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SAN BERNARDINO COUNTY

Land Use Services Department
Building and Safety Division

SIGNIFICANT CHANGES
2022 CALIFORNIA RESIDENTIAL CODE

RESIDENTIAL CODES:

- **CRC Section R602.10.1.2**

Braced wall lines must be placed on a physical wall or placed between multiple walls.

CHANGE SIGNIFICANCE: The concept that exterior walls are to be braced is not specifically stated in the 2010 CRC forward. Rather, a line is drawn on plans with braced wall panels on walls counted as part of a braced wall line when the panels are within 4 feet of the line drawn on the plans.

This sounds reasonable. It allows the designer to break up the exterior walls pushing some out and others inward along the front of a building. But what about when the front of a house is one single continuous wall? Can the designer still draw the braced wall line 4 feet inward of the actual wall?

The CRC did not address this issue leaving each jurisdiction to decide and designers arguing their case with each jurisdiction. In fact, most jurisdictions feel that the braced wall line must be on a physical wall when the wall line forms a single unbroken line.

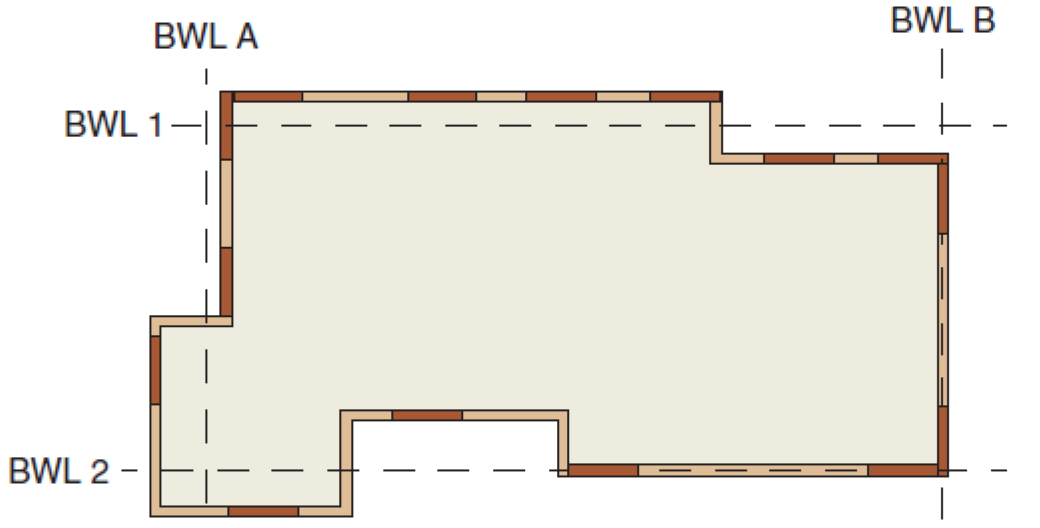
For the 2022 edition, the CRC requires that at least one-third of all braced wall panels be either on a braced wall line or on the opposite side of the braced wall line from the other braced wall panels. Braced wall panels continue to be required to be within 4 feet of the braced wall line. For the case where a single wall forms the entire braced wall line, all braced wall panels must be on the braced wall line. In other words, the braced wall line must be drawn at the physical wall.

Braced wall line (BWL) examples:

— — — Braced Wall Line

▬▬▬ Braced Wall Panel (BWP)

Example:



BWL 1: line runs between two walls, 4 of 6 panels on outside side of line, 2 of 6 panels on opposite side of line = OK
BWL 2: line runs between three walls, 1 of 4 panels outside line, 2 of 4 panels on BWL and 1 of 4 panels inside line = OK
BWL A: line runs between two walls, 2 of 3 panels on one side of line, 1 of 3 panels on opposite side of line = OK
BWL B: line runs on one wall = OK

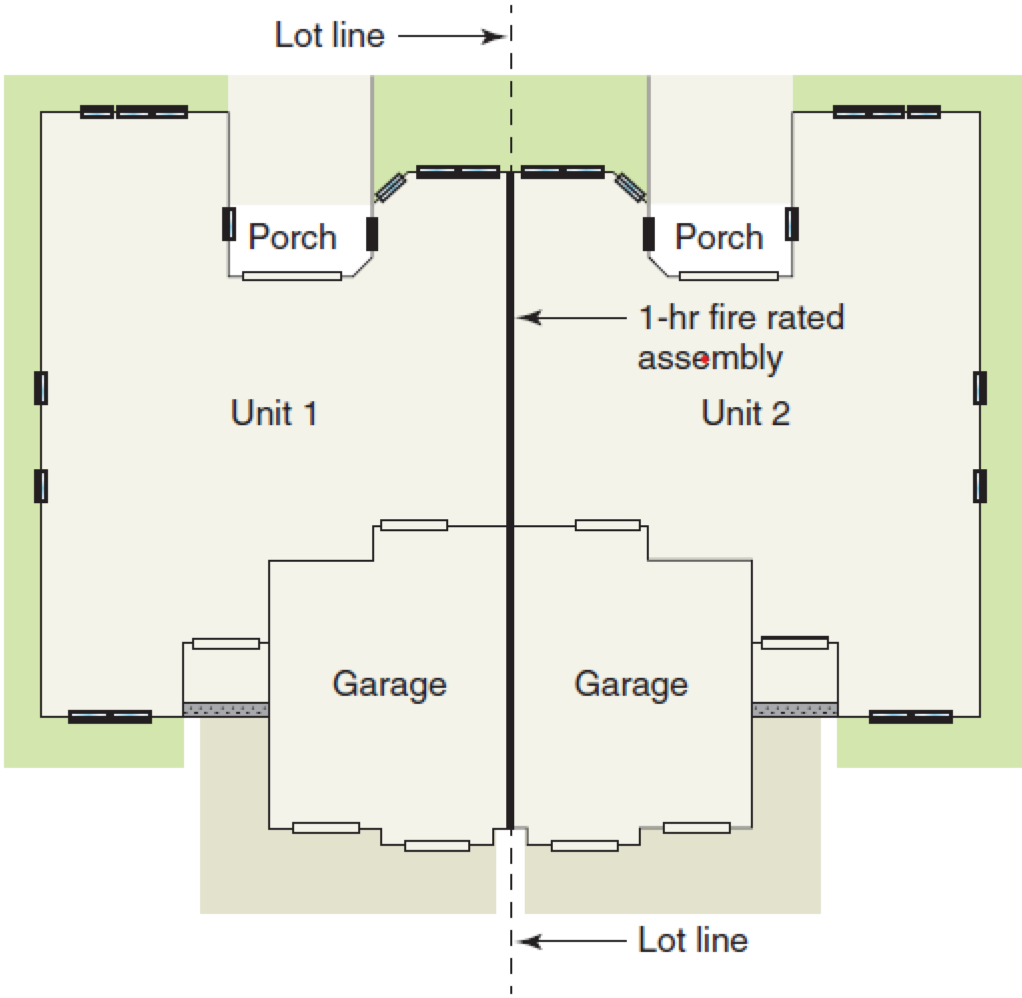
From the example, it is clear that when a single wall contains all the braced wall panels in a braced wall line, the BWL must be drawn on the wall. When there are multiple braced wall panels in a BWL, one-third of the panels need to be on one side of the line.

- **CRC Section R302.3**
  - The rated separation for two-family dwellings is 1 hour whether or not a lot line exists between units.

