2024 IBC Significant Changes - Structural

Based on the 2024 *International Building Code*® (IBC®)

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GOAL & OBJECTIVES

Description

- This seminar reviews and analyzes selected significant changes from the 2021 to the 2024 edition of the *International Building Code* (IBC). Although the focus of the presentation is on revisions to the IBC fire- and life-safety provisions, additional areas of discussion include accessibility, construction materials and building services. The seminar assists building officials, fire officials, plans examiners, inspectors and design professionals in identifying the specific code changes that have occurred and understanding the reasoning behind the changes. A substantial number of significant structural changes will also be discussed.

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INSTRUCTORS

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Referenced Documents

6

6

Structural Design

Chapter 16

13

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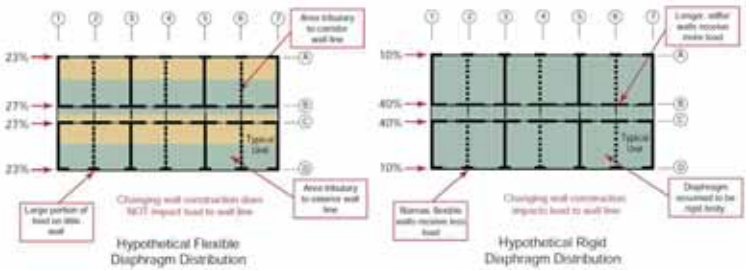
EXAMPLE

1604.4 Flexible vs Rigid Diaphragms



- Diaphragms difficult to assign as either flexible or rigid per ASCE 7, or
- Diaphragms per SDPWS

→

- Envelope analysis and design components for more severe load condition, or
- Semirigid analysis

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1604.5 Risk Category

- Every building is assigned a risk category

I II III IV

I – Low hazard to human life
II – Ordinary buildings (not RC I, III or IV)
III – Substantial hazard to human life
IV – Essential facilities

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CODE CHANGE

Table 1604.5 Risk Categories

- Power generating stations
  - No IBC definition
  - 75 MW_{AC} established as smallest power-producing unit
  - Risk Category III

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CODE CHANGE

Table 1604.5 Risk Categories

RC IV

- Essential facilities
- Buildings where loss of function represents a substantial hazard to occupants or users
  - Public utility facilities providing power generation, potable water treatment, or wastewater treatment

Credit: www.greshamsmith.com
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CODE CHANGE

Table 1604.5 Risk Categories – Group I-2 & I-3

Institutional Occupancy		RC III	RC IV
I-2	24-hr medical care for 6+ persons incapable of self-preservation		x
I-3	Prisons/jails/detention for 6+ persons		
	Condition 1 – self-preservation capability	x	
	Other than Condition 1		x

- Essential facilities
- Buildings where loss of function represents a substantial hazard to occupants or users

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CODE CHANGE

202 Definitions – PV Systems

- Photovoltaic (PV) systems
- Ground-mounted
  - Independent system without useable space underneath
  - Installed directly on the ground
- Elevated
  - Independent support structure designed with useable space beneath
    - Minimum clear height 7.5 feet
  - Intended for secondary use
    - e.g. vehicle shade or parking

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CODE CHANGE

1604.5.2 Photovoltaic (PV) Panel Systems

PV Systems & Elevated PV Support		Risk Category (RC) I	II	III	IV
1	Ground mounted for Group R-3 only	x			
2	Ground mounted other than 1 & 5		x		
3	Elevated other than 4, 5 & 6		x		
4	Rooftop and elevated PV on top of buildings	Same as building RC			
5	Paired with ESS & dedicated backup for RC IV building				x
6	Elevated & used for emergency vehicle parking				x

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CODE CHANGE

1604.5 Risk Category – Parking Garages

Exception 2

Freestanding parking garages not used for the storage of emergency services vehicles, and not providing means of egress for buildings or structures assigned to a higher risk category, shall be assigned to Risk Category II.

- Most parking garages now RC II
- Can exclude drive aisles in net area calcs
  - Table 1604.5 footnote "a"

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CODE CHANGE

1607 Live Loads

Subject	2024 IBC	2021 IBC	Changes
Uniform	1607.3	1607.3	Reorg
Partial Loading of Floors	1607.3.1	1607.13	Reorg
Partial Loading of Roofs	1607.3.2	1607.14	Reorg
Partitions	1607.5	1607.5	Reorg and ASCE 7-22
Helipads	1607.6	1607.6	Reorg and revise
Heavy Vehicle	1607.8	1607.8	Emergency vehicles
Handrails and Guards	1607.9	1607.9	ASCE 7-22
Fixed Ladders	1607.10	1607.17	Renumbered
Vehicle Barriers	1607.11	1607.10	Renumbered
Impact	1607.12	1607.11	Renumbered
Reduction Uniform LL	1607.13	1607.12	Renumbered
Alternate ULL Reduction	1607.13.2	1607.12.2	Reorg

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CODE CHANGE

1607 Live Loads

Subject	2024 IBC	2021 IBC	Changes
Reduction Uniform RLL	1607.14	1607.14.2	Reorg
Occupiable Roofs	1607.14.2	1607.14.2.2	Reorg
Awnings and Canopies	Deleted	1607.14.3	Covered elsewhere
Photovoltaic Systems	1607.14.3	1607.14.4	Reorg
Crane	1607.15	1607.15	ASCE 7-22
Library Stack Rooms	1607.17	1607.18	Renumbered
Assembly Seating	1607.18	1607.19	Renumbered
Sidewalks/Driveways – Trucks	1607.19	1607.20	Renumbered
Stair Treads	1607.20	1607.21	Renumbered
Residential Attics	1607.21	1607.22	Renumbered

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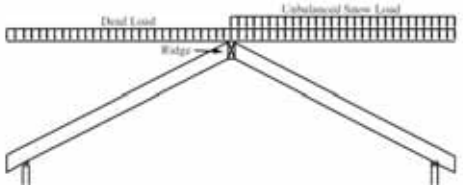
CODE CHANGE

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 not be less than the minimum uniformly distributed live loads given in Table 1607.1. Live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

- Moved from 1607.14



2018 WFCM Commentary – American Wood Council, Leesburg, VA

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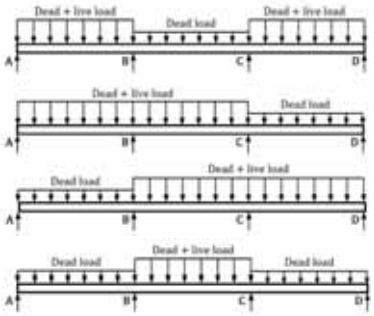
CODE CHANGE

1607.3 Live Loads – Partial Loading

- Floors and Roofs
  - Moved from 1607.13 and 1607.14 and modified
  - DL + patterned LL
    - Produce greatest load effect
  - Reduced LL permitted



