

The Effect of Curling on Floor Flatness

ASCC Position Statement #35

ACI 117-06 and ACI 117-10 “Specification for Tolerances for Concrete Construction and Materials” require F-numbers to be measured within 72 hours after slab concrete placement. This was not always the case. ACI 117-90 included no time requirement for the measurement of floor flatness, F_F , and the commentary stated the reason:

“Since neither deflection nor curling will significantly change a floor’s F_F value, there is no time limit on the measurement of this characteristic.”

The statement in the commentary indicating that curling will not significantly change a floor’s F_F value has since been shown to be incorrect by measurements published in “The Concrete Floor Tolerance/Floor Covering Conundrum,” *Concrete International*, July 2003. This is why ACI 117-06 and ACI 117-10 now require that F_F measurements be made within 72 hours.

In addition to the measured field data, it’s possible to calculate the effect of curling on floor flatness as shown in “Chapter 8, Floor Flatness and Levelness” of **Tolerances for Cast-in-Place Concrete Buildings** published by the American Society of Concrete Contractors in 2009. The calculation method was also included in “The Effect of Curling on Floor Flatness,” *Concrete Contractor*, April/May 2010. This is important because ACI 302.1R-04 “Guide for Concrete Floor and Slab Construction” states:

“Application of present technology permits only a reduction in cracking and curling, not elimination. Even with the best floor designs and proper construction, it is unrealistic to expect crack-free and curl-free floors. Consequently, every owner should be advised by both the designer and contractor that it is normal to expect some amount of cracking and curling on every project, and that such occurrence does not necessarily reflect adversely on either the adequacy of the floor’s design or the quality of its construction.”

Design professionals should consider how curling is to be dealt with on each project so that the specifications address this issue. Curling occurs because of differential moisture loss that is a time-dependent process,

thus the initial floor flatness produced by the concrete contractor will decrease with time. The table below shows how an initial F_F of 51 can decrease to 45, then 35 and finally to 22 as curling occurs and slab edges raise from 1/16, to 1/8 and 1/4 in.

To deal with changes in floor flatness with time, design professionals can use an allowance for floor grinding and leveling as described in “Division 3 versus Division 9 Floor Flatness Tolerances,” ASCC Position Statement #6, *Concrete International*, June 2003. An additional resource is “Responsibility for Controlling Slab Curling”, ASCC Position Statement #30, *Concrete International*, January 2010.

ASCC concrete contractors will meet the F_F specification requirements when measured within 72 hours. The effects of a decrease in floor flatness with time must be addressed by the design professional with respect to the work of follow-up trades. If you have any questions, contact your ASCC concrete contractor or the ASCC Technical Hotline at (800) 331-0668.

Calculated Effect of Curling on Floor Flatness

Amount of Curl	F_F Number		
Initial F_F --No Curl	51	40	25
1/16 in.	45	40	25
1/8 in.	35	35	23
1/4 in.	22	23	18
Percent Decrease from Initial			
1/16 in.	12%	0%	0%
1/8 in.	31%	13%	8%
1/4 in.	57%	43%	28%



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