



Cleaning Porous Asphalt Surfaces

The Road to Cleaner Water May Be Paved with Porous Pavement

Abridged from a study by Thomas P. Ballestero, Joshua Briggs, Robert M. Roseen, and James P. Houle of the University of New Hampshire Stormwater Center

The use of powerwashing equipment has long led to the need for wastewater collection systems. Now, the use of a particular wastewater collection system—pervious pavement—is leading to the increased need for powerwashing equipment.

Stormwater management has exhibited phenomenal growth over the past decade, primarily motivated by the Clean Water Act's requirements to address non-point source pollution. This growth has created an explosion in technologies to remove contaminants from stormwater runoff. One such technology that has been around for decades but has lately gained increased attention is the permeable pavement system.

Pervious pavement systems consist of a porous surface course that lies over one or more porous media

layers. A filtering porous media layer provides water quality treatment. Stone course layers can be used for storage, and stability layers can be used to ensure separation of layers. Plastic-reinforced turf grids, concrete pavers, pervious concrete, and porous asphalt (PA) all may be used for the pavement surface (Ferguson 2005). The permeable pavement surfaces block most of the sediments in stormwater from entering, but let the water pass through the surface.

After some time, the permeable pavement needs maintenance or the pavement slowly becomes impermeable through clogging of the pores. Sediment is the most common and ubiquitous form of stormwater runoff contaminant. However, as technologies remove sediment from stormwater, the collected residue must then be periodically removed from the technology;

otherwise the technology ceases to function properly.

Since proper maintenance is imperative for the pervious pavement to properly function long-term, and because of the mixed record of stormwater management practices, the University of New Hampshire Stormwater Center (UNHSC) studied the effectiveness of four commercially-available cleaning methods: hand tools, yard vacuums, a commercial vacuum truck, and a pressure washer. (See sidebar for specifics on the study.)

The most effective cleaning (unclogging) treatments were all associated with the pressure washer. The porous asphalt cleaning study showed that infiltration capacity—i.e., the ability of the pavement to absorb and drain water—can indeed be restored to clogged or partially clogged pavements, making this a potential market for both power washing equipment distributors and contractors.

Cleaning Tips and Techniques

The pressure washer, employed with high and low pressure nozzles at roughly a 10 to 15 degree angle to the pavement, was the single most important factor in unclogging sediments. Steeper angles drove sediments further into the pavement, which was not desirable.

The high pressure nozzle more rapidly cleared sediments from the pores than the low pressure nozzle, but during washing, a high proportion of sediments were spread in a radius approaching 10 meters (blast-effect). The high-pressure nozzle may also have driven some sediment into the pavement, which would eventually lead to more clogging.

The low pressure nozzle successfully cleared pavement pores by driving sediment-laden water in waves toward the simultaneously employed shop vacuum nozzle, placed in a local low spot. There was little-to-no unintentional spread of sediment with the low pressure nozzle, an important feature since disposal of clogging materials may be regulated.

The most effective cleaning treatment combination—soap with soak time of at least five minutes, followed by simultaneous low pressure corraling of sediment-laden water towards a shop vacuum—

The UNHSC Test

The UNHSC selected a testing area on the University of New Hampshire parking lot that had not been cleaned in three years. Some areas were beginning to exhibit significant reductions in infiltration capacity even though, as a whole, no surface runoff ever occurred on the lot. Infiltration was measured before and after cleaning to compare the effectiveness of treatments.

Four cleaning methods were used during the test:

- Hand tools—including a push broom, flat head shovel, and shop vacuum to remove surface debris, loosened debris in pavement pores, and suspended sediments in water;
- Yard vacuums—with mesh or cloth collection bags; one had higher power and an adjustable intake nozzle;
- A commercial vacuum truck; and
- A medium-duty pressure washer—with various nozzles and environmentally-friendly detergent.

Various treatments or combinations of treatments were evaluated based on the literature review and engineering judgment. Initially the site was partitioned for different non-overlapping treatments, but it became clear that more sediment could be removed with successive treatments of the same area, especially when some methods were found to be more effective than others. Infiltration testing was conducted and photographs taken before, during, and after treatments. Sediment mass recovery was another measure of treatment effectiveness.

The Results

- **Hand Tools:** The testing found that hand tools were efficient for picking up both wet and dry litter and debris. These tools also worked well in sediment removal of concentrated loose debris. The tools generated little dust and we were able to recover relatively large volumes of materials. However, hand tools are not a feasible option for sites with excessive debris, especially distributed over a large area, or with loose debris in pavement pores.

