A Four-Hour Advanced Internet Course
on
Chapter 16, Building Structural Design
Florida Building Code-Building, 5th Edition (2014)
with supplementary information on
Chapter 471, F.S. The Engineer Registration Law and
Rules 61G15-19, 30, and 31, F.A.C.
The Rules of the Florida Board of Professional Engineers

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Part I

CHAPTER 16
STRUCTURAL DESIGN

SECTION 1601
GENERAL

1601.1 Scope.
The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof regulated by this code.

> **Exception:** Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Section 1605, 1607, 1611, Sections 1616 through 1626, and, as applicable in flood hazard areas, Section 1612

SECTION 1602
DEFINITIONS AND NOTATIONS

1602.1 Definitions.
The following terms as defined in Chapter 2:

ALLOWABLE STRESS DESIGN.
A method of proportioning structural members, such that elastically computed stresses produced in the members by nominal loads do not exceed specified allowable stresses (also called “working stress design”)

DEAD LOADS.
The weight of materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding and other similarly incorporated architectural and structural items, and the weight of fixed service equipment, such as cranes, plumbing stacks and risers, electrical feeders, heating, ventilating and air-conditioning systems and automatic sprinkler systems.

DESIGN STRENGTH.
The product of the nominal strength and a resistance factor (or strength reduction factor).

DIAPHRAGM.
A horizontal or sloped system acting to transmit lateral forces to the vertical-resisting elements. When the term “diaphragm” is used, it shall include horizontal bracing systems.

Diaphragm, blocked.
In light-frame construction, a diaphragm in which all sheathing edges not occurring on a framing member are supported on and fastened to blocking.

Diaphragm boundary.
In light-frame construction, a location where shear is transferred into or out of the diaphragm sheathing. Transfer is either to a boundary element or to another force-resisting element.

Diaphragm chord.
A diaphragm boundary element perpendicular to the applied load that is assumed to take axial stresses due to the diaphragm moment. Diaphragm flexible.

Diaphragm flexible.
A diaphragm is flexible for the purpose of distribution of story shear and torsional moment where so indicated in Section 12.3.1 of ASCE 7. Diaphragm, rigid.

Diaphragm, rigid.
A diaphragm is rigid for the purpose of distribution of story shear and torsional moment when the lateral deformation of the diaphragm is less than or equal to two times the average story drift.

DURATION OF LOAD.
The period of continuous application of a given load, or the aggregate of periods of intermittent applications of the same load.

ESSENTIAL FACILITIES.
Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes.

FABRIC PARTITION.
A partition consisting of a finished surface made of fabric, without a continuous rigid backing, that is directly attached to a framing system in which the vertical framing members are spaced greater than 4 feet (1219 mm) on center.

FACTORED LOAD.
The product of a nominal load and a load factor

HELIPAD.
A structural surface that is used for the landing, taking off, taxiing and parking of helicopters.

ICE-SENSITIVE STRUCTURE.
A structure for which the effect of an atmospheric ice load governs the design of a structure or portion thereof. This includes, but is not limited to, lattice structures, guyed masts, overhead lines, light suspension and cable-stayed bridges, aerial cable systems (e.g., for ski lifts or logging operations), amusement rides, open catwalks and platforms, flagpoles and signs.

IMPACT LOAD.
The load resulting from moving machinery, elevators, crane ways, vehicles and other similar forces and kinetic loads, pressure and possible surcharge from fixed or moving loads.

LIMIT STATE.
A condition beyond which a structure or member becomes unfit for service and is judged to be no longer useful for its intended function (serviceability limit state) or to be unsafe (strength limit state).

LIVE LOAD.
A load produced by the use and occupancy of the building or other structure that does not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.

LIVE LOAD (ROOF). A load on a roof produced:
1. During maintenance by workers, equipment and materials;
2. During the life of the structure by movable objects such as planters or other similar small decorative appurtenances that are not occupancy related; or
3. By the use and occupancy of the roof such as for roof gardens or assembly areas.

LOAD AND RESISTANCE FACTOR DESIGN (LRFD).
A method of proportioning structural members and their connections using load and resistance factors such that no applicable limit state is reached when the structure is subjected to appropriate load combinations. The term “LRFD” is used in the design of steel and wood structures

LOAD EFFECTS.
Forces and deformations produced in structural members by the applied loads.

LOAD FACTOR.
A factor that accounts for deviations of the actual load from the nominal load, for uncertainties in the analysis that transforms the load into a load effect, and for the probability that more than one extreme load will occur simultaneously

LOADS.
Forces or other actions that result from the weight of building materials, occupants and their possessions, environmental effects, differential movement and restrained dimensional changes. Permanent loads are those loads in which variations over time are rare or of small magnitude, such as dead loads. All other loads are variable loads (see also “Nominal loads”)

NOMINAL LOADS.
The magnitudes of the loads specified in Chapter 16 (dead, live, soil, wind, snow, rain, flood and earthquake).

OTHER STRUCTURES.
Structures, other than buildings, for which loads are specified in Chapter 16

PANEL (PART OF A STRUCTURE).
The section of a floor, wall or roof comprised between the supporting frame of two adjacent rows of columns and girders or column bands of floor or roof construction.

RESISTANCE FACTOR.
A factor that accounts for deviations of the actual strength from the nominal strength and the manner and consequences of failure (also called “strength reduction factor”).

RISK CATEGORY.
A categorization of buildings and other structures for determination of flood, wind, snow, ice and earthquake loads based on the risk associated with unacceptable performance.

STRENGTH, NOMINAL.
The capacity of a structure or member to resist the effects of loads, as determined by computations using specified material strengths and dimensions and equations derived from accepted principles of structural mechanics or by field tests or laboratory tests of scaled models, allowing for modeling effects and differences between laboratory and field conditions.

STRENGTH, REQUIRED.
Strength of a member, cross section or connection required to resist factored loads or related internal moments and forces in such combinations as stipulated by these provisions.

STRENGTH DESIGN.
A method of proportioning structural members such that the computed forces produced in the members by factored loads do not exceed the member design strength [also called "load and resistance factor design" (LRFD)]. The term "strength design" is used in the design of concrete and masonry structural elements.

SUSCEPTIBLE BAY.
A roof or portion thereof with:
1. A slope less than 1 /4-inch per foot (0.0208 rad); or
2. On which water is impounded upon it, in whole or in part, and the secondary drainage system is functional but the primary drainage system is blocked.
A roof surface with a slope of 1 /4-inch per foot (0.0208 rad) or greater towards points of free drainage is not a susceptible bay.

VEHICLE BARRIER.
A component or a system of components, near open sides or walls of garage floors or ramps, that acts as a restraint for vehicles

NOTATIONS.

D	=	Dead load.
D_i	=	Weight of ice in accordance with Chapter 10 of ASCE 7.
E	=	Combined effect of horizontal and vertical earthquake induced forces as defined in Section 12.4.2 of ASCE 7.
F	=	Load due to fluids with well-defined pressures and maximum heights.
F_a	=	Flood load in accordance with Chapter 5 of ASCE 7.
H	=	Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.
L	=	Roof live load greater than 20 psf (0.96 kN/m2) and floor live load.
L_r	=	Roof live load of 20 psf (0.96 kN/m2) or less.
R	=	Rain load.
S.	=	Snow load.
T	=	Self-straining load.
V_{asd}	=	Nominal design wind speed (3-second gust), miles per hour (mph) (km/hr) where

applicable.

V_{ult} = Ultimate design wind speeds (3-second gust), miles per hour (mph) (km/hr) determined from Figures 1609A, 1609B, or 1609C or ASCE 7.

W = Load due to wind pressure.

W_i = Wind-on-ice in accordance with Chapter 10 of ASCE 7.

SECTION 1603
CONSTRUCTION DOCUMENTS

1603.1 General.
Construction documents shall show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the *construction documents*.

Exception: *Construction documents* for buildings constructed in accordance with the *conventional light-frame construction* provisions of Section 2308 shall indicate the following structural design information:

1. Floor and roof live loads.
2. Ground snow load, P_g.
3. Ultimate design wind speed, V_{ult}, (3-second gust), miles per hour (mph) (km/hr) and nominal design wind speed, V_{asd}, as determined in accordance with Section 1609.3.1 and wind exposure.
4. *Seismic design category* and *site class*.
5. Flood design data, if located in *flood hazard areas* established in Section 1612.3.
6. Design load-bearing values of soils.

1603.1.1 Floor live load.
The uniformly distributed, concentrated and impact floor live load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607.10 shall be indicated for each type of live load used in the design.

1603.1.2 Roof live load.
The roof live load used in the design shall be indicated for roof areas (Section 1607.12).

1603.1.3 Roof snow load data.
The ground snow load, P_g, shall be indicated. In areas where the ground snow load, P_g, exceeds 10 pounds per square foot (psf) (0.479 kN/m^2), the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:

1. Flat-roof snow load, P_f.

2. Snow exposure factor, C_e.

3. Snow load importance factor, I_s.

4. Thermal factor, C_t.

1603.1.4 Wind design data.
The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral force resisting system of the structure:

1. Ultimate design wind speed, V_{ult}, (3-second gust), miles per hour (km/hr) and nominal design wind speed, V_{asd}, as determined in accordance with Section 1609.3.1.

2. *Risk category.*

3. Wind exposure. Applicable wind direction if more than one wind exposure is utilized.

4. Applicable internal pressure coefficient.

5. Design wind pressures to be used for exterior component and cladding materials not specifically designed by the *registered design professional* responsible for the design of the structure, psf (kN/m^2).

1603.1.5 Earthquake design data.
The following information related to seismic loads shall be shown, regardless of whether seismic loads govern the design of the lateral force-resisting system of the structure:

1. *Risk category*.

2. Seismic importance factor, Ie.

3. Mapped spectral response acceleration parameters, S_S and S_1.

4. *Site class*.

5. Design spectral response acceleration parameters, S_{DS} and S_{D1}.

6. *Seismic design category*.

7. Basic seismic force-resisting system(s).

8. Design base shear(s).

9. Seismic response coefficient(s), C_S.

10. Response modification coefficient(s), *R*.

11. Analysis procedure used.

1603.1.6 Geotechnical information.
The design load bearing values of soils shall be shown on the *construction documents*.

1603.1.7 Flood design data.
For buildings located in whole or in part in *flood hazard areas* as established in Section 1612.3, the documentation pertaining to design, if required in Section 1612.5, shall be included and the following information, referenced to the datum on the community's Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. In *flood hazard areas* other than coastal high hazard areas, the elevation of the proposed lowest floor, including the basement.

2. In coastal high hazard areas, the elevation to which any nonresidential building will be dry flood proofed.

3. In coastal high hazard areas, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

1603.1.8 Special loads.
Special loads that are applicable to the design of the building, structure or portions thereof shall be indicated along with the specified section of this code that addresses the special loading condition.

1603.1.9 Systems and components requiring special inspections for seismic resistance.
Reserved.

SECTION 1604
GENERAL DESIGN REQUIREMENTS

1604.1 General.
Building, structures and parts thereof shall be designed and constructed in accordance with strength design, *load and resistance factor design*, *allowable stress design*, empirical design or conventional construction methods, as permitted by the applicable material chapters.

1604.2 Strength.
Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the factored loads in load combinations defined in this code without exceeding the appropriate strength limit states for the materials of construction. Alternatively, buildings and other structures, and parts thereof, shall be designed and constructed to support safely the

nominal loads in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the *building official*.

1604.3 Serviceability.
Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections and lateral drift. See Section 12.12.1 of ASCE 7 for drift limits applicable to earthquake loading.

TABLE 1604.3
DEFLECTION LIMITS[a, b, c, h, i]

CONSTRUCTION	*L*	*S or W*[f]	*D +L*[d, g, j]
Roof members:[e]			
Supporting plaster or stucco ceiling	*l*/360	*l*/360	*l*/240
Supporting nonplaster ceiling	*l*/240	*l*/240	*l*/180
Not supporting ceiling	*l*/180	*l*/180	*l*/120
Members supporting screen surface			*l*/60
Floor members	*l*/360	—	*l*/240
Exterior walls and interior partitions:			
With plaster or stucco finishes	—	*l*/360	—
With other brittle finishes	—	*l*/240	—
With flexible finishes	—	*l*/120	—
Farm buildings	—	—	*l*/180
Greenhouses	—	—	*l*/120

For SI: 1 foot = 304.8 mm.

a. For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed *l*/60. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed *l*/150. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed *l*/90. For roofs, this exception only applies when the metal sheets have no roof covering.
b. Interior partitions not exceeding 6 feet in height and flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607.14.
c. See Section 2403 for glass supports.
d. For wood structural members having a moisture content of less than 16 percent at time of installation and used under dry conditions, the deflection resulting from *L + 0.5D* is permitted to be substituted for the deflection resulting from *L + D.*
e. The above deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to assure adequate drainage shall be investigated for ponding. See Section 1611 for rain and ponding requirements and Section 1503.4 for roof drainage requirements.
f. The wind load is permitted to be taken as 0.42 times the “component and cladding” loads for the purpose of determining deflection limits herein.
g. For steel structural members, the dead load shall be taken as zero.
h. For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers, not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed *l*/60. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed *l*/175 for each glass lite or *l*/60 for the entire length of the member, whichever is more stringent. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed *l*/120.
i. For cantilever members, *l* shall be taken as twice the length of the cantilever.
j. Screen surfaces shall be permitted to include a maximum of 25 percent solid flexible finishes.

1604.3.1 Deflections.
The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604.3.2 through 1604.3.5 or that permitted by Table 1604.3.

1604.3.2 Reinforced concrete.
The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

1604.3.3 Steel.
The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI S100, ASCE 8, SJI CJ-1.0, SJI JG-1.1, SJI K-1.1 or SJI LH/DLH-1.1, as applicable.

1604.3.4 Masonry.
The deflection of masonry structural members shall not exceed that permitted by TMS 402/ACI 530/ASCE 5.

1604.3.5 Aluminum.
The deflection of aluminum structural members shall not exceed that permitted by AA ADM1.

1604.3.6 Limits.
The deflection limits of Section 1604.3.1 shall be used unless more restrictive deflection limits are required by a referenced standard for the element or finish material.

1604.4 Analysis.
Load effects on structural members and their connections shall be determined by methods of structural analysis that take into account equilibrium, general stability, geometric compatibility and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the added eccentricities expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral force-resisting system in proportion to their rigidities, considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements assumed not to be a part of the lateral force-resisting system are permitted to be incorporated into buildings provided their effect on the action of the system is considered and provided for in the design. Except where diaphragms are flexible, or are permitted to be analyzed as flexible, provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force-resisting system.

Every structure shall be designed to resist the overturning effects caused by the lateral forces specified in this chapter. See Section 1609 for wind loads, Section 1610 for lateral soil loads and Section 1613 for earthquake loads.

1604.5 Risk category.
Each building and structure shall be assigned a *risk category* in accordance with Table 1604.5. Where a referenced standard specifies an occupancy category, the *risk category* shall not be taken as lower than the occupancy category specified therein.

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities. Screen enclosures.
II	Buildings and other structures except those listed in Risk Categories I, III and IV
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing elementary school, secondary school or day care facilities with an occupant load greater than 250. • Buildings and other structures containing adult education facilities, such as colleges and universities, with an occupant load greater than 500. • Group I-2 occupancies with an occupant load of 50 or more resident care recipients but not having surgery or emergency treatment facilities. Group I-3 occupancies. Any other occupancy with an occupant load greater than 5,000[a]. • Power-generating stations, water treatment facilities for potable water, waste water treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *Florida Fire Prevention Code*; and Are sufficient to pose a threat to the public if released[b].
IV	Buildings and other structures designated as essential facilities, including but not limited to: Group I-2 occupancies having surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages. Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures.

	• Buildings and other structures containing quantities of highly toxic materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *Florida Fire Prevention Code*; and Are sufficient to pose a threat to the public if released [b]. Aviation control towers, air traffic control centers and emergency aircraft hangars. Buildings and other structures having critical national defense functions. Water storage facilities and pump structures required to maintain water pressure for fire suppression.

a. For purposes of occupant load calculation, occupancies required by Table 1004.1.2 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.
b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided it can be demonstrated by a hazard assessment in accordance with

1604.5.1 Multiple occupancies.
Where a building or structure is occupied by two or more occupancies not included in the same *risk category*, it shall be assigned the classification of the highest *risk category* corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required access to, required egress from or shares life safety components with another portion having a higher *risk* category, both portions shall be assigned to the higher *risk category*.

1604.6 In-situ load tests.
The *building official* is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with Section 1709.

1604.7 Preconstruction load tests.
Materials and methods of construction that are not capable of being designed by *approved* engineering analysis or that do not comply with the applicable referenced standards, or alternative test procedures in accordance with Section 1707, shall be load tested in accordance with Section 1710.

1604.8 Anchorage.
Buildings and other structures, and portions thereof, shall be provided with anchorage in accordance with Sections 1604.8.1 through 1604.8.3, as applicable.

1604.8.1 General.
Anchorage of the roof to walls and columns, and of walls and columns to foundations, shall be provided to resist the uplift and sliding forces that result from the application of the prescribed loads.

1604.8.2 Structural walls.
Walls that provide vertical load-bearing resistance or lateral shear resistance for a portion of the structure shall be anchored to the roof and to all floors and members that provide lateral support for the wall or that are supported by the wall. The connections shall be capable of resisting the horizontal forces specified in Section 1.4.5 of ASCE 7 for walls of structures assigned to Seismic Design Category A and to Section 12.11 of ASCE 7 for walls of

structures assigned to all other seismic design categories. Required anchors in masonry walls of hollow units or cavity walls shall be embedded in a reinforced grouted structural element of the wall. See Sections 1609 for wind design requirements and 1613 for earthquake design requirements.

1604.8.3 Decks.
Where supported by attachment to an *exterior wall*, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. Connections of decks with cantilevered framing members to exterior walls or other framing members shall be designed for both of the following:

1. The reactions resulting from the dead load and live load specified in Table 1607.1, or the snow load specified in Section 1608, in accordance with Section 1605, acting on all portions of the deck.

2. The reactions resulting from the dead load and live load specified in Table 1607.1, or the snow load specified in Section 1608, in accordance with Section 1605, acting on the cantilevered portion of the deck, and no live load or snow load on the remaining portion of the deck.

1604.9 Counteracting structural actions.
Structural members, systems, components and cladding shall be designed to resist forces due to earthquakes and wind, with consideration of overturning, sliding and uplift. Continuous load paths shall be provided for transmitting these forces to the foundation. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

1604.10 Wind and seismic detailing.
Lateral force-resisting systems shall meet seismic detailing requirements and limitations prescribed in this code and ASCE 7, excluding Chapter 14 and Appendix 11A, even when wind *load effects* are greater than seismic *load effects.*

SECTION 1605
LOAD COMBINATIONS

1605.1 General.
Buildings and other structures and portions thereof shall be designed to resist:

1. The load combinations specified in Section 1605.2, 1605.3.1 or 1605.3.2;

2. The load combinations specified in Chapters 18 through 23; and

3. The seismic load effects including over strength factor in accordance with Section 12.4.3 of ASCE 7 where required by Section 12.2.5.2, 12.3.3.3 or 12.10.2.1 of ASCE 7. With the simplified procedure of ASCE 7 Section 12.14, the seismic load effects including over strength factor in accordance with Section 12.14.3.2 of ASCE 7 shall be used.

Applicable loads shall be considered, including both earthquake and wind, in accordance with the specified load combinations. Each load combination shall also be investigated with one or more of the variable loads set to zero.

Where the load combinations with over strength factor in Section 12.4.3.2 of ASCE 7 apply, they shall be used as follows:

1. The basic combinations for strength design with over strength factor in lieu of Equations 16-5 and 16-7 in Section 1605.2.

2. The basic combinations for *allowable stress design* with over strength factor in lieu of Equations 16-12, 16-14 and 16-16 in Section 1605.3.1.

3. The basic combinations for *allowable stress design* with over strength factor in lieu of Equations 16-21 and 16-22 in Section 1605.3.2.

1605.1.1 Stability.
Regardless of which load combinations are used to design for strength, where overall structure stability (such as stability against overturning, sliding, or buoyancy) is being verified, use of the load combinations specified in Section 1605.2 or 1605.3 shall be permitted. Where the load combinations specified in Section 1605.2 are used, strength reduction factors applicable to soil resistance shall be provided by a *registered design professional*. The stability of retaining walls shall be verified in accordance with Section 1807.2.3.

1605.2 Load combinations using strength design or load and resistance factor design.
Where strength design or load and resistance factor design is used, buildings and other structures, and portions thereof, shall be designed to resist the most critical effects resulting from the following combinations of factored loads:

$1.4(D + F)$ **(Equation 16-1)**

$1.2(D + F) + 1.6(L + H) + 0.5(L_r \text{ or } S \text{ or } R)$ **(Equation 16-2)**

$1.2(D + F) + 1.6(L_r \text{ or } S \text{ or } R) + 1.6H + (f_1 L \text{ or } 0.5W)$ **(Equation 16-3)**

$1.2(D + F) + 1.0W + f_1 L + 1.6H + 0.5(L_r \text{ or } S \text{ or } R)$ **(Equation 16-4)**

$1.2(D + F) + 1.0E + f_1 L + 1.6H + f_2 S$ **(Equation 16-5)**

$0.9D + 1.0W + 1.6H$ **(Equation 16-6)**

$0.9(D + F) + 1.0E + 1.6H$ **(Equation 16-7)**

where:

f_1 = 1 for places of public assembly live loads in excess of 100 pounds per square foot (4.79 kN/m^2), and parking garages; and 0.5 for other live loads.

f_2 = 0.7 for roof configurations (such as saw tooth) that do not shed snow off the structure, and 0.2 for other roof configurations.

Exceptions:

1. Where other factored load combinations are specifically required by other provisions of this code, such
combinations shall take precedence.

2. Where the effect of *H* resists the primary variable load effect, a load factor of 0.9 shall be included with *H* where *H* is permanent and *H* shall be set to zero for all other conditions.

1605.2.1 Other loads.
Where flood loads, F_a, are to be considered in the design, the load combinations of Section 2.3.3 of ASCE 7 shall be used. Where self-straining loads, *T*, are considered in design, their structural effects in combination with other loads shall be determined in accordance with Section 2.3.5 of ASCE 7. Where an ice sensitive structure is subjected to loads due to atmospheric icing, the load combinations of Section 2.3.4 of ASCE 7 shall be considered.

1605.3 Load combinations using allowable stress design.

1605.3.1 Basic load combinations.
Where *allowable stress design* (working stress design), as permitted by this code, is used, structures and portions thereof shall resist the most critical effects resulting from the following combinations of loads:

$D + F$	**(Equation 16-8)**
$D + H + F + L$	**(Equation 16-9)**
$D + H + F + (L_r$ or S or $R)$	**(Equation 16-10)**
$D + H + F + 0.75(L) + 0.75(L_r$ or S or $R)$	**(Equation 16-11)**
$D + H + F + (0.6W$ or $0.7E)$	**(Equation 16-12)**
$D + H + F + 0.75(0.6W) + 0.75L + 0.75(L_r$ or S or $R)$	**(Equation 16-13)**
$D + H + F + 0.75\ (0.7\ E) + 0.75\ L + 0.75\ S$	**(Equation 16-14)**
$0.6D + 0.6W + H$	**(Equation 16-15)**
$0.6(D + F) + 0.7E + H$	**(Equation 16-16)**

Exceptions:

1. Crane hook loads need not be combined with roof live load or with more than three-fourths of the snow load or one-half of the wind load.

2. Flat roof snow loads of 30 psf (1.44 kN/m^2) or less and roof live loads of 30 psf (1.44 kN/m2) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 psf (1.44 kN/m2), 20 percent shall be combined with seismic loads.

3. Where the effect of *H* resists the primary variable load effect, a load factor of 0.6 shall be included with *H* where *H* is permanent and *H* shall be set to zero for all other conditions.

4. In Equation 16-15, the wind load, *W*, is permitted to be reduced in accordance with Exception 2 of Section 2.4.1 of ASCE 7.

5. In Equation 16-16, 0.6 D is permitted to be increased to 0.9 D for the design of special reinforced masonry shear walls complying with Chapter 21.

1605.3.1.1 Stress increases.
Increases in allowable stresses specified in the appropriate material chapter or the referenced standards shall not be used with the load combinations of Section 1605.3.1, except that increases shall be permitted in accordance with Chapter 23.

1605.3.1.2 Other loads.
Where flood loads, F a, are to be considered in design, the load combinations of Section 2.4.2 of ASCE 7 shall be used. Where self-straining loads, T, are considered in design, their structural effects in combination with other loads shall be determined in accordance with Section 2.4.4 of ASCE 7. Where an ice-sensitive structure is subjected to loads due to atmospheric icing, the load combinations of Section 2.4.3 of ASCE 7 shall be considered.

1605.3.2 Alternative basic load combinations.
In lieu of the basic load combinations specified in Section 1605.3.1, structures and portions thereof shall be permitted to be designed for the most critical effects resulting from the following combinations. When using this alternative basic load combinations that include wind or seismic loads, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind loads, only two-thirds of the minimum dead load likely to be in place during a design wind event shall be used. When using allowable stresses which have been increased or load combinations which have been reduced as permitted by the material chapter of this code or the referenced standards, where wind loads are calculated in accordance with Chapters 26 through 31 of ASCE 7, the coefficient (ω) in the following equations shall be taken as 1.3. For other wind loads, (ω) shall be taken as 1. When allowable stresses have not been increased or load combinations have not been reduced as permitted by the material chapter of this code or the referenced standards, (ω) shall be taken as 1. When using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used. When using these alternative basic load combinations for proportioning foundations for loadings, which include seismic loads, the vertical seismic *load effect,* E_v, in Equation 12.4-4 of ASCE 7 is permitted to be taken equal to zero.

$D + L + (L_r \text{ or } S \text{ or } R)$ **(Equation 16-17)**

$D + L + 0.6\,\omega W$ **(Equation 16-18)**

$D + L + 0.6\,\omega W + S/2$ **(Equation 16-19)**

$D + L + S + 0.6\,\omega W/2$ **(Equation 16-20)**

$D + L + S + E/1.4$ **(Equation 16-21)**

$0.9D + E/1.4$ **(Equation 16-22)**

Exceptions:

1. Crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind load.

2. Flat roof snow loads of 30 psf (1.44 kN/m2) or less and roof live loads of 30 psf (1.44 kN/m2) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 psf (1.44 kN/m2), 20 percent shall be combined with seismic loads.

1605.3.2.1 Other loads.
Where *F*, *H* or *T* are to be considered in the design, each applicable load shall be added to the combinations specified in Section 1605.3.2. Where self-straining loads, *T*, are considered in design, their structural effects in combination with other loads shall be determined in accordance with Section 2.4.4 of ASCE 7.

SECTION 1606
DEAD LOADS

1606.1 General.
Dead loads are those loads defined in Section 202. Dead loads shall be considered permanent loads.

1606.2 Design dead load.
For purposes of design, the actual weights of materials of construction and fixed service equipment shall be used. In the absence of definite information, values used shall be subject to the approval of the *building official*.

SECTION 1607
LIVE LOADS

1607.1 General.
Live loads are those loads defined in Section 1602.1.

TABLE 1607.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS[g]

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
1. Apartments (see residential)	—	—
2. Access floor systems Office use Computer use	 50 100	 2,000 2,000
3. Armories and drill rooms	150[m]	—

4. Assembly areas		
Fixed seats (fastened to floor)	60[m]	
Follow spot, projections and control rooms	50	
Lobbies	100[m]	
Movable seats	100[m]	—
Stages floors	150[m]	
Platforms (assembly)	100[m]	
Other assembly areas	100[m]	
5. Balconies and decks[h]	Same as occupancy served	—
6. Catwalks	40	300
7. Cornices	60	—
8. Corridors	100	
First floor	Same as occupancy served except as indicated	—
Other floors		
9. Dining rooms and restaurants	100[m]	—
10. Dwellings (see residential)	—	—
11. Elevator machine room grating (on area of 2 inches by 2 inches)	—	300
12. Finish light floor plate construction (on area of 1 inch by 1 inch)	—	200
13. Fire escapes	100	
On single-family dwellings only	40	—
14. Garages (passenger vehicles only)	40[m]	Note a
Trucks and buses	See Section 1607.7	
15. Handrails, guards and grab bars	See Section 1607.8	
16. Helipads	See Section 1607.6	
17. Hospitals		
Corridors above first floor	80	1,000
Operating rooms, laboratories	60	1,000
Patient rooms	40	1,000
18. Hotels (see residential)	—	—
19. Libraries		
Corridors above first floor	80	1,000
Reading rooms	60	1,000
Stack rooms	150[b, m]	1,000
20. Manufacturing		
Heavy	250[m]	3,000
Light	125[m]	2,000

21. Marquees	75	—
22. Office buildings		
Corridors above first floor	80	2,000
File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—
Lobbies and first-floor corridors	100	2,000
Offices	50	2,000

continued

TABLE 1607.1—continued
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS[g]

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
23. Penal institutions		
Cell blocks	40	—
Corridors	100	
24. Recreational uses:		
Bowling alleys, poolrooms and similar uses	75[m]	
Dance halls and ballrooms	100[m]	
Gymnasiums	100[m]	—
Reviewing stands, grandstands and bleachers	100[c, m]	
Stadiums and arenas with fixed seats (fastened to floor)	60[c, m]	
25. Residential		
One- and two-family dwellings		
Uninhabitable attics without storage[i]	10	
Uninhabitable attics with storage[i, j, k]	20	
Habitable attics and sleeping areas[k]	30	—
All other areas	40	
Hotels and multifamily dwellings		
Private rooms and corridors serving them	40	
Public rooms[m] and corridors serving them	100	
26. Roofs		
All roof surfaces subject to main tenance workers		300
Awnings and canopies:		
Fabric construction supported by a skeleton structure	5 nonreducible	
All other construction	20	

Ordinary flat, pitched, and curved roofs (that are not occupiable) Primary roof members, exposed to a work floor Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages All other primary roof members Occupiable roofs: Roof gardens Assembly areas All other similar areas	20 100 100[m] Note 1	 2,000 300 Note 1
27. Schools Classrooms Corridors above first floor First-floor corridors	 40 80 100	 1,000 1,000 1,000
28. Scuttles, skylight ribs and accessible ceilings	—	200
29. Sidewalks, vehicular driveways and yards, subject to trucking	250[d, m]	8,000[e]

continued

TABLE 1607.1—continued
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND
MINIMUM CONCENTRATED LIVE LOADS[g]

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
30. Stairs and exits		—
One- and two-family dwellings	40	300[f]
All other	100	300[f]
31. Storage warehouses (shall be designed for heavier loads if required for anticipated storage)		—
Heavy	250[m]	
Light	125[m]	
32. Stores Retail		
First floor	100	1,000
Upper floors	75	1,000
Wholesale, all floors	125[m]	1,000
33. Vehicle barriers	See Section 1607.8.3	
34. Walkways and elevated platforms (other than exit ways)	60	—

35.Yards and terraces, pedestrians	100 m^2	—

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kN/m^2, 1 pound = 0.004448 kN, 1 pound per cubic foot = 16 kg/m^3.

a. Floors in garages or portions of buildings used for the storage of motor vehicles shall be designed for the uniformly distributed live loads of Table 1607.1 or the following concentrated loads: (1) for garages restricted to passenger vehicles accommodating not more than nine passengers, 3,000 pounds acting on an area of 4.5 inches by 4.5 inches; (2) for mechanical parking structures without slab or deck that are used for storing passenger vehicles only, 2,250 pounds per wheel.
b. The loading applies to stack room floors that support no mobile, double-faced library book stacks, subject to the following limitations:

1. The nominal book stack unit height shall not exceed 90 inches;
2. The nominal shelf depth shall not exceed 12 inches for each face; and
3. Parallel rows of double-faced book stacks shall be separated by aisles not less than 36 inches wide.

c. Design in accordance with ICC 300.
d. Other uniform loads in accordance with an approved method containing provisions for truck loadings shall also be considered where appropriate.
e. The concentrated wheel load shall be applied on an area of 4.5 inches by 4.5 inches.
f. The minimum concentrated load on stair treads shall be applied on an area of 2 inches by 2 inches. This load need not be assumed to act concurrently with the uniform load.
g. Where snow loads occur that are in excess of the design conditions, the structure shall be designed to support the loads due to the increased loads caused by drift buildup or a greater snow design determined by the building official (see Section 1608).
h. See Section 1604.8.3 (HVHZ shall comply with Section 1616.5) for decks attached to exterior walls.
i. Uninhabitable attics without storage are those where the maximum clear height between the joists and rafters is less than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.
j. Uninhabitable attics with storage are those where the maximum clear height between the joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses.

   The live load need only be applied to those portions of the joists or truss bottom chords where both of the following conditions are met:

   i. The attic area is accessible from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is a minimum of 30 inches; and
   ii. The slopes of the joists or truss bottom chords are no greater than two units vertical in 12 units horizontal.

   The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 $lb./ft^2$.
k. Attic spaces served by stairways other than the pull-down type shall be designed to support the minimum live load specified for habitable attics and sleeping rooms.
l. Areas of occupiable roofs, other than roof gardens and assembly areas, shall be designed for appropriate loads as approved by the building official. Unoccupied landscaped areas of roofs shall be designed in accordance with Section 1607.12.3.1.
m. Live load reduction is not permitted unless specific exceptions of Section 1607.10 apply.

