

Creating an Alternative for Performance Concrete

By Jack Gibbons and Mark F. Chrzanowski, P.E.

Now more than ever, the concrete industry is looking for ways to do it better, faster, more economical, and with greater environmental stewardship. All of this requires mechanisms for innovation in an industry that can be slow to change. Author Jack Gibbons, with the help of ACI 329 Chair Mark F. Chrzanowski, look at how the American Concrete Industry has set their sights on developing a culture that encourages innovation through performance-based delivery of concrete.

One of the most significant recent developments in concrete is the creation of American Concrete Institute (ACI) Committee 329, *Performance Criteria for Ready Mixed Concrete*. This committee formally recognizes the need to move beyond prescriptive mix specifications in order to meet the demand for higher performance concrete and the more rapid cycle construction schedules that today's projects require, while addressing the need to practice greater environmental stewardship by allowing a project team to tailor the utilization of materials and construction means and methods to the specific needs of a given project.

Back in 2004, the Strategic Development Council of ACI identified the move from prescriptive to performance-based specifications as an industry-critical technology. This led to the creation of Innovative Task Group-8, (ITG-8), whose mission statement read, "to develop a report on performance criteria and test methods for concrete materials that could be used in codes and specifications."

History

Since their first meeting in Fall of 2007, members of ITG-8 have been busy writing a guide report that investigates the issue of specifying concrete through performance-based criteria. In December 2010, ACI published ITG-8R-10 *Report on Performance-Based Requirements for Concrete* and subsequently discharged the members of ITG-8. It will now be the task of newly formed ACI Committee 329 to champion the concept of performance-based concrete.

Goals

According to ACI 329 Chairman Chrzanowski, the short term goal for ACI

329 is to ballot the document and adopt the ITG-8 Report as the an ACI 329 document.

Possible future goals include:

- Develop additional performance-based criteria and guidance for future revisions to the ITG-8/ACI 329 Report.
- Review ACI Documents to identify barriers to performance-based specifications and work with committees to address the barriers.
- Review current industry practices to identify barriers to performance-based specifications and work within the industry to remove the barriers.
- Document performance projects with the intent of educating.

What does this mean? (Author's Opinion)

I participate in a seminar each year at the World of Concrete titled, *How to Use Chemical Admixtures Effectively*. Using admixtures individually, or in many cases, in combination, is the primary tool advancing the performance of concrete. Today water reducers are more powerful than we could have ever imagined, and accelerators and retarders are often used all year long. Rapid cycle concrete construction is common today and would not be possible without the creative use of chemical admixtures. It wasn't that long ago when a three-day cycle was the accepted norm for post-tensioned concrete. Then it was reduced to two. Today it's not unusual to pull strand in only one day. Durability has increased with the use of supplementary cementitious materials (SCMs), as well as our ability to produce low heat mass concrete, and SCMs are crucial to the production of high- and ultra high-strength concrete. All of this has been made possible because of mixes being designed for performance and not by prescription.

One of the best comments I've seen on the current advances in concrete construction was from Stan Korista of Skidmore, Owings & Merrill in an interview he gave on the design and construction of Chicago's 100-story Trump Tower. Korista states, "What has made the difference for concrete construction is the development of high-strength concrete mixes, the greatly increased efficiency of concrete pumps and placing

booms, and the development of forming systems that can be erected safely and quickly then moved to the next location." Having been personally involved in developing the mixes for the Trump project, the only change I would make to Stan's comment is that it isn't just about high strength, it's about high performance. Only about 40% of the Trump Tower concrete was high strength, but every cubic yard was "high performance" for construction purposes. Another published quote regarding the construction of Trump Tower came from Dave Alexander, Senior Vice President of McHugh Construction, concrete contractor for the project "...moving and placing 180,000 cubic yards of concrete.....was a technical challenge that might have been impossible only 10 years ago." SOM wrote a performance specification for the concrete which thoroughly detailed their requirements and then let Prairie Materials (the ready mix producer) use their expertise to design the mix.

Conclusion

ITG-8 and ACI 329 are laying the groundwork for how the concrete industry can proceed. We have only scratched the surface of how successful it can be designing for performance. The Trump Tower is only one example where performance was essential in every area. Future examples may be even more extreme and their success may depend on designing for performance. ■

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