2012 IBC Changes for Wood Design

Part 2

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This article is the second of two that outlines changes for wood design in the 2012 *International Building Code* (IBC). The first article focused on the 2012 *National Design Specification® (NDS®) for Wood Construction* and appeared in the January 2012 issue of Structure magazine. Part 2 will outline other updated standards and code modifications.

2012 IBC Changes

Changes to the 2012 IBC are summarized in the Table *(page 22)* and covered in more detail as follows.

1609.1.1 Wind Loads and the use of ICC-600 and WFCM

A newly referenced standard ICC-600, *Standard for Residential Construction in High-Wind Regions*, is applicable for certain residential structures within its scope. ICC-600 fulfills in a more general way what AWC's *Wood Frame Construction Manual* (WFCM) *for One- and Two-Family Dwellings* does for wood construction. The WFCM is also an acceptable alternative standard referenced in this section for determining wind loads within the limits of 1609.1.1.1.

ICC 600 requires compliance with the WFCM in Chapter 3 of the standard, and then gives all the prescriptive requirements for the rest of the building: foundations, roofing, windows, etc. This new standard can be used with the typical wind provisions of the 2012 IBC and ASCE 7-10 *Minimum Design Loads for Buildings and Other Structures*. A table in the standard provides building geometry limits based on material type for the framing, such as three stories and a certain roof pitch. It applies mostly to residential buildings in high wind areas, but certain commercial structures could be within its scope.

1905.1.9 ACI 318 Appendix D and NDS

A new exception in the 2012 IBC to ACI 318 Appendix D permits up to ⅝-inch diameter anchor bolts installed in wood sill plates attached to concrete foundations to be designed in accordance with the NDS, with certain conditions. A problem developed in Appendix D of the concrete design standard, ACI 318, regarding design and sizing of anchor bolts. A code change to the 2012 IBC clarified that design in accordance with the NDS for determining anchor bolt lateral design values parallel to grain is permitted.

2301.2 New Log Structure Standard ICC-400

A new standard on *Design and Construction of Log Structures*, ICC-400 is referenced in the 2012 IBC. This will give code officials and log structure designers a reference standard. Previously, they were approved under the alternative design provisions of Section 104.11.

2303.1.1.2 New HRA designation for End-Jointed Lumber

End-jointed (finger jointed) lumber may be used interchangeably with solid sawn lumber of the same species and grade. If used in a fire resistance rated assembly, finger-jointed lumber must have the heat resistant adhesive (HRA) designation on the grade stamp.

2305 General Design Requirements for Lateral Force-Resisting Systems

Provisions for lateral design of wood structures have been coordinated with the 2008 edition of AWC's *Special Design Provisions for Wind and Seismic* (SDPWS-08). Design values for nailed diaphragms and shear walls were deleted from the 2009 IBC tables because the values are in the SDPWS-08 standard. Design and deflection values for stapled wood-frame diaphragms and shear walls remain in the code. Although the deflection of nailed wood-frame diaphragms and shear walls is determined in accordance with SDPWS, the deflection of stapled diaphragms and shear walls is not covered in the standard. Section 2305 provides the formulae and design parameters required to calculate deflection of blocked wood structural panel diaphragms and shear walls fastened with staples.

2306 Allowable Stress Design

Section 2306 references the 2008 SDPWS for lateral design of wood structures using allowable stress design. The general term "wood frame" has been added as a clarification of the intent, so the code now refers to wood-frame diaphragms and wood-frame shear walls. Design values for nailed diaphragms and nailed shear walls have been deleted from the tables in Section 2306 because the values are in the SDPWS standard. Design values for stapled shear walls and diaphragms remain in tables in the code. Table footnotes have been revised to account for removal of allowable design values for nailed diaphragms and shear walls. Sections 2306.2 and 2306.3 have been revised to clarify that design and construction as well as limitations in the SDPWS are applicable to stapled diaphragms and shear walls. Specific sections referring to particleboard, fiberboard and lumber-sheathed shear walls have been deleted because they are covered under the general term of "wood-frame shear walls" and their design provisions are included in the SDPWS standard.