1607.2 Loads not specified.

For occupancies or uses not designated in Table 1607.1, the live load shall be determined in accordance with a method *approved* by the *building official*.

1607.3 Uniform live loads.

The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall in no case be less than the minimum uniformly distributed live loads given in Table 1607.1.

1607.4 Concentrated live loads.
Floors and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607.3 or the concentrated live loads given in Table 1607.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentration shall be assumed to be uniformly distributed over an area of 21/2 feet by 21/2 feet (762 mm by 762 mm) and shall be located so as to produce the maximum load effects in the structural members.

1607.5 Partition loads.
In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the *construction documents*, unless the specified live load exceeds 80 psf (3.83 kN/m^2). The partition load shall not be less than a uniformly distributed live load of 15 psf (0.72 kN/m^2).

1607.6 Helipads.
Helipads shall be designed for the following live loads:

1. A uniform live load, L, as specified below. This load shall not be reduced.

    1.1. 40 psf (1.92 kN/m^2) where the design basis helicopter has a maximum take-off weight of 3,000 pounds (13.35 kN) or less.

    1.2. 60 psf (2.87 kN/m^2) where the design basis helicopter has a maximum take-off weight greater than 3,000 pounds (13.35 kN).

2. A single concentrated live load, *L*, of 3,000 pounds (13.35 kN) applied over an area of 4.5 inches by 4.5 inches (114 mm by 114 mm) and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated load is not required to act concurrently with other uniform or concentrated live loads.

3. Two single concentrated live loads, *L*, 8 feet (2438 mm) apart applied on the landing pad (representing the helicopter's two main landing gear, whether skid type or wheeled type), each having a magnitude of 0.75 times the maximum take-off weight of the helicopter, and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated loads shall be applied over an area of 8 inches by 8 inches (203 mm by 203 mm) and are not required to act concurrently with other uniform or concentrated live loads.

Landing areas designed for a design basis helicopter with maximum take-off weight of 3,000 pounds (13.35 kN) shall be identified with a 3,000 pound (13.34 kN) weight limitation. The landing area weight limitation shall be indicated by the numeral "3" (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The indication for the landing area weight limitation shall be a minimum 5 feet (1524 mm) in height.

1607.7 Heavy vehicle loads.
Floors and other surfaces that are intended to support vehicle loads greater than a 10,000 pound (4536 kg) gross vehicle weight rating shall comply with Sections 1607.7.1 through 1607.7.5.

1607.7.1 Loads.
Where any structure does not restrict access for vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, those portions of the structure subject to such loads shall be designed using the vehicular live loads, including consideration of impact and fatigue, in accordance with the codes and specifications required by the jurisdiction having authority for the design and construction of the roadways and bridges in the same location of the structure.

1607.7.2 Fire truck and emergency vehicles.
Where a structure or portions of a structure are accessed and loaded by fire department access vehicles and other similar emergency vehicles, the structure shall be designed for the greater of the following loads:

1. The actual operational loads, including outrigger reactions and contact areas of the vehicles as stipulated and approved by the building official; or

2. The live loading specified in Section 1607.7.1.

1607.7.3 Heavy vehicle garages.
Garages designed to accommodate vehicles that exceed a 10,000 pound (4536 kg) gross vehicle weight rating, shall be designed using the live loading specified by Section 1607.7.1. For garages the design for impact and fatigue is not required.

Exception: The vehicular live loads and load placement are allowed to be determined using the actual vehicle weights for the vehicles allowed onto the garage floors, provided such loads and placement are based on rational engineering principles and are approved by the building official, but shall not be less than 50 psf (2.9 kN/m^2). This live load shall not be reduced.

1607.7.4 Forklifts and movable equipment.
Where a structure is intended to have forklifts or other movable equipment present, the structure shall be designed for the total vehicle or equipment load and the individual wheel loads for the anticipated vehicles as specified by the owner of the facility. These loads shall be posted per Section 1607.7.5.

1607.7.4.1 Impact and fatigue.
Impact loads and fatigue loading shall be considered in the design of the supporting structure. For the purposes of design, the vehicle and wheel loads shall be increased by 30 percent to account for impact.

1607.7.5 Posting.
The maximum weight of the vehicles allowed into or on a garage or other structure shall be posted by the owner in accordance with Section 106.1.

1607.8 Loads on handrails, guards, grab bars, seats and vehicle barriers.
Handrails, *guards*, grab bars, accessible seats, accessible benches and vehicle barriers shall be designed and constructed to the structural loading conditions set forth in this section.

1607.8.1 Handrails and guards.
Handrails and *guards* shall be designed to resist a linear load of 50 pounds per linear foot (plf) (0.73 kN/m) in accordance with Section 4.5.1 of ASCE 7. Glass handrail assemblies and *guards* shall also comply with Section 2407.

Exceptions:

1. For one- and two-family dwellings, only the single concentrated load required by Section 1607.8.1.1 shall be applied.

2. In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an *occupant load* less than 50, the minimum load shall be 20 pounds per foot (0.29 kN/m).

1607.8.1.1 Concentrated load.
Handrails and guards shall also be designed to resist a concentrated load of 200 pounds (0.89 kN) in accordance with Section 4.5.1 of ASCE 7.

1607.8.1.2 Intermediate rails.
Intermediate rails (all those except the handrail), balusters and panel fillers shall be designed to resist a concentrated load of 50 pounds (0.22 kN) in accordance with Section 4.5.1 of ASCE 7.

1607.8.2 Grab bars, shower seats and dressing room bench seats.
Grab bars, shower seats and dressing room bench seats shall be designed to resist a single concentrated load of 250 pounds (1.11 kN) applied in any direction at any point on the grab bar or seat so as to produce the maximum load effects.

1607.8.3 Vehicle barriers.
Vehicle barriers for passenger vehicles shall be designed to resist a concentrated load of 6,000 pounds (26.70 kN) in accordance with Section 4.5.3 of ASCE 7. Garages accommodating trucks and buses shall be designed in accordance with an *approved* method that contains provisions for traffic railings.

1607.9 Impact loads.
The live loads specified in Sections 1607.3 through 1607.8 shall be assumed to include adequate allowance for ordinary impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

1607.9.1 Elevators.
Members, elements and components subject to dynamic loads from elevators shall be designed for impact loads and deflection limits prescribed by ASME A17.1.

1607.9.2 Machinery.
For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact: (1) light machinery, shaftor motor-driven, 20 percent; and (2) reciprocating machinery or power-driven units, 50 percent. Percentages shall be increased where specified by the manufacturer.

1607.10 Reduction in uniform live loads.
Except for uniform live loads at roofs, all other minimum uniformly distributed live loads, L_o, in Table 1607.1 are permitted to be reduced in accordance with Section 1607.10.1 or 1607.10.2. Uniform live loads at roofs are permitted to be reduced in accordance with Section 1607.12.2.

1607.10.1 Basic uniform live load reduction.
Subject to the limitations of Sections 1607.10.1.1 through 1607.10.1.3 and Table 1607.1, members for which a value of $K_{LL}A_T$ is 400 square feet (37.16 m^2) or more are permitted to be designed for a reduced uniformly distributed live load, L, in accordance with the following equation:

$$L = L_o\left(0.25 + \frac{15}{\sqrt{K_{LL}A_T}}\right) \qquad \textbf{(Equation 16-23)}$$

$$\text{For SI: } L = L_o\left(0.25 + \frac{4.57}{\sqrt{K_{LL}A_T}}\right)$$

where:

L = Reduced design live load per square foot (m^2) of area supported by the member.
L_o = Unreduced design live load per square foot (m^2) of area supported by the member (see Table 1607.1).
K_{LL} = Live load element factor (see Table 1607.10.1).
A_T = Tributary area, in square feet (m^2).

L shall not be less than $0.50L_o$ for members supporting one floor and L shall not be less than $0.40L_o$ for members supporting two or more floors

TABLE 1607.10.1
LIVE LOAD ELEMENT FACTOR, K_{LL}

ELEMENT	K_{LL}
Interior columns	4
Exterior columns without cantilever slabs	4
Edge columns with cantilever slabs	3
Corner columns with cantilever slabs	2
Edge beams without cantilever slabs	2
Interior beams	2
All other members not identified above including: Edge beams with cantilever slabs Cantilever beams One-way slabs Two-way slabs Members without provisions for continuous shear transfer normal to their span	1

1607.10.1.1 One-way slabs.
The tributary area, A_T, for use in Equation 16-23 for one-way slabs shall not exceed an area defined by the slab span times a width normal to the span of 1.5 times the slab span.

1607.10.1.2 Heavy live loads.
Live loads that exceed 100 psf (4.79 kN/m^2) shall not be reduced.

Exceptions:

1. The live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall not be less than *L* as calculated in Section 1607.10.1.

2. For uses other than storage, where *approved*, additional live load reductions shall be permitted where shown by the *registered design professional* that a rational approach has been used and that such reductions are warranted.

1607.10.1.3 Passenger vehicle garages.
The live loads shall not be reduced in passenger vehicle garages.

Exception: The live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall not be less than *L* as calculated in Section 1607.10.1.

1607.10.2 Alternative uniform live load reduction.
As an alternative to Section 1607.10.1 and subject to the limitations of Table 1607.1, uniformly distributed live loads are permitted to be reduced in accordance with the following

provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. A reduction shall not be permitted where the live load exceeds 100 psf (4.79 kN/m^2) except that the design live load for members supporting two or more floors is permitted to be reduced by a maximum of 20 percent.

   Exception: For uses other than storage, where *approved*, additional live load reductions shall be permitted where shown by the *registered design professional* that a rational approach has been used and that such reductions are warranted.

2. A reduction shall not be permitted in passenger vehicle parking garages except that the live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent.

3. For live loads not exceeding 100 psf (4.79 kN/m^2), the design live load for any structural member supporting 150 square feet (13.94 m^2) or more is permitted to be reduced in accordance with Equation 16-24.

4. For one-way slabs, the area, *A*, for use in Equation 16-24 shall not exceed the product of the slab span and a width normal to the span of 0.5 times the slab span.

   $R = 0.08(A - 150)$ **(Equation 16-24)**

   For SI: $R = 0.861(A - 13.94)$

   Such reduction shall not exceed the smallest of:

   1. 40 percent for horizontal members;
   2. 60 percent for vertical members; or
   3. *R* as determined by the following equation.

   $R = 23.1(1 + D/L_o)$ **(Equation 16-25)**

   where:

   A = Area of floor supported by the member, square feet (m^2).
   D = Dead load per square foot (m^2) of area supported.
   L_o = Unreduced live load per square foot (m^2) of area supported.
   R = Reduction in percent.

1607.11 Distribution of floor loads.
Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in

combination with the floor live loads on spans selected to produce the greatest *load effect* at each location under consideration. Floor live loads are permitted to be reduced in accordance with Section 1607.10.

1607.12 Roof loads.
The structural supports of roofs and marquees shall be designed to resist wind and, where applicable, snow and earthquake loads, in addition to the dead load of construction and the appropriate live loads as prescribed in this section, or as set forth in Table 1607.1. The live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607.12.1 Distribution of roof loads.

Where uniform roof live loads are reduced to less than 20 psf (0.96 kN/m^2) in accordance with Section 1607.12.2.1 and are applied to the design of structural members arranged so as to create continuity, the reduced roof live load shall be applied to adjacent spans or to alternate spans, whichever produces the most unfavorable *load effect*. See Section 1607.12.2 for reductions in minimum roof live loads and Section 7.5 of ASCE 7 for partial snow loading.

1607.12.2 General.
The minimum uniformly distributed live loads of roofs and marquees, L_o, in Table 1607.1 are permitted to be reduced in accordance with Section 1607.12.2.1.

1607.12.2.1 Ordinary roofs, awnings and canopies.
Ordinary flat, pitched and curved roofs, and awnings and canopies other than of fabric construction supported by a skeleton structure, are permitted to be designed for a reduced uniformly distributed roof live load, L_r, as specified in the following equations or other controlling combinations of loads as specified in Section 1605, whichever produces the greater load effect.

In structures such as greenhouses, where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof load than specified in the following equations shall not be used unless *approved* by the *building official*. Such structures shall be designed for a minimum roof live load of 12 psf (0.58 kN/m^2).

$L_r = L_o R_1 R_2$ **(Equation 16-26)**

where: $12 \le L_r \le 20$

For SI: $L_r = L_o R_1 R_2$

where: $0.58 \le L_r \le 0.96$

L_o = Unreduced roof live load per square foot (m^2) of

horizontal projection supported by the member (see Table 1607.1).

L_r = Reduced roof live load per square foot (m^2) of horizontal projection supported by the member.

The reduction factors R_1 and R_2 shall be determined as follows:

$R_1 = 1$ for $A_t \leq 200$ square feet (18.58 m^2) **(Equation 16-27)**

$R_1 = 1.2 - 0.001A_t$ for 200 square feet $< A_t <$ 600 square feet **(Equation 16-28)**

For SI: $1.2 - 0.011A_t$ for 18.58 square meters $< A_t <$ 55.74 square meters

$R_1 = 0.6$ for $A_t \geq 600$ square feet (55.74 m^2) **(Equation 16-29)**

where:

A_t = Tributary area (span length multiplied by effective width) in square feet (m^2) supported by the member, and

$R_2 = 1$ for $F \leq 4$ **(Equation 16-30)**

$R_2 = 1.2 - 0.05F$ for $4 < F < 12$ **(Equation 16-31)**

$R_2 = 0.6$ for $F \geq 12$ **(Equation 16-32)**

where:

F = For a sloped roof, the number of inches of rise per foot (for SI: $F = 0.12 \times$ slope, with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

1607.12.3 Occupiable roofs.
Areas of roofs that are occupiable, such as roof gardens, or for assembly or other similar purposes, and marquees are permitted to have their uniformly distributed live loads reduced in accordance with Section 1607.10.

1607.12.3.1 Landscaped roofs.
The uniform design live load in unoccupied landscaped areas on roofs shall be 20 psf (0.958 kN/m2). The weight of all landscaping materials shall be considered as dead load and shall be computed on the basis of saturation of the soil.

1607.12.4 Awnings and canopies.
Awnings and canopies shall be designed for uniform live loads as required in Table 1607.1 as well as for snow loads and wind loads as specified in Sections 1608 and 1609.

1607.13 Crane loads.
The crane live load shall be the rated capacity of the crane. Design loads for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall include the maximum wheel loads of the crane and the vertical impact, lateral and longitudinal forces induced by the moving crane.

1607.13.1 Maximum wheel load.
The maximum wheel loads shall be the wheel loads produced by the weight of the bridge, as applicable, plus the sum of the rated capacity and the weight of the trolley with the trolley positioned on its runway at the location where the resulting load effect is maximum.

1607.13.2 Vertical impact force.
The maximum wheel loads of the crane shall be increased by the percentages shown below to determine the induced vertical impact or vibration force:

Monorail cranes (powered)	25 percent
Cab-operated or remotely operated bridge cranes (powered)	25 percent
Pendant-operated bridge cranes (powered)	10 percent
Bridge cranes or monorail cranes with hand-geared bridge, trolley and hoist	0 percent

1607.13.3 Lateral force.
The lateral force on crane runway beams with electrically powered trolleys shall be calculated as 20 percent of the sum of the rated capacity of the crane and the weight of the hoist and trolley. The lateral force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction perpendicular to the beam, and shall be distributed with
due regard to the lateral stiffness of the runway beam and supporting structure.

1607.13.4 Longitudinal force.
The longitudinal force on crane runway beams, except for bridge cranes with hand-geared bridges, shall be calculated as 10 percent of the maximum wheel loads of the crane. The longitudinal force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction parallel to the beam.

1607.14 Interior walls and partitions.
Interior walls and partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the loads to which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/m^2).

Exception: Fabric partitions complying with Section 1607.14.1 shall not be required to resist the minimum horizontal load of 5 psf (0.24 kN/m^2).

1607.14.1 Fabric partitions.
Fabric partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the following load conditions:

1. A horizontal distributed load of 5 psf (0.24 kN/m^2) applied to the partition framing. The total area used to determine the distributed load shall be the area of the fabric face between the framing members to which the fabric is attached. The total distributed load shall be uniformly applied to such framing members in proportion to the length of each member.

2. A concentrated load of 40 pounds (0.176 kN) applied to an 8-inch diameter (203 mm) area [50.3 square inches (32 452 mm^2)] of the fabric face at a height of 54 inches (1372 mm) above the floor.

SECTION 1608
SNOW LOADS

1608.1 General.
Design snow loads shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof load shall not be less than that determined by Section 1607.

1608.2 Ground snow loads.
The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with ASCE 7 or Figure 1608.2 for the contiguous United States and Table 1608.2 for Alaska. Site-specific case studies shall be made in areas designated "CS" in Figure 1608.2. Ground snow loads for sites at elevations above the limits indicated in Figure 1608.2 and for all sites within the CS areas shall be *approved*. Ground snow load determination for such sites shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2-percent annual probability of being exceeded (50-year mean recurrence interval). Snow loads are zero for Hawaii, except in mountainous regions as approved by the building official.

TABLE 1608.2
GROUND SNOW LOADS, p_g , FOR ALASKAN LOCATIONS

LOCATION	POUNDS PER SQUARE FOOT		LOCATION	POUNDS PER SQUARE FOOT		LOCATION	POUNDS PER SQUARE FOOT
Adak	30		Galena	60		Petersburg	150
Anchorage	50		Gulkana	70		St. Paul Islands	40
Angoon	70		Homer	40		Seward	50
Barrow	25		Juneau	60		Shemya	25
Barter Island	35		Kenai	70		Sitka	50
Bethel	40		Kodiak	30		Talkeetna	120
Big Delta	50		Kotzebue	60		Unalakleet	50
Cold Bay	25		McGrath	70		Valdez	160

Cordova	100		Nenana	80		Whittier	300
Fairbanks	60		Nome	70		Wrangell	60
Fort Yukon	60		Palmer	50		Yakutat	150

For SI: 1 pound per square foot = 0.0479 kN/m^2.

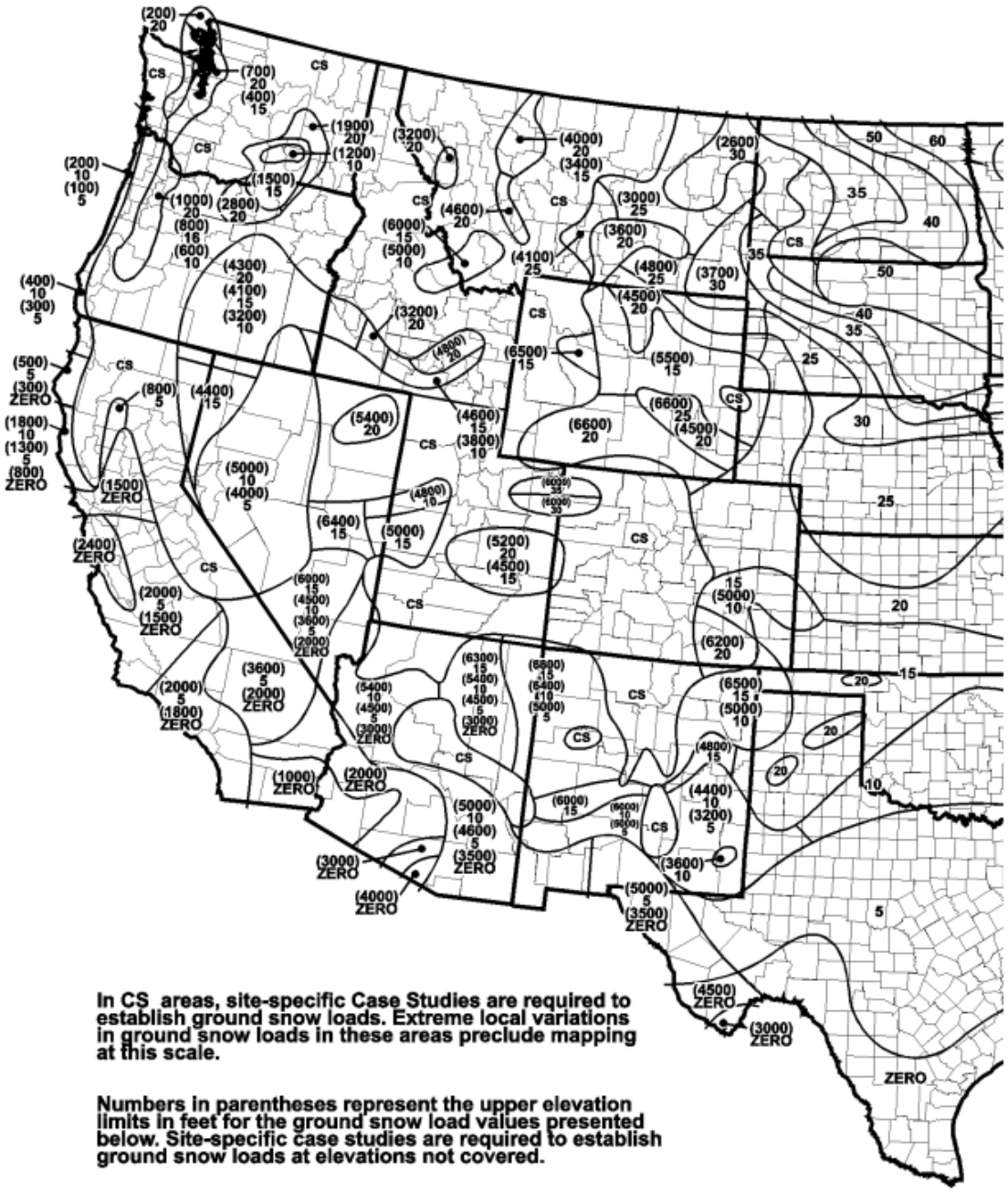

In CS areas, site-specific Case Studies are required to establish ground snow loads. Extreme local variations in ground snow loads in these areas preclude mapping at this scale.
Numbers in parentheses represent the upper elevation limits in feet for the ground snow load values presented below. Site-specific case studies are required to establish ground snow loads at elevations not covered.
To convert lb/sq ft to kNm^2, multiply by 0.0479.
To convert feet to meters, multiply by 0.3048
0
100
200
300 miles

FIGURE 1608.2
GROUND SNOW LOADS, p_g, FOR THE UNITED STATES (psf)

FIGURE 1608.2—continued
GROUND SNOW LOADS, p_g, FOR THE UNITED STATES (psf)

1608.3 Ponding instability.
Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Section 7.11 of ASCE 7.

SECTION 1609
WIND LOADS

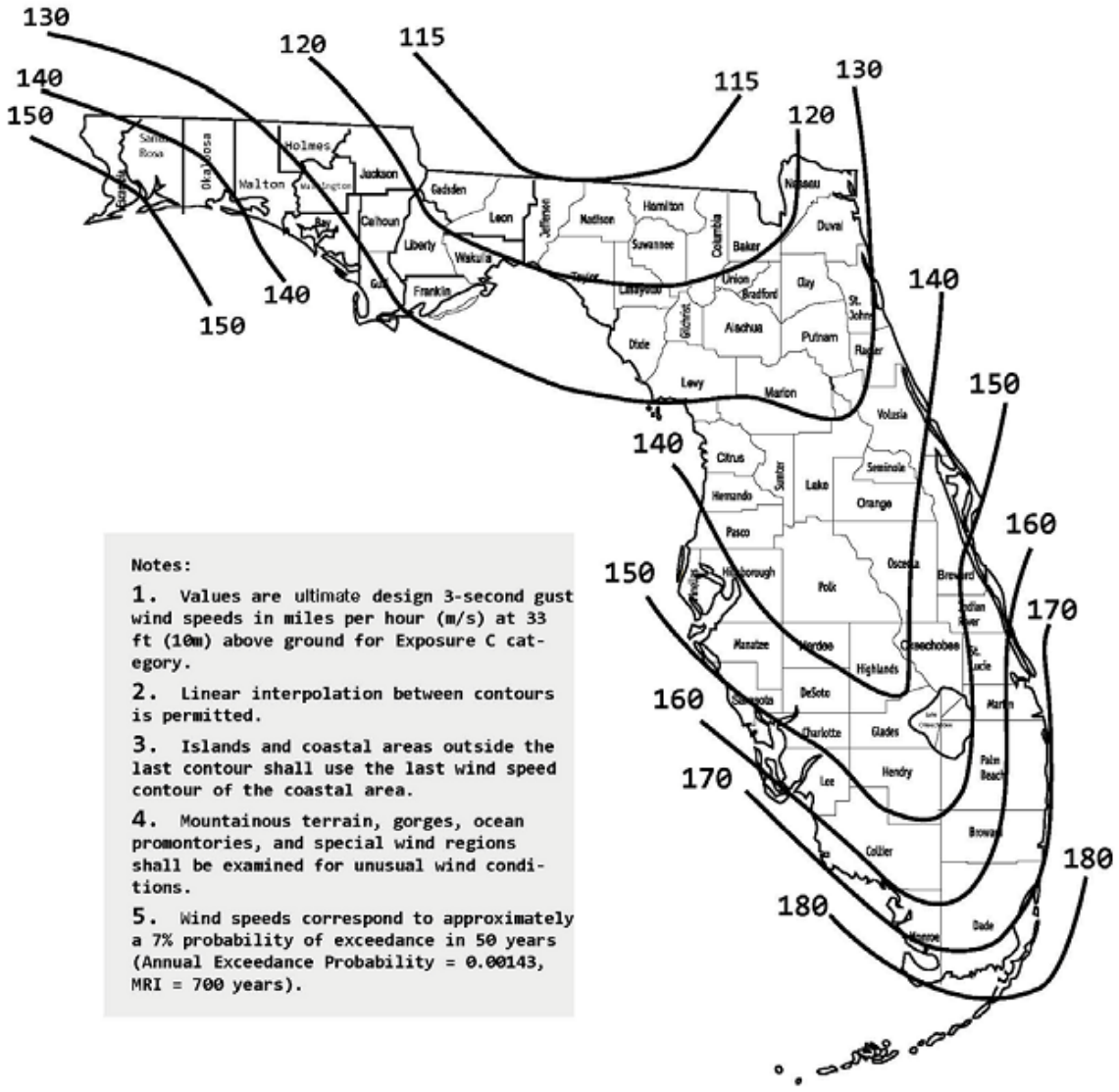


FIGURE 1609A
ULTIMATE DESIGN WIND SPEEDS, V_{ULT}, FOR RISK CATEGORY II BUILDINGS AND

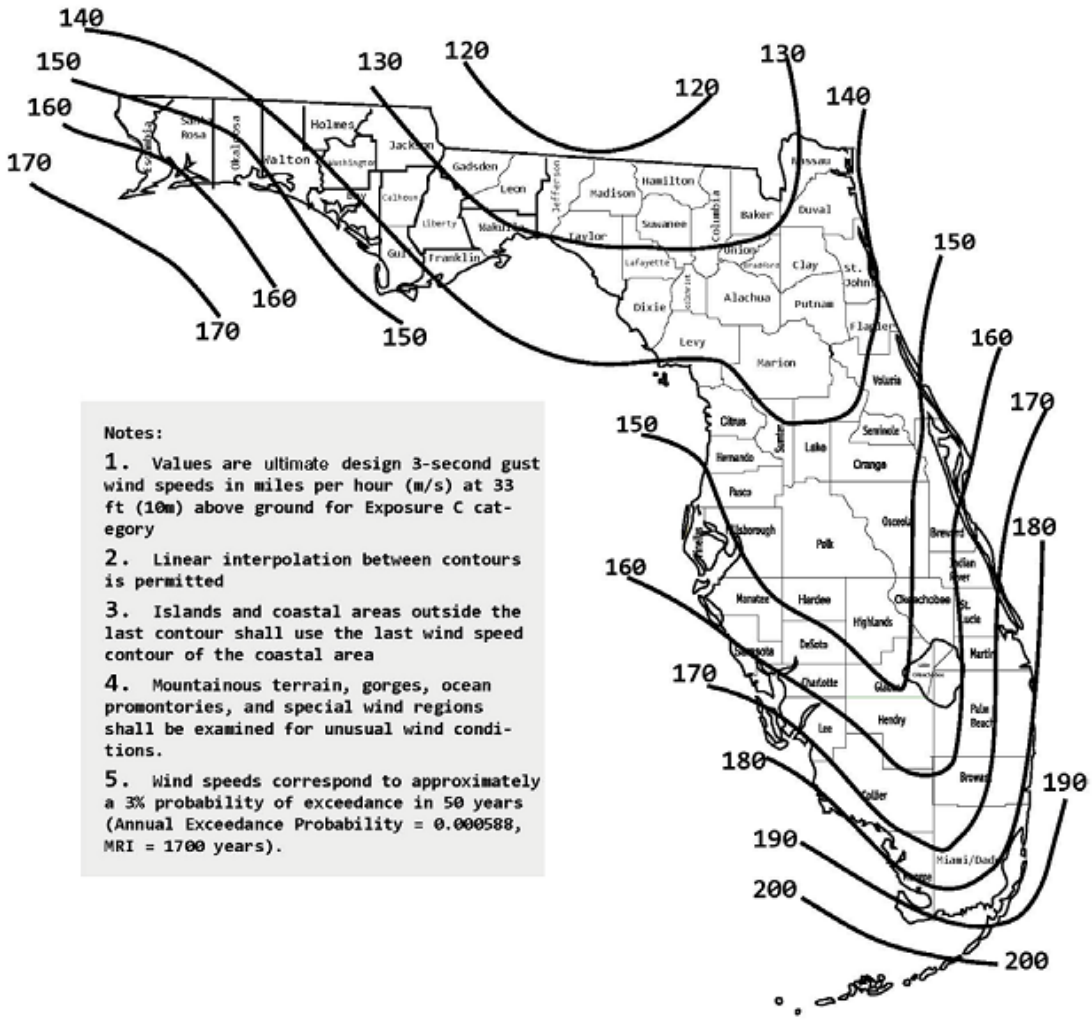


FIGURE 1609B
ULTIMATE DESIGN WIND SPEEDS, V_{ULT}, FOR RISK CATEGORY III AND IV BUILDINGS AND OTHER STRUCTURES

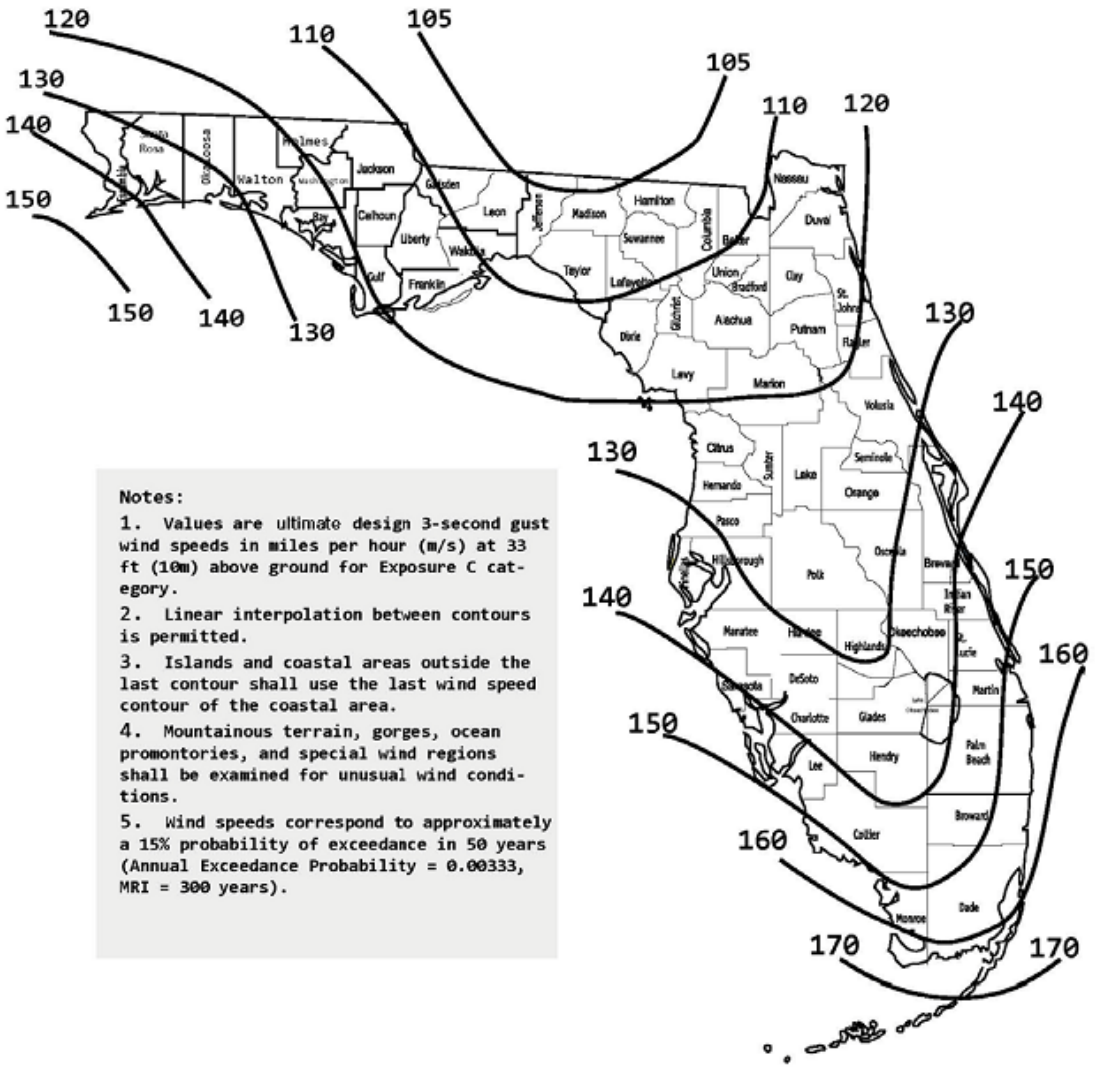


FIGURE 1609C
ULTIMATE DESIGN WIND SPEEDS, V_{ULT}, FOR RISK CATEGORY I BUILDINGS AND OTHER STRUCTURES

1609.1 Applications.
Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures.

All exterior wall coverings and soffits shall be capable of resisting the design pressures specified for walls for components and cladding loads in accordance with Section 1609.1.1. Manufactured soffits shall be labeled in accordance with Section 1710.9 of this code.