CHANGE SIGNIFICANCE: Unlike townhouse unit separations, two-family dwellings (duplexes) only require a 1-hour fire-resistance-rated separation between dwelling units. It has been debated whether a lot line between the dwelling units (which is common in some areas of the country and not common in others) impacts this separation requirement. The question has been whether the lot line means that the wall at the separation is considered to be an exterior wall that needs to meet the provisions of Section R302.1, resulting in two 1-hour walls at the lot line. In some jurisdictions, the answer was yes. Further, in some cases with a separating lot line, the interpretation has been that the building is no longer a two-family dwelling, but two separate detached single-family dwellings, each requiring a 1-hour wall at the lot line. In other jurisdictions, the answer was no: a duplex is a duplex no matter if the dwelling units are divided by a lot line. The reasoning behind this approach was that the fire does not know if there is a lot line there and only the 1-hour separation applies. The change to this section intends to end the debate and clarify the application of this separation. The intent of the new language is that a fire-resistance rating need never be greater than 1 hour, whether there is a lot line between dwelling units or not. For the lot line question, this brings the two-family dwelling provisions into agreement with the townhouse provisions. If the townhouse has fire sprinkler protection, a common 1-hour wall has been acceptable even if there was a lot line between townhouse units. If the exterior wall provisions in Section R302.1 were applied to townhouses, the 1-hour common wall would not be allowed. Presumably, this change to the code allowing a 1-hour separation when there is a lot line between duplex dwelling units is meant to apply to the exception as well. The exception permits a draft stop to separate the attics of the dwelling units if other fire-resistance requirements are satisfied.

Another exception to the 1-hour separation requirement for two-family dwellings has allowed the rating to be reduced to ½ hour if a full NFPA 13 sprinkler system was installed. This exception has not been used nor would it be used because of the extra cost associated with a full NFPA 13 system typically associated with commercial structures. The cost would far outweigh any savings realized from reducing the rating from 1 hour to ½ hour. As another incentive to install a sprinkler system for areas of the country that do not adopt the CRC sprinkler provisions, a dwelling sprinkler system installed in accordance with Section P2904 or NFPA 13D now can be used to reduce the rating to ½ hour.

Two-family dwelling.



Two-family dwelling separated by lot line and 1-hr fire-resistant separation.

- **CRC Section R310.1.1**

Emergency Escape and Rescue Opening Required

An emergency escape and rescue opening in use during a fire.

CHANGE SIGNIFICANCE: Previously, the requirements in the CRC and CBC for emergency escape and rescue openings were not consistent. Specifically, while the requirements in CRC R310.1 and CBC 1030.1 were consistent, the exceptions to where operable emergency escape and rescue openings were not. CBC 1030.1 provided additional exceptions such as basements with a ceiling height of less than 80 inches, basements or sleeping rooms with an exit door or exit door access, basements without habitable space and not more than 200 square feet, and also added storm shelters constructed in accordance with ICC 500. These exceptions have now been incorporated into Section R310.1, and the two codes are more consistent about the required locations of emergency escape and rescue openings.

Further, additional language was added to Section R310.1.1 regarding the maximum height of 70 inches for opening control devices and that the device shall be maintained at all times. The previous edition provided no such language, which allowed for the installation of control devices at heights or locations that were not accessible to occupants in the event of fire or other emergency.

Similarly, language was added regarding the requirement that exterior release device for use by the Fire Department is needed only when required by the authority having jurisdiction. In some circumstances it was found that the exterior release device decreased the intended security for the occupants by allowing exterior access. This additional language will allow the local fire department and authority having jurisdiction to determine whether the exterior release device is required or if occupant egress can be achieved by other means.

Lastly, a reference to Part 12, Chapter 12-3 for the required standards for Releasing Systems for Security Bars in Dwellings was added into this section as well. Chapter 12-3 contains requirements covering releasing systems for bars, grilles, mesh, glazing or other items intended to provide security at doors and windows required for emergency escape from dwelling units. When actuated by the occupant, the system allows the obstructions over the door or window to be moved so occupants can escape in the event of an emergency. Chapter 12-3 only cover the ability of the releasing system to be manually activated from the interior of a dwelling unit by an occupant to affect an escape through the protected opening. However, it is an important additional reference as it directs the user to the requirements of Part 12, Chapter 12-3 and its associated requirements.

- **CRC Section R323**

STORM SHELTERS

CHANGE SIGNIFICANCE: Impact-protective systems of structures intended as residential storm shelters have failed prematurely when they do not meet the testing requirements of ICC 500 *Standard for the Design and Construction of Storm Shelters*. In some cases, the structures have been placed above ground where they were not designed for loads created by tornadoes or hurricanes. Reports of failures associated with residential storm shelters that are not designed and constructed in accordance with ICC 500 underscore the importance of these new provisions.

Failures have not occurred in residential shelters engineered and certified as residential storm shelters. The provisions of ICC 500 cannot be met by prescriptive methods in the CRC and require the expertise of a registered design professional.

Section R323.1 requires that storm shelters comply with ICC 500. By adding a definition of a storm shelter to the CRC, adding a requirement in Section R106, Construction documents, for details required by ICC 500 and a requirement for sealed plans providing structural and impact protection system design, these shelters should withstand tornadoes or hurricanes keeping deaths and injuries to a minimum. The exception in Section R323.1.1 allows listed and labelled shelter designs to be submitted without an individual design as these shelters have a third-party review process checking the design’s resistance to high wind loads and impacts.

ICC 500

Exterior of storm shelter.

- **CRC Section R326**

HABITABLE ATTIC

CHANGE SIGNIFICANCE: The term "habitable attic" first appeared in the definitions of the 2010 edition of the CRC. Although finishing off habitable space in an attic was not unheard of, the origin of the term "habitable attic" is unclear, and it may have been created for use in the CRC. By definition, an "attic" is unfinished space, and it is not considered to be occupiable or habitable. The only purpose for introducing the term "habitable attic" was to add another usable level to a dwelling constructed under the CRC in addition to the maximum height in stories prescribed by the code. Since its introduction, a habitable attic has not been considered a story and has been permitted in addition to the maximum three stories above grade plane as allowed by the scope of the code. Where a dwelling or townhouse had a basement that was not a story above grade plane, identifying the top level as a habitable attic in addition to the three stories above grade plane created five usable or habitable levels. This has been a design option to benefit the designer, builder and property owner in constructing taller buildings under the CRC. There is at least a perceived advantage to building under the CRC as opposed to the CBC. Perhaps the biggest issue comes down to the installation of a fire sprinkler system, which is required in both model codes. The sprinkler provisions of the CRC have been amended out of local ordinances in many parts of the United States. Where a builder perceived an advantage to building under the CRC provisions rather than those of the CBC, a habitable attic may have provided that flexibility.

In most parts of the country, three-story houses are unusual and those exceeding three stories are rarer still. However, in some urban areas of the country, space for new construction is limited and it is desirable to build a taller building (or add to the height of an existing building) on a smaller footprint.

