Vehicle Washes

Water efficiency in commercial vehicle washes derives from both proper equipment and operational measures. Only equipment choices truly affect new business plans, and operational measures are better addressed in ongoing water-conservation and water-quality programs. Three principal types of commercial vehicle wash are considered here:

- conveyor
- in-bay automatic
- self-service

These include those vehicle washes that are available for public use at stand-alone facilities, as well as those alongside convenience stores, lube shops, and fuel stations. New-vehicle dealers, fleet-vehicle operators, and rental agencies may also have vehicle-wash systems.

Such equipment is also used for truck and bus washing, although fewer of these facilities are available to the public. Most are for washing fleets and are typically located on private property as part of businesses which own, operate, or serve a fleet of vehicles. These can include bus companies, quarries, warehousing operations, and other industrial operations involving transportation. Such controlled facilities sometimes incorporate additional water-saving measures.

When either schools or commercial/retail businesses submit plans for review, it should be determined whether vehicle washes are planned.

Conveyor and in-bay automatic vehicle washes can be constructed as friction or "touch-free." Friction systems use less water overall, because once wet, the "cloth" is rewetted by each vehicle it touches and does not need additional wetting unless a long period passes between washes. Also, friction washes do not use water under high pressure in the wash cycle, resulting in less water use.

It is cost-effective to build conveyor and in-bay automatic carwashes with water-reclaim systems, which can reduce potable water use by as much as 90 percent, although average savings found in studies are more likely to fall in the range of 50 percent. New vehicle washes with water reclaim systems should clearly indicate in which of the wash/rinse cycles reclaimed water is to be used.

The International Carwash Association summarizes the "Steps in a Professional Car Wash Process" that affect water use as follows:

- pre-soak — automated nozzle or hand-held spray
- wash — high-pressure spray or brushes with detergent solution
- rocker panel/undercarriage — brushes or high-pressure sprays on sides and bottom of vehicle
- first rinse — high-pressure rinse

By their nature, vehicle washes will use large quantities of water. New processes for highly efficient water recovery and high-quality treatment have made great strides in improving the conservation record of this industry.

- wax and sealers — optional surface finish sprays on the vehicle
- final rinse — low-pressure rinse with fresh or membrane-filtered water
- air blowers — air blows over the vehicle to remove water and assist in drying
- hand drying — vehicle is wiped down with towels or chamois cloths on site (in full-service washes these are then laundered in washing machines on-site)

Each of the three types of vehicle washes — conveyor, in-bay, and self-service — is described below, along with the water-savings opportunities related to use of reclaim systems and equipment choices which improve efficiency. An additional section discusses water-reclaim systems used in truck washing, which accounts for a large percentage of vehicle-wash water.

Conveyor Systems

The conveyor vehicle wash, usually installed in a tunnel, includes a series of cloth brushes or curtains and arches from which water is sprayed, while the car is pulled through the tunnel on a conveyor chain. In some "touch-free" vehicle washes, only spray nozzles are found. In full-service conveyor vehicle washes, hand drying usually follows the conveyor processes, and often hand-held wands like those found at self-service vehicle washes are used for the pre-soak.

In friction vehicle washes, the wash and/or pre-soak cycle is accomplished with brushes or soft cloth curtains known as mitters. Conveyors with friction components use less water than frictionless washes because the brushes or curtains pick up water and detergent from earlier vehicles and do not need to be rewetted throughout the day. Mitters can often be installed as curtains in the pre-soak area of the conveyor, and rotating brushes are often found in the wash cycle (although this is not universal).

Timing is a critical component in vehicle wash-water efficiency. In properly calibrated conveyors, nozzles are timed to turn on as the vehicle passes under an arch and to shut off as it exits each arch. Each arch is on for a matter of seconds, since conveyors can process ninety or more cars an hour. Efficiency is also maintained by proper nozzle configuration, alignment, and water pressure. A number of nozzle types can be found in conveyor vehicle washes. Nozzle tips which emit water in a fine, fan-shaped spray appear to use the least water. Nozzles referred to as "guns" or "gatling guns," however, provide high-flow volumes and should be used only with reclaimed water.

