CEL TECHNICAL BULLETIN 6-13

Water Addition to Ready-Mix Concrete

One of the responsibilities of the concrete inspector is to monitor the delivered concrete for proper mix design and compliance with the mix design proportions. This includes the amount of water added to the truck. Versions of ASTM C94 issued prior to 2013 restricted water additions after batching to a one-time addition at the jobsite. AASHTO M157 and other state DOT's have similar provisions. On many job sites the inspector is only able to inspect a portion of the trucks. When an inspector is not available, the truck driver may make a water addition to adjust the slump based on a visual assessment or feedback from the contractor. Even when the inspector checks the load, water may be added at other times when it cannot be documented, for example from a source not connected to the water tank on the truck.

ASTM C94 was recently revised to allow the in-transit addition of water for truck mixers equipped with automated systems that allow:

- Monitoring of slump or slump flow;
- Measurement of water additions with a calibrated flow meter accurate to +/-3% of the amount added; and
- Limiting the total water additions to avoid exceeding the maximum water content allowed for each load.

To ensure a homogenous mixture, each batch of concrete must be mixed at mixing speed for at least 30 revolutions after the last addition of water. Finally, the final amount of water must be reported on the batch ticket.

Truck-mounted equipment is available to measure, manage, and record concrete slump and water added to the truck from batching to discharge. Sensors on the truck are used to determine slump, concrete temperature, drum speed, number of drum revolutions, water and admixture added, age, and load size. Flow valves and meters are mounted on the truck to control the addition of water. Water is added each time the slump is less than the target value. The system communicates with the batching software at the batching plant to determine the amount of water that can be added to the truck without exceeding the water/cement ratio for the mix. Water additions are stopped when the maximum amount is added. The system can prompt the driver to mix the concrete at the proper speed after batching and water addition. Admixture additions can be similarly automated. Data on slump temperature, mixing, age, and water additions are recorded and the data can be made available to the inspector. Data is recorded throughout the delivery cycle.

Truck mixers equipped with automated systems can benefit the project by reducing variability and increasing productivity; 100% of loads are delivered within specification for slump and water content; and time can be reduced by having concrete arrive on site already adjusted for slump and water content.