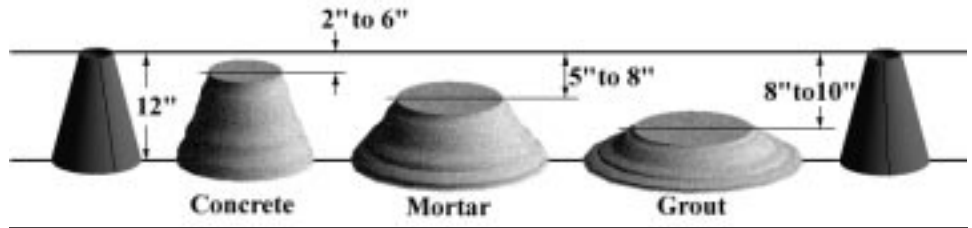


Grout is a material used in reinforced masonry that is quite misunderstood. Grout is not mortar and grout is not concrete. It is somewhere in between. For a rapid visual concept of what grout is, let's call it "soupy concrete". Soupy concrete may give the proper connotation and understanding because it is made up of a cement/water combination which is the paste that binds together the aggregate, which may be sand only or sand and gravel. These are the same ingredients that make up concrete: cement, water, sand and gravel. This is even similar to mortar, which is cement, water, sand and instead of gravel, lime. All these materials harden into a stonelike mass. The big difference between concrete, mortar and grout is in their plasticity or fluidity in the initial stage. Mortar is relatively stiff, and if a slump test were made it would have a slump of five to eight inches. Concrete is also relatively stiff with a slump varying from two inches to six inches maximum. The slump of concrete is a controlled requirement for it reflects directly to the water/cement ratio of the concrete mix. This is one major point of variance between concrete and grout. Concrete, with a tightly controlled water/cement ratio, has a relatively low slump, relatively slight plasticity and very low fluidity. This is because all the water in the concrete will stay within the concrete when it is placed in water-tight forms. All the water in the concrete mix is part of the calculation of the water/cement ratio. Also, in concrete, the forms are spread relatively far apart, and the size of member is relatively large compared to the aggregate material, which allows for easy placement. Mortar is plastic material with a low water/cement ratio and high in cement content. Mortar must be relatively stiff in order to be handled on a trowel, to be spread on the masonry unit and to evenly support the masonry units placed on it. This stiffness is required for the masonry wall to be built above without the mortar squashing or squeezing out and deforming. Although mortar has a low water/cement ratio, this ratio is further decreased after the mortar is spread on the bed and the masonry units are placed on it. Any excess water in the



Slump tests of concrete, mortar and grout

mortar is absorbed both down into the masonry unit on which the mortar is spread and up into the masonry unit that is placed on the mortar bed. This absorption helps create bond between the mortar and the masonry unit. Grout, although having the same ingredients of concrete, has a fluidity or a plasticity far greater than normal concrete as mentioned above. Grout is placed in the cells of hollow masonry units and in relatively narrow grout spaces in brick walls in heights of anywhere from just a few inches to as high as 25 feet, as in the case of high lift grouting. Accordingly, grout must be fluid, it must completely fill the cells, the grout space and the joints between masonry units in order to provide a solid, homogeneous grouted masonry wall.

If the grout is stiff, it will not flow into the cells or grout space, but will hang up and leave voids within the wall. Grout must have fluidity with a slump of eight to ten inches. This fluidity allows the grout to flow through the grout space, around the reinforcing bars and completely surround and bond to the steel and masonry unit. Now what about the water/cement ratio? This is taken into account in the design of the grout mix. The excess water, which is a placement vehicle for the grout and helps it flow through out the wall, is absorbed by the masonry units, whether brick or block, and thus the final water/cement ratio of the grout is reduced to a point where the strength of the hardened grout is in accordance with the specification or code requirements.

