

Concrete in Practice

What, why & how?



CIP 26 - Jobsite Addition of Water

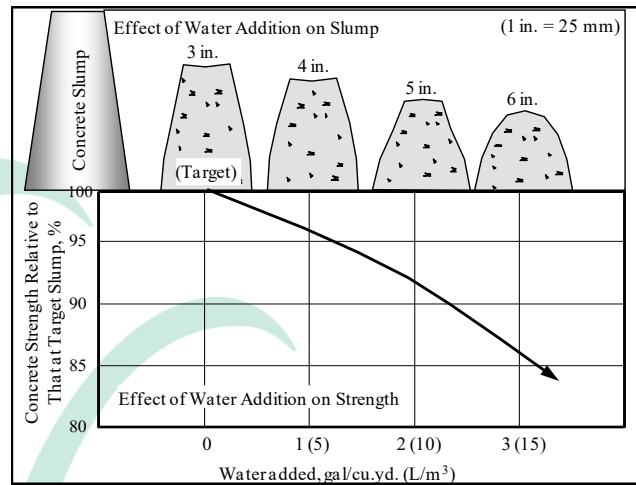
WHAT is Jobsite Addition of Water?

This is the addition of water to ready mixed concrete in a truck mixer after arrival at the location of the concrete placement. Such tempering of concrete may be done with a portion of the design mixing water that was held back (referred to as *trim* or *hold* water), during the initial mixing. The design mixing water is the quantity of water set by the mixture proportions for required performance of the concrete.

WHY is Water Added to Concrete?

Water is added to concrete at the jobsite or in the mixer during delivery using automated systems to increase its slump. When concrete arrives at the jobsite at a slump that is lower than that allowed by design or specification and/or is of such consistency so as to adversely affect the placeability of the concrete, water can be added to the concrete to bring the slump up to an acceptable or specified level. This can be done when the truck arrives on the jobsite provided the specified slump and/or water-cementitious materials ratio (w/cm) is not exceeded. Addition of water within these limitations is permitted by ASTM C94C94M, *Specification for Ready Mixed Concrete*.

The ready mixed concrete supplier establishes the proportions of materials for concrete mixtures according to industry standards to provide the intended performance. Addition of water in excess of the design mixing water will delay setting time, reduce strength, adversely impact durability, and increase the potential for cracking. If the purchaser requests additional water, in excess of the design mixing water or to increase slump greater than maximum permitted, the purchaser assumes responsibility for the resulting concrete quality. A water reducing admixture or superplasticizer can be used to increase concrete slump at the jobsite. Increasing the slump of concrete using admixtures usually will not alter concrete properties provided an excess amount is not used and the mixture does not segregate. Jobsite adjustment with admixtures is not a trivial process. This option should be decided at a pre-pour conference as qualified personnel may need to be available at the jobsite. Adding



Effect of water addition on slump and strength

admixture to achieve slump at the plant ensures better control. There is no prohibition to add water at the jobsite to concrete containing water reducing admixture or superplasticizer added at the plant.

HOW to Add Water at the Jobsite?

- The maximum allowable slump of the concrete must be specified or determined from the specified nominal slump plus tolerance.
- Prior to discharging concrete on the job, the actual slump of the concrete must be estimated or measured. If slump is measured, it should be on a preliminary sample obtained after discharging the first $\frac{1}{4}$ cu. yd. [0.2 m³]. The measured slump on this sample should be used as an indicator of concrete consistency and not an acceptance test. Tests for acceptance of concrete should be on samples obtained in accordance with ASTM C172.
- At the jobsite, water should be added before any significant quantity of concrete has been discharged from the batch so that the volume of concrete being retempered is known. Water addition can be in several increments accompanied by mixing to evaluate change in slump.

A rule of thumb that works reasonably well is— 1 gallon, or roughly 10 lb., of water per yd³ for 1 inch increase in slump [5 liters, or 5 kg, of water

- per m³ for 25 mm increase in slump].
- d. All water added to concrete on the jobsite must be measured and recorded on the delivery ticket. A designated representative of the purchaser should sign or initial the delivery ticket to acknowledge the quantity added.
 - e. ASTM C94/C94M requires an additional 30 revolutions of the mixer at mixing speed after the addition of all water or admixtures at the jobsite.
 - f. The amount of water added should be controlled so as to not exceed the maximum slump and/or water-cementitious materials ratio, as indicated in the specification. After some concrete is discharged, no water addition is permitted.
 - g. Upon obtaining the desired slump and/or maximum water-cementitious materials ratio, no further addition of water on the jobsite is permitted.
 - h. A pre-placement conference should be held to establish proper procedures to be followed, to determine who is authorized to request a water addition, and to define the method to be used for documentation of water added at the jobsite.

To ensure that the design mixing water or specified w/cm is not exceeded, it is good practice for the concrete supplier to indicate on the delivery ticket the amount of *trim* water held back when concrete was batched. This sets the limit of the jobsite water addition.

When project specifications prohibit the jobsite addition of water, the concrete supplier should be notified so that the design mixing water can be added at the plant and provisions made to adjust the slump of concrete at the jobsite, if necessary, with the use of admixtures.

Some truck mixers are equipped with automated devices that monitor slump of concrete and add water and/or admixture to maintain a target slump. This occurs while the concrete is being transported and at the jobsite. The device should be able to record the amount of water added and to terminate the addition based on set limits. ASTM C94/C94M recognizes the use of these systems.

References

1. ASTM C94, *Specification for Ready Mixed Concrete*, ASTM International, West Conshohocken, PA.
 2. NRMCA Publication 186, *Ready Mixed Concrete*, Richard D. Gaynor and Colin Lobo, NRMCA, Alexandria, VA.
 3. *Checklist for Pre-Construction Conference*, Joint publication of ASCC and NRMCA, NRMCA, Alexandria, VA
 4. NRMCA Publication 188, *Truck Mixer Driver's Manual*, NRMCA, Alexandria, VA.
 5. *Adding Water to the Mix: It's Not all Bad*, Eugene O. Goeb, *Concrete Products*, January 1994.
 6. *Adjusting Slump in the Field*, Bruce A. Suprenant, *Concrete Construction*, January 1994.
 7. *Slump Retention of Fly Ash Concrete With and Without Chemical Admixtures*, Dan Ravina, *ACI Concrete International*, April 1995.
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ASTM C94 Jobsite Water Addition

1. Establish the maximum allowable slump and mixing water content permitted for the load.
2. Measure the concrete slump from a preliminary sample discharged from the truck.
3. Add an amount of water to achieve the required slump within limits established. Water reducing admixtures can be used to increase slump.
4. Measure and record the amount of water and admixture added. Water in excess of that permitted should be authorized by a representative of the purchaser and signed off on the delivery ticket.
5. Mix the concrete for 30 revolutions of the mixer drum at mixing speed.
6. Do not add water if:
 - a. the maximum water-cementitious materials ratio is reached,
 - b. the maximum slump is obtained, or
 - c. more than about ¼ cu. yd. (0.2 m³) has been discharged from the mixer.

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