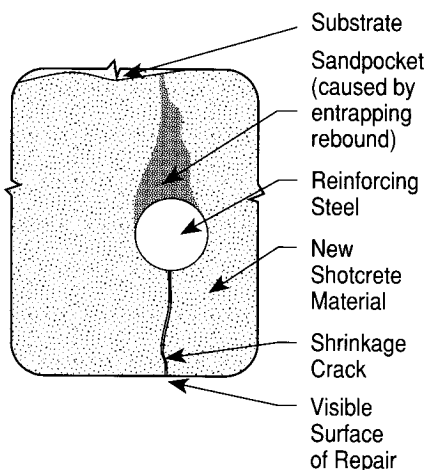


# Dry Mix Shotcrete

Enlarged View of Sandpocket Formed Behind Reinforcing Steel

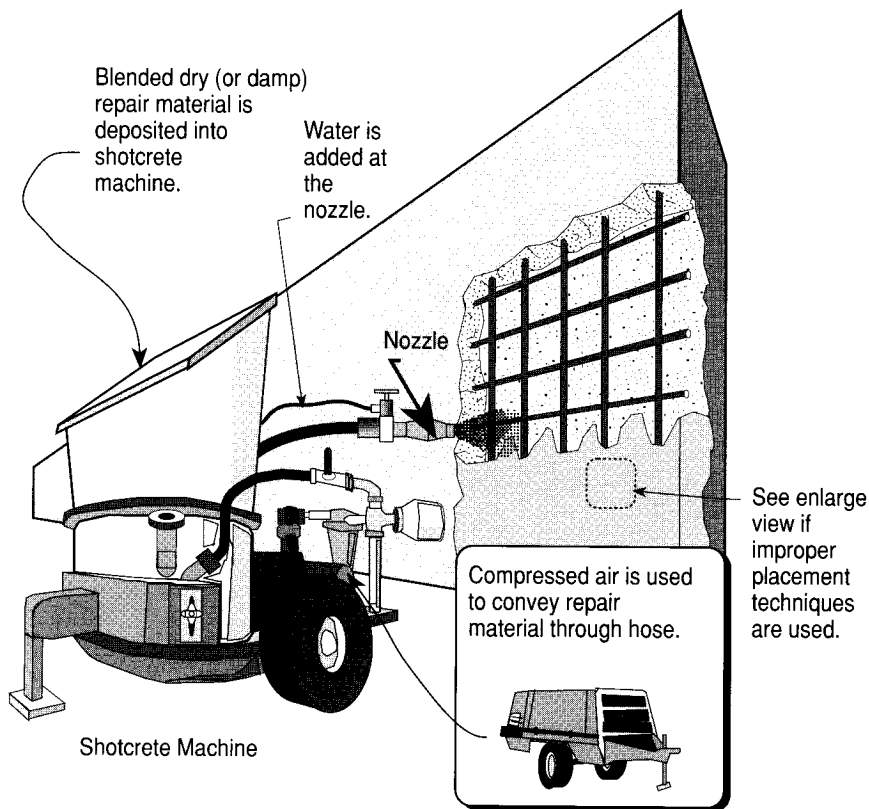


Dry mix shotcrete is a method that involves the premixing of binder and aggregates, which are then fed into a special mechanical feeder metering the premixed materials into a hose. The material is conveyed through the hose with compressed air to a nozzle which is outfitted with a water ring where additional water is mixed with the binder and aggregates. The mix is jetted from the nozzle at high velocity onto the prepared concrete surfaces. The process varies, depending upon the necessary thickness and orientation. Where the repair is thick, the process may involve the placement of multiple layers. Excessive thickness of

individual layers may result in sloughing off. The use of special admixtures has helped improve the workability and performance of shotcrete. Silica fume is a good property enhancer. It improves the concrete's adhesive and cohesive properties, along with its ability to provide for larger placement thicknesses. The resulting hardened properties include increased flexural and compressive strengths and increased durability to freeze-thaw and chemical attack. The use of chemical accelerators should be avoided where not absolutely necessary. Accelerators have been found to cause increased drying shrinkage<sup>1</sup>.

## Typical Problems Associated with Shotcrete Repairs

- Presence of voids due to encapsulated rebound; common when multiple layers are used or when heavy reinforcing is encountered.
- Shrinkage cracking caused by high cement content, improper curing, or excessive water content.



<sup>1</sup>Morgan, D.R., Developments in Shotcrete for Repairs and Rehabilitation, Concrete Construction, No. 9, September 1991.

## Additives for Dry Mix Shotcrete

Additives	Benefit	Comments
Silica Fume	<ul style="list-style-type: none"> <li>• Increased thickness</li> <li>• Increased density</li> <li>• Increased freeze-thaw resistance</li> <li>• Increased chemical resistance</li> <li>• Reduced rebound</li> <li>• Increased adhesion</li> <li>• Increased flexural and compressive strength</li> </ul>	
Accelerators	<ul style="list-style-type: none"> <li>• Increase/buildup of layers</li> <li>• Reduced initial set time</li> <li>• Increase early strength gain</li> </ul>	<ul style="list-style-type: none"> <li>• Increased drying shrinkage</li> <li>• Reduced shotcrete strength with age</li> <li>• Not necessary if silica fume is used</li> </ul>
Steel Fiber	<ul style="list-style-type: none"> <li>• Elimination of shadows and voids which are created with conventional reinforcement</li> <li>• Improved impact resistance.</li> </ul>	
Polypropylene Fibers	<ul style="list-style-type: none"> <li>• Reduced plastic shrinkage cracking</li> </ul>	
Latex	<ul style="list-style-type: none"> <li>• Improved flexural,tensile bond strengths</li> <li>• Increased resistance to freeze-thaw and chemical attack.</li> </ul>	<ul style="list-style-type: none"> <li>• Latex hardened film may occur between layers, causing delamination.</li> </ul>