2001 California Building Code
(1997 UBC)

-vs-

2007 California Building Code
(2006 IBC)

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Conventional Framing Provisions Comparison

ACKNOWLEDGEMENTS

This document was primarily authored by Bill Nagel, S.E. with contributions from James Russell, P.E. and reviewed by the conventional framing subcommittee of the CALBO Seismic Safety Committee.

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GENERAL REQUIREMENTS

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Conventional framing allowed in one, two and three story group R and U occupancy buildings regardless of seismic zone. (2320.1)	Conventional framing restricted to three stories in Seismic Design Categories (SDC) A and B and two stories in SDC C and one story in SDC's D & E. (IBC 2308.11.1 & 2308.12.1) *HCD has modified this to allow detached one and two-family dwellings to be three stories in SDC C and two stories in SDC's D & E. Note: This is exactly what was permitted under the 2003 edition of the IBC and was eliminated from the 2006 IBC because conventional construction requirements for one and two-family dwellings were removed from IBC Section 2308, to direct code users to instead apply the provisions of the International Residential Code (IRC). Because California is not adopting the IRC these amendments were necessary.* Cripple walls are considered a story for the purpose of applying bracing requirements from Tables 2308.9.3(1) or 2308.12.4 with the exception of cripple walls that are solid blocked and have studs that do not exceed 14 in height. (2308.2 # 1, 2308.9.4.1 and 2308.12.4) Conventional framing is not allowed in SDC F.
Conventional framing allowed in one-story buildings constructed on a slab on grade and on the top story of two story wood framed buildings in Occupancy Category 4 buildings (Certain non-residential uses per Table 16-K). (2320.1 #2 & #4)	Conventional framing is limited to maximum 40 psf live loads on floors thereby eliminating most commercial occupancies. (2308.2 # 3.2) Occupancy Category IV buildings (essential services) not allowed in SDC's B,C,D,E or F. (2308.2 #6 and Table 1604.5)
AF & PA Wood Frame Construction Manual (WFCM) is not a recognized document in the CBC.	Allows compliance with AF & PA WFCM subject to limitations therein and limitations in the IBC. (2308.1)

GENERAL REQUIREMENTS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Unusually shaped buildings must have engineered lateral design in Seismic Zones 3 and 4. (2320.4.4 and 2320.5.4)	Irregular portions of buildings in SDC D and E must have an engineered lateral design. HCD and local jurisdictions in SDC C should consider amending this to include SDC C, otherwise irregular buildings located in the SDC C portions of California will have less seismic protection than was previously required when these irregularities are present. Irregularity provisions were applicable to Seismic Zones 3 and 4 since the 1994 UBC, and for unusual shape, size and split levels in Seismic Zones 2, 3 and 4 in the 1991 UBC. (2308.12.6)
Buildings that contain one or more of six specified configurations are defined as unusually shaped in Sections 2320.5.4.1 through 2320.5.4.6. Section 2320.5.4.7 allows the Building Official to define other configurations not listed as an unusual shape.	Irregular buildings are defined in Section 2308.12.6 as those containing one or more of six configurations. See the portion of this chart titled Irregular Buildings for more information. Specific authority is no longer granted to the Building Official to define other types of configurations as irregular. HCD and all local jurisdictions should consider an amendment to reinstate this authority because other irregularities can exist that are not covered by the six items. Criteria for maximum opening size in floor and roof diaphragms has changed.
Concrete and masonry fireplaces, heaters and chimneys are not mentioned in the conventional framing provisions. However, chimney reinforcing and seismic anchorage to floor and roof framing is required in Seismic Zones 2, 3, and 4. (3102.4.3)	Concrete and masonry fireplaces, heaters and chimneys are specifically allowed. (2308.2 #3.1 Exception # 2) In SDC C masonry chimneys do not require any reinforcing nor anchorage to the floor or roof framing. (2113.3) A code change to require reinforcing and anchorage of chimneys in SDC C has been submitted to ICC by BSSC. HCD and all local jurisdictions in SDC C should consider amending this to include SDC C, otherwise chimneys and fireplaces located in the SDC C portions of California will have less seismic protection than has traditionally been required.

GENERAL REQUIREMENTS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
	Chimney reinforcing and anchorage provisions were applicable to Seismic Zones 2, 3 and 4 since the 1973 edition of the UBC because of the poor performance of unreinforced and/or unanchored chimneys in even moderate ground shaking events.
Masonry and stone veneer limited to 5" in thickness in all zones and may not extend above the first story in zone 4 (2320.5.3 & 2320.4.3)	Stone and masonry veneer is limited to the lesser of 5" in thickness or 50 psf. (2308.2 # 3.1 Exception 1) In SDC's B & C veneer may extend up to two stories above grade plane when certain conditions are met. (e.g. more bracing length, higher capacity bracing, hold downs and no cripple walls) (2308.11.2) Note: Section 2308.11.2 Exception 3.2 is incorrect because it prescribed greater minimum bracing percentage in the top story than in the first story level. A code change to correct this has been submitted to ICC by the Building Seismic Safety Council (BSSC) that establishes the correct percentages of 25% for the top story and 45% for the bottom story. These revised percentages are consistent with those required by the 2006 IRC for the same condition. HCD and all local jurisdictions in SDC C should definitely amend this section to correct this mistake. SDC D veneer may be used in the first story above grade plane when certain conditions are met. (e.g. more bracing length, higher capacity bracing, hold downs and no cripple walls) (2308.12.2) In SDC E veneer may not extend above the basement. (2308.12.2)

