

# What You Need to Know Before Selecting a Wet-Mix Shotcrete Pump

By Ray Schallom III

**W**et-mix shotcrete is a method of placing concrete. The concrete material is metered into the delivery hose and moved by positive displacement or compressed air to the nozzle. Compressed air is injected (minimum of 185 ft<sup>3</sup>/min. [5.2 m<sup>3</sup>/min.]) at the nozzle to increase the velocity for placement and consolidation onto the receiving surface. The purpose for this article is to identify factors to consider when selecting a wet-mix pump for low-, medium-, and high-volume wet-mix process shotcrete applications. There are several factors that dictate the proper selection of a concrete pump: type of project; pumping distance; hose size; type of application; quantity of material to be pumped; and use for the multiple applications other than shotcrete, such as grouting or placing conventional concrete.

## Choosing the Right Wet-Mix Shotcrete Pump Manufacturer or Distributor

Contractors often purchase one type of concrete pump based on the assumption that it will be suitable for several different types of wet-mix shotcrete applications. Most concrete pumps are designed to pump coarse aggregate concrete mixtures. The concrete output range is usually from 20 to 60 yd<sup>3</sup>/h (15 to 46 m<sup>3</sup>/h). These pumps are suitable for medium- to high-volume concrete pumping applications. Concrete repair jobs are considered low-volume shotcrete applications that typically use fine-aggregate mixtures. A 1.5 in. (38 mm) hose and smaller-diameter, high-velocity nozzle setup are used for fine-aggregate shotcrete mixtures. One needs to keep in mind that only about 18 yd<sup>3</sup>/h (13.8 m<sup>3</sup>/h) can be pumped through a 2 in. (50 mm) hose unless you are pumping cement grouts.

An average manually applied shotcrete application produces between 6 and 15 yd<sup>3</sup>/h (4.6 and 11.5 m<sup>3</sup>/h) of pneumatically applied concrete. Hose sizes of 2, 2.5, and 3 in. (50, 65, and 75 mm) are typically used for robotic applications. The outputs for robotic applications range from 20 to 30 yd<sup>3</sup>/h (15 to 23 m<sup>3</sup>/h).

In the 32 years I have been in the shotcrete industry, I have found several good hydraulic swing-tube piston pumps that can be used for low-, medium-, and high-volume wet-mix shotcrete applications. There are a few important things to keep in mind when choosing a wet-mix shotcrete pump. The total cost for purchasing a wet-mix shotcrete pump is substantially greater than a dry-mix shotcrete system. Wet-mix shotcrete equipment can also be more complicated to maintain. Over the years I have developed a checklist to help me choose the right manufacturer of wet-mix pumps and systems:

- Check the years of shotcrete knowledge and experience of the manufacturer's or dealer's sales staff.
- Research the equipment's track record from a production standpoint.
- Evaluate the manufacturer's or dealer's customer service. This is helpful for troubleshooting pump-related problems or other shotcrete-related issues.
- Check on the availability of repair parts and the sales staff's knowledge of the inner workings of the concrete pump (for troubleshooting problems). The manufacturer or dealer should offer on-site setup and testing prior to startup (to make sure there are no pumping problems with the mixture proportions selected for the job).
- The manufacturer or dealer should be able to offer hands-on shotcrete training as an option (check to see how many years of hands-on training experience the trainers have).
- Identify accessories the seller offers (hoses, clamps, reducers, concrete pipe, shotcrete nozzles, or fittings and accessories needed to equip the pump for a robotic arm or robotic unit if needed).

Once you have selected the right manufacturer or distributor, the next step is to choose the right pump to meet your job requirements. The price of the wet-mix pump will likely play a key role in your selection. It is important to research the performance and maintenance history of the wet-mix pumps under consideration. More time and money may be spent on repair and maintenance for a less expensive model than one that is more rugged with a good track record.



*Fig. 1: An S 5 electric version rotor/stator unit with an M-Tec continuous mixer feeding it. This electric mixer comes with an adjustable water meter and low water-pressure cutoff that maintains a steady, consistently blended material flow*



*Fig. 2: The SP 13 high-pressure piston pump. The low profile gives the operator an unobstructed view of the work area and shooting area while making a batch of wet-mix concrete*



*Fig. 3: An Allentown Powercreter 20 is shown with a hydraulic mixer attachment. The attachment is being used as a remixer for concrete supplied by a mobile, volumetric mixer to achieve a consistent mixture for pumping operations. A vibrating screen was installed to reduce the risk of plugging the 1.5 in. (38 mm) hose due to randomly occurring large aggregate particles. The new electronic technology produced a continuous flow of concrete material that allowed the nozzleman to apply a uniform shotcrete layer to the walls with very little line surge*

## **Choosing the Right Wet-Mix Shotcrete Pump**

Consider a wet-mix pump designed to handle a lower-volume output for repair and grouting applications. Low-volume wet-mix pumps can have a batch mixer attachment for mixing dry, preblended products, a stand-alone mixer, or the same pump without the batch mixer that is capable of pumping fine-aggregate ready mixed mortar. The pump should be capable of reducing the material outlet to a 1.5 in. (38 mm) diameter hose for repair and grout work.

For medium and large volume projects, consider using a piston-type pump with outputs of 20 to 60 yd<sup>3</sup>/h (15 to 46 m<sup>3</sup>/h), a remixer in the hopper (to help agitate and push low-slump mixtures toward the cylinders), and a vibrator on the grate to help with low-slump mixtures or mixtures with fibers (special grates are available that have vibrators attached and smaller openings to help keep larger rocks out of the mixture while letting stiff mixtures or mixtures with fibers pass through). An accelerator dosing

system can be connected to the concrete pump which can be designed to inject the proper accelerator dosage per cylinder stroke or as a stand-alone unit with flow control devices.

## Safety Issues to Consider with Wet-Mix Shotcrete

Concrete line pressures can reach as high as 4000 psi (27.6 MPa) when a plug occurs. It is extremely important to follow the manufacturer's

operation and safety manuals to prevent injury or even death. A safety checklist is usually provided in the equipment manual for the contractor and crew to follow daily. Depending on what type of job you are on, some governing agencies may require even tighter safety controls in addition to the manufacturer's list.

## Summary

The purpose of this article is to inform contractors about choosing the right wet-mix equipment for the project size. It is intended to be a selection guide for those who are looking to purchase wet-mix pumps for the first time or seasoned contractors looking to purchase new equipment. The application of wet-mix shotcrete is a proven method of placing concrete at an economical price.

## References

- Bridger, P., "The Value of Shotcrete Accessories," *Shotcrete*, V. 7, No. 3, Summer 2005, pp. 10-12.
- Schallom, R., and Ballou, M., "What You Need to Know About Wet Shotcrete," *Shotcrete*, V. 5, No.1, Winter 2003, pp. 22-27.
- Sulman, P., "What You Should Consider When Choosing a Wet-Mix Shotcrete," *Shotcrete*, V. 7, No. 3, Summer 2005, pp. 14-16.



Fig. 4: A REED C50HP concrete pump



Fig. 5: A Schwing 750 trailer pump that was set up for easy maneuvering in and around the job site



Fig. 6: An Allentown Powercreter 40 pump with hydraulic outriggers



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Photo courtesy of Oscar Ductworth.