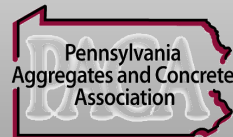


PACA Product Information Sheet

PERVIOUS CONCRETE



*Operations
and
Maintenance
Practices*





DEFINITION

Pervious concrete pavement is a rigid permeable pavement that is the surface layer of a stormwater

management system. The pervious concrete surface layer is a horizontal plane that is permeable to water and air. The second layer of the stormwater system is an open-graded, angular stone layer that is used for temporary stormwater detention. In most cases, where soils contain silty clays, the stone detention layer may be wrapped in a geotextile fabric or a pervious liner to prevent soils from migrating into this stormwater storage layer. An alternate method to prevent fines entering the detention layer of stone, is to install geotextile along all vertical edges of the detention layer, and install two inches of clean sand along the bottom. The pervious concrete filters sediments and pollution from stormwater deposited on the pavement surface and these sediments must be removed by vacuuming in the Fall to maximize permeability in the Winter, and to minimize opportunity for freeze thaw expansion of moisture trapped within the surface sediments.

Since this permeable surface is a filter, like any filter, it must be cleaned periodically. Cleaning is performed by vacuuming to remove sediments that have accumulated. The frequency of the vacuuming is directly related to the amount of sediment that the surface receives over time.

The following chart can serve as a minimal recommendation for scheduled maintenance.

ACTIVITY	SCHEDULE
Avoid sealing or repaving with impervious materials.	N/A
Inspect pervious pavement area to ensure that it: <ul style="list-style-type: none"> • is clean of debris • dewateres between storms • is clean of sediments 	Monthly
Mow upland and adjacent areas and seed bare areas. Vacuum/sweep to keep the surface free of sediment.	As needed
Inspect the surface for deterioration or spalling.	Annually

Table 1: Typical maintenance activities for pervious concrete pavement. (Adopted from Watershed Management Institute 1997)

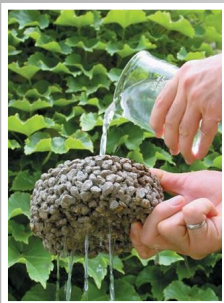


DESIGN

Proper design is the best method to reduce maintenance intervals. The pervious concrete pavement should be designed to minimize runoff from other surfaces that could contribute large amounts of sediments, and designed as flat as possible to minimize

movement of sediment deposited on the surface over a larger area of the surface. The stone detention layer may be extended past the edges of the pavement to allow stormwater from adjacent areas to enter the storage layer without introducing sediments into the surface of the pavement. The geotextile fabric should be used to protect the stone layer. Swales and other design techniques are also available to prevent sediment laden stormwater from adjacent areas from flowing onto the pervious surface.

The most critical period to prevent clogging of pervious concrete pavement is during and immediately after construction. Many sites that have become clogged have become so from large amounts of nearby unstabilized soil running onto the pavement. Appropriate erosion control techniques should be in place to prevent loose soil from clogging the surface until surrounding areas are vegetated.



PERIODIC MAINTENANCE

The first step in creating a maintenance plan is to develop a baseline infiltration rate for your pervious concrete system. ASTM C1701⁽¹⁾ is the procedure used to determine the infiltration rate of pervious concrete. Performing an initial ATSM C1701 test for a baseline is best done the



Pervious Concrete: Post-maintenance



Pervious Concrete: Pre-maintenance

day that the plastic curing is removed. The pavement has not been in service yet, so it will perform at its optimum. ASTM C1701 requires three test procedures to be performed for every 10,000 square feet and an average taken of the three tests. This will be the baseline for comparison of all future tests.

Semi-annual inspections (Spring and Fall) using the ASTM C1701 test procedure, should be

performed to determine when maintenance services are necessary. Typically an average infiltration rate decrease of 25% from the initial value triggers pre-selected maintenance activities. However, ASTM C1701 can also be performed on a case-by-case basis to identify clogged areas or to determine an optimized cleaning pattern.⁽²⁾



CLEANING EQUIPMENT

Regular cleaning should be done with vacuuming equipment that can be adjusted to

1/2" above the slab surface. Smaller projects can be cleaned with walk-behind units. There are riding vacuum machines available for medium size projects. Large scale projects can be cleaned with vacuum trucks. Cleaning equipment should allow for the debris to be bagged and removed from the unit so it can be weighed. A maintenance log should be kept on the project with:

- ASTM C1701 test results before and after the cleaning with a simple drawing of where these tests have been performed.
- The amount of material in pounds that was removed when cleaned.