Blowers at the ends of tunnels should be oriented to push water back into the tunnel. Conveyors should have a longer stretch of tunnel after the final-rinse arch, so water that otherwise would be carried out of the tunnel can flow back into the sump and be reclaimed and reused in the vehicle-wash system.

Towel drying is one of the services offered in a full-service conveyor or vehicle-detailing business. In many older car washes, towel-washing sinks were designed to have a constant flow-through of water. A float-ball valve that halts the water flow when it reaches an optimum level is one efficiency measure for such sinks. New vehicle washes should not use flow-through sinks or top-loading washing machines, but should install high-efficiency clothes washers from CEE's Tier 3. A conveyor wash, referred to by the industry as "exterior-only," does not offer drying or detailing services. A visual inspection is recommended to confirm whether a vehicle-wash system is a full-service or exterior-only conveyor.

Recommendations

Proven Practices for Superior Performance

- Vehicle-wash-water reclaim systems should, at a minimum, provide water to the pre-soak, undercarriage, and initial wash cycles.

- When present, towel washers should be front-loaded, high-efficiency machines with a CEE rating of Tier 3.
- Spray nozzles on arches should produce a fan-shaped spray, oriented parallel to the arch.
- Gun-type undercarriage nozzles should be limited to use of reclaim water.

Additional Practices That Achieve Significant Savings

- Friction components, such as mitters or brushes, should be used in every conveyor vehicle wash for pre-soak and/or wash cycles.
- Water reclaim systems should have sufficient filtration capacity to provide for use of reclaimed water in all cycles except final rinse.
- In-bay automatics that include a spot-free rinse option should use deionization equipment, rather than water-softening or reverse-osmosis systems, and reject water should be piped to a reclaim-system tank.

In-Bay Automatic Vehicle Washes

With in-bay automatics, the customer stays in the car, while the car remains stationary within the car-wash bay during the process. The carwash equipment is mounted on a gantry, which moves over or around the car. In-bay automatics can use either spray nozzles or brushes or a combination of both to wash the vehicle. In-bay automatics also have the greatest variety in basic design, with some machines comprising an entire moveable arch and others having vertical and horizontal arms suspended from the gantry. Yet other designs include spinning arms that are attached to the gantry. The actual wash machinery can vary considerably. Some in-bay automatics move an entire arch over the vehicle, others rotate an arm around the vehicle, and some include spinning arms. In-bay automatics that use brushes typically have spinning bars that roll over and alongside the vehicle.

The number, size, and alignment of nozzles; the water pressure; and the speed of the machinery all affect the water use of in-bay automatics. The number, size, and alignment of nozzles can be specified in design guidelines. Water pressure and speed are operational considerations.

As with the conveyor vehicle-wash, in-bay automatics that use brushes or cloths use less water than frictionless or “touch-free” washes. Some in-bay automatics also reduce water use by employing laser sensors to identify the length of the vehicle being washed, limiting the gantry movement and timing of the wash based upon the sensor signals.

In an in-bay automatic system, all water flows to one pit, and all chemicals mix together. Therefore water reclaim systems can be more costly and a bigger challenge to maintain than in conveyor carwashes.

Recommendations

Proven Practices for Superior Performance

- In-bay automatic vehicle-wash systems should provide reclaimed water to the pre-soak, undercarriage, and initial wash cycles, at a minimum.
- Spray nozzles on arches should produce a fan-shaped spray, oriented parallel to the spray bar.
- Gun-type undercarriage nozzles should be limited to use of reclaimed water.

Additional Practices That Achieve Significant Savings

- Friction components, such as mitters or brushes, should be used for wash cycles in every in-bay vehicle wash.
- Reclaim systems should have sufficient filtration capacity to provide reuse water for all cycles except the final rinse.

- In-bay automatics which include a spot-free rinse option should use deionization equipment, rather than water-softening or RO systems.
- Where RO is used, the reject water should be returned to the recycle system or otherwise be reused in the washing process.

Self-Service Vehicle Washes

Self-service vehicle washes are typically coin-operated and have spray wands and brushes operated by the customer. This same equipment is often found in truck washes, and some dealerships or fleet operations also use spray-wand and brush technology. A typical commercial self-service facility with four-to-six wash bays will have an equipment room where water is mixed with cleaning chemicals and where pumps and treatment equipment are housed. The customer controls whether and for how long low-pressure or high-pressure settings are used. Thus, the vehicle wash owner/operator does not have direct control over water use at the facility. The owner/operator can, however, help reduce water waste by installing the most efficient nozzles.