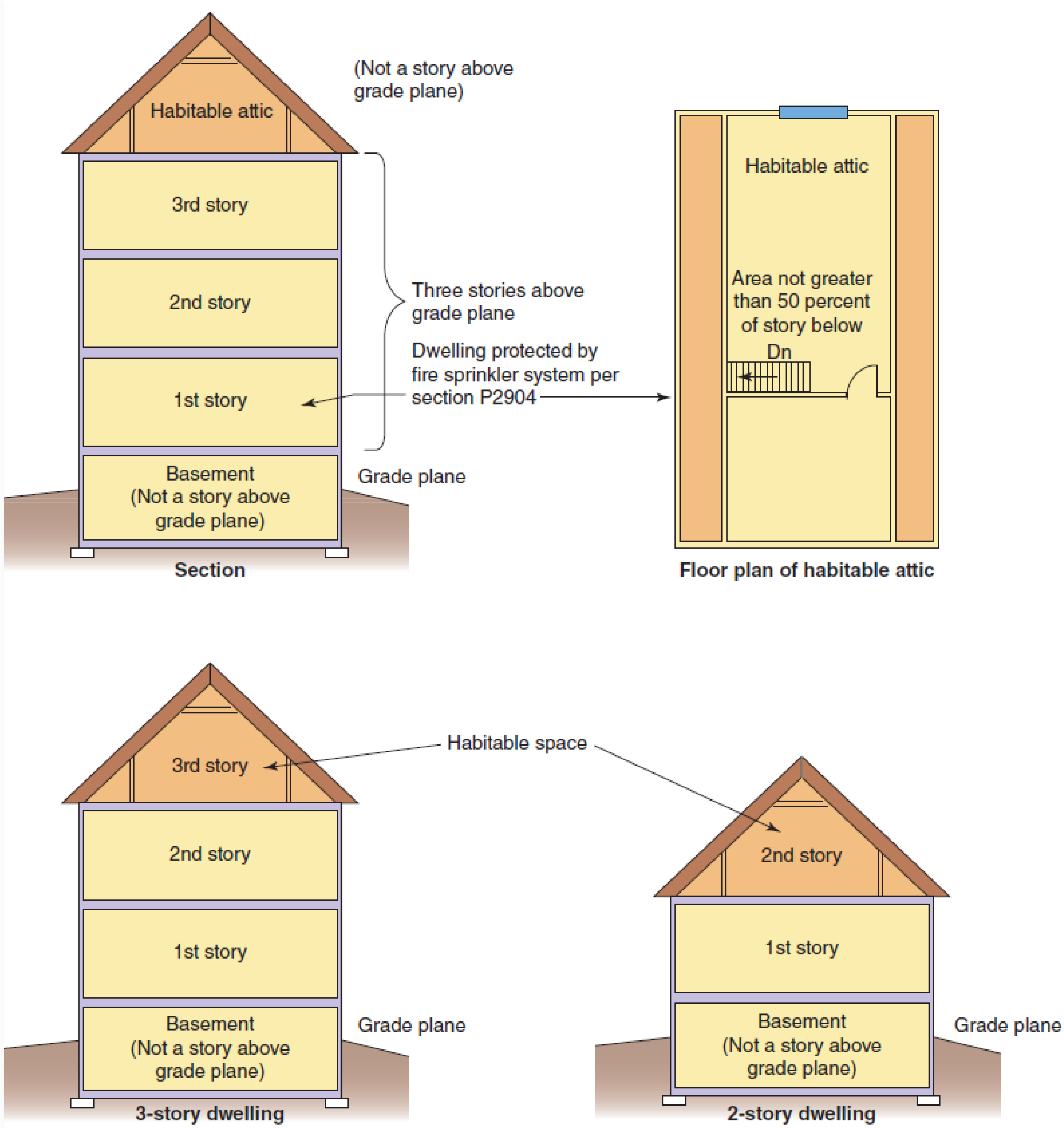
In the code editions since the 2010 CRC, the rules for a habitable attic have remained consistent and changes have been mostly editorial. Technical requirements have been removed from the definition and placed in a section near the end of Chapter 3. The space has had to meet the minimum room area and ceiling height for habitable spaces and be enclosed by the roof assembly and floor/ceiling assembly of the attic. The code has also required habitable attics to have a smoke alarm and an emergency escape and rescue opening.

Concern was expressed that the added habitable space above the third story creates a fire- and life-safety hazard for occupants because of the height above fire department access and the maximum reach of standard 35-foot extension ladders that may be used in a fire department response. Discussion has also centered around the differences between the CRC and CBC. The CBC does not have provisions for a "habitable attic." As in the CRC, an "attic" in the CBC is unfinished and is not occupiable or habitable space. If the attic is converted to habitable space, it is no longer an attic but becomes habitable space on another story because it then meets the definition of story. The addition of habitable attic in the 2010 CRC was purposeful in that it was adding an option to the CRC to avoid being under the scope of the CBC. There was no intent for the provisions in the two codes to match.

New to the 2022 CRC, Section R326.3 states that a habitable attic is a story above grade plane. The exceptions retain the concept of a habitable attic being allowed above the third story and not being considered a story above grade plane with further restrictions. This option is available only if the dwelling unit is protected with a fire sprinkler system in accordance with Section R313, and the "aggregate" area of the habitable attic does not exceed one-half of the area of the story below. These additional requirements are thought to mitigate the life-safety concerns for occupants in these taller buildings.

The limitation on "aggregate" area for a habitable attic is borrowed from the mezzanine provisions (which also have very limited use under the CRC but, like habitable attics, may be used to build taller buildings since they are not considered a story). Unlike mezzanines, attics typically match the area of the story below. Presumably the intent, though not stated, is that this 50 percent limitation only applies to the habitable area of the attic and that "aggregate" means the combined area of habitable space on that level. For example, storage areas and areas that do not meet the minimum ceiling height requirements are not considered habitable space and would not be included in the 50 percent calculation. On the other hand, the area of the story below would include both habitable space and other spaces for calculation purposes. Exception 1.1 (one-third area limitation) has no application because it applies to a building without fire sprinklers and sprinklers are required in all cases where a habitable attic is above the third story and is not considered a story. This conflict occurs because there were multiple public comments to the initial code change proposal that were approved at the public comment hearings.

The new code language presents the option to call habitable space in the attic above a one-story or two-story house a "habitable attic" but there is no advantage to doing so as a design option. As in previous editions of the CRC, including the editions before the term habitable attic was introduced to the code, and as is done in the CBC, when an attic of a one- or two-story house is finished into habitable space, it is no longer an attic and becomes habitable space. Whether or not it is considered a story is no longer an issue.



Dwellings meeting the CRC limit of 3 stories above grade plane.

