



## Hydro-Mix Nozzle Setups

By Ray Schallom III

**H**ydro-mix and predampening nozzle options have been around for many decades—some dating back to the original cement gun company days. Through the years, former licensees have used and perfected the use of the hydro-mix nozzle for dry-mix shotcrete.

The correct length for the hydro-mix nozzle placement in the hose before the nozzle began to vary from manufacturer to manufacturer. Older, more experienced shotcrete contractors normally would use an 8 to 10 ft (2.4 to 3.0 m) hydro-mix nozzle arrangement for better mixing of the concrete material before it passed through the nozzle tip (refer to Fig. 1). The nozzle setups made today are often only 3 to 4 ft (0.9 to 1.2 m) long; that places the nozzle body between the nozzleman's legs and does not allow ample time for material mixing before it leaves the nozzle.

Predampening raises moisture in the dry concrete materials to a 3 to 5% level to help start the hydration process, cut down on dust, and reduce wear in the gun. Predampening also reduces the potential for buildup of static electricity generated by conveying bone-dry bagged material through the hose.

Predampening is good for normal-set concrete mixtures but not accelerated or fast-set concrete mixtures, which may start setting up before reaching the receiving surface from the nozzle. Thus, hydro-mix nozzle setups are used with

accelerated and fast-set concrete mixtures in place of the preferred predampening method. Hydro-mix nozzle setups are also used in refractory installations, mining, and tunnel operations where fast-setting materials are routinely gunned.

When shooting bagged, dry materials, using a hydro-mix nozzle is a better alternative than using a regular nozzle setup. Having the waterbody well before the nozzle allows the concrete materials longer exposure and mixing with the water than in a standard nozzle, where the waterbody is right at the nozzle. It is still not better than predampening material before it enters the dry shotcrete gun, but it is much better than not using it without predampening.

In my opinion, using a predampener and hydro-mix nozzle setup would be the best of both worlds because we would have a more completely mixed concrete material hitting the receiving surface. The dry material is conveyed through the hose at 60 to 80 miles/h (100 to 130 km/h) as it passes through the water-spray jets of the water ring. Without the proper concrete mixing action required before it is discharged out of the nozzle, the nozzle men would have a difficult time trying to mix and blend the layers as they build out material.

In ACI and ASA committee meetings, there have been lengthy discussions over the use of a hydro-mix nozzle versus pre-dampening. Finally, 2 years ago, ACI Committee C660, Shotcrete Nozzlemen Certification, voted to accept the hydro-mix nozzle as an alternative to predampening. However, the nozzle setup must be at least 8 to 10 ft (2.4 to 3.0 m) back in the hose from the nozzle for proper mixing action.

Figure 2 is a picture of a prewetting nozzle setup to which I was exposed early in my career. It wasn't until 20 years into my nozzling career that I started using one. You must have great water pressure—at least 15 psi (0.1 MPa) higher than your air pressure at both water rings—and at least a 750 ft<sup>3</sup>/min (21 m<sup>3</sup>/min) compressor to push the concrete material through both water rings correctly. The water ring that is 8 to 10 ft (2.4 to 3.0 m) before the nozzle is for predampening the concrete materials as they pass through the hose. The water ring in the nozzle body is used for applying 90% of the mixing water as the concrete is shot from the nozzle onto the receiving surface. Both water valves need to be either needle valves or diaphragm valves to allow precise metering of the water into the concrete mixture as it passes through them.

In conclusion, after 40 years as a nozzlemen, the hydro-mix and prewetting nozzle setups do work, but it is not as



Fig. 1: A 2 in. (50 mm), 8 to 10 ft (2.4 to 3.0 m) hydro-mix nozzle and hose setup that gives good mixing action before the concrete material reaches the nozzle tip. Also, note the easy access to the water body to clean out the water ring daily



Fig. 2: A prewetting setup with two water valves and nozzle bodies with water rings

good as predampening the material prior to placing into the machine. Remember: predampening the dry material controls the dusting around the machine, reduces wear, and reduces static electricity when you convey the damp material. That's why when not predampening, the hydro-mix water body needs to be 8 to 10 ft (2.4 to 3.0 m) back in the hose to wet material before it reaches the nozzle. The material in that 8 to 10 ft (2.4 to 3.0 m) of hose is more thoroughly hydrated, thus substantially reducing the buildup of static electricity that can shock the nozzleman. Having the hydro-mix water ring 3 ft (0.9 m) back places it between the nozzleman's legs, where it is difficult to hold up due to its extra weight and with the short hose length can produce a good shock. Good shotcrete practices and common sense, with many techniques first learned back in 1909, are still applicable today. Shortcuts hurt the entire industry. There are many good resources offered by the American Shotcrete Association at [www.shotcrete.org](http://www.shotcrete.org). Of particular interest, all the past *Shotcrete* magazine articles can be found on the website and can help educate the nozzlemen, crew, and owners about the shotcrete process for high-quality, durable concrete placement in a wide variety of concrete applications.



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