An Approaching Milestone for the ACI Code

ACI 318-14 will offer benefits to design and construction professionals

by Randall W. Poston

Construction professionals rely on the provisions of ACI 318, “Building Code Requirements for Structural Concrete and Commentary,” for a wide range of applications, from building design and project specifications, to evaluation and repair of existing structures, to resolution of problems in the field. Over time, it has become clear that a modernized Code—one that more closely follows the real-world design process—was needed to address the growing complexity of construction and expectations for concrete performance. In two earlier articles, Charles Dolan and I presented the case for revising ACI 318, and we introduced the general structure of the reorganized Code.¹,² After a multi-year process, which included extensive and painstaking input and review through surveys, workshops, and committee meetings, ACI 318-14 will be released this year. Reorganized for greater ease of use, the new document will comprise the first major restructuring of the Code since 1971. It is important to note that the organization of the document is being modified to better meet the needs of users in the modern design and construction environment. While the core content of the Code is not being changed, the new format has made it necessary to make minor changes in the wording of some provisions. Also, a few new chapters have been created to fill gaps identified during the reorganization process.

In this article, I will provide a brief history of the Code; summarize the work of ACI Committee 318, Structural Concrete Building Code, as it progressed toward reorganization of the document; list some of the guiding principles that went into the reorganization; and cite the many benefits that the new document will offer to all entities that work with structural concrete.

A Quick Look Back

The first United States reinforced concrete building code dates back to 1910, produced through the auspices of the National Association of Cement Users. It was just 14 pages in length. Over time, the code evolved with changing construction needs and technologies, and it transformed from a performance-based code to a more prescriptive one.

The present code organization was developed in the 1960s and is largely structured around the fundamental behaviors of cast-in-place reinforced concrete. ACI 318-71, the first code published using this organization, had 750 provisions covered in 78 pages. With 10 Code editions published since then, ACI 318 has grown to more than 2500 provisions covered in 500 pages. These increases reflect significant changes made in areas such as development length, torsional strength, integrity reinforcement, seismic design and detailing, concrete exposure classes, and anchoring to concrete. In other words, the code evolved through the years as the result of new technologies and understanding of the behavior of structural concrete. As new provisions were added, their locations within the Code were based on the organizational structure. That is, provisions were added based on their relationships to behaviors, not on how buildings are designed. And as the number of provisions grew, related code provisions for a given member type were placed in several chapters. While the Code is based on the assumption that each user knows which provisions apply in each use, more than 2500 provisions tax this assumption and the users themselves.

Reorganizing ACI 318

Process and principles

In 2003, ACI Committee 318 began discussions on Code organization. These efforts intensified in 2006, including the convening of focus groups comprising practicing engineers. In 2007, the consensus of the committee was that the reorganization effort should go forward, and in spring 2008, assignments were made to the Code reorganization committee.
This multi-national committee comprises approximately 90 experts distributed among eight subcommittees. These individuals represent a strong diversity of experience, knowledge, and interests, and they include materials engineers, structural engineers, contractors, building officials, and university faculty members.

The ACI 318 working group follows formal procedures that ensure an honest balance of opinions. All approvals are made by consensus and technical reviews as required by the American National Standards Institute (ANSI), and the ACI Technical Review Process is underway, including a public comment period.

With the ultimate goal of making the Code easier to use, the fundamental principle behind its reorganization was to arrange it from a structural engineer’s perspective—to have it logically flow in concert with the design process. Thus, each building member type (for example, beams, columns, walls, and foundations) will have its own chapter containing complete design and detailing rules. Wherever possible, chapters and sections have been written to parallel the design process and follow the flow of forces from slab to foundation. Overall, ACI 318-14 will make it easier to follow Code requirements.

It is the committee’s hope that the new Code will not only encourage better structural concrete design but that it will also support better communication among designers, engineers, and contractors. In doing so, ACI 318-14 should foster more complete contract documents, which should lead to improved construction management and lower the potential for performance liabilities in the constructed facility. Furthermore, the committee expects that the new Code will be much easier for students and new engineers to learn and apply.