- **CRC Section R301.2**

WIND SPEED

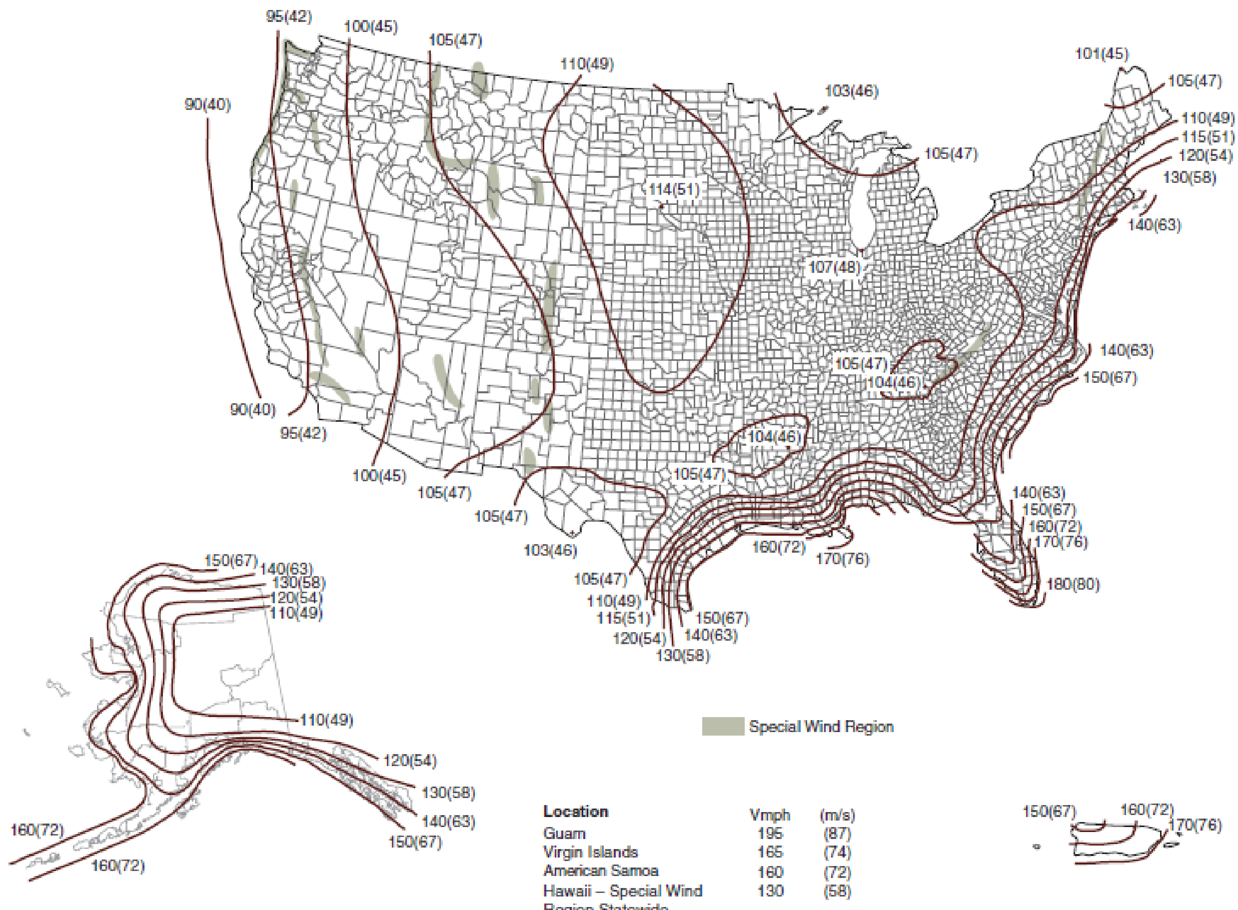
CHANGE SIGNIFICANCE: Section R301.2.1 coordinates the CRC wind design criteria with the 2016 edition of the engineering standard *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (ASCE 7). In ASCE 7-16, wind speeds in non-hurricane prone areas of the contiguous United States have been revised using contours to better reflect regional variations in extreme straight-line winds due to thunderstorms.

In Figure R301.2(2), wind speeds are no longer a minimum of 115 mph for the center of the country and 110 mph in the west. The map is updated to show lower wind speeds with isolines for 90, 95, 100 and 105 mph. Point values are added to the map to aid interpolation between isolines. Generally, wind speeds have dropped across the country, and in some locations the wind speed dropped significantly. Any area that had wind speeds set at 110 mph (west coast) or 115 mph (central United States) now has reduced wind speeds.

With updates to Figure R301.2(2), the map is now identical to the 2022 CBC and ASCE 7-16 wind speed maps for Risk Category II buildings – the category for most buildings including single- and two-family residences and townhouses. Wind speeds in hurricane-prone regions generally remained the same. For the northeastern United States, certain wind speeds dropped 5 to 10 mph inland away from the coastline. New hurricane contours were developed based on updated hurricane models, and hurricane coastline contour locations were adjusted to reflect new research into hurricane decay rates over land. The details of changes, data behind the isolines and methods used to estimate both non-hurricane and hurricane wind speeds are provided in ASCE 7-16's Commentary to Chapter 26. Note that while wind speeds have decreased in certain parts of the country, component and cladding roof wind pressures in certain cases have increased due to changes in Table R301.2.1(1). See the significant change discussion for roof components and cladding.

To see a specific wind speed for a town or individual building, go to either hazards.atcouncil.org or asce7hazardtool.online and type in an address or GPS coordinates. The website will give the wind speed assigned to the location. It is now possible to determine the ground snow load, wind speed, seismic design category and tornado risk from the Applied Technology Council (ATC) website, which remains free to users. The American Society of Civil Engineers (ASCE) website contains additional information while charging a nominal yearly fee and offering wind speeds and tsunami hazard zones for free.

Section R301.2.1 now also includes a reference for wind design of metal roof shingles. Metal roof shingles are fastened following the requirements of Section R905.4.4.



Location	Vmph	(m/s)
Guam	195	(87)
Virgin Islands	165	(74)
American Samoa	160	(72)
Hawaii – Special Wind Region Statewide	130	(58)

Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10 m) above ground for Exposure C category.
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. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).
6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed.

Updated Wind Speeds.

- **CRC Section R507**

Deck Loads

CHANGE SIGNIFICANCE: *California Residential Code* (CRC) prescriptive deck provisions historically have only assumed a 40 psf live load and 10 psf dead load for all components in the deck. However, a significant portion of the population in the United States lives in areas where the ground snow load exceeds the live load in Table R301.5, Minimum Uniformly Distributed Live Loads.

For the 2022 CRC, a deck is now either designed for a 40 pounds per square foot (psf) live load or for the ground snow load listed in a jurisdiction's table of climatic and geographic design criteria (Table R301.2). This requires use of whichever load is higher. Updated lumber tables consider ground snow loads of 50, 60 and 70 psf while allowing interpolation between loads.

For snow loading, an increase in wood strength is accounted for using a load duration factor from the *National Design Specification (NDS) for Wood Construction*. While deck geometry and nearby structures can cause drifting, these effects are outside the scope of CRC deck tables. Similarly, elevated decks have snow loads less than the ground snow load based on ASCE 7, but this reduction is not included to provide simpler tables.

Note that when comparing the *2022 California Building Code* (CBC) and the 2022 CRC, minimum deck live loads will be 1.5 times the associated room live load per the 2022 CBC. For a sleeping room, this will be 1.5 × 30 psf or 45 psf. For all other residential areas, the deck live load will be 1.5 × 40 psf or 60 psf. In the CRC, for decks accessed from any room, the minimum live load remains 40 psf.

Snow on deck.

- **CRC Section R507.10**

EXTERIOR GUARDS

CHANGE SIGNIFICANCE: The 2019 CRC had no requirements for constructing exterior guards on decks in Section R507. Guards provide the first line of defense against significant falls, which can result in serious and sometimes fatal injuries. Exterior guards on decks, particularly the guard system connection to the deck framing, are rarely engineered and even more rarely tested to verify adequacy to meet the 200-pound load requirements of Table R301.5, Minimum Live Loads.

