

2016 CBC Chapter 16 Structural Design- Changes include new plan content requirements for Photovoltaic Panel Systems as well as guidance on how to determine the dead and live loads. For mid- and high-rise designs there are new design requirements for hoists and facade access equipment. The majority of changes are clarifications.

NEW -CHANGE	CBC SECTION/TABLE NUMBER	COMMENTARY
X	1602.1	Flexible and Rigid definitions removed and found in ASCE 7-10
X	1603.1.3	Construction Documents to specify Snow load Drift surcharge, P_d , and drift width, w
X	1603.1.7	Flood design data: added design class assigned per ASCE 24 and replaces terminology to be consistent with ASCE 24
X	1603.1.8	Construction Documents to specify roof PV system dead load
X	1604.3.3	Steel serviceability standards updated
X	Table 1604.3	Deflection limit construction type interior partition has moved from "exterior wall and interior partitions" to its own category. Footnotes b, d, and f have been revised to clarify intent of height, creep, and wind effects, respectively.
X	1604.5	Risk Category III revised to clarify applicability of Occupancy Group E and education occupancies for students above the 12th grade.
X	T1607.1	Entire table has change bar, however, no significant change found
X	1607.5	Partition Loads revised so when designing an office building or other building where partition locations are subject to change and designing with a live load of 80 psf the additional 15 psf live load is not required.
X	1607.9	Elements supporting hoists for facade access equipment shall be designed for a live load consisting of the larger of the rated load of the hoist times 2.5 and the stall load of the hoist. Lifelines to be designed for a live load equal to 3100 pounds.
X	1607.10.2	Alternative uniform live load reduction Equation 16-24 upper limits clarified to 40% for members supporting one floor and 60% for members supporting two or more floors.
X	1607.12	Vegetative and Landscape Roofs language has been added to clarify the applicable dead and live loads
X	1607.12.5	Photovoltaic Panel systems section added to address attached and ballasted systems applicable dead and live loads
X	1609.1.1	ASCE 49 standard added to wind load determination Exception
X	1613.5.1	Clarifies the maximum length-to-width ratio of a wood, wood structural panel or un-topped steel deck sheathed structural sub-diaphragm system is 2.5-to-1
X	1613.6	Clarifies what an <i>approved analysis</i> is to permit ballasted photovoltaic panel systems in seismic design categories C or above.

2016 CBC Chapter 17 Special Inspection and Tests- A quick glance at this chapter reveals extensive single line margin markers throughout indicating model code changes. Much of the changes are editorial in nature, for example previous references to "special inspections" now include the phrase "...and tests" emphasizing this frequently required quality control element. The following highlights several more substantive changes.

NEW -CHANGE	CBC SECTION/TABLE NUMBER	COMMENTARY
X	1704.2	Special inspections and test- Expressly precludes the contractor from employing the “approved agency” (the special inspection and/or testing agency) whereas before the contractor was not listed as an authorized entity. Exception 4 of this provision does allow the contractor to employ the approved agency when it is also the owner, a frequent occurrence in tract home developments.
X	1704.5	Submittals to the Building Official- This new section consolidates provisions found elsewhere in the code or standards, listing types of certificates of compliance and reports to be submitted to the Building Official covering such issues as fabrication, mill tests, and material properties.
X	1705.2.2	Cold-formed steel deck- This section has been modified to delete reference to table 1705.2.2 and to require special inspections for cold-formed steel decks to conform to the publication QA/QC SDI (Steel Deck Institute’s publication Standard for Quality Control and Quality Assurance for Installation of Steel Deck added to Chapter 35 Referenced Standards)
X	1705.2.3	Open web steel joists and joist girders- This new section requires special inspection of these elements as specified in new table 1705.2.3.
X	Table 1705.3	Required Special Inspections and Tests of Concrete Construction- Special inspection requirements have been revised from a general periodic inspection requirement to either continuous or periodic depending on the circumstances.
X	1705.11.3	Wind-resisting components- this revised section expands the list of components subject to periodic inspection to include “...roof deck, and roof framing connections” and “...wall connections to roof and floor diaphragms and framing”
X	1705.12.9	Cold-formed steel special bolted moment frames- This new provision requires periodic special inspection for such frames when part of the seismic force resisting system for Seismic Design Category D, E, or F structures.
2016 CBC Chapter 21 Masonry - The changes to the masonry chapter are mainly the result of updating the referenced standard to the 2013 edition, which includes a complete reorganization into a more designer-friendly format. The following highlights several substantive changes.		
NEW -CHANGE	CBC SECTION/TABLE NUMBER	COMMENTARY
X	2101.2	Masonry Design Methods. The 2016 CBC updates the masonry referenced standard to the 2013 edition of the Building Code Requirements for Masonry Structures (TMS 402-13/ACI 530-13/ASCE 5-13) or TMS 403. The corresponding Specification (TMS 602-13/ACI 530.1-13/ASCE 6-13) was also updated. The codes and updates were developed by the Masonry Standards Joint Committee (MSJC). The 2013 TMS 402/602 Masonry Code and Specification includes a complete reorganization to be more user-friendly. As the result, the references in Chapter 21 to specific sections in the masonry

