

PERMEABLE PAVEMENT SYSTEM INSTALLATION NOTES

Permeable pavement systems are SCMs that infiltrate runoff through the pavement surface to a subsurface reservoir for infiltration to the subgrade and/or discharge via an underdrain system. Installation requires careful attention to details during construction and an understanding of the purpose and functionality of the system. The general notes in this document are provided as a starting template and should not be used without project-specific modifications to reflect the unique conditions of each installation. Designers must modify this set of notes before adding these notes to construction plans. Highlighted text in <<red double brackets >> provides options for designers to select to explain the intent of the design and installation instructions. To tailor these notes to a specific design, edits to other notes and additional notes not included below also may be necessary.

Notes Applicable to All Permeable Pavement Systems

1. This permeable pavement system is installed for << runoff reduction/stormwater treatment/aesthetic/other >> purposes.
2. Pavers ordered shall be rated for infiltration, which means there will be 1/8 to 1/2-inch joints between pavers that will be filled with small aggregates. Non-infiltrating pavers will be rejected. <<designer note: paver joints shall be selected to comply with ADA where applicable >> (ADAAG call for no more than 13 mm joints).
3. Permeable pavement system is designed to treat or manage runoff for <<water quality capture volume/excess urban runoff volume/full spectrum detention >>.
4. As-built storage volume calculations must be provided for all design storage volumes.
5. The local review jurisdiction <<will/will not >> require installation of the permeable pavement system prior to issuance of certificate(s) of occupancy
6. Paver function notes: <<label in plans as applicable >>
 - Pavers in <<Area 1 >> shall be traffic rated.
 - Pavers in <<Area 2 >> shall be pedestrian rated.
7. Excavation of subgrade shall not commence until after the pre-construction meeting.
8. Permeable pavement system installation should be as close to site construction completion as possible without delaying the issuance of certificate(s) of occupancy. The permeable pavement system must not receive runoff from disturbed portions of the site. This is best achieved through sequencing to stabilize the contributing watershed before constructing the permeable pavement system.
9. The contractor shall, at all times during and after system installation, prevent sediment, debris, runoff and dirt from any source from entering the permeable pavement system.

10. Grading and compaction equipment used in the area of the permeable pavement system shall be approved by the engineer prior to use.
11. Geotechnical engineer shall review and approve subgrade prior to placement of aggregate layers.
12. For full and partial infiltration sections, geotechnical engineer shall review subgrade for overcompaction prior to placement of filter and aggregate layers.
13. For this <<Full Infiltration/Partial Infiltration>> permeable pavement system, subgrade shall be excavated using low ground pressure track equipment to minimize over-compaction of the subgrade.
14. Buildings adjacent to the installation have <<pedestrian access/vehicular access/no access>> off the installation area and <<will/will not>> require temporary access during construction activities.
15. There <<are/are not>> utility poles in the paver installation area which will require protection and bracing for support during construction.
16. There <<are/are not>> landscape islands within the paver installation. Sleeves from the edge of the permeable pavement system to the landscape islands <<will/will not>> be required for irrigation.
17. There <<are/are not>> light poles within the paver installation, sleeves from the edge of the permeable pavement system to the light poles <<will/will not>> be required.
18. There <<are/are not>> underground <<water/sewer/storm drains>> located beneath the paver installations.
 - Separation from paver infiltration sections to gravel bedded utilities <<will/will not>> be required.
19. Adjacent building(s) <<do/do not>> have basements adjacent to the installation.
 - Adjacent foundations <<will/will not>> require waterproofing/drainage systems between permeable pavement system and building(s).
20. Adjacent concrete and asphalt paving <<does/does not>> require subgrade protection:
 - For lined permeable pavement systems: band asphalt edges with concrete curbing and attach liner to concrete.
 - For unlined systems: install appropriate edge protection below paving depth as specified by protect geotechnical engineer <<cut-off wall/liner/underdrain>>.
21. All aggregates delivered for permeable pavement installations shall be washed (less than 0.5% by weight passing the No. 200 sieve).
22. Placement of the wearing course shall be performed after fine grading and landscaping in adjacent areas is complete. If the wearing course becomes clogged due to construction

activities, vacuum the surface using equipment appropriate for the level of clogging to restore the infiltration rate after construction is complete. Verify that the pavement surface has a minimum infiltration rate of 100 inches/hour using ASTM C1781 (ICPI).