Exterior deck guards must continue to meet Section R312 requirements and the loads listed in Table R301.5. The new provisions also reinforce the need for a load path from the guard and rail into the deck joists, beams or blocking to which a guard is connected. End grain connections in withdrawal are prohibited. In other words, guard fasteners may not be installed into the ends of deck joists or beams if loading will occur parallel to the length of the joist or beam slowly pulling the fasteners out of the lumber. When guards are connected to the side of beams or joists, the beam or joist shall be connected to adjacent joists–for example by blocking or straps–to resist rotation of the beam or joist when load is applied to the guard.

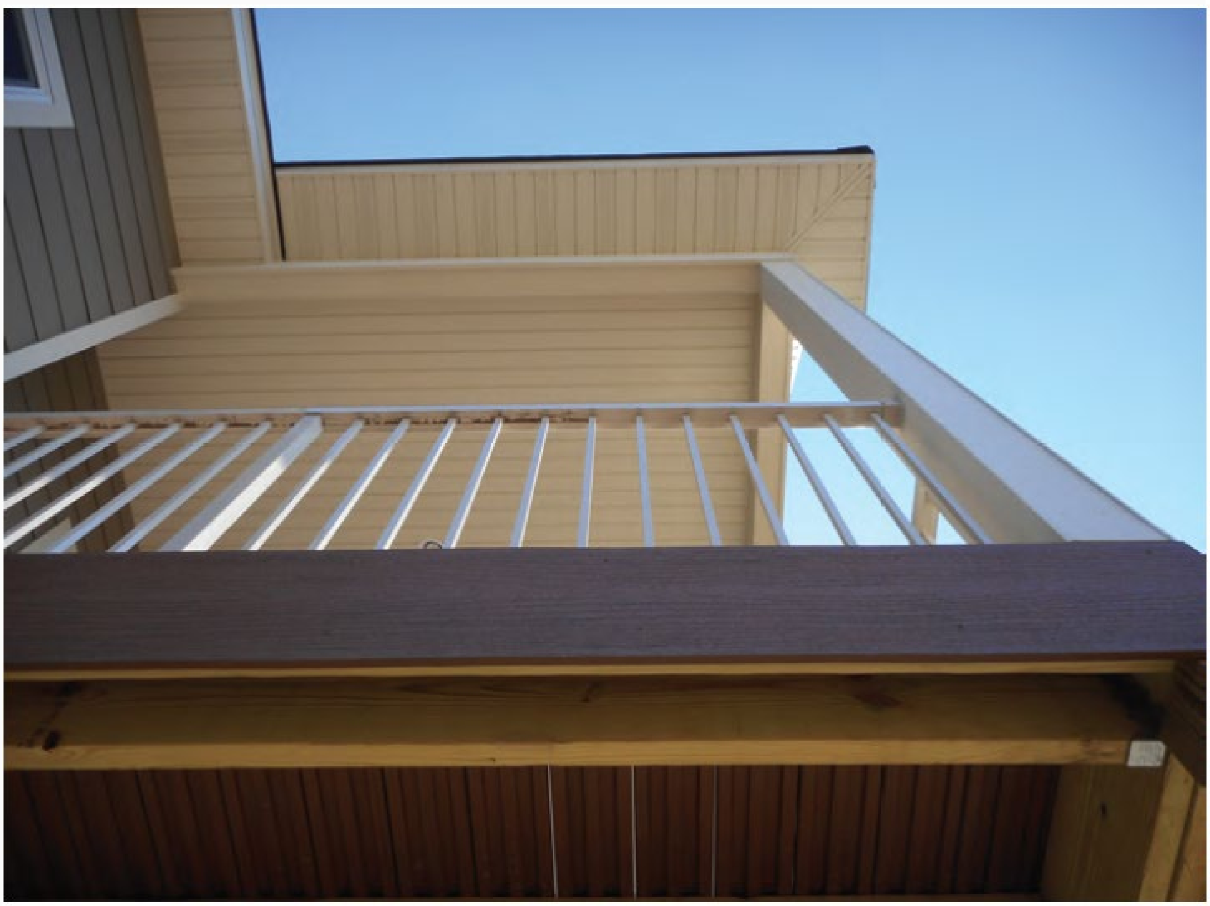


Photo courtesy of Peter Kulczyk

Deck guards are used for fall protection.

- **CRC Section R301.2.1**

COMPONENT AND CLADDING WIND PRESSURES IN TABLE R301.2.1(1) ARE UPDATED FOR NEW DESIGN WIND SPEEDS AND HIP OR GABLE ROOF PROFILES

CHANGE SIGNIFICANCE: Changes to Section R301.2 coordinate wind design criteria in the CRC with the referenced engineering load standard *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (ASCE 7-16). Simplified component and cladding loads in Table R301.2.1(1) are revised for consistency with ASCE 7 roof component and cladding loads (C&C) for buildings with mean roof heights less than or equal to 60 feet. The roof zones and pressure coefficients in ASCE 7-16 Figure 30.3-2 (which includes Figures 30.3-2A through 30.3-2I) have been revised based on analysis of an extensive wind tunnel test results database.

Compared to previous versions of the CRC, C&C pressure coefficients have increased. C&C roof zone sizes are also modified. Monitoring of buildings across the country indicates that for low-rise buildings, C&C roof zone sizes depend primarily on building height, *h.* Note that for Exposure B, when the building mean roof height is less than 30 feet, the adjustment is less than 1.0 allowing a reduction in required wind pressure.

Mean roof height is defined as the average of the ridge and eave heights. Figure R301.2.1, component and cladding pressure zones, is illustrated in the figure on gable roof wind zones and shows corner (3, 3e, 3r), edge (2e, 2r, 2n) and interior (1) roof zones. These C&C zones are different from roof zones in previous editions of the CRC. The updated Figure R301.2.1 and Table R301.2.1(1) incorporate recent research by increasing edge and corner wind pressures as appropriate. To better define which roof surface areas require increased wind resistance, gable and hip roofs are divided into two categories and low-slope roofs (0 to 7 degrees) are separated from roofs with shallow slopes (>7 to 20 degrees) and steeper slopes (>20 to 27) and (>27 to 45 degrees). By separating the roof slope into multiple categories and dividing the roof surface into multiple regions, nailing patterns are increased only when necessary and less restrictive patterns can be used where appropriate.

New vocabulary includes division of C&C corner and edge zones as follows:

2 – edge zones

2e – edge zone along bottom of roof above the soffit

2r – edge zone along roof peak

2n – edge zone along rake edge of gable roof

3 – corner zones

3e – corner zone at bottom of roof above the soffit

3r – corner zone at roof peak

a = 4 feet

Interior C&C zones are broken into two categories. For the CRC, zone 1 and zone 1′ use the same value. If the roof requires design per the CBC, these values will be different.

1 – interior zone

1′ – central interior zone, flat or low slope roof

When considering nailing patterns for buildings constructed following the 2022 CRC, consider how many different nailing patterns are reasonable to require on a single roof. A single nailing pattern is preferred by framers, but in high wind zones, it may be preferable to have a nailing pattern for corner and edge zones with a different pattern in the interior of the roof. Also note that relatively new fasteners, such as Roof Sheathing Ring Shank (RSRS) nails have been tabulated in Table R602.3(1) specifically to address these increased roof wind pressures.