Structural Load Determination: 2024 IBC and ASCE/SEI 7-22 – McGraw Hill

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CODE CHANGE

Table 1607.1 Minimum Live Loads

Moved to Recreational Use

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs)
1. Apartments (see residential)	--	--
2. Access floor systems		
Office use	50	2,000
Computer use	100	2,000
3. Armories and drill rooms	150	--
4. Assembly areas		
Fixed seats (fastened to floor)	60	--
~~Follow spot, projections and control rooms~~	~~50~~	
Lobbies	100	
Movable seats	100	
Stage floors	150	
Platforms (assembly)	100	
Bleachers, folding and telescopic seating and grandstands	100	
Stadiums and arenas with fixed seats	60	
Other assembly areas	100	

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CODE CHANGE

Table 1607.1 Minimum Live Loads

OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (lbs)
15. Garages and vehicle floors	Passenger vehicles ~~only~~ garages	40	See § 1607.7
	Trucks and buses	See § 1607.8	
	Fire trucks and emergency vehicles	See § 1607.8	
	Forklifts and movable equipment	See § 1607.8	
17. Helipads	Helicopter takeoff weight 3,000 lb or less	40	See § 1607.6.1
	Helicopter takeoff weight more than 3,000 lb	60	See § 1607.6.1

- Primarily reformatting

Live Load Reduction not Permitted

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CODE CHANGE

Table 1607.1 Minimum Live Loads

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs)
25. Public restrooms	Same as live load for area served but not required to exceed 60 psf	–

- Remaining sections renumbered

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CODE CHANGE

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* is 80 psf or greater~~. The partition *load* shall be not less than a ~~uniformly distributed~~ *live load* of 15 psf and shall not be reduced per Section 1607.13.

Exception: A partition *live load* is not required where the minimum specified *live load* is 80 psf or greater.

- Consistent with ASCE 7-22 § 4.3.2
- Partition live loads are not reducible
  - Can be relocated and clustered differently

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CODE CHANGE

1607.8.2 Fire Trucks and Emergency Vehicles

Emergency vehicle loads need not be assumed to act concurrently with other uniform live loads.

- Consistent with ASCE 7-22 new section §4.10.4
- Operating loads
- Wheel and outrigger reactions
  - Outriggers up to 60,000 lb

https://www.chicagotribune.com/news/breaking/ct-fire-engine-fall-after-parking-garage-collapsed-20190806-bt42ai7z2jhjzcjrtrwe7vrsb4-story.html

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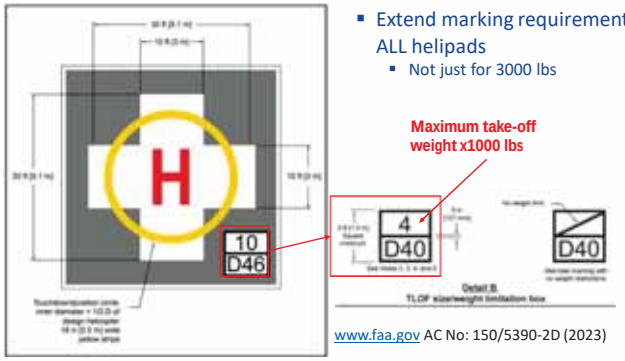
CODE CHANGE

1607.6 Helipads



- Extend marking requirements to ALL helipads
  - Not just for 3000 lbs

www.faa.gov AC No: 150/5390-2D (2023)

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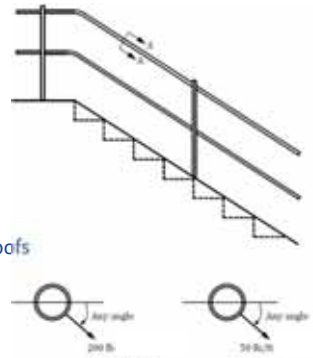
CODE CHANGE

1607.9 Handrails and Guards

- Consistent with ASCE 7-22 §4.5
- 50 plf uniform load
  - Not concurrent with 200 lb concentrated load
  - Does not apply to unoccupiable roofs



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Structural Load Determination: 2024 IBC and ASCE/SEI 7-22 – McGraw Hill

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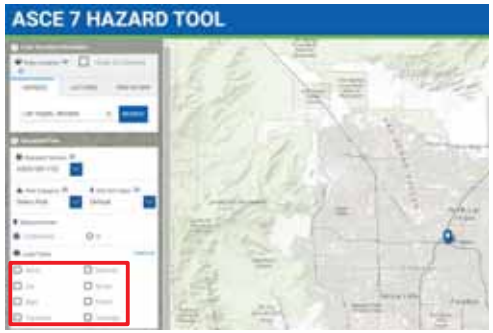
- Free resource
- Geo coordinates
- 7-10, 7-16, 7-22
- Risk Category
- Environmental Loads



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EXAMPLE

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Full Report PDF

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CODE CHANGE

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 the reliability-targeted (strength based) ground snow load values in Chapter 7 of ASCE 7 or Figures 1608.2(1) ~~and 1608.2(2)~~ through 1608.2(4) for the contiguous United States and Table 1608.2 for Alaska. Site-specific case studies shall be determined in accordance with Chapter 7 of ASCE 7 and shall be *approved* by the *building official*. ~~made in areas designated "CS" in Figures 1608.2(1) and 1608.2(2). Ground snow *loads* for sites at elevations above the limits indicated in Figures 1608.2(1) and 1608.2(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*.

- Strength-based ground snow loads
- New maps based on risk category
- ASCE Hazard tool also provides GSL values (asce7hazardtool.online)
  - Based on risk category
  - Free resource

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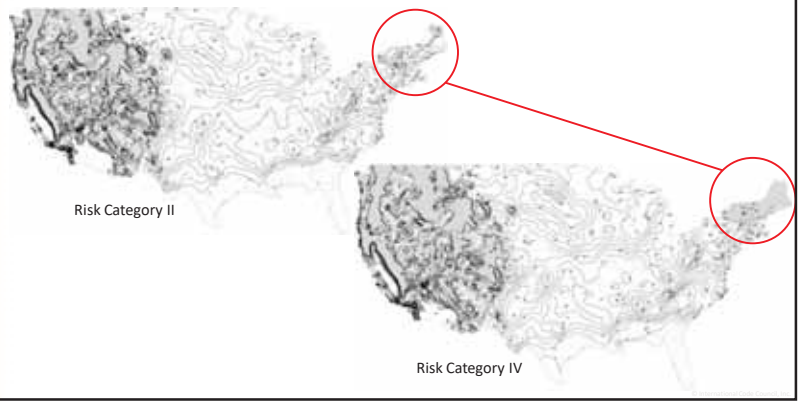
CODE CHANGE

Ground Snow Load Maps – Figs 1608.2(2&4)



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CODE CHANGE

1608.2.1 Ground Snow Conversion

Where required, the ground snow loads, p_g, of Figures 1608.2(1) through 1608.2(4) and Table 1608.2 shall be converted to allowable stress design ground snow loads, $p_{g(asd)}$, using Equation 16-17.

$$p_{g(asd)} = 0.7\, p_g \qquad \text{(Equation 16-17)}$$

where:

$p_{g(asd)}$ = Allowable stress design ground snow load.

p_g = Ground snow load determined from Figures 1608.2(1) through 1608.2(4) and Table 1608.2.

