CHAPTER

3 BUILDING PLANNING

General Comments

Chapter 3 provides guidelines for a minimum level of structural integrity, life safety, fire safety and livability for inhabitants of buildings regulated by the *International Residential Code*® (IRC®). This chapter is a compilation of the code requirements specific to the building planning sector of the design and construction process. The provisions address a wide variety of issues important to designing a building that is both safe and usable. The limitations placed on the materials and methods of construction contribute to the development of a structurally sound building. Snow, wind, seismic design and flood-resistant construction are regulated, as are the live and dead loads. Climatic and geographical issues are considered to address different areas of the country.

Fire-resistance-rated assemblies are necessary under two different conditions: where a building is situated very close to a property line, the code addresses the concern for radiant heat exposure in a fire; and where two or more dwelling units are housed in a single structure, the code mandates a minimum level of fire separation between units, with exceptions under certain conditions. In addition, the specific construction requirements for the common wall between the house and garage and the ceiling assembly between the garage and habitable space are addressed. Other concerns related to fires include the limitations on wall and ceiling finishes; limitations on the use of foam plastics and other insulation materials; the required installation of sprinkler systems and smoke alarms; the means of egress, including requirement for emergency escape and rescue openings; and safety with solar panels and energy storage systems.

This chapter sets forth traditional code requirements dealing with resident comfort, including light, ventilation, sanitation, room size, ceiling height and environmental comfort. Life-safety provisions include limitations on glazing used in hazardous areas, specifications on the use of guards at elevated surfaces, fall protection for open windows, and basic rules for the egress system.

The organization of Chapter 3 groups the sections by topic as follows:

- Structural (R301–R307)
- Fire (R308–R311)
- Rooms and spaces (R312–R317)
- Means of egress (R318–R321)
- Accessibility/Elevators (R322–R323)
- Light, Mechanical and Ventilation (R324–R328)
- Energy (R329–R332)

The sections more specifically address requirements as follows:

- Section R301 establishes the design criteria, including dead loads, live loads, roof loads, floor loads, snow loads, wind loads and seismic loads.
- Section R302 identifies the requirements for the fire-resistant construction for residential buildings.
- Section R303 addresses the use of foam plastic.
- Section R304 contains requirements for decay protection for wood and wood-based products.
- Section R305 contains requirements for termite protection.
- Section R306 establishes flood-resistant construction provisions.
- Section R307 references ICC/NSSA 500 for the construction of storm shelters in dwellings and accessory structures.
- Section R308 provides the requirements for premises identification (site address).
- Section R309 provides requirements for an automatic sprinkler system with the option of complying with NFPA 13D or Section P2904.
- Section R310 contains the requirements for smoke alarms.
- Section R311 provides criteria for the installation and location of carbon monoxide (CO) alarms.
- Section R312 establishes the minimum requirements for room areas in dwelling units.
- Section R313 establishes the ceiling height requirements for dwelling units.
- Section R314 contains requirements for mezzanines.
- Section R315 addresses provisions for sleeping lofts.

- Section R316 addresses what would be considered a habitable attic and how that would need to be addressed in the building design.
- Section R317 contains provisions for garages and carports.
- Section R318 establishes the means of egress requirements, including provisions for egress doors, hallways, stairways and ramps.
- Section R319 contains provisions for emergency escape and rescue openings.
- Section R320 contains provision for handrails.
- Section R321 addresses guards and fall prevention for openable windows.
- Section R322 provides a reference to the *International Building Code*® (IBC®) for accessibility requirements.
- Section R323 addresses elevators and platform lifts.
- Section R324 contains requirements for glazing, hazardous locations of glazing, site-built windows and skylights.
- Section R325 establishes the light, ventilation and heating requirements for dwelling units.
- Section R326 contains requirements for sanitation.
- Section R327 contains requirements for toilets and bath and shower spaces.
- Section R328 references the *International Swimming Pool and Spa Code*® (ISPSC®) for the design and construction of pools and spas.
- Section R329 provides requirements for solar energy systems. It primarily covers photovoltaic systems and references Chapter 23 for solar thermal energy systems.
- Section R330 addresses energy storage systems.
- Section R331 addresses stationary engine generators.
- Section R332 addresses stationary fuel cell power systems by referencing the *International Fire Code*® (IFC®).

