Conveyor Speeds and Vehicles per Hour

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It's important to take a look first at how one develops an appropriate conveyor speed for a tunnel wash and then discuss the potential number of vehicles per hour at that specific conveyor speed. General car wash knowledge indicates the shorter the tunnel length the slower the conveyor runs. However, it's important to understand why shorter tunnels have slower conveyor speeds. Finally, we need to understand how the conveyor speed calculates into vehicles per hour.

Conveyor speeds

Since revenue is a major concern of the car wash operator, the discussion tends to start with cars per hour and the tunnel configuration is simply a function of how many vehicles need to be washed per hour. It may be more prudent to reverse the logic and calculate conveyor speed and then cars per hour based on the tunnel length available. Before a tunnel can be built, the property must be identified and purchased. The property may not be the exact layout or size originally envisioned. The property may have great traffic counts near several large businesses and good visibility from the road but can only accommodate a 70 ft tunnel when a 120 ft tunnel was desired.

Regardless of the equipment manufacturer or chemicals utilized there will be certain dwell time or drip space required to achieve clean, dry, shiny cars. Try to think in terms of seconds when considering dwell time or drip space. Certain chemicals need time to clean or seal the vehicle. Body protectants or other finishing chemicals need the car to be thoroughly flushed of soaps before being applied. It's also helpful to allow RO water time to run off the car before entering the dryer.

If a presoak is used, the proper dwell time is normally around 20 seconds but can be specific to the type and brand of presoak. If we use 20 seconds as our presoak time, a conveyor traveling 30 feet per minute (fpm) would require 10 ft. If we double the conveyor speed to 60 feet per minute (fpm), we would require 20 ft for our dwell time.

30 ft/min x 1/3 min (20 sec) = 10 ft
60 ft/min x 1/3 min (20 sec) = 20 ft

Tire cleaner chemicals also have dwell times that need to be considered. The dwell time for a tire cleaner can depend on whether you choose and acid or alkaline cleaner. In either case, make sure the conveyor speed suits the dwell time required by the tire cleaner.

The brush components and high pressure cleaning arches are obviously designed to work at many conveyor speeds. Don't fall into the trap of assuming the conveyor speed can be set arbitrarily because the cleaning stations can operate at virtually any conveyor speed. As you'll see, there are even more considerations than just the cleaning chemicals.

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After the vehicle is thoroughly cleaned, the soap is rinsed from the vehicle with a flood rinse before finishing chemicals are applied. Flood rinses are typically high flow, softened water arches to rinse all the soap off the vehicle. For a body protectant or clearcoat to adhere to the vehicle finish, it has to remain on the vehicle after being applied. The finishing arches applying clearcoats and body protectants must be placed an adequate distance behind the flood rinse based on the conveyor speed. 10 seconds is probably a minimum to ensure the flood water has finished running off the vehicle before applying the finishing chemicals. So the tunnel length required would be:

30 ft/min x 1/6 min (10 sec) = 5 ft
60 ft/min x 1/6 min (10 sec) = 10 ft

Normally body protectants and drying agents aren't especially sensitive to mixing but it's important to provide some separation based on the manufacturers recommendations. For example, the body protectant needs time to adhere to the vehicle before the drying agent is applied. The separation may only equate to a few feet but if a polymer protectant, drying agent, and clearcoat are offered as part of the wash packages the tunnel length required is 6 ft.

The drying agent applied in the finishing chemicals needs a period of time to coat the vehicle before the RO or final rinse is applied. You might consider 10 seconds between drying agent and final rinse as a starting point. Drying agent titrations can always be increased to reduce this time or improve vehicle drying with the same dwell time. So the tunnel length required is:

30 ft/min x 1/6 min (10 sec) = 5 ft
60 ft/min x 1/6 min (10 sec) = 10 ft

Never underestimate the benefit of providing drip space after the final rinse before the dryer system. If an RO system is utilized, the water is meant to have very low surface tension and mineral content so its tendency is to run off the vehicle. By allowing the RO water to run off the vehicle, the dryer has a much better chance of removing all the water from the vehicle because it has less total water to remove. Consider 10-15 seconds to allow as much water as possible to flow off the vehicle but let's consider 15 seconds to be conservative:

30 ft/min x 1/4 min (15 sec) = 7.5 ft
60 ft/min x 1/4 min (15 sec) = 15 ft

The dryer system must always be considered with conveyor speed. A 40HP dryer system (4-10HP producers) on a single arch may dry adequately at 30 ft/min but at 60 ft/min a 120HP dryer system (6-15HP producers) on 4 separate arches may be required. So the faster the conveyor speed, the more space required by the dryer system.

