent to needed dimensions and geometry.

federated model—a building information model (BIM) that electronically links, but does not merge, single-discipline models together for analysis or presentation; the model databases remain distinct and are not combined into a single database.

placing drawings—detailed drawings that give the quantity, size, dimensions, spacing, locations, and other information required for reinforcement fabrication and installation.

CHAPTER 3—GENERAL CONSIDERATIONS

3.1—Building information modeling (BIM)

3.1.1 *Introduction to BIM*—Building information modeling is a three-dimensional process used to generate and manage digital models of buildings and other structures. This process is used by those who plan, design, and build structures, as well as those who manage these facilities. The process involves creating and maintaining intelligent models with attributes that represent characteristics of a facility and contain parametric data about the elements within the model. Many software packages exist that fall within the definition