- Many IBC and IRC provisions still rely on ASD values
- ASCE Hazard tool also provides ASD values (asce7hazardtool.online)
  - Free resource

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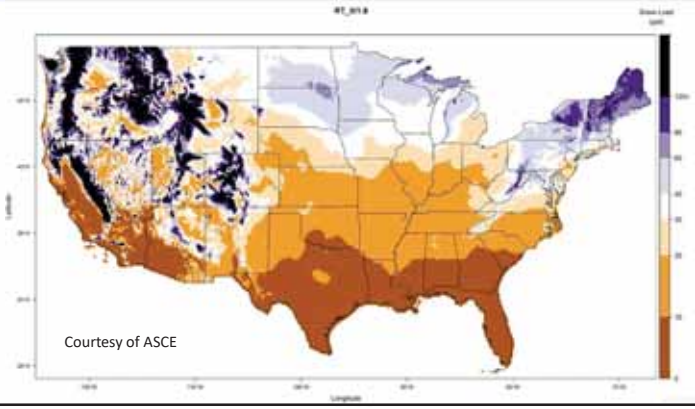
EXAMPLE

Ground Snow Loads – ASD RC II



Courtesy of ASCE

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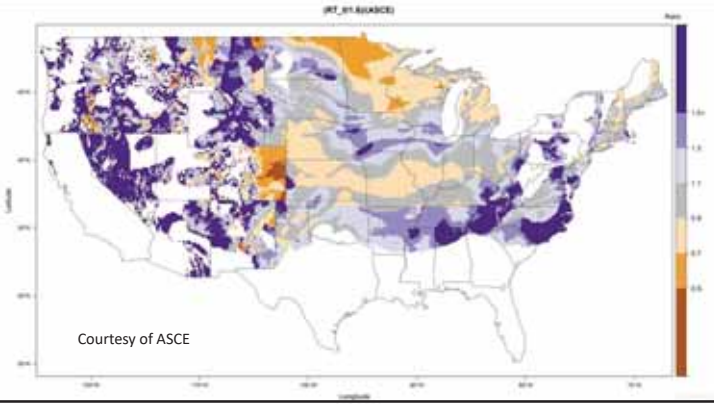
EXAMPLE

GSL Comparison – IRC 2024/2021



Courtesy of ASCE

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CODE CHANGE

202 Definitions – Wind-related

BASIC WIND SPEED, V. ~~Basic design wind speeds.~~ The wind speed used for design, as determined in Chapter 16.

WINDBORNE DEBRIS REGION. Areas within hurricane-prone regions located:

1. Within 1 mile of the mean high-water line where an Exposure D condition exists upwind at the waterline and the basic ~~design~~ wind speed, V, is 130 mph or greater; or
2. In areas where the basic ~~design~~ wind speed, V, is 140 mph or greater.

For Risk Category II buildings and structures and Risk Category III buildings and structures, except health care facilities, the windborne debris region shall be based on Figure ~~1609.3.(1)~~ 1609.3.(2). For Risk Category III health care facilities, and Risk Category IV buildings and structures ~~and Risk Category III health care facilities,~~ the windborne debris region shall be based on Figure ~~1609.3(2)~~ 1609.3(3) and Figure 1609.3(4), respectively.

WIND DESIGN GEODATABASE. The ASCE database (version 2022-1.0) of geocoded wind speed design data. The ASCE Wind Design Geodatabase of geocoded wind speed design data is available at https://asce7hazardtool.online/.

- "basic ~~design~~ wind speed" changed throughout IBC
- ASCE Wind Design Geodatabase provides values (asce7hazardtool.online)
  - Based on risk category
  - Free resource

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CODE CHANGE

1609.3 Basic Wind Speed

The basic ~~design~~ wind speed, *V*, in mph, for the determination of the wind loads shall be determined by Figures 1609.3(1) through ~~1609.3(12)~~ 1609.3(4). The basic ~~design~~ wind speed, *V*, for use in the design of Risk Category I ~~II~~ buildings and structures shall be obtained from Figures 1609.3(1), ~~1609.3(5) and 1609.3(6)~~. The basic ~~design~~ wind speed, *V*, for use in the design of Risk Category II ~~III~~ buildings and structures shall be obtained from Figures 1609.3(2), ~~1609.3(7) and 1609.3(8)~~. The basic ~~design~~ wind speed, *V*, for use in the design of Risk Category III ~~IV~~ buildings and structures shall be obtained from Figures 1609.3(3), ~~1609.3(9) and 1609.3(10)~~. The basic ~~design~~ wind speed, *V*, for use in the design of Risk Category IV ~~I~~ buildings and structures shall be obtained from Figures 1609.3(4), ~~1609.3(11) and 1609.3(12)~~. Basic wind speeds for Hawaii, US Virgin Islands, and Puerto Rico shall be determined by using the ASCE Wind Design Geodatabase. The ASCE Wind Design Geodatabase is available at https://asce7hazardtool.online, or an approved equivalent.

The basic ~~design~~ wind speed, *V*, for the special wind regions indicated near mountainous terrain and near gorges shall be in accordance with local jurisdiction requirements. The basic ~~design~~ wind speeds, *V*, determined by the local jurisdiction shall be in accordance with Chapter 26 of ASCE 7. In nonhurricane-prone regions, when the basic ~~design~~ wind speed, *V*, is estimated from regional climatic data, the basic design wind speed, *V*, shall be determined in accordance with Chapter 26 of ASCE 7.

- Related technical and editorial changes throughout IBC
- Consistent with ASCE 7-22
- Hawaii, US Virgin Islands, and Puerto Rico per ASCE Wind Design Geodatabase

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CODE CHANGE

Wind Speed Comparison – RC II

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EXAMPLE

Coastal Wind Speeds

Excerpt of ASCE 7-22 Table C26.5-3 – Basic Wind Speeds (mph)

Location	Risk Cat. II (700-year)	Risk Cat. III (1,700-year)	Risk Cat. IV (3,000-year)
Bar Harbor, Maine	109	119	121
Hampton Beach, New Hampshire	113	124	125
Boston, Massachusetts	116	125	129
Hyannis, Massachusetts	123	139	141
Newport, Rhode Island	124	139	139
New Haven, Connecticut	120	129	133
Southampton, New York	129	138	140
Manhattan, New York	116	127	130
Atlantic City, New Jersey	126	135	138
Rehoboth Beach, Delaware	122	131	136
Ocean City, Maryland	128	136	139
Virginia Beach, Virginia	125	132	138
Wrightsville Beach, North Carolina	146	156	160
Folly Beach, South Carolina	149	158	165
Sea Island, Georgia	131	145	153
Jacksonville Beach, Florida	129	140	149
Melbourne Beach, Florida	152	162	172
Miami Beach, Florida	171	183	191
Key West, Florida	176	200	200
Clearwater, Florida	146	154	160
Panama City Beach, Florida	141	146	162
Gulf Shores, Alabama	159	172	181
Biloxi, Mississippi	157	176	177
Slidell, Louisiana	138	152	155
Cameron, Louisiana	141	154	157
Galveston, Texas	151	159	166
Port Aransas, Texas	159	157	174