TABLE R301.2.1(1): Component and Cladding Loads for a Building with a Mean Roof Height of 30 Feet Located in Exposure B (ASD) (psf)

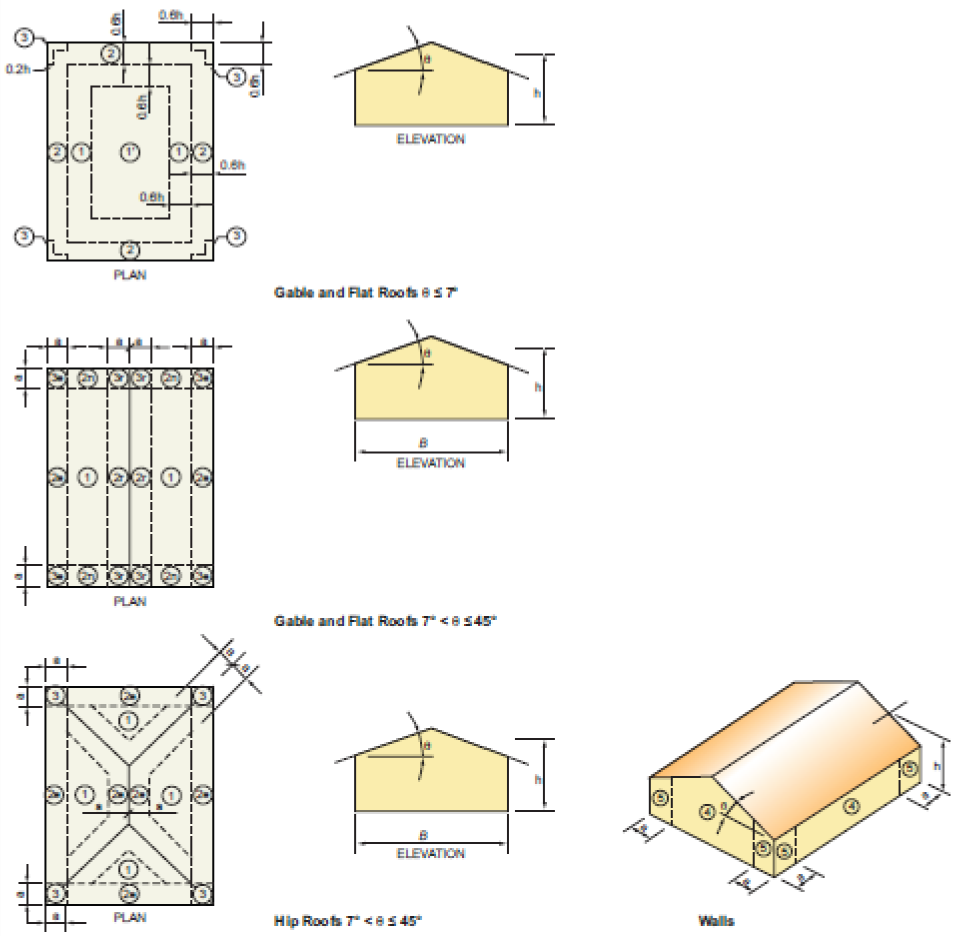
		Effective Wind Areas	Ultimate Design Wind Speed, V_{ult}													
			90		95		100		105		110		...		180	
	Zone	(ft²)	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg
Gable Roof >7 to 20 degrees	1, 2e	10	5.4	-16.2	6	-18.0	6.7	-19.9	7.4	-22	8.1	-24.1	...	...	21.6	-64.6
	1, 2e	20	4.9	-16.2	5.4	-18	6.0	-19.9	6.6	-22	7.2	-24.1	...	...	19.4	-64.6
	1, 2e	50	4.1	-9.9	4.6	-11	5.1	-12.2	5.6	-13.4	6.1	-14.7	...	...	16.4	-39.4
	1, 2e	100	3.6	-5	4	-5.6	4.4	-6.2	4.8	-6.9	5.3	-7.5	...	...	14.2	-20.2
	2n, 2r, 3e	10	5.4	-23.6	6	-26.3	6.7	-29.1	7.4	-32.1	8.1	-35.2	...	...	21.6	-94.2
	2n, 2r, 3e	20	4.9	-20.3	5.4	-22.7	6	-25.1	6.6	-27.7	7.2	-30.4	...	...	19.4	-81.4
	2n, 2r, 3e	50	4.1	-16	4.6	-17.9	5.1	-19.8	5.6	-21.8	6.1	-24	...	...	16.4	-64.2
	2n, 2r, 3e	100	3.6	-12.8	4	-14.3	4.4	-15.8	4.8	-17.4	5.3	-19.1	...	...	14.2	-51.3
	3r	10	5.4	-28	6	-30.2	6.7	-34.6	7.4	-38.1	8.1	-41.8	...	...	21.6	-112
	3r	20	4.9	-24	5.4	-26.7	6	-29.6	6.6	-32.7	7.2	-35.9	...	...	19.4	-96
	3r	50	4.1	-18.7	4.6	-20.8	5.1	-23.1	5.6	-25.4	6.1	-27.9	...	...	16.4	-74.7
	3r	100	3.6	-14.7	4	-16.3	4.4	-18.1	4.8	-20	5.3	-21.9	...	...	14.2	-58.7
Hipped Roof >7 to 20 degrees	1	10	6.5	-14.7	7.3	-16.3	8	-18.1	8.9	-20	9.7	-21.9	...	...	26.1	-58.7
	1	20	5.6	-14.7	6.3	-16.3	7	-18.1	7.7	-20	8.4	-21.9	...	...	22.5	-58.7
	1	50	4.4	-11.3	5	-12.6	5.5	-14	6.1	-15.4	6.6	-16.9	...	...	17.8	-45.3
	1	100	3.6	-8.7	4	-9.7	4.4	-10.8	4.8	-11.9	5.3	-13.1	...	...	14.2	-35
	2r	10	6.5	-19.1	7.3	-21.3	8	-23.6	8.9	-26	9.7	-28.6	...	...	26.1	-76.5
	2r	20	5.6	-17.2	6.3	-19.2	7	-21.3	7.7	-23.4	8.4	-25.7	...	...	22.5	-68.9
	2r	50	4.4	-14.7	5	-16.4	5.5	-18.2	6.1	-20	6.6	-22	...	...	17.8	-58.8
	2r	100	3.6	-12.8	4	-14.3	4.4	-15.8	4.8	-17.4	5.3	-19.1	...	...	14.2	-51.3
	2e, 3	10	6.5	-20.6	7.3	-22.9	8	-25.4	8.9	-28	9.7	-30.8	...	...	26.1	-82.4
	2e, 3	20	5.6	-18.5	6.3	-20.6	7	-22.9	7.7	-25.2	8.4	-27.7	...	...	22.5	-74.1
	2e, 3	50	4.4	-15.8	5	-17.6	5.5	-19.5	6.1	-21.5	6.6	-23.6	...	...	17.8	-63.1
	2e, 3	100	3.6	-13.7	4	-15.3	4	-16.9	4.8	-18.7	5.3	-20.5	...	...	14.2	-54.8

(Only a portion of the table is shown for brevity and clarity.)

Roof cladding damage.

TABLE R301.2.1(2) Height and Exposure Adjustment Coefficients for Table R301.2.1(1)

Mean Roof Height (ft)	Exposure		
	B	C	D
15	0.82 ~~1.00~~	1.21	1.47
20	0.89 ~~1.00~~	1.29	1.55
25	0.94 ~~1.00~~	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70



Component and cladding pressure zones.

