

**ACI 237R-07**

**(Reapproved 2019)**

*Emerging Technology Series*

# **Self-Consolidating Concrete**

Reported by ACI Committee 237



**American Concrete Institute®**



First Printing  
April 2007

American Concrete Institute®  
*Advancing concrete knowledge*

## Self-Consolidating Concrete

Copyright by the American Concrete Institute, Farmington Hills, MI. All rights reserved. This material may not be reproduced or copied, in whole or part, in any printed, mechanical, electronic, film, or other distribution and storage media, without the written consent of ACI.

The technical committees responsible for ACI committee reports and standards strive to avoid ambiguities, omissions, and errors in these documents. In spite of these efforts, the users of ACI documents occasionally find information or requirements that may be subject to more than one interpretation or may be incomplete or incorrect. Users who have suggestions for the improvement of ACI documents are requested to contact ACI.

ACI committee documents are intended for the use of individuals who are competent to evaluate the significance and limitations of its content and recommendations and who will accept responsibility for the application of the material it contains. Individuals who use this publication in any way assume all risk and accept total responsibility for the application and use of this information.

All information in this publication is provided “as is” without warranty of any kind, either express or implied, including but not limited to, the implied warranties of merchantability, fitness for a particular purpose or non-infringement.

ACI and its members disclaim liability for damages of any kind, including any special, indirect, incidental, or consequential damages, including without limitation, lost revenues or lost profits, which may result from the use of this publication.

It is the responsibility of the user of this document to establish health and safety practices appropriate to the specific circumstances involved with its use. ACI does not make any representations with regard to health and safety issues and the use of this document. The user must determine the applicability of all regulatory limitations before applying the document and must comply with all applicable laws and regulations, including but not limited to, United States Occupational Safety and Health Administration (OSHA) health and safety standards.

**Order information:** ACI documents are available in print, by download, on CD-ROM, through electronic subscription, or reprint and may be obtained by contacting ACI.

Most ACI standards and committee reports are gathered together in the annually revised *ACI Manual of Concrete Practice* (MCP).

**American Concrete Institute**  
**38800 Country Club Drive**  
**Farmington Hills, MI 48331**  
**U.S.A.**

**Phone: 248-848-3700**  
**Fax: 248-848-3701**

**[www.concrete.org](http://www.concrete.org)**

ISBN 0-87031-244-8  
ISBN-13: 978-0-87031-244-1

# Self-Consolidating Concrete

Reported by ACI Committee 237

*ACI encourages the development and appropriate use of new and emerging technologies through the publication of the **Emerging Technology Series**. This series presents information and recommendations based on available test data, technical reports, limited experience with field applications, and the opinions of committee members. The presented information and recommendations, and their basis, may be less fully developed and tested than those for more mature technologies. This report identifies areas in which information is believed to be less fully developed, and describes research needs. The professional using this document should understand the limitations of this document and exercise judgment as to the appropriate application of this emerging technology.*

Joseph A. Daczko  
Chair

Kamal H. Khayat  
Secretary

Claude Bedard  
Van K. Bui  
John F. Cook  
Charles R. Cornman  
Kirk K. Deadrick

Chiara F. Ferraris  
Sidney Freedman  
John V. Gruber  
Venkatesh S. Iyer  
Philippe Jost

Beatrix Kerkhoff  
Gary F. Knight  
Frank A. Nadeau  
H. Celik Ozyildirim  
Qizhong Sheng

Mohammed Sonebi  
Richard Szecsy  
Jody R. Wall  
James A. Wamelink

\*Associate member Mark Bury contributed to this report.

*Self-consolidating concrete (SCC) has been successfully used in many projects around the world and has made a major impact on concrete placement and construction economics. This report contains the current state of knowledge with respect to SCC. The information in this document is expected to inform concrete producers, users, and specifiers of SCC of known practices and processes. Because SCC is a viable solution to various concrete placement problems, ASTM has established Subcommittee C09.47, Self-Consolidating Concrete, to develop standard test methods for SCC.*

**Keywords:** admixture; aggregate; air entrainment; bleeding; cement; consolidation; curing; placing; self-consolidating concrete; specification; viscosity, workability.

## CONTENTS

### Chapter 1—Introduction, p. 237R-2

- 1.1—Definition of self-consolidating concrete (SCC)
- 1.2—Advantages
- 1.3—Development history of SCC
- 1.4—Selected case studies

ACI Committee Reports, Guides, Standard Practices, and Commentaries are intended for guidance in planning, designing, executing, and inspecting construction. This document is intended for the use of individuals who are competent to evaluate the significance and limitations of its content and recommendations and who will accept responsibility for the application of the material it contains. The American Concrete Institute disclaims any and all responsibility for the stated principles. The Institute shall not be liable for any loss or damage arising therefrom.

Reference to this document shall not be made in contract documents. If items found in this document are desired by the Architect/Engineer to be a part of the contract documents, they shall be restated in mandatory language for incorporation by the Architect/Engineer.

