When we take care of the earth,
it will ultimately take care of us.

BOSTON
35 Commerce Dr.
Uxbridge, MA 01569
Tel: (508) 278-4536
Fax: (508) 278-4572

BUFFALO
510 Smith St.
Buffalo, NY 14210
Tel: (716) 822-6074
Fax: (716) 822-6076

CHICAGO
301 E. Sullivan Rd.
Aurora, IL 60505
Tel: (630) 892-9191
Fax: (630) 892-9215

CLEVELAND
12560 Sheets Rd.
Rittman, OH 44270
Tel: (330) 927-4000
Fax: (330) 927-4100

DETROIT
12591 Emerson Dr.
Brighton, MI 48116
Tel: (248) 437-7037
Fax: (248) 437-4619

MILWAUKEE
W 4814 Country Hwy A
Elkhorn, WI 53121
Tel: (262) 742-3890
Fax: (262) 742-2168

NEW YORK
51 International Blvd.
Brewster, NY 10509
Tel: (845) 278-6700
Fax: (845) 278-6788

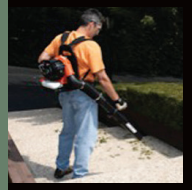
CHESTER
26 Tetz Rd.
Chester, NY 10918
Tel: (845) 469-1230
Fax: (845) 469-1213

PHILADELPHIA
229 Route 541 Bypass
Lumberton, NJ 08048
Tel: (609) 914-0000
Fax: (609) 914-0209

TORONTO
287 Armstrong Ave.
Georgetown, ON L7G 4X6
Tel: (416) 646-9000
Fax: (905) 874-3034

www.unilock.com | 1-800-UNILOCK






PERMEABLE PAVER
MAINTENANCE GUIDE

UNILOCK®
DESIGNED TO CONNECT.

UNILOCK®
DESIGNED TO CONNECT.

This guide is specific to Unilock® permeable pavers as a maintainable system for storm water runoff and does not cover cleaning concrete pavers themselves. Please see the Unilock Product Care and Maintenance Guide (available for download at www.unilock.com) for information on cleaning concrete pavers. The maintenance information in this guide is intended for Unilock permeable paver systems only and not for other types of permeable pavers or pervious systems.

Maintenance is necessary for any type of permeable pavement system, much like any impervious pavement with catch basins and underground infrastructure. Over the lifetime of the permeable paver system there will be a need to clean any sediment, soil, dirt and debris from the joint aggregate material to maintain a sufficient infiltration rate. Every project will vary in performance needs, as well as to the frequency in which the joint material must be cleaned. The surface infiltration rate must be greater than the regional 100 year rainfall intensity to adequately ensure no runoff is generated, which is only one goal for using permeable pavers. Unilock® suggests establishing a maintenance plan using the techniques in this document to prevent clogging.

PRECEDING MAINTENANCE

Before providing maintenance on permeable paver systems, proper installation and protection during construction is required. Here are a few conditions to observe, require and prevent for establishing a successful system:

1. Verify correct installation and materials:
- Hire contractors with knowledgeable experience installing permeable pavers.
- Review and approve all sub-base, base and joint aggregate materials.
- Do not allow sand and dense-graded aggregates.

2. Prevent construction damage:
- Limit subgrade soil compaction when infiltration is necessary.
- Restrict vehicles with muddy tires from driving over newly placed pavers.
- Do not mix aggregate materials.

3. Refill joint material:
- Once, between 3 and 6 months after initial installation.
- Repeat as needed - approximately every 5-10 years.

4. Avoid stockpiling of materials such as:
- Topsoil.
- Mulch.

The proper materials and installation execution can be found in the Unilock specifications for permeable pavers. Both residential and commercial projects will utilize the same base, setting bed and joint aggregates. Some projects many not require sub-base materials, underdrainage or geotextile. It is not necessary to separate the setting bed from the base aggregates with a geotextile.

EXAMPLES OF COMMON MAINTENANCE ISSUES

Below are several warning signs and visual clues of common maintenance issues which must be prevented and addressed or remediated to ensure continued surface infiltration.