Purpose

Chapter 3 provides guidelines for a minimum level of structural integrity, life safety, fire safety and livability for inhabitants of dwelling units regulated by the code. The chapter sets forth the requirements that affect the most basic planning and design aspects of dwelling construction. It identifies the various structural loads that are imposed on a building, and it establishes criteria that address each of the imposed loads. In the design of residential structures scoped by the code, there are many climatic and geographical issues that must be considered. This chapter provides guidance in the determination of all appropriate design criteria. In addition, it sets forth the limiting conditions under which a building may be designed and constructed using the code.

Fundamental issues of livability and sanitation are satisfied through the regulation of minimum room sizes and ceiling heights, as well as basic requirements for toilet rooms, kitchens, swimming pools, spas and hot tubs. Life safety concerns are addressed in a number of areas, including provisions regulating emergency escape and rescue openings, glazing in areas subject to human impact and exiting. The chapter establishes minimum specifications for a number of different building components and systems, including stairways, ramps, handrails, guards, and fall protection for open windows. It deals with fire-safety issues, such as automatic sprinkler systems, early fire detection by smoke alarms, exterior wall protection for proximity to property lines, separation of dwelling units in multiple-family buildings, and control of fire spread across wall and ceiling finishes. Other life safety concerns are dealt with by requirements for CO detectors and guidance for the design of storm shelters. Property protection is also a concern, with provisions established for protection against decay and termites. Energy systems are discussed for solar, stationary battery storage, stationary engine generators and stationary fuel cell power.

SECTION R301—DESIGN CRITERIA

R301.1 Application. *Buildings* and structures, and parts thereof, shall be constructed to safely support all loads, including *dead loads*, *live loads*, roof loads, flood loads, snow loads, wind loads and seismic loads as prescribed by this code. The construction of *buildings* and structures in accordance with the provisions of this code shall result in a system that provides a complete load path that meets the requirements for the transfer of loads from their point of origin through the load-resisting elements to the foundation. *Buildings* and structures constructed as prescribed by this code are deemed to comply with the requirements of this section.

C This section specifies the minimum design loads required for structures built in accordance with the provisions of the code. In structural design, loads are generally divided into two categories: gravity loads, which act vertically; and lateral loads, which act horizontally. Lateral loads typically result from wind (see Section R301.2.1), earthquakes (see Section R301.2.2) or flood loads (see Section R301.2.4). Although wind, flood and earthquake design are concerned with lateral loads, there are also vertical force components that must be considered.

All structures must be designed to support these loads and provide a complete load path capable of transferring these loads from their points of origin through the appropriate load-resisting elements and foundation and, ultimately, to the supporting soil. The charging statement makes clear that any building or structure built in strict compliance with the code will provide a complete load path that meets all requirements for load transfer from the point of origin to the foundation. A load path that is either incomplete or inadequate will expose the structure to damage just as surely as an undersized structural member will. The concept of a complete load path is a fundamental principle in structural engineering, and the code makes it clear that a complete load path must be provided.

R301.1.1 Alternative provisions. As an alternative to the requirements in Section R301.1, the following standards are permitted subject to the limitations of this code and the limitations therein. Where engineered design is used in conjunction with these standards, the design shall comply with the *International Building Code*.

1. AWC *Wood Frame Construction Manual* (WFCM).
2. AISI *Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings* (AISI S230).
3. ICC *Standard on the Design and Construction of Log Structures* (ICC 400).

C This section permits the use of alternative prescriptive framing methods. Wood framing is permitted to comply with the provisions of the American Forest and Paper Association's (AF&PA) WFCM. Cold-formed steel framing is permitted to comply with American Iron and Steel Institute's (AISI) S230. Log homes can be constructed using ICC 400. Where these standards do not address a specific load (e.g., flood loads), the loads not covered by those standards must still be addressed. Engineered design in accordance with the IBC is required where a building is beyond (or exceeds) the applicability limits of these standards.