23. The finish surface of the pavers shall be smooth and uniform. Paver unit-to-unit vertical offset (lippage) shall not exceed 1/8 inch. Changes in grades shall be made gradually. Prior to installing pavers, the surveyor shall blue top the finish grades, and the contractor shall mark a stringline along the face of all curbs. The finish curb height shall be uniform in accordance with the grading plans and details.
24. Pavers shall not be cut smaller than 40% of full brick size. Contractor shall provide matching color concrete collars around drains, cleanouts, manholes, and other features within the SCM as required.
25. Chamfer-cut paver edges to avoid sharp edges.
26. Loose materials shall not be stored on the permeable pavement area.
27. Pavers in parking areas/bike lanes shall use << painted/colored paver brick >> striping.
28. Discharges onto the permeable pavement surface from concentrated flows from adjacent areas must be spread out as sheet flow to fully use the pavement surface. Avoid concentrated discharges to the permeable pavement system through grading to achieve sheet flow from adjacent areas and use practices such as level spreaders to transition concentrated flow to sheet flow.
29. Roof drains discharging onto paver surfaces should not:
 - Be installed to discharge vertically onto paver surface (to prevent joint washout)
 - Be installed greater than 6 inches from paver surface (to prevent joint washout)

Notes Applicable to No Infiltration Permeable Pavement Systems

1. Subgrade shall be raked and cleaned of all sharp debris (rolled with a magnetic roller prior to liner installations).
2. Subgrade shall be free of sharp edged native aggregates. If natural sharp aggregates are found when excavating, contractor shall consult with the geotechnical engineer on appropriate subgrade treatment prior to placement of the liner. Contractor << shall /shall not >> over-excavate to prepare subgrade.
3. Compact subgrade to minimize settlement per geotechnical report.
4. Vehicles and construction equipment must not be allowed on the liner to avoid damage.
5. Place non-woven geotextile fabric (Mirafi 80N or equal) above and below the liner.

Protection Notes to Minimize Clogging of Permeable Pavement System during Ongoing Construction Activities

1. Provide educational signs around the paver installation area during construction to explain the function of the SCM, the need to avoid compaction of the area, and the need to manage pollutants in areas draining to the installation area. Educational signs explaining the function of the SCM and the need for pollutant management in contributing drainage areas to the general public are recommended following construction.
2. At a minimum, buildings surrounding the permeable pavement system should be erected prior to installation of the pavement, including framing, siding, floor and roof. The goal of delaying the installation of paver installations is to minimize the amount of construction debris, traffic, and equipment driving over the pavers that potentially could clog the infiltration ability of the system, resulting in degraded performance.
3. If buildings will be constructed concurrently to the pavement system installation or if there are gaps in construction sequencing at the site, then protect the permeable pavement system by implementing these protective measures:
 - a. Lay a mat of Mirafi s1200 over the permeable pavers. Use 3-inch nails of a diameter less than the paver joint width with large plastic washers to secure fabric at paver brick joints at approximately 18 inches oc.
 - b. Lay 3/4 inch 4'x12' sheets of plywood continuous over the paver system. Secure adjacent edges of plywood together with a 1-inch gap between adjacent plywood sheets.
 - c. After sod, landscape and construction traffic is no longer tracking debris around the site, plywood and/or Mirafi filter fabric should be removed.
 - d. After removal of the protective cover, the contractor shall vacuum the pavers clean of loose debris using appropriate vacuum equipment. If significant mud and contaminants have become hard-packed, it may become necessary to use a pressure washer at a low angle to the paver surface to knock out packed debris prior to vacuuming. Backfill paver joints with new clean material per manufacturer specifications prior to issuance of certificate(s) of occupancy.

