

## The Correct Use of Line Lubricants

By Oscar Duckworth

**T**he man who sold me my first concrete pump was an excellent teacher. “You put the concrete in here and it comes out there,” he assured me. On my first job, I found out that



Fig 1: Line lubricant added directly to placement system



Fig 2: Line lubricant discarded outside the work area

half of his information was correct. Plugging or packing during the initial prime of a wet-mix placement system can be time consuming and dangerous. Long, complex delivery systems or steep downhill runs can create challenges during the initial prime. Although some crews still rely on the “hammer and hope” method, the correct use of a line lubricant is the safest, most effective method to prime a wet-mix placement system.

### Why Placement Systems Plug during the Initial Prime

During placement, hoses that convey the shotcrete mixture from the pump to the nozzle are lubricated by the mixture’s cement paste. Low-slump mixtures (1 to 2 in. [25 to 51 mm] slump) or lean mixtures containing less cement paste can be more difficult to pump than mixtures with more water or cement paste. Because wet-mix shotcrete must be pumped through a placement system, the shotcrete mixture must possess sufficient moisture and paste volume. During the initial prime, if the shotcrete mixture is conveyed through an unprimed placement hose, some of the cement paste will be lost as it coats the interior of the hose. This is similar to a moving paintbrush losing its paint to a dry surface. Pumping a shotcrete mixture even a short distance through an unprimed placement system will cause the mixture to lose enough cement paste to become too lean to pump through the system. The lean mixture lacks sufficient lubrication and will quickly form a pack that will plug the system, regardless of the amount of pressure applied by the pump. This can create a burst hazard within the system if the pump pressure is not relieved. Forcing a pack forward using maximum pump pressure is never successful and always dangerous. A pack within the hose can only be removed by relieving the pump pressure, opening the hose, and shaking the lean material completely out of the system before attempting to resume pumping.

# Nozzleman Knowledge

## How Line Lubricants Work

The proper use of a line lubricant can prevent plugging during the initial prime by providing both additional moisture and a paste coating to the interior of the placement system just ahead of the shotcrete mixture as it is initially conveyed through the hose. To use a line lubricant correctly, the lubricant must be added to the delivery system prior to adding the shotcrete mixture to the pump hopper (Fig. 1). The shotcrete mixture pushed by pump pressure will act as a piston, forcing the line lubricant ahead of the mixture and effectively coating the interior of the line ahead of the shotcrete as it is pumped through the system. If a placement system is adequately coated with a line lubricant, cement paste will not be lost from the mixture as it is conveyed through the hose. A lean pack is not likely to occur. Shotcrete mixtures have been successfully primed and pumped over 1 mile (1.6 km) without plugging in underground mining operations.

## Line Lubricants Are Not Admixtures

Never add line lubricants to the shotcrete mixture at the hopper. Line lubricants are much lighter than other components of the mixture. Lubricants added to the pump hopper will quickly float up as the shotcrete mixture enters the hopper. This defeats the purpose of the lubricant. When line lubricant is floating at the top of the hopper it cannot be drawn into the pump material cylinders ahead of the mixture; therefore, the lubricant cannot initially coat the unprimed lines.

Plugging during the initial prime is likely to occur. Always discard material contaminated with line lubricant. Most lubricants are not compatible with concrete mixtures; therefore, strength and durability may be affected. Discard all lubricant and contaminated concrete prior to beginning placement (Fig. 2). The correct use of a line lubricant is the best method to assure that, as my teacher said, "If it goes in here, it comes out there."

## Checklist

- Use line lubricants correctly to reduce plugging and possible burst hazard during the initial prime.
- Add line lubricant to the delivery system, not the pump.
- If a plug does occur, do not attempt to force a plug forward using maximum pump pressure. Relieve the pump pressure, open the hose and shake out the plug.
- Discard line lubricant and contaminated shotcrete prior to beginning placement.



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