

# Y Not Try a Double Nozzle System

By Derek Pay

**A**lthough many shotcrete workers “claim” to be capable of placing massive amounts of concrete in a daily shift, or shooting with the pump turned “wide open,” in reality, the nozzleman tends to ultimately be the limiting factor on production speed and daily placement volume. Plain and simple they get tired. Shooting too fast diminishes accuracy and overall quality.



Fig. 1: Delivery line “Y” Splitter



Fig. 2: Ground support shotcrete placement benefited from the two nozzles

Could there be a better way? Y not consider double nozzling? In other words, two nozzlelemen operating from the same pump and placement system. In many situations, simply adding a “Y” and a second nozzle to the line increases the amount of yardage output, increases work production, decreases the amount of time spent on the job, and most importantly, decreases the amount of physical strain on the nozzleman.

What is double nozzling? Adding a second line to the concrete pump (Fig. 1), enabling a second nozzleman to simultaneously place material in a different location of the project. Double nozzling is very job specific and works best when you require high volumes placement (Fig. 2) on either large or small projects (Fig. 3 and 4).

There are hidden advantages to running a double nozzle. It allows the pump volume to function at a much higher rate, cutting in half the stroke duration and thrust from concrete flow a nozzleman feels. Greatly reducing a portion of the physical exertion required by the nozzleman, allows the nozzleman to accurately place more yardage in a shorter amount of time (Fig. 5).

For example, assume a 9 yd<sup>3</sup> (7 m<sup>3</sup>) delivery each hour, with a yardage total of 72 yd<sup>3</sup> (55 m<sup>3</sup>). When adding staging, wash down, traffic, and pump clean out, the majority of us would end our day after eight or nine hours (every crew may vary depending on job requirements). By adding a second nozzle, that same job requiring 72 yd<sup>3</sup> with 9 yd<sup>3</sup> loads every 30 min would be finished on average in half the time thus facilitating a higher placement of total yardage per day.

Another hidden advantage is the dramatic decrease in required pressure when using a properly configured Y pipe set up. The back pressure on the pump is decreased, which in turn can increase the longevity of the pump. On a single nozzle, and a common shotcrete pump, we know that the more we increase the volume, the higher the material cylinder pressure will rise. On a job that requires a pump distance of 250 ft (76 m) using a rubber hose, at a 3 1/2 ft (90 mm) slump, depending on mix design, can require that material cylinder pressure to reach above 3200-3400 lb/in<sup>2</sup> (22 – 23 MPa). The increased pressure creates much higher wear rates and may also increase the risk of failure. However, by adding a properly configured second nozzle system to the line, the material cylinder pressure will dramatically decrease often by 1000-1200 lb/in<sup>2</sup> (7 – 8 MPa), even as your volume of shotcrete output is doubled.



Fig. 3: Project with Separate Sections Shot Simultaneously; Fig. 4: Two Wet-Mix Nozzles – One Pump; Fig. 5: More Flexibility with Two Nozzles

Keep in mind that by adding a second line, the amount of air needed to sufficiently supply a nozzle and a blow pipe increases. A 185 ft<sup>3</sup>/min (5 m<sup>3</sup>/min) air compressor is not enough to sufficiently supply enough air to two nozzles and two blowpipes. However, there are many ways to acquire sufficient air. Running a separate air compressor for each nozzle will work, but it increases the amount of equipment needed on site. Increasing the size of both the compressor

and air hose for the majority of the run, then splitting the last length of hose, reducing it down to 3/4 in. (19 mm) for the nozzle and blow pipe, will also work, while limiting the amount of equipment needed to supply sufficient air to both systems. A 375 ft<sup>3</sup>/min (10.6 m<sup>3</sup>/min) air compressor or higher is required to sufficiently supply the proper amount of air for two nozzles and two blow pipes.

## SAFETY CONSIDERATIONS

It is important to remember that when double nozzling, you have added a second line which will require more to manage. That said, safety should always be the number one concern.

There are specific requirements to accomplish double nozzling, safely and efficiently:

1. Running a double nozzle is only for advanced certified nozzlemen. Nozzlemen who are still in the Nozzlemans In Training (NIT) program or a nozzleman with limited experience should not be allowed to hold the nozzle.
2. There must be a full understanding of plugs. These include knowing how to brace for them, proper techniques to safely withstand them, how to unplug them, and understanding the feel of the short skip of a pump stroke which generally means that there is a potential blockage coming through the hose headed for the nozzle. Know that a plug can happen at any time and catch us unawares, since the volume is at a much higher rate. If one line of the double nozzle plugs, the other side gets the full volume of shotcrete coming through the hose. Knowing how to prepare and brace for that is key to the success of double nozzling, keeping the nozzleman and everyone else around safe.



Fig. 6: Delivery Line Splitter on Reducer from Pump

3. The remote operator should be an experienced pump and/or nozzle operator, whose job is primarily to receive communication from either of the two nozzle-men and be always ready to stop and reverse the pump in case plugs in the line occur.
4. If using a radio remote control, it must have volume increase/decrease capabilities. Many times, depending on the job, one nozzle may need to produce at a lower volume to properly encapsulate rebar and stack the shotcrete. Having this function will allow you to communicate with either nozzle-men as they are placing the shotcrete.
5. The “Y” should always be placed at the end of the reducer coming out the pump, with the “Y” having a 3 in. (75 mm) diameter opening on all three ends (Fig. 6). After the “Y” is placed, both 3 in. to 2 in. (50 mm) reducers are to be placed with an EQUAL distance of hose on both lines to the nozzle. Splitting the hose with a hard pipe “Y” at the last section of hose is not recommended and will greatly increase the potential for plugs creating a hardship for the crew and the shotcrete system. Having an unequal amount of hose on each line will significantly reduce the pressure in one nozzle line, not allowing the double nozzle to function properly. Equal hose means equal output pressure.

Finally, use common sense with all safety practices, considering jobsite-specific conditions. Running two hoses can greatly increase the amount of yardage placed but can also double the number of shotcrete issues that can occur. Using common sense can really help avoid safety issues.

Double nozzling is a great way to accomplish a job. It is very job specific and is a great tool to have as a business owner. It increases production and longevity of the shotcrete equipment. Most importantly, it reduces the physical strain on a nozzle-man, affording greater endurance throughout their nozzling careers.



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