Shotcrete Delivery System—A Football Perspective

By Nathen Bent

"SET…HUT…HIKE." Football season is upon us again. In football, the goal is to march down the field and score as many points as possible. In shotcrete, the goal is to get the job done safely and go home to our friends and families at the end of every day. Shotcrete workers can be seriously injured, crippled, or possibly killed doing their job. I personally have seen nozzlemen lifted well off the ground due to the pressures of a plugged hose.

Pregame Meeting

Your shotcrete team could be playing together for months, if not years. The team knows the plan completely, versed on all safety practices and procedures outlined by the company manual. The nozzleman has years of experience, and the finishers are the "best in the business." But we are continually inviting an "unknown celebrity" onto the team. Somebody who may know nothing about your game plan of shotcrete: the concrete mixer driver. Doing the best they can, they will try and run over the pump, or the operator. They will park in the neighbor's driveway, who is already mad about the construction. Adding water without permission for any reason is a favorite game-changing play of your new teammate. The most consistent contribution of play is not paying attention and running the pump low or empty. Pumps must be kept full. Pumps that are not full are prone to produce "slugging" or uneven delivery to the nozzleman. "Slugging" will tire the nozzleman quickly and with the interrupted delivery, the nozzleman can get frustrated and lose focus. Many times I have seen this occur; the irritated nozzleman turns to say something, and WHAM—the pump kicks in and throws the nozzleman off balance, possibly resulting in an injury.

Fig. 1: A few pieces of metal pipe can greatly improve work station safety

First and Goal

Pumping low-slump concrete over distance can result in very high pumping pressures. One of the easiest ways to start lowering pressures is by the use of a slick line or rigid pipe instead of a rubber hose. Although it involves some calculation and a great deal of clamps, it is effective and safe. The pipe is easy to clean and disassemble as you pump during the day, making washout at the end of the day safer as well. Some of the highest consistent pressures are right out of the reducers, where we see considerable hose whip close to the concrete pump operator and concrete mixer truck driver stations (refer to Fig. 1). A 90-degree elbow and two lengths of pipe greatly reduce pressure and increase operator safety.

Offense

A simple thrust chain installed to reduce pumping system surge is a safety must. Broken elbows and reducers at the rear of the pump, during pumping operations, can be deadly. The surging of the pumping process is easy to see, but the strain on the ends of the reducers and

Fig. 2: A great example of a thrust chain setup

elbows under the clamps is often overlooked. Misalignment through movement of the pumping system during pumping can put a huge strain on the components at the rear of the pump (refer to Fig. 2).

Defense

Surging with a rubber hose needs to be closely monitored; when positioned over a concrete curb or a sharp rock, friction can quickly wear a hole through the rubber hose and the hose can then burst under pressure. Rubber hoses can "walk off" scaffolding, causing great injury to the nozzleman, finishers, and other nearby construction workers. The use of a scaffold hook is a simple way to make sure this does not happen. It is easily adjustable anywhere on the length of the hose to give the nozzleman the range he/she needs to work. Use several hooks if necessary to hold the weight of the hose while moving along the scaffolding (refer to Fig. 3).

Final Drive

Metal system parts wear from everyday use. Be sure to thoroughly inspect all parts on a daily basis.[1] Another great way to ensure the operator's safety is with the use of an elbow shield or blowout protector on the main reducing elbow at the rear of the pump (refer to Fig. 4). The

Fig. 3: This hose quickly wore down against a concrete corner and burst

Fig. 4: This elbow failed due to excessive force being transmitted by the pumping system

routing of the pumping delivery system should be considered with everyone's safety in mind. Making sure that construction equipment of any kind does not run over the delivery system is critical. During pumping, running over the system can cause bursting, plugging, and surging that may injure the nozzleman. If construction equipment must pass over the pumping system, relieve pressure and decouple the system, and then recouple after the equipment has been moved. In addition to the exterior damage to a rubber hose, the inner liner of the hose may become damaged and rupture at a later date without warning.

Fig. 5: Parts wear from everyday use. Inspect daily to prevent accidents

Postgame

It seems so simple, the act of shotcreting—you put the concrete in the pump over here, and it comes out over there. In its simplest forms, yes, that's true, but we all know the very real dangers associated with what we do. Take time to double-check everything, to make sure everyone gets to go home a winner (refer to Fig. 5).

References

Duckworth, O., 2010, "Is Your Company Policy on Equipment Wear Putting you at Risk?" *Shotcrete*, V. 12, No. 4, Fall, pp. 35-38.

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