

Top Ten Sustainability Benefits of Shotcrete

The United States Green Concrete Council's (USGCC) book, *The Sustainable Concrete Guide—Applications*, includes a list of the top 10 sustainability benefits of shotcrete in its chapter on shotcrete. Over the next 10 issues of *Shotcrete* magazine, this Sustainability column will elaborate on each one of the listed advantages. Previous discussion of advantages from past issues can be viewed on the ASA Web site at www.shotcrete.org/sustainability.



1. Formwork savings of 50 to 100% over conventional cast-in-place construction.
2. Formwork does not have to be designed for internal pressures.
3. Complex shapes require very little—if any—formwork.
4. **Crane and other equipment savings or elimination** (see below).
5. Labor savings of at least 50% in repair applications.
6. New construction speed savings of 33 to 50%.
7. Speed of repair reduces or eliminates downtime.
8. Better bonding to the substrate, which enhances durability.
9. Adaptability to repair surfaces that are not cost-effective with other processes.
10. Ability to access restricted space and difficult-to-reach areas, including overhead and underground.

Crane and Other Equipment Savings or Elimination

An often overlooked sustainability benefit of the shotcrete process is one of the most basic of construction problems: the conveying and handling of materials. Because shotcrete transports material over distances efficiently, it can often eliminate the need for concrete buckets, cranes, hoists, freight elevators, motorized concrete buggies, and other costly methods of transporting cementitious materials to the desired work areas.



Shotcrete is easily conveyed directly to where it is needed, as shown in this shotcrete repair of the upper wall area of this Coke Plant Quench Tower

Shotcrete applications in both the dry- and wet-mix processes convey concrete materials over distances and propel the material directly onto the receiving surface. Shotcrete is placed under high velocity in what is essentially a sprayed installation of concrete material. These methods of transport provide us with several advantages.

On elevated structures or scaffolding, shotcrete hoses or pipe can run directly to the level where the material is needed and completely eliminate the need for cranes, hoists, concrete buckets, or other lifting equipment. The material runs through the shotcrete hose or piping in a continuous manner straight to the work area.

In industrial applications, shotcrete provides an efficient method of transporting material through man-doors or observation ports and up into boilers, vessels, and units, where double handling of materials is often necessary. The same can be said for smokestacks and ductwork, where concrete materials or refractory can be moved with shotcrete equipment, eliminating the need to use hoists or climbers, which often results in double handling of the material. One industrial project in particular, a power plant scrubber, required the contractor to load refractory brick onto a bucket, lift the materials up to a work platform, lower them down to the access door, and then hoist them up into the vessel. The handling of material multiple times could have easily been eliminated by using shotcrete.

In sewers, tunnel inverts, and underground culverts, shotcrete can be placed by feeding hoses through manhole

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In boilers and other industrial structures, the only access is often through man-doors and up into the boiler or vessel. Shotcrete provides an efficient method of transporting and placing material

openings and other access points and transported long distances underground, eliminating the need for hoists and concrete buggies. On a past tunnel project some years back, the contractor set up operations on the roadway, where the distance between manholes was 600 ft (183 m). Shotcrete hoses were run horizontally in each direction to transport repair materials to each repair area. Shotcrete eliminated the need for hoists and motorized buggies and provided a more effective method of material placement.

On concrete bridges, the shotcrete material hose can be strung directly to the arch, beam, pier, or abutment where the repair material is needed without using any cranes or hoists. By using shotcrete, the placement process is simplified and, in many cases, eliminates the extra work involved in the double handling of materials.

The need for lifting equipment can be eliminated or substantially reduced anywhere a shotcrete hose can be run or shotcrete can be used for the placement of cement-based materials. Sustainability is about reducing costs in material, energy, and transportation. Moving material on site exactly to where it's needed is just one area where shotcrete always provides an advantage. Remember, shotcrete is not a product—it is a process for placing concrete. It's a method that saves time, money, and in many cases, unnecessary labor.



The shotcrete hose running up into the smokestack conveys the refractory material directly to the areas where it is sprayed in place. This can easily be accomplished without the double handling of materials that would have been necessary with the installation of refractory brick