1609.1.1 Determination of wind loads.
Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7 or provisions of the alternate all-heights method in Section 1609.6. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.

2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AF&PA WFCM.

3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.

4. Designs using NAAMM FP 1001.

5. Designs using TIA-222 for antenna-supporting structures and antennas, provided the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment. Design using this standard shall be permitted for communication tower and steel antenna support structures.

6. Wind tunnel tests in accordance with Chapter 31 of ASCE 7.

7. Wind loads for screened enclosures shall be determined in accordance with Section 2002.4

The wind speeds in Figures 1609A, 1609B and 1609C are ultimate design wind speeds, V_{ult}, and shall be converted in accordance with Section 1609.3.1 to nominal design wind speeds, V_{asd}, when the provisions of the standards referenced in Exceptions 1, 3, 4 and 5 are used unless the wind provisions in the standards are based on Ultimate Wind Speeds as specified in Figures 1609A, 1609B, or 1609C or Chapter 26 of ASCE 7.

1609.1.1.1 Applicability.
The provisions of ICC 600 are applicable only to buildings located within Exposure B or C as defined in Section 1609.4. The provisions of ICC 600, AF&PA WFCM and AISI S230 shall not apply to buildings sited on the upper half of an isolated hill, ridge or escarpment meeting the following conditions:

1. The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C;

2. The maximum average slope of the hill exceeds 10 percent; and

3. The hill, ridge or escarpment is unobstructed upwind by other such topographic features for a distance from the high point of 50 times the height of the hill or 1 mile (1.61 km), whichever is greater.

1609.1.2 Protection of openings.
In *wind-borne debris regions*, glazed openings in buildings shall be impact resistant or protected with an impact-resistant covering meeting the requirements of SSTD 12, ANSI/DASMA 115 (for garage doors and rolling doors) or TAS 201, 202 and 203, AAMA 506. ASTM E 1996 and ASTM E 1886 referenced herein, or an *approved* impact-resistant standard as follows:

1. Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the large missile test of ASTM E 1996.

2. Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the small missile test of ASTM E 1996.

3. Storage sheds that are not designed for human habitation and that have a floor area of 720 square feet (67 m^2) or less are not required to comply with the mandatory windborne debris impact standards of this code.

4. Openings in sunrooms, balconies or enclosed porches constructed under existing roofs or decks are not required to be protected provided the spaces are separated from the building interior by a wall and all openings in the separating wall are protected in accordance with Section 1609.1.2 above. Such spaces shall be permitted to be designed as either partially enclosed or enclosed structures.

Exceptions:

1. Wood structural panels with a minimum thickness of $^{7}/_{16}$ inch (11.1 mm) and maximum panel span of 8 feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings classified as Group R-3 or R-4 occupancy. Panels shall be precut so that they shall be attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the components and cladding loads determined in accordance with the provisions of ASCE 7, with corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table 1609.1.2 with corrosion-resistant attachment hardware provided and anchors permanently installed on the building is permitted for buildings with a mean roof height of 45 feet (13 716 mm) or less where V_{asd} determined in accordance with Section 1609.3.1 does not exceed 140 mph (63 m/s).

2. Glazing in *Risk Category* I buildings as defined in Section 1604.5, including greenhouses that are occupied for growing plants on a production or research basis, without public access shall be permitted to be unprotected.

3. Glazing in *Risk Category* II, III or IV buildings located over 60 feet (18 288 mm) above the ground and over 30 feet (9144 mm) above aggregate surface roofs located within 1,500 feet (458 m) of the building shall be permitted to be unprotected.

TABLE 1609.1.2
WIND-BORNE DEBRIS PROTECTION FASTENING
SCHEDULE FOR WOOD STRUCTURAL PANELS[a, b, c, d]

FASTENER TYPE	FASTENER SPACING (inches)		
	Panel Span ≤ 4 feet	4 feet < Panel Span ≤ 6 feet	6 feet < Panel Span ≤ 8 feet
No. 8 wood-screw-based anchor with 2-inch embedment length	16	10	8
No. 10 wood-screw-based anchor with 2-inch embedment length	16	12	9
1/4-inch diameter lag-screw-based anchor with 2-inch embedment length	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N,
1 mile per hour = 0.447 m/s.

a. This table is based on a V_{asd} determined in accordance with Section 1609.3.1 of 140 mph and a 45-foot mean roof height.
b. Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located a minimum of 1 inch from the edge of the panel.
c. Anchors shall penetrate through the exterior wall covering with an embedment length of 2 inches minimum into the building frame. Fasteners shall be located a minimum of 2 1/2 inches from the edge of concrete block or concrete.
d. Where panels are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum ultimate withdrawal capacity of 1,500 pounds.

1609.1.2.1 Louvers.
Louvers protecting intake and exhaust ventilation ducts not assumed to be open that are located within 30 feet (9144 mm) of grade shall meet the requirements of ANSI/AMCA 540 or shall be protected by an impact-resistant cover complying with the large missile test of ASTM E 1996 or an approved impact-resistance standard. Louvers required to be open for life safety purposes such as providing a breathable atmosphere shall meet the requirements of AMCA 540.

1609.1.2.2 Application of ASTM E 1996.
The text of Section 6.2.2 of ASTM E 1996 shall be substituted as follows:

6.2.2 Unless otherwise specified, select the wind zone based on the strength design wind speed, Vult, as follows:

6.2.2.1 *Wind Zone 1*—130 mph = ultimate design wind speed, *Vult* < 140 mph.

6.2.2.2 *Wind Zone 2*—140 mph = ultimate design wind speed, *Vult* < 150 mph at greater than one mile (1.6 km) from the coastline. The coastline shall be measured from the mean high water mark. 6.2.2.3 Wind Zone 3—150 mph (67 m/s) = ultimate design wind speed, *Vult* = 170 mph (76 m/s), or 140 mph (63 m/s) = ultimate design wind speed, *Vult* = 170 mph (76 m/s) and within one mile(1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.3 *Wind Zone 3*—150 mph (67 m/s) = ultimate design wind speed, *Vult* = 170 mph (76 m/s), or 140 mph (63 m/s) = ultimate design wind speed, *Vult* = 170 mph (76 m/s) and within one mile(1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.4 *Wind Zone 4*— ultimate design wind speed, *Vult* >170 mph (76 m/s).

1609.1.2.2.1 Modifications to ASTM E 1886 and ASTM E 1996. Table 1 of ASTM E 1886 and ASTM E 1996—revise the third column to read as follows:

Air Pressure Cycles

0.2 to 0.5 Ppos1

0.0 to 0.6 Ppos

0.5 to 0.8 Ppos

0.3 to 1.0 Ppos

0.3 to 1.0 Pneg2

0.5 to 0.8 Pneg

0.0 to 0.6 Pneg

0.2 to 0.5 Pneg

Notes:

1. Ppos = 0.6 × positive ultimate design load in accordance with ASCE 7.
2. Pneg = 0.6 × negative ultimate design load in accordance with ASCE 7.

1609.1.2.3 Garage doors.
Garage door glazed opening protection for wind-borne debris shall meet the requirements of an *approved* impact-resisting standard or ANSI/DASMA 115.

1609.1.2.4 Impact-resistant coverings.

1609.1.2.4.1
Impact-resistant coverings shall be tested at 1.5 times the design pressure (positive or negative) expressed in pounds per square feet as determined by Section 1609 or ASCE 7, for which the specimen is to be tested. The design pressures, as determined from ASCE 7, are permitted to be multiplied by 0.6.

1609.1.2.4.2 Impact-resistant coverings.
Impact-resistant coverings shall be labeled in accordance with the provisions of Section 1710.8.

1609.2 Definitions.
For the purposes of Section 1609 and as used elsewhere in this code, the following terms are defined in Chapter 2.

HURRICANE-PRONE REGIONS.

WIND-BORNE DEBRIS REGION.

WIND SPEED, V_{ult}.

WIND SPEED, V_{asd}.

1609.3 Basic wind speed.
The ultimate design wind speed V_{ult}, in mph, for the determination of the wind loads shall be determined by Figures 1609A, 1609B and 1609C. The ultimate design wind speed, V_{ult}, for use in the design of Risk Category II buildings and structures shall be obtained from Figure 1609A. The ultimate design wind speed, V_{ult}, for use in the design of Risk Category III and IV buildings and structures shall be obtained from Figure 1609B. The ultimate design wind speed, V_{ult}, for use in the design of Risk Category I buildings and structures shall be obtained from Figure 1609C. The exact location of wind speed lines shall be established by local ordinance using recognized physical landmarks such as major roads, canals, rivers and lake shores wherever possible.

In nonhurricane-prone regions, when the ultimate design wind speed, Vult, is estimated from regional climatic data, the ultimate design wind speed, V_{ult}, shall be determined in accordance with Section 26.5.3 of ASCE 7.

1609.3.1 Wind speed conversion.
When required, the ultimate design wind speeds of Figures 1609A, 1609B and 1609C shall be converted to nominal design wind speeds, V_{asd}, using Table 1609.3.1 or Equation 16-33.

$$V_{asd} = V_{ult}\sqrt{0.6} \qquad \textbf{(Equation 16-33)}$$

where:

V_{asd} = nominal design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1.
V_{ult} = ultimate design wind speeds determined from Figures 1609A, 1609B or 1609C.

TABLE 1609.3.1
WIND SPEED CONVERSIONS[a, b, c]

V_{ult}	100	110	120	130	140	150	160	170	180	190	200
V_{asd}	78	85	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.447 m/s.
a. Linear interpolation is permitted.
b. V_{asd} = nominal design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1..
c. V_{ult} = ultimate design wind speed determined from Figures 1609A, 1609B, or 1609C.

1609.4 Exposure category.
For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features.

1609.4.1 Wind directions and sectors.
For each selected wind direction at which the wind loads are to be evaluated, the exposure of the building or structure shall be determined for the two upwind sectors extending 45 degrees (0.79 rad) either side of the selected wind direction. The exposures in these two sectors shall be determined in accordance with Sections 1609.4.2 and 1609.4.3 and the exposure resulting in the highest wind loads shall be used to represent winds from that direction.

1609.4.2 Surface roughness categories.
A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609.4.3 from the categories defined below, for the purpose of assigning an exposure category as defined in Section 1609.4.3.

Surface Roughness B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Surface Roughness C. Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country, and grasslands. This surface roughness shall also apply to any building located within surface roughness Btype terrain where the building is within 100 feet (30 m) horizontally in any direction of open areas of surface roughness C or D-type terrain that extends more than 600 feet (182.9 m) in the upwind direction and a width greater than 150 feet (46 m).

Surface Roughness D. Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats and unbroken ice.

1609.4.3 Exposure categories.
An exposure category shall be determined in accordance with the following:

Exposure B. For buildings with a mean roof height of less than or equal to 30 feet (9144 mm), Exposure B shall apply where the ground surface roughness, as defined by Surface Roughness B, prevails in the upwind direction for a distance of at least 1,500 feet (457 m). For buildings with a mean roof height greater than 30 feet (9144 mm), Exposure B shall apply where Surface Roughness B prevails in the upwind direction for a distance of at least 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.

Exposure C. Exposure C shall apply for all cases where Exposures B or D do not apply.

Exposure D. Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance of at least 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall also apply where the ground surface roughness immediately upwind of the site is B or C, and the site is within a distance of 600 feet (183 m) or 20 times the building height, whichever is greater, from an exposure D condition as defined in the previous sentence.

1609.5 Roof systems.
Roof systems shall be designed and constructed in accordance with Sections 1609.5.1 through 1609.5.3, as applicable.

1609.5.1 Roof deck.
The roof deck shall be designed to withstand the wind pressures determined in accordance with ASCE 7.

1609.5.2 Roof coverings.
Roof coverings shall comply with Section 1609.5.1.

Exception: Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609.5.1 are permitted to be designed in accordance with Section 1609.5.3.

Asphalt shingles installed over a roof deck complying with Section 1609.5.1 shall comply with the wind-resistance requirements of Section 1507.2.7.1.

1609.5.3 Rigid tile.
Wind loads on rigid tile roof coverings shall be determined in accordance with the following equation:

$$M_a = q_h C_L b L L_a [1.0 - GC_p] \qquad \textbf{(Equation 16-34)}$$

For SI: $$M_a = \frac{q_h C_L b L L_a [1.0 - GC_p]}{1,000}$$

where:

b = Exposed width, feet (mm) of the roof tile.
C_L = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1711.2.
GC_p = Roof pressure coefficient for each applicable roof zone determined from Chapter 30 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.
L = Length, feet (mm) of the roof tile.
L_a = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at 0.76L from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.
M_a = Aerodynamic uplift moment, feet-pounds (N-mm) acting to raise the tail of the tile.
q_h = Wind velocity pressure, psf (kN/m^2) determined from Section 27.3.2 of ASCE 7.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by this section.

1. The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.

2. The roof tiles shall be installed on solid sheathing which has been designed as components and cladding.

3. An underlayment shall be installed in accordance with Chapter 15.

4. The tile shall be single lapped interlocking with a minimum head lap of not less than 2 inches (51 mm).

5. The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).

6. The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).

7. The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).

8. Roof tiles using mortar set or adhesive set systems shall have at least two-thirds of the tile's area free of mortar or adhesive contact.

1609.6 Alternate all-heights method.
The alternate wind design provisions in this section are simplifications of the ASCE 7 Directional Procedure.

1609.6.1 Scope.
As an alternative to ASCE 7 Chapters 27 and 30, the following provisions are permitted to be used to determine the wind effects on regularly shaped buildings, or other structures that are regularly shaped, which meet all of the following conditions:

1. The building or other structure is less than or equal to 75 feet (22 860 mm) in height with a height-to-least-width ratio of 4 or less, or the building or other structure has a fundamental frequency greater than or equal to1 hertz.

2. The building or other structure is not sensitive to dynamic effects.

3. The building or other structure is not located on a site for which channeling effects or buffeting in the wake of upwind obstructions warrant special consideration.

4. The building shall meet the requirements of a simple diaphragm building as defined in ASCE 7 Section 26.2, where wind loads are only transmitted to the main wind-force-resisting system (MWFRS) at the diaphragms.

5. For open buildings, multispan gable roofs, stepped roofs, sawtooth roofs, domed roofs, roofs with slopes greater than 45 degrees (0.79 rad), solid free-standing walls and solid signs, and rooftop equipment, apply ASCE 7 provisions.

1609.6.1.1 Modifications.
The following modifications shall be made to certain subsections in ASCE 7: in Section 1609.6.2, symbols and notations that are specific to this section are used in conjunction with the symbols and notations in ASCE 7 Section 26.3.

1609.6.2 Symbols and notations.
Coefficients and variables used in the alternative all-heights method equations are as follows:

C_{net} = Net-pressure coefficient based on $K_d[(G)(C_p) - (GC_{pi})]$, in accordance with Table 1609.6.2.
G = Gust effect factor for rigid structures in accordance with ASCE 7 Section 26.9.1.
K_d = Wind directionality factor in accordance with ASCE 7 Table 26-6.
P_{net} = Design wind pressure to be used in determination of wind loads on buildings or other

structures or their components and cladding, in psf (kN/m^2).

TABLE 1609.6.2

NET PRESSURE COEFFICIENTS, C_{net} [a, b]

STRUCTURE OR PART THEREOF	DESCRIPTION		C_{net} FACTOR			
			Enclosed		**Partially enclosed**	
	Walls:		**+ Internal pressure**	**- Internal pressure**	**+ Internal pressure**	**- Internal pressure**
	Windward wall		0.43	0.73	0.11	1.05
	Leeward wall		-0.51	-0.21	-0.83	0.11
	Sidewall		-0.66	-0.35	-0.97	-0.04
	Parapet wall	**Windward**	1.28		1.28	
		Leeward	-0.85		-0.85	
	Roofs:		**Enclosed**		**Partially enclosed**	
	Wind perpendicular to ridge		**+ Internal pressure**	**- Internal pressure**	**+ Internal pressure**	**- Internal pressure**
	Leeward roof or flat roof		-0.66	-0.35	-0.97	-0.04
	Windward roof slopes:					
	Slope = 2:12 (10°)	Condition 1	-1.09	-0.79	-1.41	-0.47
		Condition 2	-0.28	0.02	-0.60	0.34
	Slope = 4:12 (18°)	Condition 1	-0.73	-0.42	-1.04	-0.11
		Condition 2	-0.05	0.25	-0.37	0.57
	Slope = 5:12 (23°)	Condition 1	-0.58	-0.28	-0.90	0.04
		Condition 2	0.03	0.34	-0.29	0.65
	Slope = 6:12 (27°)	Condition 1	-0.47	-0.16	-0.78	0.15
		Condition 2	0.06	0.37	-0.25	0.68
	Slope = 7:12 (30°)	Condition 1	-0.37	-0.06	-0.68	0.25
		Condition 2	0.07	0.37	-0.25	0.69
	Slope = 9:12 (37°)	Condition 1	-0.27	0.04	-0.58	0.35
		Condition 2	0.14	0.44	-0.18	0.76
	Slope = 12:12 (45°)		0.14	0.44	-0.18	0.76
	Wind parallel to ridge and flat roofs		-1.09	-0.79	-1.41	-0.47
1. Main wind- force-resisting frames and systems	**Nonbuilding Structures: Chimneys, Tanks and Similar Structures:**					
				h/D		
				1	**7**	**25**
	Square (Wind normal to face)			0.99	1.07	1.53
	Square (Wind on diagonal)			0.77	0.84	1.15
	Hexagonal or Octagonal			0.81	0.97	1.13
	Round			0.65	0.81	0.97
	Open signs and lattice frameworks			Ratio of solid to gross area		
				< 0.1	0.1 to 0.29	0.3 to 0.7
	Flat			1.45	1.30	1.16
	Round			0.87	0.94	1.08

(continued)

TABLE 1609.6.2—continued
NET PRESSURE COEFFICIENTS, C_{net} [a, b]

STRUCTURE OR PART THEREOF	DESCRIPTION		C_{net} FACTOR	
2. Components and cladding not in areas of discontinuity—roofs and overhangs	**Roof elements and slopes**		**Enclosed**	**Partially enclosed**
	Gable of hipped configurations (Zone 1)			
	Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 1			
	Positive	10 square feet or less	0.58	0.89
		100 square feet or more	0.41	0.72
	Negative	10 square feet or less	-1.00	-1.32
		100 square feet or more	-0.92	-1.23
	Overhang: Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2A Zone 1			
	Negative	10 square feet or less	-1.45	
		100 square feet or more	-1.36	
		500 square feet or more	-0.94	
	6:12 (27°) < Slope < 12:12 (45°) See ASCE 7 Figure 30.4-2C Zone 1			
	Positive	10 square feet or less	0.92	1.23
		100 square feet or more	0.83	1.15
	Negative	10 square feet or less	-1.00	-1.32
		100 square feet or more	-0.83	-1.15
	Monosloped configurations (Zone 1)		**Enclosed**	**Partially enclosed**
	Flat < Slope < 7:12 (30°) See ASCE 7 Figure 30.4-5B Zone 1			
	Positive	10 square feet or less	0.49	0.81
		100 square feet or more	0.41	0.72
	Negative	10 square feet or less	-1.26	-1.57
		100 square feet or more	-1.09	-1.40
	Tall flat-topped roofs h > 60 feet		**Enclosed**	**Partially enclosed**
	Flat < Slope < 2:12 (10°) (Zone 1) See ASCE 7 Figure 30.8-1 Zone 1			
	Negative	10 square feet or less	1.34	-1.66
		500 square feet or more	-0.92	-1.23
3. Components and cladding in areas of discontinuities—roofs and overhangs (continued)	Gable or hipped configurations at ridges, eaves and rakes (Zone 2)			
	Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 2			
	Positive	10 square feet or less	0.58	0.89
		100 square feet or more	0.41	0.72
	Negative	10 square feet or less	-1.68	2.00
		100 square feet or more	-1.17	-1.49
	Overhang for Slope Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 2			
	Negative	10 square feet or less	-1.87	
		100 square feet or more	-1.87	
	6:12 (27°) < Slope < 12:12 (45°) Figure 30.4-2C		**Enclosed**	**Partially enclosed**
	Positive	10 square feet or less	0.92	1.23
		100 square feet or more	0.83	1.15
	Negative	10 square feet or less	-1.17	-1.49
		100 square feet or more	-1.00	-1.32
	Overhang for 6:12 (27°) < Slope < 12:12 (45°) See ASCE 7 Figure 30.4-2C Zone 2			
	Negative	10 square feet or less	-1.70	
		500 square feet or more	-1.53	

(continued)

TABLE 1609.6.2—continued
NET PRESSURE COEFFICIENTS, C_{net} [a, b]

	STRUCTURE OR PART THEREOF	DESCRIPTION		C_{net} FACTOR	
		Roof elements and slopes		**Enclosed**	**Partially enclosed**
		Monosloped configurations at ridges, eaves and rakes (Zone 2)			
		Flat < Slope < 7:12 (30°) See ASCE 7 Figure 30.4-5B Zone 2			
		Positive	10 square feet or less	0.49	0.81
			100 square feet or more	0.41	0.72
		Negative	10 square feet or less	-1.51	-1.83
			100 square feet or more	-1.43	-1.74
		Tall flat topped roofs h > 60 feet		**Enclosed**	Partially enclosed
		Flat < Slope < 2:12 (10°) (Zone 2) See ASCE 7 Figure 30.8-1 Zone 2			
		Negative	10 square feet or less	-2.11	-2.42
			500 square feet or more	-1.51	-1.83
		Gable or hipped configurations at corners (Zone 3) See ASCE 7 Figure 30.4-2B Zone 3			
		Flat < Slope < 6:12 (27°)		**Enclosed**	Partially enclosed
		Positive	10 square feet or less	0.58	0.89
			100 square feet or more	0.41	0.72
		Negative	10 square feet or less	-2.53	-2.85
			100 square feet or more	-1.85	-2.17
3.	Components and cladding in areas of discontinuities—roofs and overhangs	Overhang for Slope Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 3			
		Negative	10 square feet or less	-3.15	
			100 square feet or more	-2.13	
		6:12 (27°) < 12:12 (45°) See ASCE 7 Figure 30.4-2C Zone 3			
		Positive	10 square feet or less	0.92	1.23
			100 square feet or more	0.83	1.15
		Negative	10 square feet or less	-1.17	-1.49
			100 square feet or more	-1.00	-1.32
		Overhang for 6:12 (27°) < Slope < 12:12 (45°)		**Enclosed**	Partially enclosed
		Negative	10 square feet or less	-1.70	
			100 square feet or more	-1.53	
		Monosloped Configurations at corners (Zone 3) See ASCE 7 Figure 30.4-5B Zone 3			
		Flat < Slope < 7:12 (30°)			
		Positive	10 square feet or less	0.49	0.81
			100 square feet or more	0.41	0.72
		Negative	10 square feet or less	-2.62	-2.93
			100 square feet or more	-1.85	-2.17
		Tall flat topped roofs h > 60 feet		**Enclosed**	Partially enclosed
		Flat < Slope < 2:12 (10°) (Zone 3) See ASCE 7 Figure 30.8-1 Zone 3			
		Negative	10 square feet or less	-2.87	-3.19
			500 square feet or more	-2.11	-2.42
4.	Components and cladding not in areas of discontinuity—walls and parapets (continued)	Wall Elements: h ≤ 60 feet (Zone 4) ASCE 7 Figure 30.4-1		**Enclosed**	Partially enclosed
		Positive	10 square feet or less	1.00	1.32
			500 square feet or more	0.75	1.06
		Negative	10 square feet or less	-1.09	-1.40
			500 square feet or more	-0.83	-1.15

	Wall Elements: h > 60 feet (Zone 4) ASCE 7 Figure 30.6-1			
	Positive	20 square feet or less	0.92	1.23
		500 square feet or more	0.66	0.98

(continued)

TABLE 1609.6.2—continued
NET PRESSURE COEFFICIENTS, C_{net} [a, b]

STRUCTURE OR PART THEREOF	DESCRIPTION		C_{net} FACTOR	
4. Components and cladding not in areas of discontinuity-walls and parapets	Negative	20 square feet or less	-0.92	-1.23
		500 square feet or more	-0.75	-1.06
	Parapet Walls			
	Positive		2.87	3.19
	Negative		-1.68	-2.00
5. Components and cladding in areas of discontinuity—walls and parapets	Wall elements: $h \leq$ 60feet (Zone 5) Figure 30.4-1		**Enclosed**	**Partially enclosed**
	Positive	10 square feet or less	1.00	1.32
		500 square feet or more	0.75	1.06
	Negative	10 square feet or less	-1.34	-1.66
		500 square feet or more	-0.83	-1.15
	Wall elements: h > 60feet (Zone 4) See ASCE 7 Figure 30.6-1			
	Positive	20 square feet or less	0.92	1.23
		500 square feet or more	0.66	0.98
	Negative	20 square feet or less	-1.68	-2.00
		500 square feet or more	-1.00	-1.32
	Parapet walls			
	Positive		3.64	3.95
	Negative		-2.45	-2.76

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 degree = 0.0175 rad.
a. Linear interpolation between values in the table is permitted.
b. Some C_{net} values have been grouped together. Less conservative results may be obtained by applying ASCE 7 provisions.

1609.6.3 Design equations.
When using the alternative all-heights method, the MWFRS, and components and cladding of every structure shall be designed to resist the effects of wind pressures on the building envelope in accordance with Equation 16-35.

$$P_{net} = 0.00256V^2K_zC_{net}K_{zt} \qquad \textbf{(Equation 16-35)}$$

Design wind forces for the MWFRS shall not be less than 16 psf (0.77 kN/m^2) multiplied by the area of the structure projected on a plane normal to the assumed wind direction (see ASCE 7 Section 27.4.7 for criteria). Design net wind pressure for components and cladding shall not be less than 16 psf (0.77 kN/m^2) acting in either direction normal to the surface.

1609.6.4 Design procedure.
The MWFRS and the components and cladding of every building or other structure shall be designed for the pressures calculated using Equation 16-35.

1609.6.4.1 Main wind force-resisting systems.
The MWFRS shall be investigated for the torsional effects identified in ASCE 7 Figure 27.4-8.

1609.6.4.2 Determination of Kz and Kzt.
Velocity pressure exposure coefficient, K_z, shall be determined in accordance with ASCE 7 Section 27.3.1 and the topographic factor, K_{zt}, shall be determined in accordance with ASCE 7 Section 26.8.

1. For the windward side of a structure, K_{zt} and K_z shall be based on height z.

2. For leeward and sidewalls, and for windward and leeward roofs, K_{zt} and K_z shall be based on mean roof height h.

1609.6.4.3 Determination of net pressure coefficients, Cnet.
For the design of the MWFRS and for components and cladding, the sum of the internal and external net pressure shall be based on the net pressure coefficient, C_{net}.

1. The pressure coefficient, C_{net}, for walls and roofs shall be determined from Table 1609.6.2.

2. Where C_{net} has more than one value, the more severe wind load condition shall be used for design.

1609.6.4.4 Application of wind pressures.
When using the alternative all-heights method, wind pressures shall be applied simultaneously on, and in a direction normal to, all building envelope wall and roof surfaces.

1609.6.4.4.1 Components and cladding.
Wind pressure for each component or cladding element is applied as follows using C_{net} values based on the effective wind area, A, contained within the zones in areas of discontinuity of width and/or length “a,” “2a” or “4a” at: corners of roofs and walls; edge strips for ridges, rakes and eaves; or field areas on walls or roofs as indicated in figures in tables in ASCE 7 as referenced in Table 1609.6.2 in accordance with the following:

1. Calculated pressures at local discontinuities acting over specific edge strips or corner boundary areas.

2. Include “field” (Zone 1, 2 or 4, as applicable) pressures applied to areas beyond the boundaries of the areas of discontinuity.

3. Where applicable, the calculated pressures at discontinuities (Zone 2 or 3) shall be combined with design pressures that apply specifically on rakes or eave overhangs.

1609.7 Garage doors and rolling doors.
Pressures from Table 1609.7(1) for wind loading actions on garage doors and rolling doors for buildings designed as enclosed shall be permitted.

TABLE 1609.7(1)
NOMINAL (ASD) GARAGE DOOR AND ROLLING DOOR WIND LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET
LOCATED IN EXPOSURE B (PSF) [1, 2, 3, 4, 5]

ULTIMATE DESIGN WIND SPEED (V_{ult}) DETERMINED IN ACCORDANCE WITH SECTION 1609.3 (MPH - 3 SECOND GUST)												
Width (ft)	**Height (ft)**	**100 MPH**	**110 MPH**	**120MPH**	**130MPH**	**140 MPH**	**150 MPH**	**160 MPH**	**170 MPH**	**180 MPH**	**190 MPH**	200 MPH
Roof Angle 0 - 10 degrees												
8	8	8.7 – 9.8	10.5 – 11.9	12.5 – 14.2	14.7 – 16.6	17.1 – 19.3	19.6 – 22.2	22.3 – 25.2	25.1 – 28.5	28.2 – 31.9	31.4 – 35.5	34.8 – 39.4
10	10	8.4 – 9.4	10.2 – 11.4	12.1 – 13.6	14.2 – 16.0	16.5 – 18.5	18.9 – 21.2	21.5 – 24.2	24.3 – 27.3	27.3 – 30.6	30.4 – 34.1	33.7 – 37.8
14	14	8.0 – 8.9	9.7 – 10.8	11.5 – 12.8	13.5 – 15.0	15.7 – 17.4	18.0 – 20.0	20.5 – 22.8	23.1 – 25.7	25.9 – 28.8	28.9 – 32.1	32.0 – 35.6
Roof Angle > 10 degrees												
9	7	9.6 – 10.9	11.4 – 12.9	13.7 – 15.5	16.1 – 18.2	18.5 – 20.9	21.3 – 24.1	24.3 – 27.5	27.6 – 31.2	30.6 – 34.6	34.2 – 38.6	38.0 – 43.0
16	7	9.2 – 10.3	10.9 – 12.2	13.1 – 14.6	15.5 – 17.2	17.7 – 19.7	20.4 – 22.7	23.3 – 26.0	26.4 – 29.4	29.3 – 32.6	32.7 – 36.5	36.4 – 40.6
		78 MPH	85 MPH	93 MPH	101 MPH	108 MPH	116 MPH	124 MPH	132 MPH	139 MPH	147 MPH	155 MPH

For SI: 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h, 1 psf = 47.88 N/m^2.
Nominal Design Wind Speed (Vasd) converted from Ultimate Design Wind Speed per Section 1609.3.1.

1. For effective areas or wind speeds between those given above the load may be interpolated, otherwise use the load associated with the lower effective area.
2. Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table 1609.7(2)
3. Plus and minus signs signify pressures acting toward and away from the building surfaces.
4. Negative pressures assume door has 2 feet of width in building’s end zone.
5. Table values include the 0.6 load reduction factor.

TABLE 1609.7(2)
ADJUSTMENT FACTOR FOR BUILDING HEIGHT AND EXPOSURE, (λ)

MEAN ROOF HEIGHT (feet)	EXPOSURE		
	B	C	D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

SECTION 1610
SOIL LATERAL LOADS

1610.1 General.
Foundation walls and retaining walls shall be designed to resist lateral soil loads. Soil loads specified in Table 1610.1 shall be used as the minimum design lateral soil loads unless determined otherwise by a geotechnical investigation in accordance with Section 1803. Foundation walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top shall be permitted to be designed for active pressure. Design lateral pressure from surcharge loads shall be added to the lateral earth pressure load. Design lateral pressure shall be increased if soils at the site are expansive. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1805.4.2 and 1805.4.3.

Exception: Foundation walls extending not more than 8 feet (2438 mm) below grade and laterally supported at the top by flexible diaphragms shall be permitted to be designed for active pressure.

TABLE 1610.1
LATERAL SOIL LOAD

DESCRIPTION OF BACKFILL MATERIAL[c]	UNIFIED SOIL CLASSIFICATION	DESIGN LATERAL SOIL LOAD[a] (pound per square foot per foot of depth)	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-and-clay mixes	GC	45	60
Well-graded, clean sands; gravelly sand mixes	SW	30	60
Poorly graded clean sands; sand-gravel mixes	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60

Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	ML-CL	60	100
Inorganic clays of low to medium plasticity	CL	60	100
Organic silts and silt clays, low plasticity	OL	Note b	Note b
Inorganic clayey silts, elastic silts	MH	Note b	Note b
Inorganic clays of high plasticity	CH	Note b	Note b
Organic clays and silty clays	OH	Note b	Note b

For SI: 1 pound per square foot per foot of depth = 0.157 kPa/m, 1 foot = 304.8 mm.

a. Design lateral soil loads are given for moist conditions for the specified soils at their optimum densities. Actual field conditions shall govern. Submerged or saturated soil pressures shall include the weight of the buoyant soil plus the hydrostatic loads.
b. Unsuitable as backfill material.
c. The definition and classification of soil materials shall be in accordance with ASTM D 2487.

