

Shotcrete Equipment: Wet or Dry?

By Paul Sulman

When I was first asked to write an article with “Wet or Dry” in the title, I was sure this topic had been beaten to death. In fact, I cannot think of a more talked-about topic when discussing shotcrete.

Because most of us have read more than one article on the benefits and disadvantages to both methods, I thought “what can I possibly write about that hasn’t already been covered?” Nevertheless, before we go there, this reminds me of when I first started in the industry almost 20 years ago. Someone asked me “which is better, gunite or shotcrete?” After figuring out that gunite is simply a term used to describe the dry-mix shotcrete process, I was on a mission to get the answer once and for all.

I was fortunate back then to be traveling all across the U.S., Canada, and even Australia. Who better to answer this question than the many contacts I would meet in the industry. Little did I know what I was in for! I received so much contradictory information that I thought I would never get a straight answer. It turns out that no single method is clearly better than the other. The decision to use dry-mix shotcrete (gunite) or wet-mix shotcrete depends on the variables of each project. Every job is different. The following factors must be considered before choosing either the wet- or dry-mix process:

- project size (quantity of shotcrete required);
- accessibility;
- application rate required (cubic yards or cubic meters per hour or shift);
- availability of an air compressor;

- material availability (distance from job site and [sand/cement] transport method);
- availability of water;
- storage space;
- dust—are you going to be doing work in a confined space where the production of dust could be an issue? (less dust is generated in wet mix);
- nozzleman skill;
- rebound (generally, wet-mix shotcrete will generate less rebound);

Equipment Costs

This is how an accountant would look at the question:

Dry-Mix (Gunite)

- Machine, hoses, nozzle—\$12k to 16k
- Air compressor—\$33k to 70k (dry process requires a much larger air compressor than wet process, so if a large air compressor is already on the job site—major bonus!)

Total equipment cost: \$45k to 86k (if you need to purchase an air compressor)

Shotcreting capacity range is 8 to 15 yd³/h (6.1 to 11.5 m³/h)

- \$45k for 8 yd³/h (6.1 m³/h [assuming you need to purchase an air compressor])
- \$86k for 15 yd³/h (11.5 m³/h [assuming you need to purchase an air compressor])

Wet-Mix

- Machine, hoses, nozzle—\$45k to 95k
- Air compressor—\$15k to 20k (wet process requires a smaller air compressor (185 ft³/min [5.24 m³/min]))

Total equipment cost: \$60k to 115k (if you need to purchase an air compressor)

Shotcreting capacity range is 12 to 20 yd³/h (9.2 to 15.3 m³/h)

- \$60k for 12 yd³/h (9.2 m³/h [assuming you need to purchase an air compressor])
- \$115k for 20 yd³/h (15.3 m³/h [assuming you need to purchase an air compressor])

The aforementioned examples illustrate that the initial costs for both wet- and dry-mix shotcrete equipment are not that different (except if you already have a large air compressor on the site, in which case the dry-process wins the “equipment cost per applied cubic yard capacity” competition hands-down). If you consider the production rate per dollar and include the purchase of an air compressor, the two methods are very similar.



Wet-mix B50HP shotcrete pump (left) and dry-mix Lova shotcrete (gunite) gun (right)

Material Availability

While considering the differences and similarities, along with the plusses and minuses, material availability kept showing up as the common denominator. One area of the country would predominantly use the dry-mix process while another area would predominantly use the wet-mix process. Historically, only one shotcrete method would be introduced into particular areas. This method took hold and became accepted by engineers, pool builders, and contractors. With this in mind, the material suppliers got the product dialed in.

For example, some isolated areas in California have only dry-mix shotcrete contractors available while some areas have only wet-mix shotcrete applicators. Consequently, ready-mix suppliers are comfortable shipping mixer trucks with dry-mix shotcrete mixtures in some areas and may refuse to quote dry-mix materials in others.

Often, ready mixed concrete is simply not available. Tunnels, mines, and many projects in undeveloped parts of the world sometimes do not have a ready mixed concrete facility nearby. To get around this, mining and tunneling companies often use “super-sacks” of dry, preblended shotcrete mixtures that are positioned above the dry-mix gun.

Small repair or architectural projects sometimes require a lot of starting and stopping, usually with a very small amount of shotcrete applied between breaks. In these cases, the dry-mix shotcrete (guniting) method is advantageous because the material won't set up in the hoses. It will remain in the powder form because the water is applied at the nozzle. The workers can take a break any time.

A contractor may decide to, in the wet-mix situation, buy mixer trucks, and perhaps a batch plant to have control over the material supply. In the dry-mix scenario, the contractor could do the same. He may invest in a mobile volumetric concrete mixer. This could be brought to the job site and fed with sand using a dump truck and loader. The cement can be stored in the mobile concrete mixer unit. In either case, the shotcrete contractor could gain control of the entire shotcrete process. This can allow for better scheduling and less down time. It may even reduce the overall cost of the process.

Maintenance

The equipment maintenance costs should also be considered when choosing dry- or wet-mix shotcrete equipment. Let's look at only the equipment in contact with the concrete. First, we'll look at the dry-mix shotcrete (guniting) machine. This unit is used to convey the dry shotcrete mixture, which produces considerable wear on all items in contact with the dry-mix shotcrete

material. This includes wear pads, gooseneck liners, bowls, plates, hoses, and nozzles.

Shotcrete pumps convey the shotcrete material in a wet state, which is less abrasive. Thus, it saves money and time from less part wear. The wet shotcrete pump has the following wear items: wear plate, cutting ring, piston cups, hoses, pipes, and nozzles.

Conclusion

We all know that both wet- and dry-mix methods are viable shotcrete processes that produce a sound final product. The decision to use either dry- or wet-mix shotcrete is dependent on the factors previously identified.

There are many variables to consider when choosing to use either a wet-mix shotcrete pump or a dry-mix shotcrete gun. As in most equipment decisions, you will need to consider the requirements for most of your projects. It would be wise to choose the equipment that will get you the most work. You may even conclude that you need to purchase equipment for both dry- and wet-mix shotcrete processes to give you maximum flexibility. I would encourage you to contact the many suppliers who have experience and knowledge for help in your selection. Let's face it, in this economy, purchasing equipment is a big step and needs to be well thought out prior to issuing the purchase order.



REED C50HP set up and wet-mix shotcrete being pumped for pool construction in Southern California



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