By Rick Yelton

Developing the Norm for SCC

Researchers are working hard to place self-consolidating concrete in its proper form.

In a hotel conference room filled to capacity with many of the concrete industry's leading experts, Martin Vachon had the difficult task of defining an industry's dream. The focus of the group's attention was the definition of the concrete industry's innovation—self-consolidating concrete (SCC).

The task was difficult for ASTMC09.47, the diverse group of concrete practitioners who comprised the task group. To the material research scientists, SCC represents the optimum design of composite slurry and can be measured in terms like pore spacing. To the contractors and producers in the room, SCC represents a traditional material that offers levels of enhanced workability. To the representatives of testing agencies, SCC represents a material that, when in its plastic state, shares little in common with traditional concrete, but in its hardened state, appears to share many of the same qualities.

And in addition to the participants' perspectives of job function, the debate over SCC has polarized concrete experts. On one side of the spectrum, there are those concrete traditionalists who view SCC as a radically new material. These experts feel that SCC should be subjected to lengthy and long-term testing before making its way into the construction norm. And there are those free thinkers who believe SCC represents the industry's first and perhaps best opportunity to introduce computer modeling in the mix design process. This group feels that with proper comparison testing, industry acceptance of SCC should be fast tracked. And perhaps just as important, the acceptance of SCC should be an industrywide effort.

If that happens, SCC technology could break the normal industry acceptance of 14 years. But is the concrete community ready?

Where does the responsibility lie?

For many producers and others involved in the concrete industry, there also seems to be the question of who does what in approving concrete mixes. With SCC, this question is even more complex. The material has just enough changed characteristics to affect some traditionally held concepts, but not enough to have SCC characterized as something completely new.

In the mix design submittal process, most structural engineers would be hard pressed to notice any change from a producer's other gap-graded mixes. Aggregate proportions appear normal. Higher quantities of cementitious materials yield higher 28-day compressive strengths. And water-cement ratios look good. Even a post-jobsite visit would yield few clues of SCC usage. That's because once SCC hardens, it is extremely difficult to distinguish its final form from other well-proportioned mixes, even with petrographic tests.

So it's only in its plastic state that SCC appears to have an identity crisis. That's because on-site testing technicians can't provide the acceptable results to the design engineer using time-accepted test procedures. Imagine an engineer's horror when he reads that the slump of what appeared on paper to be a great mix was only 1.5 inches. To an engineer unfamiliar with SCC, the first thought is that the producer had an improper batch or the contractor added too much water.

Not only is the design engineer dismayed by the lack of control of fresh SCC, there's the field technician who must abandon traditional lessons. Traditional slump tests fail to provide indications of mix consistency. Since the SCC's fluid concrete properties rely on materials other than ex-

cess water to achieve its viscosity, inspectors find it difficult to judge the producer/contractor compliance with designed water-cement ratios.

And then there's the owner's construction expert who insists that there is no variation from standard construction procedures. Concerns about pouring heights in vertical forms, use of vibrators for consolidation, and reduced rates of pumps and material handling can cause trepidation to the uninformed.

SCC's identity crisis has been limited to consideration into normal construction projects. And only when it achieves a comfort level of acceptance, can the economics of use help lower the introductory costs.

What's happening now

Industry acceptance of SCC is currently mired in the committees of the American Concrete Institute (ACI) and the Association for Material Test Standards (ASTM). Only after their committee work is finished can SCC be written into the guidelines of acceptable concrete construction. But before that can happen, there must be agreement on how to field-test the material.

The long-term agreement between these two organizations places the development of testing procedures for concrete into the ASTM committee work. Thus, it falls to Vachon's subgroup to develop acceptable procedures.

In the ASTM subcommittee's efforts, there has been a two-point attack on upgrading the testing standards to reflect current and future needs for SCC. The committee identified 10 current ASTM test methods that, with some minor adjustment in either wording or definition, can be modified to be applicable to SCC. Currently, wording changes are being submitted to the appropriate task groups so that ballot items can be proposed following next fall's meeting.

But the more controversial work being undertaken by the committee involves developing standards for field testing procedures. The committee has focused on the concept of developing a spread test and how it relates to the traditional slump. A series of round robin tests were conducted in February 2003 when committee members met in Cleveland. Together, they conducted numerous tests using a proposed test procedure on a wide range of mix designs. This was important because SCC can be batched using many combinations of admixtures and materials. Test results for this round robin effort are currently being analyzed to measure precision. If the method proves accurate for all mix types, the committee will propose the standard to the subcommittee and begin the approval process.

More round robin tests on an appropriate viscosity test method are scheduled for this month in conjunction with the ACI committee meetings.

Stressing quick action

While the debate was going on at the ASTM meeting, many of these same committee members were involved in developing the first North American published guidelines for self-consolidating concrete. In the May-June issue of the *PCI Journal*, a magazine published by the Chicago-based Precast/Prestressed Concrete Institute, members of the FAST Team displayed the interim guidelines for production and placement.

A special committee composed of producers, testing lab personnel, admixture representatives, and precast design engineers prepared the guidelines. With the wide acceptance of SCC in its member plants, PCI members felt that they couldn't wait years for the development of industrywide standards.

The guidelines cover material design, performance specifications, test methods, plant production procedures, and even sample mix designs. Hardcover copies of the documents can be purchased from the PCI Web site at *www.pci.com*.

Working to Move Technology Forward

Moving technology forward into the concrete construction industry is an important goal of the Strategic Development Council (SDC). At its meeting next month in San Antonio, there will be a follow-up to a proposal to form the Concrete Innovations Pathfinder Service (CIPS). This new SDC service would, among other things, enable/assist purveyors of new technologies in finding the best pathways to commercialization through ACI's system. The SDC Executive Committee is reviewing a white paper prospectus, and will share the document with the general membership at the San Antonio meeting.

CIPS will nicely complement ACI's Concrete Innovation Appraisal Service (CIAS). CIAS currently appraises client claims about technologies as a tool for ACI committees. CIPS will help roadmap the appropriate paths clients/innovators need to move ideas through the ACI process. CIAS is about technologies, and CIPS is about the process of reviewing them. This is about as straightforward as it gets. Assuming Executive Committee approval, we anticipate that George Hoff, who will handle CIPS operations, will begin client development activities soon after San Antonio.

Through short, decisive engagements, CIPS would assist innovators needing help understanding ACI's system with guidance about the best channels to move their technologies through the review/approval process. After determining if a subject technology has merit (some will not), CIPS will, for a fee (no attempt to profit), assemble an appropriate panel of experts to investigate and produce a road map. The usual prohibitions will be in effect against safety, environmental, and legally charged issues; the client will have to prove ownership; experts will be indemnified; publishing and promotion will be restricted; no endorsements or certifications will be made; and CIPS will not participate in client design.

To learn more about the Strategic Development Council's efforts on decreasing the acceptance time of new technology into practice, or to learn how to attend the San Antonio meeting Nov. 17-19, go to its Web site at www.concretesdc.org. Or contact William H. Plenge, Managing Director, Strategic Development Council, 410-867-9702, 410.867.9703 (fax) or bill.plenge@concrete.org.