GENERAL REQUIREMENTS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
No limits on dead loads for walls and partitions. Dead loads for ceiling joists, rafters, and floor joists are limited by the use of span tables. In seismic zone 4 total loads exceeding those prescribed in certain span tables require an engineered lateral-force-resisting system. (2320.5.2) The ceiling joists, rafters and floor joists that exceed loads prescribed in certain span tables require an engineered gravity load system in all zones. (2320.1)	Average dead loads for combined roof and ceiling, exterior walls, floors and partitions limited to 15 psf with the exception of stone or masonry veneer. (2308.2 #3.1)
Allows non-conventional structural "elements" to be designed using engineered design. (2320.2)	Allows "portions" and their supporting load path to be designed in accordance with accepted engineering practice. "Portions" is defined as "parts of buildings containing volume and area such as a room or a series of rooms". (2308.1.1) Allows combining of engineered elements or systems (e.g. Simpson Strong Wall or similar products) with conventional construction using accepted engineering practice. (2308.4) In SDC's D & E "portions" of structures must be designed to resist the forces specified in Chapter 16 to the extent such irregular features affect the performance of the conventional framing system. (2308.12.6)
Table 23-II-B-1 provides values for nails only and does not address roof sheathing fastening. Requires (3) 16d (common or box) at ceiling joists to parallel rafters. Does not specify minimum nailing for collar ties.	Table 2304.9.1 provides values for nails and staples for minimum fastening requirements and includes fastening for roof sheathing. Allows 2" planks to be fastened with only (1) 16d at each bearing.

GENERAL REQUIREMENTS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Requires 2" planks to be fastened with (2) 16d at each bearing.	Requires (3) 16d common connecting ceiling joists to parallel rafters. A category was added for collar tie to rafters which requires (3)10d commons. (Note: Refer to the roof rafter and ceiling joist portion of this chart regarding new requirements and Table 2308.10.4.1 which appears to supersede Table 2304.9.1 minimum requirements.) Added categories for jack rafter to hip, roof rafter to 2 x ridge beam, joist to band joist and ledger strip to stud.
Special anchorage requirements for exit facilities located in seismic zones 3 & 4. (2320.13)	The same special anchorage requirements exist for exit facilities located in SDC's D & E. (2308.12.7) Note: HCD and local jurisdictions in SDC C should consider amending this section to include SDC C because the special seismic anchorage requirements for exit facilities previously applied to buildings in Seismic Zone 3.
Occupancy group #'s rank from # 1, most important, to # 4, least important. (Table 16-K)	Occupancy category #'s rank from # IV, most important, to # I, least important. (Table 1604.5)

ROOFS AND CEILINGS

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Rafter span tables go to 30 psf live plus 15 psf dead maximum load. In seismic zone 4, total loads exceeding those prescribed in certain span tables require an engineered lateral-force-resisting system. (2320.5.2)	Restricts snow loads to a maximum of 50 psf ground. (2308.2 #3.3)
Does not specify any span limits on engineered trusses.	Engineered trusses limited to a maximum span of not more than 40' between points of vertical support. (2308.2 #5)
	Prefabricated I-joists, glue-lams and composite lumber may not be notched or drilled except where permitted by manufacturers recommendations or where designed by a licensed professional. (2308.10.7)
Trusses are required to be supported laterally at points of bearing by solid blocking to prevent rotation and lateral displacement. (2320.12.8)	Similar language does not exist in the conventional framing provisions for trusses. Wood trusses are required to be designed in accordance with the engineering provisions of section 2303.4. (2308.10.10) Section 2303.4 requires permanent "bracing" to be installed for engineered truss installations. However, section 2303 is silent as to blocking at points of bearing. (2303)
Ceiling Joists Ceiling Joists are to be sized per Tables 23-IV-J-3 or 23-IV-J-4. (2320.12.2) Both tables limit deflections to l/240. One table is for a live load of 10 psf and a dead load of 5 psf. The other table is for a live load of 20 psf and a dead load of 10 psf. The tables are applicable to many different grades of over two dozen species of lumber.	***Ceiling Joists*** Ceiling joists are to be sized per table 2308.10.2(1) or 2308.10.2(2). Other grades and species allowed per AF&PA *Span Tables for Joists and Rafters*. (2308.10.2) Both tables limit deflections to l/240. One table is for uninhabitable attics without storage having a live load of 10 psf and a dead load of 5 psf. The other table is for uninhabitable attics with limited storage having a live load of 20 psf and a dead load of 10 psf. Uninhabitable attics without storage and with limited storage are defined in Table 1607.1 footnotes i and j.