R301.1.2 Construction systems. The requirements of this code are based on *platform* and balloon-frame construction for light-frame *buildings*. The requirements for concrete and masonry buildings are based on a balloon framing system. Other framing systems must have equivalent detailing to ensure force transfer, continuity and compatible deformations.

C The requirements of the code are based on platform or balloon-frame construction for light-frame buildings (see the definitions of "Platform construction" and "Light-frame construction" in Chapter 2) and on a balloon-framing system for concrete and masonry buildings.

R301.1.3 Engineered design. Where a building of otherwise conventional construction contains structural elements exceeding the limits of Section R301 or otherwise not conforming to this code, these elements shall be designed in accordance with accepted engineering practice. The extent of such design need only demonstrate compliance of nonconventional elements with other applicable provisions and shall be compatible with the performance of the conventional framed system. Engineered design in accordance with the *International Building Code* is permitted for *buildings* and structures, and parts thereof, included in the scope of this code.

C Generally, proper application of the code requires a clear understanding of and adherence to its prescriptive limitations, which are based on conventional construction. However, a building may contain structural elements that are either unconventional or exceed the prescriptive limitations of the code. This is acceptable, if these elements are designed in accordance with accepted engineering practice by a design professional.

R301.1.4 Intermodal shipping containers. *Intermodal shipping containers* that are repurposed for use as *buildings* or structures shall be designed in accordance with the structural provisions in Section 3114 of the *International Building Code*.

C This section addresses six-sided steel units originally constructed as general cargo containers used for the transport of materials and repurposed for use as buildings or structures. This section references IBC Section 3114, where the provisions for shipping container structural safety are contained. As Section R301.1 applies to structural design only, the other nonstructural provisions of this code would apply as required (energy, plumbing, mechanical, electrical, etc.).

R301.2 Climatic and geographic design criteria. *Buildings* shall be constructed in accordance with the provisions of this code as limited by the provisions of this section. Additional criteria shall be established by the local *jurisdiction* and set forth in Table R301.2.

C This section establishes the design criteria that vary based on location and/or climate. Some of the criteria reflect loading, such as earthquake, flood and wind; others reflect susceptibility to damage from hazards, such as weather exposure or termites. Additional criteria may be established by local jurisdictions as necessary. These would include, for example, whether a site is within a windborne debris region as described in the commentary to Section R301.2.1.2. Table R301.2 lists the criteria that must be established within each jurisdiction for any project constructed under the code. The table must be filled in by the jurisdiction adopting the code for their particular area. In reality, the information required to be inserted into the table is typically included in the adopting ordinance and may not actually appear in the code. For this reason, it may be wise for designers, contractors, manufacturers and other code users to acquire a copy of the adopting ordinance for the code for each jurisdiction in which they do business.

Note that some of these criteria (e.g., wind exposure category or flood hazard) can vary within a given jurisdiction and may need to be established on a site-by-site (or project-by-project) basis. The table serves as a useful reminder for code enforcement personnel, builders, designers and owners. Verifying this information up front aids compliance with the code. Also see the commentary to Table R301.2.

TABLE R301.2—CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD[o]	WIND DESIGN				SEISMIC DESIGN CATEGORY[f]	SUBJECT TO DAMAGE FROM			ICE BARRIER UNDERLAYMENT REQUIRED[h]	FLOOD HAZARDS[g]	AIR FREEZING INDEX[i]	MEAN ANNUAL TEMP[j]
	Speed[d] (mph)	Topographic effects[k]	Special wind region[l]	Windborne debris zone[m]		Weathering[a]	Frost line depth[b]	Termite[c]				
—	—	—	—	—	—	—	—	—	—	—	—	—
MANUAL J DESIGN CRITERIA[n]												
Elevation			Altitude correction factor[e]	Coincident wet bulb	Indoor winter design relative humidity	Indoor winter design dry-bulb temperature			Outdoor winter design dry-bulb temperature		Heating temperature difference	
—			—	—	—	—			—		—	
Latitude			Daily range	Summer design gains	Indoor summer design relative humidity	Indoor summer design dry-bulb temperature			Outdoor summer design dry-bulb temperature		Cooling temperature difference	
—			—	—	—	—			—		—	

