Permeable Paver Exercise

Divide the class into groups of 3 to 5 participants (at least four groups). Ask each group to solve the problem presented below. Upon completion, ask each group to discuss one of the four steps, in order discussing the design factors involved in solution of that step.

Site

Consider a 5-acre parking area to be constructed. It is anticipated that 25% of that area will be lightly enough trafficked to be suitable for permeable pavers. There is no off-site drainage contribution to the area. The rainfall intensity of the 2-yr, 1-hr storm is 1.53 in/hr. Tests have shown that the infiltration rate of the surrounding soil is 0.29 in/hr and the depth to seasonal high groundwater is 8.2 feet. Detention time is to be 24 hours and the stone to be used in the reservoir has a typical void ratio of 0.4.

Task

Determine whether or not a full permeable paver system can be designed to dissipate the 2-yr, 1-hr storm volume from the entire paved surface of the parking lot.

Useful Equations

$$H = \frac{(E)(t)}{12r} \quad (1)$$

Determines the depth of the reservoir layer (H) in feet given infiltration rate (E) in in/hr, detention time (t) in hours, and void ratio (r) of subbase.

$$V = 3630(A)(i)(t_R) \quad (2)$$

Determines the volume of storage (V) in ft^3 given drainage area (A) in acres, rainfall intensity (i) in in/hr, and rainfall time (t_R) in hours

$$A_S = \frac{V}{(r)(H)} \quad (3)$$

Determines the required surface area of permeable pavers (A_S) in ft^2 given the required storage volume (V) in ft^3, the void ratio (r) of the storage layer and its depth (H) in inches.

Steps

1. Determine the volume of runoff to be stored.
2. Calculate the depth of the storage reservoir required.
3. Check the storage time provided against the required infiltration time.
4. Re-calculate the required surface area of permeable pavers required to determine whether it can be designed within the available 1.25 acres (25% of 5 acres).