ASTM C1701

- Observation describing the nature of the material that has been removed and description of the overall condition of the pavement.





CLEANING A NEGLECTED SYSTEM

If a pervious concrete system is not periodically cleaned, over time, the void structure system will plug with debris. Equipment manufacturers have developed vacuum/pressure washing systems that have proven to rehabilitate the pore structures. In attempting to rehabilitate a system, the first thing that needs to be done is the ASTM C1701 test procedure to determine a

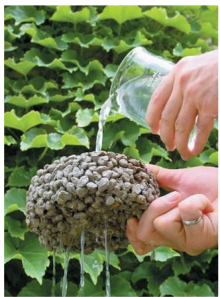
baseline for comparison to areas that you clean. Neglected projects that had never been cleaned and were completely plugged solid have been restored to a drainage rate of 100-200 inches per hour using specialized vacuum/pressure washing equipment.



Cleaning pervious concrete



Cleaning pervious concrete



WINTER MAINTENANCE PROCEDURES

Winter maintenance issues affect pervious concrete the same as

standard concrete. Deicing chemicals should not be used on any type of concrete in the first year. The most chemically damaged concrete parking lots and driveways are those that are placed late in the year. Concrete that is not fully cured is more susceptible to damage from deicing chemicals. Concrete takes longer to cure in lower temperatures, thus resulting in more chemical damage when concrete is placed late in the year. Some local jurisdictions in Pennsylvania now have codes prohibiting sidewalks from being placed after a specific date in the Fall of the year.

The following recommendations should be followed:

- No deicers containing Magnesium Chloride should ever be used.
- Calcium Chloride impregnated sand is allowed after the first year.
- Sand can be used as an anti-skid material with the understanding that vacuum cleaning will be performed after the winter season.
- Snow plowing can be performed with trucks mounted with plows, but the plow should be fitted with a rubber cutting edge and/or set so that the steel edge is 1/2"-1" from the finished surface. Snow removal should not be performed using front end loaders or skid loaders by either scooping or back dragging.

Where pervious concrete parking areas have been installed at academic institutions, the number one concern of the institutions' facilities managers interviewed is liability. This concern is not limited to academic institutions as the liability of winter safety affects all of us. Facilities managers instruct their maintenance personnel to salt and plow when snow begins to lay on the surface. We suggest holding the plow blade 1/2"- 1" off the surface to keep from damaging the it. In most cases, that minimal amount of snow will melt when the sun comes out or when temperatures even slightly rise. Studies have been conducted⁽³⁾ using thermo-couples located under pervious concrete



slabs. These studies have been conclusive in showing that the ground does not freeze under the system due to the insulation properties of the air space in the aggregate base. This also allows the heat from the ground to rise and helps in the melting of the 1" of snow. Once the snow melts, it infiltrates into the pervious concrete and does not refreeze on

the surface as it does on an impervious surface. This is very beneficial to the facilities managers who are concerned about safety factors and liability.

Pervious concrete should *never* be used as a storage area to pile snow from other areas. The snow that has been plowed from other surfaces is now full of debris that will clog the pervious concrete voids. The plowed snow will most likely have a very high salt or anti-skid content.

Pervious concrete is part of a stormwater management system.

If water does not infiltrate through the void structure, the system does not work!

References

- (1) ASTM C-1701 "Standard Test Method for Infiltration Rate of In Place Pervious Concrete" Annual Book of ASTM Standards 4(2), 2009, West Conshohocken, PA ASTM International
- (2) Kevern, J.T. "Operations and Maintenance of Pervious Concrete Pavements, TBR#11-0656 November 15, 2010
- (3) Kevern, J.T., Schaefer, V.R., and Wang, K. "Temperature Behavior of a Pervious Concrete System. Transportation Research Record: Journal of the Transportation Research Board(TBR), Construction 2009 No. 2098.

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