From the Editor's Desk

Grouting in concrete and masonry structures is one of the most critical applications in the construction chemical division that any engineer may face. The required hardened properties of the grout materials depend on fluid properties, set properties at the wet stage of the material and mechanical properties of the grout mix at the hardened stage. While placing the grout material into a void or a crack or inside any cavity depends upon the flowabilty of the material and required pressure that may fill every nook and corner of the space. Without knowing the internal grouting space such as the position and space distribution inside the structure; grouting is often made with some assumptions or with the practical experiences of the skilled applicator. In some cases, grouting may fail if all the void spaces are not filled in.

There are mainly three different types of grouts: cementitious-based structural grouts, epoxy resin-based grouts and polyurethane-based grouts, apart from many specially formulated chemical grouts for specific applications for concrete and masonry structures. The success of cementitious grouts depends upon the selection of the grout mix, admixture such as expanding agents, accelerators, retarders, thixotropic agents, air entertainers and plasticizers as well as hole spacing, mixing and placing of the grout. When the filler is added to the grout, high speed mixing using a shearing action is necessary to ensure thorough distribution and wetting of cementitious particles throughout the mix. A grout having colloidal characteristics is thus formed, and the segregation of the sand is prevented which helps to reduce the bleeding of the mix. When using a two component epoxy or polyurethane based grouts, a thorough mixing of both resin and hardener compounds is required. While mixing such type of grouts, care should be taken to take as much quantity that can be used within its pot life, or else it will thicken very quickly.

Pressure grouting is used in new construction as well as in the repair and rehabilitation of all types of existing structures. In structural work, there are various types of grouting for which each contractor or applicator does specific work because of the complex nature of each job. In new construction, grouting is part of virtually all post-tensioned concrete work, wherein the spaces remaining in the tendon ducts after tensioning are filled with a cementitious grout. Grouting of tall vertical prestressed ducts prevents corrosion of prestressing tendons and provides an efficient bond between the tendons and concrete members. Construction joints of all new massive concrete structures are frequently filled with a cementitious grout once the initial major shrinkage has occurred. Void spaces under and around precast elements are also filled with cementitious grouts in order to attain monolithic construction. The bearing spaces below base plates of all types and sizes are supported by injected grout. The bases of wide variety of tanks, machinery and mechanical equipment are injected with cementitious injection grouts or free flow grouts. Resinous grouts such as epoxy are injected into narrow joints to bond different elements of concrete to arrest fine cracks inside the concrete. Both cementious and resinous grouts are widely used in the repair and rehabilitation of concrete and masonry structures. New reinforcement bars are sometimes placed in holes drilled into masonry/ concrete to grout with polyster resin injection to provide additional tensile capacity to the section and similarly to concrete structures as anchor bars. Epoxy injection into cracks represents one of the largest areas of structural grouting. Masonry and RCC structures that are damaged due to earthquakes also need epoxy injections with some flexibility. The control of water leakage into structures and form within water-retaining structures is possible by injection with polyurethane grouts. In new construction of water retaining structures, waterbar is preplaced at all joints prior to concrete placement. Once the concrete is cured the section is injected with chemical solution grout. The most commonly used are based on urethane resin, which can be formulated into a solid, flexible gel or either rigid or flexible foam. Several urethanes are water activated and will react soon as they come in contact with water. Although urethane-based grouts are the most commonly used, acrylic resins are also used, especially for injection into low-permeability, porous area and very fine crack networks. Siliconate injection grouts are used for preventing rising dampness in masonry structures. Cementitious suspensions are injected into masonry to have the integrity of the structure where as cementitious slurries are injected into masonry structures to fill small to large voids.

One has to understand various tests that need to be carried at laboratory such as flowability, bleeding, setting time and volume change, drying shrinkage to satisfy the requirements of the Standard. The setting of grouts may be based on many different chemical reactions involving different binders such as Portland and non-Portland cements, sodium silicate, sodium aluminates, polyacrylamides, polyacrylates, polyurethanes and a wide range of resins. Similarly, volume change is a critical parameter especially in chemical grouts. It is not possible to consider all the volume change mechanisms that may occur in chemical grouts. But more important is grout specifications which must be appropriate to the grout material for particular usage under various conditions. This can be achieved with the right kind of formulations of grout material in terms of desired properties and long term durability. The laboratory test is only for conformity of the material, however, the performance of material may vary at the actual site which depends upon many factors. In fact, it is very difficult to simulate the exact condition in the laboratory during the trial with actual site conditions.

Earlier, we had also published a special issue on grouting in our ReBuild describing the various test properties and application methods. But in this issue of ReBuild, we are focusing more on the formulation and specifications and hope our readers will find it extremely useful.