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EXAMPLE

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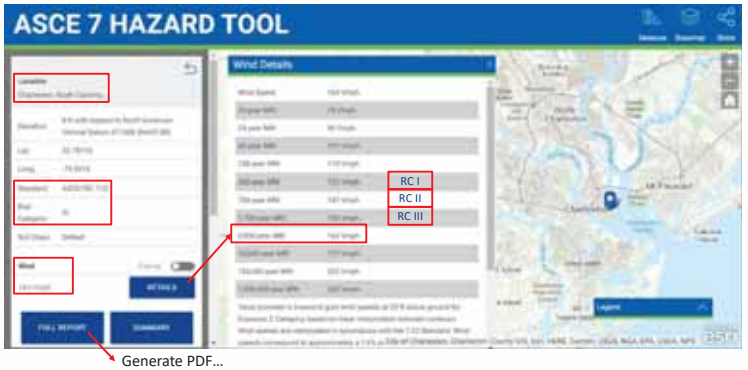

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CODE CHANGE

1609.5 Tornado Loads

The design and construction of Risk Category III and IV buildings and other structures located in the tornado-prone region as shown in Figure 1609.5 shall be in accordance with Chapter 32 of ASCE 7, except as modified by this code.

- Risk Category III and IV buildings
- Tornado-prone region
- New ASCE 7 Chapter 32

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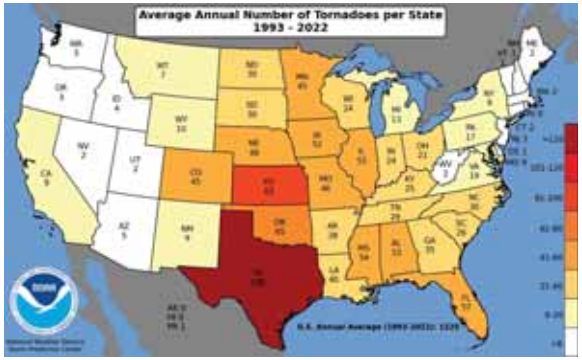
Why is this important?



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Why is this important?

Reported tornadoes from 1995 to 2016

Scale	Wind Speed (mph)	Damage
EF0	65–85	Light damage
EF1	86–110	Moderate damage
EF2	111–135	Considerable damage
EF3	136–165	Severe damage
EF4	166–200	Devastating damage
EF5	>200	Incredible damage

89%

97%

Enhanced Fujita (EF) Scale

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CODE CHANGE

1609.5 Tornado-prone Region

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CODE CHANGE

§ 32.1.1

Tornado Loads – Scope

Buildings and other structures classified as Risk Category III or IV and located in the tornado-prone region as shown in Figure 32.1-1, including the main wind force resisting system (MWFRS) and all components and cladding (C&C) thereof, shall be designed and constructed to resist the greater of the tornado loads determined in accordance with the provisions of this chapter or the wind loads determined in accordance with Chapters 26 through 31, using the load combinations provided in Chapter 2.

- Design for greater of tornado loads or wind loads
- Evaluate both MWFRS and C&C

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CODE CHANGE

§ 32.5.2

Design for Tornado Loads Not Required

V_T < 60 mph

Where $V_T \geq 60$ mph but less than

- Exposure B: $V_T < 0.50V$
- Exposure C: $V_T < 0.60V$
- Exposure D: $V_T < 0.67V$

V_T (mph)	V (mph) Exposure B	C	D
60	120	100	90
70	140	117	104
80	160	133	119
90	180	150	134
100	200	167	149
110	-	183	164
120	-	200	179
130	-	-	194
140	-	-	-

- V_T = tornado speed (Chapter 32)
- V = basic wind speed (Chapter 26)
- Exposure category (Chapter 26)
  - Only used to determine applicability – not to determine loads

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CODE CHANGE

§ 32.1.1

Not for Storm Shelter Design

… A building or other structure designed for tornado loads determined exclusively in accordance with Chapter 32 **cannot be designated as a storm shelter without meeting additional critical requirements** provided in the applicable building code and ICC 500, the ICC/NSSA *Standard for the Design and Construction of Storm Shelters…*

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EXAMPLE

423.4 Storm Shelters

- Critical services → RC IV
  - 911 call stations
  - Emergency ops centers
  - Fire, rescue, ambulance and police stations
- Storm shelter per ICC 500
- V = 250 mph (red zone)

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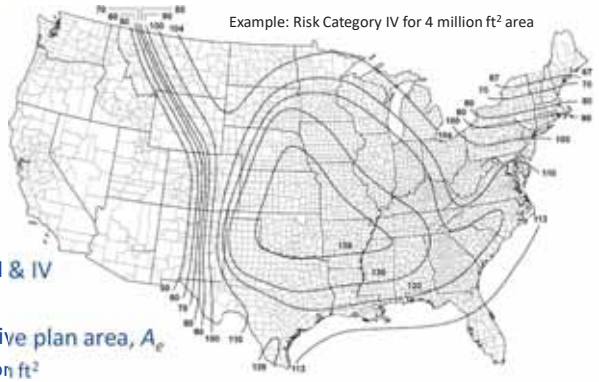
CODE CHANGE

§ 32.5.1

Tornado Speed, V_T

Example: Risk Category IV for 4 million ft² area



- Risk Category III & IV
  - 16 maps
- Based on effective plan area, A_e
  - 1 ft² to 4 million ft²

Figure 32.5-2H from *ASCE/SEI 7-22* – ASCE

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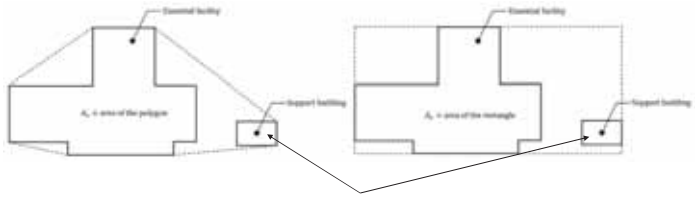
CODE CHANGE

§ 32.5.4

Effective Plan Areas, A_e



Required to maintain functionality of essential facility

Figure 5.24 from *Structural Load Determination: 2024 IBC and ASCE/SEI 7-22* – McGraw Hill

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EXAMPLE

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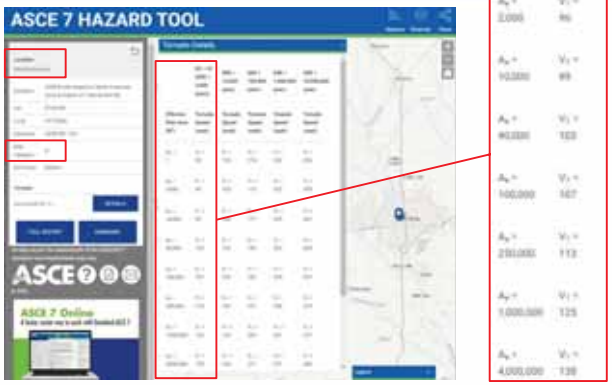

