

# USING POROUS PAVEMENT TO REDUCE RUNOFF

## Part Two of Three

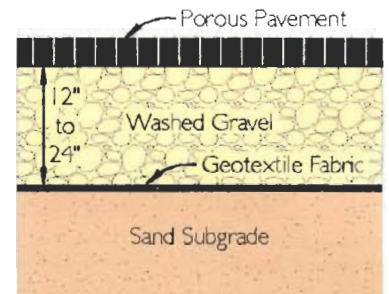
### INTRODUCTION

In a previous *Perspectives* article, different porous pavement systems were introduced as methods to reduce stormwater runoff. In this article, we will describe some porous pavement trials that are underway in Northern Lower Michigan, and discuss porous pavement construction details and relative costs. In a third installment, we will discuss pavement maintenance considerations along with code and ordinance modifications that may be needed to take advantage of porous pavement's reduction of the overall impervious footprint of development.

### CONSTRUCTION OF POROUS PAVEMENTS

Construction techniques for all types of porous pavement systems have a common feature: a relatively deep layer of clean gravel or washed crushed aggregate is installed beneath the pavement surface. This layer of stone is typically 12" to 24" deep and provides both structural support for the porous pavement and water storage beneath the pavement.

It is generally agreed by porous pavement designers that water should not be allowed to reside in the pavement. This is particularly true in cold weather climates where freezing water within a pavement will lead to early failure. In addition, porous pavements do not have as much structural strength as conventional surfaces and must rely on a deep, solid base to reduce pavement flexing and failure. Furthermore, the stone base must have sandy soil beneath it to drain runoff into the ground. This thick layer of stone is a significant part of a porous pavement system's cost. To prevent the underlying soil from clogging the voids in the stone base, a layer of geotextile is usually installed on the soil before the stone is installed.



**Plastic and Concrete Grids** are used normally in areas of light traffic or areas that are occasionally used for parking or fire lane construction. They offer the advantage of providing a stable driving surface that can be covered with turf grass. However, heavy vehicles and turning movements can damage these grid systems.



After a geotextile fabric is placed over the subgrade and a deep layer of washed stone is installed for drainage, the grids can be installed. Washed stone that has been crushed is preferable to natural round stones to provide a more stable base. Grid sections interlock or are fastened together to form a continuous surface. The cells in the grid are then filled with washed gravel or sandy soils, and the soil is planted with grass seed. It is important to irrigate the soil and seed to establish the turf.

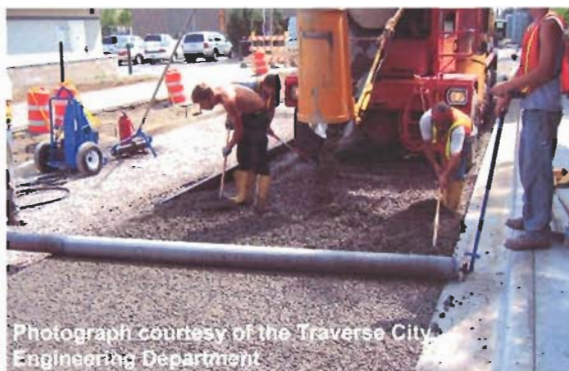


**Brick and Concrete Pavers** are often used for decorative walkways but not much for streets or parking areas. The porosity of these pavements results from the gaps between the brick units, allowing water to seep into the underlying soil. Some concrete pavers are manufactured to provide gaps between units for drainage. These same units typically have a deep cross-section to support vehicle loads. Sand or finely crushed stone is swept over the installed brick surface to fill gaps between units. This allows drainage into the underlying stone and secures the bricks in place.

Concrete pavers and bricks form an attractive pavement, although the cost of the bricks and labor to install them typically make this type of pavement more costly than porous asphalt or concrete.

**Porous Concrete** is also installed on a thick layer of drainage stone. It uses the same components as conventional Portland cement concrete; however, very little or no sand (fine aggregate) is added to the mixture. This creates voids of about 15 to 35% in the concrete. Without fine aggregate in the concrete mixture, its texture looks like a gravel surface. The lack of fine aggregate also decreases the mixture strength. Suppliers will increase the cement content in the concrete and add chemicals to the concrete to compensate for the loss in strength.

Care must be taken when placing porous concrete. Normally, cement finishers will repetitively move floats (trowels) across the concrete surface to consolidate it and smooth the surface. This dense mixture and smooth surface helps seal water from the concrete – exactly the opposite effect that is desired with porous pavements. The preferred method to obtain a level and finished surface with porous concrete is to move a vibrating tube or roller float across the top of the concrete. The roller float should only make one pass over the concrete to prevent completely smoothing and sealing the surface. Curing is accomplished by covering the concrete with plastic sheeting rather than spraying it with curing compound.



Photograph courtesy of the Traverse City Engineering Department

**Porous Asphalt** mixtures, like porous concrete mixtures, do not contain fine aggregates. To help improve its strength, liquid asphalts differing from conventional mixtures may be used. When in place, it has an open or course texture.



City of Traverse City  
Porous Asphalt Pavement Test Area

Placing porous asphalt is similar to conventional asphalt. Temperature of the mixture at the time of rolling must be monitored closely. Static rather than vibrating rollers are used and the rollers make only a single pass over the mat to prevent over-compaction of the asphalt, thereby reducing its porosity. Porous asphalt is more costly than traditional asphalt mixes. However, it may be the material of choice for larger applications such as parking lots, because it requires less installation labor than other hard surface porous paving options.

### POROUS PAVEMENT CONSTRUCTION COSTS

In the summer of 2007, the City of Traverse City bid construction of four different types of porous pavements as a trial for parking in the downtown area. About six parking stalls were constructed of each of the four different pavements. The bid prices included installation of a 14" deep bed of washed gravel beneath the pavement.

City of Traverse City Pervious Pavement Bids	
Pavement Type	Bid Range
Brick	\$16.00 to \$19.00 per sq.ft.
Pervious Concrete	\$8.75 to \$11.00 per sq.ft.
Pervious Asphalt	\$10.60 to \$13.00 per sq.ft.
Plastic Grid with Gravel	\$10.00 to \$14.00 per sq.ft.

Roughly \$2.00 per sq.ft. of the unit cost can be attributed to the washed gravel bed below the pavement. The bids for the porous asphalt and concrete pavements are about 75% higher than conventional concrete paving and about 500% higher than conventional asphalt paving.

In the third part of this newsletter series, we will discuss deicing, maintenance, code and ordinance modifications that might be needed to take advantage of porous pavement's reduction of the overall impervious footprint of developed properties.



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