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ROOF DRAINAGE ACCORDING TO THE 2018 INTERNATIONAL CODES – DRAINS? SCUPPERS?

CLEAR AS MUD!

The International Building Code requires both primary and secondary roof drainage for roof areas on which standing water may occur due to surrounding features such as parapets. The height of this feature is not defined, but the determination of the maximum load due to accumulated water must be included in the structural analysis of the roof.

The IBC says: ***"****Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Sections 1106 and 1108, as applicable, of the International Plumbing Code"* (IBC 1502.2)

Further, if scuppers are used: *"Where scuppers are used for secondary (emergency overflow) roof drainage, the quantity, size, location and inlet elevation of the scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1611.1. Scuppers shall not have an opening dimension of less than 4 inches (102 mm). The flow through the primary system shall not be considered when locating and sizing scuppers."* (IBC 1502.3)

IBC 1611.1 says: ***"****Each portion of a roof shall be designed to sustain the load of rainwater that will accumulate on it if the primary drainage system for that portion is blocked plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow. The design rainfall shall be based on the 100-year hourly rainfall rate… ."*

Another requirement of which most designers may not be aware: ***"****In sizing roof drains and storm drainage piping, one-half of the area of any vertical wall that diverts rainwater to the roof shall be added to the projected roof area for inclusion…"* in the drainage calculations. (IPC 1106.4). Therefore, a high vertical wall contiguous to a small roof area may increase significantly the quantity of water that has to be accommodated by the small roof drainage system.

And after years of not addressing drainage scuppers, the 2018 IPC now includes this definition and requirement: *"Where scuppers are used for primary roof drainage or for secondary (emergency overflow) roof drainage or both, the quantity, size, location and inlet elevation of the scuppers shall be chosen to prevent the depth of ponding water on the roof from exceeding the maximum water depth that the roof was designed for as determined by Section 1611.1 of the International Building Code. Scupper openings shall be not less than 4 inches (102 mm) in height and have a width that is equal to or greater than the circumference of a roof drain sized for the same roof area. The flow through the primary system shall not be considered when locating and sizing secondary scuppers."*

So what does that mean? Scuppers must be designed using the same criteria as a roof drain system. And do not be misled; the size description in the IPC (4" minimum height x circumference width) is the MINIMUM SIZE for scuppers. In fact, scuppers probably will be much larger due to another phenomenon - *Standing water flows straight down a drain a lot faster than sideways out a scupper.*

One could say the full weight of the standing water helps push water down a drain while the sideways push of water out a scupper is a lot less.

Let's look at a simple example of water flow through roof drains vs. scuppers.

According to Table C8-1 in ASCE/SEI 7-10, "Minimum Design Loads for Buildings and Other Structures," water needs to stand about 3.5 inches deep above a 6 inch roof drain to flow at 540 gpm (a typical rate). If your roof design will safely accommodate 3.5 inches of standing water, that 3.5 inches will create a discharge out of a 6 inch by 6 inch scupper only at 114 gpm (Source: FM Global Property Loss Prevention Data Sheet 1-54).

To discharge water through a 6 inch by 6 inch scupper at about 540 gpm, you need the water to stand about 16-inches deep (which probably is not practical for a structural design load). To discharge water at 540 gpm and keep the "head" (i.e., standing water) at a reasonable depth of 3.5 inches, you need a 28 inch wide scupper.

In other words, an equal flow rate through a scupper when compared to a vertical drain will require a much larger scupper opening. In order to avoid an excessive depth of water on the roof, only a portion of the scupper height can be used in the calculations. Hence, to achieve the desired flow rate through a scupper without overloading the roof, the scupper width must be larger (or additional scuppers may be installed).

Hopefully, this will clear the water.