1. Slow Draining/Runoff:
- Verify with simple infiltration testing or observe after rain storms.
- Surface should drain immediately.

2. Ponding and Bird Baths:
- Rule of thumb: if more than a nickel deep one minute after a rainfall event, maintenance is necessary.
- Verify correct materials were installed.
- Exceptions at bottom of slopes.

3. Surface Crusting:
- Identify if there is a problem such as run on sediments.
- Increase cleaning frequency in troubled areas.
- Remove debris immediately.

4. Weeds:
- Weeds will not germinate unless there is a collection of soil or moisture.
- Remove weeds immediately.
- Clean sediment from joint material.
- Chemical treatment may be required prior to maintenance removal.

5. Covered Joint Material:
- Identify problem and correct.
- Remove immediately.
- Joint material should appear as photo on right.

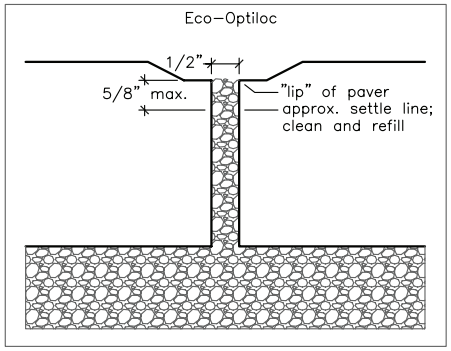
These common problems can often be easily remedied by maintaining the proper joint aggregate level.

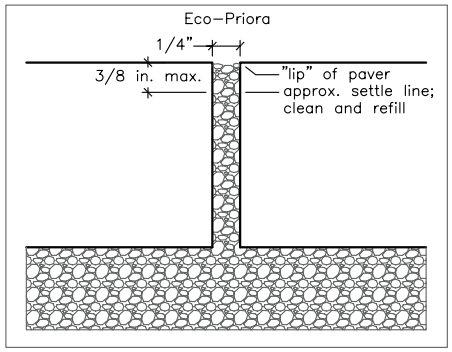
MAINTENANCE TYPES

There are two service types for maintaining the integrity of a permeable paver system.

1. Preventative – removes most miscellaneous debris before being trapped in the joint aggregate material causing clogging. This usually does not require removal of any joint material to restore infiltration.

2. Restorative – requires some removal or complete removal of the joint material to renew infiltration. Occurs after miscellaneous debris has been captured and lodged in the joint aggregate.





*__Note:__ *Both maintenance types will be most effective when the joint aggregate material is filled to the "lip" of the paver. If the joint material has settled more than the joint width, plus 1/8 inch below the paver lip, the maintenance equipment is significantly less effective and potentially more expensive.*

MAINTENANCE EQUIPMENT

Maintenance equipment requirements will vary according to project size, age, and product type.

Project Type 1: For smaller pedestrian type areas such as sidewalks, driveways, plazas, patios or similar:

Preventative:

1. Hand-Held Bristle Broom
- Available at any hardware store.
- Sweep as needed to keep the surface clear of debris.
- Approximate cost: $15.

2. Leaf Blower
- Electric or gas powered.
- Minimum air speed of 120 mph.
- Joint aggregate material will remain in place while removing debris from paver surface.
- Approximate cost: $50 to $300.

3. Rotary Brush
- Poly bristles only.
- Flips debris from joint.
- Will require slight refilling of the joint aggregate material.
- Approximate cost: varies depending on attachment vehicle.

Restorative:

1. Wet/Dry Shop Vacuum
- Minimum 4 HP (peak) motor with 130 cubic feet per minute suction.
- Will remove some joint aggregate material.
- Replenish removed joint aggregate material to "lip" of paver.
- Approximate cost: $50 to $150.

2. Riding Litter Vacuum
- Tennant ATLV 4300.
- 48 inch wide vacuum head.
- 110 gallon capacity.
- Can also be used as a preventative technique.
- Will evacuate most debris from joint except for aggregate material.
- Approximate cost: approx. $25K new.

