

Acceptable Concrete Cracking

Q. *What is considered as acceptable concrete cracking in cast-in-place foundation walls and slabs per ACI documents? My company is the concrete contractor on a large warehouse project, and I want to discuss the potential for cracking with the contractor and the owner.*

A. Concrete cracks are possible on any project, so it's wise to set reasonable expectations for yours. Foundation walls are normally designed as reinforced concrete. Reasonable crack widths for reinforced concrete under service loads are listed in Table 4.1 of ACI 224R-01¹ (refer to Table 1). However, a footnote warns that, with time, "a significant portion" of the cracks in a structure can exceed these values. Commentary Provision R24.3.1 of ACI 318-14² discusses flexural reinforcement for one-way slabs and beams. That provision indicates that visible cracks will develop under service loads, and crack widths are usually widely scattered and influenced by "shrinkage and other time-dependent effects." The associated Code provision provides reinforcement detailing requirements for controlling crack widths (that provision applies to the design team, so you should consider including at least one more party in your discussions).

In general, when it comes to slabs, both ACI 302.1R-15³ and ACI 360R-10⁴ state in their prefaces that it's unrealistic to expect crack-free and curl-free floors regardless of the best design and construction practices. Also, those documents state that the designer and contractor need to advise every owner that "it is completely normal to expect some amount of cracking and curling on every project." ASCC Position Statement #33⁵ provides similar guidance, stating that:

"ASCC concrete contractors will meet with the design team, construction manager, and general contractor to discuss crack expectations for the project. Concrete contractors want to ensure awareness by all parties that cracking will occur when the structure is built in accordance with the Contract Documents."

For more information on educating your clients and minimizing legal issues related to cracking, refer to Coleman's article, "Cracking...Defect or Normal?"⁶

References

1. ACI Committee 224, "Control of Cracking in Concrete Structures (ACI 224R-01 (Reapproved 2008))," American Concrete Institute, Farmington Hills, MI, 2001, 45 pp.
2. ACI Committee 318, "Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)," American Concrete Institute, Farmington Hills, MI, 2014, 519 pp.
3. ACI Committee 302, "Guide to Concrete Floor and Slab Construction (ACI 302.1R-15)," American Concrete Institute, Farmington Hills, MI, 2015, 76 pp.
4. ACI Committee 360, "Guide to Design of Slabs-on-Ground (ACI 360R-10)," American Concrete Institute, Farmington Hills, MI, 2010, 72 pp.
5. "ASCC Position Statement #33: Cracks in Structural Concrete," *Concrete International*, V. 32, No. 10, Oct. 2010, pp. 72.
6. Coleman, J.W., "Cracking...Defect or Normal?," *Concrete International*, V. 35, No. 9, Sep. 2013, pp. 35-38.

Table 1:
Guide to reasonable crack widths for reinforced concrete under service loads* (Table 4.1 in ACI 224R-01¹)

Exposure conditions	Crack width	
	in.	mm
Dry air or protective membrane	0.016	0.41
Humidity, moist air, soil	0.012	0.30
Deicing chemicals	0.007	0.18
Seawater and seawater spray, wetting and drying	0.006	0.15
Water-retaining structures†	0.004	0.10

*It should be expected that a portion of the cracks in the structure will exceed these values. With time, a significant portion can exceed these values. These are general guidelines for design to be used in conjunction with sound engineering judgement.

†Excluding nonpressure pipes.

Questions in this column were asked by users of ACI documents and have been answered by ACI staff or by a member or members of ACI technical committees. The answers do not represent the official position of an ACI committee. Comments should be sent to rex.donahey@concrete.org.