6.4.1 Refractory Mortars

Refractory mortars may range from residential fireplace installations to extremely high-heat industrial boiler incinerators or steel pouring pits. Refractory mortars are made primarily from fire clay, with calcium aluminate or sodium silicate as a binder. Mortar joints for refractory mortars should not exceed ¼ in. The fire bricks are often dipped to get a thin mortar coating, with no conventional mortar bed laid. Exposure to heat in the firebox, smoke chamber, and flue ceramically fuses the mortar and seals the joints against heat penetration. For residential and commercial fireplaces, use a medium-duty mortar as determined by ASTM C199, *Pier Test for Refractory Mortar*. Manufacturers or suppliers should be consulted regarding design details and performance characteristics for special applications.

6.4.2 Chemical-Resistant Mortars

The field of chemical-resistant mortars is highly specialized and complex in nature. Durability depends very heavily on proper mortar selection. Even with the use of chemical-resistant brick or structural clay tile, mortar may still be attacked by acids or alkalis, causing joint disintegration and loosening of the masonry units. There are few chemicals which do not attack regular portland cement mortars. Consequently, it is necessary to develop chemical resistance by means of admixtures or surface treatments. Special cements or coatings are available which will withstand almost all service conditions, but different types react differently with various chemicals. The success of any particular treatment depends on local conditions, type and concentration of the chemical solution, temperatures, wear, vibration, type of subsurface, and workmanship. Joints should be as narrow as possible to minimize the exposed area and reduce the quantity of special material required. The selection of the optimum material for a particular installation must include the consideration of mechanical and physical properties as well as chemical-resistant characteristics.

Several special types are available, including sulfur mortars, silicate mortars, phenolic resin mortars, and furan, polyester, and epoxy resin mortars. The properties and capabilities may be altered by changing the formulations. For specific installations, full use should be made of available standards and test procedures, and the engineering advice, services, and recommendations of manufacturing specialists in this field should be solicited.

6.5 GROUT

Grout is a fluid mixture of cementitious material and aggregate with enough water added to allow the mix to be poured or pumped into masonry cores and cavities without segregation (*see Fig. 6-11*). ASTM C476, *Standard Specification for Grout for Masonry,* covers both fine and coarse mixtures based on aggregate size and grading.

Selecting a fine or coarse grout is based on the size of the core or cavity as well as the height of the lift to be grouted. (Some building codes and standards have different requirements for the relationship of maximum aggregate size to clear opening, so for specific projects the governing code should always be checked.) In accordance with ASTM C404, *Standard Specification for Aggregates for Masonry Grout,* if the maximum aggregate size is ⅜ in. or larger, the grout is classified as *coarse*. If the maximum aggregate size is less than ⅜ in., it is classified as *fine*. The smaller the grout space, the smaller the maxi-

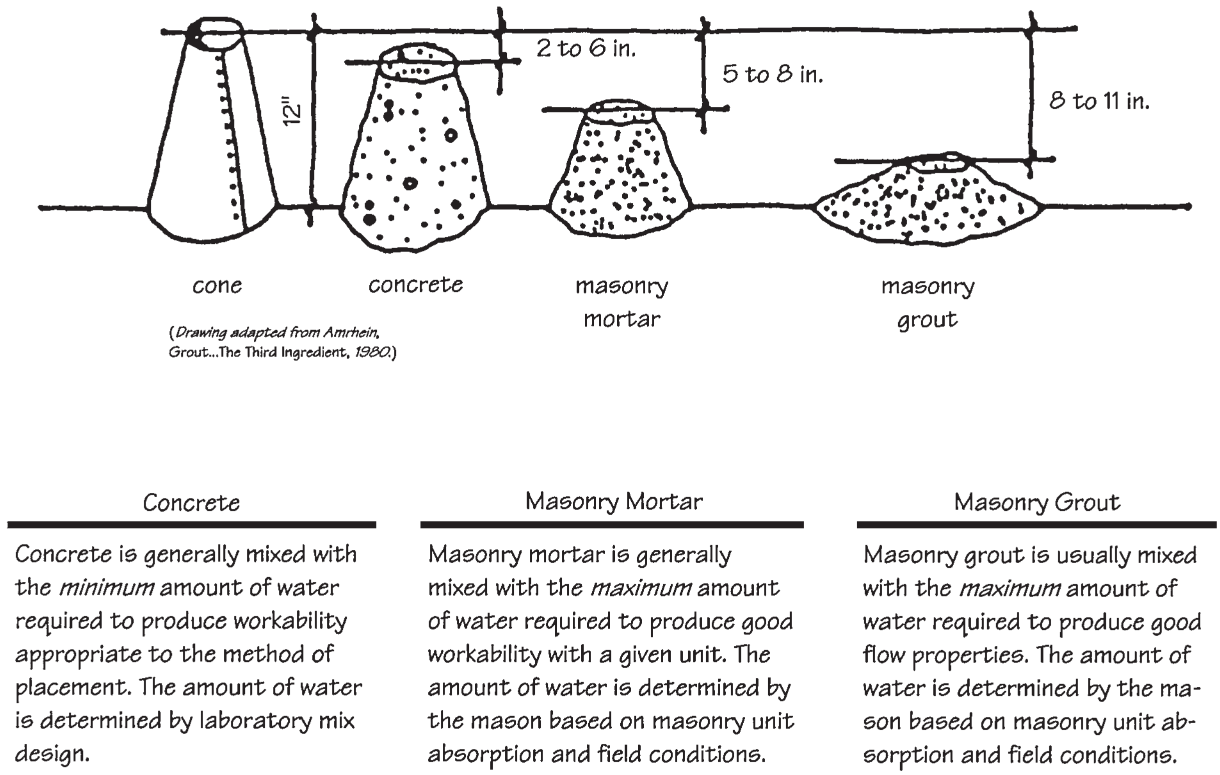

Figure 6-11 Relative consistency of concrete, mortar, and grout as measured by slump test.

mum aggregate size allowed. Although ASTM C404 limits the maximum aggregate size to ⅜ in., some engineers allow up to ¾-in. aggregate for grouting large voids such as columns and pilasters. The larger aggregate takes up more volume, reduces grout shrinkage, and requires less cement for equivalent strength. The table in *Fig. 6-12* shows the recommended grout type for various grout spaces from the Masonry Standards Joint Committee (MSJC) *Specifications for Masonry Structures.*

Grout is an essential element of reinforced masonry construction. It must bond the masonry units and the steel together so that they perform integrally in resisting superimposed loads. In unreinforced loadbearing construction, unit cores are sometimes grouted to give added strength, and in non-loadbearing construction, to increase fire resistance. The fluid consistency of grout is important in determining compressive strength, in assuring that the mix will pour or pump easily and without segregation, and in assuring it will flow around reinforcing bars and into corners and recesses without voids. ASTM C476 specifies grout by volume proportions or by minimum strength. Optimum water content, consistency, and slump will depend on the absorption rate of the units as well as job-site temperature and humidity conditions. Performance records indicate that a minimum slump of 8 in. is necessary for units with low absorption, and as much as 10 in. for units with high absorption.

ASTM C476 permits specifying grout either by mix proportions (*see Fig. 6-13*) or by compressive strength. When the compressive strength method is