		code have been deleted to simply reference the 2013 TMS 402/602 Masonry Code and Specification.
X	2103	Masonry Construction Materials. Many material specification provisions have been deleted and replaced with references to the 2013 TMS 602/ACI 530.1/ASCE 6 MSJC Specification.
X	2104	Masonry Construction. Many masonry construction provisions have been deleted and replaced with references to the 2013 TMS 602/ACI 530.1/ASCE 6 MSJC Specification.
X	2105	Quality Assurance. Quality assurance provisions have been deleted and replaced with references to the 2013 TMS 602/ACI 530.1/ASCE 6 MSJC Specification for quality assurance and Chapter 17 for special inspection and testing requirements.
X	2111 and 2113	Masonry Fireplaces and Chimney. For masonry fireplaces and chimneys, provisions for seismic reinforcement and anchorage have been clarified and reorganized. The definitions for "masonry fireplace" and "masonry chimney" have been removed from Chapter 21 and relocated to Chapter 2.
X	2013 TMS 402/602 Building Code Requirements and Specification for Masonry Structures	<ul style="list-style-type: none"> The 2013 TMS 402 Masonry Code has been reorganized to be more designer-friendly and divides the code provisions into five parts with several chapters in each part. The compressive strengths for concrete masonry were significantly updated in 2013 TMS 602 Table 2. The changes were based on testing and analysis and accompanied by a change to ASTM C90 that required the minimum compressive strength of concrete masonry units to be 2,000 psi rather than 1,900 psi. For 2,000 psi concrete masonry units using Type M or S mortar, the specified compressive strength, f'_{m}, has been increased from 1,500 psi to 2,000 psi. A new Appendix C, Limit Design of Masonry for Special Shear Walls, has been added to provide an optional design method for special reinforced masonry shear walls. For highly perforated special reinforced masonry shear walls, the appendix may offer more efficient wall designs. A moment magnifier method for strength design of walls subjected to out-of-plane loads has been added. For partially grouted shear walls, there has been a reduction in the shear strength. A factor, based on research, has been added to both allowable stress design and strength design. The factor is 0.75 for partially grouted shear walls and 1.0 for all other members. The effect of the factor is partially offset by the increase in compressive strength f'_{m}.

2016 CBC Chapter 22 Steel - The referenced standards for structural steel and seismic design, the 2010 edition of AISC 360 and AISC 341, respectively remain unchanged from the 2013 CBC. The following, however, highlight two new standards for cold-formed steel.

NEW -CHANGE	CBC SECTION/TABLE NUMBER	COMMENTARY
X	2210	Cold-Formed Steel. For composite concrete slabs on steel decks, a new Steel Deck Institute (SDI) standard for their design and construction has been added to Section 2210 and Chapter 35 – SDI-C-2011, Standard for Composite Steel Floor Deck Slabs.
X	2211	Cold-Formed Steel Light-Frame Construction. For cold-formed steel light-frame non-structural members, a new American Iron and Steel Institute (AISI) standard for their design and construction has been added to Section 2211 and Chapter 35 – AISI S220-11, North American Standard for Cold-formed Steel Framing-Nonstructural Members.

2016 CBC Chapter 23 Wood - New to chapter 23 is the inclusion of **Structural Glued Cross-Laminated Timber** and **Engineered Wood Rim Board**. Modifications to **Exterior Wall Sheathing, Load Path, and Protection Against Decay and Termites** clarify minimum structural performance, minimum thickness and where waterborne preservatives are required respectively.