For SI: 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

a. Where weathering requires a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code, the frost line depth strength required for weathering shall govern. The weathering column shall be filled in with the weathering index, "negligible," "moderate" or "severe" for concrete as determined from Figure R301.2(1). The grade of masonry units shall be determined from ASTM C34, ASTM C55, ASTM C62, ASTM C73, ASTM C90, ASTM C129, ASTM C145, ASTM C216 or ASTM C652.

b. Where the frost line depth requires deeper footings than indicated in Figure R403.1(1), the frost line depth strength required for weathering shall govern. The jurisdiction shall fill in the frost line depth column with the minimum depth of footing below finish grade.

c. The jurisdiction shall fill in this part of the table to indicate the need for protection depending on whether there has been a history of local subterranean termite damage.

d. The jurisdiction shall fill in this part of the table with the wind speed from the ultimate design wind speeds map [Figure R301.2(2)]. Wind exposure category shall be determined on a site-specific basis in accordance with Section R301.2.1.4.

e. The jurisdiction shall fill in this section of the table to establish the design criteria using Table 10A from ACCA Manual J or established criteria determined by the jurisdiction.

f. The jurisdiction shall fill in this part of the table with the seismic design category determined from Section R301.2.2.1.

g. The jurisdiction shall fill in this part of the table with: the date of the jurisdiction's entry into the National Flood Insurance Program (date of adoption of the first code or ordinance for management of flood hazard areas); and the title and date of the currently effective Flood Insurance Study or other flood hazard study and maps adopted by the authority having jurisdiction, as amended.

h. In accordance with Sections R905.1.2, R905.4.3.1, R905.5.3.1, R905.6.3.1, R905.7.3.1 and R905.8.3.1, where there has been a history of local damage from the effects of ice damming, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall fill in this part of the table with "NO."

i. The jurisdiction shall fill in this part of the table with the 100-year return period air freezing index (BF-days) from Figure R403.3(2) or from the 100-year (99 percent) value on the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."

j. The jurisdiction shall fill in this part of the table with the mean annual temperature from the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."

k. In accordance with Section R301.2.1.5, where there is local historical data documenting structural damage to buildings due to topographic wind speed-up effects, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

l. In accordance with Figure R301.2(2), where there is local historical data documenting unusual wind conditions, the jurisdiction shall fill in this part of the table with "YES" and identify any specific requirements. Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

m. In accordance with Section R301.2.1.2 the jurisdiction shall indicate the wind-borne debris wind zone(s). Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

n. The jurisdiction shall fill in these sections of the table to establish the design criteria using Table 1a or 1b from ACCA Manual J or established criteria determined by the jurisdiction.

o. The jurisdiction shall fill in this section of the allowable stress design table using the Ground Snow Loads in Figure R301.2(3).

C Table R301.2 is designed so that jurisdictions recognize certain climatic and geographic design criteria that vary from location to location. Communities are directed to complete the table with a variety of factors. See the table footnotes for the sources of the information to be determined by the local jurisdiction to complete the table.

Table R301.2 requires the jurisdiction to specify the date of the jurisdiction's entry into the National Flood Insurance Program (NFIP), which is typically the date of adoption of the first code or ordinance for management of flood hazard areas. With respect to the official map that shows flood hazard areas, the community inserts the title and date of the currently effective Flood Insurance Study (FIS). Another flood hazard map may be specified if it shows flood hazard areas that are larger than those shown on the Flood Insurance Rate Map (FIRM), as may be the case if a community elects to define its flood plains based on higher standards, such as the "flood of record," "ultimate development" of an upstream watershed, sea level rise or climate change projections, or "no-rise" rules to define the floodway.

From time to time, the Federal Emergency Management Agency (FEMA) may revise and republish FISs and FIRMs. New and revised FIRMs are produced in digital format. Affected communities also receive paper maps to support legal adoption of the maps and supporting data. Communities that prefer to cite the digital data should obtain a legal opinion as to whether doing so is acceptable. Federal law and FEMA policy allow use of the paper or digital maps. However, in some cases, state or local law or policy may require adoption of the paper map as the official record. Digital map products are registered to the primary coordinate system of the state or community. FEMA advises that the horizontal location of flood hazard areas relative to specific sites should be determined using the coordinate grid, rather than planimetric base map features, such as streets.