SECTION 1611
RAIN LOADS

1611.1 Design rain loads.

Each portion of a roof shall be designed to sustain the load of rainwater that will accumulate on it if the primary drainage system for that portion is blocked plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow. The design rainfall shall be based on the 100-year hourly rainfall rate indicated in Figure 1611.1 or on other rainfall rates determined from *approved* local weather data.

$$R = 5.2(d_s + d_h) \qquad \textbf{(Equation 16-36)}$$

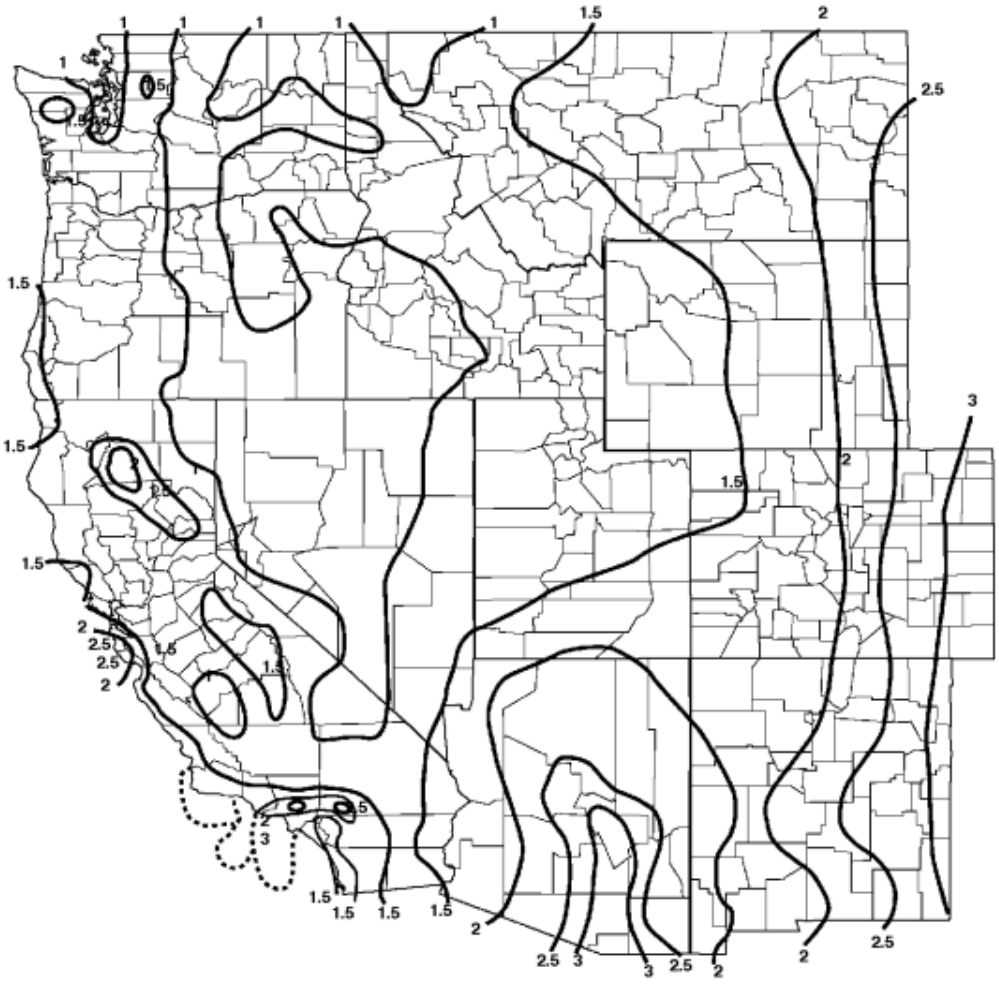
For SI: $R = 0.0098(d_s + d_h)$

where:

d_h = Additional depth of water on the undeflected roof above the inlet of secondary drainage system at its design flow (i.e., the hydraulic head), in inches (mm).

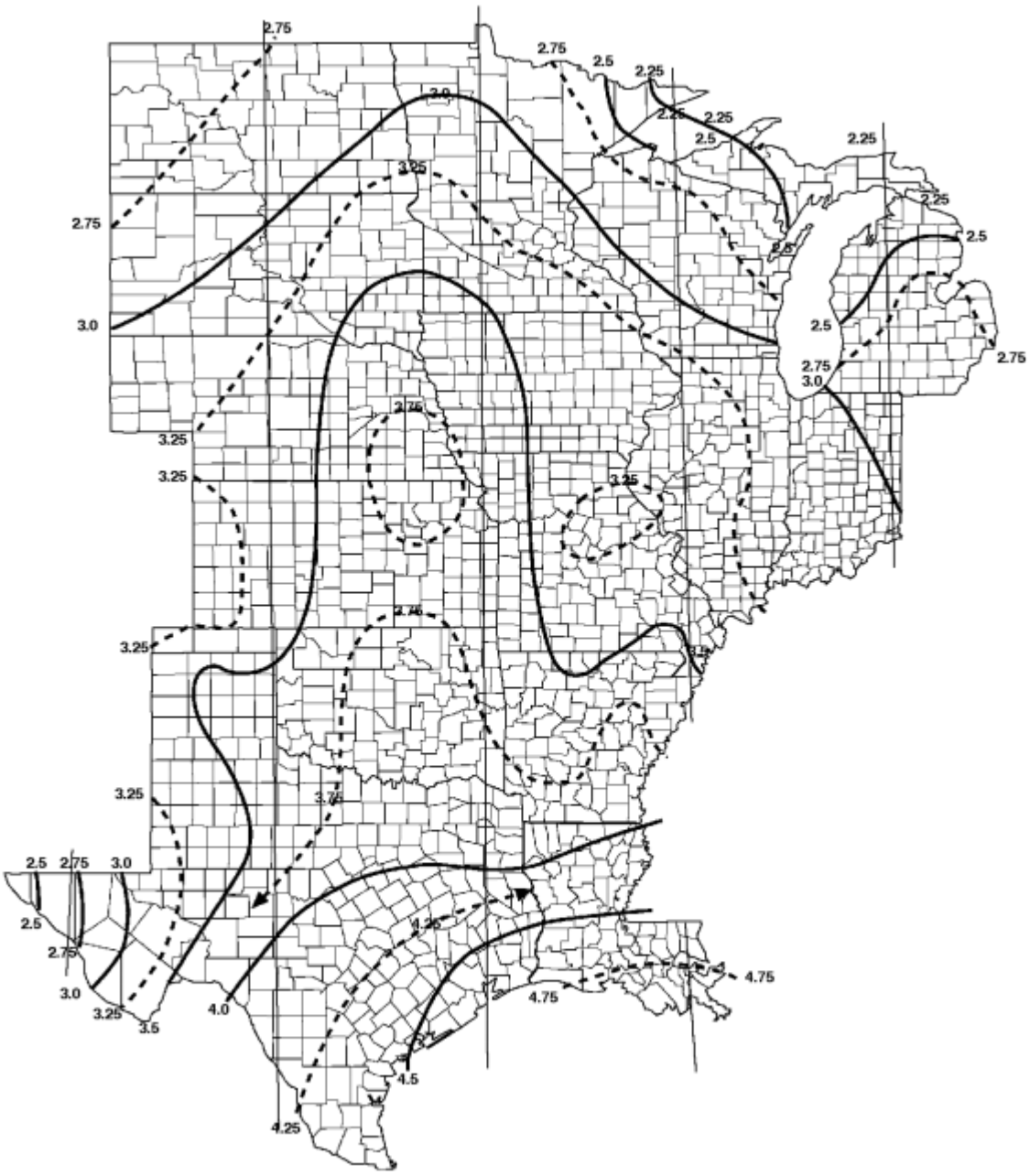
d_s = Depth of water on the undeflected roof up to the inlet of secondary drainage system when the primary drainage system is blocked (i.e., the static head), in inches (mm).

R = Rain load on the undeflected roof, in psf (kN/m^2). When the phrase “undeflected roof” is used, deflections from loads (including dead loads) shall not be considered when determining the amount of rain on the roof.



[P] FIGURE 1611.1
100-YEAR, 1-HOUR RAINFALL (INCHES) WESTERN UNITED STATES

For SI: 1 inch = 25.4 mm.
Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

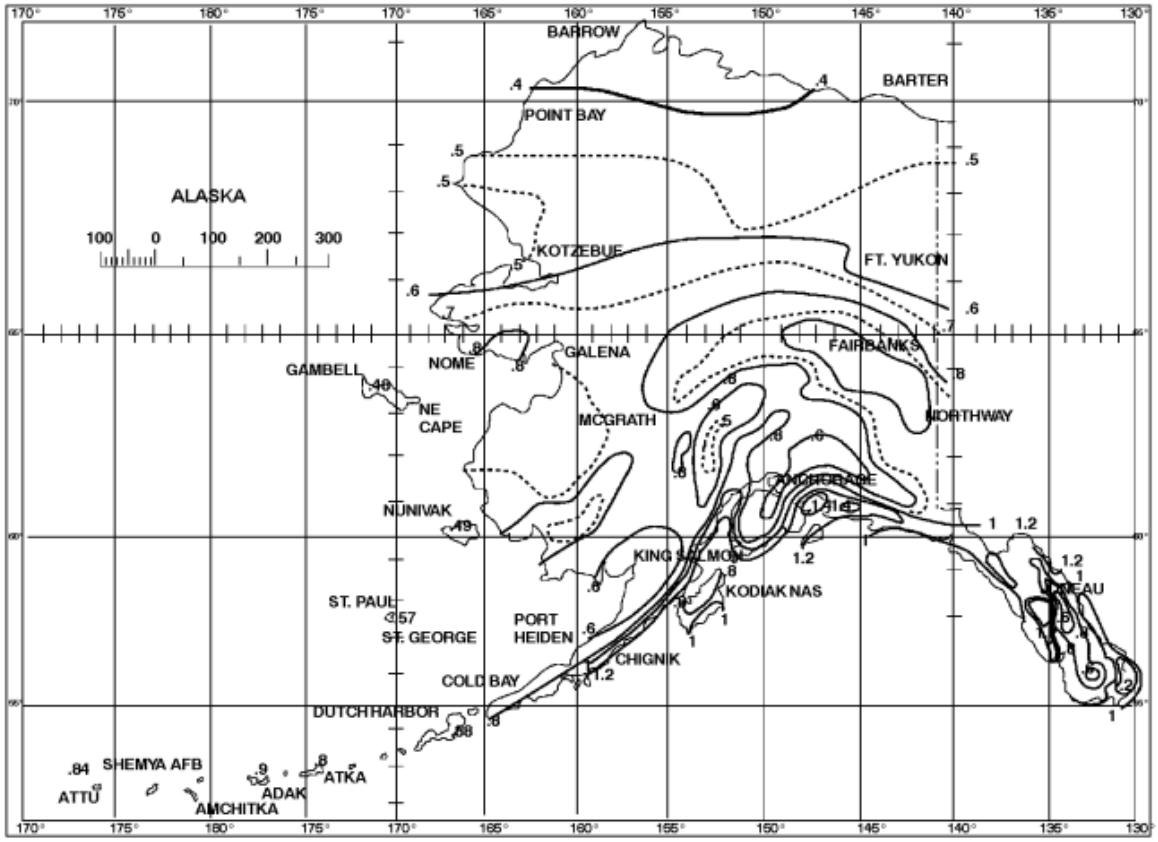


[P] FIGURE 1611.1—continued
100-YEAR, 1-HOUR RAINFALL (INCHES) CENTRAL UNITED STATES

For SI: 1 inch = 25.4 mm.
Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

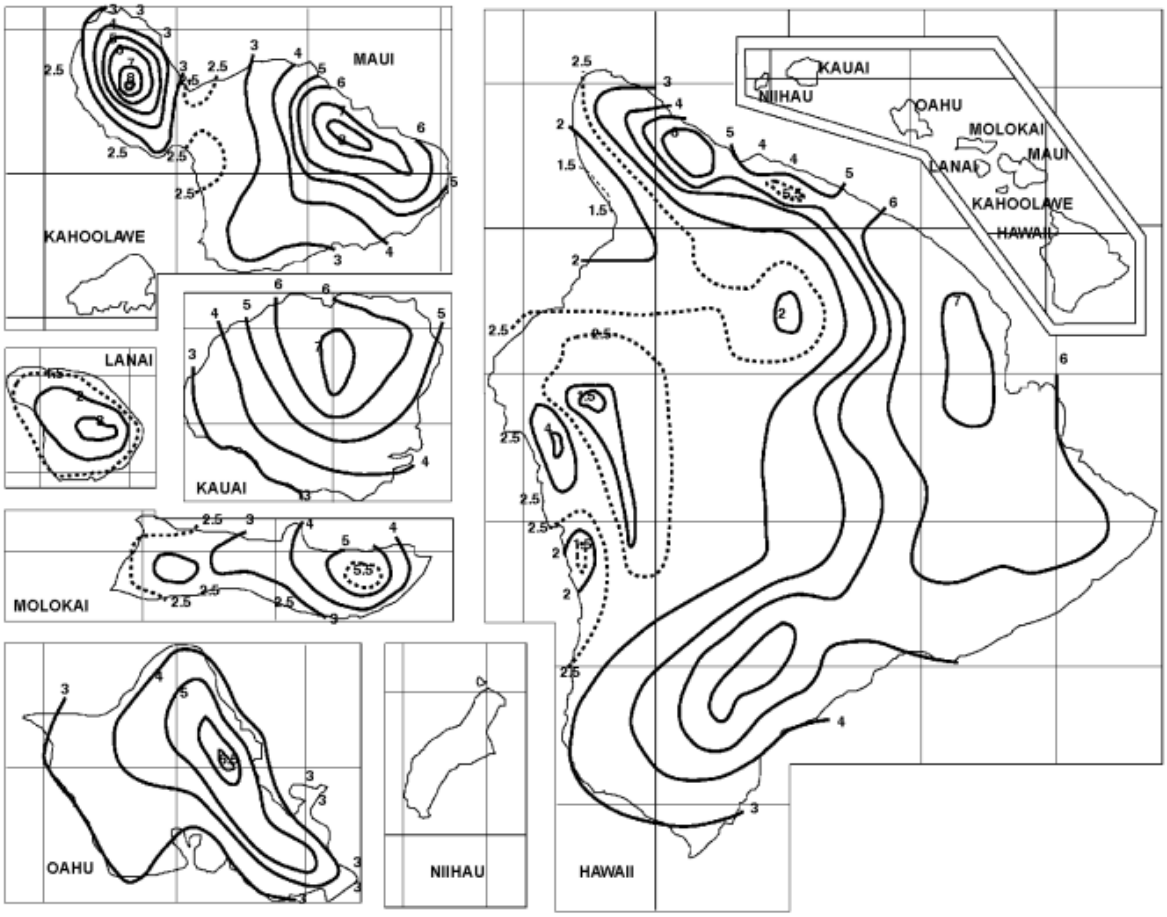
[P] FIGURE 1611.1—continued
100-YEAR, 1-HOUR RAINFALL (INCHES) EASTERN UNITED STATES

For SI: 1 inch = 25.4 mm.
Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.



[P] FIGURE 1611.1—continued
100-YEAR, 1-HOUR RAINFALL (INCHES) ALASKA

For SI: 1 inch = 25.4 mm.
Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.



[P] FIGURE 1611.1—continued
100-YEAR, 1-HOUR RAINFALL (INCHES) HAWAII

For SI: 1 inch = 25.4 mm.
Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

1611.2 Ponding instability.
Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Section 8.4 of ASCE 7.

1611.3 Controlled drainage.
Roofs equipped with hardware to control the rate of drainage shall be equipped with a secondary drainage system at a higher elevation that limits accumulation of water on the roof above that elevation. Such roofs shall be designed to sustain the load of rainwater that will accumulate on them to the elevation of the secondary drainage system plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow determined from Section 1611.1. Such roofs shall also be checked for ponding instability in accordance with Section 1611.2.

SECTION 1612
FLOOD LOADS

1612.1 General.
Within *flood hazard areas* as established in Section 1612.3, all new construction of buildings, structures and portions of buildings and structures, including substantial improvement and restoration of substantial damage to buildings and structures, shall be designed and constructed to resist the effects of flood hazards and flood loads. For buildings that are located in more than one *flood hazard area*, the provisions associated with the most restrictive *flood hazard area* shall apply.

Table 1612.1
CROSS REFERENCES DEFINING FLOOD RESISTANT PROVISIONS OF THE *FLORIDA BUILDING CODE*

Florida Building Code – Building			
Section		**Section**	
Chapter 1	Administration	Chapter 14	Exterior Walls
102	Applicability	1403	Performance Requirements
107	Construction Documents		
110	Inspections	Chapter 16	Structural Design
111	Certificates of Occupancy and Completion	1601	General
		1603	Construction Documents
Chapter 2	Definitions	1605	Load Combinations
202	Definitions	1612	Flood Loads
Chapter 4	Special Detailed Requirements Based on Use and Occupancy	Chapter 18	Soils and Foundations
449	Hospitals	1804	Excavation, Grading and Fill
450	Nursing Homes	1805	Dampproofing and Waterproofing
454	Swimming Pools and Bathing Places (Public And Private)		
Chapter 8	Interior Finishes	Chapter 30	Elevators and Conveying Systems
801	General	3001	General
Chapter 12	Interior Environment	Chapter 31	Special Construction
1203	Ventilation	3102	Membrane Structures
Florida Building Code – Residential			
Section		**Section**	
Chapter 2	Definitions	Chapter 22	Special Piping and Storage Systems
202	Definitions	M2201	Oil Tanks

Chapter 3	Building Planning	Chapter 24	Fuel Gas
R301	Design Criteria	G2404 (301)	General
R309	Garages and Carports		
R322	Flood Resistant Construction	Chapter 26	General Plumbing Requirements
		P2601	General
Chapter 4	Foundations		
R401	General	Chapter 27	Plumbing Fixtures
R404	Foundation and Retaining Walls	P2705	Installation
R408	Under-Floor Space		
Chapter 13	General Mechanical System Requirements	Chapter 30	Sanitary Drainage
M1301	General	P3001	General
Chapter 14	Heating and Cooling Equipment	Chapter 31	Vents
M1401	General	P3101	Vent Systems
Chapter 16	Duct Systems	Chapter 42	Swimming Pools, Electrical
M1601	Duct Construction	R4201	

(continued)

Table 1612.1—continued
CROSS REFERENCES DEFINING FLOOD RESISTANT PROVISIONS OF THE *FLORIDA BUILDING CODE*

Florida Building Code – Residential

Section		**Section**	
Chapter 17	Combustion Air	Chapter 44	High-Velocity Hurricane Zones
M1701	General	R4403	High-Velocity Hurricane Zones – General
Chapter 20	Boilers and Water Heaters	Chapter 45	Private Swimming Pools
M2001	Boilers	R4501	

Florida Building Code – Existing

Section		**Section**	
Chapter 1	Administration	Chapter 11	Additions
101	General	1103	Structural
Chapter 2	Definitions		

202	Definitions	Chapter 12	Historic Buildings
Chapter 3	Compliance Methods	1201	General
301.1	General		
Chapter 4	Prescriptive Compliance Method		
402	Additions		
403	Alterations	Chapter 13	Relocated or Moved Buildings
404	Repairs	1302	Requirements
Chapter 6	Repairs		
601	General	Chapter 14	Performance Compliance Methods
606	Structural	1401	General
Chapter 7	Alterations – Level I		
701	General		
Florida Building Code – Mechanical			
Section		**Section**	
Chapter 3	General Regulations	Chapter 6	Duct Systems
M301	General	M602	Plenums
		M603	Duct Construction and Installation
Chapter 4	Ventilation		
M401	General	Chapter 12	Hydronic Piping
		M1206	Piping Installation
Chapter 5	Exhaust Systems		
M501	General	Chapter 13	Fuel Oil Piping and Storage
		M1305	Fuel Oil System Installation
Florida Building Code – Plumbing			
Section			
Chapter 3	General Regulations		
P309	Flood Hazard Resistance		
Florida Building Code – Fuel Gas			
Section			
Chapter 3	General Regulations		
FG301	General		

1612.1.1 Cross references.
See Table 1612.1.

1612.2 Definitions.
The following terms are also defined in Chapter 2:

BASE FLOOD. The *flood* having a 1-percent chance of being equaled or exceeded in any given year.

BASE FLOOD ELEVATION. The elevation of the *base flood*, including wave height, relative to the National Geodetic Vertical Datum (NGVD), North American Vertical Datum (NAVD) or other datum specified on the *Flood Insurance*
Rate Map (FIRM).

BASEMENT. A *story* that is not a *story above grade plane* (see "*Story above grade plane*"). This definition of "Basement" does not apply to the provisions of Section 1612 for flood *loads.*

DESIGN FLOOD. The *flood* associated with the greater of the following two areas:

1. Area with a flood plain subject to a 1-percent or greater chance of *flooding* in any year; or
2. Area designated as a *flood hazard area* on a community's flood hazard map, or otherwise legally designated

DESIGN FLOOD ELEVATION. The elevation of the "*design flood*," including wave height, relative to the datum specified on the community's legally designated flood hazard map. In areas designated as Zone AO, the *design flood elevation* shall be the elevation of the highest existing grade of the *building's* perimeter plus the depth number (in feet) specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2 feet (610 mm).

DRY FLOODPROOFING. A combination of design modifications that results in a building or structure, including the attendant utilities and equipment and sanitary facilities, being water tight with walls substantially impermeable to the passage of water and with structural components having the capacity to resist *loads* as identified in ASCE 7.

EXISTING CONSTRUCTION. Any buildings and structures for which the *start of construction* commenced before the effective date of the community's first flood plain management code, ordinance or standard. "Existing construction" is also referred to as "existing structures."

EXISTING STRUCTURE. (For Section 1612.2). See "Existing construction".

FLOOD or FLOODING. A general and temporary condition of partial or complete inundation of normally dry land from:

1. The overflow of inland or tidal waters.
2. The unusual and rapid accumulation or runoff of surface waters from any source.

FLOOD DAMAGE-RESISTANT MATERIALS. Any construction material capable of withstanding direct and prolonged contact with floodwaters without sustaining any damage that requires more than cosmetic *repair*.

FLOOD HAZARD AREA. The greater of the following two areas:

1. The area within a flood plain subject to a 1-percent or greater chance of *flooding* in any year.
2. The area designated as a flood hazard area on a community's flood hazard map, or otherwise legally designated

FLOOD HAZARD AREA SUBJECT TO HIGH-VELOCITY WAVE ACTION.

FLOOD INSURANCE RATE MAP (FIRM). An official map of a community on which the Federal Emergency Management Agency (FEMA) has delineated both the *special flood hazard areas* and the risk premium zones applicable to the community.

FLOOD INSURANCE STUDY. The official report provided by the Federal Emergency Management Agency containing the Flood Insurance Rate Map (FIRM), the Flood Boundary and Floodway Map (FBFM), the water surface elevation of the *base flood* and supporting technical data.

FLOODWAY. The channel of the river, creek or other watercourse and the adjacent land areas that must be reserved in order to discharge the *base flood* without cumulatively increasing the water surface elevation more than a designated height.

LOWEST FLOOR. The lowest floor of the lowest enclosed area, including *basement*, but excluding any unfinished or flood-resistant enclosure, usable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the structure in violation of this section

SPECIAL FLOOD HAZARD AREA. The land area subject to flood hazards and shown on a *Flood Insurance Rate Map* or other flood hazard map as Zone A, AE, A1-30, A99, AR, AO, AH, V, VO, VE or V1-30.

START OF CONSTRUCTION. *improvements* to *existing structures,* provided the actual start of construction, *repair*, reconstruction, rehabilitation, *addition*, placement or other improvement is within 180 days after the date of issuance. The actual start of construction means the first placement of permanent construction of a building (including a manufactured home) on a site, such as the pouring of a slab or footings, installation of pilings or construction of columns. Permanent construction does not include land preparation (such as clearing, excavation, grading or filling), the installation of streets or walkways, excavation for a *basement*, footings, piers or foundations, the erection of temporary forms or the installation of accessory buildings such as garages or sheds not occupied as *dwelling units* or not part of the main building. For a *substantial improvement*, the actual "start of construction" means the first *alteration* of any wall, ceiling, floor or other structural part of a building, whether or not that *alteration* affects the external dimensions of the building.

SUBSTANTIAL DAMAGE. Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

SUBSTANTIAL IMPROVEMENT. Any *repair*, reconstruction, rehabilitation, alteration, *addition* or other improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the improvement or *repair* is started. If the structure has sustained *substantial damage*, any repairs are considered substantial improvement regardless of the actual *repair* work performed. The term does not, however, include either:

1. Any project for improvement of a building required to correct existing health, sanitary or safety code violations identified by the *building official* and that is the minimum necessary to assure safe living conditions.
2. Any *alteration* of a historic structure provided that the *alteration* will not preclude the structure's continued designation as a historic structure.

SUBSTANTIAL STRUCTURAL DAMAGE. A condition where:

1. In any *story*, the vertical elements of the lateral force resisting system have suffered damage such that the lateral load-carrying capacity of the structure in any horizontal direction has been reduced by more than 33 percent from its pre-damage condition; or
2. The capacity of any vertical gravity load-carrying component, or any group of such components, that supports more than 30 percent of the total area of the structure's floors and roofs has been reduced more than 20 percent from its pre-damage condition and the remaining capacity of such affected elements, with respect to all dead and *live loads,* is less than 75 percent of that required by this code for new buildings of similar structure, purpose and location.

1612.3 Establishment of flood hazard areas.

To establish *flood hazard areas*, the applicable governing authority shall, by local floodplain management ordinance, adopt a flood hazard map and supporting data. The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency in an engineering report entitled "The Flood Insurance Study for **[INSERT NAME OF JURISDICTION],**" dated **[INSERT DATE OF ISSUANCE],** as amended or revised with the accompanying Flood Insurance Rate Map (FIRM) and Flood Boundary and Floodway Map (FBFM) and related supporting data along with any revisions thereto. The adopted flood hazard map and supporting data are hereby adopted by reference and declared to be part of this section.

1612.3.1 Design flood elevations.

Where design flood elevations are not included in the *flood hazard areas* established in Section 1612.3, or where floodways are not designated, the *building official* is authorized to require the applicant to:

1. Obtain and reasonably utilize any design flood elevation and floodway data available from a federal, state or other source; or

2. Determine the design flood elevation and/or floodway in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a *registered design professional* who shall document that the technical methods used reflect currently accepted engineering practice.

1612.3.2 Determination of impacts.

In riverine *flood hazard areas* where design flood elevations are specified but floodways have not been designated, the applicant shall provide a floodway analysis that demonstrates that the proposed work will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction of the applicable governing authority.

1612.4 Design and construction.

The design and construction of buildings and structures located in *flood hazard areas*, including coastal high hazard areas, shall be in accordance with Chapter 5 of ASCE 7 and with ASCE 24.

1612.4.1 Modification of ASCE 24.

Table 6-1 and Section 6.2.1 in ASCE 24 shall be modified as follows:

1. The title of Table 6.1 shall be “Minimum Elevation of Floodproofing, Relative to Base Flood Elevation (BFE) or Design Flood Elevation (DFE), in Coastal A Zones and in Other Flood Hazard Areas that are not High Risk Flood Hazard Areas.”

2. Section 6.2.1 shall be modified to permit dry floodproofing in Coastal A Zones, as follows: “Dry floodproofing of nonresidential structures and nonresidential areas of mixed-use structures shall not be allowed unless such structures are located outside of High Risk Flood Hazard areas and Coastal High Hazard Areas. Dry floodproofing shall be permitted in Coastal A Zones provided wave loads and the potential for erosion and local scour are accounted for in the design. Dry floodproofing of residential structures or residential areas of mixed-use structures shall not be permitted.”

1612.5 Flood hazard documentation.
The following documentation shall be prepared and sealed by a *registered design professional* and submitted to the *building official:*

1. For construction in *flood hazard areas* other than coastal high hazard areas:

   1.1. The elevation of the lowest floor, including basement, as required by the foundation inspection and the final inspection in Section 110.3.

   1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.6.2.1 of ASCE 24, *construction documents* shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.6.2.2 of ASCE 24.

   1.3. For dry floodproofed nonresidential buildings, *construction documents* shall include a statement that the dry floodproofing is designed in accordance with ASCE 24.

2. For construction in coastal high hazard areas:

   2.1 The elevation of the bottom of the lowest horizontal structural member as required by the foundation inspection and the final inspection in Section 110.3.

   2.2 Construction documents shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.

   2.3 For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m^2) determined using allowable stress design, *construction documents* shall include a statement that the breakaway wall is designed in accordance with ASCE 24.

SECTION 1613
EARTHQUAKE LOADS

1613.1 Scope.
Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with ASCE 7, excluding Chapter 14 and Appendix 11A. The *seismic design category* for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

Exceptions:

1. Detached one- and two-family dwellings, assigned to *Seismic Design Category* A, B or C, or located where the mapped short-period spectral response acceleration, S_S, is less than 0.4 g.

2. The seismic force-resisting system of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section.

3. Agricultural storage structures intended only for incidental human occupancy.

4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.

1613.2 Definitions.
The following terms are defined in Chapter 2:

DESIGN EARTHQUAKE GROUND MOTION. The earthquake ground motion that *buildings* and *structures* are specifically proportioned to resist in Section 1613.

MECHANICAL SYSTEMS. For the purposes of determining seismic *loads* in ASCE 7, mechanical systems shall include plumbing systems as specified therein.

ORTHOGONAL. To be in two horizontal directions, at 90 degrees (1.57 rad) to each other

RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCER) GROUND MOTION RESPONSE ACCELERATIONS. The most severe earthquake effects considered by this code, determined for the orientation that results in the largest maximum response to horizontal ground motions and with adjustment for targeted risk.

ROOF ASSEMBLY (For application to Chapter 15 only).
A system designed to provide weather protection and resistance to design *loads.* The system consists of a *roof covering* and *roof deck* or a single component serving as both the roof covering and the *roof deck*. A roof assembly includes the *roof deck*, *vapor retarder*, substrate or thermal barrier, insulation, *vapor retarder* and *roof covering*.

SEISMIC DESIGN CATEGORY. A classification assigned to a structure based on its *risk category* and the severity of the *design earthquake ground motion* at the site.

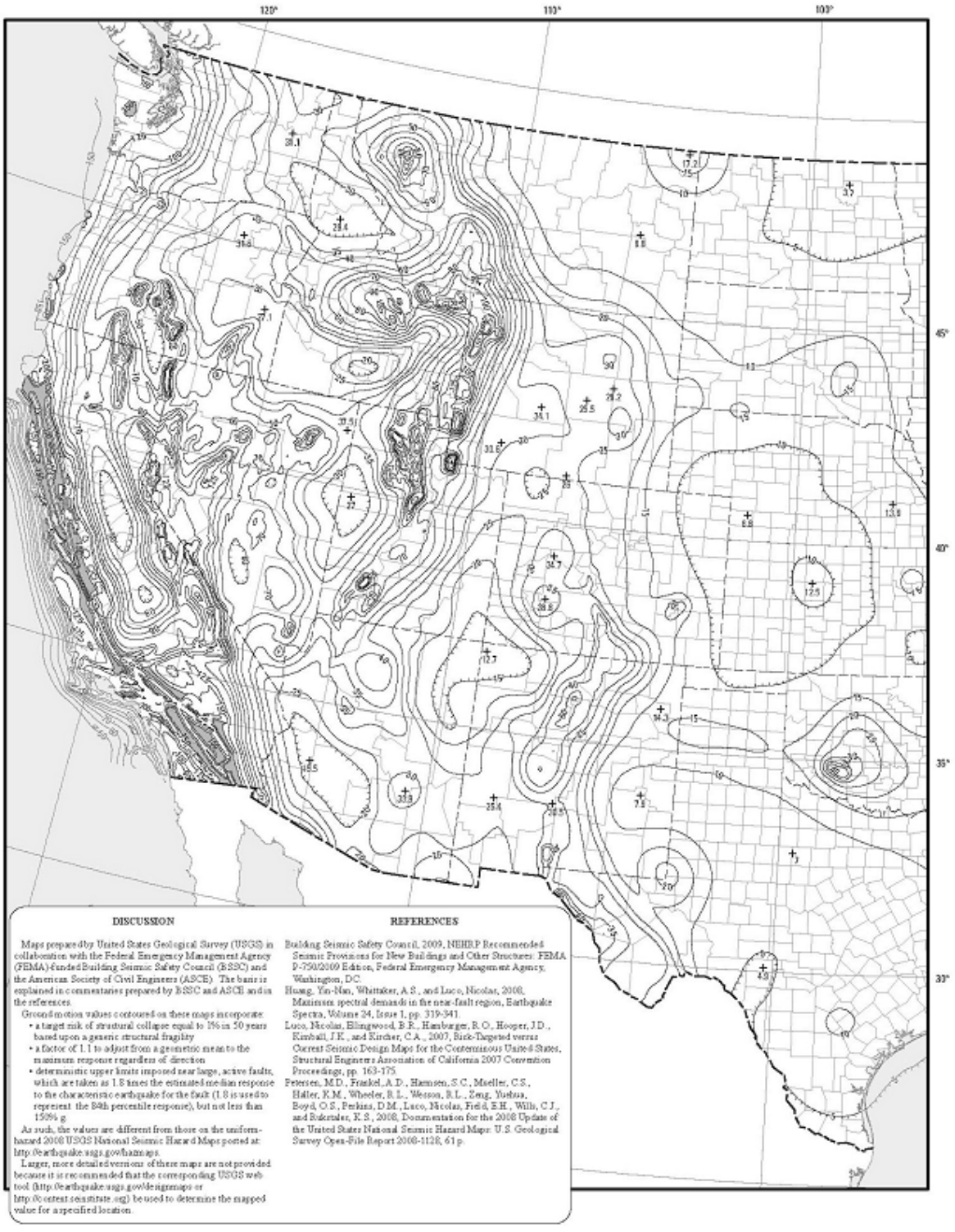
SEISMIC FORCE-RESISTING SYSTEM. That part of the structural system that has been considered in the design to provide the required resistance to the prescribed seismic forces.