NEW -CHANGE	CBC SECTION/TABLE NUMBER	COMMENTARY
X	2303.1.4	<p>Structural Glued Cross-Laminated Timber. A new definition for a wood-based product identified as cross-laminated timber (CLT) has been added to Chapter 2. The new manufacturing standard ANSI/APA PRG 320 is now referenced in Chapter 23 and has been added to Chapter 35.</p> <p>ANSI/APA PRG 320-2011, Standard for Performance-Rated Cross-Laminated Timber, provides requirements and test methods for qualification and quality assurance for performance-rated cross-laminated timber, which is manufactured from solid-sawn lumber or structural composite lumber. For reference, in addition to the new definition of Cross Laminated Timber in CBC Section 202 and the PRG-320 product standard in CBC Section 2303.1.4, there are several code sections relating to the application of CLT in the 2016 CBC including:</p> <ul style="list-style-type: none"> • Types I and II, (CBC Section 603.1, Item 19): Roof construction and secondary members (footnote c in CBC Table 601), Exterior structural members (CBC Section 602.4.9 (misprint as 602.4.7)), and Balconies and similar projections (CBC Section 1406.3). • Type III: Interior building elements (CBC Section 602.3) • Type IV HT: General (CBC Section 602.4), Exterior walls (CBC Sections 602.4.2 and 602.4.8.2), Floors (CBC Section 602.4.6.2), Roofs (CBC Section 602.4.7), Interior walls and partitions (CBC Section 602.4.8.1). • Type V: all elements (CBC Section 602.5)

		<ul style="list-style-type: none"> • Other specific references where Type IV HT or Heavy Timber is specified: Canopies (CBC Section 406.7.2), Grain processing and storage (CBC Section 426.1) Combustible projections (CBC Section 705.2.3), Interior finish (CBC Section 803.3 and CFC 803.1), Balconies and similar projections (CBC Section 1406.3), Penthouses (CBC Section 1510.2.5), Tank supports (CBC Section 1510.3), Awning frames (CBC Section 3105.3) and Permanent canopies (CBC Section 3105.3) • Structural fire resistance calculation for exposed CLT: Reference to 2015 NDS – Chapter 16, (CBC Section 722.1) Note: CBC (Sections 703.2 and 703.3) establishes ASTM E119 or UL263 as the method for tests and other methods to establish fire resistance rating. CBC (Section 703.3, item 3) refers to calculations in CBC Section 722. CBC (Section 703.3, item 4) permits engineering analysis based on a comparison of a building element, component or assemblies design determined by test (for example to utilize integrity requirements from an E 119 tested assembly for a NDS calculated CLT horizontal or fire barrier assembly).
X	2303.1.13	Engineered Wood Rim Board. A new definition for engineered wood rim board has been added to Chapter 2 and two new standards are now referenced in Chapter 23 and have been added to Chapter 35. Two new standards address products intended for engineered wood rim board applications. Both ANSI/APA PRR 410 and ASTM D7672 address the fundamental requirements for the testing and evaluation of engineered rim board. ASTM D7672 is applicable in the determination of product specific rim board performance (i.e., structural capacities) for engineered wood products that may be recognized in a manufacturer's product evaluation reports. The PRR 410 standard also includes performance categories for engineered wood products used in engineered rim board applications. Under PRR 410, products are assigned a grade based on performance category (e.g., categories based on structural capacity) and must bear a mark in accordance with the grade.
X	2304.6	Exterior Wall Sheathing. Section 2304.6 has been modified to establish minimum structural performance requirements and clarify that wall sheathing on the outside of exterior walls, as well as connection of sheathing to framing, must be capable of resisting wind pressures in accordance with Section 1609, which in turn references ASCE/SEI 7-10. The new term "gable" has been added to clarify that exterior wall sheathing requirements for out-of-plane wind resistance are equally applicable to the gable area at end walls.
X	2304.10.6	Load Path. The minimum required thickness of steel straps used to splice discontinuous framing members has been modified to be consistent with the standard thickness established in the new AISI Product Data Standard, S201.
X	2304.12	Protection Against Decay and Termites. The provisions have been reorganized and modified to identify exactly where waterborne preservatives are required and where they are not required.
X	2306	Allowable Stress Design. American Forest and Paper Association has been updated to American Wood Council. Chapter 35 now references the 2015 <i>National Design Specification® (NDS®) for Wood Construction</i> and the 2015 <i>Special Design Provisions for Wind and Seismic (SDPWS)</i> . For an article on the

		significant changes to the 2015 NDS see http://awc.org/pdf/codes-standards/publications/nds/StructureMag-NDS2015-Changes-1501.pdf For an article on the significant changes to the 2015 SDPWS see http://awc.org/pdf/codes-standards/publications/sdpws/StructureMag-SDPWS2015-Changes-1507.pdf
X	2308	Conventional Light-Frame Construction This section contains prescriptive requirements for conventional wood frame construction, and has been reformatted and reorganized in its entirety. Significant changes include the introduction of new designations for wall bracing methods similar to those in the CRC as shown in new Table 2308.6.3(1), and reformatted wall bracing requirements set forth in Table 2308.6.1. The specific wall bracing requirements based on Seismic Design Category have been reformatted and are shown in tabular form in Table 2308.6.1, which is similar to the presentation approach in the CRC.
X	2308.2.5	Allowable Roof Span. Provisions related to limitations on roof span have been clarified as a part of the reformatting and reorganization of Section 2308.
X	2308.7	Roof and Ceiling Framing. The provisions and tables have been modified to incorporate the CRC provisions.
X	2309	Wood Frame Construction Manual. Section has been added to reference the American Wood Council's (AWC) Wood Frame Construction Manual (WFCM) for structural design of wood frame buildings assigned to Risk Category I or II. See http://awc.org/pdf/codes-standards/publications/updates-errata/AWC-WFCM2015-Changes-1505.pdf for an article on significant changes to the 2015 WFCM.