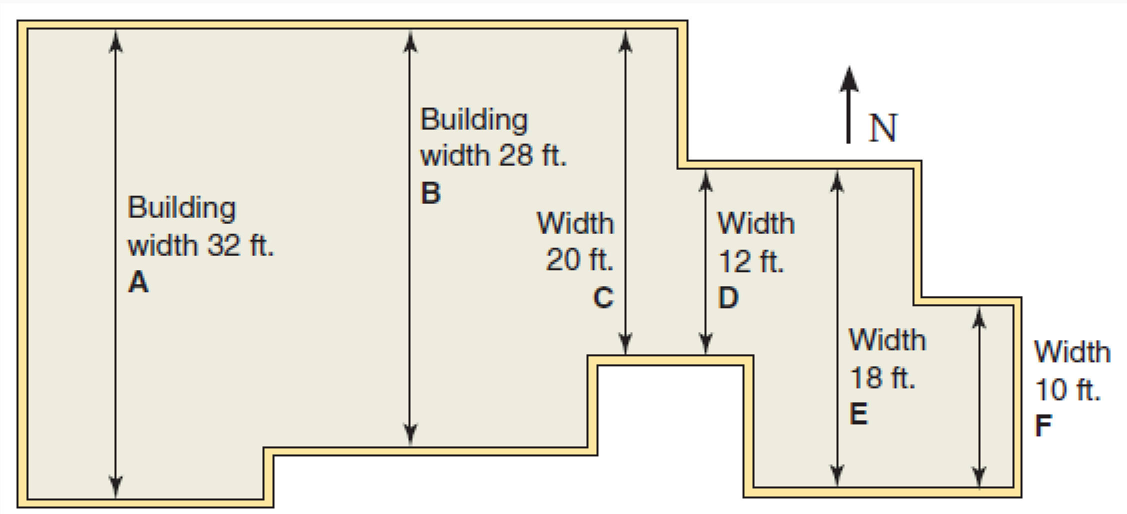
- **CRC Section R403.1**

MINIMUM FOOTING SIZE TABLES ARE REVISED TO MORE ACCURATELY REFLECT CURRENT PRACTICE

CHANGE SIGNIFICANCE: Designers using Tables R403.1(1), (2) or (3), minimum width and thickness for concrete footings, introduced in the 2016 *California Residential Code* (CRC), have found in certain instances footing widths required by the table to be different than those required by previous editions of the CRC. In fact, due to conservative assumptions for the tables, some footing widths were wider than an engineering analysis would suggest necessary. A review of underlying calculations found minimum widths and thicknesses where load assumptions were incorrect.
Therefore, changes to the tables were proposed for the *2022 California Residential Code*.
Revised assumptions and calculations for concrete footing tables include the following:
1. Application of roof snow load rather than ground snow load to the roof. The actual roof snow load per ASCE 7, unadjusted by any other factors, is 70 percent of the ground snow load or 20 pounds per square foot, whichever is greater. Consistent with Chapter 8 rafter tables, a thermal factor (*Ct*) of 1.1 per ASCE 7 is also applied to roof snow load calculations.
2. A 100-pound per square foot (psf) load was previously used for above-grade concrete or masonry walls, representing a solid or fully grouted 8-inch CMU wall. Such walls are more likely to be either 8-inch CMU grouted at 48 inches on center or 8-inch insulated concrete forms, both of which impose only a 55 pound per square foot load. This change affects Table R403.1(3) for footings under above-grade concrete or CMU walls.
3. Previous calculations used the ASCE 7 load combination applying a 0.75 factor for concurrent roof/snow and floor live loads, ignoring load combinations that apply to just a roof/attic live load, just a snow load, or just a floor live load. These additional load combinations apply for a single-story building and for interior footings.
4. Calculations were formerly based on tributary width, yet footnote b added 2 inches of footing width for every 2 feet of additional building width. For a building with interior concrete footings, the tributary width is half the distance between footings, not half the entire building width. As a result of confusing building and tributary width, footnote b potentially doubled the additional footing width for buildings wider than 32 feet.

In many cases, revised footing widths in the 2022 CRC are more consistent with historic practice, while still technically justified under engineering standards and accepted practices. There are a few cases for houses on weaker soils (1500 psf and 2000 psf soil bearing strength) with slab-on grade or crawlspace foundations, where a revised assumption of clear spanning roof trusses led to a slight increase to footing widths.
Footnote b allowing adjustment of footing width and depth is now divided into two footnotes. Footnote c requires an increase in footing width and depth when the building width perpendicular to a wall footing exceeds 32 feet. Footnote d permits, but does not require, a decrease in footing width and depth for a building width narrower than 32 feet.

Example: Footing Size with Variable Building Width
A single-family home has the following attributes:
• Two-story
• Gable roof
• Crawl space foundation
• Thirty psf ground snow load
• 1500 psi soil capacity assumed
• Building width varies between 12 and 32 feet
• Clear-span trusses at 24 inches on center
• Center-bearing floors



For building widths A – F, the tributary length is:
A. Tributary length = 16 ft
B. Tributary length = 14 ft
C. Tributary length = 10 ft
D. Tributary length = 6 ft
E. Tributary length = 9 ft
F. Tributary length = 5 ft
For building widths A–F, the worst case footing size is a 16 × 6 footing for a 32-foot building width. The footing could be reduced to 12 × 6 where applicable on the north and south walls of the building.
Footings support building loads which include the weight of the building (dead loads), live loads (people and furnishings) and environmental loads, for example snow. Exterior bearing walls carry roof loads based on an assumption of a clear-span roof, such as a truss, which means the roof's tributary area is calculated based on half the building width.
With an assumption of a center-bearing wall or beam carrying the load from floor joists or trusses, the tributary area for floors is based on one quarter of the building width.
Gable-end exterior walls carry only the weight of no-load-bearing walls and the roof load from one-half of the truss or rafter spacing. In the example, the truss spacing is 24 inches on-center so the roof load tributary width is only 1 foot. Gable-end walls will typically never need more than

the 12 × 6 minimum footing size.
For a hip roof, it is reasonable to measure the building width perpendicular to the wall from the peak of the hip (where it connects to the ridge) to the end wall—in other words, the length of the longest hip truss or rafter.