SITE CLASS. A classification assigned to a site based on the types of soils present and their engineering properties as defined in Section 1613.3.2.

SITE COEFFICIENTS. The values of F_a and F_v indicated in Tables 1613.3.3(1) and 1613.3.3(2), respectively.

1613.3 Seismic ground motion values.
Seismic ground motion values shall be determined in accordance with this section.

1613.3.1 Mapped acceleration parameters.
The parameters S_s and S_1 shall be determined from the 0.2 and 1-second spectral response accelerations shown on Figures 1613.3.1(1) through 1613.3.1(6). Where S_1 is less than or equal to 0.04 and S_s is less than or equal to 0.15, the structure is permitted to be assigned to Seismic Design Category A. The parameters S_S and S_1 shall be, respectively, 1.5 and 0.6 for Guam and 1.0 and 0.4 for American Samoa.



DISCUSSION

Maps prepared by United States Geological Survey (USGS) in collaboration with the Federal Emergency Management Agency (FEMA)-funded Building Seismic Safety Council (BSSC) and the American Society of Civil Engineers (ASCE). The basis is explained in commentaries prepared by BSSC and ASCE and in the references.

Ground motion values contoured on these maps incorporate:

- a target risk of structural collapse equal to 1% in 50 years based upon a generic structural fragility
- a factor of 1.1 to adjust from a geometric mean to the maximum response regardless of direction
- deterministic upper limits imposed near large, active faults, which are taken as 1.8 times the estimated median response to the characteristic earthquake for the fault (1.8 is used to represent the 84th percentile response), but not less than 150% g.

As such, the values are different from those on the uniform-hazard 2008 USGS National Seismic Hazard Maps posted at: http://earthquake.usgs.gov/hazmaps.

Larger, more detailed versions of these maps are not provided because it is recommended that the corresponding USGS web tool (http://earthquake.usgs.gov/designmaps or http://content.seismotate.org) be used to determine the mapped value for a specified location.

REFERENCES

Building Seismic Safety Council, 2009, NEHRP Recommended Seismic Provisions for New Buildings and Other Structures: FEMA P-750/2009 Edition, Federal Emergency Management Agency, Washington, DC.

Huang, Yin-Nan, Whittaker, A.S., and Luco, Nicolas, 2008, Maximum spectral demands in the near-fault region, Earthquake Spectra, Volume 24, Issue 1, pp. 319-341.

Luco, Nicolas, Ellingwood, B.R., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007, Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States, Structural Engineers Association of California 2007 Convention Proceedings, pp. 163-175.

Petersen, M.D., Frankel, A.D., Harmsen, S.C., Mueller, C.S., Haller, K.M., Wheeler, R.L., Wesson, R.L., Zeng, Yuehua, Boyd, O.S., Perkins, D.M., Luco, Nicolas, Field, E.H., Wills, C.J., and Rukstales, K.S., 2008, Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008-1128, 61 p.

FIGURE 1613.3.1(1)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION

RESPONSE ACCELERATIONS
FOR THE CONTERMINOUS UNITED STATES OF 0.2-SECOND SPECTRAL RESPONSE ACCELERATION
(5% OF CRITICAL DAMPING), SITE CLASS B

(continued)

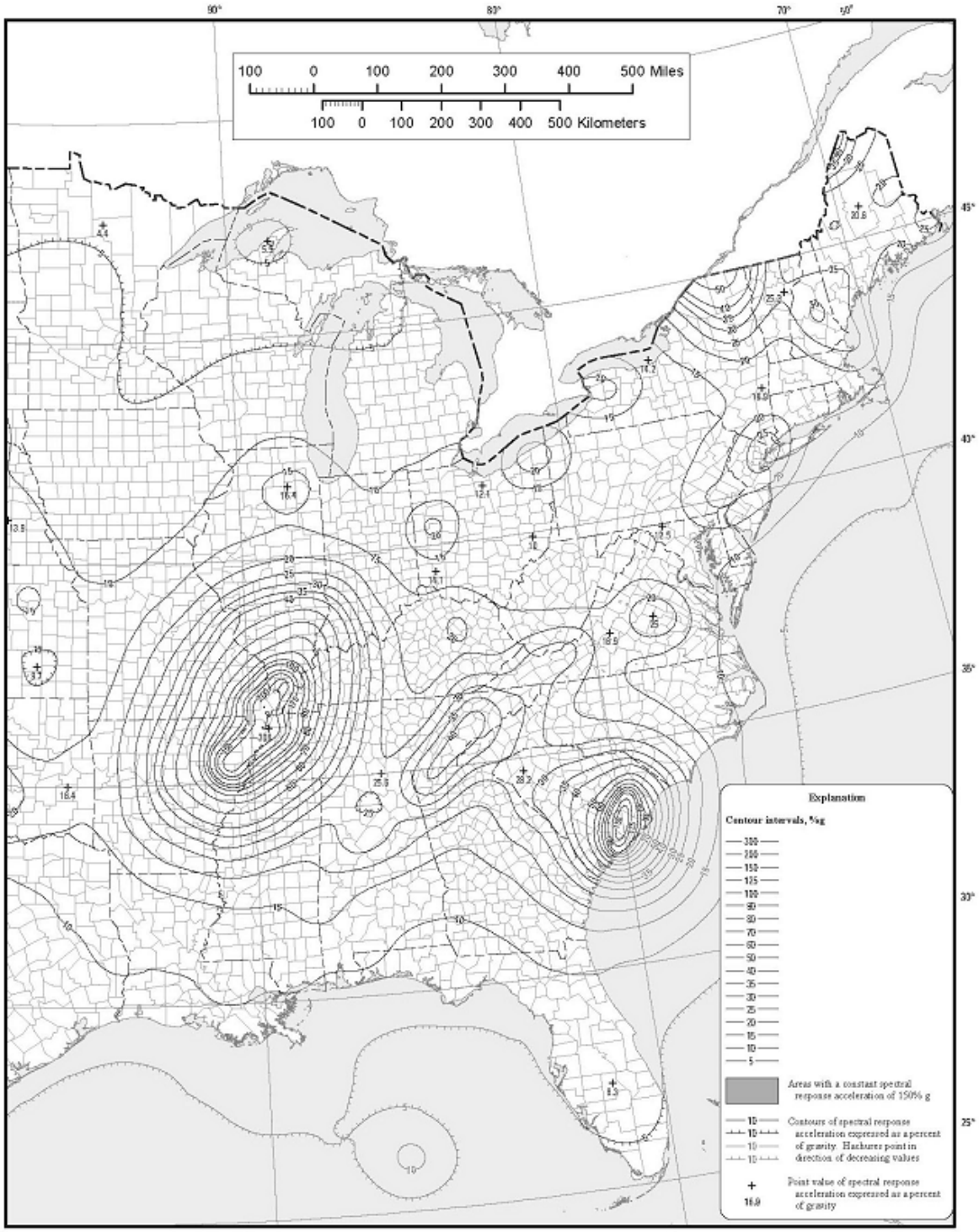
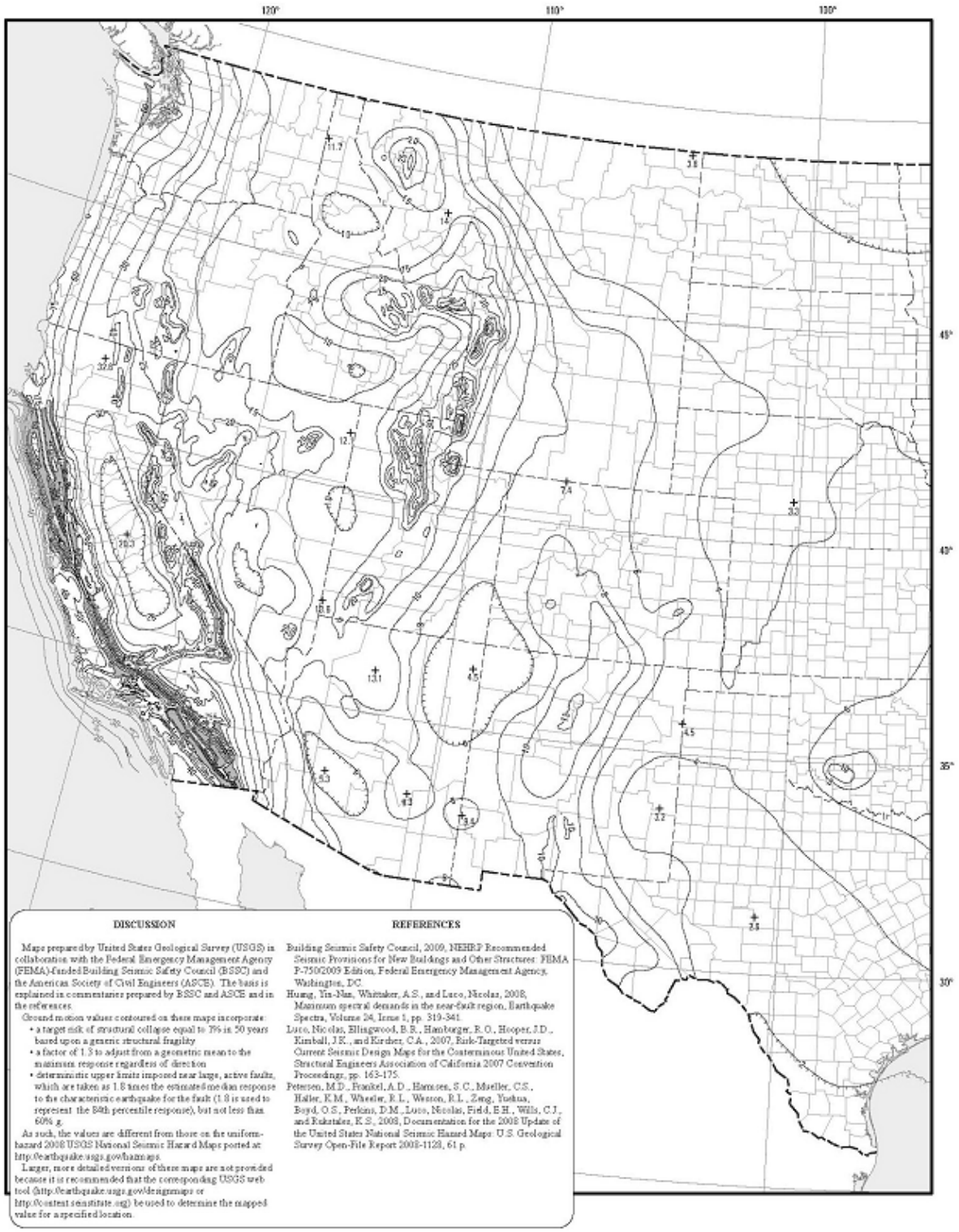


FIGURE 1613.3.1(1)—continued
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS
FOR THE CONTERMINOUS UNITED STATES OF 0.2-SECOND SPECTRAL RESPONSE

ACCELERATION
(5% OF CRITICAL DAMPING), SITE CLASS B



DISCUSSION

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Ground motion values contoured on these maps incorporate:

- a target risk of structural collapse equal to 1% in 50 years based upon a generic structural fragility
- a factor of 1.3 to adjust from a geometric mean to the maximum response regardless of direction
- deterministic upper limits imposed near large, active faults, which are taken as 1.8 times the estimated median response to the characteristic earthquake for the fault (1.8 is used to represent the 84th percentile response), but not less than 60% g.

As such, the values are different from those on the uniform-hazard 2008 USGS National Seismic Hazard Maps ported at http://earthquake.usgs.gov/hazmaps.

Larger, more detailed versions of these maps are not provided because it is recommended that the corresponding USGS web tool (http://earthquake.usgs.gov/designmaps or http://content.seaintitute.org) be used to determine the mapped value for a specified location.

REFERENCES

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Huang, Yin-Nan, Whittaker, A.S., and Luco, Nicolas, 2008, Maximum spectral demands in the near-fault region, Earthquake Spectra, Volume 24, Issue 1, pp. 319-341.

Luco, Nicolas, Ellingwood, B.R., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007, Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States, Structural Engineers Association of California 2007 Convention Proceedings, pp. 163-175.

Petersen, M.D., Frankel, A.D., Harmsen, S.C., Mueller, C.S., Haller, K.M., Wheeler, R.L., Wesson, R.L., Zeng, Yuehua, Boyd, O.S., Perkins, D.M., Luco, Nicolas, Field, E.H., Wills, C.J., and Rukstales, K.S., 2008, Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008-1128, 61 p.

FIGURE 1613.3.1(2)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS
FOR THE CONTERMINOUS UNITED STATES OF 1-SECOND SPECTRAL RESPONSE ACCELERATION
(5% OF CRITICAL DAMPING), SITE CLASS B

(continued)

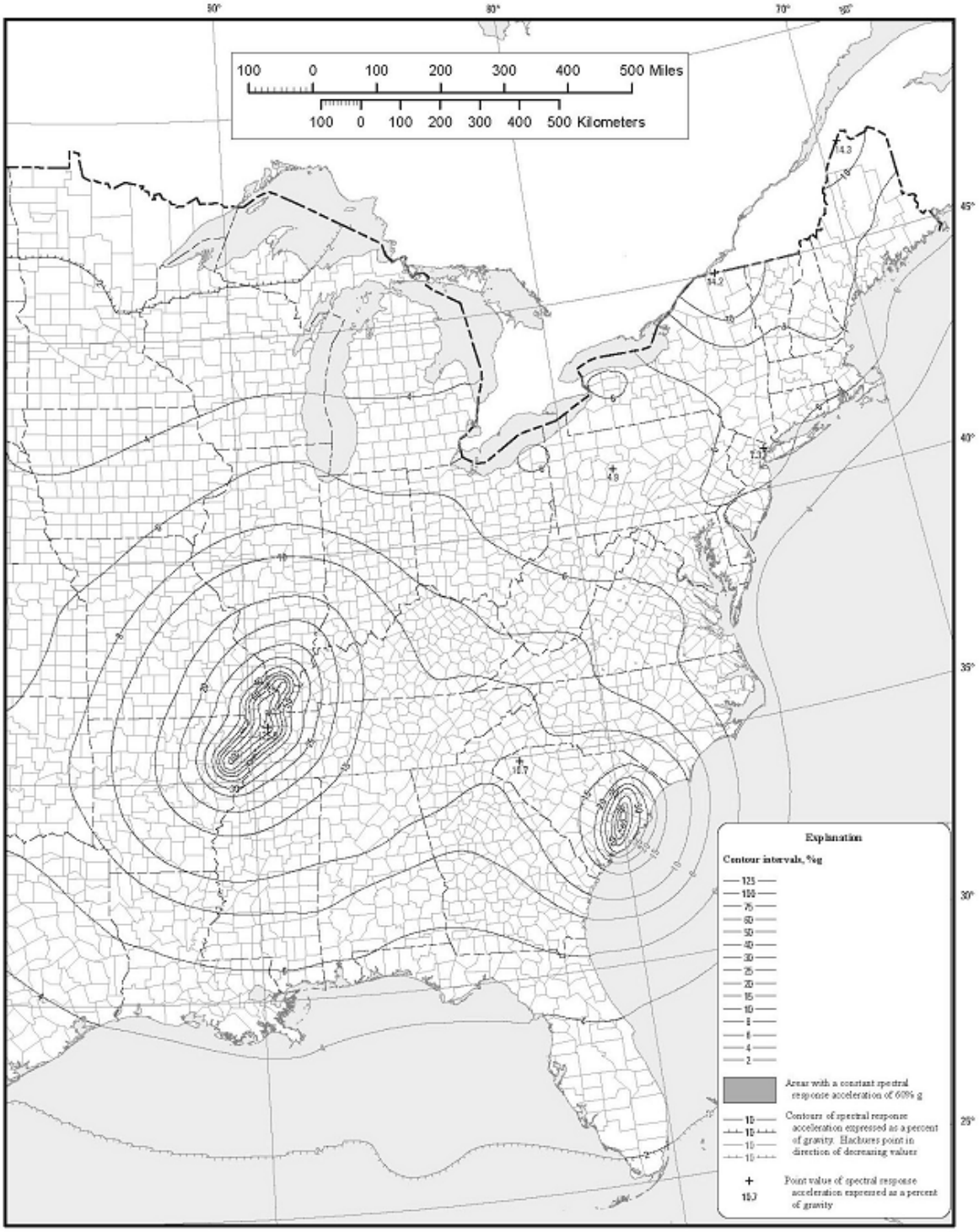
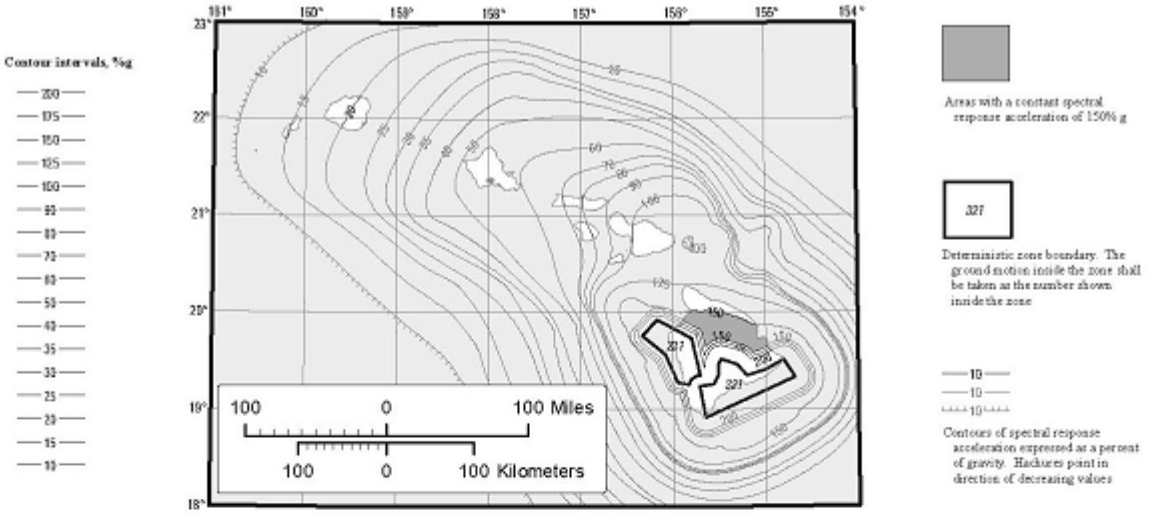
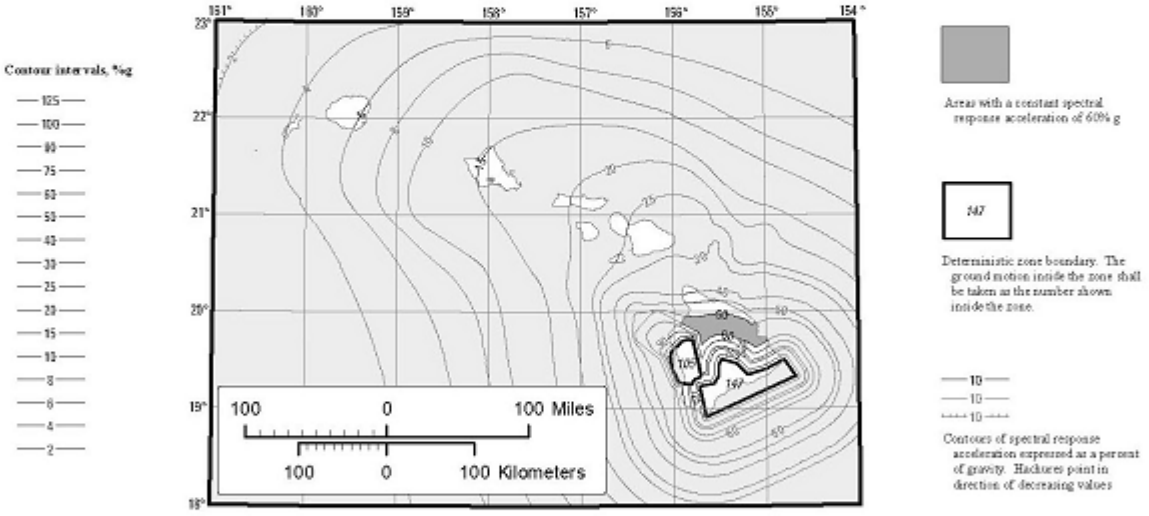


FIGURE 1613.3.1(2)—continued
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS
FOR THE CONTERMINOUS UNITED STATES OF 1-SECOND SPECTRAL RESPONSE

ACCELERATION
(5% OF CRITICAL DAMPING), SITE CLASS B



0.2 Second Spectral Response Acceleration (5% of Critical Damping)



1.0 Second Spectral Response Acceleration (5% of Critical Damping)

DISCUSSION

Maps prepared by United States Geological Survey (USGS) in collaboration with the Federal Emergency Management Agency (FEMA)-funded Building Seismic Safety Council (BSSC) and the American Society of Civil Engineers (ASCE). The basis is explained in commentaries prepared by BSSC and ASCE and in the references.

Ground motion values contoured on these maps incorporate:

- a target risk of structural collapse equal to 1% in 50 years based upon a generic structural fragility
- deterministic upper limits imposed near large, active faults, which are taken as 1.8 times the estimated median response to the characteristic earthquake for the fault (1.8 is used to represent the 84th percentile response), but not less than 150% and 60% g for 0.2 and 1.0 sec, respectively.

As such, the values are different from those on the uniform-hazard 1998 USGS National Seismic Hazard Maps for Hawaii posted at http://earthquake.usgs.gov/hazmaps.

Larger, more detailed versions of these maps are not provided because it is recommended that the corresponding USGS web tool (http://earthquake.usgs.gov/designmaps or http://content.seinstitute.org) be used to determine the mapped value for a specified location.

REFERENCES

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Huang, Yin-Nan, Whittaker, A.S., and Luco, Nicolas, 2008, Maximum spectral demands in the near-fault region, Earthquake Spectra, Volume 24, Issue 1, pp. 319-341.

Klein, F., Frankel, A.D., Mueller, C.S., Wesson, R.L., and Okubo, P., 2001, Seismic hazard in Hawaii: high rate of large earthquakes and probabilistic ground-motion maps, Bulletin of the Seismological Society of America, Volume 91, pp. 479-498.

Luco, Nicolas, Ellingwood, B.R., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007, Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States, Structural Engineers Association of California 2007 Convention Proceedings, pp. 163-175.

FIGURE 1613.3.1(3)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS
FOR HAWAII OF 0.2- AND 1-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B

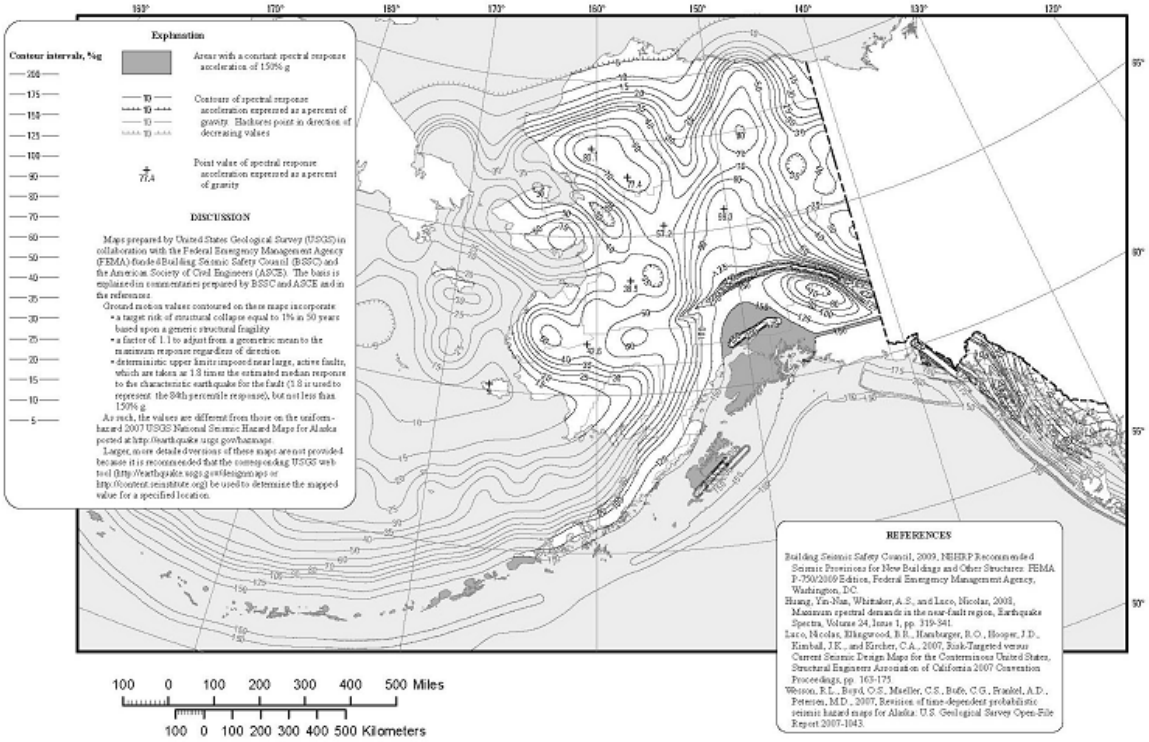

FIGURE 1613.3.1(4)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS
FOR ALASKA OF 0.2-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B

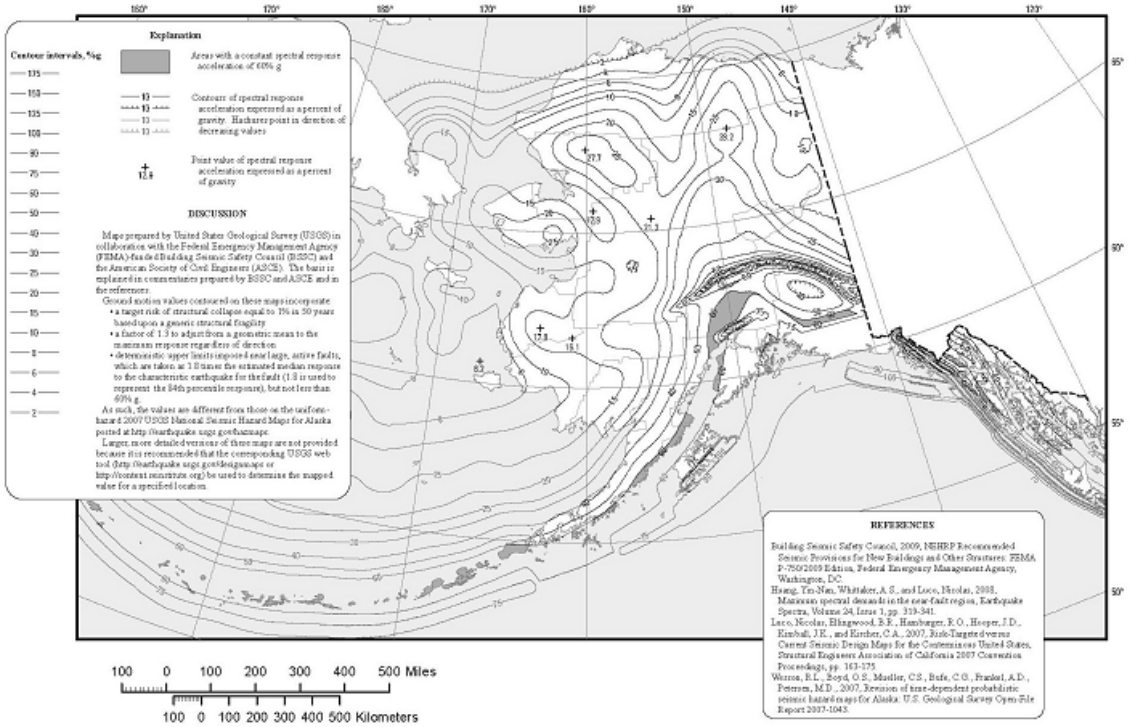

FIGURE 1613.3.1(5)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR ALASKA OF 1.0-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B

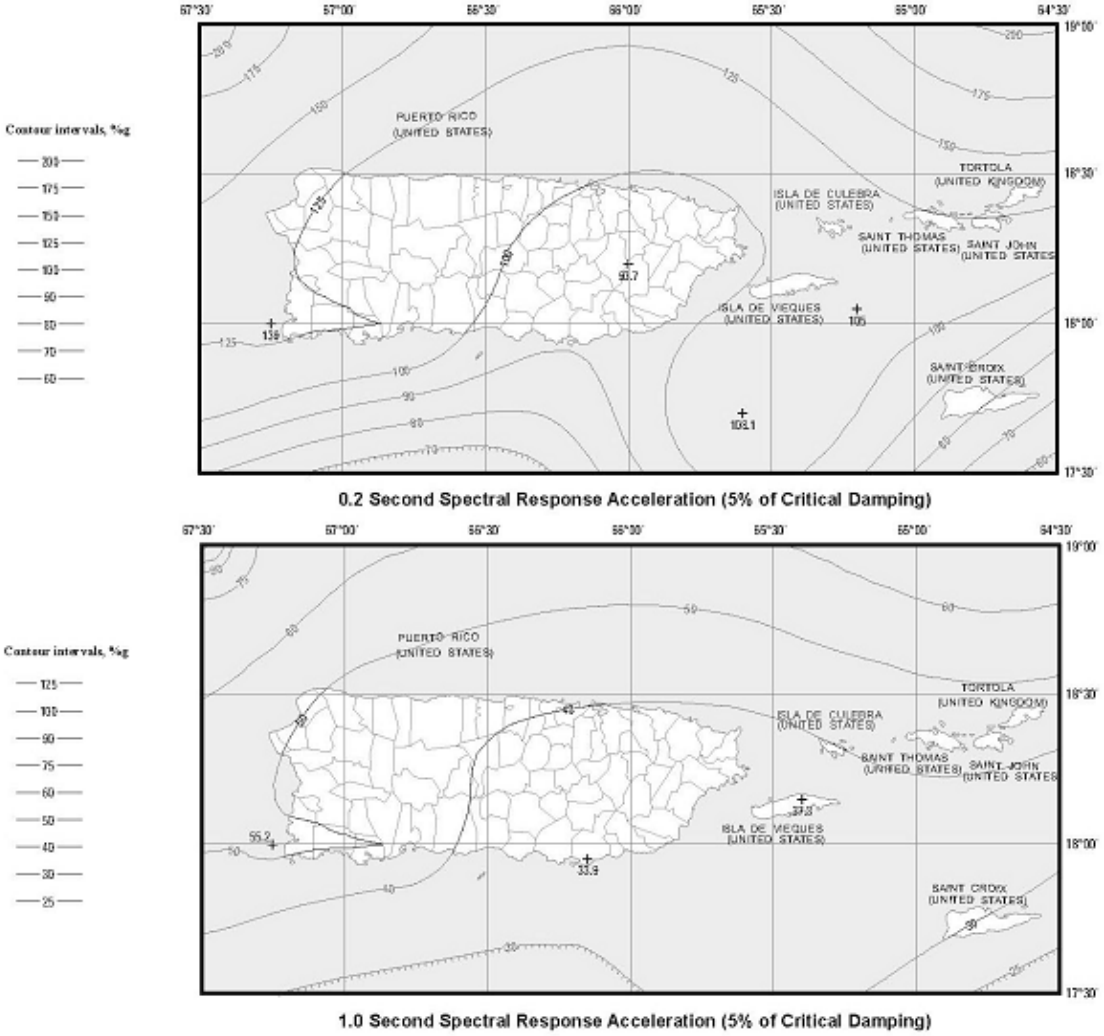

FIGURE 1613.3.1(6)

RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR PUERTO RICO AND THE UNITED STATES VIRGIN ISLANDS OF 0.2- AND 1-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B

1613.3.2 Site class definitions.
Based on the site soil properties, the site shall be classified as Site Class A, B, C, D, E or F in accordance with Chapter 20 of ASCE 7. Where the soil properties are not known in sufficient detail to determine the site class, Site Class D shall be used unless the building official or geotechnical data determines Site Class E or F soils are present at the site.

1613.3.3 Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters.
The maximum considered earthquake spectral response acceleration for short periods, S_{MS}, and at 1-second period, S_{M1}, adjusted for *site class* effects shall be determined by Equations 16-37 and 16-38, respectively:

$$S_{MS} = F_a S_s \qquad \textbf{(Equation 16-37)}$$

$$S_{M1} = F_v S_1 \qquad \textbf{(Equation 16-38)}$$

where:

F_a = Site coefficient defined in Table 1613.3.3(1).
F_v = Site coefficient defined in Table 1613.3.3(2).
S_S = The mapped spectral accelerations for short periods as determined in Section 1613.3.1.
S_1 = The mapped spectral accelerations for a 1-second period as determined in Section 1613.3.1.

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a [a]

SITE CLASS	MAPPED SPECTRAL RESPONSE ACCELERATION AT SHORT PERIOD				
	$S_s \leq 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at short period, S_s.
b. Values shall be determined in accordance with Section 11.4.7 of ASCE 7.

TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT F_v [a]

SITE CLASS	MAPPED SPECTRAL RESPONSE ACCELERATION AT 1-SECOND PERIOD				
	$S_1 \leq 0.1$	$S_1 = 0.2$	$S_1 = 0.3$	$S_1 = 0.4$	$S_1 \geq 0.5$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at 1-second period, S_1.
b. Values shall be determined in accordance with Section 11.4.7 of ASCE 7.

1613.3.4 Design spectral response acceleration parameters.
Five-percent damped design spectral response acceleration at short periods, S_{DS}, and at 1-second period, S_{D1}, shall be determined from Equations 16-39 and 16-40, respectively:

$$S_{DS} = \frac{2}{3} S_{MS} \qquad \textbf{(Equation 16-39)}$$

$$S_{D1} = \frac{2}{3} S_{M1} \qquad \textbf{(Equation 16-40)}$$

where:

S_{MS} = The maximum considered earthquake spectral response accelerations for short period as determined in Section 1613.3.3.
S_{M1} = The maximum considered earthquake spectral response accelerations for 1-second period as determined in Section 1613.3.3.

1613.3.5 Determination of seismic design category.
Structures classified as *Risk Category* I, II or III that are located where the mapped spectral response acceleration parameter at 1-second period, S_1, is greater than or equal to 0.75 shall be assigned to *Seismic Design Category* E. Structures classified as *Risk Category* IV that are located where the mapped spectral response acceleration parameter at 1-second

period, S_1, is greater than or equal to 0.75 shall be assigned to *Seismic Design Category* F.

All other structures shall be assigned to a *seismic design category* based on their *risk category* and the design spectral response acceleration parameters, S_{DS} and S_{D1}, determined in accordance with Section 1613.3.4 or the site-specific procedures of ASCE 7. Each building and structure shall be assigned to the more severe *seismic design category* in accordance with Table 1613.3.5(1) or 1613.3.5(2), irrespective of the fundamental period of vibration of the structure, T.

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

1613.3.5.1 Alternative seismic design category determination.
Where S_1 is less than 0.75, the *seismic design category* is permitted to be determined from Table 1613.3.5(1) alone when all of the following apply:

1. In each of the two orthogonal directions, the approximate fundamental period of the structure, Ta, in each of the two orthogonal directions determined in accordance with Section 12.8.2.1 of ASCE 7, is less than 0.8 T_s determined in accordance with Section 11.4.5 of ASCE 7.

2. In each of the two orthogonal directions, the fundamental period of the structure used to calculate the story drift is less than T_s.

3. Equation 12.8-2 of ASCE 7 is used to determine the seismic response coefficient, C_s.

4. The diaphragms are rigid as defined in Section 12.3.1 of ASCE 7 or, for diaphragms that are flexible, the distances between vertical elements of the seismic force-resisting system do not exceed 40 feet (12 192 mm).

1613.3.5.2 Simplified design procedure.
Where the alternate simplified design procedure of ASCE 7 is used, the *seismic design category* shall be determined in accordance with ASCE 7.

1613.4 Alternatives to ASCE 7.
The provisions of Section 1613.4 shall be permitted as alternatives to the relevant provisions of ASCE 7.

1613.4.1 Additional seismic force-resisting systems for seismically isolated structures.
Add the following exception to the end of Section 17.5.4.2 of ASCE 7:

Exception: For isolated structures designed in accordance with this standard, the structural system limitations including structural height limits in Table 12.2-1 for ordinary steel concentrically braced frames (OCBFs) as defined in Chapter 11 and ordinary moment frames (OMFs) as defined in Chapter 11 are permitted to be taken as 160 feet (48 768 mm) for structures assigned to *Seismic Design Category* D, E or F, provided that the following conditions are satisfied:

1. The value of R_I as defined in Chapter 17 is taken as 1.

2. For OMFs and OCBFs, design is in accordance with AISC 341.

SECTION 1614
ATMOSPHERIC ICE LOADS

1614.1 General.
Ice-sensitive structures shall be designed for atmospheric ice loads in accordance with Chapter 10 of ASCE 7.

SECTION 1615
STRUCTURAL INTEGRITY

1615.1 General.
High-rise buildings that are assigned to *Risk Category* III or IV shall comply with the requirements of this section. Frame structures shall comply with the requirements of Section 1615.3. Bearing wall structures shall comply with the requirements of Section 1615.4.

1615.2 Definitions.
The following words and terms are defined in Chapter 2:

BEARING WALL STRUCTURE.

FRAME STRUCTURE.

1615.3 Frame structures.
Frame structures shall comply with the requirements of this section.

1615.3.1 Concrete frame structures.
Frame structures constructed primarily of reinforced or prestressed concrete, either cast-in-place or precast, or a combination of these, shall conform to the requirements of ACI 318 Sections 7.13, 13.3.8.5, 13.3.8.6, 16.5, 18.12.6, 18.12.7 and 18.12.8 as applicable. Where ACI 318 requires that nonprestressed reinforcing or prestressing steel pass through the region bounded by the longitudinal column reinforcement, that reinforcing or prestressing steel shall have a minimum nominal tensile strength equal to two-thirds of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

Exception: Where concrete slabs with continuous reinforcement having an area not less than 0.0015 times the concrete area in each of two orthogonal directions are present and are either monolithic with or equivalently bonded to beams, girders or columns, the longitudinal reinforcing or prestressing steel passing through the column reinforcement shall have a nominal tensile strength of one-third of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

1615.3.2 Structural steel, open web steel joist or joist girder, or composite steel and concrete frame structures.
Frame structures constructed with a structural steel frame or a frame composed of open web steel joists, joist girders with or without other structural steel elements or a frame composed of composite steel or composite steel joists and reinforced concrete elements shall conform to the requirements of this section.

1615.3.2.1 Columns.
Each column splice shall have the minimum design strength in tension to transfer the design dead and live load tributary to the column between the splice and the splice or base immediately below.

1615.3.2.2 Beams.
End connections of all beams and girders shall have a minimum nominal axial tensile strength equal to the required vertical shear strength for *allowable stress design* (ASD) or two-thirds of the required shear strength for *load and resistance factor design* (LRFD) but not less than 10 kips (45 kN). For the purpose of this section, the shear force and the axial tensile force need not be considered to act simultaneously.

Exception: Where beams, girders, open web joist and joist girders support a concrete slab or concrete slab on metal deck that is attached to the beam or girder with not less than $^{3}/_{8}$-inch-diameter (9.5 mm) headed shear studs, at a spacing of not more than 12 inches (305 mm) on center, averaged over the length of the member, or other attachment having equivalent shear strength, and the slab contains continuous distributed reinforcement in each of two orthogonal directions with an area not less than 0.0015 times the concrete area, the nominal axial tension strength of the end connection shall be permitted to be taken as half the required vertical shear strength for ASD or one-third of the required shear strength for LRFD, but not less than 10 kips (45 kN).

1615.4 Bearing wall structures.
Bearing wall structures shall have vertical ties in all load-bearing walls and longitudinal ties, transverse ties and perimeter ties at each floor level in accordance with this section and as shown in Figure 1615.4.

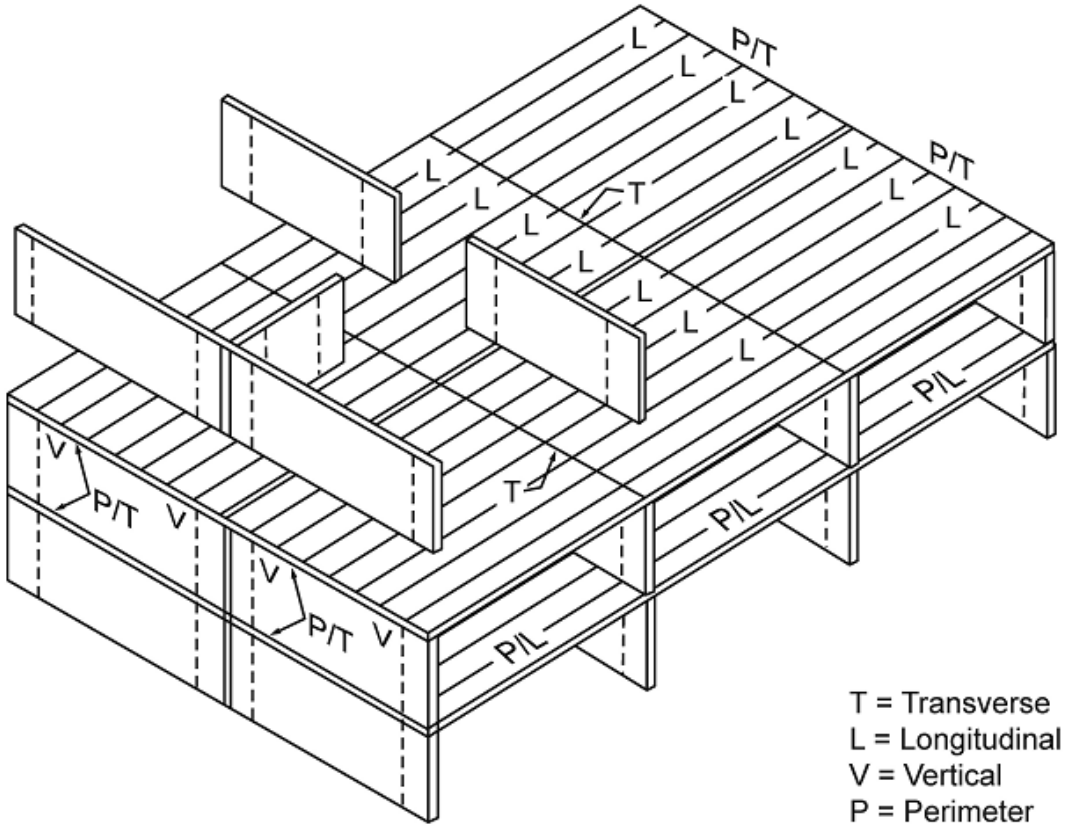

FIGURE 1615.4

LONGITUDINAL, PERIMETER, TRANSVERSE AND VERTICAL TIES

1615.4.1 Concrete wall structures.
Precast bearing wall structures constructed solely of reinforced or prestressed concrete, or combinations of these shall conform to the requirements of Sections 7.13, 13.3.8.5 and 16.5 of ACI 318.

1615.4.2 Other bearing wall structures.
Ties in bearing wall structures other than those covered in Section 1615.4.1 shall conform to this section.

1615.4.2.1 Longitudinal ties.
Longitudinal ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Longitudinal ties shall extend across interior load-bearing walls and shall connect to exterior load-bearing walls and shall be spaced at not greater than 10 feet (3038 mm) on center. Ties shall have a minimum nominal tensile strength, T_T, given by Equation 16-41. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_T = wLS \leq \alpha_T S \qquad \textbf{(Equation 16-41)}$$

where:

L = The span of the horizontal element in the direction of the tie, between bearing walls, feet (m).
w = The weight per unit area of the floor or roof in the span being tied to or across the wall, psf (N/m^2).
S = The spacing between ties, feet (m).
α_T = A coefficient with a value of 1,500 pounds per foot (2.25 kN/m) for masonry bearing wall structures and a value of 375 pounds per foot (0.6 kN/m) for structures with bearing walls of cold-formed steel light-frame construction.

1615.4.2.2 Transverse ties.
Transverse ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Transverse ties shall be placed no farther apart than the spacing of load-bearing walls. Transverse ties shall have minimum nominal tensile strength T_T, given by Equation 16-46. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

1615.4.2.3 Perimeter ties.
Perimeter ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Ties around the perimeter of each

floor and roof shall be located within 4 feet (1219 mm) of the edge and shall provide a nominal strength in tension not less than T_p, given by Equation 16-42. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_p = 200w \leq \beta_T \qquad \textbf{(Equation 16-42)}$$

For SI:

$$T_p = 90.7w \leq \beta_T$$

where:

w = As defined in Section 1615.4.2.1.
β_T = A coefficient with a value of 16,000 pounds (7200 kN) for structures with masonry bearing value of 4,000 pounds (1300 kN) for structures with bearing walls of cold-formed steel light-frame

1615.4.2.4 Vertical ties.
Vertical ties shall consist of continuous or spliced reinforcing, continuous or spliced members, wall sheathing or other engineered systems. Vertical tension ties shall be provided in bearing walls and shall be continuous over the height of the building. The minimum nominal tensile strength for vertical ties within a bearing wall shall be equal to the weight of the wall within that *story* plus the weight of the diaphragm tributary to the wall in the *story* below. No fewer than two ties shall be provided for each wall. The strength of each tie need not exceed 3,000 pounds per foot (450 kN/m) of wall tributary to the tie for walls of masonry construction or 750 pounds per foot (140 kN/m) of wall tributary to the tie for walls of cold-formed steel light-frame construction.

SECTION 1616
HIGH-VELOCITY HURRICANE ZONES—
GENERAL, DEFLECTION, VOLUME CHANGES AND MINIMUM LOADS

1616.1 General design requirements.

1616.1.1
Any system, method of design or method of construction shall admit of a rational analysis in accordance with well-established principles of mechanics and sound engineering practices.

1616.1.2
Buildings, structures and all parts thereof shall be designed and constructed to be of sufficient strength to support the estimated or actual imposed dead, live, wind, and any other loads, both during construction and after completion of the structure, without exceeding the allowable materials stresses specified by this code.

1616.1.3
Reserved.

1616.1.4
Reserved.

1616.1.5
Reserved.

1616.1.6
Floor and roof systems shall be designed and constructed to transfer horizontal forces to such parts of the structural frame as are designed to carry these forces to the foundation. Where roofs or floors are constructed of individual prefabricated units and the transfer of forces to the building frame and foundation is totally or partially dependent on such units, the units and their attachments shall be capable of resisting applied loads in both vertical and horizontal directions. Where roofs or floors are constructed of individual prefabricated units and the transfer of forces to the building frame and foundation is wholly independent of such units, the units and their attachments shall be capable of resisting applied loads normal to the surface, in and out.

1616.2 General design for specific occupancies and structures.

1616.2.1 Fences.
Fences not exceeding 6 feet (1829 mm) in height from grade may be designed for 75 mph (33 m/s) fastest mile wind speed or 115 mph (40 m/s) 3-second gust.

1616.2.1.1 Wood fences.
Wood fence design shall be as specified by Section 2328.

1616.2.2 Sway forces in stadiums.

1. The sway force applied to seats in stadiums, grandstands, bleachers and reviewing stands shall be not less than 24 pounds per lineal foot (350 N/m), applied perpendicularly and along the seats.

2. Sway forces shall be applied simultaneously with gravity loads.

3. Sway forces need not be applied simultaneously with other lateral forces.

1616.3 Deflection.

1616.3.1 Allowable deflections.
The deflection of any structural member or component when subjected to live, wind and other superimposed loads set forth herein shall not exceed the following:

1. Roof and ceiling or components supporting plaster	L/360
2. Roof members or components not supporting plaster under	L/240
3. Floor members or components	L/360
4. Vertical members and wall members or components consisting of or supporting material that hardens in place, is brittle or lacks resistance to cracking caused by bending	L/360

strains

5. Vertical members and wall members or components not required to meet the conditions of Section 1616.3, Item 4	L/180
6. Roof and vertical members, wall members and panels of carports, canopies, marquees, the roof projection is greater than 12 feet (3.7 m) in the direction of the span, for free-standing roofs and roofs supported by existing structures. Existing structures supporting such roofs shall be capable of supporting the additional loading	L/180
7. For Group R-3 occupancies only, roof and vertical members, wall members and panels of carports, canopies, marquees, patio covers, utility sheds and similar minor structures not to be considered living areas, where the roof projection is 12 feet (3.7 m) or less in the direction of the span and for free standing roofs and roofs supported by existing structures	L/80
8. Members supporting screens only	L/80
9. Storm shutters and fold-down awnings, which in the closed position shall provide a minimum clear separation from the glass of 1 inch (25 mm) but not to exceed 2 inches (51 mm) when the shutter or awning is at its maximum point of permissible deflection	L/30
10. Roofs and exterior walls of utility sheds having maximum dimensions of 10 feet (3 m) length, 10-feet (3 m) width, and 7-feet (2.1 m) height	L/80
11. Roofs and exterior walls of storage buildings larger than utility sheds	L/180

1616.4 Volume change.
In the design of any building, structure or portion thereof, consideration shall be given to the relief of stresses caused by expansion, contraction and other volume changes.

1616.5 Live loads.
Live loads for balconies and decks shall be designed in accordance with ASCE 7.

1616.6 Concentrated loads.
Reserved

SECTION 1617
HIGH-VELOCITY HURRICANE ZONES—
ROOF DRAINAGE
RESERVED

SECTION 1618
HIGH-VELOCITY HURRICANE ZONES—
SPECIAL LOAD CONSIDERATIONS

1618.1 Floors.
Reserved.

1618.2 Below grade structures.
Reserved.

1618.3 Helistops/heliports.
Reserved.

1618.4 Safeguards.
Reserved.

1618.4.6 Railing.

1618.4.6.1 Reserved.

1618.4.6.2 Reserved.

1618.4.6.3
Laminated glazing will be permitted as an equal alternate to pickets, if tested by an accredited laboratory to satisfy the resistance requirements of this code for wind, live and kinetic energy impact loading conditions. The kinetic energy impact loading shall comply with ANSI Z97.1 using a 400 foot-pound (542 N) energy impact. The safety requirements of the impact test shall be judged to have been satisfactorily met if breakage does not occur or numerous cracks and fissures occur but no shear or opening through which a 3-inch (76 mm) diameter sphere may freely pass. The glass panel shall remain within the supporting frame.

1618.4.6.4
If the posts that support the top rail of exterior railings are substituted with glass, the assembly shall be tested to TAS 201, where the impacted glass continues to support the top rail and all applicable loads after impact.

1618.5 Vehicle safeguard barriers.
Reserved.

1618.6 Special requirements for cable safeguard barriers.
Reserved.

1618.7 Ornamental projections.
Reserved.

1618.8 Interior wall and partitions.
Reserved.

1618.9 Load combination.
Reserved.

SECTION 1619
HIGH VELOCITY HURRICANE ZONES—
LIVE LOAD REDUCTIONS
RESERVED

SECTION 1620
HIGH-VELOCITY HURRICANE ZONES—
WIND LOADS

1620.1
Buildings and structures, and every portion thereof, shall be designed and constructed to meet the requirements of Chapters 26 through 31 of ASCE 7.

1620.2
Wind velocity (3-second gust) used in structural calculations shall be as follows:

Miami-Dade County

Risk Category I Buildings and Structures: 165 mph

Risk Category II Buildings and Structures: 175 mph

Risk Category III and IV Buildings and Structures: 186 mph

Broward County

Risk Category I Buildings and Structures: 156 mph

Risk Category II Buildings and Structures: 170 mph

Risk Category III and IV Buildings and Structures: 180 mph

1620.3
All buildings and structures shall be considered to be in Exposure Category C, unless Exposure Category D applies, as defined in Section 26.7 of ASCE 7.

1620.4
For wind force calculations, roof live loads shall not be considered to act simultaneously with the wind load.

1620.5
Utility sheds shall be designed for a wind load of not less than 15 psf (718 Pa).

1620.6 Rooftop structures and equipments.
The lateral force on rooftop structures and equipment with A_f less than (0.1Bh) located on buildings of all heights shall be determined from Equation 29.5-1 of ASCE 7 in which the value of GC_f shall be taken as 3.1. GC_f shall be permitted to be reduced linearly from 3.1 to 1.1 as the value of A_f is increased from (0.1Bh) to (Bh). The value of G from Section 26.9 of ASCE 7 shall not be used. Additionally, a simultaneous uplift force shall be applied, given by Equation 29.5-1 of ASCE 7 in which $GC_f = 1.5$ and A_f is replaced by the horizontal projected area, A_r, of the rooftop structure or equipment. For the uplift force GC_f shall be permitted to be reduced linearly from 1.5 to 1.0 as the value of A_r is increased from (0.1BL) to (BL).

SECTION 1621
HIGH-VELOCITY HURRICANE ZONES—
OVERTURNING MOMENT AND UPLIFT

1621.1
Computations for overturning moment and uplift shall be based on ASCE 7.

1621.2
Overturning and uplift stability of any building, structure or part thereof taken as a whole shall be provided, and shall be satisfied by conforming to the load combination requirements of ASCE 7.

SECTION 1622
HIGH-VELOCITY HURRICANE ZONES—
SCREEN ENCLOSURES

1622.1 Screen enclosures.

1622.1.1
The wind loads on screen surfaces shall be in accordance with ASCE 7 based on the ratio of solid to gross area.

1622.1.2
Design shall be based on such loads applied horizontally inward and outward to the walls with a shape factor of 1.3 and applied vertically upward and downward on the roof with a shape factor of 0.7.

Exception: Screen enclosures shall be permitted to be designed in accordance with the AAF *Guide to Aluminum Construction in High Wind Areas.* Construction documents based on the *AAF Guide to Aluminum Construction in High Wind Areas* shall be prepared and signed and sealed by a Florida registered architect or engineer.

1622.2 Windbreakers.

1622.2.1
Vinyl and acrylic glazed panels 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.

1622.2.2
Permanent frame shall be designed in accordance with Sections 1620 and 1622.1.2.

SECTION 1623
HIGH-VELOCITY HURRICANE ZONES— LIVE LOADS POSTED AND OCCUPANCY PERMITS
RESERVED

SECTION 1624
HIGH-VELOCITY HURRICANE ZONES— FOUNDATION DESIGN
RESERVED

SECTION 1625
HIGH-VELOCITY HURRICANE ZONES— LOAD TESTS

1625.1 Application.
Whenever there is insufficient evidence of compliance with the provisions of this code or evidence that any material or any construction does not conform to the requirements of this code, or in order to substantiate claims for alternate materials or methods of construction, the building official may require testing by an approved agency, at the expense of the owner or his agent, as proof of compliance. Testing methods shall be as specified by this code for the specific material.

1625.2 Testing method.
Such testing shall follow a nationally recognized standard test, or when there is no standard test procedure for the material or assembly in question, the building official shall require the material or assembly under dead plus live load shall deflect not more than as set forth in Section 1616.3, and that the material or assembly shall sustain dead load plus twice the live load for a period of 24 hours, with a recovery of at least 80 percent or a 100-percent recovery after one-half test load.

1625.3 Alternate test methods.
When elements, assemblies or details of structural members are such that their load-carrying capacity, deformation under load, or deflection cannot be calculated by rational analysis, their structural performance shall be established by test in accordance with test procedures as approved by the building official based on consideration of all probable conditions of loading.

1625.4 Fatigue load testing.
Where cladding assemblies (including cladding and connections) or roofing framing assemblies (including portions of roof structure and connections) are such that their load-carrying capacity

or deformation under load cannot be calculated by rational analysis, the assemblies may be tested to resist the fatigue loading sequence given by Table 1625.4.

Assemblies shall be tested with no resultant failure or distress and shall have a recovery of at least 90 percent over maximum deflection.

Any cladding assembly not incorporated into the *Florida Building Code, Building* after successfully completing the impact test outlined in Section 1626, shall be subject to fatigue loading testing and shall obtain product approval by the building official.

TABLE 1625.4
FATIGUE LOADING SEQUENCE

RANGE OF TEST	NUMBER OF CYCLES[1]
0 to $0.5p_{max}$[2]	600
0 to $0.6p_{max}$	70
0 to $1.3p_{max}$	1

1. Each cycle shall have minimum duration of 1 second and a maximum duration of 3 seconds and must be performed in a continuous manner.
2. P_{max} = 0.6 × ultimate design load in accordance with ASCE 7.

SECTION 1626
HIGH-VELOCITY HURRICANE ZONES—
IMPACT TESTS FOR WIND-BORNE DEBRIS

TABLE 1626
CYCLIC WIND PRESSURE LOADING

INWARD ACTING PRESSURE		OUTWARD ACTING PRESSURE	
RANGE	NUMBER OF CYCLES[1]	RANGE	NUMBER OF CYCLES[1]
0.2 P_{MAX} to 0.5 P_{MAX}[2]	3,500	0.3 P_{MAX} to 1.0 P_{MAX}	50
0.0 P_{MAX} to 0.6 P_{MAX}	300	0.5 P_{MAX} to 0.8 P_{MAX}	1,050
0.5 P_{MAX} to 0.8 P_{MAX}	600	0.0 P_{MAX} to 0.6 P_{MAX}	50
0.3 P_{MAX} to 1.0 P_{MAX}	100	0.2 P_{MAX} to 0.5 P_{MAX}	3,350

NOTES:
1. Each cycle shall have minimum duration of 1 second and a maximum duration of 3 seconds and must be performed in a continuous manner.

2. P_{MAX} = 0.6 × ultimate design load in accordance with ASCE 7. The pressure spectrum shall be applied to each test specimen beginning with inward acting pressures followed by the outward acting pressures in the order from the top of each column to the bottom of each column.

1626.1

All parts or systems of a building or structure envelope such as, but not limited to, exterior walls, roof, outside doors, skylights, glazing and glass block shall meet impact test criteria or be protected with an external protection device that meets the impact test criteria. Test procedures to determine resistance to wind-borne debris of wall cladding, outside doors, skylights, glazing, glass block, shutters and any other external protection devices shall be performed in accordance with this section.

Exception: The following structures or portion of structures shall not be required to meet the provisions of this section:

a. Roof assemblies for screen rooms, porches, canopies, etc., attached to a building that do not breach the exterior wall or building envelope and have no enclosed sides other than screen.

b. Soffits, soffit vents and ridge vents. Size and location of such vents shall be detailed by the designer and shall not compromise the integrity of the diaphragm boundary.

c. Vents in a garage with four or fewer cars. Size and location of such vents shall be detailed by the designer and shall not exceed the minimum required area by more than 25 percent.

d. Exterior wall or roof openings for wall- or roof-mounted HVAC equipment.

e. Openings for roof-mounted personnel access roof hatches.

f. Storage sheds that are not designed for human habitation and that have a floor area of 720 square feet (67 m^2) or less are not required to comply with the mandatory windborne debris impact standards of this code.

g. Louvers, as long as they properly considered ASCE 7 in the design of the building.

h. Buildings and structures for marinas, cabanas, swimming pools, and greenhouses.

i. Exterior balconies or porches under existing roofs or decks enclosed with screen or removable vinyl and acrylic panels complying with Section 1622.1 or Section 1622.2 shall not be required to be protected and openings in the wall separating the unit from the balcony or porch shall not be required to be protected unless required by other provisions of this code.

1626.2 Large missile impact tests.

1626.2.1

This test shall be conducted on three test specimens per test protocols TAS 201 and TAS

203. This test shall be applicable to the construction units, assemblies and materials to be used up to and including 30 feet (9.1 m) in height in any and all structures.

1626.2.2
The test specimens shall consist of the entire assembled unit, including frame and anchorage as supplied by the manufacturer for installation in the building, or as set forth in a referenced specification, if applicable. Fasteners used in mounting the test specimen shall be identical in size and spacing to what is used in field installations.

1626.2.3
The large missile shall be comprised of a piece of timber having nominal dimensions of 2 inches by 4 inches (51 mm by 102 mm) weighing 9 pounds (4.1 kg).

1626.2.4
The large missile shall impact the surface of each test specimen at a speed of 50 feet per second (15.2 m/s); 80 feet per second (24.38 m/s) for Risk Category IV— essential facility buildings or structures.

1626.2.5
Each test specimen shall receive two impacts, except as noted in Sections 1626.2.5.1 and 1626.2.5.2, the first within a 5-inch (127 mm) radius circle having its center on the midpoint of the test specimen and the second within a 5-inch (127 mm) radius circle in a corner having its center in a location 6 inches (152 mm) away from any supporting members.

1626.2.5.1
For window, glass block, fixed glass and skylight assemblies, both impacts shall be to glass or other glazing infill. For test specimens with more than one light of glass, a single light closest to the center of the assembly shall be selected and impacted twice in accordance with Section 1626.2.5. If a light of glass is sufficiently small to cause the 5-inch (127 mm) radius circle to overlap, two separate lights shall be impacted, one time each.

1626.2.5.1.1
For window, fixed glass and skylight assemblies comprised of different glass thickness, types of glass or different types of glazing infill, each separate thickness or type shall be impacted twice in accordance with Section 1626.2.5.

1626.2.5.2
For doors, wall cladding and external protection devices, both impacts shall be to the thinnest section through the assembly. For doors, wall cladding and external protection devices with horizontal and/or vertical bracing, both impacts shall be within a single area that is not reinforced and shall be in accordance with Section 1626.2.5.

1626.2.5.2.1
For doors with glass, the glass shall be impacted twice and the thinnest section through the assembly that is not glass shall be impacted twice in accordance with Section 1626.2.5.

1626.2.6
In the case of glazing, if the three test specimens that comprise a test successfully reject the

two missile impacts, they shall then be subjected to the cyclic pressure loading defined in Table 1626.

1626.2.6.1
If external protection devices are employed to protect windows, fixed doors or skylights, they must resist the large missile impacts specified in Sections 1626.2.3 and 1626.2.4 without deformations which result in contact with the windows, fixed glass, glass block, and doors or skylights they are intended to protect.

1626.2.6.2
If external protection devices are not designed to be air tight, following the large missile impact test, they must resist an application of force corresponding to those listed in Table 1625.4 (fatigue load testing) without detaching from their mountings. The acting pressure cycles shall be simulated with loads applied through a mechanical system attached to the shutter specimen to apply uniformly around the shutter perimeter a force equal to the product of the required pressure and the area of the shutter specimen.

1626.2.7
If air leakage through the test specimen is excessive, tape may be used to cover any cracks and joints through which leakage is occurring. Tape shall not be used when there is a probability that it may significantly restrict differential movement between adjoining members. It is also permissible to cover both sides of the entire specimen and mounting panel with a single thickness of polyethylene film no thicker than 0.050 mm (2 mils). The technique of application is important in order that the full load is transferred to the specimen and that the membrane does not prevent movement or failure of the specimen. Apply the film loosely with extra folds of material at each corner and at all offsets and recesses. When the load is applied, there shall be no fillet caused by tightness of plastic film.

1626.2.8
A particular system of construction shall be deemed to comply with this recommended practice if three test specimens reject the two missile impacts without penetration and resist the cyclic pressure loading with no crack forming longer than 5 inches (127 mm) and $^{1}/_{16}$-inch (1.6 mm) wide through which air can pass.

1626.2.9
If only one of the three test specimens in a test fails to meet the above listed criteria, one retest of this system of construction (another test sequence with three specimens) shall be permitted.

1626.3 Small missile impact test.

1626.3.1
This test shall be conducted on three test specimens per test protocols TAS 201 and TAS 203. This test shall be applicable to the construction units, assemblies, and materials to be used above 30 feet (9.1 m) in height in any and all structures; Risk Category IV—essential facility buildings or structures shall follow the large missile impact testing in Section 1626.2.4 at 50 feet per second (15.2 m/s).

1626.3.2
Each test specimen shall consist of the entire assembled unit, including frame and anchorage as supplied by the manufacturer for installation in the building, or as set forth in a referenced specification, if applicable. The fasteners used in mounting the test specimen shall be identical in size and spacing to those to be used in field installations.

1626.3.3
The missiles shall consist of solid steel balls, each having a mass of 2 grams (0.07 oz) (+/-5 percent) with a $^{5}/_{16}$-in. (7.9 mm) nominal diameter.

1626.3.4
Each missile shall impact the surface of each test specimen at a speed of 130 feet per second (40 m/s).

1626.3.5
Each test specimen shall receive 30 small missile impacts, except as noted in Sections 1626.3.5.1 and 1626.3.5.2, delivered in groups of 10 at a time: the first 10 distributed uniformly over a 2-square-foot (0.19 m^2) area located at the center of the test specimen, the second 10 distributed uniformly over a 2-square-foot (0.19 m^2) area located at the center of the long dimension of the specimen near the edge, and the third 10 distributed uniformly over a 2-square-foot (0.19 m^2) area located at a corner of the specimen.

1626.3.5.1
For window and skylight assemblies, all impacts shall be to glass or other glazing infill. For test specimens with more than one light of glass, a single light closest to the center of the assembly shall be selected and impacted in accordance with Section 1626.3.5. If a light of glass is sufficiently small to cause the 5-inch (127 mm) radius circles to overlap, separate lights may be impacted; however, there must be a total of 30 impacts within the assembly.

1626.3.5.1.1
For window, fixed glass and skylight assemblies comprised of glass with different thickness, types of glass or different types of glazing infill, each separate thickness or type shall be impacted in accordance with Section 1626.3.5.

1626.3.5.2
For doors, wall cladding and external protection devices, all impacts shall be to the thinnest section through the assembly. For doors, wall cladding and external protection devices with horizontal and/or vertical bracing, all impacts shall be within a single area that is not reinforced and shall be impacted in accordance with Section 1626.3.5.

1626.3.5.2.1
For doors with glass, the glass shall be impacted in accordance with Section 1626.3.5 and the thinnest section through the assembly that is not glass shall be impacted in accordance with Section 1626.3.5.

1626.3.6
In the case of glazing, after completion of the small missile impacts, each test specimen shall then be subjected to the cyclic pressure loading defined in Table 1626.

1626.3.6.1
If external protection devices are employed to protect windows, doors or skylights, they must resist the small missile impacts specified in Sections 1626.3.3 and 1626.3.4 without deformations that result in contact with the windows, glass, doors or skylights they are intended to protect.