ROOFS AND CEILINGS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Ceiling Joist Continued:	***Ceiling Joist Continued:*** The tables are only applicable to four different grades in four commonly used species of lumber. (Douglas fir, hemlock fir, southern pine and spruce-pine-fir.)
The user must look up the Modulus of Elasticity (E) and the required bending design value (Fb) in table 23-IV-V-1 or 23-IV-V-2 to use the tables.	The user is not required to look up values for the Modulus of Elasticity (E) and the required bending design value (Fb).
Use of these tables is somewhat confusing and may require interpolation to obtain an exact maximum span.	Overall the tables are easier to apply.
For a 10 psf live load and a 5 psf dead load:	For a 10 psf live load and a 5 psf dead load:
A D.F. #2 2 x 8 ceiling joist at 24" o.c. can span 18'-9"	A D.F. #2 2 x 8 ceiling joist at 24" o.c. can span 18'-9"
A D.F. #2 2 x 6 ceiling joist at 24" o.c. can span 14'-9"	A D.F. #2 2 x 6 ceiling joist at 24" o.c. can span 14'-10"
(Tables 23-IV-J-3 and 23-IV-J-4)	(Table 2308.10.2(1))
Rafters Rafters are to be sized per tables 23-IV-R-1 through 23-IV-R-12. (Tables 23-IV-R-1 through 23-IV-R-12)	***Rafters*** Rafters are to be sized per tables 2308.10.3(1) through 2308.10.3(6). Other grades and species allowed per AF&PA *Span Tables for Joists and Rafters.* (2308.10.3)
Six tables limit deflections to l/240 and six limit deflections to l/180. Six different live load/dead load combinations are available for each of the two deflection limits. They are LL/DL of 20/10, 30/10, 20/15, 30/15, 20/20 and 30/20.	The tables limit deflections to either l/180 or l/240. Each table has an option for either a 20 psf or a 10 psf dead load.
There is no consideration in the rafter span tables of whether the ceiling finish is attached or not attached to roof rafters.	The design options in the six tables consider for Roof Live Load or Snow Load/Deflection/ and whether or not there is an attached or detached ceiling. They are: 20PSF/(L/180)/detached, 20PSF/(L/240)/detached, 30PSF/(L180)/detached, 50PSF/(L/180)/detached, 30PSF/(L/240)/attached and 50PSF/(L/240)/attached.

ROOFS AND CEILINGS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Rafters Continued: The tables are applicable to many different grades of over two dozen species of lumber. The user must look up the Modulus of Elasticity (E) and the required bending design value (Fb) in table 23-IV-V-1 or 23-IV-V-2 to use the tables. Use of these tables is somewhat confusing and may require interpolation to obtain an exact maximum span. The use of the rafter tables differs from that of the ceiling and floor joist tables, thereby requiring the user to learn two different methods. For a 20 psf live load, a 10 psf dead load and a deflection limit of l/240: A D.F. #2 2 x 12 rafter at 24" o.c. can span 18'-9" A D.F. #2 2 x 10 rafter at 24" o.c. can span 16'-2" A D.F. #2 2 x 8 rafter at 24" o.c. can span 13'-3" (Tables 23-IV-R-1and 23-IV-V-1)	***Rafters Continued:*** The tables are only applicable to four different grades in four commonly used species of lumber. Douglas fir, hemlock fir, southern pine and spruce-pine-fir. The user is not required to look up values for the Modulus of Elasticity (E) and the required bending design value (Fb). Overall the tables are easier to apply. For a 20 psf live load, a 10 psf dead load and a deflection limit of l/240: A D.F. #2 2 x 12 rafter at 24" o.c. can span 21'-0" A D.F. #2 2 x 10 rafter at 24" o.c. can span 18'-2" A D.F. #2 2 x 8 rafter at 24" o.c. can span 14'-10" (Table 2308.10.3(2))
One paragraph is dedicated to rafter ties (2320.12.6) Rafter ties are required to be nailed to adjacent ceiling joists to form a continuous tie between walls when parallel to the rafters. (2320.12.6) Minimum 1 x 4 cross ties spaced at not more than 4' o.c. are required when ceiling joists are not parallel to rafters. (2320.12.6) (3) 16d face nails minimum between the face of ceiling joists and parallel rafters are specified in table 23-II-B-1.	Three paragraphs and a table are dedicated to rafter tie and cross tie connections to rafters. (2308.10.4.1) Ceiling joists and rafters are required to be nailed to each other and to the wall plate. Ceiling joists must be continuous or securely joined where they meet over interior partitions. (2308.10.4.1) Ceiling joists are required to have a minimum of 1 ½" bearing. (2308.10.4.1) An "equivalent tie" must be provided at not more than 4' o.c. when ceiling joists are not parallel to rafters.

ROOFS AND CEILINGS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Rafters Continued: There is no specific mention of nailing for cross ties.	***Rafters Continued:*** A ridge beam may support rafters when ceiling joists or rafter ties are not provided. Table 2308.10.4.1 specifies the minimum number of nails required at rafter tie connections. The number of nails is dependant on roof slope, tie spacing, roof loading and roof span. Rafter/joist/tie connections are required to be of sufficient size and number to prevent splitting from nailing.
No special requirements for rafter and truss ties or a continuous load path to resist wind uplift.	New significantly increased connection requirements are prescribed between rafters or trusses to walls below to transfer wind uplift forces to the foundation using a continuous load path. (2308.10.1) Table 2308.10.1 contains capacity requirements for uplift connectors for roof level wind uplift.

