

The Effect of Deflection on Floor Flatness

ASCC Position Statement #36

ACI 117-06 and ACI 117-10, “Specifications 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, as ACI 117-90 provided 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 that deflection will not significantly change a floor’s F_F value has since been shown to be incorrect. This is why ACI 117-06 and ACI 117-10 require that F_F measurements be made within 72 hours after completion of slab concrete finishing operations and before removal of any supporting shores. ACI requires the measurements to exclude the effect of deflection on the floor flatness.

ACI 435R-95, “Control of Deflection in Concrete Structures,” states that deflection “can only be estimated in the range of 20-40 percent accuracy.” ACI 318-08 indicates that shrinkage and creep cause additional long-term deflection of 1.0 to 1.4 times the initial deflection for times between 3 to 12 months. Thus, when interior finishes are applied at this age, the total floor deflection might be 2 to 2.4 times the initial deflection. ACI 318-08 also requires that “drawing, details, and specifications shall show: provision for dimensional changes resulting from creep, shrinkage, and temperature.”

It’s possible to calculate the effect of deflection 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.

Design professionals should consider how deflection effects will be dealt with on each project so that the specifications address this issue. Initial dead load deflection occurs, increases with deflection due to construction loads, and then increases more with the

time-dependent creep deflection. Thus, the initial floor flatness number provided by the concrete contractor will decrease with time. The table below shows how an initial F_F of 51 can decrease to 39, then 25 and finally to 20 for a midspan deflection of 3/8, to 3/4 and 1 in. for a 30 ft span.

Calculated Effect of Deflection on Floor Flatness

| Deflection span ratio | Deflection for 30 ft span | F_F Number | | | |
|--------------------------------------|---------------------------|--------------|-----|-----|-----|
| | | 51 | 40 | 30 | 25 |
| Initial F_F -- no deflection | | 51 | 40 | 30 | 25 |
| L / 960 | 3/8 in. | 39 | 34 | 28 | 24 |
| L / 480 | 3/4 in. | 25 | 23 | 21 | 19 |
| L / 360 | 1 in. | 20 | 19 | 19 | 16 |
| Percent decrease from initial | | | | | |
| L / 960 | 3/8 in. | 24% | 15% | 7% | 4% |
| L / 480 | 3/4 in. | 51% | 43% | 30% | 24% |
| L / 360 | 1 in. | 61% | 53% | 37% | 36% |

ASCC concrete contractors will meet the F_F specification requirements when measured within 72 hours and before the removal of supporting shores. The effects of a decrease in floor flatness with time due to deflection 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.



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