1626.3.6.2
If external protection devices are not designed to be air tight, following the small missile impact test, they must resist an application of force corresponding to those listed in Table 1625.4 (fatigue load testing) without detaching from their mountings. The acting pressure cycles shall be simulated with loads applied through a mechanical system attached to the shutter specimen to apply uniformly around the shutter perimeter a force equal to the product of the required pressure and the area of the shutter specimen.

1626.3.7
If air leakage through the test specimen is excessive, tape may be used to cover any cracks and joints through which leakage is occurring. Tape shall not be used when there is a probability that it may significantly restrict differential movement between adjoining members. It is also permissible to cover both sides of the entire specimen and mounting panel with a single thickness of polyethylene film no thicker than 0.050 mm (2 mils). The technique of application is important for the full load to be transferred to the specimen and to insure the membrane does not prevent movement or failure of the specimen. Apply the film loosely with extra folds of material at each corner and at all offsets and recesses. When the load is applied, there shall be no fillet caused by tightness of plastic film.

1626.3.8
A particular system of construction shall be deemed to comply with this test if three test specimens reject the small missile impacts without penetration and resist the cyclic pressure loading with no crack forming longer than 5 inches (127 mm) and $^{1}/_{16}$ inch (1.6 mm) in width through which air can pass.

1626.3.9
If only one of the three test specimens in a test fails to meet the above listed criteria, one retest of the system (another test sequence with three specimens) of construction shall be permitted.

1626.4 Construction assemblies deemed to comply with Section 1626.

1. Exterior concrete masonry walls of minimum nominal 8-inch (203 mm) thickness, constructed in accordance with Chapter 21 (High-Velocity Hurricane Zones) of this code.

2. Exterior frame walls or gable ends constructed in accordance with Chapter 22 and Chapter 23 (High-Velocity Hurricane Zones) of this code, sheathed with a minimum $^{19}/_{32}$ -

inch (15 mm) CD exposure 1 plywood and clad with wire lath and stucco installed in accordance with Chapter 25 of this code.

3. Exterior frame walls and roofs constructed in accordance with Chapter 22 (High-Velocity Hurricane Zones) of this code sheathed with a minimum 24-gage rib deck-type material and clad with an approved wall finish.

4. Exterior reinforced concrete elements constructed of solid normal weight concrete (no voids), designed in accordance with Chapter 19 (High-Velocity Hurricane Zones) of this code and having a minimum 2-inch (51 mm) thickness.

5. Roof systems constructed in accordance with Chapter 22 or Chapter 23 (High-Velocity Hurricane Zones) of this code, sheathed with a minimum $^{19}/_{32}$-inch (15 mm) CD exposure 1 plywood or minimum nominal 1-inch (25 mm) wood decking and surfaced with an approved roof system installed in accordance with Chapter 15 of this code.

All connectors shall be specified by the building designer of record for all loads except impact.

Part II
Excerpts from the Rules of
The Florida Board of Professional Engineers

The following are responsibilities for Professional Engineers who design Structures under the Florida Building Code as well as Rules of Responsibility Common to all Engineers and the Grounds for Disciplinary Proceeding against engineers in violation of these rules.. These requirements specific to Professional Engineers are:

1. Requirement to take continuing education courses on the Florida Building Code.
   See Chapter 471.0195 F.S.

2. Grounds for Disciplinary Proceedings.
   See Chapter 61G15-19.001, F.A.C.

3. Rules of Responsibility Common to All Engineers.
   See Chapter 61G15-30, F.A.C.

4. Responsibility Rules of Professional Engineers Concernig the Design of Structures
   See Chapter 61G15-31, F.A.C.

471.0195 Florida Building Code training for engineers.—All licensees actively participating in the design of engineering works or systems in connection with buildings, structures, or facilities and systems covered by the Florida Building Code shall take continuing education courses and submit proof to the board, at such times and in such manner as established by the board by rule, that the licensee has completed any specialized or advanced courses on any portion of the Florida Building Code applicable to the licensee's area of practice. The board shall record reported continuing education courses on a system easily accessed by code enforcement jurisdictions for evaluation when determining license status for purposes of processing design documents. Local jurisdictions shall be responsible for notifying the board when design documents are submitted for building construction permits by persons who are not in compliance with this section. The board shall take appropriate action as provided by its rules when such noncompliance is determined to exist.
History.—s. 38, ch. 2000-356; s. 23, ch. 2002-299; s. 12, ch. 2009-195.

CHAPTER 61G15-19
GROUNDS FOR DISCIPLINARY PROCEEDINGS

61G15-19.001 Grounds for Disciplinary Proceedings.

(1) Pursuant to Section 471.033(2), F.S., the Board, to the extent not otherwise set forth in Florida Statutes, hereby specifies that the following acts or omissions are grounds for disciplinary proceedings pursuant to Section 471.033(1), F.S.

(2) A professional engineer shall not advertise in a false, fraudulent, deceptive or misleading manner. As used in Section 471.033(1)(f), F.S., the term “advertising goods or services in a manner which is fraudulent, false, deceptive, or misleading in form or content” shall include without limitation a false, fraudulent, misleading, or deceptive statement or claim which:

(a) Contains a material misrepresentation of facts;

(b) Omits to state any material fact necessary to make the statement in the light of all circumstances not misleading;

(c) Is intended or is likely to create an unjustified expectation;

(d) States or implies that an engineer is a certified specialist in any area outside of his field of expertise;

(e) Contains a representation or implication that is likely to cause an ordinary prudent person to misunderstand or be deceived or fails to contain reasonable warnings or disclaimers necessary to make a representation or implication not deceptive;

(f) Falsifies or misrepresents the extent of his education, training or experience to any person or to the public at large, tending to establish or imply qualification for selection for engineering employment, advancement, or professional engagement. A professional engineer shall not misrepresent or exaggerate his degree of responsibility in or for the subject matter of prior assignments;

(g) In any brochure or other presentation made to any person or to the public at large, incident to the solicitation of an engineering employment, misrepresents pertinent facts concerning a professional engineer’s employer, employees, associates, joint ventures, or his or their past accomplishments with the intent and purpose of enhancing his qualifications and his works.

(3) A professional engineer, corporation or partnership shall not practice engineering under an assumed, fictitious or corporate name that is misleading as to the identity, responsibility or status of those practicing thereunder or is otherwise false, fraudulent, misleading or deceptive within the meaning of subsection 61G15-19.001(2), F.A.C. When an individual is practicing engineering as a sole proprietor under a combination of his own given name, and terms such as “engineering,” “and associates” or “and company,” then said person is practicing engineering under a fictitious name, and must obtain a certificate of authorization pursuant to Section 471.023(2), F.S. The name of a corporation or partnership, if otherwise authorized, may include the name or names of one or more deceased or retired members of the firm, or of a predecessor firm in a continuing line of succession. An engineering firm may not offer services to the public under a firm name which contains only the name of an individual not licensed as a

professional engineer, registered architect, land surveyor, landscape architect, or professional geologist, in any state.

(4) A professional engineer shall not be negligent in the practice of engineering. The term negligence set forth in Section 471.033(1)(g), F.S., is herein defined as the failure by a professional engineer to utilize due care in performing in an engineering capacity or failing to have due regard for acceptable standards of engineering principles. Professional engineers shall approve and seal only those documents that conform to acceptable engineering standards and safeguard the life, health, property and welfare of the public.

Failure to comply with the procedures set forth in the Responsibility Rules as adopted by the Board of Professional Engineers shall be considered as non-compliance with this section unless the deviation or departures therefrom are justified by the specific circumstances of the project in question and the sound professional judgment of the professional engineer.

(5) A professional engineer shall not be incompetent to practice engineering. Incompetence in the practice of engineering as set forth in Section 471.033(1)(g), F.S., shall mean the physical or mental incapacity or inability of a professional engineer to perform the duties normally required of the professional engineer.

(6) A professional engineer shall not commit misconduct in the practice of engineering. Misconduct in the practice of engineering as set forth in Section 471.033(1)(g), F.S., shall include, but not be limited to:

(a) Expressing an opinion publicly on an engineering subject without being informed as to the facts relating thereto and being competent to form a sound opinion thereupon;

(b) Being untruthful, deceptive, or misleading in any professional report, statement, or testimony whether or not under oath or omitting relevant and pertinent information from such report, statement or testimony when the result of such omission would or reasonably could lead to a fallacious conclusion on the part of the client, employer or the general public;

(c) Performing an engineering assignment when not qualified by training or experience in the practice area involved;

1. All professional engineer asbestos consultants are subject to the provisions of Sections 455.301-.309, F.S., Chapter 471, F.S., and Rule 61G15-19, F.A.C., and shall be disciplined as provided therein.

2. The approval of any professional engineer as a “special inspector” under the provisions of Chapter 553, F.S., does not constitute acceptance by the Board that any such professional engineer is in fact qualified by training or experience to perform the duties of a “special inspector” by virtue of training or experience. Any such professional engineer must still be qualified by training or experience to perform such duties and failure to be so qualified could result in discipline under this chapter or Chapter 471, F.S.;

(d) Affixing a signature or seal to any engineering plan of document in a subject matter over which a professional engineer lacks competence because of inadequate training or experience;

(e) Offering directly or indirectly any bribe or commission or tendering any gift to obtain selection or preferment for engineering employment with the exception of the payment of the usual commission for securing salaried positions through licensed employment agencies;

(f) Becoming involved in a conflict of interest with an employer or client, without the knowledge and approval of the client or employer, but if unavoidable a professional engineer shall immediately take the following actions:

1. Disclose in writing to his employer or client the full circumstances as to a possible conflict of interest; and

2. Assure in writing that the conflict will in no manner influence the professional engineer’s judgment or the quality of his services to his employer or client; and

3. Promptly inform his client or employer in writing of any business association, interest or circumstances which may be influencing his judgment or the quality of his services to his client or employer;

(g) Soliciting or accepting financial or other valuable considerations from material or equipment

suppliers for specifying their products without the written consent to the engineer's employer or client;

(h) Soliciting or accepting gratuities directly or indirectly from contractors, their agents or other parties dealing with the professional engineer's client or employer in connection with work for which the professional engineer is responsible without the written consent of the engineer's employer or client;

(i) Use by a professional engineer of his engineering expertise and/or his professional engineering status to commit a felony;

(j) Affixing his seal and/or signature to plans, specifications, drawings, or other documents required to be sealed pursuant to Section 471.025(1), F.S., when such document has not been personally prepared by the engineer or prepared under his responsible supervision, direction and control;

(k) A professional engineer shall not knowingly associate with or permit the use of his name or firm name in a business venture by any person or firm which he knows or has reason to believe is engaging in business or professional practices of a fraudulent or dishonest nature;

(l) If his engineering judgment is overruled by an unqualified lay authority with the results that the public health and safety is threatened, failure by a professional engineer to inform his employer, responsible supervision and the responsible public authority of the possible circumstances;

(m) If a professional engineer has knowledge or reason to believe that any person or firm is guilty of violating any of the provisions of Chapter 471, F.S., or any of these rules of professional conduct, failure to immediately present this information to FEMC;

(n) Violation of any law of the State of Florida directly regulating the practice of engineering;

(o) Failure on the part of any professional engineer or certificate holder to obey the terms of a final order imposing discipline upon said professional engineer or certificate holder;

(p) Making any statement, criticism or argument on engineering matters which is inspired or paid for by interested parties, unless the professional engineer specifically identifies the interested parties on whose behalf he is speaking, and reveals any interest he or the interested parties have in such matters;

(q) Sealing and signing all documents for an entire engineering project, unless each design segment is signed and sealed by the professional engineer in responsible charge of the preparation of that design segment;

(r) Revealing facts, data or information obtained in a professional capacity without the prior consent of the professional engineer's client or employer except as authorized or required by law.

(7) A professional engineer who performs building code inspector or plans examiner duties in accordance with Section 471.045, F.S., or Sections 468.603(6), (7), F.S., shall be subject to disciplinary action for commission of the following:

(a) Violating or failing to comply with any provision of Chapter 471, F.S., or the rules of the Board of Professional Engineers;

(b) Having been convicted of a crime in any jurisdiction which directly relates to the practice of building code inspection or plans examination;

(c) Making or filing a false report or record, inducing another to file a false report or record, failing to file a report or record required by state or local law, impeding or obstructing such filing, or inducing another person to impede or obstruct such filing.

(8) A professional engineer shall not be negligent in the practice of engineering while performing duties as a special inspector. Negligence is herein defined as the failure by a professional engineer to utilize due care in performing in an engineering capacity or failing to have due regard for acceptable standards of engineering and special inspection principles. Failure to comply with the procedures set forth in the Responsibility Rules for Professional Engineers Providing Threshold Building Inspection, as adopted by the Board of Professional Engineers, shall be considered non-compliance with this section unless the deviation or departures therefrom are justified by the specific circumstances of the project in question and the sound professional judgment of the engineer.

Rulemaking Authority 471.033(2) FS. Law Implemented 471.025(1), 471.033(1)(f), (g), (2) FS. History–New 1-8-80, Amended 6-23-80, 3-23-81, 6-4-85, Formerly 21H-19.01, Amended 5-14-86, 4-23-87, 11-8-88, 1-11-89, 7-3-90, 11-9-

92, Formerly 21H-19.001, Amended 11-27-94, 5-20-02.

61G15-19.002 Payments of Fine.

All fines imposed by the Board for violations of Section 471.033, F.S., shall be paid within a period of thirty (30) days from the date of the final order entered by the Board. This time limit may be modified by the Board at its discretion in order to prevent undue hardship to the public.

Rulemaking Authority 455.227(2) FS. Law Implemented 455.227(2), 471.033(3)(c) FS. History–New 8-19-80, Formerly 21H-19.02, 21H-19.002.

61G15-19.003 Purpose.

Rulemaking Authority 471.033(2) FS. Law Implemented 471.001, 471.033 FS. History–New 5-14-86, Formerly 21H-19.003, Repealed 2-2-12.

61G15-19.004 Disciplinary Guidelines; Range of Penalties; Aggravating and Mitigating Circumstances.

(1) The Board sets forth below a range of disciplinary guidelines from which disciplinary penalties will be imposed upon practitioners (including holders of certificate of authorization) guilty of violating Chapter 471, F.S. The purpose of the disciplinary guidelines is to give notice to licensees of the range of penalties which will normally be imposed upon violations of particular provisions of Chapter 471, F.S. The disciplinary guidelines are based upon a single count violation of each provision listed. Multiple counts of violations of the same provision of Chapter 471, F.S., or the rules promulgated thereto, or other unrelated violations contained in the same administrative complaint will be grounds for enhancement of penalties. All penalties at the upper range of the sanctions set forth in the guidelines, i.e., suspension, revocation, etc., include lesser penalties, i.e., fine, probation or reprimand which may be included in the final penalty at the Board's discretion. All impositions of probation as a penalty shall include successful completion of the Engineering Law and Rules Study Guide, completion of a Board-approved course in Engineering Professionalism and Ethics, and an appearance before the Board at the option of the Board at the end of the probationary period. Other terms may be imposed by the Board at its discretion.

(2) The following disciplinary guidelines shall be followed by the Board in imposing disciplinary penalties upon licensees for violation of the below mentioned statutes and rules:

VIOLATION	PENALTY RANGE	
	FIRST VIOLATION	SECOND AND SUBSEQUENT VIOLATIONS
(a) Violating any provision of Section 455.227(1), 471.025 or 471.031, F.S., or any other provision of Chapter 471, F.S., or rule of the Board or Department (Sections 471.033(1)(a) and 455.227(1)(b), (q), F.S)	Reprimand and $1,000 fine, to One (1) year suspension, two (2) years probation and $5,000 fine	One (1) year suspension, two (2) years probation and $5,000 fine to Revocation
1. Failure to sign, seal or date documents (Section 471.025(1), F.S.)	Reprimand to one (1) year probation	Reprimand and one (1) year probation to Revocation
2. Sealing any document after license has expired or been revoked or suspended, or failure to surrender seal if the license has been revoked or suspended (Section 471.025(2), F.S.)	Suspended license: Revocation and $1,000 fine Revoked license: Referral to State's Attorney's office	Suspended license: Revocation and $5,000 fine Revoked license: Referral to State's Attorney's office

3. Signing or sealing any document that depicts work the licensee is not licensed to perform or which is beyond his or her profession or specialty therein or practicing or offering to practice beyond the scope permitted by law or accepting and performing responsibilities the licensee is not competent to perform (Sections 471.025(3), 455.227(1)(o), F.S., paragraphs 61G15-19.001(6)(c), (d), F.A.C.)	Reprimand, one (1) year probation and $1,000 fine; to $5,000 fine, one (1) year suspension and two (2) years probation	Reprimand, $5,000 fine, one (1) year suspension and two (2) years probation to Revocation
4. Firm practicing without certificate of authorization (Section 471.023, F.S. and subsection 61G15-19.001(3), F.A.C.)	Reprimand, $1,000 fine to one (1) year suspension and $5,000 fine	Reprimand, one (1) year suspension and $5,000 fine to Revocation
5. Failure to complete continuing education (Section 471.017(3), F.S. and Rule 61G15-22.001, F.A.C.)	Reprimand and $1,000 fine, to Suspension until licensee demonstrates compliance	Suspension until licensee demonstrates compliance to Revocation
6. Practicing engineering without a license or using a name or title tending to indicate that such person holds an active license as an engineer (Sections 471.031(1)(a), (b), F.S.)	$1,000 fine to $5,000 fine	$5,000 fine to $10,000 fine to referral to State Attorney's Office
7. Presenting as his or her own the license of another (Section 471.031(1)(c), F.S.)	$1,000 fine to $5,000 fine	$5,000 fine to $10,000 fine and referral to State Attorney's Office
8. Giving false or forged evidence to the Board or concealing information relative to violations of this chapter (Sections 471.031(1)(d), (g), F.S.)	$1,000 fine to $5,000 fine and suspension	Reprimand and $5,000 fine to Revocation
9. Employing unlicensed persons to practice engineering or aiding, assisting, procuring, employing unlicensed practice or practice contrary to Chapter 455 or 471, F.S. (Sections 471.031(1)(f) and 455.227(1)(j), F.S.)	$1,000 fine and reprimand; to $5,000 and suspension	Reprimand and $5,000 fine to Revocation
10. Having been found liable for knowingly filing a false complaint against another licensee (Section 455.227(1)(g), F.S.)	$1,000 fine and reprimand; to $5,000 per count and suspension	Reprimand and $5,000 fine to Revocation
11. Failing to report a person in violation of Chapter 455, Chapter 471, F.S., or the rules of the Board or the Department (Section 455.227(1)(i), F.S.)	Reprimand to $5,000 and suspension for one (1) year	Reprimand and $5,000 fine to Revocation

12. Failing to perform any statutory or legal obligation (Section 455.227(1)(k), F.S.)	Depending on the severity of the offense, from a Reprimand to Revocation	Depending on the severity of the offense, from a Reprimand to Revocation
13. Exercising influence on a client for financial gain (Section 455.227(1)(n), F.S.)	Reprimand to one (1) year suspension and $5,000 fine	Reprimand and $5,000 fine to Revocation
14. Improper delegation of professional responsibilities (Section 455.227(1)(p), F.S.)	$1,000 fine and probation for one (1) year, to suspension	Reprimand and $5,000 fine to Revocation
15. Improperly interfering with an investigation or inspection or disciplinary proceeding (Section 455.227(1)(r), F.S.)	$1,000 fine and probation for one (1) year; to suspension	Reprimand and $5,000 fine to Revocation
(b) Attempting to procure a license by bribery, fraudulent misrepresentation, or error of the Board or Department (Sections 471.033(1)(b) and 455.227(1)(h), F.S.)	One (1) year suspension and $1,000 fine, to Revocation if licensed; if not licensed, denial of license and referral to State Attorney	Revocation and $5,000 fine if licensed; if not licensed, denial of license and referral to State Attorney
(c) Having a license to practice engineering acted against or denied by another jurisdiction (Sections 471.033(1)(c) and 455.227(1)(f), F.S.)	Same penalty as imposed in other jurisdiction or as close as possible to penalties set forth in Florida Statutes	Same penalty as imposed in other jurisdiction or as close as possible to penalties set forth in Florida Statutes
(d)1. Being convicted or found guilty of, or entering a plea of nolo contendere to a crime which relates to the practice or ability to practice (Sections 471.033(1)(d) and 455.227(1)(c), F.S.)	Depending on the severity of the crime, from Reprimand $1,000 fine, and one (1) year probation, to Revocation	Depending on the severity of the crime, from one (1) year suspension with 2 years probation to Revocation
2. Conviction of crime related to building code inspection or plans examination (paragraph 61G15-19.001(7)(a), F.A.C.)	Reprimand $1,000 fine, and one (1) year probation	One (1) year suspension with 2 years probation to Revocation
(e) Knowingly making or filing a false report or record, failing to file a report or record required by law, impeding or obstructing such filing (Sections 471.033(1)(e), 455.227(1)(l), F.S. and paragraph 61G15-19.001(7)(c), F.A.C.)	Reprimand and $1,000 fine to one (1) year suspension, two (2) years probation	One (1) year suspension, 2 years probation, and $1,000 fine, to Revocation and $5,000 fine
(f) Fraudulent, false, deceptive or misleading advertising (Sections 471.033(1)(f), F.S. and subsection 61G15-19.001(2), F.A.C.)	Reprimand to one (1) year probation and $5,000 fine	One (1) year probation and $5,000 fine to Revocation

(g) Fraud, deceit, negligence, incompetence or misconduct (Sections 471.033(1)(g) and 455.227(1)(a), (m), F.S.)		
1. Fraud or deceit	Reprimand, two (2) years probation and $1,000 fine, to one (1) year supension and $5,000 fine	One (1) year suspension and $5,000 fine to Revocation
2.a. Negligence (subsection 61G15-19.001(4), F.A.C.)	Reprimand, two (2) years probation and $1,000 fine, to $5,000 fine, five (5) year suspension and ten (10) years probation	Two (2) years probation and $1,000 fine, to $5,000 fine and Revocation
b. Negligence in procedural requirements (subsections 61G15-30.003(2),(3) and (5), F.A.C.; Rules 61G15-30.005 and 61G15-30.006, F.A.C.)	Reprimand to two (2) years probation and $1,000 fine	Two (2) years probation and $1,000 fine, to $5,000 fine and Revocation
c. As a special inspector	Reprimand, two (2) years probation and $1,000 fine, to $5,000 fine	Two (2) years probation and $1,000 fine, to $5,000 fine and Revocation
3. Incompetence (subsection 61G15-19.001(5), F.A.C.)	Two (2) year probation to Suspension until ability to practice proved followed by two (2) year probation	Suspension until ability to practice proved followed by two (2) year probation, to Revocation
4. Misconduct (subsection 61G15-19.001(6), F.A.C.)	Reprimand and $1,000 fine to one (1) year suspension	One (1) year suspension to Revocation and $5,000 fine.
a. Expressing an opinion publicly on an engineering subject without being informed as to the facts and being competent to form a sound opinion (paragraph 61G15-19.001(6)(a), F.A.C.)	Reprimand and $1,000 fine to one (1) year suspension	One (1) year suspension to Revocation and $5,000 fine
b. Being untruthful, deceptive or misleading in any professional report, statement or testimony or omitting relevant and pertinent information from such report, statement or testimony when the result or such omission would or reasonably could lead to a fallacious conclusion (paragraph 61G15-19.001(6)(b), F.A.C.)	Reprimand and $1,000 fine to one (1) year suspension	One (1) year suspension to Revocation and $5,000 fine
c. Offering directly or indirectly any bribe or commission or tendering any gift to obtain selection or preferment for engineering employment other than the payment of the usual commission for securing salaried positions through licensed employment agencies	Reprimand, $5,000 fine per count and suspension for five (5) years, to Revocation	Five (5) years suspension to Revocation

(paragraph 61G15-19.001(6)(e), F.A.C.)		
d. Soliciting or accepting gratuities without client knowledge (paragraphs 61G15-19.001(6)(g), (h), F.A.C.)	Reprimand, one (1) year probation and $1,000 fine, to one (1) year suspension, two (2) years probation and $5,000 fine	One (1) year suspension, two (2) years probation and $5,000 fine to Revocation
e. Failure to preserve client's confidence (paragraph 61G15-19.001(6)(r), F.A.C.)	Reprimand, one (1) year probation and $1,000 fine, to one (1) year suspension, two (2) years probation (if pecuniary benefit accrues to engineer)	One (1) year suspension, two (2) years probation and $5,000 fine to Revocation
f. Professional judgment overruled by unqualified person (paragraph 61G15-19.001(6)(i), F.A.C.)	Reprimand, one (1) year probation and $1,000 fine, to one (1) year suspension, two (2) years probation and $5,000 fine	One (1) year suspension, two (2) years probation and $5,000 fine to Revocation

g. Use of name/firm in fraudulent venture (paragraph 61G15-19.001(6)(k), F.A.C.)	Reprimand, one (1) year probation and $1,000 fine, to $5,000 fine, one (1) year suspension and two (2) years probation	One (1) year suspension, two (2) years probation and $5,000 fine to Revocation
h. Undisclosed conflict of interest (paragraphs 61G15-19.001(6)(f), (p), F.A.C.)	Reprimand, $1,000 fine and two (2) years probation, to Revocation and $5,000 fine	One (1) year suspension, two (2) years probation and $5,000 fine to Revocation
(h) Violating any provision of Chapter 455, F.S. (Sections 471.033(1)(h) and 455.227(1)(q), F.S.)	Depending on the severity of the violation, Reprimand and $1,000 fine per count, to $5,000 fine and revocation	Depending on the severity of the violation, One (1) year suspension, two (2) years probation and $5,000 fine to Revocation
(i) Practicing on a revoked, suspended, inactive or delinquent license (Sections 471.033(1)(i) and 471.031(1)(e), F.S.)		
1. Delinquent license	Fine based on length of time in practice while inactive; $100/month or $1,000 maximum, renewal of license or cease practice-	
2. Inactive license	Fine based on length of time in practice while inactive; $100/month or $1,000 maximum, renewal of license or cease practice	
3. Suspended license	Revocation and $1,000 fine	
4. Revoked license	Referral to State Attorney	Referral to State Attorney
(j) Affixing or permitting to be affixed his or her seal, name, or digital signature to any documents that were not prepared by him or her or under his or her responsible supervision, direction or control (Section 471.033(1)(j), F.S. and paragraphs 61G15-19.001(6)(j), (q), F.A.C.)	Reprimand, one (1) year probation and $1,000 fine, to $5,000 fine, one (1) year suspension and two (2) years probation	One (1) year suspension, two (2) years probation and $5,000 fine to Revocation
(k) Violating any order of the board or department (Sections 471.033(1)(k), 455.227(1)(q), F.S. and paragraph 61G15-19.001(6)(o), F.A.C.)	Depending on the severity of the violation, from Suspension until compliant with the order of the Board and $1,000 fine,	Depending on the severity of the violation, Suspension until compliant with the order of the Board and $1,000 fine, to

	to Revocation and $5,000 fine	Revocation and $5,000 fine
(l) Aiding, assisting, procuring, employing unlicensed practice or practice contrary to Chapter 455 or 471, F.S. (Section 455.227(1)(j), F.S.)	$1,000 fine and probation for one (1) year, to $5,000 fine and suspension	Reprimand and $5,000 fine to Revocation
(m) Failing to report in writing a conviction or plea of nolo contendere, a crime in any jurisdiction (Section 455.227(1)(t), F.S.)	Reprimand to $5,000 fine	Six (6) month suspension to $5,000 fine and Revocation

(3) The board shall be entitled to deviate from the above-mentioned guidelines upon a showing of aggravating or mitigating circumstances by clear and convincing evidence presented to the board prior to the imposition of a final penalty. The fact that a Hearing Officer of the Division of Administrative Hearings may or may not have been aware of the below mentioned aggravating or mitigating circumstances prior to a recommendation of penalty in a Recommended Order shall not obviate the duty of the board to consider aggravating and mitigating circumstances brought to its attention prior to the issuance of a Final Order.

(a) Aggravating circumstances; circumstances which may justify deviating from the above set forth disciplinary guidelines and cause the enhancement of a penalty beyond the maximum level of discipline in the guidelines shall include but not be limited to the following:

1. History of previous violations of the practice act and the rules promulgated thereto.

2. In the case of negligence; of the magnitude and scope of the project and the damage inflicted upon the general public by the licensee's misfeasance.

3. Evidence of violation of professional practice acts in other jurisdictions wherein the licensee has been disciplined by the appropriate regulatory authority.

4. Violation of the provision of the practice act wherein a letter of guidance as provided in Section 455.225(3), F.S., has previously been issued to the licensee.

(b) Mitigating circumstances; circumstances which may justify deviating from the above set forth disciplinary guidelines and cause the lessening of a penalty beyond the minimum level of discipline in the guidelines shall include but not be limited to the following:

1. In cases of negligence, the minor nature of the project in question and lack of danger to the public health, safety and welfare resulting from the licensee's misfeasance.

2. Lack of previous disciplinary history in this or any other jurisdiction wherein the licensee practices his profession.

3. Restitution of any damages suffered by the licensee's client.

4. The licensee's professional standing among his peers including continuing education.

5. Steps taken by the licensee or his firm to insure the non-occurrence of similar violations in the future.

Rulemaking Authority 455.227, 471.008, 471.031, 471.033 FS. Law Implemented 455.227, 471.031, 471.033 FS. History–New 1-7-87, Formerly 21H-19.004, Amended 11-27-94, 5-22-01, 11-15-01, 5-20-02, 11-21-06, 2-21-10.

61G15-19.0051 Notice of Noncompliance.

(1) As an alternative to investigation and prosecution, when a complaint is received, FEMC shall provide a licensee with a notice of noncompliance for an initial offense for the following violations:

(a) Failure to date documents when affixing signature and seal.

(b) Practice with an inactive or delinquent license less than one month.

(c) Firm practicing without a current certificate of authorization less than one month.

(d) Failing to report a criminal conviction or plea of nolo contendere, regardless of adjudication, pursuant to Section 455.227(1)(t), F.S., if the licensee self reports after 30 days from the date of

conviction or plea but within one (1) year after the date of the conviction or plea.

(2) A second offense shall result in issuance of a citation pursuant to Rule 61G15-19.0071, F.A.C.

Rulemaking Authority 455.225 FS. Law Implemented 455.224 FS. History–New 4-2-00, Amended 5-5-10, 8-26-13.

61G15-19.006 Mediation.

Pursuant to Section 455.2235, F.S., the Board designates the following areas as appropriate for mediation for a first offense:

(1) Practice with an improper seal. (See Rule 61G15-23.001, F.A.C.).

(2) Failure to date documents when affixing signature and seal.

Rulemaking Authority 455.2235 FS. Law Implemented 455.2235 FS. History–New 2-20-95, Amended 10-20-96, 4-2-00.

61G15-19.0071 Citations.

(1) As used in this rule, "citation" means an instrument which meets the requirements set forth in Section 455.224, F.S., and which is served upon a licensee or certificateholder for the purpose of assessing a penalty in an amount established by this rule.

(2) In lieu of the disciplinary procedures contained in Section 455.225, F.S., FEMC is hereby authorized to dispose of any violation designated herein by issuing a citation to the subject within six months after the filing of the complaint that is the basis for the citation. If a violation for which a citation may be issued is discovered during the course of an investigation for an unrelated violation, the citation must be issued within 6 months from the discovery of the violation and filing of the uniform complaint form by the investigator.

(3) The following violations with accompanying fines may be disposed of by citation:

(a) An engineer who has practiced or offered to practice engineering through a corporation, partnership, or fictitious name which has not been duly certified. The fine shall be $100 for each month or fraction thereof of said activity, up to a maximum of $5,000. (See Sections 455.227(1)(j), 471.023, and 471.033(1)(a), F.S.)

(b) Practice with an inactive or delinquent license more than one month or if a Notice of Noncompliance has previously been issued for the same offense. The fine shall be $100 for each month or fraction thereof. (See Section 471.033(1)(i), F.S.)

(c) Firm practicing without a current certificate of authorization more than one month or if a Notice of Noncompliance has previously been issued for the same offense. The fine shall be $100 for each month or fraction thereof. (See Section 471.023, F.S.)

(d) Failure to notify the Board of a change in the principal officer of the corporation or partner in a partnership who is the qualifying professional engineer for said corporation or partnership within one month of such change. The fine shall be $500. (See Section 471.023(4), F.S.)

(e) Unlicensed practice of engineering. The fine shall be up to $250 for each month depending on the severity of the infraction practice, up to a maximum of $5,000.00. (See Section 455.228(3)(a), F.S.)

(4) If the subject does not dispute the matter in the citation in writing within 30 days after the citation is served by personal service or within 30 days after receipt by certified mail, the citation shall become a final order of the Board of Professional Engineers. The subject has 30 days from the date the citation becomes a final order to pay the fine and costs. Failure to pay the fine and costs within the prescribed time period constitutes a violation of Section 471.033(1)(k), F.S., which will result in further disciplinary action. All fines and costs are to be made payable to "Florida Engineers Management Corporation – Citation."

(5) Prior to issuance of the citation, the investigator must confirm that the violation has been corrected or is in the process of being corrected.

(6) Once the citation becomes a final order, the citation and complaint become a public record pursuant to Chapter 119, F.S., unless otherwise exempt from the provisions of Chapter 119, F.S. The

citation and complaint may be considered as aggravating circumstances in future disciplinary actions pursuant to Rule 61G15-19.004, F.A.C.

(7) Subsequent violation(s) of the same rule or statute shall require the procedure of Section 455.225, F.S., to be followed. In addition, should the offense for which a citation could be issued occur in conjunction with violations not described herein, then the procedures of Section 455.255, F.S., shall apply.

