Recent Advances in Concrete Technology and Sustainability Issues

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Terence C. Holland Pawan R. Gupta V. Mohan Malhotra



# Thirteenth International Conference on Recent Advances in Concrete Technology and Sustainability Issues

Editors: Terence C. Holland Pawan R. Gupta V. Mohan Malhotra



SP-303

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## Preface

The Canada Center for Mineral and Energy Technology (CANMET) of Natural Resources of Canada, Ottawa, has played a significant role for more than 40 years in the broad area of concrete technology in Canada. In recent years CANMET has become increasingly involved in research and development dealing with the supplementary cementing materials, high-performance normal weigh and lightweight concretes, and alkaliaggregate reactions. As part of CANMET's technology transfer program, an international symposium on Advances in Concrete Technology was sponsored jointly with the American Concrete Institute (ACI) and other organizations in Athens, Greece, May 1992. In June 1995 CANMET, in Association with ACI and other organizations in Canada and the U.S., sponsored the Second CANMET/ACI International Symposium on Advances in Concrete Technology in Las Vegas, Nevada. For the Athens symposium, the CANMET publication, "Advances in Concrete Technology," constituted the proceedings of the symposium. Proceedings from the Las Vegas symposium were published by ACI as SP-154.

In August 1997, CANMET, in association with ACI and other organizations in Canada and New Zealand, sponsored the Third CANMET/ACI International Symposium on Advances in Concrete Technology in Auckland, New Zealand. The main purpose of the symposium was to bring together representatives from industry, universities, and government agencies to present the latest information in concrete technology, and to explore research and development. Thirty-three refereed papers from 15 countries were presented and distributed at the symposium. Proceedings were published as ACI SP-171.

In June 1998, CANMET, in association with ACI, Japan Concrete Institute (JCI), and several other organizations in Canada and Japan, sponsored the Fourth CANMET/ACI International Conference on Recent Advances in Concrete Technology in Tokushima, Japan. More than 80 papers from 20 countries were received and reviewed in accordance with the policies of ACI. Sixty-one refereed papers were accepted for presentation at the conference and for publication as ACI SP-179. In addition to the refereed papers, more than 30 more papers were presented and distributed at the symposium.

In July-August 2001, CANMET, in association with ACI and several organizations in Singapore, sponsored the Fifth CANMET/ACI International Conference on Recent Advances in Concrete Technology in Singapore. More than 100 papers from more than 25 countries were received and reviewed in accordance with the policies of ACI. Fortysix refereed and more than 25 additional papers were accepted for presentation at the conference and published as ACI SP-200. In June 2003 CANMET, in association with ACI and several organizations in Romania, sponsored the Sixth CANMET/ACI International Conference on Recent Advances in Concrete Technology in Bucharest, Romania. More than 40 papers presented at the conference were distributed "as received," and no formal ACI special publication was published.

In May 2004, CANMET, in association with ACI and several organizations in the U.S., sponsored the Seventh CANMET/ACI International Conference on Recent Advances in Concrete Technology in Las Vegas, Nevada. Seventeen refereed papers from more than 10 countries were presented and distributed at the conference. The proceedings, consisting of refereed papers, were published as ACI SP-222. In addition to the refereed papers, 20 additional papers were presented and distributed at the conference.

In May 2006, CANMET, in association with ACI and several organizations in Canada and the U.S., sponsored the Eighth CANMET/ACI International Conference on Recent

Advances in Concrete Technology in Montreal, Canada. Proceedings of the conference, consisting of 17 refereed papers, were published as ACI SP-235. In addition to the refereed papers, more than 30 additional papers were presented and distributed at the conference.

In May 2007, CANMET, in association with ACI and several organizations in Canada, Europe, and the U.S., sponsored the Ninth CANMET/ACI International Conference on Recent Advances in Concrete Technology in Warsaw, Poland. Proceedings of the conference consisted of 10 refereed papers that were published as ACI SP-243. More than 20 additional papers were presented and distributed at the conference.

