design methods to preclude instability from ponding are presented in AISC (2005) and SJI (2007).

Regardless of roof slope, if water is impounded on the roof in order to reach a secondary drainage system, ponding instability can occur. Where such impounded water situations exist, the bay is considered a susceptible bay. Shown in Fig. C8.3 are typical susceptible bays for a roof with slope of 1/4 in./ft or greater. For the same structure with a roof slope less than 1/4 in./ft, all bays are susceptible. Figure C8.4 shows a roof with perimeter overflow (secondary) drains and interior primary drains. Irrespective of the roof slope, all bays are susceptible. Susceptible bays must be checked to preclude ponding instability.

C8.5 CONTROLLED DRAINAGE

In some areas of the country, ordinances are in effect that limit the rate of rainwater flow from roofs into storm drains. Controlled-flow drains are often used on such roofs. Those roofs must be capable of sustaining the storm water temporarily stored on them. Many roofs designed with controlled-flow drains have a design rain load of 30 lb/ft^2 (1.44 kN/m^2) and are equipped with a secondary drainage system (for example, scuppers) that prevents water depths (d_s + d_h) greater than 5.75 in. (145 mm) on the roof.

Examples

The following two examples illustrate the method used to establish design rain loads based on Chapter 8 of this standard.

Example 1: Determine the design rain load, R, at the secondary drainage for the roof plan shown in Fig. C8-1, located at a site in Birmingham, AL. The design rainfall intensity, i, specified by the plumbing code for a 100-yr, 1-h rainfall is 3.75 in./h (95 mm/h). The inlet of the 4 in. diameter (102 mm) secondary roof drains are set 2 in. (51 mm) above the roof surface.

Flow rate, Q, for the secondary drainage 4 in. diameter (102 mm) roof drain:

$$Q = 0.0104A\ i \qquad \text{(C8-1)}$$

$Q = 0.0104(2{,}500)(3.75) = 97.5$ gal/min (0.0062 m^3/s)

Hydraulic head, d_h:

Using Table C8-1, for a 4 in. diameter (102 mm) roof drain with a flow rate of 97.5 gal/min (0.0062 m^3/s) interpolate between a hydraulic head of 1 and 2 in. (25 mm and 51 mm) as follows:

$d_h = 1 + [(97.5 - 80) \div (170 - 80)] = 1.19$ in. (30.2 mm)

Static head d_s = 2 in. (51 mm); the water depth from drain inlet to the roof surface.

Design rain load, R, adjacent to the drains:

$$R = 5.2(d_s + d_h) \qquad \text{(8-1)}$$

$R = 5.2(2 + 1.19) = 16.6$ psf (0.80 kN/m^2)

Example 2: Determine the design rain load, R, at the secondary drainage for the roof plan shown in Fig. C8-2, located at a site in Los Angeles, CA. The design rainfall intensity, i, specified by the plumbing code for a 100-yr, 1-h rainfall is 1.5 in./h (38 mm/h). The inlet of the 12 in. (305 mm) secondary roof scuppers are set 2 in. (51 mm) above the roof surface.

Flow rate, Q, for the secondary drainage, 12 in. (305 mm) wide channel scupper:

$$Q = 0.0104A\ i \qquad \text{(C8-1)}$$

$Q = 0.0104(11{,}500)(1.5) = 179$ gal/min (0.0113 m^3/s)

Hydraulic head, d_h:

Using Tables C8-1 and C8-2, by interpolation, the flow rate for a 12 in. (305 mm) wide channel scupper is twice that of a 6 in. (152 mm) wide channel scupper. Using Tables C8-1 and C8-2, the hydraulic head, d_h, for one-half the flow rate, Q, or 90 gal/min (0.0057 m^3/s), through a 6 in. (152 mm) wide channel scupper is 3 in. (76 mm).

d_h = 3 in. (76 mm) for a 12 in. wide (305 mm) channel scupper with a flow rate, Q, of 179 gal/min (0.0113 m^3/s).

Static head, d_s = 2 in. (51 mm); depth of water from the scupper inlet to the roof surface.

Design rain load, R, adjacent to the scuppers:

$$R = 5.2(d_h + d_s)$$

$R = 5.2(2 + 3) = 26$ psf (1.2 kN/m^2)

REFERENCES

American Institute of Steel Construction (AISC). (2005). *Specifications for structural steel buildings,* American Institute of Steel Construction, Chicago.

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