Rulemaking Authority 455.224, 455.225, 455.228(3)(a) FS. Law Implemented 455.224, 455.227, 455.228(3)(a), 471.023, 471.033 FS. History–New 4-2-00, Amended 9-26-05, 8-26-13.

61G15-19.008 Confidentiality of Investigations.

The following violations have been deemed to involve the potential for substantial physical or financial harm to the public:

Negligence, as defined in subsection 61G15-19.001(4), F.A.C., or misconduct, as defined in subsection 61G15-19.001(6), F.A.C., involving threshold buildings as defined in Section 553.71(7), F.S.

Rulemaking Authority 471.038(7) FS. Law Implemented 471.038(7) FS. History–New 5-20-02, Amended 6-5-12.

CHAPTER 61G15-30
RESPONSIBILITY RULES COMMON TO ALL ENGINEERS

61G15-30.001 Purpose.

The Board has adopted these responsibility rules pursuant to Section 471.033(2), F.S., to safeguard the life, health, property and welfare of the public by promoting proper conduct in the practice of engineering and due care and regard for acceptable engineering principles and standards. The Board considers that professional engineers may avoid disciplinary actions by observing the procedures set forth herein. Failure to comply with these rules may be considered as noncompliance with subsection 61G15-19.001(4), F.A.C., unless the deviation or departure therefrom is justified by the specific circumstances of the project in question. Furthermore, these rules are intended to apply as general guidelines where no contractual relationship exists between the parties addressed herein. These rules are not intended to take precedence over contractual relationships developed between the parties addressed herein, so long as those contractual relationships do not violate Chapter 471, F.S., or the stated purpose of these responsibility rules. These responsibility rules shall apply to every person holding a certificate of registration as a professional engineer, every certified engineer intern, and every holder of a certificate of authorization, as appropriate. A professional engineer's practices, education, training, experience, qualifications, technical competence, conduct, and responsibilities in connection with his authorized engineering practice, services, and creative work are subject to regulation solely by the Board of

professional engineers, the courts, and local jurisdictions.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1) FS. History–New 1-26-93, Formerly 21H-30.001, Amended 11-13-08.

61G15-30.002 Definitions Common to All Engineer's Responsibility Rules.

(1) Engineer of Record. A Florida professional engineer who is in responsible charge for the preparation, signing, dating, sealing and issuing of any engineering document(s) for any engineering service or creative work.

(2) Prime Professional. A Florida professional engineer or a duly qualified engineering corporation or partnership, who is engaged by the client to provide any planning, design, coordination, arrangement and permitting for the project and for construction observations in connection with any engineering project, service or creative work. The prime professional engineer may also be an engineer of record on the same project.

(3) Delegated Engineer. A Florida professional engineer who undertakes a specialty service and provides services or creative work (delegated engineering document) regarding a portion of the engineering project. The delegated engineer is the engineer of record for that portion of the engineering project. A delegated engineer usually falls into one of the following categories:

(a) An independent consultant.

(b) An employee or officer of an entity supplying components to a fabricator or contractor, so long as the engineer acts as an independent consultant or through a duly qualified engineering corporation.

(c) An employee or officer of a fabricator or contractor, so long as the engineer acts as an independent consultant or through a duly qualified engineering corporation.

(4) Engineering Documents. Engineering documents are designs, plans, specifications, drawings, prints, reports, or similar instruments of service in connection with engineering services or creative work that have been prepared and issued by the professional engineer or under his responsible supervision, direction or control.

(5) Delegated Engineering Documents. Delegated engineering documents are those engineering documents that are prepared by a delegated engineer.

(6) Public Record. An engineering document is "filed for public record" when said document is presented with the engineer of record's knowledge and consent to any federal, state, county, district, authority, municipal or other governmental agency in connection with the transaction of official business with said agency.

(7) "Engineering Documents Prepared for Public Record" are those documents filed for public record with the Authority Having Jurisdiction (AHJ) to determine compliance with Codes and Standards and to be used for execution of the project. These documents are required to be signed and sealed.

(8) Shop Drawings: Drawings depicting installation means and methods, catalog information on standard products, prepared by a contractor, manufacturers, or professional engineers for incorporation into the project which are prepared based on engineering direction contained in Engineering Documents. Shop drawings do not require the signature, date and seal of a professional engineer.

(9) Record Documents: Documents that are a compiled representation of the constructed project. If the engineer is relying on information provided by others not under the direct supervision and control of the engineer, then the engineer shall not be required to sign, date and seal these Documents. If relying on information by others, as a minimum, the following shall be included on the Documents:

(a) Statement that the documents are a compiled representation of the constructed project.

(b) Listing of the sources and basis of information used in the preparation of the Documents.

(c) Statement that the Documents are believed to be correct to the best of the engineer's knowledge, and that the accuracy of the information cannot be guaranteed.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1), 471.023, 471.025 FS. History–New 1-

26-93, Formerly 21H-30.002, Amended 11-13-08.

61G15-30.003 Minimum Requirements for Engineering Documents.

(1) Engineering Documents are prepared in the course of performing engineering services. When prepared for inclusion with an application for a general building permit, the Documents shall meet all Engineer's Responsibility Rules, set forth in Chapters 61G15-31, 61G15-32, 61G15-33, and 61G15-34, F.A.C., and be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of the Florida Building Code, adopted in Section 553.73, F.S., and applicable laws, ordinances, rules and regulations, as determined by the AHJ. The Documents shall include:

(a) Information that provides material specifications required for the safe operation of the system that is a result of engineering calculations, knowledge and experience.

(b) List Federal, State, Municipal, and County standards, codes, ordinances, laws, and rules, with their effective dates, that the Engineering Documents are intended to conform to.

(c) Information, as determined by the Engineer of Record, needed for the safe and efficient operation of the system.

(d) List engineering design criteria; reference project specific studies, reports, and delegated Engineering Documents.

(e) Identify clearly elements of the design that vary from the governing standards and depict/identify the alternate method used to ensure compliance with the stated purpose of these Responsibility Rules.

(2) Engineers shall legibly indicate their name and business address, on engineering documents. Engineering documents which are issued for preliminary or conceptual use, shall clearly note the intended purpose of such documents.

(3) When elements of the project are shown on an engineering document only for information or clarification and the Engineer does not intend to accept responsibility for the elements, the engineer shall clearly note on the documents the extent of his responsibility.

(4) Engineering drawings shall be legible and clearly define and delineate the work in the project. They must also comply with Chapter 61G15-23, F.A.C., Seals.

(5) Engineers shall clearly note on any preliminary engineering documents that such documents are not in final form, but are being transmitted to the public agency to receive agency reviews, comments and interpretations. The documents may subsequently be revised by the engineer to reflect resolution of issues with the public agency prior to final action by the agency. Changes, revisions and modifications to a project may prompt additional document submittal for agency approval action on the same project.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g), 471.025(3) FS. History–New 1-26-93, Formerly 21H-30.003, Amended 11-13-08.

61G15-30.004 Engineering Document Submittal to Public Agencies.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g), 471.025 FS. History–New 1-26-93, Formerly 21H-30.004, Repealed 2-11-08.

61G15-30.005 Delegation of Engineering Documents: Obligations of the Engineer of Record.

(1) An engineer of record who delegates a portion of his responsibility to a delegated engineer is obligated to communicate in writing his engineering requirements to the delegated engineer.

(2) An engineer of record who delegates a portion of his design responsibility to a delegated engineer shall require submission of delegated engineering documents prepared by the delegated engineer and shall review those documents for compliance with his written engineering requirements and to confirm the following:

(a) That the delegated engineering documents have been prepared by an engineer.

(b) That the delegated engineering documents of the delegated engineer conform with the intent of

the engineer of record and meet the written criteria.

(c) That the effect of the delegated engineer's work on the overall project generally conforms with the intent of the engineer of record.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g) FS. History–New 1-26-93, Formerly 21H-30.005.

61G15-30.006 Delegation of Engineering Documents: Obligations of the Delegated Engineer of Record.

(1) It is the delegated engineer's responsibility to review the Engineer of Record's written engineering requirements and authorization for the delegated engineering document to determine the appropriate scope of engineering.

(2) The delegated engineering document shall comply with the written engineering requirements received from the engineer of record. They shall include the project identification and the criteria used as a basis for its preparation. If a delegated engineer determines there are details, features or unanticipated project limits which conflict with the written engineering requirements provided by the engineer of record, the delegated engineer shall timely contact the engineer of record for resolution of conflicts.

(3) The delegated engineer shall forward the delegated engineering document to the engineer of record for review. All final delegated engineering documents require the impressed seal and signature of the delegated engineer and include:

(a) Drawings introducing engineering input such as defining the configuration and structural capacity of structural components and/or their assembly into structural systems.

(b) Calculations.

(c) Computer printouts which are an acceptable substitute for manual calculations provided they are accompanied by sufficient design assumptions and identified input and output information to permit their proper evaluation. Such information shall bear the impressed seal and signature of the delegated engineer as an indication that said engineer has accepted responsibility for the results.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g) FS. History–New 1-26-93, Formerly 21H-30.006.

61G15-30.007 Prime Professional's Responsibility.

It is the responsibility of the prime professional engineer, where one exists, to retain and coordinate the services of such other professionals as needed to complete the services contracted for the project.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g) FS. History–New 1-26-93, Formerly 21H-30.007, Amended 11-13-08.

61G15-30.008 Use of Computer Software and Hardware.

The engineer shall be responsible for the results generated by any computer software and hardware that he or she uses in providing engineering services.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g) FS. History–New 1-26-93, Formerly 21H-30.008.

61G15-30.009 Retention of Engineering Documents.

At least one copy of all documents displaying the licensee's signature, seal, which is legible to the reader, date and all related calculations shall be retained by the licensee or the licensee's employer for a minimum of three years from the date the documents were sealed. These documents shall be maintained in hardcopy or electronic format.

Rulemaking Authority 471.008, 471.033(2) FS. Law Implemented 471.033(1)(g), (j) FS. History–New 5-9-04,

Amended 11-13-08, 8-26-13.

61G15-30.010 Energy Conservation Compliance.

The engineer who prepares the compliance calculations, and certifies the accuracy thereof, shall verify that the building construction documents conform to compliance calculations. Data used in calculations shall be under the signature, date and seal of the responsible design professionals. The Engineer of Record for energy conservation compliance calculations shall retain the signed, dated and sealed data as provided for in Rule 61G15-30.009, F.A.C., Retention of Engineering Documents.

Rulemaking Authority 471.008, 471.033(2) FS. Law Implemented 471.033(1)(g), (j) FS History–New 11-13-08.

CHAPTER 61G15-31
RESPONSIBILITY RULES OF PROFESSIONAL ENGINEERS CONCERNING THE DESIGN OF STRUCTURES

61G15-31.001 General Responsibility.

The Engineer of Record is responsible for all structural aspects of the design of the structure including the design of all of the structure's systems and components. As noted herein the engineer of record may delegate responsibility for the design of a system or component part of the structure to a delegated engineer. In either case the structural engineering documents shall address, as a minimum, the items noted in the following subsections covering specific structural systems or components. The Engineer of Record's structural engineering documents shall identify delegated systems and components. Both the Engineer of Record for the structure and the delegated engineer, if utilized, shall comply with the requirements of the general responsibility rules, Chapter 61G15-30, F.A.C., and with the requirements of the more specific structural responsibility rules contained herein. The Engineer of Record for the Structural System(s) shall provide design requirements in writing to the delegated engineer if one is used and shall review the design documents of the delegated engineer for conformance with his written instructions in accordance with Rule 61G15-30.005, F.A.C. When information collected from the engineer or the engineer's authorized representative from a site visit is part of the engineer's deliverative process, the engineer is responsible for the accuracy of such information.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g) FS. History–New 1-26-93, Formerly 21H-31.001, Amended 9-28-10.

61G15-31.002 Definitions.

(1) Engineer of Record. The Florida licensed professional engineer who develops the overall structural design and the structural design criteria for the structure, and is responsible for the preparation of the structural engineering documents.

(2) Structural Component. An individual structural member or element designed to be part of the

structure or structural system. This definition of component should not be confused with any other published definitions.

(3) Structure. The entity to be built.

(4) Structural System. A portion of a structure comprising an assembly of structural components which carry and transmit loads.

(5) Structural Engineering Documents. The structural drawings, specifications and other documents setting forth the overall design and requirements for the construction, alteration, repair, removal, demolition, arrangement and/or use of the structure, prepared by and signed and sealed by the engineer of record for the structure. Structural engineering documents shall identify the project and specify design criteria both for the overall structure and for structural components and structural systems. The drawings shall identify the nature, magnitude and location of all design loads to be imposed on the structure. The structural engineering documents shall provide construction requirements to indicate the nature and character of the work and to describe, detail, label and define the structure's components, systems, materials, assemblies, and equipment.

(6) Structural Submittals. Submittals required by the structural engineering documents which do not require the seal of a professional engineer, such as:

(a) Drawings prepared solely to serve as a guide for fabrication and installation and requiring no engineering input such as reinforcing steel shop drawings, and structural steel, steel joist and joist girder erection drawings.

(b) Catalog information on standard products not fabricated for a specific project.

(7) Structural Delegated Engineering Documents. Documents prepared by a delegated engineer to whom the engineer of record for the structure has delegated responsibility for the design of a structural component or system.

(8) Specialty Engineer. A licensed professional engineer, who is not the structural engineer of record, who provides engineering criteria or designs necessary for the structure to be completed. The specialty engineer may be a delegated engineer.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g), (j) FS. History–New 1-26-93, Formerly 21H-31.002, Amended 10-19-97, 9-28-10.

61G15-31.003 Design of Structures Utilizing Prefabricated Wood Trusses.

(1) When a Structural Engineer of Record and a Delegated Engineer exist as may be determined by applicable Florida law, the apportionment of responsibilities between the Structural Engineer of Record and a Delegated Engineer shall be as set forth in Chapter 2 of ANSI/TPI 1-1995, wherein the Structural Engineer of Record is the Building Designer and the Delegated Engineer is the Truss Designer as those terms are defined in said standard.

(2) The Structural Engineer of Record shall provide design requirements in writing to the Delegated Engineer and shall review the design documents of the delegated engineer for conformance to his written instructions in accordance with Rule 61G15-30.005, F.A.C.

(3) For the purposes of this rule, the following definitions shall apply:

(a) “Truss System” shall mean an assemblage of trusses and truss girders, together with all bracing, connections, and other structural elements and all spacing and locational criteria, that, in combination, function to support the dead, live and wind loads applicable to the roof of a structure with respect to a Truss System for the roof, and the floor of a structure with respect to a Truss System for the floor. A Truss System does not include walls, foundations, or any other structural support systems.

(b) “Truss System Engineer” shall mean an engineer who designs a Truss System.

(c) “Truss Design Engineer” shall mean an engineer who designs individual trusses, but does not design a Truss System.

(4) An engineer is a Truss System Engineer if he designs a Truss System. Each of the drawings in the Truss System design package for the Truss System shall include a title block bearing the printed

name, address, and license number of the Truss System Engineer and the date of the drawing. The design documentation prepared by the Truss System Engineer shall also include a truss placement plan for the Truss System, showing the location and designation of each truss. Said design documentation for the Truss System shall be signed and sealed by the Truss System Engineer. The cover or index sheet of the Truss System design package may be signed and sealed in lieu of signing and sealing each individual sheet, provided that the cover or index sheet contains the following information:

(a) The name, address and license number of the Structural Engineer of Record, if there is one, and the name, address and license number of the Truss System Engineer.

(b) Identification of the project, by address or by lot number, block number, section or subdivision and city or county.

(c) Identification of the applicable building code and chapter(s) that the Truss System design is intended to meet, the engineering design criteria relied upon in designing the Truss System and the truss design loading.

(d) Identification of any computer program used for engineering the Truss System.

(e) An index of the attached Truss System design drawings. The naming and numbering system utilized for the drawings shall be clear as to how many drawings there are in the set and the date and sequence number of each of these drawings shall be included.

(5) An engineer is a Truss Design Engineer if he designs individual trusses, but does not design the Truss System. Each of the drawings in the truss design package for individual trusses shall include a title block bearing the printed name, address, and license number of the Truss Design Engineer and the date of the drawing. The Truss Design documents prepared by the Truss Design Engineer shall be signed and sealed by the Truss Design Engineer. The cover or index sheet of the truss design package may be signed and sealed in lieu of signing and sealing each individual sheet, provided that the cover or index sheet contains the following information:

(a) The name, address and license number of the Structural Engineer of Record, if there is one, and the name, address, and license number of the Truss Design Engineer.

(b) Identification of the project, by address or by lot number, block number, section or subdivision and city or county.

(c) Identification of the applicable building code and chapter(s) that the truss design is intended to meet, the engineering design criteria relied upon in designing the trusses and the truss design loading.

(d) Identification of any computer program used for engineering the trusses.

(e) An index of the attached truss design drawings. The naming and numbering system utilized for the drawings shall be clear as to how many drawings there are in the set and the date and sequence number of each of these drawings.

Rulemaking Authority 471.008, 471.033(2) FS. Law Implemented 471.033(1)(g) FS. History–New 1-26-93, Formerly 21H-31.003, Amended 6-16-99, 3-21-01, 4-30-03.

61G15-31.004 Design of Cast-in-Place Post-Tensioned Concrete Structural Systems.

(1) Structural engineering documents shall show the nature, type of post-tensioning system, location of the prestressing tendons and the magnitude of all prestressing forces and all design assumptions.

(2) If the engineer of record elects to delegate the responsibility for preparation of calculations and installation drawings to a delegated engineer for the post-tensioning system(s), the Engineer of Record shall require the submission of installation drawings for review by the engineer of record. Calculations shall also be submitted by the delegated engineer which show sufficient information to confirm that the number and size of tendons provided are adequate to provide the prestressing forces shown on the structural engineering documents. Installation drawings shall identify the structure and provide all details of post-tensioning materials to be used including necessary accessories and instructions for construction. The installation drawings and calculations shall bear the impressed seal, date, and signature of the delegated engineer who prepared them and shall be reviewed by the engineer of record for the structure.

A cover sheet listing the drawings and calculations may be used.

(3) It is the responsibility of the engineer of record for the structure to review the post-tensioning system installation drawings together with the shop drawings of all required reinforcing steel needed for a complete structural design.

(4) The effect of post-tensioning on other parts of the structure is the responsibility of the engineer of record.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g) FS. History–New 1-26-93, Formerly 21H-31.004, Amended 9-28-10.

61G15-31.005 Design of Structures Utilizing Precast and Prestressed Concrete Components.

(1) Structural engineering documents shall indicate the configuration of precast and prestressed components and shall include details of supports, anchors and connections for those components.

(2) If the engineer of record elects to delegate responsibility for the design of precast or prestressed concrete components, or structural systems utilizing those components, to a delegated engineer, the engineer of record shall require structural delegated engineering documents for review. Structural delegated engineering documents shall bear the impressed seal, date, and signature of the delegated engineer and shall be reviewed by the Engineer of Record as an indication that the intent has been understood and that the specified criteria have been used.

(3) Structural delegated engineering documents shall include component details, calculations, and fabrications and erection drawings. All such submittals shall identify the specific project. The effect of precast and prestressed concrete members on other parts of the building is the responsibility of the engineer of record.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g) FS. History–New 1-26-93, Formerly 21H-31.005, Amended 9-28-10.

61G15-31.006 Design of Structural Systems Utilizing Open Web Steel Joists and Joist Girders.

(1) The Engineer of Record shall indicate on the Structural Engineering Documents the steel joist and joist girder designations from the 1997 Steel Joist Institute's Specifications and load tables and shall indicate the appropriate standards for joist and joist girder design, layout, end supports, anchorage, bridging requirements, etc., including connections to walls. These documents shall indicate special requirements for concentrated loads, non-uniform loads, openings, extended ends, and resistance to uplift loads.

(2) The steel joist and joist girder manufacturer shall design the steel joist and joist girder members in accordance with the 1997 Steel Joist Institute Specifications and load tables to support the loads per the Engineer of Record's specified joist and joist girder designations and/or special loading diagrams, as set forth in Structural Engineering Documents. The Engineer of Record may require the submission of the steel joist and joist girder design calculations as an indication of compliance. When required to submit the steel joist and joist girder calculations, the steel joist and joist girder manufacturer shall submit a cover letter along with the steel joist and joist girder design calculations. The cover letter shall bear the seal and signature of a Florida registered professional engineer responsible for design of the steel joist and joist girders.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g), (j) FS. History–New 1-26-93, Formerly 21H-31.006, Amended 10-19-97.

61G15-31.007 Design of Metal Building Systems.

(1) A metal building system is defined as an integrated set of components and assemblies that are specifically designed to form a complete structural system. This typically includes primary framing comprised of constant depth or web-tapered structural steel frames, secondary members that are cold-

formed steel or steel joists, a metal panel roof system and exterior wall cladding. These components and assemblies are manufactured in a manner that permits plant and/or field inspection prior to assembly or erection.

(2) Structural engineering documents prepared by the engineer of record shall reflect the design criteria for the metal building system as required in subsection 61G15-31.002(5), F.A.C. They shall indicate all openings, concentrated loads and other special requirements. Foundation conditions assumed in the design shall be indicated as well as the location and magnitude of building reactions on that foundation under all design conditions.

(3) The engineer of record may delegate responsibility of the design of the metal building system to a delegated engineer requiring submittal of structural delegated engineering documents.

(4) Structural delegated engineering documents shall identify the project and list loading and other design criteria. Structural delegated engineering documents shall include erection drawings which indicate in detail the construction of the structure used for the specific project. The structural delegated engineering documents shall indicate all connection details, openings and other special details. They shall show the magnitude and location of building reactions on the foundation under all design conditions. Calculations shall be provided, if requested by the engineer of record, to prove the design is in compliance with the written engineering requirements for the specific project. Structural delegated engineering documents shall bear the signature, date, and impressed seal of the Florida licensed delegated engineer.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g) FS. History–New 1-26-93, Formerly 21H-31.007, Amended 9-28-10.

61G15-31.008 Design of Foundations.

(1) The structural engineering documents shall designate the foundation capacity used as the basis of design and shall include data indicating the nature of the foundation and sub-grade material.

(2) Site and sub-grade preparation requirements, necessary to provide the foundation capacity, shall be specified in the structural engineering document(s).

(3) The foundation capacity and site preparation requirements shall be determined on the basis of scientific analysis utilizing investigations, tests or studies conducted for or provided by the engineer of record for the structure or by a licensed professional engineer, in accordance with code procedures.

(4) The engineer of record is responsible for the design of foundation components and shall take into account anticipated loads and load paths along with the evaluation of any existing structural conditions.

(5) The engineer of record may delegate the design of certain components of the foundation, such as piles and retaining walls, to a delegated engineer. Structural delegated engineering documents for these components, signed, sealed and dated by the delegated licensed professional engineer, shall be submitted to the engineer of record.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g) FS. History–New 1-26-93, Formerly 21H-31.008, Amended 9-28-10.

61G15-31.009 Design of Structural Steel Systems.

(1) The engineer of record is responsible for all aspects of the structure’s design including the design of components and connections.

(2) The engineer of record may detail all structural connections on the structural engineering documents and require fabrication and erection in accordance with these details.

(3) Alternately, the engineer of record may specify criteria for the design of the structural connections and identify the nature, magnitude, and location of all design loads to be supported by the connections in the structural engineering documents. The engineer of record may then delegate design responsibility for the selection or modification of the structural connections to a delegated engineer and require delegated engineering documents, which the engineer of record may require to be signed, sealed and dated by the

delegated licensed professional engineer.

(4) The structural engineering documents may assign to the fabricator responsibility for implementing the design as specified and for maintaining fabrication and erection tolerances and for ensuring the fit and erectability of the structure.

(5) The fabricator shall forward fabrication and erection drawings for review by the engineer of record.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g) FS. History–New 1-26-93, Formerly 21H-31.009, Amended 9-28-10.

Part III
Course Exam
Chapter 16, Building Structural Design

1. Information related to wind loads shall be shown on the construction documents as follows:
   a. Ultimate design wind speed
   b. Risk category of structure
   c. Applicable exposure category classification
   d. All of the above (Section 1603.1.4)

2. A risk category assigned to a building or structure is based on:
   a. The net floor area of a building
   b. The nature of the occupancy of the building (Table 1604.5)
   c. The total building occupant load
   d. Surrounding topographic features

3. Anchorage of a building is required to resist
   a. Uplift
   b. Sliding forces
   c. Wind Loads
   d. Both A and B (Section 1604.8)

4. Whenever there is reason to question the safety of the construction of a building for the intended occupancy, an engineering analysis or load test, or both, may be required by:
   a. The lender
   b. The client
   c. The permitting agency or agencies
   d. The building official (Section 1604.6)

5. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes are known as:
   a. Risk category III structures
   b. Essential facilities (Section 1602 Definitions and Notations)
   c. Buildings that represent a substantial hazard to human life in the event of failure
   d. Designated emergency shelters

6. The load combinations to be investigated when designing a building or structure:
   a. Depend on the design method being utilized (Section 1605)
   b. Are based on the nature of the occupancy
   c. Are at the discretion of the designer
   d. Are mandated by the building official

7. In the absence of definitive information, values for dead loads shall be:
   a. The value published by the manufacturer of the material
   b. Approved by the building official (Section1606.2)
   c. Taken from ASCE 7
   d. Taken from the Civil Engineers Handbook

8. The uniform live loads used to design buildings and other structures shall be:
   a. Those shown in table 1607.1
   b. Determined by the design professional
   c. The maximum loads expected by the intended use or occupancy (Section 1607.3)
   d. Approved by the building official

9. Provisions for partition weight shall be made whether or not partitions are shown on the construction documents:
   a. Unless the specified live load exceeds 80 PSF (Section 1607.5)
   b. Unless the specified concentrated load exceeds 2000 lbs.
   c. Provided partition weights do not exceed 15 PSF
   d. Unless partitions are fixed in place and not subject to change.

10. Offices in office buildings shall be designed for a minimum uniform distributed live load of ___ PSF:
   a. 80
   b. 100
   c. 40
   d. 50 (Table 1607.1)

11. Handrails and guards shall be designed to resist:
   a. A minimum load of 20 lbs / ft.
   b. A linear load of 50 lbs. / ft.
   c. A concentrated load of 2000 lbs.
   d. Both B and C (Section 1607.8)

12. The code permits uniform live loads to be reduced subject to certain

limitation described in the code. Which of the following statements are correct?

a. The methodology for both floor and roof loading reductions is similar
b. The methodology for floor and roof loading reduction differs and each is described in the code **(Sections 1607.10 through Section 1607.12)**
c. Live loads may be reduced in passenger vehicle garages
d. Heavy live loads may be reduced.

13. The ground snow load for the state of South Carolina is ____ PSF.

a. zero
b. 5
c. 10 (Figure 1608.2)
d. Mandated by the building official

14. Wind loads on every building or structure shall be based on wind speeds:

a. Prevalent in the geographical area of the state in which the building or structure is located
b. Determined by the risk category of the building or structure
c. For exposure "C" category
d. All of the above (Section 1609)

15. Glazed openings in buildings or structures located in wind boarne debris regions shall be:

a. Located more than 30 feet above grade
b. Protected (Section 1609.1.2)
c. Are not permitted
d. Are permitted in partially enclosed structures

16. For a structure to be designed in Ft. Pierce, FL an ultimate design wind speed of 150 MPH is selected from Figure 1609C. The minimal design wind speed is:

a. 150 MPH
b. 124 MPH
c. 116 MPH (Table 1609.3.1)
d. 108 MPH

17. The ultimate design wind speed for a risk category III building located in central Orange County, FL. is:

a. 140 MPH
b. 1**45 MPH (Figure 1609.B)**
c. 150 MPH
d. 130 MPH

18. Exposure categories are determined based on:
    a. **The characteristics of ground surface irregularities for the site at which the building or structure is situated. (Section 1609.4)**
    b. The risk category of the building or structure
    c. The intensity of the wind speed
    d. The wind direction being considered

19. Which of the following conditions must be met in order to utilize the alternate all-heights methods to determine wind effects?
    a. The building is less than or equal to 75 feet in height with a height-to-least-width ratio of 4 or less
    b. The building shall meet the requirements of a simple diaphragm building
    c. The building is an open building
    d. Both A and B above (Section 1609.6.1)

20. The net positive internal pressure coefficient for MWFRS of the windward wall of an enclosed building is:
    a. 0.43 (Table 1609.6.2)
    b. 0.73
    c. 1.28
    d. 0.11

21. When using the alternative all-heights method, design wind forces for the MWFRS shall not be less than ___ multiplied by the area of a structure projected on a plane normal to the assumed wind direction.
    a. 8 PSF
    b. 16 PSF (Section 1609.6.3)
    c. There is no minimum
    d. The value determined by the formula $P_{net}=0.00256V^2 K_z C_{net} K_{zt}$

22. Foundation walls and retaining walls shall be designed to resist
    a. The vertical loads from the superstructure
    b. Lateral soil loads
    c. Surcharge loads
    d. B and C (Section 1610.1

23. A foundation wall extending 6 feet below grade and latteraly supported at the top is situated in an area of well graded clean sand. It should be designed to resist lateral soil load of:
    a. 60 PSF per foot of depth (Table 1610.1)
    b. 45 PSF per foot of depth
    c. 30 PSF per foot of depth
    d. 180 pounds per LF of wall

24. Each portion of a roof shall be designed to sustain the load of rainwater that will accumulate on it:
    a. From a 100 year hourly rain event
    b. If the primary drainage system for that portion is blocked
    c. From the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow
    d. B plus C (Section 1611.1)

25. The 100-year, 1-hour rainfall for Orange County, Florida is"
    a. A rate determined from approved local weather data
    b. Obtained by contacting the National Weather Service
    c. Obtained by contacting the water management district
    d. Approximately 4.5 inches (Figure 1611.1)

26. Who is responsible for establishing flood hazard areas?
    a. Federal Emergency Management Agency (FEMA)
    b. Water Management Districts
    c. Applicable governing authority (Section 1612.3)
    d. Licensed design professionals

27. Where design flood elevations are not included in the flood hazard area shown on the flood hazard map, the applicant may be required to:
    a. Design the building or structure to be anchored to resist flotation, collapse, or lateral movement due to the effects of flood loads.
    b. Obtain and utilize any design flood elevation and floodway data available from a federal, state or local source.
    c. Determine the design flood elevation and / or the floodway in accordance with accepted hydrologic and hydraulic engineering practices used to define flood hazard areas.
    d. Either B or C (Section 1612.3.1)

28. Documentation required for construction in flood hazard areas <u>other</u> than coastal high hazard areas includes:
    a. The elevation of the lowest floor, including basement
    b. A statement that the design will provide equalization of hydrostatic flood forces
    c. A statement that the breakaway wall is designed in accordance with ASCE 24
    d. A and B (Section 1612.5)

29. An exception to the requirement that structures be designed to resist the effects of earthquake motions include:
    a. One and two story buildings
    b. Agricultural storage structures
    c. Structures that require special consideration of their response characteristics and environment
    d. B and C (Section 1613.1)

30. Site class(es) are:
    a. Shown in Table 1613.3.3(1)
    b. Shown on Figures 1613.3(1) through 1613.3.1(6)
    c. Based on site soil properties (Section 1613.3.2)
    d. Not applicable to seismic design

31. The seismic design category is determined based on:
    a. The risk category of the structure
    b. The height of the structure
    c. mapped spectral response acceleration parameter
    d. A and C (Section 1613.3.5)

32. Bearing wall structures shall have ___ ties in all load bearing walls.
    a. Longitudinal
    b. Transverse
    c. Vertical (Section 1615.4)
    d. Perimeter

33. Ties around the perimeter of each floor and roof shall be located within _____feet of the edge.
    a. 0.5
    b. 1.0
    c. 2.0
    d. 4.0 (Section 1615.4.2.3)

34. In high velocity hurricane zones, floor and roof systems shall be designed and constructed to transfer horizontal forces to such parts of the structural frame as are designed to carry the forces to:
    a. The foundation (Section1616.1.6)
    b. The bearing walls
    c. The building columns
    d. The building frame

35. The sway force applied to seats in stadiums, grandstands, bleachers, and reviewing stands shall be not less than ____ lbs/l.f.
    a. 12
    b. 24 (Section1616.2.2)
    c. 36
    d. Mandated by the building official

36. For a Risk Category II building located in Miami-Dade County the wind velocity to be used in structural calculations is ___ MPH
    a. 165 MPH
    b. 170 MPH
    c. 175 MPH (Section 1620.2)
    d. 186 MPH

37. Building Structures and parts thereof shall be designed in accordance with:
    a. Strength design
    b. Load and resistance factor design
    c. Allowable stress design
    d. Any of the above methods (Section 1604.1)

38. The maximum weight of the vehicles allowed into or on a garage or other structure shall be:
    a. Determined by the design professional
    b. Posted by the owner
    c. Established by the building official
    d. None of the above (Section 1607.7.5)

39. Wind loads on every building or structure shall be determined in accordance with chapters 26-30 of ASCE 7 or provisions of the alternate all-heights method in Section 1609.6 of the Florida Building Code. There are ___ exceptions to this requirement:
    a. 5
    b. 6
    c. 7 (Section 1609.1.1)
    d. 8

40. The adjustment coefficient for a nominal garage door situated in exposure C and having a mean roof height of 30 feet is ___.
    a. 1.35
    b. 1.66
    c. 1.40 (Table 1609.7.2)
    d. 1.49