

Part III—Building Planning and Construction

CHAPTER 3

BUILDING PLANNING

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.

Exception: Buildings and structures located within the High Velocity Hurricane Zone shall comply with Sections R302 to R328, inclusive and the provisions of Chapter 44, Sections R301.2.5 and R406. In addition, buildings and structures located in flood hazard areas established in Table R301.2(1) shall comply with Sections R301.2.4, R301.2.5 and R322.

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 *Florida Building Code, Building*.

1. AF&PA *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).

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.

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 appli-

cable provisions and shall be compatible with the performance of the conventional framed system. Engineered design in accordance with the *Florida Building Code, Building* is permitted for buildings and structures, and parts thereof, included in the scope of this code.

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 set forth in Table R301.2(1).

Figure R301.2(4)A Ultimate Design Wind Speed. Reserved.

Figure R301.2(4)B Regions Where Wind Design Is Required. Reserved.

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(1) as determined from Figure R301.2(4). 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(2) adjusted for height and exposure using Table R301.2(3) shall be used to determine design load performance requirements for wall coverings, curtain walls, roof coverings, exterior windows, skylights, and exterior doors (other than garage doors). Where loads for garage doors are not otherwise specified, the loads listed in Table R301.2(4) adjusted for height and exposure using Table R301.2(3) shall be used to determine design load performance requirements. 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 from the roof assembly to the foundation.

R301.2.1.1 Wind design required. In regions where the ultimate design wind speed, V_{ult} from Figure R301.2(4) equals or exceeds 115 miles per hour (51 m/s), the design of concrete, masonry, wood and steel buildings for wind loads shall be in accordance with one or more of the following methods:

1. AWC *Wood Frame Construction Manual* (WFCM).
2. Concrete and masonry walls are permitted to be designed in accordance with ICC *Standard for Residential Construction in High-Wind Regions* (ICC 600).

3. ASCE *Minimum Design Loads for Buildings and Other Structures* (ASCE 7).
4. AISI *Standard for Cold-Formed Steel Framing—Prescriptive Method For One- and Two-Family Dwellings* (AISI S230).
5. *Florida Building Code, Building*; or
6. The MAF *Guide to Concrete Masonry Residential Construction in High Wind Areas* shall be permitted for applicable concrete masonry buildings for a basic wind speed of 130 mph (58 m/s) or less in Exposure B and 110 mph (49 m/s) or less in Exposure C in accordance with Figure R301.2(4) as converted in accordance with R301.2.1.3.

Exceptions:

1. Footings and foundations shall comply with Chapter 4.
2. Exterior windows and doors shall comply with Section R609.
3. For structural insulated panels, the provisions of this code apply in accordance with the limitations of Section R610.
4. Exterior wall coverings and soffits shall comply with Chapter 7.
5. Roof sheathing shall be attached in accordance with Section R803.
6. Roof coverings shall comply with Chapter 9.
7. For concrete construction, the provisions of this code apply in accordance with the limitations of Section R608.2.

The elements of design not addressed by the methods in Items 1 through 6 shall be in accordance with the provisions of this code.

R301.2.1.1.1 Sunrooms. Sunrooms shall comply with AAMA/NSA 2100. For the purpose of applying the criteria of AAMA/NSA 2100 based on the intended use, sunrooms shall be identified as one of the following categories by the permit applicant, design professional or the property owner or owner’s agent in the construction documents. Component and cladding pressures shall be used for the design of elements that do not qualify as main windforce-resisting systems. Main windforce-resisting system pressures shall be used for the design of elements assigned to provide support and stability for the overall *sunroom*.

Category I: A thermally isolated sunroom with walls that are open or enclosed with insect screening or 0.5 mm (20 mil) maximum thickness plastic film. The space is nonhabitable and unconditioned.

Category II: A thermally isolated sunroom with enclosed walls. The openings are enclosed with translucent or transparent plastic or glass. The space is nonhabitable and unconditioned.

Category III: A thermally isolated sunroom with enclosed walls. The openings are enclosed with translucent or transparent plastic or glass. The sunroom fenestration complies with additional requirements for air infiltration resistance and water penetration resistance. The space is nonhabitable and unconditioned.