A new national consensus standard, APA PRP-210, has been added to address wood structural panel siding products that were formerly covered under several national standards such as APA PRP-108. Siding products manufactured

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Summary of Changes to 2012 IBC.

IBC Section	Standard or topic	Modification
1609.1.1 Determination of wind loads	AWC 2012, *Wood Frame Construction Manual* (WFCM) *for One- and Two-Family Dwellings*	Updated standard
	ICC 600 *Standard for Residential Construction in High-Wind Regions*	Updated standard
1905.1.9 ACI 318, Section D.3.3	ACI 318-11 Appendix D	Permits NDS anchor bolt design
2301.2 General design requirements	AWC WFCM 2012	Updated standard
	ICC-400-12 *Log Structure Standard*	Updated standard
2301.1.1.2 End-jointed lumber	End-jointed lumber	New heat resistant adhesive designation
2303.1.4 Wood structural panels 2304.6.2 Interior paneling	*DOC PS 1-09 and PS 2-10 for Plywood and Wood-based Structural-use Panels*	Updated standards
2305 Lateral Force Resisting System	AWC 2008 *Special Design Provisions for Wind and Seismic* (SDPWS)	Removed code criteria duplicated in 2008 SDPWS
2306 Allowable stress design	AWC 2008 SDPWS	Removed code criteria duplicated in 2008 SDPWS
2306.1 Allowable stress design reference standards	AWC NDS-2012	Updated standard
	AITC 113-10 Standard glulam dimensions	Updated standard
	AITC 117-10 Softwood glulam	Updated standard
	APA PRP-210 plywood siding	New standard
2306.1.1 Joists and Rafters	AWC *Span Tables for Joists and Rafters 2012*	Updated standard
2307 Load and resistance factor design	AWC 2008 SDPWS	Removed code criteria duplicated in 2008 SDPWS
2307.1 Load and resistance factor design reference standards	AWC NDS-2012	Updated standard
2308.2.1 Nominal design wind speed greater than 100 mph (3-second gust)	AWC WFCM 2012	Updated standard
2308.12.4 Braced wall line sheathing	Braced wall line requirements for seismic design categories D and E	Table 2308.12.4 revised and new section 2308.12.4.1 added

to the ANSI/APA PRP-210 standard have been developed specifically for wall-covering/weatherproofing applications, carry an exterior exposure durability classification, and have equivalent shear performance on a thickness-by-thickness basis when fastened in accordance with shear wall Table 2306.3(1). The code permits panels complying with ANSI/APA PRP-210 to be designed using values for plywood siding in SDPWS.

To clarify the intent, the figure that accompanies the diaphragm table has been modified in the 2012 IBC. The figure in previous editions of the code has been difficult to interpret because of improper placement of annotation lines. The new figure has a legend to better differentiate between blocking and framing members, and annotation lines are more accurately placed in the figure. The design engineer is concerned with a specific diaphragm sheathing layout pattern with two loading cases, one for each orthogonal direction. Instead of six separate diaphragm configurations, the new figure shows three diaphragm layout patterns and two load cases for each diaphragm configuration. Although no technical changes were made to the figure, the new figure better illustrates the intent of the diaphragm design table.

The reference to AWC's *Span Tables for Joists and Rafters* in 2306.1.1 has been updated to the 2012 edition. The companion supplement, *Design Values for Joists and Rafters*, has been updated to the 2012 NDS *Design Values Supplement*. Changes include new design values for Coast Sitka Spruce and Yellow Cedar, and updates to Northern Species design values.

2307 Load and resistance factor design

LRFD provisions are now coordinated with 2008 SDPWS. Requirements for 3X members at abutting panel joints in the 2009 IBC Section 2307.1.1 are no longer necessary because similar provisions are contained in Section 4.3.7.1 of SDPWS-08. SDPWS requires 3X framing at adjoining panel edges and staggered nailing where nail spacing is 2 inches on center or less at adjoining panel edges, or where 10d common nails having penetration into framing members and blocking of more than 1½ inches are nailed at 3 inches on center or less at adjoining panel edges, or where required nominal unit shear capacity on either side of the shear wall exceeds 700 plf for buildings in Seismic Design Category D, E, or F. An exception permits two 2X framing members, provided they are fastened together in accordance with the NDS to transfer shear between members. When fasteners connecting the two framing members are spaced less than 4 inches on center, fasteners are required to be staggered.