In October 2009, ACI, in association with several organizations in Canada, Europe and the U.S., sponsored the Tenth ACI International Conference on Advances in Concrete Technology in Seville, Spain. Proceedings of the conference consisting of 20 refereed papers that were published as ACI SP-261. In addition to the refereed papers, more than 20 additional papers were presented at the conference and published in a Supplementary Papers Volume.

In May 2010, the Committee for the Organization of International Conferences (COIC) (formerly CANMET/ACI Conferences), in association with the Chinese Ceramics Society (CCS) and several other organizations in China, sponsored the Eleventh International Conference on Advances in Concrete Technology and Sustainability Issues in Jinan, China. More than 40 papers were presented at the conference. The proceedings of the conference were published by the (CCS), Beijing, China.

In October 2012, the COIC, in association with ACI, sponsored the Twelfth International Conference on Advances in Concrete Technology and Sustainability Issues in Prague, Czech Republic. The proceedings of the conference consisted of more than 30 refereed papers that were published as SP-288. In addition to the refereed papers, more than 40 other papers were presented at the conference and were published in the Supplementary Papers Volume.

In July 2015, the (COIC), in association with the ACI sponsored the Thirteenth International Conference on Advances in Concrete Technology and Sustainability Issues in Ottawa, Canada. The proceedings of the conference consisting of 28 refereed papers were published by the ACI as SP-303. In addition to the refereed papers, more than 40 other papers were presented at the conference and were published in the Supplementary Papers Volume.

Many thanks are extended to the members of the Technical Paper Review Panel who met in Bahamas in October 3 to 11, 2014 to review the papers. Without their dedicated efforts, it would not have been possible to publish the proceedings for distribution at the conference. The cooperation of the authors in accepting the reviewers' suggestions and in revising the manuscripts accordingly is greatly appreciated.

The help and assistance of Dr. Pawan R. Gupta and Prabha Gupta are gratefully acknowledged in the administrative work associated with the conference, and processing of the manuscripts for both the ACI proceedings (SP-303) and the Supplementary Papers Volume.

Terence C. Holland Pawan R. Gupta V. Mohan Malhotra Editors

Thirteenth International Conference on Advances in Concrete Technology and Sustainability Issues July 14 to 17, 2015 Ottawa, Canada

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## Responsibility, Durability, and Construction Requirements in ACI 318-14

## by Terence C. Holland

ACI 318, "Structural Concrete Building Code," has been completely reorganized for the 2014 edition. While the technical provisions of most of the code have been unchanged, changes have been made in the provisions dealing with responsibility, durability, and construction. The responsibility for use of the code has been assigned to the licensed design professional (LDP.) Minor changes have been made to the durability provisions to clarify the intent of the code and to help the LDP select exposure classes. The most significant changes in ACI 318-2014 are in a new chapter that addresses construction requirements. Previously, construction provisions were located throughout the code. The new code is based upon the premise that the contractor should not have to search the code for construction requirements. Instead, all such requirements must be in the contractor. The new chapter makes the LDP responsible for writing the applicable design information and compliance requirements into the construction documents.

**Keywords:** building codes; building codes history; responsibility; durability; construction documents; construction requirements.

#### INTRODUCTION

The primary purpose of the concrete building code is to provide for the life safety of occupants of concrete structures. Life safety is achieved by ensuring uniformity of design and meeting minimum construction requirements. From the very first code, both structural engineering and construction requirements have been included in the code. Durability requirements were not included in the early codes, but they have gradually been included in more and more detail over the years.

Starting with the very first code, there has been ambiguity over who the code is written for: is it the design engineer or the contractor? Until very recently, there was no attempt to address the requirements at a particular user. While the majority of the code is implicitly directed at the designer, there have always been numerous construction requirements that the contractor has been expected to find and implement.

Prior to the 2014 code cycle, ACI Committee 318 decided it was appropriate to undertake a major review and reorganization of the code. The planning, process, and outcome