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CODE CHANGE

1611.1 Design Rain Load

Each portion of a roof shall be designed to sustain the load of rainwater as per the requirements of Chapter 8 of ASCE 7. Rain loads shall be based on the summation of the static head, d_s, hydraulic head, d_h, and ponding head, d_p, using Equation 16-19. The hydraulic head shall be based on hydraulic test data or hydraulic calculations assuming a flow rate corresponding to a rainfall intensity equal to or greater than the 15-minute duration storm with return period given in Table 1611.1. Rainfall intensity shall be determined in inches per hour for 15-minute duration storms for Risk Category given in Table 1611.1. ~~The design rainfall shall be based on the 100-year 15-minute duration event, or on other rainfall rates determined from approved local weather data. Alternatively, a design rainfall of twice the 100-year hourly rainfall rate indicated in Figures 1611.1(1) through 1611.1(5) shall be permitted.~~ The ponding head shall be based on structural analysis as the depth of water due to deflections of the roof subjected to unfactored rain load and unfactored dead load.

- Consistent with ASCE 7-22 §8.2
  - Ponding head added
- Primary drain typically designed for 1-hour duration
- Secondary drain must be designed for 15-minute duration
  - Option for 2x hourly rate deleted

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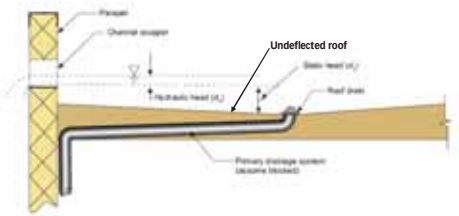
CODE CHANGE

1611.1 Rain Loads

$R = 5.2(d_s + d_h + d_p)$ (IBC Equation 16-20)

R – rain load on undeflected roof
d_s – static head
d_h – hydraulic head
d_p – ponding head



61

61

CODE CHANGE

1611.1 Rain Loads

- Secondary drainage system for structural loading (SDSL)
  - Roof drainage system through which water is drained when primary drainage system blocked
  - SDSL ≥ 2" above primary drain

62

62

CODE CHANGE

1611.1 Rain Loads

IBC Table 1611.1 Design Storm Return Period by Risk Category

Risk Category	Design Storm Return Period
I & II	100 years
III	200 years
IV	500 years

- Existing IBC rainfall maps deleted
- Intensity based on risk category
- ASCE Hazard Tool
  - Free resource for determining rain load
  - 15-min and 60-min intensities

63

63

CODE CHANGE

1612.3 Flood Loads – Design and Construction

The design and construction of buildings and structures located in *flood hazard areas*, including *coastal high hazard areas* and *coastal A zones*, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24. Elevators, escalators, conveying systems and their components shall conform to ASCE 24 and ASME A17.1/CSA B44 as applicable.

Exception: *Temporary structures* complying with Section 3103.6.1.3.

- Elevators & escalators per ASCE 24 and ASME A17.1
- New exception for temporary structures
- Similar provisions for wind and seismic

64

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CODE CHANGE

Summary of ASCE 7-22 s2 Major Flood Load Changes

- Flood Hazard Area increased from 100-year flood plain to 500-year flood plain for Risk Categories II, III, and IV structures
- Significant reorganization
- New provisions
  - Flood Velocity
  - Wave Effects
  - Scour
  - Debris Impact

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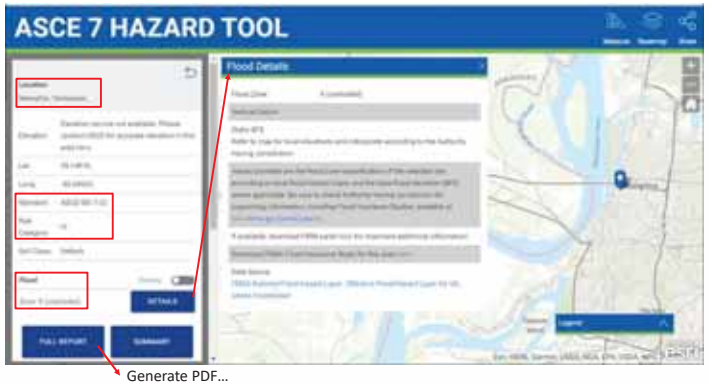
EXAMPLE

asce7hazardtool.online



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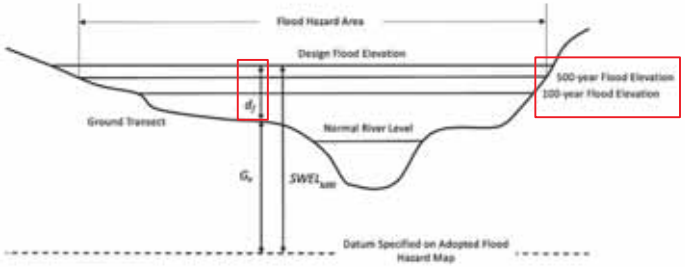
CODE CHANGE

Design Stillwater Flood Depth, d_f



Flood Parameters in Riverine Areas

S2 §F5.2-2

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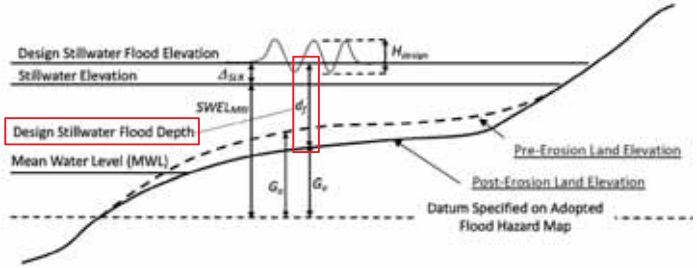
CODE CHANGE

Design Stillwater Flood Depth, d_f



Flood Parameters in Coastal Areas

S2 §F5.2-1

68

68

CODE CHANGE

1613.1 Earthquake Loads – 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 Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. 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.~~

(no changes to exceptions 2-5)

6. *Temporary structures* complying with Section 3103.6.1.4.

- Application based on SDC alone not S_S
- New exception for temporary structures

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69

CODE CHANGE

1613.2 Determination of Seismic Design Category

~~**Seismic ground motion values**~~ **Determination of Seismic Design Category.** ~~Seismic ground motion values shall be determined in accordance with this section.~~ Structures shall be assigned to a Seismic Design Category based on one of the following methods unless the authority having jurisdiction or geotechnical data determines that Site Class DE, E or F soils are present at the site.

1. Based on the structure risk category using Figures 1613.2(1) through 1613.2(7).
2. Determined in accordance with ASCE 7.

Where Site Class DE, E or F soils are present, the Seismic Design Category shall be determined in accordance with ASCE 7.

