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Emerging Technology Series

Self-Consolidating Concrete

Reported by ACI Committee 237

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Self-Consolidating Concrete

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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

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*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.

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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 economical 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 result 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.