Impermeable Liner/Geomembrane Installation Notes

The intent of impermeable liners (geomembranes) is to prevent stormwater from entering the subgrade. The installation of the liner shall include the following:

1. The liner shall be prefabricated to the maximum extent practicable to fit the design configuration. Minimize field seams.
2. All seams (factory and field) shall be seam-welded per the liner manufacturer's recommendations.
3. Pipe penetrations through the liner should be completed with pre-fabricated boots that can be field-welded and attached with two stainless steel band straps per boot connection.

4. At a minimum lay **S1200 below the liner and a S2400** above the liner to minimize the chances of damage to the liner from materials under or over the liner.
5. A layer with a minimum thickness of 15 inches of material must be placed on top of the liner prior to any vehicle driving on it. This is a critical to avoid damaging the liner. Aggregates should be placed proceeding from the edge of the liner inward. Avoid bobcat or other vehicle wheels from driving directly on and damaging the liner.
6. Liner shall completely encompass light poles and utility poles. Special details are required to allow occasional replacement without damaging liner system.

Permeable Paver Maintenance Notes

The primary maintenance requirement for permeable pavers is to clean the surface drainage voids. Fine debris and dirt accumulate in the drainage openings and reduce the pavement's infiltration capacity. It is natural for clogging to occur over time, but routine maintenance can reduce this problem. Property management should follow manufacturer and MHFD maintenance recommendations, including the following:

1. Inspection of the site should occur monthly for the first few months after construction. Then inspections can occur on a semi-annual basis, preferably after >0.5-inch rain events, when clogging will be obvious.
2. If the joints between pavers are not completely filled with aggregate to finished paver surface, additional filler materials will be required to keep pavers from shifting, settling or moving.
3. Regenerative air sweepers can be used for routine maintenance to restore permeability. Vacuum sweep ideally (1-2) times a year, properly disposing of the removed material. Add additional aggregate fill material made up of clean filler material per details as needed to prevent shifting of the pavers.
4. Replace damaged interlocking paving blocks as part of routine maintenance.
5. An active street sweeping program in the site's drainage area will also help to prolong the functional life of the pavement.
6. Keep pavement surface clean. Do not dump or store sand, chemicals, oils, petroleum products, debris, landscape materials, organic materials or any loose material on the permeable pavers.
7. Even though some loss in permeability is expected over the pavement system's lifetime, its longevity can be increased by following the maintenance schedule. Restricting the permeable pavement area from use by heavy vehicles, limiting the use of de-icing chemicals and sand, and implementing a stringent sediment control plan will prolong the system lifespan.
8. If after installation there are area(s) of settlement, these can be repaired by a qualified professional by removing pavers and adding additional aggregate to obtain a level finished surface. (Note: minor settlement areas should drain adequately through permeable pavement system). Leveling of the paving surface is primarily a visual, safety, and ADA conformance issue.
9. For winter snow removal, use equipment with rubber-tipped blades. For small installations, remove snow using a plastic shovels or similar equipment that will not scrape the pavement surface or dislodge pavers.

10. Avoid use of deicers, road salts, and sand whenever possible on the permeable pavement surface. Sand will clog permeable paver pavements. Consider using the paver joint material as the anti-slip agent if needed for surface safety, and apply at a rate of 5-10 pounds/1000 square feet.
11. For rehabilitation of permeable pavement system, see operations and maintenance manual.

As-built Requirements for Permeable Pavement System Installations

Contractor shall coordinate timing and execution of the surveys necessary for as-builts:

1. Surveyor shall survey bottom of subgrade prior to liner installation. Engineer should verify subgrade elevations before installation of material above the liner proceed.
2. Surveyor shall survey all underdrain and monitoring well elevations.
3. Surveyor shall survey all storm drain manholes, pipes, and other structures within the SCM.
4. Surveyor shall survey top of parking lot paver elevations.
5. Surveyor shall survey all walks and curb walls for paver system.