3. Powerwasher
- Capable of spraying 1,400 to 1,800 psi.
- Spray at a 30 degree angle approximately 18 to 24 inches from the surface.
- Will evacuate joint material.
- Replenish removed joint aggregate material to "lip" of paver.
- Approximate cost: $125 to $500.

Project Type 2: For larger vehicular areas such as roads, parking lots, alleys, plazas or similar that can support vehicles:

Preventative:

1. Rotary Brush
- Poly bristles only.
- Flips debris from joint.
- Will require slight refilling of the joint aggregate material.
- Approximate cost: Varies depending on attachment vehicle.

2. Broom Sweepers

- Typical “street sweeper” type.
- Rotating curb brushes with center pickup.
- Poly bristles only.
- Do not utilize water to clean the surface as this can have detrimental effects on the cleaning.
- Best for seasonal cleaning.
- Approximate cost: $100 to $120 per hour from a service company.

3. Regenerative Air Sweepers

- Light duty suction cleaning.
- Utilizes stream of air blowing horizontally across surface and vacuuming.
- No rotating brushes.
- Approximate cost: $45 to $65 per hour from a service company.

Restorative:

1. Vacuum Sweepers

- Vacall Dynamic Multi-Purpose Vacuum. *(top photo)*
- Elgin Whirlwind. *(bottom photo)*
- Heavy duty cleaning.
- Minimum suction of 14,000 cubic feet per minute.
- Complete evacuation of joint aggregate material.
- Replenish removed joint aggregate material to “lip” of paver.
- Approximate cost: $2.50 to $4.50 per parking space.

2. Powerwashers

- Capable of spraying 1,400 to 1,800 psi.
- Spray at a 30 degree angle approximately 18 to 24 inches from the surface.
- Will evacuate joint aggregate material.
- Replenish removed joint aggregate material to “lip” of paver.

STRATEGIC PROCEDURES FOR MAINTAINING INFILTRATION

Observe and implement the following habitual procedures to ensure longevity of the system.

1. Weekly – prevent contamination from routine landscape maintenance such as grass clippings from mowing, hedge trimming, mulching plant beds, etc. by implementing the following joint opening cleaning procedures immediately after contamination occurs:

- Hand broom debris from the paver surface.
- Blow debris from the paver surface with backpack blower type device, collect and dispose.
- Mechanically sweep paver surface.

2. Monthly – observe any collection areas of debris, dirt, topsoil, mulch, etc. after season events such as snowfall, rain storms, leaf litter, etc. and investigate if clogging is occurring. Immediately restore infiltration using the following cleaning options:

- Break up any crust covering the joint aggregate material with hand broom for smaller areas or mechanically with a rotary sweeper for larger areas. Remove debris material.
- When necessary, restore infiltration using wet/dry shop vacuum for small areas or vacuum truck for larger areas by removing debris from joint aggregate material.
- Replenish joint aggregate material to “lip” of paver.

3. Yearly – establish a seasonal maintenance schedule that includes the following:

- Sweep entire permeable paving surface with appropriate preventative sweeping devices.
- Replenish joint aggregate material to “lip” of paver.

4.Ten years plus – plan long term maintenance to rejuvenate infiltration rates:

- Complete restoration of the joint aggregate material.
- Replenish joint with cleaned or new aggregate material to “lip” of paver.

RECOMMENDED SEASONAL MAINTENANCE SCHEDULE

Unilock suggests establishing a best practices maintenance program to ensure longevity of the systems before restorative action is required. Biannual preventative maintenance is suggested as shown in the schedule below. This includes sweeping once in the early spring and once again in the late fall. Below is a preventative maintenance timeline that includes four maintenance suggestions:

1. After the snow melt – March 1 through April 15

- Broom, blow, rotary brush or sweep entire surface.
- Clean debris from paver surface in location of snow stockpile area.
- Replenish joint aggregate material after cleaning.
- Every fifth year, vacuum or power wash problem areas and refill joint material.