Category IV: A thermally isolated sunroom with enclosed walls. The sunroom is designed to be heated or cooled by a separate temperature control or system and is thermally isolated from the primary structure. The sunroom fenestration complies with additional requirements for water penetration resistance, air infiltration resistance and thermal performance. The space is nonhabitable and conditioned.

Category V: A sunroom with enclosed walls. The sunroom is designed to be heated or cooled and is open to the main structure. The sunroom fenestration complies with additional requirements for water penetration resistance, air infiltration resistance and thermal performance. The space is habitable and conditioned.

R301.2.1.1.1.1 Aluminum structure design. The AAF *Guide to Aluminum Construction in High-Wind Areas* shall be permitted for the construction of the aluminum structures therein addressed. Screen enclosures shall be permitted to be designed in accordance with the *Florida Building Code, Building* Section 2002. Wind speeds shall be as for Risk Category I of Figure 1609.3(4) of the *Florida Building Code, Building*. Vinyl, tempered glass, and acrylic panels shall be permitted and shall be removable. Removable panels shall be identified as removable by a decal. The identification decal shall essentially state: “Removable panel SHALL be removed when wind speeds exceed 75 mph (34 m/s).” Decals shall be placed such that the decal is visible when the panel is installed.

R301.2.1.1.2 Alternative design method for screen enclosure.

- (1) The purpose of this section is to provide an alternate method for designing aluminum screen enclosures as defined by the *Florida Building Code*, permitting the loads of the structural frame to be based on portions of the screen in the screen walls removed, retracted, moved to the open position, or cut. The use of framing materials other than aluminum is allowed in accordance with Section 104.11 of the *Florida Building Code, Building*. The method applies only to walls and roofs with 100-percent screen.
 - (a) Screen enclosure frames designed in accordance with the screen removal alternates of this section, shall be designed using signed and sealed site-specific engineering and shall be

designed in accordance with the wind load provisions of the *Florida Building Code, Building*, Section 1609.1.1,

- (b) Designs that consider these screen alternates shall comply with *Florida Building Code, Building* Section 2002.4 and Table 2002.4, using the 110 mph column as modified by Table 2002.4A with all screen panels in place.
 - (c) Designs using strength design or load and resistance factor design in accordance with the *Florida Building Code, Building*, Section 1605.2 or allowable stress design methods of the *Florida Building Code, Building*, Section 1605.3.1 shall be permitted.
 - (d) The design shall be by rational analysis or by 3D Finite Element Analysis. Either method will be acceptable.
- (2) Where screen enclosures are designed in accordance with the screen removal alternates of this section, removable screen may consist of removable panels, retractable panels, or by designating specific screen panels in the design in which the screen is to be removed by cutting the screen. Removable panels shall be removed; retractable panels shall be placed in the retracted position without increasing the load on the affected area. Screen designated in the design to be cut shall be completely cut when wind speeds are forecast to exceed 75 mph.
 - (3) Where screen enclosures designed in accordance with the screen removal alternates of this section serve as the barrier required by Section R4501.17.1, the required minimum height of the barrier shall be maintained when screen panels are retracted, removed, moved to the open position, or cut.
 - (4) Where screen enclosures are designed in accordance with the screen removal alternates of this section, retractable screen panels, removable screen panels, and screen panels identified to be cut shall be clearly identified on adjacent structural members with highly visible permanent labels, at each panel, or by other means approved by the local building department.
 - (5) Where screen enclosures are designed in accordance with the screen removal alternates of this section, the retraction of screen panels, removal of screen panels, or cutting of screen panels shall not require the use of ladders or scaffolding.
 - (6) Engineering documents submitted with building permit applications shall identify the panels to be removed, retracted, opened, or cut.
 - (7) Where screen enclosures are designed in accordance with the screen removal alternates of this section based on removing screen panels by cutting the screen, the contractor shall provide replacement screen for a one-time replacement of all screen and spline designated by the design to be cut.
 - (8) Where screen enclosures are designed in accordance with the screen removal alternates of this section, the contractor shall provide written notice to the owner and the local building code enforcement department that the owner must retract, remove, or cut a panel or panels of the screen enclosure in accordance with the project engineering design or the manufacturer's instructions when wind speeds are expected to exceed 75 mph.

