

LID ELEMENT #14: PERMEABLE PAVEMENTS

OBJECTIVE

Improve treatment and infiltration through use of permeable paving.

CONSIDERATIONS

The use of permeable pavement has both advantages and limitations as discussed in the memorandum. Olympia has considerable, longstanding experience with permeable pavement. Some installations have been successful; others problematic. The technology continues to evolve and improve.

RELATED ELEMENTS

Element 4 Restrict Maximum Impervious Surface Coverage
Element 5 Reduce Impervious Surface Associated with On-site Parking

TRADITIONAL PAVING TECHNIQUES

Since the days of the Romans, roads and pathways for travel have been hardened. Hardening surfaces allowed roads to be traversable regardless of weather conditions. In modern times, roads are paved with concrete, asphalt and pavers. Use of these materials started with roads and then was expanded to sidewalks, paths, driveways, and parking lots. Although the utilization of these surfaces has allowed travel ways to be traversable year round, it creates the need to manage stormwater. Impervious materials create runoff that must be managed to avoid flooding and reduce contamination associated with the collection of pollutants. Pavement associated with roads, sidewalks, and parking lots occupies approximately twice the space of buildings in our communities. Therefore, eliminating or reducing the runoff from hard surfaces greatly improves both the quality and quantity of storm runoff.

“Permeable paving surfaces are an important integrated management practice within the LID approach and can be designed to accommodate pedestrian, bicycle, and auto traffic while allowing infiltration, treatment and storage of stormwater.”

*Low Impact Development
Technical Guidance Manual for
Puget Sound, Puget Sound
(2012)*

In the City of Olympia, the current surfacing components include curb and gutter, traditional asphalt and concrete, catch basin and pipe systems for stormwater conveyance and ponds for stormwater management. The City has been working to use permeable paving on City projects for over 10 years, primarily for sidewalks. Various products and applications have been used. Private development has also used permeable pavements, typically in parking lots. Overall results have been mixed in terms of durability and effectiveness. However through their experience with these projects, the City has learned about specific product effectiveness. This experience can inform future code requirements.

CODES AND STANDARDS REVIEWED

Drainage Design and Erosion Control Manual (DDECM) Volumes 3 & 5
Engineering Design and Development Standards (EDDS) 4B.160
Olympia Municipal Code (OMC) Section 18.38.220.A.4

BENEFITS OF USING PERMEABLE PAVING

One of the primary premises of low impact design is to mimic the pre-disturbance hydrologic process of infiltration, filtration and storage. For sites with infiltrative soils, permeable paving achieves all of these goals. Rather than collecting runoff and conveying it away, rainwater that hits pervious paving is treated and infiltrated in place. This is a much closer approximation of the pre-development hydrologic process (how runoff is processed on undeveloped land) than traditional stormwater methods. Pervious pavements also increase recharge of groundwater.

In some applications, use of permeable paving can also reduce initial construction costs. Although permeable paving construction costs are usually higher than impervious costs, stormwater construction costs can be lower because catch basin, pipe and pond systems can be minimized. Traditional systems cannot be completely eliminated because emergency overflow systems are required. In general, the construction and cost implications of permeable paving are site specific.

OLYMPIA CODE ANALYSIS

Road, driveway, sidewalk, and pathway surfaces are generally addressed in Chapter 4 of the EDDS. Section 4B.160 addresses surfacing requirements. Per this code section, sidewalks and bikeways have the option to be constructed of pervious concrete materials but only with approval of the City Engineer. Permeable paving options are not offered for the roadway or the driveway within the public right of way (between the street and edge of sidewalk) surfacing. Private driveways are allowed to be constructed of permeable surfacing.

Permeable paving options are not offered for public roadway surfacing under current regulations.

Parking lot surfacing is addressed in OMC Section 18.38.220.A.4. Pervious surfacing is allowed only in limited applications (overflow parking) or in other applications with approval of the Site Plan Review Committee (SPRC). The SPRC has routinely allowed 100% permeable parking lots.

Permeable/porous pavements are a Best Management Practice allowed within Volume 5 of the DDECM. Specific allowed applications are not addressed and the DDECM defers to local codes as explained above. Criteria are provided for when use of permeable paving is suitable or unsuitable. The criteria for feasibility or infeasibility are not exhaustive in the current DDECM. Examples of suitable applications include parking lots, low-speed residential roads, residential driveways, and sidewalks. Examples of unsuitable applications are slopes greater than 5% for pervious asphalt and 10% for pervious concrete, infiltration rates less than 0.25 inches per hour, and areas where the depth to bedrock or groundwater is less than 3 feet.