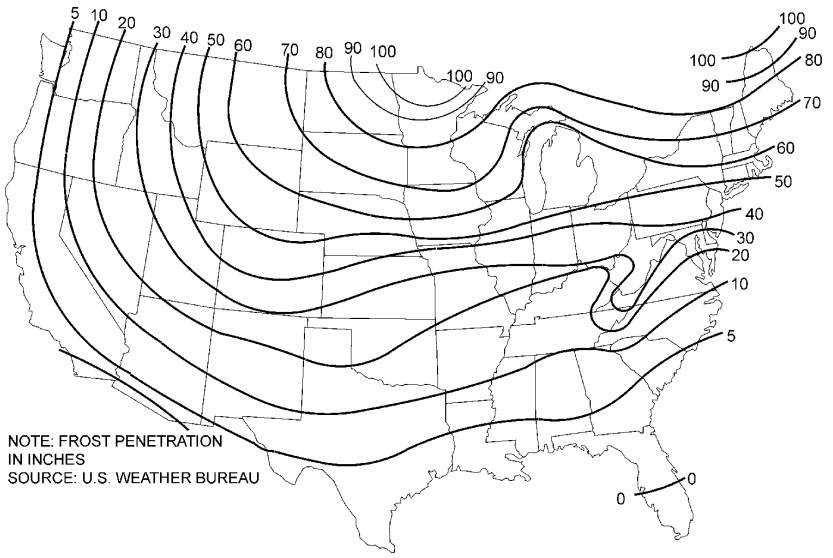
When maps are revised and flood hazard areas, base flood elevations and flood zones are changed, FEMA involves the community and provides a formal opportunity to review the documents. Once the revisions are finalized, FEMA requires adoption of the new maps by the community. Communities may be able to minimize having to adopt each revision by referencing the date of the map and study, as amended or revised. This is a method by which subsequent revisions to flood maps and studies may be automatically adopted administratively without requiring legislative action on the part of the community. Communities should check with their state NFIP coordinator to determine whether this automatic adoption-by-reference approach is allowed under their state's enabling authority and due process requirements. If not allowed, communities are to follow their state's requirements, which may require public notices, public hearings and specific adoption of revised maps by the community's legislative body.

Table R301.2 requires the local municipality or code user to insert a frost line depth entry for the particular geographical area they are located in. Commentary Figure R301.2 provides some guidance to do this more accurately based on the US Weather Bureau information. Since elevation above sea level may increase frost depth, another local resource for frost depth can be local graveyard owners.

In Table R301.2, under the title of Wind Design, Topographic effects, a jurisdiction must enter "yes" or "no." This is in consideration of historical information indicating unusually high wind speeds due to local topography (see commentary, Section R301.2.1.5).

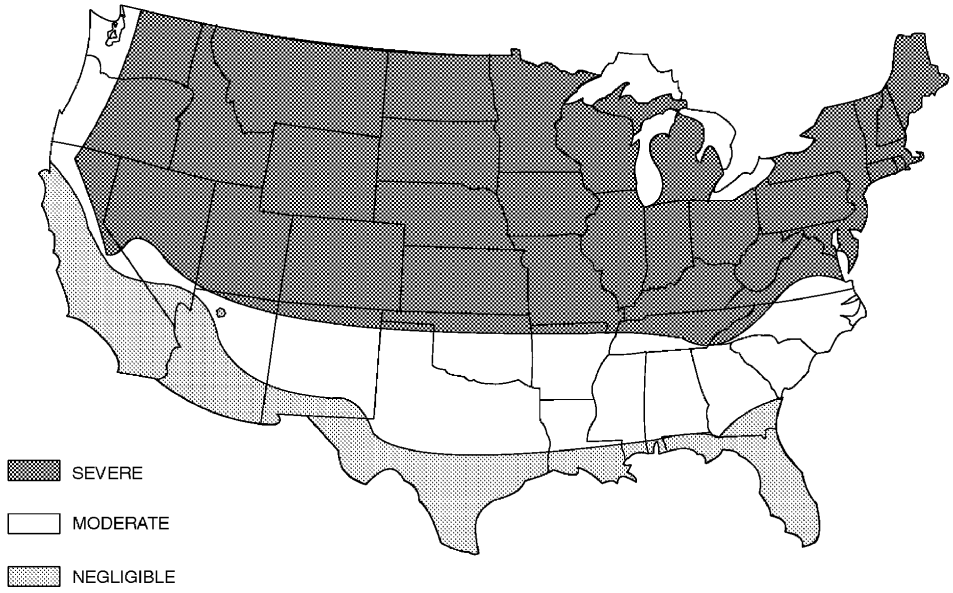
In the 2018 code, Table R301.2 was revised to add criteria related to ACCA Manual J for HVAC equipment sizing, which jurisdictions must designate based on Table 1a or 1b of Manual J and local conditions.

