17.5.2 Standards for Concrete Masonry Units

ASTM C90, Standard Specification for Load-Bearing Concrete Masonry Units. Hollow and solid loadbearing concrete blocks are covered in this standard. Weight classifications are divided into Light Weight (less than 105 lb/cu ft oven dry weight of concrete), Medium Weight (105 to less than 125 lb/cu ft), and Normal Weight (125 lb/cu ft or more). Unit weight affects water absorption, sound absorption, sound transmission, and thermal and fire resistance. There are no default requirements in ASTM C90, so the specifier must designate unit type and weight classification if these properties are important to the design.

The minimum *net area* compressive strength required for all three weight classifications for ASTM C90 loadbearing units is 1900 psi. Compressive strength is largely a function of the characteristics of the aggregate used in the units, and may vary regionally according to the types of aggregates available. Aggregates in some areas may routinely produce units with much higher compressive strengths without a cost premium. If a specific unit strength requirement greater than the standard minimum is required, that compressive strength should be required by the project specifications.

Compliance with the requirements of ASTM C90 is verified by testing in accordance with ASTM C140, *Standard Method of Sampling and Testing Concrete Masonry Units.* C140 is referenced in the C90 standard and need not be listed separately in the project specification. ASTM C90 also references ASTM C33, *Standard Specification for Aggregates for Concrete,* and ASTM C331, *Lightweight Aggregates for Concrete Masonry Units,* as well as standards for the cementitious materials that are permitted in these units. It is not necessary for the specifier to list these referenced standards separately.

Size tolerances and limits on chippage and cracking are covered in the text of the standard. These requirements are more liberal than those for clay brick because of the nature of the material and the method of manufacture. For exposed architectural units such as split-face, ribbed, or ground-face units, these requirements may not be appropriate. Rough units may require greater tolerances and ground face units tighter tolerances. For such products, it may be more appropriate to consult local manufacturers for tolerance requirements. Color is not covered in this standard, so the specifier must designate the desired color by specifying a proprietary product, with color and color range verified with a sample panel or mock-up panel.

ASTM C129, Standard Specification for Non-Load-Bearing Concrete Masonry Units. The requirements of this standard are similar to those of C90 except that the units are designed for non-loadbearing applications. Unit weight classifications are the same, as well as referenced standards for aggregates, cements, sampling, and testing. Since the units are designated as non-loadbearing, the minimum requirements for net area compressive strength are lower than for ASTM C90 units at an average of only 600 psi. For typical non-loadbearing applications, this strength is more than adequate, but stronger units may be commonly available without a cost premium in some areas. Color requirements are not covered in the specification, and should be specified in the same way as that recommended for ASTM C90 units.

ASTM C55, Standard Specification for Concrete Building Brick. Concrete brick can be loadbearing or non-loadbearing. Grading is based on strength and resistance to weathering. Grade N provides "high strength and

resistance" to moisture penetration and severe frost action. Grade S has only "moderate strength and resistance" to frost action and moisture penetration. Minimum gross area compressive strength for Grade N units is 3500 psi and for Grade S units, 2500 psi. ASTM C55 does not include requirements for color, texture, weight classification, or other special features. These properties must be covered separately in the project specifications. Sampling and testing are referenced to ASTM C140, and standards for aggregates and cements are also referenced, so the specifier need not list these separately.

17.5.3 Standards for Masonry Mortar and Grout

ASTM C270, Standard Specification for Mortar for Unit Masonry. This standard covers four types of masonry mortar made from a variety of cementitious materials, including portland cement (ASTM C150), mortar cement (ASTM C1329), and masonry cement (ASTM C91), as well as blended hydraulic cement and slag cement (ASTM C595), quicklime (ASTM C5), and hydrated masonry lime (ASTM C207). These material standards are referenced in ASTM C270, so the specifier need not list them separately. If any materials are to be excluded for any reason, this should be noted in the project specifications. Requirements for mortar aggregates are referenced to ASTM C144.

Types M, S, N, and O mortar may be specified to meet either the proportion requirements or the property requirements of ASTM C270. If the project specifications do not designate which method the contractor must use, then the proportion method governs by default. The proportion method is the most conservative, and will usually produce mortars with higher compressive strengths than those required by the property method. It is generally not desirable to use mortar that is stronger in compression than the application requires. To optimize mix design, property-specified mortar requires preconstruction laboratory testing in accordance with the test methods included in ASTM C270. These test methods are not suitable for testing of field-sampled mortar during construction, and cannot be compared to the results of such tests. If field testing of mortar will be required, then *both* preconstruction and construction phase testing should be performed in accordance with ASTM C780 rather than ASTM C270. There is no test method for accurately measuring the compressive strength of hardened mortar removed from a completed masonry wall or structure.

Recommendations for appropriate use of the four basic mortar types are included in a non-mandatory Appendix X1 to ASTM C270 and are summarized in Chapter 6.

ASTM C476, Standard Specification for Grout for Masonry. This standard covers two types of masonry grout—fine and coarse. The same standards for cementitious materials are referenced as those in ASTM C270, but aggregates must conform to ASTM C404. Fine grout is used for small grout spaces and coarse grout for economy in larger grout spaces (see Chapter 6). Masonry grout may be specified to meet the proportion requirements included in the standard, or it may be required to have a minimum compressive strength of 2000 psi when sampled and tested in accordance with ASTM 1019. If higher compressive strength is required for structural masonry, the required strength should be indicated in the contract documents.

ASTM C476 permits the use of "pumping aid" admixtures in cases where the brand, quality, and quantity are approved in writing. Such admix-