

ASCE STANDARD

ASCE/SEI

7-16

Minimum Design Loads and Associated Criteria for Buildings and Other Structures

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A complete list of current standards is available in the ASCE Library (<http://ascelibrary.org/page/books/s-standards>).

Tips for Using This Standard

The **standard provisions** are contained in chapters 1 to 31. Standard provisions are mandatory.

The **standard commentary** is contained in chapters C1 to C31. Standard commentary is intended to help you understand how the provisions were determined and how to apply them.

Gray bars down the side in the provisions (but not the commentary) indicate sections with substantive changes from the previous edition of this standard, ASCE/SEI 7-10, Third Printing.

Referenced consensus standards are listed at the end of each chapter of provisions, where they are listed by number with title, publisher, year of publication (and the sections that cite them). In text, they are mentioned only by number: ACI 318, ANSI/AISI S100, ASTM D1536.

This standard uses both **customary and metric (S.I.) units**. Customary units appear first, followed by S.I. units in parentheses. When numbered display equations have customary and S.I. versions, the one in customary units is numbered like this: (Eq. 8.3-1). The one in S.I. units is numbered like this: (Eq. 8.3-1.si).

Reference citations are listed at the end of each chapter of commentary, where they are listed by author and date with accompanying bibliographic information. In the text, these references are called out by author and date: ASHRAE (2000); Bachman and Dowty (2008); NEHRP (2009).

CHAPTER 8 RAIN LOADS

8.1 DEFINITIONS AND SYMBOLS

8.1.1 Definitions

CONTROLLED DRAINAGE: System intentionally regulating the rate of flow through the primary drains.

PONDING: The accumulation of water caused by the deflection of the roof structure, resulting in added load.

PONDING INSTABILITY: Member instability caused by progressive deflection due to ponding on roofs.

PRIMARY DRAINAGE SYSTEM: Roof drainage system through which water is normally conveyed off the roof.

PRIMARY MEMBERS: For the purposes of determining a susceptible bay, structural members having direct connection to the columns, including girders, beams, and trusses.

UPPER: An opening in the side of a building (typically parapet wall) for the purpose of draining water off the roof.

SECONDARY DRAINAGE SYSTEM: Roof drainage system higher than the primary drainage system, through which water is conveyed off the roof when the primary system is blocked.

8.3 DESIGN RAIN LOADS

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.

$$R = 5.2(d_s + d_h) \quad (8.3-1)$$

$$R = 0.0098(d_s + d_h) \quad (8.3-1.si)$$

If the secondary drainage systems contain drain lines, such lines and their point of discharge shall be separate from the primary drain lines. Rain loads shall be based on the total head (static head plus hydraulic head $[d_h]$) associated with the design flow rate of the specified secondary drains and drainage system corresponding to the design flow rate for the specified design based on hydraulic test data.

CHAPTER C8 RAIN LOADS

C8.1 DEFINITIONS AND SYMBOLS

A = Tributary roof area, plus one-half the wall area that diverts rainwater onto the roof, serviced by a single drain outlet in the secondary drainage system, in ft² (m²).

D = Drain bowl diameter for a primary roof drain, or overflow dam or standpipe diameter for a secondary roof drain, in in. (mm). Design rainfall intensity, in/h (mm/h).

Q = Flow rate out of a single drainage system, in gal./min (m³/s).

h = Height of level roof edge that allows for free overflow drainwater when the roof edge is acting as the secondary drainage system, in ft (m).

DRAINAGE

Roofs are not always designed to handle all the flow from short-duration rainfall events. For example, the International Building Code (ICC 2012) uses a 1-h duration storm period for the design of both the primary and secondary drainage systems.

The National Oceanic and Atmospheric Administration (NOAA) National Weather Service Precipitation Frequency Atlas (PFA) and the National Weather Service Precipitation Frequency Atlas Design Studies Center provide data in inches per hour for the 15-min duration/100-year recurrence interval (<http://hdsc.nws.noaa.gov/hdsc/pfa/>). Precipitation intensity (i in Eq. [C8.3-1]) is in the units of in./h; if precipitation depth is provided, a conversion to intensity is required.

The following roof conditions adversely affect the critical duration, or increase the peak flow rate, and should be avoided or appropriately considered by the designer when determining the design rain load:

1. Roofs with internal gutters that have limited storage capacity and quickly fill with rainwater. Gutters are typically sized for 2- to 5-min duration storms since their capacity is much shorter than the critical duration of the roof drains or internal drains.
2. Architecturally complex roofs with internal gutters and significant gutter slopes. Significant gutter slopes can cause water to accumulate in the gutters.

CONSENSUS STANDARDS AND OTHER REFERENCED DOCUMENTS

This section lists the consensus standards and other documents that shall be considered part of this standard to the extent referenced in this chapter.

ACI 318, Building code requirements for structural concrete and commentary. American Concrete Institute, 2014.

ANSI/AISI S100, North American specification for the design of cold-formed steel structural members. American Iron and Steel Institute, 2009.

ASTM D1536, Method of test for color difference using the colormaster differential calorimeter, 1964.

REFERENCES

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). (2000). *Practical guide to seismic restraint, RP-812*. ASHRAE, Atlanta, GA.

Bachman, R. E., and Dowty, S. M. (2008). "Nonstructural component or nonbuilding structure?" *Bldg. Safety J.* (April–May).

National Earthquake Hazards Reduction Program (NEHRP). (2009). NEHRP recommended provisions for seismic regulations for new buildings and other structures, NEHRP, Washington, DC.

Supplements, errata, and interpretations may become available in the future.
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