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD	WIND DESIGN			SEISMIC DESIGN CATEGORY ^f	SUBJECT TO DAMAGE FROM			WINTER DESIGN TEMP ^e	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		Wind-borne debris zone ^m	Weathering ^a	Frost line depth ^b					
NA	See Fig. R301.2(4)			NA	Negligible	NA	Very Heavy		NA		NA	NA

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

- a. Weathering may require a higher strength concrete or *grade* of masonry than necessary to satisfy the structural requirements of this code. The weathering column shall be filled in with the weathering index, “negligible,” “moderate” or “severe” for concrete as determined from Figure R301.2(3). The *grade* of masonry units shall be determined from ASTM C34, C55, C62, C73, C90, C129, C145, C216 or C652. Reserved.
- b. Reserved.
- c. Termite infestation per Figure R301.2(6) is “very heavy.”
- d. Wind speed shall be from the basic wind speed map [Figure R301.2(4)]. Wind exposure category shall be determined on a site-specific basis in accordance with Section R301.2.1.4.
- e. The outdoor design dry-bulb temperature shall be selected from the columns of 97^{1/2}-percent values for winter from Appendix D of the *Florida Building Code, Plumbing*. Deviations from the Appendix D temperatures shall be permitted to reflect local climates or local weather experience as determined by the *building official*.
- f. Reserved.
- g. The applicable governing body shall, by local floodplain management ordinance, specify (a) 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), (b) the date(s) of the Flood Insurance Study and (c) the panel numbers and dates of the currently effective FIRMs and FBFMs or other flood hazard map adopted by the authority having *jurisdiction*, as amended.
- h. Reserved.
- i. Reserved.
- j. Reserved.
- k. Reserved.
- l. Reserved.
- m. Reserved.

TABLE R301.2(2)
COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN
ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf)^{a, b, c, d, e, f}