The current Department of Ecology Manual also includes a requirement that a redundant stormwater conveyance system be provided. This redundant system shall be designed to provide adequate conveyance as if the paving were impervious. This is a financially challenging requirement.

The City's sidewalk program installs pervious paving on a regular basis unless site conditions make it infeasible. The first pervious concrete sidewalk was constructed along North Street east of Henderson Boulevard in 1999. The City currently has seven miles of pervious concrete sidewalk.

In summary, current regulations allow permeable paving in limited applications within City right-of-way but then only with approval from the City Engineer. On private land, the City has allowed permeable paving where feasible and with approval from the SPRC.

HURDLES TO IMPLEMENTING PERMEABLE PAVING

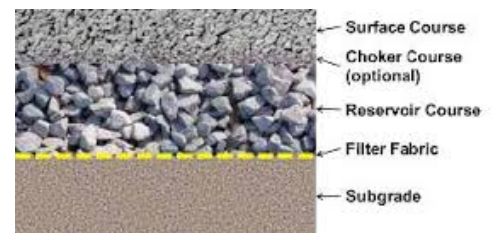
Encouraging or requiring widespread use of permeable paving presents the following challenges:

Uncertain Long Term Durability – Use of permeable surfaces has not been widespread, especially pervious concrete and asphalt. It is a fairly new technology. Therefore, the expected life span and overall durability of the products is not well-understood. However, City experience has shown that pervious concrete appears to be more durable than porous asphalt. Sites that have used pervious paving options have had issues of raveling and structural failure. In some cases, this is due to poor design or construction. Regardless, these structural failures have not bolstered the confidence of private developers or public agencies to use permeable paving options. Failures are common, ongoing, and typical of growing pains of a new technology. Failures must be reconstructed, typically at considerable unanticipated public cost.

Increased Long Term Maintenance – Permeable paving is only effective if its perviousness is preserved. Therefore, plugging from sediment and moss must be prevented. To remove sediments, permeable paving requires regular cleaning through suction. Periodic testing to ensure preservation of infiltration capabilities is also needed. Therefore, maintenance costs for permeable paving is higher than for standard pavements.

In addition, the life of a traditional pavement is typically extended by the City using chip seal, an inexpensive surface treatment that extends the life of an aging pavement. Chip sealing would not be possible with permeable paving.

Infeasible in Many Locations – The current DOE Drainage Manual Section (Volume 5 BMP T5.15) on permeable paving includes a list of infeasibility criteria. Assuming that the updated DDECM will include a similar list, applications of permeable paving will be limited by these criteria. Permeable paving is a great LID tool but its feasibility is limited.



Typical Pervious Concrete Section

Some limiting factors include:

- Infiltration capability of soils
- Depth to groundwater
- Slope of site
- Adjacency to sensitive areas such as landfills, steep slopes, land slide hazard areas, drinking water well, etc.
- High volume of traffic and heavy vehicles

Construction Challenges – Construction of a permeable paving facility such as a parking lot requires different construction practices from standard paving including:

- Permeable paving should be completed late in the project to prevent plugging during construction activities. Traditional paving occurs early in a project schedule in order to help with site management, erosion control and to provide stable surfaces for heavy equipment movement and storage of construction materials. Paving also helps protect natural soil structure in adjacent areas, a key objective in low impact development. Early paving is not possible with permeable paving as construction activities generate sediment to the street and plug the permeability. Additionally, heavy equipment and trucks working in the tight constraints of construction sites can structurally damage the paved section.
- The subgrade cannot be compacted (or compaction should be limited) so infiltration capabilities are preserved. Construction traffic must be limited on subgrade; excavation to subgrade should not be completed until ready to pave.
- Increased erosion and sedimentation prevention – runoff from abutting areas with loose soil or similar erodible materials must be kept away from permeable pavement areas in order to prevent plugging and reduction of infiltration. Adjacent landscaped areas need to be stabilized prior to paving.
- Maintenance and repair of underground utilities will be challenging. This will require cuts into the permeable paving and then subsequent patching. Small patch areas could be constructed of traditional pavement materials but larger removals will require repaving with permeable materials.
- Experience has shown that the concrete industry is challenged to provide appropriate crushed aggregates to achieve the desired strength and surface smoothness. Finding suitable materials has been difficult for both private and public contractors.