Commentary Figure R301.2—Frost Line Depth



For SI: 1 inch = 25.4 mm.

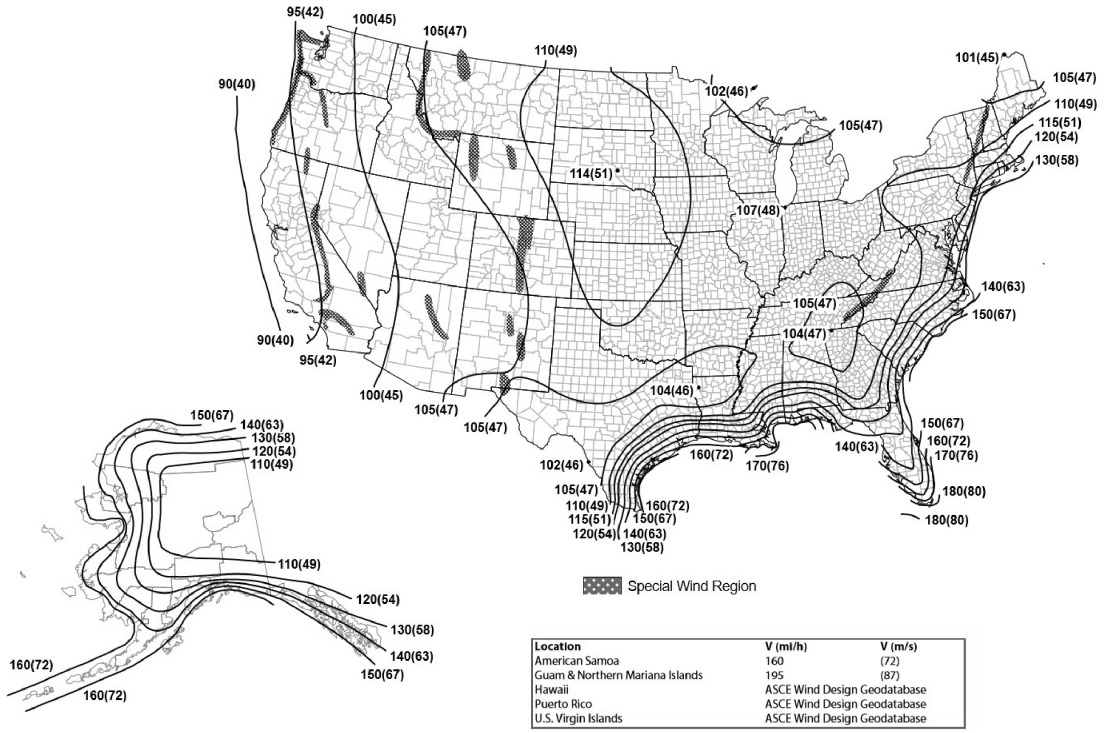
FIGURE R301.2(1)—WEATHERING PROBABILITY MAP FOR CONCRETE [a, b]



a. Alaska and Hawaii are classified as severe and negligible, respectively.
b. Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by region classification. A severe classification is where weather conditions result in significant snowfall combined with extended periods during which there is little or no natural thawing, causing deicing salts to be used extensively.

C See the commentary to Section R301.2 and Table R301.2.