	ZONE	EFFECTIVE WIND AREA (ft ²)	ULTIMATE DESIGN WIND SPEED, V_{ULT} (mph)															
			115		120		130		140		150		160		170		180	
			Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg
Gable Roof 0 to 7 degrees	1, 1 ^g	10	10.0	-22.7	10.0	-24.8	10.0	-29.1	10.0	-33.7	10.0	-38.7	11.2	-44.0	12.7	-49.7	14.2	-55.7
	1, 1 ^g	20	10.0	-20.2	10.0	-22.0	10.0	-25.8	10.0	-29.9	10.0	-34.4	10.5	-39.1	11.9	-44.1	13.3	-49.5
	1, 1 ^g	50	10.0	-16.8	10.0	-18.3	10.0	-21.5	10.0	-24.9	10.0	-28.6	-29.9	-32.5	10.8	-36.7	12.2	-41.2
	1, 1 ^g	100	10.0	-14.3	10.0	-15.5	10.0	-18.2	10.0	-21.2	10.0	-24.3	-29.9	-27.6	10.0	-31.2	11.3	-35.0
	2	10	10.0	-30.0	10.0	-32.7	10.0	-38.3	10.0	-44.5	10.0	-51.0	11.2	-58.1	12.7	-65.6	14.2	-73.5
	2	20	10.0	-26.7	10.0	-29.1	10.0	-34.2	10.0	-39.6	10.0	-45.5	10.5	-51.8	11.9	-58.4	13.3	-65.5
	2	50	10.0	-22.4	10.0	-24.4	10.0	-28.6	10.0	-33.2	10.0	-38.1	-29.9	-43.3	10.8	-48.9	12.2	-54.8
	2	100	10.0	-19.1	10.0	-20.8	10.0	-24.4	10.0	-28.3	10.0	-32.5	10.0	-37.0	10.0	-41.8	11.3	-46.8
	3	10	10.0	-40.9	10.0	-44.5	10.0	-52.2	10.0	-60.6	10.0	-69.6	11.2	-79.1	12.7	-89.4	14.2	-100.2
	3	20	10.0	-34.4	10.0	-37.4	10.0	-43.9	10.0	-50.9	10.0	-58.4	10.5	-66.5	11.9	-75.1	13.3	-84.2
	3	50	10.0	-25.6	10.0	-27.9	10.0	-32.8	10.0	-38.0	10.0	-43.6	10.0	-49.6	10.8	-56.0	12.2	-62.8
	3	100	10.0	-19.1	10.0	-20.8	10.0	-24.4	10.0	-28.3	10.0	-32.5	10.0	-37.0	10.0	-41.8	11.3	-46.8
Gable Roof > 7 to 20 degrees	1, 2e	10	10.6	-26.4	11.6	-28.7	13.6	-33.7	15.8	-39.1	18.1	-44.9	20.6	-51.0	23.3	-57.6	26.1	-64.6
	1, 2e	20	10.0	-26.4	10.0	-28.7	11.7	-33.7	13.6	-39.1	15.6	-44.9	17.8	-51.0	20.1	-57.6	22.5	-64.6
	1, 2e	50	10.0	-16.1	10.0	-17.5	10.0	-20.6	10.8	-23.8	12.3	-27.4	14.0	-31.1	15.9	-35.2	17.8	-39.4
	1, 2e	100	10.0	-8.2	10.0	-9.0	10.0	-10.5	10.0	-12.2	10.0	-14.0	11.2	-15.9	12.7	-18.0	14.2	-20.2
	2n, 2r, 3e	10	10.6	-38.5	11.6	-41.9	13.6	-49.2	15.8	-57.0	18.1	-65.4	20.6	-74.5	23.3	-84.1	26.1	-94.2
	2n, 2r, 3e	20	10.0	-33.2	10.0	-36.2	11.7	-42.4	13.6	-49.2	15.6	-56.5	17.8	-64.3	20.1	-72.6	22.5	-81.4
	2n, 2r, 3e	50	10.0	-26.2	10.0	-28.5	10.0	-33.5	10.8	-38.8	12.3	-44.6	14.0	-50.7	15.9	-57.2	17.8	-64.2
	2n, 2r, 3e	100	10.0	-20.9	10.0	-22.8	10.0	-26.7	10.0	-31.0	10.0	-35.6	11.2	-40.5	12.7	-45.7	14.2	-51.3
	3r	10	10.6	-45.7	11.6	-49.8	13.6	-58.4	15.8	-67.8	18.1	-77.8	20.6	-88.5	23.3	-99.9	26.1	-112.0
	3r	20	10.0	-39.2	10.0	-42.7	11.7	-50.1	13.6	-58.1	15.6	-66.7	17.8	-75.9	20.1	-85.6	22.5	-96.0
	3r	50	10.0	-30.5	10.0	-33.2	10.0	-39.0	10.8	-45.2	12.3	-51.9	14.0	-59.0	15.9	-66.6	17.8	-74.7
