MANAGING STORM WATER WITH ASPHALT PAVEMENT

By Richard O. Wolters, P.E., MAPA Executive Director and Jill M. Thomas, P.E., MAPA Associate Director

The concept of managing storm water with porous or dense graded asphalt pavement has been done successfully in Minnesota since 2005, and nationally since the 1970's to provide a solution to storm water runoff and groundwater table recharge. Asphalt pavements have been used in various climate conditions with the benefits of providing runoff control, aquifer recharge, reduction of drainage structures needed to comply with storm water regulations, and increased skid resistance and safety. The most common locations for use include parking lots and low volume roads, and in high activity recreational areas like basketball and tennis courts or playground lots. Pavement design is also available for heavier load facilities.

As shown in Figure 1, a typical pavement section consists of either a porous or a dense graded asphalt pavement layer on top of a choker course layer, a reservoir course (designed for runoff detention frost penetration, and structural capacity), and an non-woven geotextile over the existing soil or subgrade material.

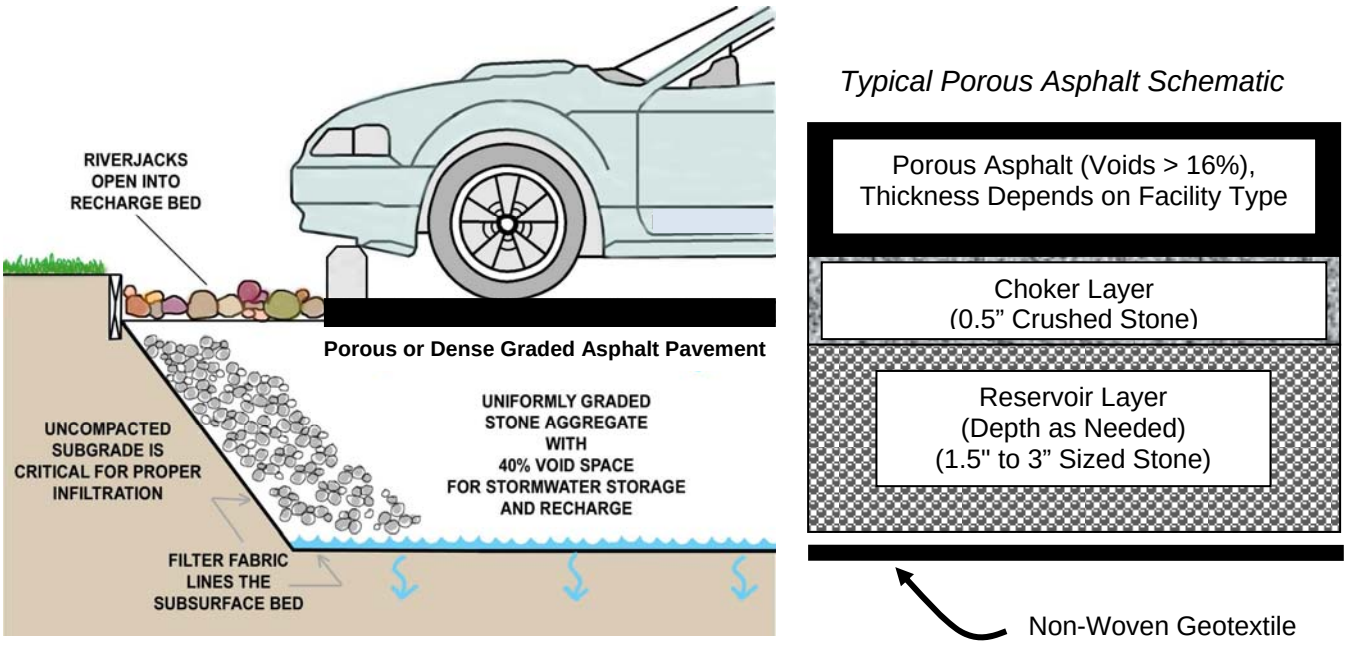

FIGURE 1 – MANAGING STORM WATER WITH ASPHALT PAVEMENT

The proper design and application of storm water asphalt pavement design is important for successful use of the concept. Soil characteristics, local topography, and climate conditions are physical factors that will be used in the planning and design processes. Other considerations include traffic loading, use of the facility, and agency regulations (i.e. storm water regulations). The MAPA Asphalt Paving Design Guide is available for pavement design guidance at www.AsphaltIsBest.com.

Special consideration is needed in the design relative to soil type, topography, and climate conditions. It is recommended that sites with a relatively deep water table be used. Areas with gentle sloping topography are ideal to allow the water to percolate through the system, although terracing the parking lot and using dense-graded asphalt pavement in steeper areas has worked successfully in hilly terrain. Several climate factors should be considered in the design including precipitation rate, depth of frost penetration, and excessive dust in the area. The design should be free of frost susceptible materials (depth as needed).

The following is a brief description of the materials needed in a porous asphalt pavement. A draft guidance spec for porous asphalt pavements is available at MAPA's web site at www.asphaltisbest.com/resources_engineering.asp. The typical depth of the asphalt pavement layer is 2 to 4-inches, depending upon the facility type. A porous asphalt layer contains little sand or dust, with an air void space of approximately 16 percent or more as compared to the dense graded asphalt pavement [Mn/DOT, Plant Mix 2360 Specification at http://www.dot.state.mn.us/materials/bituminous.html] with traditionally 2-4 percent voids. Note, a dense graded asphalt pavement could be used rather than porous asphalt layer, however it would require a piping system to distribute water in the reservoir layer.

The choker course with ½" sized crushed rock is typically just enough to fill in some voids and lock the surface, thus creating a stable paving platform.

The large-stone reservoir layer is the heart of the porous structure and is a crushed stone (between 1.5" and 3" in size) with a depth determined by the storage volume needed, structural capacity, or frost depth, whichever requires the greater thickness. For example, a nine inch layer of No. 2 AASHTO gradation stone with 40 percent voids will provide a little over 3.5-inches of runoff storage. There may be some economy to utilizing a smaller aggregate size, such as a No. 5 AASHTO and increasing the reservoir course depth to achieve the same void volume as that calculated when using the larger material.

A non-woven geotextile fabric is placed between the large stone reservoir layer and the subgrade or in-place, uncompacted soil to prevent fines from migrating into the reservoir layer.

Porous asphalt pavements should be inspected several times in the first few months after construction, and annually thereafter. Inspections should be conducted after large storms to check for surface ponding that might indicate possible clogging. The surface can be vacuumed to assist in the maintenance of the pavement surface porosity. A liquid de-icer or fine salt should be used in place of sand, which will clog the system. Self flushing of porous asphalt pavement is common in Minnesota.

According to Cahill Associates, porous pavement does not usually cost more than conventional pavement. The slight increase in cost for the underlying stone bed is generally offset by the significant reduction in storm water pipes and inlets.

References

- NAPA, "Design, Construction and Maintenance Guide for Porous Asphalt Pavements," Information Series No. 131, Lanham, Maryland, 2003.
- Public Works Engineering, Construction & Maintenance, "Managing Stormwater with: Porous Asphalt," *Public Works Journal Corporation*, July 2003. www.pwmag.com
- U.S. Environmental Protection Agency, Office of Water, Washington, D.C., "Storm Water Technology Fact Sheet Porous Pavement," EPA 832-F-99-023, September 1999.
- Minnesota Asphalt Pavement Association, *Asphalt Paving Design Guide*, www.asphaltisbest.com, 2003.