

## What surface defects require repair?

Concrete specifications often require contractors to repair surface defects immediately after removing formwork. However, surface defects aren't well defined. Nor do specifications give limits on the size or extent of a defect.

For instance, section 5.3.7.3 of ACI 301-99, "Specifications for Structural Concrete," instructs the contractor to outline honeycombed or otherwise defective concrete with a 1/2- to 3/4-inch-deep sawcut and remove such concrete down to sound concrete. We know that honeycomb refers to voids left in concrete when mortar doesn't effectively fill spaces between coarse-aggregate particles. But ACI 301 doesn't indicate the size and number of such voids that will trigger required repairs nor does it define "otherwise defective concrete."

Concrete Construction asked concrete contractor Ron Simonetti, Cleveland Cement Contractors Inc., Cleveland, and engineer and specifier Douglas Sordyl, P.E., ARCADIS Giffels, Southfield, Mich., for their views on repairing surface defects.

**CC:** How big, in terms of void diameter and depth and area covered, should honeycomb have to be before repairs are required? And what other concrete defects should require repairs?

**Sordyl:** Although most surface defects are not structural in nature, a honeycombed concrete surface can affect structural performance, depending on the extent and location of the defect and the environment in which the concrete element will function.

Repairs are essential if the defect affects the required concrete section or reinforcing cover or if permeability is a design consideration. —Douglas Sordyl

Repairs are essential if the defect affects the required concrete section or reinforcing cover or if permeability is a design consideration. But in most cases, honeycomb is just another, sometimes more obvious, aesthetic surface defect.

Lightly honeycombed surfaces that do not affect the structural integrity of a concrete element and that are hidden in the final construction need not be repaired. Deep honeycomb, aside from being unsightly, affects the concrete section and reduces concrete cover and should be repaired. Surface honeycomb on concrete that is intended to retain or exclude fluids or where reduced permeability is a concern also should be repaired. These conditions are relatively easy to define, communicate, and measure.

Harder to answer is the question of acceptable void diameter and area covered on



exposed construction where aesthetics is an issue. Here is where "beauty is in the eye of the beholder." Not only is an acceptable finish more difficult to define, some

architect/engineers and owners may have unrealistic expectations for the final product. Thus the dilemma, since ACI doesn't establish firm numbers for void size

and extent.

**Simonetti:** As contractors, we certainly have opinions on what, and how, honeycomb should be repaired. Unfortunately, today's specifications are based on opinions, which is precisely the problem. Often such opinions aren't formulated until the finished surface is ready to view. A similar case existed with the 1/8-inch-in-10-foot floor flatness tolerance, which was a longstanding source of jobsite disputes. This problem was solved with application of an easily specified and measured standard. Why can't this be done with the definitions of defects?

**CC:** What steps can be taken during the prebid and preconstruction phases of a project to avoid disputes over what constitutes a defect?

**Sordyl:** Disagreements about what will be acceptable can be prevented or mitigated. While we don't specify specific dimensions or percent of surface, we have been relatively successful in avoiding significant disagreements on concrete finishes. Some suggestions to establish the level of quality (i.e., the level of architect/engineer expectation and acceptability) include:

■ The A/E must address his (and the owner's) expectations in the bid documents by stating in the contract document the quality of finish required for various concrete elements. (Sec-

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tion 5.3.3 of ACI 301 provides the types of finishes, but the A/E must define where they apply.)

■ If the quality of expected finish is very high, a rubbed finish should be specified. By specifying this type of finish, the A/E (and owner) acknowledge upfront the additional cost and work required to produce the finish.

■ ACI does have some standards (measurables) for aesthetic conditions. But where measurables are not available, examples depicting expectations can be provided. Project specifications can require a mock-up for approval before construction. In critical cases, mock-ups could be required before award of contract.

■ When contractors are concerned that finishes may become an issue on a project, they can reference in their bid completed projects as examples of their intended results. Similarly, owners can cite existing projects as examples of their expectations.

In many cases of dispute, the owner's expectations are unrealistic or beyond what the industry normally provides. Many owners have an expectation of zero tolerance. The A/E

can help himself and the contractor by ensuring that the owner understands what he is buying. By educating the owner that concrete is not defect-free and arranging visits to projects to establish a reasonable expectation in the mind of the owner, A/Es and contractors can avoid this too-common problem. This applies not only to honeycomb, but also to other common surface defects.

**Simonetti:** Preconstruction conferences and test panels serve a very useful purpose in clarifying jobsite expectations. At this point, the contractor may find these expectations much higher than his costing anticipated. Fairness dictates that clarification must occur at the prebid phase. In the absence of a prebid conference, the specifications must be clear or sample panels must be available for reference. The American Society of Concrete Contractors' Guide to Surface Finish of Formed Concrete includes photographs of various interpretations of a smooth-form finish. Use of such photographs would easily convey intent and serve as a benchmark for checking compliance. ■

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