	3r	100	10.0	-24.0	10.0	-26.1	10.0	-30.6	10.0	-35.5	10.0	-40.8	11.2	-46.4	12.7	-52.3	14.2	-58.7
Gable Roof > 20 to 27 degrees	1, 2e	10	10.6	-20.3	11.6	-22.1	13.6	-26.0	15.8	-30.1	18.1	-34.6	20.6	-39.3	23.3	-44.4	26.1	-49.8
	1, 2e	20	10.0	-20.3	10.0	-22.1	11.7	-26.0	13.6	-30.1	15.6	-34.6	17.8	-39.3	20.1	-44.4	22.5	-49.8
	1, 2e	50	10.0	-17.3	10.0	-18.8	10.0	-22.1	10.8	-25.6	12.3	-29.4	14.0	-33.5	15.9	-37.8	17.8	-42.4
	1, 2e	100	10.0	-14.9	10.0	-16.2	10.0	-19.0	10.0	-22.1	10.0	-25.3	11.2	-28.8	12.7	-32.5	14.2	-36.5
	2n, 2r, 3e	10	10.6	-32.4	11.6	-35.3	13.6	-41.4	15.8	-48.0	18.1	-55.2	20.6	-62.8	23.3	-70.8	26.1	-79.4
	2n, 2r, 3e	20	10.0	-28.4	10.0	-31.0	11.7	-36.3	13.6	-42.1	15.6	-48.4	17.8	-55.0	20.1	-62.1	22.5	-69.6
	2n, 2r, 3e	50	10.0	-23.1	10.0	-25.2	10.0	-29.5	10.8	-34.2	12.3	-39.3	14.0	-44.7	15.9	-50.5	17.8	-56.6
	2n, 2r, 3e	100	10.0	-19.1	10.0	-20.8	10.0	-24.4	10.0	-28.3	10.0	-32.5	11.2	-37.0	12.7	-41.8	14.2	-46.8
	3r	10	10.6	-38.5	11.6	-41.9	13.6	-49.2	15.8	-57.0	18.1	-65.4	20.6	-74.5	23.3	-84.1	26.1	-94.2
	3r	20	10.0	-32.4	10.0	-35.3	11.7	-41.4	13.6	-48.0	15.6	-55.2	17.8	-62.8	20.1	-70.8	22.5	-79.4
	3r	50	10.0	-24.0	10.0	-26.1	10.0	-30.6	10.8	-35.5	12.3	-40.8	14.0	-46.4	15.9	-52.3	17.8	-58.7
	3r	100	10.0	-24.0	10.0	-26.1	10.0	-30.6	10.0	-35.5	10.0	-40.8	11.2	-46.4	12.7	-52.3	14.2	-58.7
Gable Roof > 27 to 45 degrees	1, 2e, 2r	10	13.1	-24.0	14.2	-26.1	16.7	-30.6	19.4	-35.5	22.2	-40.8	25.3	-46.4	28.5	-52.3	32.0	-58.7
	1, 2e, 2r	20	11.6	-20.3	12.6	-22.1	14.8	-26.0	17.2	-30.1	19.8	-34.6	22.5	-39.3	25.4	-44.4	28.5	-49.8
	1, 2e, 2r	50	10.0	-15.5	10.5	-16.9	12.4	-19.8	14.3	-22.9	16.5	-26.3	18.7	-30.0	21.1	-33.8	23.7	-37.9
	1, 2e, 2r	100	10.0	-11.9	10.0	-12.9	10.5	-15.1	12.2	-17.6	14.0	-20.2	15.9	-22.9	18.0	-25.9	20.2	-29.0
	2n, 3r	10	13.1	-26.4	14.2	-28.7	16.7	-33.7	19.4	-39.1	22.2	-44.9	25.3	-51.0	28.5	-57.6	32.0	-64.6
	2n, 3r	20	11.6	-23.6	12.6	-25.7	14.8	-30.1	17.2	-34.9	19.8	-40.1	22.5	-45.6	25.4	-51.5	28.5	-57.8
	2n, 3r	50	10.0	-19.9	10.5	-21.6	12.4	-25.4	14.3	-29.4	16.5	-33.8	18.7	-38.4	21.1	-43.4	23.7	-48.6
	2n, 3r	100	10.0	-17.1	10.0	-18.6	10.5	-21.8	12.2	-25.3	14.0	-29.0	15.9	-33.0	18.0	-37.3	20.2	-41.8
	3e	10	13.1	-32.4	14.2	-35.3	16.7	-41.4	19.4	-48.0	22.2	-55.2	25.3	-62.8	28.5	-70.8	32.0	-79.4
	3e	20	11.6	-28.8	12.6	-31.3	14.8	-36.8	17.2	-42.7	19.8	-49.0	22.5	-55.7	25.4	-62.9	28.5	-70.5
	3e	50	10.0	-24.0	10.5	-26.1	12.4	-30.6	14.3	-35.5	16.5	-40.8	18.7	-46.4	21.1	-52.3	23.7	-58.7
	3e	100	10.0	-20.3	10.0	-22.1	10.5	-26.0	12.2	-30.1	14.0	-34.6	15.9	-39.3	18.0	-44.4	20.2	-49.8

