

## 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](http://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.
5. **Labor savings of at least 50% in repair applications** (see below).
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.

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# Labor Savings of at Least 50% in Repair Applications

**S**hotcrete has substantial benefits for enhanced sustainability in the repair industry. Shotcrete is an efficient repair method that offers—in addition to significant material savings—exceptional labor and speed advantages in many repair applications, all of which are critical sustainability advantages.

Using shotcrete allows the repair contractor to economically and efficiently address a wide range of concrete repairs with these labor-saving benefits:

- The use of minimal, if any, formwork;
- The allowance of unique overhead placement quality and efficiency;
- Increased speed of placement;
- The ability to provide the precise shape and thickness required for the structural or aesthetic functionality of the repaired concrete members in a significantly more efficient manner than form-and-pour;
- The possible elimination—or at least reduction—of shoring and scaffolding that would be needed for form-and-pour repair methods; and
- The possible elimination of the need for labor to operate heavy lifting equipment or forklifts on the site that would be needed for form-and-pour methods to build, set, and strip formwork.

In addition to significant sustainability benefits from material resource savings by eliminating formwork, the use of shotcrete can result in a labor savings of up to 50% on a repair project. The shotcrete process offers all the sustainability advantages of

concrete as a repair material, plus a significant number of sustainability advantages inherent in the placement process.

In small repair areas, forming is labor-intensive. With shotcrete, the repair material can be gunned in from the open side against a prepared substrate, completely eliminating the need for forming. This not only saves the costs of the forming materials but also the costs of the labor involved in making the forms, securing them in place, the time-consuming procedure of conveying the concrete to the scattered repair areas, and stripping the forms. Additional labor costs are saved by eliminating the need to pour concrete through chutes to adequately fill the small formed repair areas without leaving voids, honeycombs, and air pockets. The ability to transport the shotcrete material through hoses directly to the repair areas eliminates the need for hoists, cranes, buckets, and the additional handwork that is involved in physical concrete placement. Thus, shotcrete placement provides a more efficient and cost-effective method of conveying the repair material.

In overhead areas, shotcrete can be gunned in place from the underside of the repair area and quickly and efficiently placed. On overhead forming and pouring installations, the concrete flows along the bottom side of the form, often leaving a gap or air pockets between the existing overhead concrete substrate and newly placed repair. With shotcrete, the receiving surface is fully visible and the repair material is shot in place from the top down, ensuring an excellent bond to the existing overhead concrete substrate. Additionally, overhead forming requires a

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*Shotcrete can easily conform to rounded or irregular shapes and varying depths, as illustrated by this freshly gunned circular-shaped bridge pier*



*On this pier hammer head, the shotcrete is easily gunned in place without the need for forming*

great deal of time and labor to secure and often support scaffolding and bracing to hold the formwork in place. This step becomes completely unnecessary with a shotcrete installation.

Shotcrete can easily conform to complex shapes or rounded shapes where forming becomes difficult and expensive. Forming the underside of a dome or arch or building forms for repair areas on a cone or cylinder shape becomes a time-consuming and labor-intensive operation. The shotcrete, when shot in place, will fill in and conform to irregular depths and shapes easily and efficiently, taking the shape of the receiving surface.

In summary, for the rehabilitation of concrete structures, there is no more efficient repair method than using shotcrete. In most repair applications, shotcrete can be gunned directly onto the receiving surface, completely eliminating the need for forming. This yields big savings in time, labor, and material. Additional benefits include: 1) the speed and efficiency of placement; 2) the ease in overhead placement; 3) the elimination of bracing and support scaffolding for the formwork; 4) the reduction or elimination of hoists and handwork; 5) the advantages in material transport and handling; and 6) the unique feature of being able to conform to irregular shapes. In light of all these advantages, it is plainly evident that a 50% reduction in labor costs is easily realized using the shotcrete process for concrete repairs.



*In this dry-process shotcrete repair of an industrial sump, the repair mortar is gunned in place without the need to make or install forms*



*The deteriorated concrete on this bridge pier has been removed, the reinforcing bar exposed, and the surface prepared prior to the shotcrete placement. The use of shotcrete eliminates the need for forming and labor costs involved*



*Shotcrete can be efficiently gunned overhead in concrete repair applications, where forming and material placement can be difficult and expensive, as evidenced by this dry-process shotcrete repair*