TABLE R403.1(1) Minimum Width and Thickness for Concrete Footings for Light-Frame Construction (inches) [a, b, c, d]

Ground Snow Load or Roof Live Load	Story and Type of Structure with Light Frame	Load Bearing Value of Soil (psf)					
		1500	2000	2500	3000	3500	4000
20 psf Roof Live Load or 25 psf Ground Snow Load	1 story – slab on grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story – with crawl space	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story – plus basement	16 × 6 ~~18 × 6~~	12 × 6 ~~14 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6
	2 story – slab on grade	13 × 6 ~~12 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story – with crawl space	15 × 6 ~~16 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story – plus basement	19 × 6 ~~22 × 6~~	14 × 6 ~~16 × 6~~	12 × 6 ~~13 × 6~~	12 × 6	12 × 6	12 × 6
	3 story – slab on grade	16 × 6 ~~14 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story – with crawl space	18 × 6 ~~19 × 6~~	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story – plus basement	22 × 7 ~~25 × 8~~	16 × 6 ~~19 × 6~~	13 × 6 ~~15 × 6~~	12 × 6 ~~13 × 6~~	12 × 6	12 × 6
30 psf	1 story – slab on grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story – with crawl space	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story – plus basement	16 × 6 ~~19 × 6~~	12 × 6 ~~14 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6
	2 story – slab on grade	13 × 6 ~~12 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story – with crawl space	16 × 6 ~~17 × 6~~	12 × 6 ~~13 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6
	2 story – plus basement	19 × 6 ~~23 × 6~~	14 × 6 ~~17 × 6~~	12 × 6 ~~14 × 6~~	12 × 6	12 × 6	12 × 6
	3 story – slab on grade	16 × 6 ~~15 × 6~~	14 × 6 ~~12 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6
	3 story – with crawl space	19 × 6 ~~20 × 6~~	14 × 6 ~~15 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6
	3 story – plus basement	22 × 7 ~~26 × 8~~	16 × 6 ~~20 × 6~~	13 × 6 ~~16 × 6~~	12 × 6 ~~13 × 6~~	12 × 6	12 × 6

continues

TABLE R403.1(1) *(continued)*

Ground Snow Load or Roof Live Load	Story and Type of Structure with Light Frame	Load Bearing Value of Soil (psf)					
		1500	2000	2500	3000	3500	4000
50 psf	1 story – slab on grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story – with crawl space	14 × 6 ~~16 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story – plus basement	18 × 6 ~~21 × 6~~	13 × 6 ~~16 × 6~~	12 × 6 ~~13 × 6~~	12 × 6	12 × 6	12 × 6
	2 story – slab on grade	15 × 6 ~~14 × 6~~	13 × 6 ~~12 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6
	2 story – with crawl space	17 × 6 ~~19 × 6~~	13 × 6 ~~14 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6
	2 story – plus basement	21 × 7 ~~25 × 7~~	15 × 6 ~~19 × 6~~	12 × 6 ~~15 × 6~~	12 × 6	12 × 6	12 × 6
	3 story – slab on grade	18 × 6 ~~17 × 6~~	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story – with crawl space	20 × 6 ~~22 × 6~~	15 × 6 ~~17 × 6~~	12 × 6 ~~13 × 6~~	12 × 6	12 × 6	12 × 6
	3 story – plus basement	24 × 8 ~~28 × 9~~	18 × 6 ~~21 × 6~~	14 × 6 ~~17 × 6~~	12 × 6 ~~14 × 6~~	12 × 6	12 × 6
70 psf	1 story – slab on grade	14 × 6 ~~12 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story – with crawl space	16 × 6 ~~18 × 6~~	12 × 6 ~~13 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6
	1 story – plus basement	19 × 6 ~~24 × 7~~	14 × 6 ~~18 × 6~~	12 × 6 ~~14 × 6~~	12 × 6	12 × 6	12 × 6
	2 story – slab on grade	17 × 6 ~~16 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story – with crawl space	19 × 6 ~~21 × 6~~	14 × 6 ~~16 × 6~~	12 × 6 ~~13 × 6~~	12 × 6	12 × 6	12 × 6
	2 story – plus basement	22 × 7 ~~27 × 9~~	17 × 6 ~~20 × 6~~	13 × 6 ~~16 × 6~~	12 × 6 ~~14 × 6~~	12 × 6	12 × 6
	3 story – slab on grade	20 × 6 ~~19 × 6~~	15 × 6 ~~14 × 6~~	12 × 6	12 × 6	12 × 6	12 × 6
	3 story – with crawl space	22 × 7 ~~25 × 7~~	16 × 6 ~~18 × 6~~	13 × 6 ~~15 × 6~~	12 × 6	12 × 6	12 × 6
	3 story – plus basement	24 × 8 ~~30 × 10~~	19 × 6 ~~23 × 6~~	15 × 6 ~~18 × 6~~	13 × 6 ~~15 × 6~~	12 × 6 ~~13 × 6~~	12 × 6

a. ~~Interpolation allowed.~~ Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not ~~allowed~~ permitted.

b. ~~Based on 32-foot-wide house with load-bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house, add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick).~~ The table is based on the following conditions and loads: Building width: 32 feet; Wall height: 9 feet; Basement wall height: 8 feet; Dead loads: 15 psf roof and ceiling assembly, 10 psf floor assembly, 12 psf wall assembly; Live loads: Roof and ground snow loads as listed, 40 psf first floor, 30 psf second and third floors. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.

c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.

continues

d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width, provided the minimum width is 12 inches (304.8 mm) and minimum depth is 6 inches (152.4 mm).

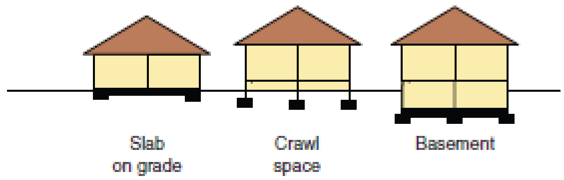


TABLE R403.1(2) **Minimum Width and Thickness for Concrete Footings for Light-Frame Construction with Brick Veneer or Lath And Plaster (inches)[a, b, c, d]**

Ground Snow Load or Roof Live Load	Story and Type of Structure With Brick Veneer	Load-Bearing Value of Soil (psf)					
		1500	2000	2500	3000	3500	4000

TABLE R403.1(3) **Minimum Width and Thickness for Concrete Footings with Cast-In-Place Concrete or ~~Fully~~ Partially Grouted Masonry Wall Construction (inches)[a, b, c, d]**

Ground Snow Load or Roof Live Load	Story and Type of Structure With CMU or Concrete	Load-Bearing Value of Soil (psf)					
		1500	2000	2500	3000	3500	4000

(For changes to Tables R403.1(2) and R403.1(3) please see the 2021 CRC)

Stem wall and interior footings.

- **CRC Section R602.9**

Cripple wall requirements apply only to exterior cripple walls.

CHANGE SIGNIFICANCE: The CRC and CBC require foundation cripple walls, below exterior walls, with studs less than 14 inches tall to be "continuously-sheathed" in all seismic regions. This requirement is not related to wall bracing which is covered in Section R602.10. The requirement for continuous sheathing on cripple wall studs with a height less than 14 inches (or solid-blocking) is intended to ensure the integrity of the studs when nails are end-nailed into top and bottom plates by face-nailing sheathing into the top and bottom plates as well as studs.

In regions with shallow frost-depth it is common to have shallow crawl spaces. Typically, a concrete stem wall forms the exterior foundation walls and directly supports the floor. The interior walls, typically 2 to 4 feet tall, are cripple walls laid on a strip footing. These walls move with the exterior concrete walls during an earthquake and have few issues. Therefore, continuous blocking or sheathing is not required for these interior walls when the exterior foundation is concrete up to the floor framing and bottom plate. Continuous sheathing on these short walls in a crawl space also creates issues for ventilation, under-floor mechanical systems, plumbing and access.

In past earthquakes, exterior cripple walls have been very vulnerable to out-of-plane movement with the cripple wall losing its ability to support the walls above causing the cripple wall to rock out of plumb and collapse. As exterior cripple walls need protection and interior cripple walls simply need to be nailed appropriately, the requirement for a cripple wall to be continuously sheathed is updated from a provision for all cripple walls to a requirement for exterior walls only in the 2022 CRC.

Cripple wall along exterior of house – unsheathed.

Interior cripple wall.