The shop vacuum (SV) was highly effective for cleaning relatively large volumes of concentrated, loose debris. It picked up debris, wet and dry, from silt to gravel range, without generating dust, as there was full recovery of sediments without blow-by.

- **Yard Vacuums:** The smaller yard vacuum (BG1), when operated dry, created a “dust storm,” as there was no mechanism for dust control built into the machine, which was designed as a yard (leaf) vacuum. A significant proportion of the debris shot out the gaps in the mesh bag and through various gaps in the machine and were redeposited on the pavement surface.

The larger yard vacuum (BG2) had three distinct advantages over the smaller unit: the intake nozzle was adjustable and could create a good seal with the pavement; the engine (6.5 hp) was more powerful; and it had three drive-gears. The BG2 was operated dry, moist, and in standing water. Dry operation was similar to the BG1 with excessive dust generation. When operated in standing water (shallow puddles), the BG2 was highly effective at removing all standing sediment-laden water. The majority of water and associated sediments, however, were ejected through holes in the mesh bag and various holes in the machinery, unacceptably splattering the operator and everything within a three-meter radius.

When operated on moist pavement at full suction with the intake nozzle flush to the pavement, the BG2 was fairly effective in removing loose sediments with little blow-by in this mode. The BG2 had difficulty in capturing debris larger than fine gravel and could not unclog fine sediments.

- **Vacuum Truck:** The commercial sweeper vacuum truck, at full suction (1,800–2,000 rpm) and operating with the center feeder broom, removed more debris than the hand tools or yard vacuums, picking up loose debris that the other tested methods did not remove. It still could not fully unblock deep-clogging sediments, although its effect reached deeper in the pores than other vacuum technologies. When operated in conjunction with the onboard pressure washer wand, it successfully unclogged pores embedded with fine sediments. However, once it became clear that much of the debris and turbid water generated from the unclogging operation was discharging from the exhaust port on the rear of the truck, this practice was discontinued.
- **Pressure Washers:** The most effective cleaning (unclogging) treatments were all associated with the pressure washer.

showed a 94.8 percent increase in infiltration capacity. This is a preferred treatment since there is little-to-no unintentional spread of sediments.

When cleaning pervious pavement, keep the following additional tips in mind:

- Consider the level of effort required, and prioritize areas critical to the function of the entire lot.
- Remove loose sediment and debris first with a shop vacuum and broom/shovel.
- Treat clogged areas by working from the high points to low spots.
- Apply a benign detergent onto clogged pavements and soak for several minutes.
- Corral suspended sediments in soaped areas with water from a pressure washer in low pressure mode with nozzle angled towards local low spots, with simultaneous shop vacuum extraction of water and suspended sediments.
- Do not pressure wash with a high-pressure nozzle before other treatments have been exhausted.
- Do not operate a pressure washer when there are other vehicles on the lot, since there may be unintentional splatter of sediments or sediment-laden water.
- Modify cleaning treatments if anything is damaging the

pavement structure or loosening stones from the mix.

- Regularly observe sediment loading, and schedule cleaning as needed; it is much easier to remove loose sediment before it becomes clogging sediment.

Additionally, knowledge of how the pervious pavement system works can help a contractor or distributor take the best care of his customer's paving. The following general considerations should be considered before approaching customers who need to clean their porous asphalt and pervious concrete:

- Cleaning recommendations are made for porous asphalt and pervious concrete, which have similar interconnected pore structure and air void content. Treatments for other permeable pavements should be applied with caution, since sediments may be part of the pavement structure.
- No amount of cleaning can unclog pavement that initially has low infiltration capacity due to issues with mix design, mix production, or construction.
- Clogging can, in most cases, be determined by close examination and observing water poured on the pavement: "If it looks clogged, it probably is."

- Good site design and construction can significantly limit the introduction of sediments onto the pavement surface that may eventually lead to clogging.
- A well-designed and built lot will still function if some areas become clogged.
- Accept that a certain level of clogging will occur; the site may still function as intended as long as the majority of the pavement is prevented from clogging.

Finally, additional factors to consider in selection of cleaning treatments for porous asphalt and pervious concrete include lot size, degree and type of clogging, treatment effectiveness, cost, time, manpower, equipment availability, access to water and power, disruption to parking, unintentional spread of sediments, and disposal of captured sediments.

Ideally, preventative cleaning should be done at least twice annually, and should be specific to the sediment loading and usage. A pressure washer can play a valuable role in removing sediment which has infiltrated the pore system and has begun to interfere with the pavement's ability to receive and filter water.

Additional information on several aspects of this study is available in the full study posted at www.cleanertimes.com.

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