As you can see, conveyor speed can be determined in some respects by the length of tunnel available. The length of tunnel available is sometimes determined by the property available for the wash site. The property not only has to house the tunnel wash but the vacuums, an entrance line, landscaping, etc. As we review the footage calculations above, the 30 fpm tunnel requires 33.5 ft and the 60 fpm tunnel requires 61 ft without including the wash components or the length of the dryer. If you consider 25 ft of length for brush stations and 4 ft for the single arch dryer, the 30 fpm tunnel requires at least 62.5 ft of tunnel length. Each tunnel wash has its own criteria

so it's not reasonable to say it's impossible to run a conveyor speed of 30 fpm in a 50 ft tunnel but it's essential to consider each of the functions of the tunnel and ensure the result is clean, dry, shiny cars with a good customer experience.

Vehicles per Hour

Vehicles per hour has been calculated many different ways and by many different organizations but in the end it's just a calculation. The calculation generally shows the maximum number of cars with the optimum loading of an average sized vehicle. Calculations will be provided showing some assumed numbers with specific roller spacing but selecting shorter roller spacing like 3'3" versus 6'6" should not be decided solely on throughput.

Oftentimes an average vehicle size and a distance between vehicles are used to calculate the vehicles per hour. A Honda Civic and a Toyota Prius are approximately 14.5 foot long while a Chevy Tahoe is 16.5 foot and a Ford Excursion is almost 19 foot in length. So an average vehicle of 16 foot is acceptable for a general calculation but to keep it in perspective, it's just a calculation.

The distance between cars can also be deceptive. If an automated cashier is utilized, the customer will be loading their own vehicle. The customer may need extra time selecting the wash they desire, the currency their trying to use may not accept in the bill exchanger readily, or they may just be preoccupied on a cell phone conversation. Delays can occur even where an attendant would be present so it's not just an automated cashier issue. So go ahead and assume a distant between vehicles of 4 feet.

Most conveyor manufacturers offer standard roller spacing and a shorter spacing option for a premium. In this discussion 6'6" is used as standard and 3'3" is used as the premium option. If we use the 16 ft average vehicle and the 4 foot spacing between cars mentioned above, we have 20 feet. The rollers for 6'6" would be placed on the conveyor chain at 0, 6'6", 13', 19'6", and the roller which would be used would be 26'. With the 3'3" spacing, a roller would be available at 22'9", saving 3'3" of conveyor length.

Let's look at a 30 feet per minute conveyor speed with the 26' spacing (6'6" rollers) and the 22'9" spacing (3'3" rollers) to see the potential for increased vehicles per hour.

<u>6'6" roller spacing calculation</u>
26' spacing yields 1.15 vehicles/min (30 fpm/26ft)
Or 69 vehicles/hr

<u>3'3" roller spacing calculation</u>
22'9" spacing yields 1.32 vehicles/min (30 fpm/22.75ft)
Or 79 vehicles/hr

So the yield is 10 more cars per hour with the assumptions we've made but let's change the assumptions a little and see what happens. Let's keep 30 fpm conveyor speed but let's pick a 17 foot average vehicle and 6 foot spacing between cars or an equivalent length of 23 ft. We use 6 ft to assume a tight turn radius to get to the correlator or a driver struggling to get through the

correlator and onto the conveyor. With a 23 foot length the 3'3" spacing and the 6'6" spacing yield the same results because the 22'9" roller can no longer be used for the 3'3" roller spacing.

6'6" roller spacing calculation
26' spacing yields 1.15 vehicles/min (30 fpm/26ft)
Or 69 vehicles/hr

3'3" roller spacing calculation
26" spacing yields 1.15 vehicles/min (30 fpm/26ft)
Or 69 vehicles/hr

Neither of these examples is right or wrong but the calculation is based on a set of assumptions.

Another issue to consider is the roller up mechanism and how it works. If the roller is past the roller up mechanism when the customer drives onto the conveyor, the customer will wait for the next roller. The wait could either be 3'3" or 6'6" depending on roller spacing. Not only does that cause the next vehicle to wait longer but it also provides the driver a chance to think, "am I far enough in the conveyor" or "maybe something is wrong." If a customer is uncomfortable, they may try to pull forward or back off the conveyor if no one is waiting behind them. A traffic light asking them to leave their car in neutral may not be enough.

Shorter roller spacing also provides a chance to spread the wear over more rollers and potentially extend the mean time to repair for the conveyor. This assumes a normally busy wash. Some conveyor manufacturers may point out infrequently used rollers can actually wear faster so there can be disadvantages other than added cost for increasing the number of rollers. The rollers can be activated automatically even without vehicles present but there are safety concerns with this type of functioning of the rollers.

Summary

Conveyor speed can be arbitrarily set without regard to tunnel length but to achieve clean, dry, shiny cars without excess chemical usage or operating costs, considerations have to be made to the different functions within the tunnel wash. Start with a conservative conveyor speed with standard chemical titrations based on the length available for the tunnel. It's far easier to increase titrations slowly with increased conveyor speeds over time rather than at startup. Finally, use the conveyor speed to calculate the potential vehicles per hour and realize the maximum vehicles per hour will only occur during peak times so calculate revenue accordingly.