Technical Q & A

Height Limitations of Wood Framed Buildings

by Will Warlick and Richard Zimmermann

Get familiar with the height restrictions for wood framed buildings.

Question

Is a 4-story residential occupancy wood-framed building allowed per code, and what stud spacing is required in the first story?

As a 4-story residential building, this structure falls outside the limits of the International Residential Code (IRC) which is limited to three stories above grade. One then needs to determine how this building fits within the provisions of the IBC. The IBC covers height limitations in Table 503 Allowable Height and Building Areas (see Figure 1). Heights and areas are based on construction type (I to V) and use and occupancy classification groups.

TABLE 503
ALLOWABLE HEIGHT AND BUILDING AREAS[a]
Height limitations shown as stories and feet above grade plane.
Area limitations as determined by the definition of "Area, building," per story

			E IV	TYPE V	
		A	r	A	B
GROUP	HGT(feet) HGT(S)	UL		50	40
R-1	S	UL		3	2
	A	UL	00	12,000	7,000
R-2	S	UL		3	2
	A	UL	00	12,000	7,000
R-3	S	UL		3	3
	A	UL	L	UL	UL
R-4	S	UL		3	2
	A	UL	00	12,000	7,000

Figure 1.

A structure with wood-framed exterior bearing walls would be categorized as Type V. If it is also categorized as sub-type A (1-hour fire-protected structural elements), a height of three stories is permitted with a maximum height of 50'.

The IBC allows for increases to the values in Table 503. Since the question only involves number of stories, we will only consider the height increases given in Section 504:

504.2 Automatic sprinkler system increase. For Group R buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.2, the value specified in Table 503 for maximum height is increased by 20 feet (6096 mm) and the maximum number of stories is increased by one, but shall not exceed 60 feet (18 288 mm) or four stories, respectively.

So a wood-framed building can be four stories tall and not more than 60 feet high, and still fall within the provisions of the IBC.

Stud spacing requirements are covered in IBC Chapter 23 for buildings which fall within the prescriptive provisions; however, these are applicable only to buildings up to three stories per Section 2308 Conventional Light-Frame Construction:

2308.2 Limitations. Buildings are permitted to be constructed in accordance with the provisions of conventional light-frame construction, subject to the following limitations, and to further limitations of Sections 2308.11 and 2308.12.

1. Buildings shall be limited to a maximum of three stories above grade. For the purposes of this section, for buildings in Seismic Design Category D or E as determined in Section 1613, cripple stud walls shall be considered to be a story.

at a glance

- Wood-framed buildings over three stories above grade should be designed under the IBC.
- These buildings fall outside the prescriptive/conventional construction provisions of the IRC and IBC and must be designed using engineering principles.

Based on this, the prescriptive stud spacing requirements of the IBC are not applicable. This building must be designed according to another permitted method (2301.2 General design requirements):

2301.2 General design requirements. The design of structural elements or systems, constructed partially or wholly of wood or wood-based products, shall be in accordance with one of the following methods:

1. Allowable stress design in accordance with Sections 2304, 2305 and 2306.
2. Load and resistance factor design in accordance with Sections 2304, 2305 and 2307.
3. Conventional light-frame construction in accordance with Sections 2304 and 2308.

Exception: Buildings designed in accordance with the provisions of the AF&PA WFCM shall be deemed to meet the requirements of the provisions of Section 2308.

So for this building, the design of the wood framing members and connections requires engineering.

- For buildings under the 2003 IBC one would use the 2001 edition of the National Design Specification® (NDS®) for Wood Construction for allowable stress design (ASD). Alternatively, one could use ASCE 16, Standard for Load Resistance Factor Design (LRFD) for Engineered Wood Construction.
- For buildings under the 2006 IBC one would use the 2005 edition of the NDS® for both ASD and LRFD.

Since every structure could have different load considerations, the requirements for the studs in the lower story (as well as headers, etc.), would be based upon the flow of loads calculations and engineered design. Typically the first floor of a 4-story apartment complex will have doubled 2x4 studs spaced at 12" on center to provide a frame of reference. There is no canned response to the question asked regarding the stud spacing for the first story of a four story structure. However, 4-story wood frame construction is reasonably common, and there are many engineering firms that can provide design solutions. SBC

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