C – 23: Shotcrete Placement

According to ACI, shotcrete is "concrete or mortar conveyed through a hose and pneumatically projected at high velocity onto a surface".

Shotcrete is actually a method of placing concrete and mortar, much the same as we would describe placing concrete or mortar by pumping, bucket and crane or by the use of conveyors.

Shotcrete is used for both new construction and repair applications. Shotcreting equipment is capable of placing as much as 20 yd^3 (15 m^3) per hour for high volume applications such as tunnel lining and as little as ¼ yd^3 (0.2m^3) per hour for small repairs. Most shotcrete is placed with coarse aggregate no larger than 3/8" (10 mm) top size, although 3/4" (19 mm) top size aggregate is sometimes used.

There are two shotcreting processes. One is called ***dry mix shotcrete*** and is commonly called "gunite" by many people. In this process, the shotcreting materials with some moisture in the sand are placed in a piece of equipment called a "gun". The mix is then conveyed through a hose riding on a bed of compressed air to a nozzle where most of the mix water is added, and then projected at high velocity onto a surface. Damp sand is used to reduce rebound when materials are mixed on the job site. In the case of pre-bagged mixes, 3 - 6% moisture by weight of sand is added to the mix before being emptied into the gun. This process is called pre-dampening.

The second shotcreting process is called ***wet mix shotcrete***. In this process, all the shotcreting materials (except the shotcrete accelerator) are thoroughly mixed and then dumped into a concrete pump and conveyed through a hose to the nozzle. At the nozzle, compressed air is introduced which projects the mix at high velocity onto a surface. Wet mix shotcrete is essentially a pumping operation until compressed air is added (with or without a shotcrete accelerator) at the nozzle.

Liquid shotcrete accelerators, when used, must be added at the nozzle in both processes. They are used to reduce rebound, increase the depth of placement in one pass and promote early strength gain. Initial set (500 psi (3.4 MPa) penetration resistance) can occur in as little as 5 seconds!

Shotcrete continues to gain acceptance as a method of placing quality concrete and mortar. As the science of shotcrete continues to evolve, more exotic materials and advanced methods of placement, including the use of robots, is becoming more and more common.