FLOORS

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
No provisions for built up girders constructed from multiple 2x members.	New language and design tables have been added for built up headers and girders using multiple 2x members. (2308.7 and Tables 2308.9.5 and 2308.9.6)
No provisions for cuts, notches and holes in trusses, structural composite lumber, structural glue-laminated members or I-joists.	Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members or I-joists are not permitted except where permitted by the manufacturer's recommendations or where designed by a licensed professional. (2308.8.2.1 and 2308.10.7)
Requires double joists under and parallel to support bearing partitions. (2320.8.5)	Allows bearing partitions parallel to joists to be supported on beams, girders, walls and other bearing partitions in addition to using doubled joists. (2308.8.4)
Bearing partitions perpendicular to joists may not be offset from supporting girders, walls, or partitions more than the joist depth. (2320.8.5)	Same as 2001 CBC except that offset limitations are waived when joists are of "sufficient size" to carry the additional loads. Engineering documentation of "sufficient size" would be necessary if the offset limit is exceeded (2308.8.4)
Floor Joists are to be sized per tables 23-IV-J-1 and 23-IV-J-2 (2320.8.1)	Floor joists to be sized per table 2308.8(1) or 2308.8(2). Other grades and species allowed per AF&PA *Span Tables for Joists and Rafters*. (2308.8)
Both tables are for a 40 psf live load and limit deflections to l/360. One table is for a 10 psf dead load and the other for a 20 psf dead load.	One table is for a 30 psf live load applicable to residential sleeping areas and the other is for a traditional 40 psf live load. Both tables limit deflections to l/360. Both tables contain values for 10 psf and 20 psf dead loads.
The tables are applicable to many different grades of over two dozen species of lumber.	The tables are only applicable to four different grades in four commonly used species of lumber. Douglas fir, hemlock fir, southern pine and spruce-pine-fir.
The user must look up the Modulus of Elasticity (E) and the required bending design value (Fb) in table 23-IV-V-1 or 23-IV-V-2 to use the tables.	The user is not required to look up values for the Modulus of Elasticity (E) and the required bending design value (Fb).
Use of these tables is somewhat confusing and may require interpolation to obtain an exact maximum span.	Overall the tables are easier to apply.

FLOORS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
For a 40 psf live load and a 10 psf dead load: A D.F. #2 2 x 12 floor joist at 16" o.c. can span 17'-10" A D.F. #2 2 x 10 floor joist at 16" o.c. can span 15'-4" A D.F. #2 2 x 8 floor joist at 16" o.c. can span 12'-7" (Tables 23-IV-J-1and 23-IV-V-1)	For a 40 psf live load and a 10 psf dead load: A D.F. #2 2 x 12 floor joist at 16" o.c. can span 20'-7" A D.F. #2 2 x 10 floor joist at 16" o.c. can span 17'-9" A D.F. #2 2 x 8 floor joist at 16" o.c. can span 14'-2" (Table 2308.8(2))
Section 2316.1 adopt the 1997 NDS and section 2316.2 # 18 and #19 amends NDS section 4.4.1.1 and 4.4.1.2 pertaining to lateral support of bending members. NDS section 4.4.1.2, as amended, lists five different levels of support for various depth to breadth (d/b) ratios. (2316 & NDS 4.4.1.2) No special support requirements exist for members with a d/b ratio less than or equal to 2:1 Members with a d/b ratio greater than 2 and less than or equal to 4 must have both ends held in position by an acceptable means. Members with a d/b ratio greater than 4 and less than or equal to 5 must be held in line along the entire compression edge and ends at points of bearing must be held in position to prevent rotation and/or lateral displacement.	Section 2308.8.5 contains requirements for lateral support of bending members and does not refer to the NDS. There are three levels of support for different depth to thickness (d/t) ratios. Note: The IBC requirements are less restrictive and are not as comprehensive as the NDS provisions, and there does not appear to be any justification for not using the NDS provisions. HCD and all local jurisdictions should consider an amendment to 2308.8.5 to delete its current provisions and reference the 2005 NDS Section 4.4.1.2 (or specify the actual language used in the NDS in this code section) (2308.8.5) No special support requirements exist for members with a d/t ratio less than 5:1.

FLOORS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Members with a d/b ratio greater than 5 and less than or equal to 6 must meet all the requirements for d/b ratio greater than 4 and in addition provide bridging, cross bracing or full depth solid blocking is required at intervals not exceed 8' on center.	Members with a d/t ratio greater than or equal to 5:1 and less than 6:1 are required to have one edge held in line for the entire span. A code change has been submitted to ICC by the Shasta Cascade ICC to delete the word "one" and substitute the word "compression" before the word "edge" to clarify which edge must be held in line to effectively prevent rotation or lateral displacement. Such an amendment would match the wording in the 2005 NDS Section 4.4.1.2 item (c). Such an amendment should be considered by HCD and all local jurisdictions to clarify this item.
Members with a d/b ratio greater than 6 and less than or equal to 7 must have both edges held in line for their entire length and ends at points of bearing must be held in line to prevent rotation and/or lateral displacement.	Members with a d/t ratio exceeding 6:1 must have one line of bridging for each 8' of span unless both edges of the member are held in line. A line of bridging is required at supports where equivalent lateral support is not otherwise provided.

WALLS

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Bearing wall stud height 10'-0"maximum. (Table 23-IV-B)	Bearing wall floor to floor limited to 10'-0" stud height plus maximum 16" floor framing height. (2308.2)
Only addresses notches or holes in sawn lumber floor joists, studs, ceiling joists or rafters. (Sections 2320.8.3, 2320.11.9, 2320.11.10 and 2320.12.4)	Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members or I-joists are not permitted except where permitted by the manufacturer's recommendations or where designed by a licensed professional. (2308.8.2.1) Limits on boring & notching of sawn lumber joists, studs, ceiling joists and rafters remain unchanged. (Sections 2308.8.2, 2308.9.10, 2308.9.11 and 2308.10.4.2
Table 23-IV-B specifies permitted height and spacing of various size studs in bearing and nonbearing walls.	No change to stud size, height and spacing. (Table 2308.9.1)
No requirement for top plate thickness and width except for walls with 24 inch stud spacing. (2320.11.2).	Top plates to be minimum 2x nominal depth and a width equal to the width of the studs. (2308.9.2.1)
Nonbearing wall stud spacing limited to 24" o.c. (Table 23-IV-B)	Nonbearing wall stud spacing limited to 28" o.c. max. (2308.9.2.3)
Studs with wide dimension parallel to the wall (e.g., flat framing) are not allowed.	Studs in non-bearing walls may be set with the wide dimension parallel to the wall (e.g., flat framing). (2308.9.2.3)
Headers and lintels together with their supporting systems are to be "designed to support" the specified loads. (2320.11.6) Openings in bearing walls 4'-0" or less in width are to be provided with headers consisting of (2) 2x members placed on edge or 4x lumber of equivalent cross section. (2320.11.6) Openings more than 4'-0" require headers or lintels but no sizes are specified in the code. (2320.11.6) Each lintel or header is required to have a minimum of 1 ½" of bearing full width of the lintel. (2320.11.6)	***Exterior Walls*** Headers are required over each opening in exterior bearing walls. Table 2308.9.5 can be used to size headers for one and two family dwellings. Headers for other buildings must be designed in accordance with section 2301.2 # 1 or # 2. Headers are required to be two pieces of 2x framing set on edge or of solid lumber of equivalent size. (2308.9.5.1) Wall studs are required to support the ends of the header in accordance with Table 2308.9.5. A minimum bearing of 1 1/2" for the full width of the header is required (2308.9.5.2)