2. Late Spring – April 1 through May 15

- Broom, blow, rotary brush or sweep flowers from trees and shrubs.
- Collect any additional debris from areas mulched or planted with annual flowers.
- Replenish joint aggregate material as necessary.

3. Late Summer – July 15 through August 30

- Broom, blow, rotary brush or sweep lawn and shrub clippings or tree fruits.
- Collect any additional debris from summer activities such as charcoal coals inadvertently dumped on the permeable surface, beach sand, etc.
- Replenish joint aggregate material as necessary.

4. Late Fall – October 15 through November 30

- Broom, blow, rotary brush or sweep plant leaves.
- Replenish joint aggregate material as necessary.

Various factors will affect each project’s preventative maintenance timeline and must be reviewed individually.

See the Recommended Seasonal Maintenance Schedule chart on next page.

Recommended Maintenance Schedule		Seasonal BMP			
		After Snow Melt	Late Spring	Late Summer	Late Fall
Techniques	**Project Type 1: Preventative - choose one**		1x per season	optional	1x per season
	Bristle Broom	**	*	*/**	*
	Leaf Blower	**	*	*/**	*
	Rotary Brush		*	*/**	*
	Project Type 1: Restorative		**		**
	Wet-Dry Vacuum	**	**	**	**
	Riding Litter Vacuum		*	**1x every 5 yrs.	*
	Powerwasher	**	**	**	**
	Project Type 2: Preventative - choose one		1x per season	optional	1x per season
	Rotary Brush		*	*	*
	Broom Sweepers		*		*
	Regenerative Air Sweepers		*		*
	Project Type 2: Restorative				
	Vacuum Sweepers			** 1x every 10 yrs.	
	Powerwasher	**	**	**	**

* recommended

** as needed per Strategic Procedures

WINTER MAINTENANCE AND DE-ICING

Durability is one benefit that Unilock paving stones are known for. Almost all Unilock paving stones have a slight bevel around the edge of the stone. This helps protect the edges from potential chipping by snow clearing equipment. Always use a plastic snow shovel for paving stones. Also fit snow blowers with plastic shoes on the adjustable gliders and on the scoop edge.

When using commercial snow removal companies, confirm in writing they have protective edges on the snowplow equipment to avoid scratching the surface. Although the metal on snow clearing equipment will not adversely affect Unilock paving stones structurally, the contact of any steel on concrete can potentially leave tiny particles of metal in the paver surface which will rust and leave unsightly brown streaks. (A good example of this can be seen on the municipal curbs at the street). To reduce aesthetic damage to the paver surface, only use a polymer or rubber cutting edge on the plow.

De-icing substances, when used in proper amounts, will not damage good-quality concrete. They will, however, speed up the surface wear on some styles of pavers. Many of the exposed aggregate products and tumbled products are unaffected by virtue of their style.

There are three primary types of de-icing salts:

- Sodium chloride (common rock salt) is the most popular de-icing salt. It is widely available and it will melt snow and ice at temperatures down to approximately 16° F. Below 16° F, rock salt stops melting snow and ice. Sodium chloride can damage adjacent grass, plants and metal. Apply with caution and use as sparingly as possible.

- Calcium chloride is another de-icing salt. It generally looks like small, white, round, pellets. It will melt snow down to about 0° F. It can irritate skin. Studies indicate that depending on the concentration, calcium chloride is less damaging to grass than sodium chloride is. Heavy concentrations of calcium chloride can chemically attack concrete.

- Potassium chloride is a de-icing salt available in some markets. It will not hurt skin or damage plants. However, it melts ice only when the air temperature is above 15° F, but it can be combined with sand to improve effectiveness.

Note: *Do not use magnesium chloride.*

Note: *Do not use sand for anti-skid with permeable pavers as it will clog the joint material.*

Note: *Fertilizers that contain ammonium nitrate and ammonium sulfate should not be used for de-icing since these substances attack the integrity of concrete. Always read the manufacturer's recommendations for use and heed all warnings and cautions.*

NOTES