

Specifying Architectural Concrete

Q. *I'm working on a project that includes architectural formed concrete elements. What requirements should be included in contract documents? Are full-scale field mockups required? How can I define an acceptable amount of bugholes to be allowed on the formed surfaces?*

A. Section 6 of ACI 301-20¹ provides information that is required to define the scope and finishes for architectural concrete. The Mandatory Requirements Checklist instructs the specifier to include the following items in contract documents:

- Designating the portions of the project to be constructed as architectural concrete and specifying requirements for each designated area (Section 6.1.1);
- Specifying the cone diameter for form ties (Section 6.2.1.8(a)); and
- Specifying which of the finishes listed in Section 6.3.9 (textured, exposed aggregate, abrasive blast, mechanical tooling, or as-cast formed finish) or other finishes that are required.

Additional requirements can be found in the Optional Requirements Checklist.

Per Section 6.1.3.2(a), field mockups must be provided for all concrete elements designated as architectural concrete. They will be used to establish acceptance criteria for the project.

The mockups should include repaired area(s) to define acceptable color and texture matches if any repairs are needed. Section 3.5.4 of ACI 303R-12² suggests that the repair should be aged at least 1 month to provide a true indication of its color in service. After mockup(s) have been constructed, the owner's inspection agency should review the specifications and meet with the architect/engineer and contractor to avoid ambiguities and confirm evaluation criteria for the final product against the mockup(s) (Section 3.5.6.1 of ACI 303R-12).

Details regarding constructing mockups and acceptance of architectural concrete based on mockups are discussed in Section 6.1.4.4 of ACI 301-20. Completed portions of architectural concrete will be checked by the architect/engineer for conformance with accepted field mockups (Section 6.1.4.5(a)). Unacceptable concrete surfaces will have to be repaired or replaced (Section 6.1.4.5(b)). Per Section 6.3.12, the final acceptance of architectural concrete (with

surface repairs and patching of tie holes) is based on matching it with approved field mockups viewed in daylight at 20 ft (6 m).

To help describe mockups in contract documents, ACI 347.3R-13³ provides information about different categories of formed concrete surfaces and pertaining requirements, as well as visible effects on as-cast formed surfaces (refer to Tables 3.1a and 3.1b, respectively). The information on concrete surface void ratios on formed surfaces (bugholes) and suggested concrete placement practices to achieve the desired appearance can be found in Table 3.1d. Even though ACI 347.3R is not a specification, items within this document can be rephrased in mandatory language and incorporated into the contract documents.

As stated in ASCC Position Statement #8: "Because bugholes are a natural feature of all as-cast vertical concrete structural components, it is unrealistic to expect that surfaces will be free of bugholes."⁴ However, if bugholes are not acceptable in architectural formed concrete, ASCC concrete contractors recommend specifying a rubbed finish.⁴ Details of the rubbed finish are discussed in Section 5.3.3.3 of ACI 301-20.

References

1. ACI Committee 301, "Specifications for Concrete Construction (ACI 301-20)," American Concrete Institute, Farmington Hills, MI, 2020, 69 pp.
2. ACI Committee 303, "Guide to Cast-in-Place Architectural Concrete Practice (ACI 303R-12)," American Concrete Institute, Farmington Hills, MI, 2012, 32 pp.
3. ACI Committee 347, "Guide to Formed Concrete Surfaces (ACI 347.3R-13)," American Concrete Institute, Farmington Hills, MI, 2013, 17 pp.
4. "ASCC Position Statement #8: Bugholes in Formed Concrete," American Society of Concrete Contractors, St. Louis, MO, Aug. 2011, 1 pp.

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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 keith.tosolt@concrete.org.