Increased erosion and sedimentation prevention is needed for permeable paving to prevent plugging and reduction of infiltration.

In addition, many contractors are not familiar with permeable paving construction techniques. Poor installation can result.

Standard Specifications Needed – In order to ensure more uniformity in design, production, installation, inspection and success of these systems, standard specifications are needed. Like others, the City struggles to provide industry standards for these systems. Effective standards are being investigated and developed by the pavement industry with aid of engineers, materials professionals, and municipalities in western Washington.

Inspection and Enforcement – Because permeable paving is both a pavement and a stormwater management facility, it requires regular inspection and monitoring to ensure continued functionality. Inspection is also needed to ensure permeable pavement is not resurfaced, either inadvertently or intentionally, with traditional materials. If violations occur, enforcement will be challenging.

OPTIONS

The options considered are as follows:

- Option 1: Continue to allow the limited use of permeable pavement (no change).
- Option 2: Change City codes to allow use of permeable pavements without additional approvals or limitations on private property. Emphasize the use of permeable paving for public sidewalks and shared-use paths, as well as residential driveways and walkways.
- Option 3: Require use of permeable pavements for all hard surfaces where feasible, excluding roadway surfaces.

ANALYSIS

Permeable pavements are a valuable tool for successful implementation of LID. Since permeable paving is a new technology with uncertain durability and longevity and increased maintenance costs and requirements, it is not recommended that permeable paving be used for roadway surfacing at this time. Roadways are also vulnerable to hazardous spills and higher levels of pollutants which could result in groundwater contamination. Therefore, permeable paving for roadways (public or private) is not proposed as part of any option.

Option 1 (no change) will keep the status quo. Pervious pavements will be allowed in limited areas and will require additional approvals from the Site Plan Review Committee or City Engineer. Current regulation does not encourage the use of pervious paving.

To implement Option 2 (change codes to allow permeable pavement on private property and in public right-of-way for specific applications), several code sections will require modification. OMC 18.38 will require amendment to allow and prioritize permeable paving on sidewalks and pathways and require permeable paving on residential driveways. OMC 18.38 will require amendment to allow permeable paving beyond just in parking lot overflow areas. All updates should specify permeable pavement usage only where feasible. In application, the City is already allowing the use of permeable paving for 100% of

parking surfaces on private property. The OMC code updates would make code language consistent with City practice. Clarification should also be provided to the DDECM Volume 5 BMP T5.15 per current DOE standards including the requirement for an overflow system.

Option 2 removes barriers to the use of permeable pavements but will likely only affect its use on public rights-of-way and private residential driveways (excluding driveway approaches that are located within the right-of-way). Removing barriers to the use of permeable paving for private property is not likely to appreciably increase its use by developers at this time. Private developers typically consider the use of pervious pavement when traditional stormwater techniques are challenging and/or expensive. As permeable paving can be more costly both in installation and maintenance and the long term durability is unknown, private developers typically will not use permeable pavement.

Option 3 (require permeable paving wherever feasible) would require that permeable pavement be used everywhere that the infeasibility criteria are not met, excluding roadways. In order to implement this Option, the EDDS and OMC 18.38 would require amendment to specify that permeable paving is required for parking lots, sidewalks, bikeways, and residential driveways.

Option 3 may or may not increase the use of permeable pavement for private projects. Given the infeasibility criteria, it is likely that most private projects could opt out if so desired. The increase in use for public projects would largely be the same as Option 2.

The current risks associated with permeable paving are relatively high, but could decrease in the foreseeable future as the technology advances. Regardless of the preferred option, the City needs to stay current with the technology and be prepared to support the expanded use of permeable pavements.

RECOMMENDATION

Staff recommends Option 2. Option 2 may provide increased use of permeable paving in the City of Olympia through removal of code barriers to its usage. Option 2 removes current code barriers to usage and prioritizes usage in public rights-of-way for sidewalks and shared-use paths, but not for vehicle lanes. It can be achieved with minor code changes to the OMC and EDDS. Removal of barriers, however, does not necessarily mean increased usage, especially on private property.

Option 1 does not expand the use of permeable paving. Option 3 would require extensive use of permeable pavement at a time when the technology is not fully developed. Public and private risks would be high.

