

6.7 Pervious Paving



Figure 6-28: The City of Menlo Park used permeable concrete for parking stalls and standard paving in the drive aisles in this public parking lot.

Best uses

- Parking areas
- Common areas
- Pathways

Advantages

- Flow attenuation
- Removes fine particulates
- Reduces need for treatment

Limitations

- May clog without periodic cleaning
- Use in lightly trafficked areas only
- Higher installation costs

Pervious paving is used for areas with light vehicle loading and lightly trafficked areas, such as automobile parking areas. Table 6-2 shows possible applications for different types of pervious paving. The term pervious paving describes a system comprised of a load-bearing, durable surface together with an underlying layered structure that temporarily stores water prior to infiltration or drainage to a controlled outlet. The surface is porous such that water infiltrates across the entire surface of the material (e.g., crushed aggregate, porous concrete and porous asphalt). If an area of pervious paving is underlain with pervious soil or pervious storage material, such as a gravel layer sufficient to hold at least the Municipal Stormwater Regional Permit Provision C.3.d volume of rainfall runoff, it is not considered an impervious surface and can function as a self-treating area, as described in Section 4. 2. Please note that projects that the CalGREEN Building Code does not define pervious paving in the same way as the MRP. Projects that include pervious paving per CalGREEN requirements must also verify that the pervious paving meets the MRP definition of pervious pavement.

Table 6-2: Types of Pervious Paving and Possible Applications		
Paver Type	Description	Possible Applications
Porous Asphalt	Open-graded asphalt concrete over an open-graded aggregate base, over a draining soil. Contains very little fine aggregate (dust or sand) and is comprised almost entirely of stone aggregate and asphalt binder; surface void content of 12-20%.	Low traffic use, such as parking lots, travel lanes, parking stalls. Surface may be too rough for bicycle path.

Table 6-2: Types of Pervious Paving and Possible Applications		
Paver Type	Description	Possible Applications
Pervious Concrete	A discontinuous mixture of coarse aggregate, hydraulic cement and other cementitious materials, admixtures, and water which has a surface void content of 15-25% allowing water to pass through.	Sidewalks and patios, low traffic volume and low speed (less than 30 mph limit) bikeways, streets, travel lanes, parking stalls, and residential driveways.
Source: Design Guidelines for Permeable Pavements, Redwood City		

Design and Sizing Guidelines

The design of each layer of the pavement must be determined by the likely traffic loadings and the layer’s required operational life. To provide satisfactory performance, the following criteria shall be considered.

SUBGRADE AND SITE REQUIREMENTS

- The sub-grade shall be able to sustain traffic loading without excessive deformation.
- The sub-grade shall be either ungraded in-situ material with a percolation rate of 5-inches per hour, backfilled with coarser fill material, or installed with an underdrain that will remove detained flows within the pervious paving and base.
- Depth to groundwater shall be at least 10 feet from bottom of base.
- Permeable pavements must be laid on a relatively flat slope, generally 5% or flatter. If permeable pavements are laid on steep slopes, the open graded crushed aggregate base may tend to migrate downhill, causing the surface to deform.

BASE LAYER

- The granular capping and base layers shall give sufficient load-bearing to provide an adequate construction platform and base for the overlying pavement layers.
- The base aggregate particles shall be selected based on strength and durability when saturated and subjected to wetting and drying.
- To allow for subsurface water storage, the base must be open graded, crushed stone (not pea gravel), meaning that the particles are of a limited size range, with no fines, so that small particles do not choke the voids between large particles.
- If the base layer is sized to hold at least the Municipal Stormwater Regional Permit Provision C.3.d volume of rainfall runoff, the area of pervious paving is not considered an impervious surface and can function as a self-treating area (see Section 4. 2).
- If the base layer has sufficient capacity in the void space to store the C.3.d amount of runoff for both the area of pervious paving and the area that drains to it, it is not considered an impervious surface and can function as a self-retaining area, described in Section 4.2.
- If an underdrain is used, allow a minimum of 2 inches between underdrain and bottom of base course. To be considered a self-treating area or self-retaining area, the underdrain shall be positioned above the portion of the base layer that is sized to meet the C.3.d sizing criteria.
- Design calculations for the base shall quantify the following:

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- Type of soil, type of fill if used, permeability of base, k-values (psi/cubic inch)
- Compressibility (clay and silt contents, organics, muck)
- Traffic loading (in 18,000 lb. single axle loads)
- Drainage routing of detained flows within the pervious pavement and base (infiltration through minimum 5-inch per hour base into in-situ soils, or collection in underdrain if percolation rate cannot be met with in-situ soils)

PAVEMENT MATERIALS

- The pavement materials shall not crack or suffer excessive rutting under the influence of traffic. This is controlled by the horizontal tensile stress at the base of these layers.
- Pervious pavements require a single size grading to give open voids. The choice of materials is therefore a compromise between stiffness, permeability and storage capacity.

DESIGN AND INSTALLATION

- Design shall be reviewed by manufacturer or National Ready Mixed Concrete Association (NRMCA, www.nrmca.org).
- Installation shall be by contractors familiar with pervious paving installation. Only contractors with certification from NRMCA should be considered. More information can be found at www.concreteparking.org.