(continued)

TABLE R301.2(2)—continued
COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN
ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf)^{a, b, c, d, e, f}

	ZONE	EFFECTIVE WIND AREA (ft ²)	ULTIMATE DESIGN WIND SPEED, <i>V_{ULT}</i> (mph)																
			115		120		130		140		150		160		170		180		
			Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	
Hip Roof 7 to 20 degrees ^h	1	10	10.6	-24.0	11.6	-26.1	13.6	-30.6	15.8	-35.5	18.1	-40.8	20.6	-46.4	23.3	-52.3	26.1	-58.7	
	1	20	10.0	-24.0	10.0	-26.1	11.7	-30.6	13.6	-35.5	15.6	-40.8	17.8	-46.4	20.1	-52.3	22.5	-58.7	
	1	50	10.0	-18.5	10.0	-20.2	10.0	-23.7	10.8	-27.4	12.3	-31.5	14.0	-35.8	15.9	-40.4	17.8	-45.3	
	1	100	10.0	-14.3	10.0	-15.5	10.0	-18.2	10.0	-21.2	10.0	-24.3	11.2	-27.6	12.7	-31.2	14.2	-35.0	
	2r	10	10.6	-31.2	11.6	-34.0	13.6	-39.9	15.8	-46.3	18.1	-53.1	20.6	-60.4	23.3	-68.2	26.1	-76.5	
	2r	20	10.0	-28.1	10.0	-30.6	11.7	-35.9	13.6	-41.7	15.6	-47.9	17.8	-54.4	20.1	-61.5	22.5	-68.9	
	2r	50	10.0	-24.0	10.0	-26.1	10.0	-30.7	10.8	-35.6	12.3	-40.9	14.0	-46.5	15.9	-52.5	17.8	-58.8	
	2r	100	10.0	-20.9	10.0	-22.8	10.0	-26.7	10.0	-31.0	10.0	-35.6	11.2	-40.5	12.7	-45.7	14.2	-51.3	
	2e, 3	10	10.6	-33.6	11.6	-36.6	13.6	-43.0	15.8	-49.8	18.1	-57.2	20.6	-65.1	23.3	-73.5	26.1	-82.4	
	2e, 3	20	10.0	-30.3	10.0	-32.9	11.7	-38.7	13.6	-44.8	15.6	-51.5	17.8	-58.6	20.1	-66.1	22.5	-74.1	
	2e, 3	50	10.0	-25.8	10.0	-28.0	10.0	-32.9	10.8	-38.2	12.3	-43.8	14.0	-49.9	15.9	-56.3	17.8	-63.1	
	2e, 3	100	10.0	-22.4	10.0	-24.4	10.0	-28.6	10.0	-33.2	10.0	-38.1	11.2	-43.3	12.7	-48.9	14.2	-54.8	
Hip Roof > 20 to 27 degrees	1	10	10.6	-19.1	11.6	-20.8	13.6	-24.4	15.8	-28.3	18.1	-32.5	20.6	-37.0	23.3	-41.8	26.1	-46.8	
	1	20	10.0	-16.9	10.0	-18.4	11.7	-21.6	13.6	-25.1	15.6	-28.8	17.8	-32.8	20.1	-37.0	22.5	-41.5	
	1	50	10.0	-14.0	10.0	-15.3	10.0	-17.9	10.8	-20.8	12.3	-23.9	14.0	-27.2	15.9	-30.7	17.8	-34.4	
	1	100	10.0	-11.9	10.0	-12.9	10.0	-15.1	10.0	-17.6	10.0	-20.2	11.2	-22.9	12.7	-25.9	14.2	-29.0	
	2e, 2r, 3	10	10.6	-26.4	11.6	-28.7	13.6	-33.7	15.8	-39.1	18.1	-44.9	20.6	-51.0	23.3	-57.6	26.1	-64.6	
	2e, 2r, 3	20	10.0	-23.6	10.0	-25.7	11.7	-30.1	13.6	-34.9	15.6	-40.1	17.8	-45.6	20.1	-51.5	22.5	-57.8	
	2e, 2r, 3	50	10.0	-19.9	10.0	-21.6	10.0	-25.4	10.8	-29.4	12.3	-33.8	14.0	-38.4	15.9	-43.4	17.8	-48.6	
	2e, 2r, 3	100	10.0	-17.1	10.0	-18.6	10.0	-21.8	10.0	-25.3	10.0	-29.0	11.2	-33.0	12.7	-37.3	14.2	-41.8	
	Hip Roof > 27 to 45 degrees	1	10	10.2	-20.3	11.1	-22.1	13.0	-26.0	15.1	-30.1	17.3	-34.6	19.7	-39.3	22.2	-44.4	24.9	-49.8