WALLS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
	Interior Bearing Walls Headers are required over each opening. One of two design tables may be used to size the headers. Walls studs are required to support the ends of headers per tables. (2308.9.6) ***Interior Non-Bearing Walls*** Openings are permitted to be framed with single studs and headers. A minimum of 1 ½" bearing is required for full width of the lintel (2308.9.7) No provisions are included for exterior non-bearing walls.

CRIPPLE WALLS

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
No specific requirements for cripple walls to be considered as a story. However, Table 23-IV-C-2 bracing lengths were developed considering cripple walls as an additional story level.	Cripple walls having a stud height exceeding 14 inches, or having studs 14 inches or less that are not solid blocked, are considered a story. (2308.2 #1, 2308.12.4 & 2308.9.4.1)
Braced wall panel type 7 (Stucco) is prohibited on cripple walls in seismic zone 4. (2320.11.5)	Lath and plaster is permitted for use only on cripple walls that are not considered a story (stud height is 14 inches or less and is solid blocked) in table 2308.12.4 for SDC D & E (Table 2308.12.4) *HCD has revised this to allow lath and plaster on cripple walls that are considered a story, only when $S_{DS} < 0.50$ (HCD Table 2308.12.4) Note: This is exactly what was permitted under the 2003 edition of the IBC and was eliminated from the 2006 IBC because conventional construction requirements for one and two-family dwellings were removed from IBC Section 2308, to direct code users to instead apply the provisions of the International Residential Code (IRC).*
Bracing on cripple walls with studs exceeding 14 inches in height must comply with a special bracing table (Table 23-IV-C-2). (2320.11.5) Table 23-IV-C-2 requires 3/8" wood structural panels on 30% to 75% of the cripple walls depending on seismic zone, number of stories above the cripple wall, and the spacing of edge nails. (Note: values for three stories above the cripple wall are specifically excluded in the table because this cripple wall bracing is predicated on the cripple wall being considered an additional story. (Section 2320.11.5) Braced panel length required to be a minimum of two times the cripple wall height (h/w ratio minimum 1:2) but not less than 48". This was required to avoid uplift that would potentially occur at narrow braced wall panels. (Table 23-IV-C-2 footnote #1)	*SDC A, B and C* Cripple wall bracing to comply with table 2308.9.3(1) (Braced wall panels) for SDC A,B, & C. (2308.9.4.1) *SDC D & E* Cripple walls are not permitted in buildings where masonry veneer is used in the first story (2308.12.2 Exception # 4) Cripple wall bracing to comply with Table 2308.12.4 for SDC D & E. (2308.12.4) Length of cripple wall bracing is dependent on S_{DS} and sheathing type. (Table 2308.12.4)

CRIPPLE WALLS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
All panels along the cripple wall are required to be nearly equal in length and nearly equally spaced along the length of the wall. (Table 23-IV-C-2 footnote #2)	*Gypsum board, fiberboard, particle board, lath and plaster or gypsum sheathing boards are only permitted to brace cripple walls that are considered a story where S_{DS} less than 0.50. Wood structural panels or diagonal sheathing are required bracing material for cripple walls where S_{DS} is greater or equal to 0.50. (HCD Table 2308.12.4)*
	When the interior braced wall lines occur without a continuous foundation below, the length of the cripple wall bracing in Table 2308.12.4 must be increased by 50% along each parallel exterior cripple wall. Note: This was required to address the additional forces from interior braced wall lines in the story above the cripple wall level that must be resisted along parallel exterior wall lines at the cripple wall level. (2308.12.4) When sheathing type S-W (wood structural panel sheathing) is used on cripple walls, and the required length of bracing cannot be obtained when applying the 50% bracing length increase factor, the capacity of the sheathing shall be increased by reducing fastener spacing to 4" o.c. along the perimeter of each piece of sheathing. This reduced fastener spacing is not applicable to diagonal wood sheathing installations (2308.12.4)