FIGURE R301.2(2)—ULTIMATE DESIGN WIND SPEEDS



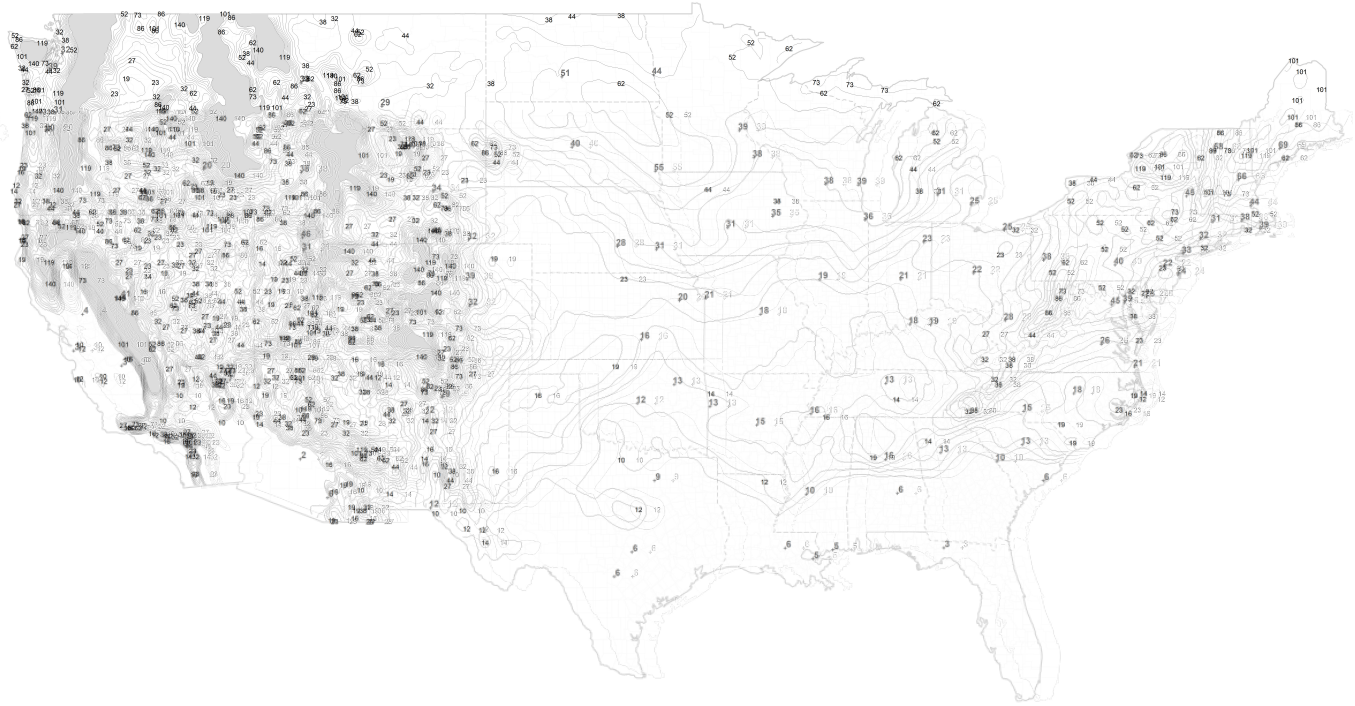
Location	V (mi/h)	V (m/s)
American Samoa	160	(72)
Guam & Northern Mariana Islands	195	(87)
Hawaii	ASCE Wind Design Geodatabase	
Puerto Rico	ASCE Wind Design Geodatabase	
U.S. Virgin Islands	ASCE Wind Design Geodatabase	

Notes:

1. Values are 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure Category C.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas and land boundaries outside the last contour shall use the last wind speed contour.
4. Location-specific basic wind speeds shall be permitted to be determined using the ASCE Wind Design Geodatabase.
5. Wind speeds for Hawaii, US Virgin Islands and Puerto Rico shall be determined from the ASCE Wind Design Geodatabase.
6. Mountainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions. Site specific values for selected special wind regions shall be permitted to be determined using the ASCE Wind Design Geodatabase.
7. Wind speeds correspond to approximately a 7 percent probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 years).
8. The ASCE Wind Design Geodatabase can be accessed at the ASCE 7 Hazard Tool (https://asce7hazardtool.online) or approved equivalent.

