Porous Concrete Sidewalk Cleaning Trial
Using a Pressure Washer

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What We Did

The City of Olympia installed a porous concrete sidewalk in 1999. No maintenance was performed on the sidewalk during the first four years after construction. In 2003 the surface of the concrete showed significant clogging. Very few voids were visible due to the debris filling the surface voids. In high leaf and needle litter areas, moss was growing on the concrete.

How did it do?

The pressure washing worked extremely well; all of the surface debris has been removed. (We have not done any coring to see if material was forced into the concrete). The surface looks to be in new condition, equivalent to when it was first built. Some minor sections of loose rock were removed during washing. The loose rock was more common along the edge with the curb and in patches of poor quality concrete. In my opinion, this indicates that the edge along the curb is not getting rolled well or is drying too fast, which results in lower strength.

The data: The sidewalk is 1,500 feet long, 5.5 feet wide. It took 41 man-hours of pressure washing to get it clean. Potable water from fire hydrants was used, along with gas powered 11 Hp pressure washers. Conventional nozzles did a very poor (slow) job of removing debris. A hydro scrubber attachment was very good about loosening the debris but left the material still on the surface of the concrete. A second washing with a conventional nozzle was required to remove the material. The best attachment for loosening and removal of the debris was a power head cone nozzle. This attachment produced a cone of water by rotating the nozzle.

Conclusions

Pressure washing is a very effective means of removing the surface material trapped in the voids. It is unclear how much of the material was forced deeper into the pervious material. If material builds up at a deep level this may permanently clog the pavement. The pressure washing is expensive. I estimate with labor at $35/hour the cost is $1.60/SY.

Photos

1. Sidewalk Before Pressure Washing - This is moss growing in voids.
2. Pressure Washing Sidewalk – It is a slow operation.
3. Hydro Scrubber – Good at loosening debris.
4. Power Nozzle – Produces Cone Spray – Good for cleaning the surface.
5. Cleaned Porous Concrete Sidewalk.
Photo 1. Sidewalk Before Pressure Washing - This is moss growing in voids

Photo 2. Pressure Washing Sidewalk – It is a slow operation
Photo 3. Hydro Scrubber – Good at loosening the moss

Photo 4. Power Nozzle – Produces Cone Spray – Good for cleaning the surface

Photo 5. Cleaned Porous Concrete Sidewalk
Porous Concrete Sidewalk Cleaning Trial
Using a Sidewalk Sweeper

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July to August 2004

What We Did

The City of Olympia installed a porous concrete sidewalk in 1999. The surface was pressure washed in 2003. A year and half after the initial cleaning, the sidewalk was cleaned with commercially available sidewalk cleaning equipment.

The trial was performed with a Tennant 6400 power sweeper, a Power Boss Badger SW/6XV sweeper and a Green Machine 525 HS. The Tenant and Power Boss machines sweep the surface with a horizontally mounted brush the full width of the sweeper. Both machines use a vacuum system that applies a vacuum to the brush area for dust control. The vacuum is not directly applied to the surface. The green machine has two vertically mounted edge brushes and a center vacuum mounted parallel to the surface. The concept is that the edge brushes bring material into the vacuum slot. The vacuum slot is narrower than the width of the machine and vacuum is not applied directly to the surface.

How did it do?

The Tennant and Power Boss did a fair job of removing material from the surface of the porous concrete. Neither machine cleaned deep into the concrete pores. There were still some pine needles lodged in the surface voids after cleaning. The operations are quick and one can work at a walking pace. Both machines required two passes to clean the entire sidewalk width.

The Green Machine did not do a very good job of cleaning the porous surface. The edge brooms were able to move material to the center of the machine, but the vacuum is not applied in a way that allows the machine to pick up pin needles from the surface.

Conclusions

Commercially available sweepers provide a reasonable level of cleaning for porous concrete sidewalks. To be effective the sweeper must have a horizontal broom with a vacuum dust control system. The sweepers are able to clean at a much faster rate than pressure washing but do not clean as well as pressure washing. A sweeping program that uses these machines should reduce the frequency between sweeping to a point where material does not penetrate deep into the concrete pores. Given the speed of operation, these sweepers provide a lower cost sidewalk-cleaning program than pressure washing.
Photographs

Photo 1. Sidewalk Sweeping - Left side un-swept, right side swept with Tenant Machine

Photos 2 and 3. Tennant 6400 power sweeper, a Power Boss Badger SW/6XV sweeper
Porous Concrete Sidewalk Cleaning Trial  
Using a Hard Surface Cleaner

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June 28, 2006

What We Did

The City of Olympia installed a porous concrete sidewalk in 1999. The surface was pressure washed in 2003. Three years later the surface of the concrete was again showing signs of clogging. Pine needles were lodged in the surface voids and there were visible dirt accumulations within the surface voids. A section of the porous concrete was cleaned with a hard surface cleaner.