(Sections 1613.2.1 through 1613.2.5 deleted without substitution)

- Site classes A, B, BC, C, CD, D
- SDC determined by
  - 1 of 7 IBC maps
  - ASCE 7 maps
  - asce7hazardtool.online
- All other site classes per ASCE 7

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CODE CHANGE

Site Classification

Site Class	v_s (ft/s)	
A. Hard rock	>5,000	Based on shear wave velocity tests only
B. Medium hard rock	~~2,500~~>3,000 to 5,000	
BC. Soft rock	>2,100 to 3,000	
C. Very dense ~~soil and soft rock~~ sand or hard clay	~~1,200~~>1,450 to ~~2,500~~2,100	Use if soil properties unknown
CD. Dense sand or very stiff clay	>1,000 to 1,450	
D. ~~Stiff soil~~ Medium dense sand or stiff clay	~~600~~>700 to ~~1,200~~1,000	
DE. Loose sand or medium stiff clay	>500 to 700	
E. ~~Soft clay soil~~ Very loose sand or soft clay	~~<600~~≥500	
F. Soils requiring a site response analysis in accordance with ASCE/ SEI 21.1	See Section 20.2.1	

Average shear wave velocity parameter, v_s, is derived from the measured shear wave velocity profile from the ground surface to a depth of 100 ft.

Adapted from ASCE 7-22 Table 20.2-1

T 20.2-1

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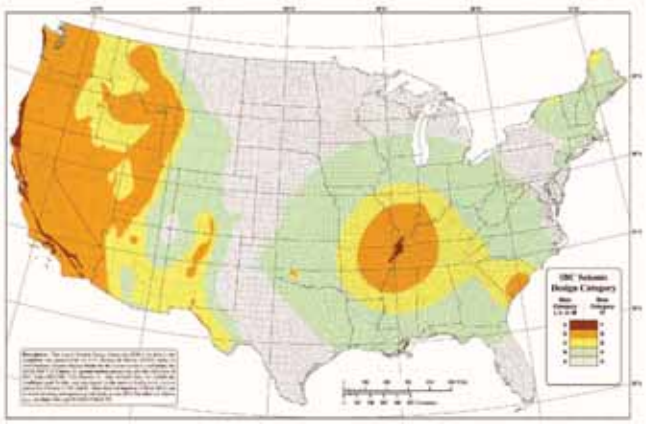
Seismic Design Categories



Figures 1613.2.1(1) & (2) Western and Eastern U.S.

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EXAMPLE

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CODE CHANGE

1613.4 Ballasted Photovoltaic Panel Systems

Ballasted, roof-mounted photovoltaic panel systems need not be rigidly attached to the roof or supporting structure. ~~Ballasted non-penetrating systems~~ Ballasted, unattached PV panel systems shall be designed and installed only on roofs with slopes not more than one unit vertical in 12 units horizontal. ~~Ballasted nonpenetrating systems~~ Ballasted, unattached PV panel systems shall be designed to ~~resist~~ accommodate sliding ~~and uplift~~ in accordance with ASCE 7 Chapter 13. ~~resulting from lateral and vertical forces as required by Section 1605, using a coefficient of friction determined by acceptable engineering principles. In structures assigned to Seismic Design Category C, D, E or F, ballasted nonpenetrating systems shall be designed to accommodate seismic displacement determined by nonlinear response-history or other approved analysis or shake-table testing, using input motions consistent with ASCE 7 lateral and vertical seismic forces for nonstructural components on roofs.~~

- Ballasted, unattached PV systems
  - Roofs ≤ 1:12
  - Designed to accommodate sliding per ASCE 7
  - Simplified provisions

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CODE CHANGE

1613.6 Automatic Sprinkler Systems

Where required, automatic sprinkler systems, including anchorage and bracing, shall comply with ASCE 7 and Section 903.3.1.1.

- Nonstructural components
- Consistent with ASCE 7-22
  - Clearances for sprinkler drops and sprigs
- Consistent with NFPA 13
  - *Standard for the Installation of Sprinkler Systems*

75

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CODE CHANGE

1605.1 Load Combinations

General. Buildings and *other structures* and portions thereof shall be designed to resist the strength load combinations specified in ASCE 7, Section 2.3, the *allowable stress design* load combinations specified in ASCE 7, Section 2.4, or the alternative *allowable stress design* load combinations of Section 1605.2.

Exceptions:

1. The modifications to load combinations of ASCE 7 Section 2.3, ASCE 7 Section 2.4, and Section 1605.2 specified in ASCE 7 Chapters 18 and 19 shall apply.
2. Where the allowable stress design load combinations of ASCE 7 Section 2.4 are used, flat roof snow loads of ~~30~~ 45 pounds per square foot and roof live loads of 30 pounds per square foot or less need not be combined with seismic load. Where flat roof snow loads exceed ~~30~~ 45 pounds per square foot, ~~20~~ 15 percent shall be combined with seismic loads.

- Strength Design per ASCE 7 Section 2.3
- ASD per ASCE 7 Section 2.4
- Alternative ASD per 1605.2
- ASD snow load values adjusted for new risk-based approach

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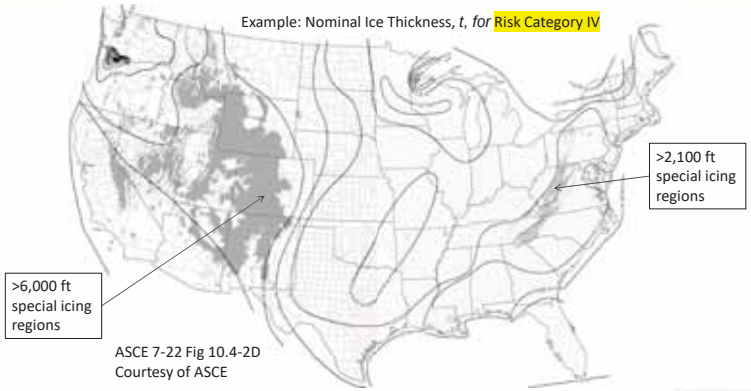
CODE CHANGE

1614 – Atmospheric Ice Loads



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CODE CHANGE

1615.1 Tsunami Loads – General

The design and construction of Risk Category III and IV buildings and structures located in the Tsunami Design Zones defined in the Tsunami Design Geodatabase shall be in accordance with Chapter 6 of ASCE 7, except as modified by this code.

Exception: Temporary structures complying with Section 3103.6.1.6.

- New exception for temporary structures

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CODE CHANGE

Summary of ASCE 7-22 Major Tsunami Load Changes

- Updated subsidence maps
- High-resolution maps for highly populated areas (CA)
- Higher order models permitted
- Overtopped wall pressure provisions updated
- Tumbling debris impact on interior columns for SoG design
- Building drag coefficient simplified
- Clarification for push-over analysis
- Provisions for hydrodynamic load on pipes
- Debris impact zone extended to grounding limit or resilient structures
- Debris damming for warehouses and parking garages
- Improved provisions for scour and pore pressure softening around foundations
- Exception for SDC D-F if SFRS is adequate to resist tsunami loads

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EXAMPLE

asce7tsunami.online

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Soils and Foundations

Chapter 18

84

84

CODE CHANGE

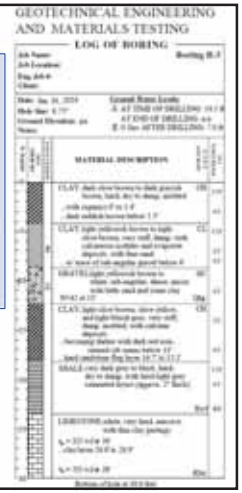
1803.5.4 ~~Ground-water table~~ Groundwater. A ~~subsurface soil~~ geotechnical investigation shall be performed to determine ~~whether~~ if:

1. ~~the existing ground-water table~~ Groundwater is above or within 5 feet (1524 mm) below the elevation of the lowest floor level where such floor is located below the finished ground level adjacent to the foundation.