ANCHORAGE TO FOUNDATIONS

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Sill bolt diameter and spacing to be specifically designed in three story buildings located in zones 3 & 4. (1806.6.1 #1)	Reduces ½" anchor bolt spacing to 4' o.c. for structures over two stories in height. (2308.3.3)
½" diameter anchor bolts at 6' o.c. are required. (1806.6) 5/8" diameter anchor bolts at 6' o.c. are required in zone 4. (1806.6) In seismic zones 3 and 4, 2 x 2 by 3/16 inch plate washers are required on each bolt. (1806.6.1 #2)	½" diameter anchor bolts at 6' o.c. required. (2308.6) 5/8" diameter anchor bolts at 6' o.c. required in SDC E. (2308.12.9) 3 x 3 by 0.229 inch plate washer required on each bolt in SDC's D and E. (2308.12.8 SDC's D & E). Note: HCD and local jurisdictions in SDC C should consider extending the plate washer requirement to SDC C to provide parity with the plate washer requirements that were required in Seismic Zone 3 since the 1998 CBC.
No provisions for slotted plate washers.	Diagonally slotted washers are allowed. Slots are permitted to be up to 3/16" larger than the bolt diameter and a slot length not to exceed 1 ¾", provided a standard cut washer is placed between the plate washer and the nut. (2308.12.8 SDC's D & E). Note: The slot is intended to facilitate installation of the 3x3 square washer within the width of a 3-1/2 inch wide sill plate when foundation bolts are located more than plus or minus ¼ inch from the sill plate centerline.
Sill plate anchorage devices other than bolts are not specifically recognized.	Allows other sill plate anchorage devices having equivalent capacity (2308.3.3)
	Contains provisions for anchorage to an all wood foundations system. (2308.3.3.1)

CRAWL SPACE VENTILATION

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Under floor areas may be ventilated by either openings under the floor area or by approved mechanical means. (2306.7)	Underfloor ventilation is relocated to Chapter 12. Requires ventilation openings with four exceptions. Exception # 3 allows mechanical ventilation. (1203.3.1)
Openings under floor area require a minimum of one square foot of ventilation for each 150 square feet of under floor space. (2306.7) The openings are required to be located as close to corners as practical and must provide cross ventilation. (2306.7) The openings are required to be distributed approximately equal on at least two opposite sides. (2306.7)	Openings under floor area require a minimum of one square foot of ventilation for each 150 square feet of under floor space. (1203.3.1) Openings are required to be placed so as to provide cross ventilation of the under-floor space. (1203.3)
Openings must be covered with a wire mesh with maximum sized openings of not less than ¼" nor more than ½" in any direction. (State Pest Control Board 2306.7)	There are six different options for opening coverings. Perforated sheet metal plates, expanded sheet metal plates, Cast-iron grilles, extruded load bearing vents, Hardware cloth, and corrosion resistant wire mesh are all acceptable materials. (1203.3.1)
No specifications provided for approved mechanical means of ventilations.	Mechanical ventilation specified as continuous 1cfm for every 50 square feet of crawl space. (1203.3.2 # 3)
Exception allows operable louvers and with a vapor retarder at the ground surface when approved by the Bldg. Official based on climatic and geographic conditions.	Exception # 1 allows ventilation openings to the interior of the building when warranted by climatic conditions.
	Exception # 2 allows openings to be reduced to 1/1500 of the under-floor area where the ground surface is treated with an approved vapor retarder material and the openings are placed so as to provide cross ventilation. (1203.3.2 # 2)
	Exception # 4 waives openings when the ground surface is covered with an approved vapor retarder, the perimeter walls are insulated and the space is conditioned per the California Energy Code.
	Exception # 5 allows ventilation openings to double as flood openings in flood hazard areas.

IRREGULAR BUILDINGS

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
In seismic zones 3 & 4 an engineered lateral design is required when buildings are unusually shaped. (2320.4.4 & 2320.5.4)	In SDC's D & E conventional light-frame construction is not permitted in irregular portions of structures as defined in 2308.12.6 (2308.2 #7) Note: HCD and local jurisdictions in SDC C should consider amending this to include SDC C, otherwise irregular buildings located in the SDC C portions of California will have less seismic protection than was previously required when these irregularities are present. Irregularity provisions were applicable to Seismic Zones 3 and 4 since the 1994 UBC, and for unusual shape, size and split levels in Seismic Zones 2, 3 and 4 under the 1991 UBC.
Braced wall panels offset in the out of plane direction are considered irregular unless they meet the requirements of an exception having five criteria. (2320.5.4.1) The exception item #4 requires either a continuous rim joist or one with a splice and a metal tie. The minimum yield stress of the metal tie is not specified. (2320.5.4.1 Exception #4) The exception item #5 limits the gravity loads applied at the end of cantilevered floor joists to uniform wall and roof loads or reactions from headers not spanning more than eight feet. (2320.5.4.1 Exception)	Braced wall panels offset in the out of plane direction are considered irregular unless they meet the requirements of an exception having five criteria that are nearly identical to the 2001 CBC. (2308.12.6 #1) The exception #4 specifies the minimum yield stress of the metal tie at 33,000 psi. (2308.12.6 #1 Exception 4) The exception item 5 limits the gravity loads applied at the end of cantilevered floor joists from not more than a single story having uniform wall and roof loads or reactions from headers having a span less than eight feet. (2308.12.6 #1 Exception 5)
Openings in floor and roof diaphragms restricted to the lesser of 12' or 50% of the least floor or roof dimension. (2320.5.4.4)	Openings in floor and roof diaphragms are restricted to not more than 50% of the distance between braced wall lines or an area not more than 25% of the area between orthogonal pairs of braced wall lines. The prescriptive dimensional limit of 12 feet has been deleted in favor of percentages. (2308.12.6 #6)