### Chapter 2—Fresh properties, p. 237R-9

- 2.1—Terminology relative to SCC
- 2.2—Performance requirements of SCC
- 2.3—General
- 2.4—Characteristics
- 2.5—Target guidelines for fresh properties
- 2.6—Quality control

### Chapter 3—Hardened properties, p. 237R-12

- 3.1—General
- 3.2—Mechanical properties
- 3.3—Long-term durability
- 3.4—Aesthetics

### Chapter 4—Guide for selecting proportions for SCC, p. 237R-14

- 4.1—General
- 4.2—Performance requirements
- 4.3—Materials
- 4.4—Mixture proportioning procedure
- 4.5—Examples of SCC mixture proportions

### Chapter 5—Production, p. 237R-18

- 5.1—General
- 5.2—Production issues that influence fresh SCC properties
- 5.3—Performance targets

ACI 237R-07 was adopted and published April 2007.

Copyright © 2007, American Concrete Institute.

All rights reserved including rights of reproduction and use in any form or by any means, including the making of copies by any photo process, or by electronic or mechanical device, printed, written, or oral, or recording for sound or visual reproduction or for use in any knowledge or retrieval system or device, unless permission in writing is obtained from the copyright proprietors.

- 5.4—Mock-up
- 5.5—Employee training

## Chapter 6—Transport, placement, and finishing, p. 237R-20

- 6.1—General
- 6.2—Transport
- 6.3—Discharge of SCC for slabs or open-top molds for factory-type precast elements
- 6.4—Forms, element characteristics, and reinforcement
- 6.5—Placement techniques
- 6.6—Finishing
- 6.7—Curing

## Chapter 7—SCC specification guidelines, p. 237R-24

- 7.1—Concrete materials
- 7.2—Execution

## Chapter 8—Test methods, p. 237R-24

- 8.1—Measuring SCC characteristics
- 8.2—Slump flow
- 8.3—Visual stability index
- 8.4— $T_{50}$
- 8.5—J-ring
- 8.6—L-box
- 8.7—Column segregation
- 8.8—Other tests

## Chapter 9—References, p. 237R-27

- 9.1—Referenced standards and reports
- 9.2—Cited references

### CHAPTER 1—INTRODUCTION

#### 1.1—Definition of self-consolidating concrete (SCC)

Self-consolidating concrete (SCC) is highly flowable, nonsegregating concrete that can spread into place, fill the formwork, and encapsulate the reinforcement without any mechanical consolidation. In general, SCC is concrete made with conventional concrete materials and, in some cases, with a viscosity-modifying admixture (VMA). SCC has also been described as self-compacting concrete, self-placing concrete, and self-leveling concrete, which all are subsets of SCC. The nomenclature of this technology has been previously discussed (Szecsy 2002). In this report, conventional concrete is referred to as concrete that does not meet the definition of SCC.

#### 1.2—Advantages

Properly proportioned and placed SCC can result in both economic and technological benefits for the end user. The in-place cost savings, performance enhancements, or both, are the driving forces behind the use of SCC. Specifically, SCC can provide the following benefits:

- Reduce labor and equipment.
  - No need for vibration to ensure proper consolidation. This also results in savings in equipment purchasing and equipment maintenance and operation; and
  - Less need for screeding operations to ensure flat surfaces (self-leveling characteristic).
- Enable the casting of concrete that develops the desired

mechanical properties independent of the skill of the vibrating crew;

- Accelerate construction through higher rate of casting or placing and shorter construction duration;
- Facilitate and expedite the filling of highly reinforced sections and complex formwork while ensuring good construction quality. This can ensure better productivity, reduce the labor requirement and cost, or both;
- Enable more flexibility in spreading placing points during casting. This can reduce the need for frequent movement of transit trucks and the need to move the pump lines to place concrete (possible reduction in the number of pumps, pump operators, and so on). This greater flexibility in scheduling construction activities and procuring the required resources results in both time and resource savings;
- Reduce noise on the job site (especially critical in urban areas and for sections requiring heavy vibration consolidation):
  - Reduce the need of vibration for construction typically requiring the use of heavy consolidation (such as fiber-reinforced concrete and precast operations). In some cases, the use of noise-free or silent concrete can potentially extend construction hours in urban areas, enabling the scheduling of some construction activities during otherwise curfew periods to alleviate difficulties related to traffic conditions in urban areas; and
  - Reduce insurance premiums. Precasting facilities generating considerable noise pollution are sometimes required to pay premiums to national insurance agencies responsible for eventual treatment of hearing-impaired workers. Insurance premium reductions can partially offset the additional material cost of SCC, making it attractive for precast operations.
- Decrease employee injuries by facilitating a safer working environment where strenuous and labor-intensive operations can reduce tripping hazards through the removal of some electrical cords or air lines (Walraven 2003);
- Permit more flexibility for detailing reinforcing bars. Avoid the need to bundle reinforcement to facilitate placement and consolidation, and in some cases, enable the use of small and closely spaced reinforcing steel to control cracking;
- Create smooth surfaces free of honeycombing and signs of bleeding and discoloration, obtained when using a well-proportioned SCC mixture, high-quality formwork with an adequate release agent, and sound placement practices (Chapter 6). Superior surface quality is critical in architectural concrete and cast-in-place and precast concrete for residential construction (walls); and
- Eliminate the need for materials, such as underlayments, that are used to level and prepare substrates for final flooring materials, such as carpeting and tile, whenever allowed by building regulations.