Self-service vehicle washes use the least water on average per vehicle. This can be attributed to the direct relationship between water use and price in the self-service vehicle wash: the longer the customer runs the wash, the more expensive the service, since they are charged by the minute.

Self-service operators sometimes find evidence of oil dumping or larger debris, like yard waste, in the wash pits. This can occur because customers wash their own cars unattended. In addition to water used in the pre-soak and wash cycles, many self-service operations also offer a spot-free rinse. As with in-bay automatics, reject water from the RO unit can be used in landscape watering, where landscape exists.

Due to the relatively low potential water savings and the potential for organic materials and debris to foul the filters, water-reclaim systems are seldom cost-effective in a self-service vehicle wash. Where zero discharge is required by regulations, self-service operators have installed reclaim systems, but have also hired on-site staff, thereby increasing the cost of doing business.

Recommendations

Proven Practices for Superior Performance

- Based upon pump design, optimum operating pressure nozzle flow-rate should be no more than three gpm.

Additional Practices That Achieve Significant Savings

- Self-service carwashes that include a spot-free rinse option should use deionization equipment, rather than water-softening or RO systems.
- Where RO is used, the reject water should be routed to landscape or used in the wash cycle.

Advanced Water-Reclaim Vehicle Washes in Industrial Settings

This section deals with the following kinds of businesses:

- cement plants, quarries, concrete, and asphalt operations
- bus- and truck-washes in non-public facilities

Conveyor Washes

In addition to the savings already mentioned for conveyor washes, a full-reclaim system can be installed. These have additional filtration for rinse water. They can also be designed so the pit extends outside the

edge of the tunnel, and the driveway and roof gutters direct rainwater into the pit, thus providing rainwater as an alternative water supply.

These types of conveyors can be built in commercial settings, but safety considerations typically preclude their use except on private property. Because the pit would extend outside the area of the tunnel, safety should be improved by placing a steel grate above the pit to prevent workers from accidentally falling in.

Stand-alone Arches and Spray Wands

Some outdoor vehicle washes in industrial or commercial settings restrict public contact and use a single arch to rinse off the vehicle prior to returning it to the public right-of-way. These washes, built on private property, can use aerobic biotreatment in open pits which capture both the wash runoff and the rain that falls on the pit, the pad, and the paved area around the pad. Such "total" reclaim systems can also be designed or used for tire-washing, which reduces entrained dust on vehicles leaving quarries and other industrial facilities.

Water-Savings Potential

The ICA's *Water Use in the Professional Car Wash Study* found that conveyors with water reclaim systems used an average of 49.6 gallons per vehicle, of which 23.7 gallons were reclaimed water. The study also found that in-bay automatics with reclaim systems used an average of 64.0 gallons per vehicle, of which 33.5 gallons were reclaimed water. The California Urban Water Conservation Council analysis of vehicle-wash BMPs indicates an approximate savings of 10 percent for certification programs which require low-flow nozzles on self-serve vehicle washes.

Cost-Effectiveness Analysis

Example: A water reclaim system in a conveyor-type wash, which treats all water except hand-preparation, clear-coat sealant, and final rinses (or approximately 80 percent of a typical wash):

- Equipment capital costs: $35,000 per reclaim system.
- Estimated equipment life: 10 years.
- Water savings: Approximately 20 percent of previous year's water use at 3,190,000 gallons, for a savings of 2,552,000 gallons. Estimated savings on water and sewer are $12,760. Cost of operating the systems is approximately $400 per year.
- Incremental benefit of efficient equipment: 78.3 AF savings over the life of the equipment. Estimating the cost of equipment financed over 10 years at 8 percent interest, the annual savings due to water and wastewater reduction is $7,260. The benefit is $927 per AF saved.

Recommendations

Proven Practices for Superior Performance

- Vehicle washes for buses and other commercial vehicles should have filtration systems sufficient to allow all wash and rinse cycles to use reclaimed water.
- Wash pads, parking and staging areas around vehicles, and tire-rinse systems at industrial sites should be designed to capture rainfall and wash water for reuse.

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