		1	20	10.0	-18.0	10.0	-19.6	11.3	-23.0	13.1	-26.7	15.1	-30.7	17.1	-34.9	19.4	-39.4	21.7	-44.2
1		50	10.0	-15.0	10.0	-16.3	10.0	-19.2	10.5	-22.2	12.1	-25.5	13.8	-29.0	15.5	-32.8	17.4	-36.7	
1		100	10.0	-12.7	10.0	-13.8	10.0	-16.2	10.0	-18.8	10.0	-21.6	11.2	-24.6	12.7	-27.8	14.2	-31.1	
2e		10	10.2	-24.2	11.1	-26.3	13.0	-30.9	15.1	-35.9	17.3	-41.2	19.7	-46.8	22.2	-52.9	24.9	-59.3	
2e		20	10.0	-19.1	10.0	-20.8	11.3	-24.4	13.1	-28.3	15.1	-32.5	17.1	-37.0	19.4	-41.8	21.7	-46.8	
2e		50	10.0	-11.9	10.0	-12.9	10.0	-15.1	10.5	-17.6	12.1	-20.2	13.8	-22.9	15.5	-25.9	17.4	-29.0	
2e		100	10.0	-11.9	10.0	-12.9	10.0	-15.1	10.0	-17.6	10.0	-20.2	11.2	-22.9	12.7	-25.9	14.2	-29.0	
2r		10	10.2	-30.6	11.1	-33.3	13.0	-39.1	15.1	-45.4	17.3	-52.1	19.7	-59.2	22.2	-66.9	24.9	-75.0	
2r		20	10.0	-25.7	10.0	-28.0	11.3	-32.8	13.1	-38.1	15.1	-43.7	17.1	-49.8	19.4	-56.2	21.7	-63.0	
2r		50	10.0	-19.2	10.0	-20.9	10.0	-24.5	10.5	-28.4	12.1	-32.6	13.8	-37.1	15.5	-41.9	17.4	-47.0	
2r		100	10.0	-14.3	10.0	-15.5	10.0	-18.2	10.0	-21.2	10.0	-24.3	11.2	-27.6	12.7	-31.2	14.2	-35.0	
3		10	10.2	-32.7	11.1	-35.6	13.0	-41.7	15.1	-48.4	17.3	-55.6	19.7	-63.2	22.2	-71.4	24.9	-80.0	
3		20	10.0	-24.6	10.0	-26.7	11.3	-31.4	13.1	-36.4	15.1	-41.8	17.1	-47.5	19.4	-53.7	21.7	-60.2	
3		50	10.0	-14.3	10.0	-15.5	10.0	-18.2	10.5	-21.2	12.1	-24.3	13.8	-27.6	15.5	-31.2	17.4	-35.0	
3		100	10.0	-14.3	10.0	-15.5	10.0	-18.2	10.0	-21.2	10.0	-24.3	11.2	-27.6	12.7	-31.2	14.2	-35.0	
Walls	4	10	14.3	-15.5	15.5	-16.9	18.2	-19.8	21.2	-22.9	24.3	-26.3	27.6	-30.0	31.2	-33.8	35.0	-37.9	
	4	20	13.6	-14.8	14.8	-16.1	17.4	-19.0	20.2	-22.0	23.2	-25.2	26.4	-28.7	29.8	-32.4	33.4	-36.3	
	4	50	12.8	-14.0	13.9	-15.2	16.3	-17.9	19.0	-20.7	21.8	-23.8	24.8	-27.1	27.9	-30.6	31.3	-34.3	
	4	100	12.1	-13.3	13.2	-14.5	15.5	-17.1	18.0	-19.8	20.6	-22.7	23.5	-25.8	26.5	-29.2	29.7	-32.7	
	4	500	10.6	-11.9	11.6	-12.9	13.6	-15.1	15.8	-17.6	18.1	-20.2	20.6	-22.9	23.3	-25.9	26.1	-29.0	
	5	10	14.3	-19.1	15.5	-20.8	18.2	-24.4	21.2	-28.3	24.3	-32.5	27.6	-37.0	31.2	-41.8	35.0	-46.8	
	5	20	13.6	-17.8	14.8	-19.4	17.4	-22.8	20.2	-26.4	23.2	-30.3	26.4	-34.5	29.8	-38.9	33.4	-43.6	
	5	50	12.8	-16.1	13.9	-17.6	16.3	-20.6	19.0	-23.9	21.8	-27.5	24.8	-31.2	27.9	-35.3	31.3	-39.5	
	5	100	12.1	-14.8	13.2	-16.1	15.5	-19.0	18.0	-22.0	20.6	-25.2	23.5	-28.7	26.5	-32.4	29.7	-36.3	
	5	500	10.6	-11.9	11.6	-12.9	13.6	-15.1	15.8	-17.6	18.1	-20.2	20.6	-22.9	23.3	-25.9	26.1	-29.0	

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