The hard surface cleaner trial was performed by Belarde Company, Seattle, (206) 510-2325. They used a Prochems rotary spray jet hard surface cleaning tool. A hard surface cleaner sprays a rotating jet of hot water under high pressure at the surface of the sidewalk. A vacuum retrieves the water and debris.

An Everest drive unit powered the hard surface cleaner. The drive unit had a 46 HP engine and generates 405 CFM at 13-in hg with water at 3000 psi and a flow rate of 5 gpm.

How did it do?

The combination of hot water, pressure washing the surface, and vacuum retrieval did a very good job of cleaning the porous concrete sidewalk. On the coarse, textured concrete the cleaning was not able to remove 100% of pine needles and the effective cleaning depth was about one-quarter of an inch.

The hard surface cleaner was not able to remove large piles of leaf or other litter on the sidewalk surface. The surface must be sweep free of loose material to start the cleaning.

The production rate on the cleaning is equivalent to that of pressure washing. The set up time and limits of the water supply hose and vacuum hose lengths lower production rates. The equipment needed to do the cleaning is large, and the power unit and storage tank required an 8- by 10-foot box trailer. The equipment is not very portable and obstruction of travel lanes will be required for most applications.

The vacuum retrieval of the spray water is far superior to pressure washing alone. The retrieved water was black in color upon discharging. There was a lot of fines/dirt in the retrieved water. Pressure washing alone removes the large debris but forces this ‘dirty’ water into the porous concrete. During the trial, 75 gallons of water was used and about 50% of the water was collected in the return tank. The other 50% entered the porous concrete.

Conclusions

Hard surface cleaner is better than pressure washing, but has the same limitations as pressure washing. Slow production rates result in an operation that is expensive to perform.
I feel the vacuum component reduces the amount of debris that is forced lower into the pores of the pavement, possibly resulting in longer life for the pavement.

Photo 1. Cleaning Head
Photo 2. Hard surface cleaner operating.
Photo 3. Left side uncleaned, Right side cleaned
Porous Concrete Sidewalk Cleaning Trial
Using a Leaf/Litter Vacuum Machine

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September 2006

What we Did

The City of Olympia installed a porous concrete sidewalk in 1999. The surface was pressure washed in 2003 and swept in 2004. After a year and a half of no attention, the sidewalk was cleaned with a leaf/litter vacuum machine. Another section of percocrete pervious sidewalk was also cleaned at the same time. The cleaning was performed with a Minuteman Parker Vac-35. This machine applies a vacuum directly at the surface to be cleaned. There are no brushes or scrubbing of the surface. The machine is self-propelled and operates at a walking pace.

How did it do?

The vacuum machines did a great job of removing loose debris on the sidewalk surface and of removing material from the surface voids. The machine operates quickly and was able to collect a large amount of material in a short time. We collected about 100 pounds of material in 30 minutes. The vacuum machine does a better job of cleaning the surface voids then the sweeping machines tried on the same material. The vacuum machine was also effective on the percocrete porous concrete.

We encountered several problems during the trial work:

1) The vacuum machine had a tough time ingesting leaf piles when they were more than 2 to 3 inches thick. One section of sidewalk is confined on the backside; this results in a strip of deep leaf piles. The vacuum machine had to be slowed down and worked around to collect the piles of leaves.
2) The debris collection bag is the exhaust for the air from the vacuum head. As the bag fills, there is less room in the bag for air resulting in back pressure and less suction force. The bag should be emptied when half full.
3) The particular machine we used generated a lot of dust when emptying the bag. The design of the machine made changing the bag difficult.

Conclusions

Leaf/Litter vacuums are a very effective way to clean porous sidewalks. To be effective, the vacuum must be applied to the cleaning surface. The machines operate quickly and effectively. When making a machine choice, one should consider how easy it is to empty the debris collection bag. Leaf/Litter vacuums are more effective than sweepers with dust control vacuum systems.

Any sidewalk cleaning program which uses these vacuum machines should probably also include a pressure washing component in the program to restore porosity if debris migrates lower than the level at which the vacuum machines can remove the material.
Photographs

Photo 1. Minuteman Parker Vac-35
Photo 2. One side cleaned with vacuum machine
Photo 3. Close up of cleaned and un-cleaned porous sidewalk.