5.4 POROUS PAVEMENT

5.4.1. INTRODUCTION

Porous pavements allow rain to pass through and can be used on both permeable and impermeable soils. In the latter case, these porous pavements are designed with an underdrain system. Where soils are sufficiently permeable, runoff can infiltrate into the soil and the discharge of stormwater or associated pollutants can be avoided. Systems designed with an underdrain provide substantial pollutant removal and increase the time of concentration, which are substantial benefits even when the volume of runoff is not substantially reduced.

There are several types of porous pavement, including porous asphalt, pervious concrete, pavers, and grid-type systems. Porous asphalt consists of an open-graded coarse aggregate, bonded together by asphalt cement, with sufficient interconnected voids to make it highly permeable to water. Pervious concrete differs from regular concrete in the proportion of coarse aggregate, the absence of fine material, and the reduced quantity of water in the mix. Pervious concrete has enough void space to allow rapid percolation of rainfall through the pavement. Pavers themselves are typically impermeable; however, infiltration occurs either in the gaps between the pavers or within openings cast as part of the geometry of the paver. The use of pavers in a portion of a parking lot in South Texas are presented in Figure 5-5.

Figure 5-5: Permeable pavers in parking stall of Cascade Park parking lot in Cameron County.

Porous pavement is typically placed over a highly permeable layer of open-graded gravel and crushed stone as shown in Figure 5-6. The void spaces in the aggregate layers act as a storage reservoir for runoff. The liner and underdrain are optional features that might be required because of structural considerations and/or low soil permeability.

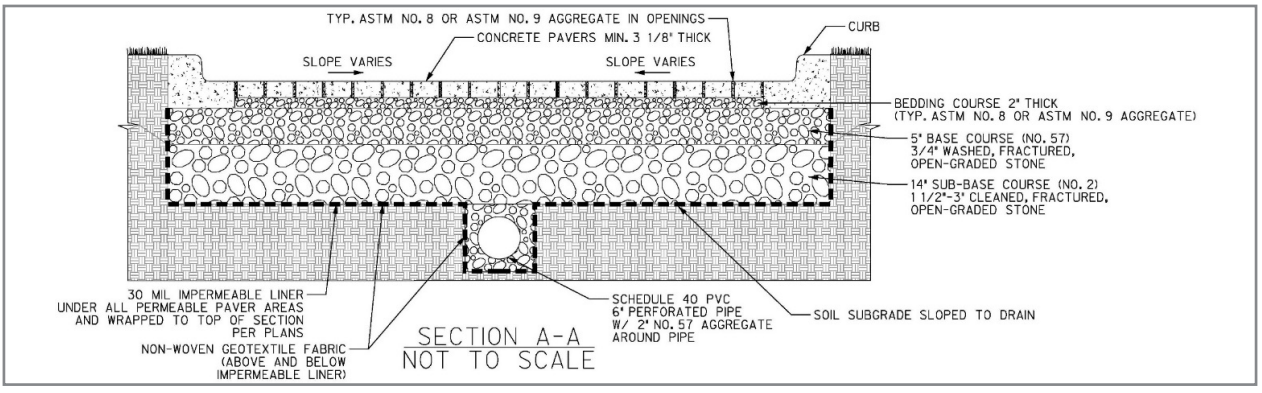

Figure 5-6: Representative cross-section of porous pavement.

SELECTION CRITERIA

Porous pavement may substitute for conventional pavement on parking areas, streets, sidewalks, and patios. Slopes should be flat or very gentle. Soils should have field-verified permeability rates of greater than 0.5 in/hour, and there should be a 4-foot minimum clearance from the bottom of the system to bedrock or the water table for systems installed without underdrains.

The advantages of using porous pavement include:

- Substantial pollutant reduction, even in systems with underdrains and surface discharge.
- Less need for curbing and storm sewers.
- Potential for groundwater recharge

LIMITATIONS

The use of porous pavement is constrained, requiring deep permeable soils (in systems without underdrains), and consideration of impacts to adjacent buildings. Some specific disadvantages of porous pavement include the following:

- Porous pavement has a tendency to become clogged if improperly installed.
- Pervious concrete and porous asphalt have a tendency to ravel in areas with a short turning radius.

5.4.2. POROUS PAVEMENT DESIGN GUIDLINES

Most porous pavement installations are designed to infiltrate water into the soil, resulting in the requirements described below for minimum infiltration rate and separation from groundwater. If these requirements are not met, porous pavement can be installed with an underdrain in order to increase concentration time and reduce pollutants in runoff. Information on the structural requirements for various pavement types can be found at industry websites such as:

- Permeable pavers: http://www.icpi.org/
- Pervious concrete: http://www.perviouspavement.org/
- Porous asphalt: http://www.asphaltpavement.org/index.php?option=com_content&view=article&id=359&Itemid=863

Recommended design guidelines for porous pavement that does not incorporate an underdrain include the following elements:

1. A minimum of 6 inches of reservoir rock must be provided below the pavement to store the 1.5-inch rainfall event.
2. As part of the site evaluation, obtain a soil boring to a depth of at least 4 feet below bottom of stone reservoir to check for soil permeability, porosity, depth of water table, and depth to bedrock.
3. Minimum infiltration rate 3 feet below bottom of stone reservoir is 0.5 inch per hour or an underdrain is required.
4. Provide an under-drain system with perforated pipe in areas where infiltration rates do not meet the design requirements.
5. Minimum depth to the seasonally high-water table is 4 feet.
6. Minimum setback from water supply wells is 100 feet.
7. Minimum setback from building foundations is 10 feet down-gradient.

8. Porous pavement should be used for sidewalks, patios, parking areas and lightly used access roads.
9. Excavate and grade with light equipment with tracks or oversized tires to prevent soil compaction.
10. Divert stormwater runoff away from planned pavement area before and during construction.

5.4.3. MAINTENANCE REQUIREMENTS

Like all BMPs, porous pavements need to be maintained. Maintenance requirements will depend on the environmental context, intensity of use, etc. and may include periodic street sweeping, vacuum sweeping, and/or high pressure washing. Potholes and cracks can be filled with patching mixes unless more than 10% of the surface area needs repair. Spot-clogging may be fixed by drilling half-inch holes through the porous pavement layer every few feet. The pavement should be inspected several times during the first few months following installation and annually thereafter. Annual inspections should take place after large storms, when puddles will make any clogging obvious.