PERMEABLE PAVEMENT CALCULATOR

These calculators size the area of permeable pavement to treat the Water Quality Volume (WQv). The calculator can be used for underdrained installations or infiltration installations.

Input cell =		User enters value
Default value =		User should only change value if able to provide explanation for adjustment
Calculation cell =		User should not change cell

CALCULATOR

Permeable Pavement Calculator - by Water Quality Volume

1	Water Quality Volume - WQv	2,500	cubic feet
2	Drainage Management Area	40,000	square feet (include the area planned for permeable pavement)
3	Permeable Pavement (PP) Type	Permeable Pavers	select pavement type
4	PP Area as % of Total Drainage Area	40%	min allowable is 40%, i.e., 1 part permeable pavement to 1.5 parts impermeable paved drainage area
5	**Minimum PP Area**	**16,000**	square feet
6	Infiltration Rate of In Situ Soils - f	0.4	inches/hour (enter 0 if system will be lined due to subsurface constraints)
	Safety Factor	2	recommend 2 to account for decline over time and uncertainty in measurement
7	Underdrains Required	Yes	required if f ≤ 0.5 inches/hour
8	Porosity of Storage Media - n	0.35	recommend 0.35
	Fill Time - T	2	hours (generally 2)

9	Depth of Bedding Layer	2	inches (generally 2")
	Depth of Transition Layer	3	inches (generally 3 to 4")
10	**Minimum Depth of Storage Layer**	**6**	inches (as needed to store the WQv, minimum of 6")

11	Time Needed to Infiltrate WQV (no underdrain)	N/A	hours (if greater than 48 hours, install underdrains)
12	Drain Time (for underdrained systems) - t	48	hours (24 to 48, recommend 48)
13	Ave. Discharge Rate for Drain Time	6	gpm (use orifice or other means to control discharge rate)

INSTRUCTIONS

Use steps 1 through 13 to determine the required area and drain rate for permeable pavement.

Step	
1	Enter the Water Quality Volume (WQv) for the drainage management area (DMA). The WQv is calculated in Step 14 of the Water Quality Volume and Water Quality Flow Rate Calculator.
2	Enter the square footage of the DMA draining to the Permeable Pavement (PP). The DMA includes the area planned for PP. Only impervious surfaces should drain to PP.
3	Select the type of PP system: permeable pavers, pervious concrete, or porous asphalt.
4	The allowable PP area as a percent of the total drainage area is given here. To reduce pollutant loadings and extend the expected life of the system, the area of the permeable pavement system must be 40% or more of the total drainage area (i.e., 1 part permeable pavement facility area to 1.5 parts impervious paved drainage area). To allow run-on to permeable pavers, they must have 20% or more of their surface area open. See the PP fact sheet for more information regarding design requirements.
5	The minimum PP area required is calculated here.
6	Enter the infiltration rate of the underlying soils. This should be determined by geotechnical testing or, for conceptual studies, soil infiltration maps. If the PP is going to be underdrained and lined to prevent infiltration, then use 0. A default safety factor of two will be applied to the infiltration rate to account for soils compaction and clogging, as well as the inherent uncertainty in rate measurement.
7	The need for underdrains is determined based on the infiltration rate. If other constraints require underdrains, such as high groundwater or bedrock, set the infiltration rate in Step 6 to 0. See the PP fact sheet for infiltration constraints.
8	The default porosity of the media and the fill time have been entered. Adjusting these values is not recommended.
9	Enter the depths of the subsurface media layers. Layers include the bedding layer, transition (i.e., base) layer, and storage (i.e., subbase) layer. Recommend using a 2" deep bedding layer and a 3 or 4" deep transition layer. The required depth of the underlying storage layer is calculated in Step 10. See the Permeable Pavement fact sheet for more information on the media layers.
10	The required depth of the storage layer is calculated here. The depth is as needed to store the WQv, with a minimum depth of 6".
11	If the system is not underdrained, the time to infiltrate the WQv is calculated here.
12	For underdrained systems, specify the desired drain time. For the full benefit of pollutant reduction through detention, 48 hours is recommended.
13	The average rate at which the underdrain system must drain the media layers is calculated here. During design, outlet controls must be sized accordingly to achieve the desired WQv drain time.

DEFINITIONS

Water Quality Volume (WQv)	The runoff volume to be managed by the stormwater BMP such that treatment requirements are met. The WQv is calculated by the Water Quality Volume and Water Quality Flow Rate Calculator.
Infiltration Rate (f)	The rate of water entry into the soil, generally expressed as inches/hour, and determined by geotechnical tests or estimated from soil maps. It equals the hydraulic conductivity of the soil times the hydraulic gradient.
Porosity (n)	Volume of void space to total volume. This is expressed as a ratio, e.g. 0.35 means that one cubic foot of gravel contains 0.35 cubic feet of empty space.
Fill Time (T)	The time taken for the subsurface media to fill with runoff.
Bedding Layer	The layer that the permeable pavement is laid on, also called choker or setting layer. Consists of AASHTO No. 8 stone. (Note: Bedding layers are typically No. 57 stone for asphalt and concrete; however, the size has been reduced in this application to improve filtering performance of the system).
Transition Layer	The layer located beneath the bedding layer which serves as a transition to the storage layer. It is also known as the base layer, is typically 3 to 4" deep, and consists of AASHTO No. 57 stone.
Storage Layer	The layer above the native soil subgrade that distributes loads and stores the runoff. It is also called the subbase or reservoir layer and consists of AASHTO No. 3 stone (i.e., 0.5 to 2.5" diameter crushed aggregate).
Drain Time (t)	The time for the storage area to drain the water quality volume.