C See the commentary to Section R301.2 and Table R301.2.

FIGURE R301.2(3)—ALLOWABLE STRESS DESIGN GROUND SNOW LOADS, $P_{g\,(asd)}$, FOR THE UNITED STATES (lb/ft^2)



For SI:1 foot = 34.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mile = 1.61 km.

Notes:

1. Location-specific ground snow load values are provided in the Ground Snow Load Geodatabase of geocoded design ground snow load values, which can be accessed at the ASCE 7 Hazard Tool at https://asce7hazardtool.online/ or an approved equivalent.
2. Lines shown on the figure are contours separated by a constant ratio 1.18 with values of 10, 12, 14, 16, 19, 23, 27, 32, 38, 44, 52, 62, 73, 86, 101, 119 and 140 psf.
3. Values denoted with a "+" symbol indicate design ground snow loads at state capitals or other high-population locations.
4. Areas shown in gray represent areas with ground snow loads exceeding 140 psf. Ground snow load values for these locations can be determined from the Geodatabase.

C The ground snow-load map is taken from the ASCE 7 snow-load provisions and is based on statistical analysis of ground snow data. This map provides ground snow loads for the western half of the continental United States for direct use in the prescriptive provisions and tables of the code. Snow loads may increase due to lake effect or elevations. Confirm with local authorities for more refined snow-load maps. The allowable stress design (ASD) ground snow loads are a conversion to ASD of the strength-based loads provided in the updated reliability-targeted ground snow load (p_g) maps in ASCE 7 and the IBC.

R301.2.1 Wind design criteria. *Buildings* and portions thereof shall be constructed in accordance with the wind provisions of this code using the ultimate design wind speed in Table R301.2 as determined from Figure R301.2(2). The structural provisions of this code for wind loads are not permitted where wind design is required as specified in Section R301.2.1.1. Where different construction methods and structural materials are used for various portions of a *building*, the applicable requirements of this section for each portion shall apply. Where not otherwise specified, the wind loads listed in Table R301.2.1(1) adjusted for height and exposure using Table R301.2.1(2) shall be used to determine design load performance requirements for wall coverings, curtain walls, *roof coverings*, exterior windows, *skylights*, garage doors and exterior doors. Asphalt shingles shall be designed for wind speeds in accordance with Section R905.2.4. *Metal roof shingles* shall be designed for wind speeds in accordance with Section R905.4.4. A continuous load path shall be provided to transmit the applicable uplift forces in Section R802.11 from the *roof assembly* to the foundation. Where ultimate design wind speeds in Figure R301.2(2) are less than the lowest wind speed indicated in the prescriptive provisions of this code, the lowest wind speed indicated in the prescriptive provisions of this code shall be used.

C Buildings must be capable of withstanding the wind loads based on the wind speed specified in Table R301.2. Jurisdictions determine the wind speeds used for entry in the table by the application of Figure R301.2(2). The structural provisions in the code are limited, however, and do not apply where wind design or structural engineering is required in accordance with Section R301.2.1.1. As buildings typically contain multiple construction methods and structural materials, the code's wind criteria applicable to each of the methods and materials that are incorporated in a building must be complied with. Wall coverings, curtain walls, roof coverings, exterior windows, skylights, garage doors and exterior doors must be capable of withstanding the component and cladding wind pressures of Table R301.2.1(1), as adjusted by the height and exposure coefficients given in Table R301.2.1(2).

Section R905.2.6 addresses the attachment details for asphalt shingles. Roofs with higher slopes or in areas subject to higher wind speeds may require special methods of attachment (see commentary, Section R905.2.6).

Wind loads are a major consideration in designing a structure's lateral-force-resisting system. See Commentary Figure R301.2.1 for a schematic representation of the lateral component of wind loading on a building. Wind loads affect more

than the lateral load system, as evidenced by provisions such as the roof tie-down requirements of Section R802.11. A continuous load path must be provided to transmit the roof uplift forces to the foundation.

Wind resistance of metal roof shingles is addressed in Section R905. This section recognizes the major issue is that wind uplift testing is currently addressed by multiple standards that determine compliance through uplift ratings.

Commentary Figure R301.2.1—Wind Forces Acting on Area