In support of these goals, the organization principles for ACI 318-14 include:

- A logical flow of chapters so that users find the information they need more quickly and more comprehensively;
- A structure that allows a user to design a member by following the provisions within a chapter on that specific member type and be assured that all provisions for the design of that member have been satisfied;
- A structure that follows, in general, a hierarchy of methods, with the simplest followed by more complex alternatives;
- A structure that includes Toolbox Chapters for provisions that apply to multiple sections of the Code. In much the same way that a subroutine is accessed within a computer program, the user accesses the toolbox information only if the toolbox is cited within a system or member chapter, and the user then returns to the system or member chapter to continue the design;
- Maintaining the current side-by-side Code and Commentary format; and
- Improving the consistency of language and style in phrases, tables, equations, lists, notations, and figures, while making greater use of graphs and tables.

**Review and Implementation**

As noted, this reorganization has been many years in the making. The “reorganization” itself has followed an
extremely rigorous development, authentication, and approval process. As a final check, there will be a public comment period in mid-2014, followed by committee response. Publication is expected to occur in late 2014.

The reorganized Code will be published in both U.S. Customary and Système International (S.I.) units and will appear in English, Spanish, Chinese, and other languages.

Additionally, ACI Committee 318 is pleased that ACI 318-14 will be referenced by the 2015 International Building Code (IBC), as developed and published by the International Code Council (ICC). This will support our goal of uniform and comprehensive application of ACI 318-14, as the IBC forms the foundation for building codes throughout the United States and many other countries.

ACI 318-14 will be available in various electronic formats and the traditional printed copy. Resource publications will include a transition key that maps the provisions in ACI 318-11 to those in ACI 318-14. To ensure that users are aware of the upcoming developments, ACI is already hosting presentations in numerous cities, conducting webinars, and participating in national and international conferences and other events to introduce the reorganized Code.

**Benefits**

Organized from an engineer’s perspective, ACI 318-14 will provide many benefits to the concrete and construction community, including designers, contractors, building inspectors, and the academic community. Among these benefits:

- The Code will flow better, with eliminated gaps and redundancies, reduced cross-references, and increased use of graphs and tables;
- It will be much easier to understand which code requirements apply to a particular design, increasing certainty on whether a design fully meets the Code;
- As much as possible, chapters and sections will parallel the design process and follow the flow of forces from slab to foundation;
- It will be much easier for students and new engineers to learn and apply the Code;
- The Code will foster more complete contract documents, which should result in better construction management and lower potential costs.
for performance liabilities in the constructed facility; and
• It will be easier to introduce new topics in the future.

In closing, as Chair of ACI Committee 318, I am extremely proud of the structural concrete community for their input and contributions to this effort and the herculean effort of the Committee 318 membership. The thousands of volunteer hours put into this reorganization reflect well on the talent, knowledge, commitment and, at times, diplomacy of those taking part in this work. All involved understand the responsibility of reorganizing such a core document for our industry: one that will inform and impact every structural concrete design, construction, inspection, insurance appraisal, and end-user experience going forward. We have engaged in a long, careful process, with extensive reviews and checks and balances—all in support of our core mission to construct the safest buildings possible for occupants.

We believe that the result of our efforts will be a Code that is much more accessible and useable than its predecessor, adaptable to new topics, knowledge, and construction standards for many decades to come.

For more information about ACI 318-14, visit www.concrete.org/ACI318.

References

Randall W. Poston, FAcI, is a Principal of WDP & Associates, PC, Austin, TX. He is Chair of ACI Committee 318, Structural Concrete Building Code. He is a former member of the ACI Board of Direction and the Technical Activities Committee (TAC) and Past Chair of the TAC Repair and Rehabilitation Committee. He is a member of the Board Advisory Committee on ISO TC-71 and ACI Committees 222, Corrosion of Metals in Concrete; 224, Cracking; and 562, Evaluation, Repair, and Rehabilitation of Concrete Buildings. He received his engineering degrees from the University of Texas at Austin.

Visit www.ConcreteSDC.org to learn more and to register for this important event.