Adding water to ready mixed concrete

SCENE: *It's a hot July day and the ready mix truck had to sit a while. Now the finishing crews are waiting and the concrete looks stiff. The contractor calls for water. The driver adds water and revs up to mix it in. It still doesn't slump enough.*

Should you add water and exceed the spec? Will that affect the strength? What are your options?

Learn the answers to these and other questions at the April T.I.C. workshops on the basics of concrete. See the *Calendar* on page 6 for details.

"Sometimes mixing alone will work out the stiffness," says Andrea Breen, technical sales engineer for cementitous supplier Lafarge North America. "Most specs allow for a one-time addition of water." Many ready mixed concrete producers print the information directly on the delivery ticket.

The mixer needs time to work the water in thoroughly. The truck should make at least 30 revolutions at mixing speed, which takes about two minutes. Shortchange the process and the front and back of the load will have different water/cement ratios. This produces concrete of different strengths, workabilities, and colors.

Too much water can weaken the concrete. "The batch needs only about a 0.28 to 0.3 water/cement ratio to begin the process of hydration," says Breen. "Extra water is not used in the chemical process and later evaporates, leaving small capillaries." Later, de-icing salt and water can get in and cause the re-bar to rust and expand, breaking the concrete apart. A water/cement ratio of 0.45 is generally considered sufficient to provide durability for concrete exposed to freeze/thaw cycles and de-icer salts.

Extra water can also slow the finishing process. The finisher watches for water to appear at the surface, then disappear. If it's slow to bleed because of excess water in the mix, the finisher may end up finishing the surface anyway. The surface then has a higher water/cement ratio and less durability than the body of the concrete. The result can be early scaling.

To protect concrete quality, control water. Only one person on the jobsite should have authority to request it. Water additions should be measured and recorded. Once the desired slump is obtained and discharging starts, no more water should be added.

Another approach is to use admixtures to increase workability so you get a more durable concrete with the same or less water. Finishing is easier too since the admixtures disperse the cement, helping it coat the coarse aggregate.

A rule of thumb says that adding one gallon of water per cubic yard of concrete will increase the slump one inch. While this is a useful guideline, it may not apply when the concrete has water-reducing admixtures.

Contractors should be familiar with how effective a particular water reducer is and the differences in admixtures used by different suppliers. For example, a 0.45 water/cement ratio might have a 4-inch slump with a normal water reducer but a 5-inch slump with a mid-range reducer and a 9-inch slump with a high-range reducer.

"Slump is just a guide," says Breen. "What determines the effectiveness of concrete is the actual ratio of pounds of water to pounds of cement." These should be specified by the architect or engineer and designed into the mix by the supplier to produce the required strength. Add too much water at the job site and you run the risk of putting in substandard concrete.

How to do a slump test

In a slump test a sample of freshly-mixed concrete is placed and compacted in a 12-inch high, cone-shaped mold. The mold is raised and the concrete is allowed to subside. The tester measures the height of the released concrete. The slump is the difference in inches between the two. Slump generally increases with the amount of water in the concrete mixture. The test should be done carefully and precisely by a certified technician.

1. Collect a sample. If the concrete includes coarse aggregate larger than 1 1/2 inches in diameter, use a wet sieve to remove the bigger stones.
2. Dampen the mold and place it on a flat, moist, non-absorbent surface. Hold it firmly down with feet.
3. Fill the slump mold in three layers of equal volume. The mold should be a smooth-sided, 12-inch high cone with an 8-inch diameter base and a 4-inch diameter top. (One-third is about 2 1/2 inches deep, two-thirds is about 6 inches deep.)
4. Rod each layer uniformly in a spiral from perimeter to center with exactly 25 strokes of the tamping rod. When rodding middle and top layers, just penetrate into the layer below.
5. Heap top layer above the mold. If it subsides below the edge, add more.
6. Level the concrete with the top of the cone using the tamping rod.
7. Clear the area around the cone's base so nothing interferes with the concrete's movement.
8. Lift the cone straight up with no side-to-side or twisting motions.
9. Complete the entire test in 2 1/2 minutes.
10. Measure immediately. Report in inches to the nearest quarter inch. If there is a decided falling away or shearing off of concrete from one side, do the test over.

It is impossible to bring concrete exactly to a specified slump on a consistent basis. Here are suggested tolerances for slump specified as a target:

Specified target	Tolerance
2" and less	**±0.5 in.**
2- 4"	**±1.0 in.**
More than 4"	**±1.5 in.**

Based on Standard Test Method for Slump of Hydraulic-Cement Concrete, ASTM C 143/C 143M-00. Copyright 2000 ASTM.

Superpave use now common

Many communities around the state are now routinely using Superpave for all their asphalt pavement projects. "We've been using Superpave on all contracted paving for the last three years," says Ken Pesch, Washington County Highway Commissioner. "It's working just fine as far as we're concerned."

Superpave is an asphalt mix design method that uses design equipment and techniques that better simulate actual traffic. It also specifies asphalt binder that is better suited to specific temperature zones. Superpave is now the standard for WisDOT construction projects.

"Everybody is getting on board," agrees Gerry Waelti, executive director of WAPA (the Wisconsin Asphalt Pavement Association). "We just need to get the knowledge out."

"We did it the first time in 2000," says Mike Lynett, Village of Fox Point public works director. "We were concerned whether local asphalt plants could produce this type of mix design, but we had good competition—three or four bidders—so that's not a concern any more." Lynett learned about the new specs at asphalt conferences he attended in the Milwaukee area. The pavement was laid on 12 street sections in Fox Point last year, including rural cross-section roads, residential roads, and collectors.

"It's getting pretty routine," says Washington County's Pesch. "I can't perceive why anybody wouldn't use it."

"I'm an engineering department of one and also the public works director," says Lynett. "Some smart person did the research and decided that this was a better way to specify pavements. I'm not going to try to analyze if they're right or not. Any commodity or technique that's state of the art is what we do here. We try to purchase things that will last a long time because budgets don't always cover replacements."

Superpave specs and information are available on the WAPA Web page: http://www.wispave.org. Also, the T.I.C.'s Road Maintenance Workshops in late March will discuss the benefits of Superpave and show participants how to include it in bid documents.