The reference to AWC's NDS in 2307.1 has been updated to the 2012 edition.

2308 Conventional light-frame construction

Three modifications were made to Section 2308.12.4 that clarify the intent of provisions regarding prescriptive wall bracing of buildings in Seismic Design Categories (SDC) D and E. Conventional wood frame buildings in SDC A, B, and C require braced wall panels spaced every 25 feet in accordance with Table 2308.9.3(1). Conventional wood frame

buildings in SDC D and E are regulated by Table 2308.12.4 for determining required wall bracing. This table previously provided the minimum length of wall bracing per 25 feet of braced wall line length but did not give a minimum percentage. Because there was no percentage given, it was not clear how to properly apply table requirements. For example, for a building sited where S_{DS} > 1.00g, the table required 12 feet of wall bracing for each 25 feet of wall. It was clear that a 25-foot-long wall required 12 feet of bracing, and a 50-foot-long wall required 24 feet of bracing, but it was not explicitly clear what amount of bracing would be required for a 40-foot-long wall. To resolve this, Section 2308.12.4 and Table 2308.12.4 were revised to specify a minimum percentage of wall bracing instead of a minimum length of bracing per 25 feet. For example, for a building sited where S_{DS} > 1.00g, the table now requires 48 percent of wall bracing. Thus, a 40-foot-long braced wall line requires 0.48 x 40 = 19 feet of wall bracing.

Second, for buildings in SDC A, B, and C, Sections 2308.9.3.1 and 2308.9.3.2 are quite clear that alternate braced wall panels and alternate braced wall panels adjacent to a door or window opening can be substituted for wall bracing required by Section 2308.9.3. However, for buildings in SDC D and E, the code was not clear that these alternate braced wall panels could be substituted for wall bracing required by Table 2308.12.4. Although it was the intent of the code, it was difficult to conclude this by simply reading this section. To resolve this issue, a new Section 2308.12.4.1 has been added that clearly states that alternate braced wall panels constructed in accordance with Section 2308.9.3.1 or 2308.9.3.2 are permitted to be substituted for braced wall panels required by Table 2308.12.4.

Third, footnote "a" of Table 2308.12.4 states that the height-to-width ratio for braced wall panels cannot exceed 2:1. For a typical 8-foot-high wall, this means the minimum length of the braced wall panel must be 4 feet. The alternate braced wall panel described in Section 2308.9.3.1 is 2 feet 8 inches in length, and the alternate braced wall panels adjacent to an opening in Section 2308.9.3.2 can be only 16 inches in length for a one-story building. It was not clear whether footnote "a" in effect meant that the alternate braced wall panels of Section 2308.9.3.1 and 2308.9.3.2 cannot be used in SDC D and E because of the restriction on height-to-width ratio. This table is derived from Section 12.4 and Table 12.4-2 of the 2003 *NEHRP Provisions*, which do not require overturning restraint and do not include alternate braced wall panels. According to the *NEHRP Commentary*, it appears that the primary concern that led to the aspect ratio requirement is aimed at minimizing overturning demand due to lack of overturning restraint at braced wall panels. The alternate braced wall panels address overturning directly by specifically requiring overturning restraint devices; thus, they should not be subject to the 2:1 h/w limit. To resolve this, footnote "a" was modified so that the 2:1 height-to-width ratio limitation does not apply to alternate braced wall panels.

Conclusion

The 2012 IBC represents the state-of-the-art for design and construction of buildings outside the scope of the *International Residential Code* (IRC). Enforcement has already begun in those jurisdictions adopting the latest building code. However, building officials are also apt to accept designs prepared in accordance with newer reference standards even if the latest building code has not been adopted in their jurisdiction. IBC 104.11 and IRC R104.11 for alternate materials and design provides the authority having jurisdiction with that leeway.▪