2. The groundwater depth will affect the design and construction of buildings and structures.

~~Exception:~~ ~~A subsurface soil investigation to determine the location of the ground-water table shall not be required where waterproofing is provided in accordance with Section 1805.~~

- "geotechnical investigation" used throughout
- Waterproofing exception deleted
- Groundwater depth required for design
  - Example: identifying hydrostatic pressures



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CODE CHANGE

1809.14 & 1810.3.12 Grade Beams

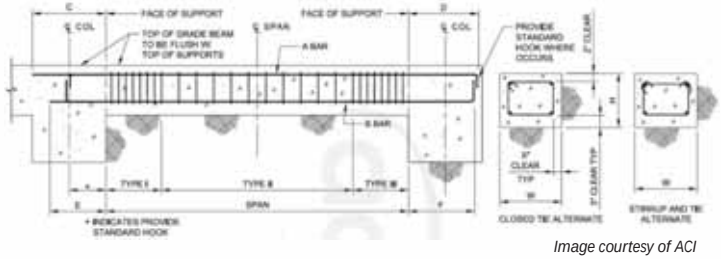

Image courtesy of ACI

- Applicable to shallow and deep foundations
- High seismic regions
- Designed per ACI 318 and ASCE 7

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CODE CHANGE

1810.3.2.8 Higher Allowable Stresses

- Pile tests justify higher tabulated values
- Not to justify values higher than tabulated

Table 1810.3.2.6 (excerpt) Allowable Stresses for Materials Used in Deep Foundation Elements

Material Type and Condition	Maximum Allowable Stress*
3. Steel in compression	
Pipes, tubes or Hpiles, where justified in accordance with Section 1810.3.2.8	$0.5\,F_y \le 32{,}000$ psi
Other pipes, tubes or Hpiles	$0.35\,F_y \le 24{,}000$ psi
5. Steel in tension	
Pipes, tubes or Hpiles, where justified in accordance with Section 1810.3.2.8	$0.5\,F_y \le 32{,}000$ psi
Other pipes, tubes or Hpiles	$0.35\,F_y \le 24{,}000$ psi
Helical piles	$0.6\,F_y \le 0.5\,F_u$

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Concrete

Chapter 19

89

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1901.2.1 Concrete with GFRP Reinforcement

CODE CHANGE

- Glass fiber-reinforced polymer (GFRP)
- ACI 440.11-22 for design
- ASTM D7957 for manufacture
- Uses include
  - Near MRI equipment
  - Highly corrosive environments
    - Bridge decks
    - Parking garages
    - Marine structures

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1905 Seismic Requirements

CODE CHANGE

Section	Summary of Changes
1901.2, 1901.3	Reflects conceptual changes to Section 1905 supplemental seismic provisions
1902.1	▪ 1902.1.1 added for design earthquake diaphragm displacement in ASCE 7-22 ▪ Permitted as zero for diaphragms idealized as rigid
1903.2	Deleted – duplicated 1901.6
1905.1	Implements conceptual change to Section 1905 supplemental seismic provisions
1905.2	New definitions added from ASCE 7-22 Chapter 14 which is not adopted in 2024 IBC ▪ Cast-in-Place Concrete Equivalent Diaphragm ▪ Precast Concrete Diaphragm
1905.1.2, 1905.3, 1905.1.4, 1905.4, 1905.5, 1905.7	Deletions and additions implement conceptual changes to Section 1905
1905.6	▪ SDC A or B: detached one- and two-family dwellings up to 3 stories constructed with stud bearing walls permitted to have plain concrete footings without longitudinal reinforcement ▪ Structures in SDC C – F: plain structural concrete not permitted with exceptions

Reorganized and revised – supplemental to ACI 318 seismic design

91

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Masonry

Chapter 21

92

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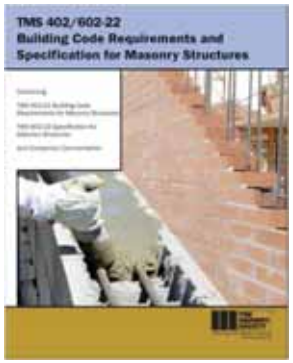
CODE CHANGE

2101.2 Design Methods

- Compression-controlled section requirements added for strength design of reinforced masonry under flexure and axial load
- Updated mortar requirements for adhered masonry veneer
- New Appendix D – GFRP Reinforced Masonry
  - Limited to SDC A - C for elements not part of seismic-force-resisting system
- Removal of TMS 402 Appendix A: Empirical Design
  - Empirical design via reference to TMS 402-16



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Steel

Chapter 22

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CODE CHANGE

Chapter 22 Steel – Reorganization

2021 IBC Section	Summary of Section and Content Changes
2201 General	Content added from other sections
2202 Identification of Steel for Structural Purposes	Content deleted and comparable language added to 2201.2
2203 Protection of Steel for Structural Purposes	Content deleted and comparable language added to 2201.3
2204 Connections	Content deleted and comparable language added to 2201.4
2205 Structural Steel	Renumbered as 2202 and renamed to capture composite structural steel and concrete
2206 Composite Structural Steel and Concrete Structures	Content deleted and enabling language added to 2202
	New Section 2203 Structural Stainless Steel Created
	New Section 2205 Cold-Formed Stainless Steel Created
2207 Steel Joists	No section number change
2208 Steel Cable Structures	Renumbered as 2214
2209 Steel Storage Racks	No section number change
2210 Cold-Formed Steel	Renumbered as 2204 and new Section 2208 Steel Deck created
2211 Cold-Formed Steel Light-Frame Construction	Renumbered as 2206
	New Section 2210 Metal Building Systems Created
	New Section 2211 Industrial Boltless Steel Shelving Created
	New Section 2212 Industrial Steel Work Platforms Created
	New Section 2213 Stairs, Ladders and Guarding for Steel Storage Racks and Industrial Steel Work Platforms Created

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CODE CHANGE

Chapter 22 Referenced Steel Standards

96

96

CODE CHANGE

2210 Metal Building Systems

- New definition
- Structural steel per 2202
- CFS per 2204
- Steel joists per 2207
- Steel cable per 2214
- Special inspection per 1705.2.6