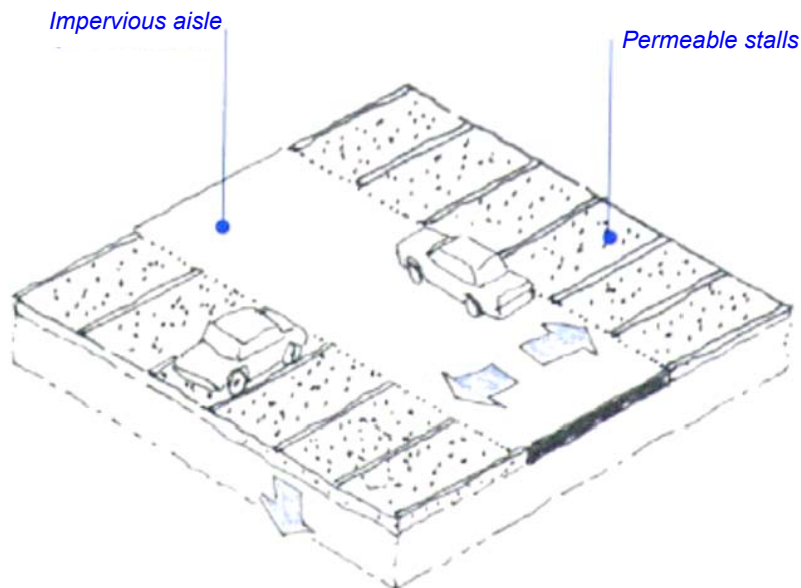


Figure 6-29: Surface view of parking lot with pervious paving in lightly-trafficked areas. (Source: Bay Area Stormwater Management Agencies Association [BASMAA], Start at the Source, 1999)

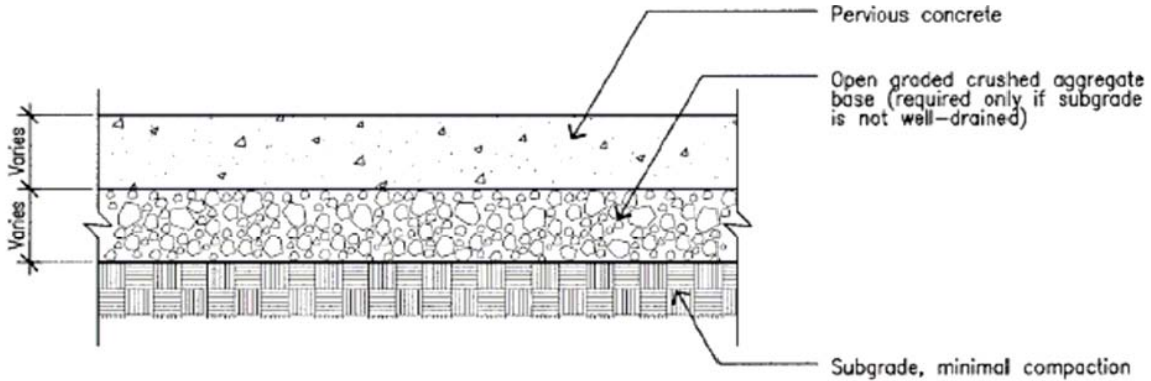


Figure 6-30: Pervious Concrete Installation. (Source: BASMAA, 1999). Depth of pervious concrete will vary with type of usage.

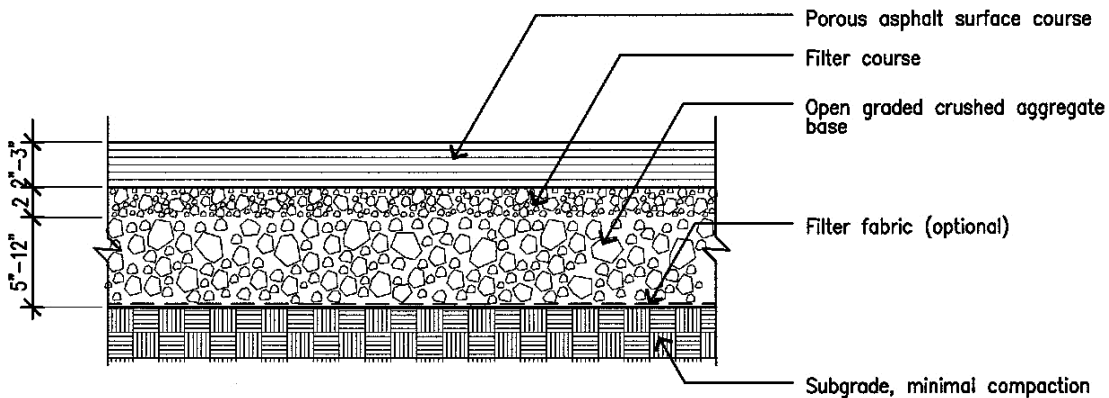


Figure 6-31: Porous Asphalt Installation (Source: BASMAA, 1999)

Maintenance

A maintenance plan shall be provided.

Standards for Ongoing Maintenance and Upkeep:

- Keep landscaped areas well maintained.
- Prevent soil from washing onto the pavement. Pervious pavement surface shall be vacuum cleaned using commercially available sweeping machines at following times:
 - End of winter (April)
 - Mid-summer (July / August)
 - After autumn leaf-fall (November)
- Inspect outlets yearly, preferably before wet season. Remove accumulated trash/debris.
- When vacuum cleaning, inspect pervious paving for any signs of hydraulic failure.

As needed maintenance:

- If routine cleaning does not restore infiltration rates, then reconstruction of part of the pervious surface may be required.
- The surface area affected by hydraulic failure should be lifted, if possible, for inspection of the internal materials to identify the location and extent of blockage.
- Lift and replace surface materials as needed to restore infiltration. Geotextiles may need complete replacement.
- Sub-surface layers may need cleaning and replacing.
- Removed silts may need to be disposed of as controlled waste.