BRACED WALL LINES

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Spacing of braced wall lines not to exceed 34' o.c. when wind speeds do not exceed 80 mph. (2320.4.1) Spacing of braced wall lines not to exceed 25' o.c. when wind speeds exceed 80 mph. An exception allows 34' o.c. to accommodate one room of 900 sq. ft. maximum. (2320.4.2) When specifically adopted, additional requirements for high wind areas are specified in appendix chapter23. (2320.3) Zone 4 braced wall line spacing limited to 25' o.c. An exception allows zone 4 bracing to be a maximum of 34' o.c. to accommodate one room of 900 square feet maximum. (2320.5.1 & 2320.4.2 Exception)	Spacing of braced wall lines not to exceed 35' o.c. (2308.3.1) The use of conventional framing limited to areas with wind speeds not exceeding 100 mph (3 second gust). In exposure category B winds speeds may not exceed 110 mph. (2308.2 #4) May use AF & PA Wood Frame Construction Manual (WFCM) or SBCCI SSTD 10 when wind speeds exceed 100 mph. (2308.2.1) Braced wall line spacing limited to 25' o.c. in SDC D & E (2308.12.3)
In one story buildings interior braced wall lines must be supported on continuous foundations at intervals not exceeding 50'. In buildings exceeding one story all interior braced wall lines must be supported by continuous foundations. An exception allows two story buildings to have braced wall lines supported on continuous foundations at intervals not exceeding 50' provided: 1) cripple walls do not exceed 4'-0" in height and 2), first floor braced wall panels are supported on doubled floor joist, continuous blocking or floor beams and 3) the distance between bracing lines does not exceed twice the building width parallel to the braced wall line. (2320.5.6)	Braced wall lines must be supported by continuous foundations. An exception allows structures with a maximum plan dimension not over 50' to have continuous foundations at exterior walls only. (2308.3.4) Note: This is less restrictive than the 2001 CBC for two story buildings, because the limits regarding cripple wall height, floor framing support below interior braced wall panels, and the distance between bracing lines are no longer required. HCD and all local jurisdictions should consider amending 2308.3.4 to allow enforcement of the three 2001 CBC conditions that allow omitting a continuous foundation below interior braced wall lines.
Wall bracing is required per table 23 IV-C-I Braced panels to be located at the ends of braced wall lines. (Table 23-IV-C-I) Braced panels must start no more than 8' from each end of a braced wall line. (2320.11.3)	Wall bracing is required per table 2308.9.3(1) in SDC's A, B & C. Wall bracing is required per table 2308.12.4 in SDC's D & E.

BRACED WALL LINES (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
	In SDC A, B and C, braced panels must start no more than 12'-6"' from each end of a braced wall line In SDC D and E braced wall panels must start no more than 8' from each end of a braced wall line. (2308.9.3 & 2308.12.4) Bracing requirements in SDC's A and B in Table 2308.9.3(1) are identical to Seismic Zone 0, 1 and 2A requirements in Table 23 IV-C-I Bracing requirements in SDC C in table 2308.9.3(1) are identical to Seismic Zone 2B, 3 and 4 requirements in Table 23 IV-C-I for one story or the top of two stories and the first story of two stories. Requirements for the first story of three stories have been eliminated in the IBC. *HCD has modified Table 2308.9.3(1) by adding bracing requirements for the first of three stories thereby allowing three story buildings in SDC C. Note: This is consistent with the HCD amendment to Section 2308.11.2. Three story detached one and two-family dwellings were permitted under the 2003 edition of the IBC. That was eliminated from the 2006 IBC because conventional construction requirements for one and two-family dwellings were removed from IBC Section 2308 to direct code users to instead apply the provisions of the International Residential Code (IRC).* Bracing requirements in SDC D and E are located in a new table. Minimum length of wall bracing per each 25 linear feet of braced wall line is specified. The required length of bracing is dependent on the S_{DS} and the sheathing type. The table is for one story only. (Table 2308.12.4)

BRACED WALL LINES (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
	HCD has modified Table 2308.12.4 to add bracing requirements for a story below the top story thereby allowing two story detached one and two-family dwellings in SDC D & E. Note: This is consistent with the HCD amendment to Section 2308.12.1. This is what was permitted under the 2003 edition of the IBC and was eliminated from the 2006 IBC because conventional construction requirements for one and two-family dwellings were removed from IBC Section 2308, to direct code users to instead apply the provisions of the International Residential Code (IRC). Bracing panels in the first story of a two story building are limited to structural wood panels and diagonal wood sheathing where S_{DS} is equal to or greater than 0.50 (HCD amendments to Table 2308.12.4 and Section 2308.12.1)
Gypsum sheathing boards are permitted under Item # 5 of section 2320.11.3.	Gypsum sheathing boards (sheathing type G-P) are an allowed bracing material for one-story buildings in SDC's D and E and for two story where the value of S_{DS} is less than 0.50. The very large minimum braced lengths within every 25 foot length of braced wall line that are required for gypsum boards and similar low capacity sheathing materials, make it unlikely that they will be used. (Table 2308.12.4 Footnote b)