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CODE CHANGE

2211 Industrial Boltless Steel Shelving

Photo courtesy of A&A Boltless Rack and Shelving

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CODE CHANGE

2212 Industrial Steel Work Platforms

Photo courtesy of tbd

99

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CODE CHANGE

2213 Stairs, Ladders and Guards

Photo courtesy of Steel King

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Wood

Chapter 23

101

101

2303.2 FRT Wood

CODE CHANGE

- ASTM E84 extended 20 min
- FRT wood and plywood including connections
  - All untreated adjustments
  - Plus adjustment for fire-retardant treatment
- FRT LVL recognized

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Table 2304.6.1 WSP Wind Capacity

CODE CHANGE

TABLE 2304.6.1 Maximum Allowable Stress Design Basic Wind Speed, V_{asd}, Permitted for Wood Structural Panel Wall Sheathing Used to Resist Wind Pressures [a, b, c]

Minimum Nail Size	Minimum Nail Penetration (Inches)	Minimum Wood Structural Panel Span Rating	Minimum Nominal Panel Thickness (Inches)	Maximum Wall Stud Spacing (Inches)	Panel Nail Spacing Edges (Inches o.c.)	Panel Nail Spacing Field (Inches o.c.)	Maximum Allowable Stress Design Basic Wind Speed, V_{asd} [d] (mph) Wind Exposure Category B	C	D
6d common (2.0" × 0.113")	1.3	24/0	7/16	16	6	12[e]	140[f][g]	115[g]	110[g]
		24/16	7/16	16	6	12[e]	130[f][g]	125[g]	115[g]
						6[e]	130[f][g]	160[g][h]	130[f][g]

- Tabulated values modified for basic wind speeds consistent with ASCE 7-22
- New footnote provides prescriptive option for framing species with specific gravity lower than 0.42

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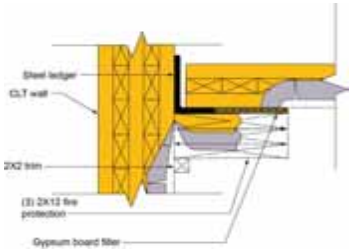
2304.10.1 Fire Protection of Connections

CODE CHANGE

- Connections in Type IV-A, IV-B and IV-C construction
- Required fire protection for time associated with
  - Columns
  - Primary structural frame other than columns
- ASTM E119 testing of connections not required



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CODE CHANGE

2305.1 Wood Shear Walls and Diaphragms

- Language modified to allow for CLT shear walls and diaphragms
- Capacity reductions account for permanent lateral loads such as soils

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CODE CHANGE

2305.1 Wood Shear Walls and Diaphragms

- Revised shear provisions
- New provisions for taper cuts
- Notching provisions clarified
- Built-up column provisions clarified
- Revised provisions for multiple member shear connections
- Revised fire design chapter to coordinate with FDS

Image courtesy of AWC

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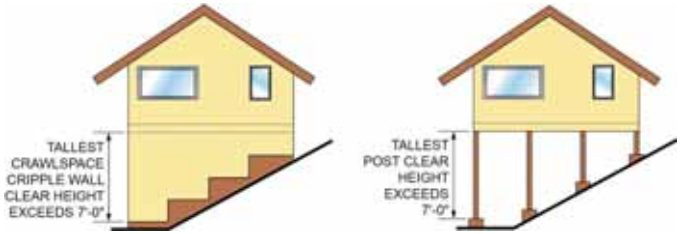
CODE CHANGE

2308.2.7 Hillside Light-frame Wood Construction

- New load path requirements intended to improve seismic performance of hillside light-frame wood buildings



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CODE CHANGE

Table 2308.11.4 Wind Uplift

Nominal Design Basic Wind Speed, V_{asd}[1]	Roof Span (feet)							Overhangs (pounds/ foot)[4]
	12	20	24	28	32	36	40	
Exposure B								
85 90	-72 64	-109 85	-145 96	-169 107	-193 117	-217 128	-241 139	-36.55
90 100	-89 102	-134 129	-181 158	-213 177	-242 195	-272 214	-303 233	-43.22
100 110	-131 143	-201 199	-262 226	-305 254	-349 282	-393 310	-436 338	-53.06

- Roof-to-wall connection uplift loads updated to ASCE 7-22
- Tabulated for 90-140 mph
- Exposure B, C and D
- Assume 24" overhangs

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CODE CHANGE

2309.1 Wood Frame Construction Manual

- Updates align with SDPWS-2021 provisions
- C&C-based roof tables consistent with ASCE 7-22
- Snow load tables add strength-based GSL values
  - Enable use with new strength-based maps and ASD-based snow loads

Image courtesy of AWC

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Resources

Available for use or that can be used for support or help

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Codes and Standards

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IBC Significant Changes

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Digital Codes Premium

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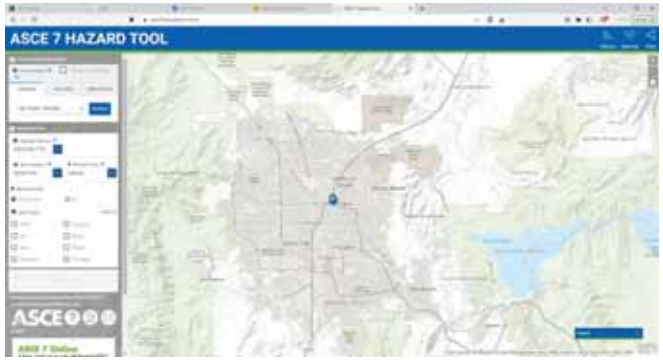
asce7hazardtool.online



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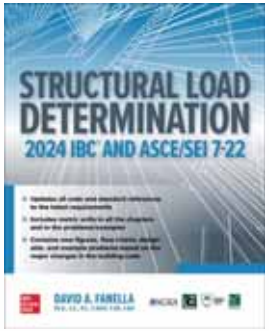
Textbook with Solved Examples



- Figures, flow charts, design aids, and example problems
- Loads: dead, live, rain, snow, ice, wind (including tornado), earthquake, flood and tsunami

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STRUCTURE Magazine Articles

- Nov ‘23 - Roof Assemblies (Ch 15)
- Dec ‘23 - Special Inspection (Ch 17) and Soils/Foundations (Ch 18)
- Jan ‘24 - Concrete (Ch 19) and Masonry (Ch 21)
- Feb ‘24 - Steel (Ch 22)
- Mar ’24 - Structural Design (Ch 16) – Risk Categories
- Apr ‘24 - Structural Design (Ch 16) – ASCE 7-22 Loads
- May ‘24 - Wood (Ch 23)
- Jun ’24 - Glass and Glazing (Ch 24)
- Jul ‘24 - Temporary Structures (Ch 31)

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Webinar Series – ICC Learn Live

Demystifying Loads for Building Officials – 2024 IBC and ASCE 7-22

Topics in this series for 2024

• Load Path, Load Combinations and Risk Categories	June 12
• Dead, Live and Rain Loads	July 10
• Snow and Ice Loads	August 14
• Wind and Tornado Loads	September 11
• Earthquake Loads	October 9
• Flood and Tsunami Loads	November 13
• Temporary Structures	December 11

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