ACI 318-14 - ACI 318 has undergone a complete reorganization from its 2011 to 2014 edition. ACI 318-14, the reference standard for the 2016 CBC, has been reorganized as a member based document where the necessary requirements to design a member (Beam, column, walls, diaphragm, one & two way slabs and foundation) is found within a chapter for that particular member. However, design information which applies to multiple member types such as strength reduction factor, development length etc., is found in chapters 21 through 25.

NEW -CHANGE	ACI 318-14 SECTION/TABLE NUMBER	COMMENTARY
		<i>Note: ACI 318-11 code sections are shown in parenthesis</i>
X	Chapter 2	Notation and terminology - Hoop definition has been modified (Chapter 2)
X	8.6.2.3	Flexural members - Requirement for minimum area of bonded reinforcement is required for bonded tendons. Previously only required for unbonded tendons. (18.9.1)
X	8.7.5.6	Two-way slabs - Requirement for minimum area of bonded reinforcement is required for bonded tendons. Previously only required for unbonded tendons. (18.12.6)
X	9.5.4.7	Beams - Section was added to allow deep precast spandrels to have open web reinforcement. Previously required closed stirrups.
X	18.7.5.2	Column confinement for lateral and gravity columns - Parts (a), (b), (c) and (e) were already part of ACI 318-11. Parts (d) and (f) are new to ACI 318-14. Major

		difference is for highly axial loaded columns or $f'c > 10,000$ psi every longitudinal bar around perimeter needs to be laterally supported by tie and spacing of longitudinal bars shall not exceed 8 inches. (21.6.4.2)
X	Table 18.7.5.4	Amount of transverse reinforcement in lateral and gravity columns - Table 18.7.5.4 was added to ACI 318-14 and equation (c) was added for both rectilinear and spiral or circular hoops with new factors. These apply for highly axial loaded columns or $f'c > 10,000$ psi. (21.6.4.4)
X	18.8.2.4	Special moment frame beam-column joints - New section was added to ACI 318-14 which restricts the total height of a special moment frame beam to no greater than 2 times the depth of the column.
X	18.8.3.4	Special shear walls - Section applies to walls or wall piers with $h_w/l_w \geq 2$ only for cantilever walls. Compression zones shall be reinforced with Special boundary elements. Equation for neutral axis check has a new 1.5 factor on the denominator. Ratio of Δ/h_w shall not be taken less than 0.005 instead of 0.007 in ACI 318-11. (21.9.6.2 (a))
X	18.8.5.1	Special shear walls - Section was added to enforce minimum wall thickness of 12 inches throughout the specially confined boundary zone where the wall section is not tension controlled.
X	18.8.5.2	Special shear walls - Maximum center-to-center horizontal spacing of crossties and hoop legs is now restricted to the lesser of two-thirds the boundary element wall thickness or 14 inches. (21.6.4.2)
X	18.10.6.2 (a)	Special shear walls - Section was added to include a limit on the slenderness ratio of $l_u/16$ for special boundary elements.
X	18.10.6.4(c)	Special shear walls - Requires two curtains of web reinforcement in all walls having $h_w/l_w \geq 2$. (21.9.2.2)
X	18.10.6.4(e)	Sectional strength - Code is now explicit about shape of critical section beyond the outermost peripheral line of shear reinforcement shall be a polygon selected to minimize b_o . (11.11.1.2)
X	18.10.6.4 (b)	Special shear walls - Section applies to walls or wall piers with $h_w/l_w \geq 2$ only for cantilever walls. Compression zones shall be reinforced with Special boundary elements. Equation for neutral axis check has a new 1.5 factor on the denominator. Ratio of Δ/h_w shall not be taken less than 0.005 instead of 0.007 in ACI 318-11. (21.9.6.2 (a))
X	18.10.2.2	Special shear walls - Section was added to enforce minimum wall thickness of 12 inches throughout the specially confined boundary zone where the wall section is not tension controlled.
X	22.6.4.2	Special shear walls - Maximum center-to-center horizontal spacing of crossties and hoop legs is now restricted to the lesser of two-thirds the boundary element wall thickness or 14 inches. (21.6.4.2)