BRACED WALL PANELS

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Braced wall panels must start at not more than 8 feet from each end of a braced wall line. (2320.11.3)	Braced wall panels must start at not more than 12'-6" from each end of a braced wall line in SDC's A, B and C. (2308.9.3) Braced wall panels must start at not more than 8 feet from each end of a braced wall line in SDC D & E. (2308.12.4)
Braced wall panel type 4 for fiberboard sheathing requires 4' x 8' panels applied vertically. (2320.11.3)	Braced wall panel type 4 for fiberboard sheathing does not specify panel size and allows horizontal or vertical installation. Note: HCD and all jurisdictions should consider placing a 4' x 8'limit on the minimum size of fiberboard panels except at boundaries and changes in framing, and also require all fiberboard edges be blocked whether applied vertically or horizontally as required in the Section 4.3.7.3 of the 2005 AF & PA Special Design Provision for Wind and Seismic (SDPWS-2005). (2308.9.3 # 4)
Requires sill plates to be bolted to foundation or slab in accordance with 1806.6 (2320.11.3)	No mention of sill plate bolting requirements in bracing section 2308.9.3. Sill bolting requirements are located in 2308.6.
Braced wall panel type 1 (1x4 diagonal let in brace) eliminated from seismic zones 2B, 3, and 4. (Table 23-IV-C-1)	1x4 diagonal let in braces allowed in SDC A & B only. (Table 2308.9.3(1) & Table 2308.12.4)
Braced wall panel sole plates must be nailed to the floor framing and top plates are required to be connected to the "framing above" in accordance with Table 23-II-B-1. (2320.11.3)	Forces are required to be transferred from the roofs and floors to braced wall panels and from the braced wall panels in upper stories to the braced wall panels in the story below by the following. (2308.3.2) Braced wall panel top and bottom plates must be fastened to joists, rafters or full-depth blocking. Braced wall panels must be extended and fastened to roof framing at intervals not to exceed 50' between parallel braced wall lines. (2308.3.2 #1) Note: A code change has been submitted to ICC by Jim Russell to clarify where the braced wall panels must be extended and fastened to roof framing. The problem with the wording of the current code section is that it does not differentiate between locations where roof framing is parallel or perpendicular to the braced wall panel.

BRACED WALL PANELS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
	Braced wall panel exterior sheathing can easily be extended and connected to roof framing occurring on gable end walls where the roof framing is parallel. However, when roof framing is perpendicular it is unclear how this provision is intended to be applied. Additionally it is not clear if the 50 foot limit means that interior braced wall lines are not intended to have braced wall panels extended to the roof framing. An exception to Section 2308.3.2 #1, states that when roof trusses are used, lateral forces must be transferred from the roof diaphragm to the braced wall by blocking of the ends of the trusses or by other approved means. (2308.3.2 #1 Exception) Note: A code change has been submitted to ICC by Jim Russell to clarify this exception. The current wording of this provision for blocking of the ends of trusses would only make sense where trusses are perpendicular to a braced wall. When a truss is parallel to the braced wall, the current exception does not describe what type of connection is necessary.

ALTERNATE BRACED WALL PANELS

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Alternate panels only 2'-8" wide can substitute for a standard 4'-0" wide braced wall panel. Requires "plywood" sheathing to be used on alternate braced wall panels (2320.11.4)	Requires "wood structural panel" sheathing. (2308.9.3.1)
Two anchor bolts required at quarter points in one-story condition. (2320.11.4 # 1)	Two anchor bolts required outside quarter points in one-story condition. (2308.9.3.1 # 1)
Footings are required to be continuous for alternate braced panels with no requirements for detailing or size. (2320.11.4 # 1)	Continuous footing with #4 reinforcing bars top and bottom is required along entire length of braced wall line where alternate panel occurs. Where the continuous footing depth is greater than 12 inches, a 12" x 12" continuous footing is permitted at door openings in that braced wall line. (2308.9.3.1 # 1)
Three anchor bolts on alternate braced panels on the first story of two story buildings are required at the panel one-fifth points. (2320.11.4 # 2) Note: 1/5 points would result in 4 bolts instead of 3, and was corrected in the IBC to read ¼ points.	Three anchor bolts on alternate braced panels on the first story of two story buildings are required at the panel one-fourth points. (2308.9.3.1 # 2)

ALTERNATE BRACING AT OPENINGS

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
No provisions for alternate braced wall panels less than 2'-8" in width.	An entirely new section allows a portal frame type of braced panel with a 16" width on single story or a 24" width on two story structures. The panels are limited to 10' in height to the top of header. Wood structural panel sheathing is required on one side only and must extend to the top edge of a continuous header at the top of the panel. Straps between the header and the studs or posts, and tiedowns between the bottom of the of the panel studs or post to the foundation are required (2308.9.3.2)
	Figure 2308.9.3.2 shows and the text describes a condition with a single braced panel at one end of a wall opening and a post supporting the header at the other end. Figure 2308.9.3.2 clarifies that this is a single portal frame equivalent to one braced wall panel, whereas the double portal frame shown with a panel at each side of the opening provides the equivalent of two braced wall panels. Each braced wall line still requires a minimum of one braced wall panel at each end as indicated in Figure 2308.9.3. Therefore the single portal frame can only be used when at least one other braced wall panel occurs on that braced wall line. (2308.9.3.2 & Figure 2308.9.3.2)
	Figure 2308.9.3.2 shows three 2x members at the bottom of the portal frame panel. The text does not specify that this is a requirement. However, these extra blocks above the sill plate are needed to provide backing for the required three rows of nailing along the bottom edge of the sheathing. (Figure 2308.9.3.2)

ALTERNATE BRACING AT OPENINGS (Continued)

2001 CBC / 1997 UBC	2007 CBC / 2006 IBC
Narrow wall panels were not included because of concerns for the potentially large deflections that might result.	Note: There is a potential for shrinkage of sawn lumber headers which in turn may allow the vertical straps attaching to the header to buckle. Such a condition will lead to larger deflections of the portal frame system because the strap elongates when it is loaded It is recommended that sawn lumber used in portal frame bracing be allowed to reach equilibrium prior to nailing of the straps. Because these portal frames are a site-built item but were constructed, tested and qualified for use in a laboratory, it is important to provide very stringent inspection of the actual construction.