



Pervious pavements are load-bearing pavement structures that are permeable to water.

Pervious pavements feature a permeable surface layer overlying an aggregate storage ('reservoir') layer. There is a wide variety of pervious pavement types, however, the surface layers fall into two broad categories:

- Porous pavements which are comprised of a layer of highly porous material; and
- Permeable pavements which are comprised of a layer of paving blocks, typically impervious, specially shaped to allow the ingress of water. There are generally large 'gaps' between paved areas for infiltration.

The reservoir storage layer consists of crushed stone or gravel which is used to store water before it is infiltrated to the underlying soil or discharged towards a drainage system or to an underground tank.

Pervious paving has many runoff management benefits including:

- Reduced peak runoff discharges;
- Increased groundwater recharge;
- Potential to harvest runoff for reuse; and
- Improved runoff quality.

What is Water Sensitive Urban Design?

Water Sensitive Urban Design (WSUD) is an approach to urban planning and design that integrates the management of the total water cycle into the urban development process.

WSUD incorporates all water resources, including surface water, groundwater, urban and roof runoff, drinking water and wastewater. It includes:

- Utilising water saving measures within and outside domestic, commercial, industrial and institutional premises to minimise requirements for drinking and non-drinking water supplies;
- Storage, treatment and beneficial use of runoff (at building and street level, including stormwater);
- Treatment and reuse of wastewater; and
- Using vegetation for treatment purposes, water efficient landscaping and enhancing biodiversity and amenity.

There are many different WSUD measures which together form a 'tool kit' from which individual measures can be selected to form a specific response suiting the characteristics of each development (or redevelopment).

Those measures are described in detail in the WSUD Technical Manual, which can be found online at www.planning.sa.gov.au/go/wsud

Pervious pavements are one such measure.

Application and Scale

Pervious paving can be utilised in carparks, streets with low traffic volumes and light traffic weight, and for paving within residential, commercial and institutional developments.

Pervious pavements have been found to be most practical and cost effective when serving catchment areas between 0.1 and 0.4 hectares. As a guide, the contributing catchment area to a pervious area should not exceed 4 to 1. Where sediment and organic loads are high, the ratio should be reduced to 2 to 1.

Design Considerations

- The factors that will maximise the likely success of pervious pavement installation include: low traffic volumes and light vehicle weights, low sediment loads, moderate soil infiltration rates, and regular and appropriate maintenance of the surface;
- Pervious paving must be carefully designed in areas with high water table levels, wind blown or loose sands, clay soils that collapse in contact with water, and soils with a hydraulic conductivity of less than 0.36 millimetres/hour;
- In locations where infiltration will cause shrinking of clays and possible damage to structures, a minimum clearance of 5 metres or an impermeable lining should be used;
- Pre-treatment of surface runoff should be considered to minimise clogging of the paving media and protect groundwater quality. Suitable pre-treatment systems could include leaf and roof guards for roof gutters, buffer strips, swales or a small sediment forebay for larger scale developments;
- Systems with vegetation grown in the voids have demonstrated good long-term performance in the Greater Adelaide Region. Designs need to demonstrate sufficient soil depth and nutrient provision for growth, mitigation of heat retained in pavers, and wear from vehicle movement;
- Where possible, flows that are 'above design' flows should be designed to bypass the pervious paving system. This can be achieved in a number of ways, including an overflow pipe or pit which is connected to the downstream drainage system;
- In locations where vehicles may be stopping or turning, structural integrity should be considered as these forces can cause slippage between paver bedding material and the basecourse or geotextile. Lateral forces are better resisted by interlocking pavers;
- Considerations for the safe design of pervious paving systems in pedestrian traffic areas should include minimising trip hazards and falls associated with a slippery pavement surface. Careful construction tolerances and subsequent maintenance regimes are required; and
- Clogging with sediment and oil can occur during construction or through long-term use. The construction process, pre-treatment techniques and maintenance requirements should be designed to minimise clogging.

Design Process

The key steps in the design process include:

- Identify any site constraints and catchment characteristics (e.g. sediment loading, traffic use and loading, soil type, services, current and future groundwater use, groundwater quality and catchment use);
- Establish design objectives and targets (e.g. generally systems operate as infiltration systems - allowance for infiltration to the subsoil between storm events - or detention systems - adequate capacity to reduce peak discharges to specified conditions);
- Liaise with the local council to determine whether a development application is required, and clarify the location and any access requirements of existing services;
- Determine if a design tool is needed. Available tools include hydrological effectiveness curves and the PermPave software;
- Select the type of pervious pavement based on site conditions, desired amenity or local character requirements. The pavement could be one of the many varieties of either permeable or porous pavements available;
- Undertake the structural design of a pervious pavement system. A key consideration is the need for the basecourse to be able to infiltrate runoff;
- The design flow for the surface area, detention (or retention) volume and the overflow pit should be the minor storm event. The overflow or bypass entering the stormwater drainage system should be designed based on the major storm event;
- Size the pervious pavement using the effective design life infiltration rate. A suitable ratio to adopt is 20% of the initial pavement infiltration rate which is consistent with evidence based on 10-year-old pavements;
- Ensure necessary design and specification requirements are documented including pervious paving surface (proprietary requirements/specifications), retention/aggregate layer (material required), geotextile fabric and filter media; and
- Complete a construction plan and maintenance plan assigning specific roles and responsibilities for maintenance and data collation.

Legislative Requirements and Approvals

A thorough investigation of required permits and approvals should be undertaken as part of the conceptual design. A proposed system needs to meet the requirements of the following legislation:

- *Development Act 1993;*
- *Public and Environmental Health Act 1987;* and
- *Environment Protection Act 1993;*
- *Natural Resources Management Act 2004.*

Maintenance Requirements

For efficient operation of pervious pavements it is essential that the gaps between the paver and the underlying bedding layer do not become clogged by fine sediment. These maintenance activities include high pressure hosing/sweeping/vacuuming to remove sediments, repair of potholes/cracks, maintaining surface vegetation and periodic replacement of the aggregate layer (every 20 years).

Following construction, pervious pavements should be inspected every month (or after each major rainfall event) for the initial six months of operation to determine whether or not the infiltration zone requires immediate maintenance. After the initial six months, inspections may be extended to the frequencies stated in the maintenance plan.

Further Information

While there is a large range of useful resources and further information available on pervious pavements, in the first instance it is suggested that people read Chapter 7 of the *Water Sensitive Urban Design in Greater Adelaide Technical Manual*. Further information is available at www.planning.sa.gov.au/go/wsud

Other Summary Sheets

Other Water Sensitive Urban Design Summary Sheets for the Greater Adelaide Region are available in this series. To download the summary sheets, visit www.planning.sa.gov.au/go/wsud

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