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</tr>
<tr>
<td>8.7</td>
<td>Rafter spans for common lumber species, No. 2 grade (ground snow load = 30 psf, ceiling attached to rafters, L/240, dead load = 10 psf)</td>
</tr>
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<td>8.8</td>
<td>Rafter spans for common lumber species, No. 2 grade (ground snow load = 50 psf, ceiling attached to rafters, L/240, dead load = 10 psf)</td>
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Acknowledgments

The author is grateful to Ron Van Note, master carpenter and builder, for his usual expert counsel.
Introduction

Home Builders’ Jobsite Codes is a field guide for builders, trade contractors, design professionals, inspectors, and others involved in the design and construction of residential buildings. It is based on the 2012 International Residential Code® (IRC). This comprehensive stand-alone code establishes minimum regulations for the construction of one- and two-family dwellings and townhomes. It includes provisions for

- Structural design
- Fire and life safety
- Energy conservation
- Mechanical systems
- Fuel-gas systems
- Plumbing
- Electrical systems

The IRC’s purpose is to safeguard public safety, health, and general welfare from fire and other po-
Potential hazards attributed to the built environment, while keeping homes affordable. The code provides for strong, stable, and sanitary homes that conserve energy and yet offer adequate lighting and ventilation.

Published by the International Code Council® (ICC), the IRC is maintained and updated through an open code development process and is available internationally for adoption by governing authorities.

Home Builders’ Jobsite Codes focuses on the prescriptive provisions of the IRC—“recipes,” if you will, for meeting code requirements without the need for an engineered design. These provisions address all aspects of conventional construction of dwellings and their accessory buildings. Illustrations and tables assist the reader in understanding the code requirements and address frequently asked questions. Some terms appear in italics the first time they are used in the text. The glossary at the back of the book defines these terms. Home Builders’ Jobsite Codes also includes other useful information not in the IRC, such as weights of building materials and components.

Although this guide is organized into chapters similar to the IRC, there are some important exceptions. For example, for ease of use, IRC “Building
Planning” requirements, detailed in chapter 3 of the code itself, are divided into three separate chapters in this pocket guide:
1. Structural Design Criteria
2. Fire Protection
3. Safe and Healthy Living Environments

*Home Builders’ Jobsite Codes* explores these important issues in more detail in other chapters as well.

*Home Builder’s Jobsite Codes* is not an official code, and has not been adopted as such in any jurisdiction. The publication intends to serve as a guide only. It does not include all applicable requirements of the IRC. For example, certain *performance* criteria related to engineered design are outside the limited scope of this publication. Builders should consult the IRC, local amendments, and local building departments for more detailed requirements and for criteria related to other methods of construction.

Builders also should obtain specific information on design criteria for wind, snow, seismic (earthquake) events, flood, soil, or other atmospheric and geological conditions, as well as any amendments to the code, from their local building departments. Since code requirements for energy conservation, decay resistance, and termite control requirements also
may vary by geographic region, builders should obtain that information from local building code departments.

Structural Design Criteria

The IRC establishes minimum structural design criteria necessary to accommodate normal loads placed on a building and, depending on a home’s location, resist the forces of natural hazards such as snow, wind, earthquake, and flood. In most cases, the tried-and-true construction practices offered in the IRC incorporate these criteria, eliminating the need for an engineered design or complex calculations. For example, the code provides span tables for conventional wood framing elements such as joists, girders, headers, and rafters.

Construction must safely support all loads:
- Snow, wind, seismic, and flood loads, which vary by geographic region
- Live loads
- Dead loads
- Roof loads
Note: The roof is designed for the roof live load (not more than 20 psf) or the snow load, whichever is greater.

To correctly apply the values of the tables and the prescriptive methods of construction, builders must know the structural design criteria in the planning chapter of the code. Determining the appropriate live loads is fairly straightforward. However, seismic, wind, snow, soil, or flood area values differ by geographic location. In addition, frost depth, weathering severity, ice barrier underlayment requirements, and history of termite damage vary by climate and geography. Therefore, builders often must obtain information through the maps found in the IRC or through their local building departments.

Moreover, some structural elements still may require an engineered design. For example, the sizing of wide-flange steel beams commonly used in dwelling construction is outside the scope of the IRC. Instead, accepted engineering practices will determine their sizes.

**Live Loads**

Minimum required live loads for floors are based on the use of the space. Guards and handrails also must be secured to safely resist forces against them (table 1.1).
<table>
<thead>
<tr>
<th>Use</th>
<th>Live load (psf)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rooms other than sleeping rooms</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Sleeping rooms</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Decks and exterior balconies</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Stairs</td>
<td>40</td>
<td>Concentrated load of 300 lb. per 4 sq. in.</td>
</tr>
<tr>
<td>Habitable attics and attics served by fixed stairs</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Uninhabitable attics with limited storage</td>
<td>20</td>
<td>Access hatch or pull-down stair to storage area at least 24 in. wide × 42 in. high</td>
</tr>
<tr>
<td>Uninhabitable attics without storage</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Passenger vehicle garages</td>
<td>50</td>
<td>Elevated garage floors must support a concentrated load of 2,000 lb. per 20 sq. in.</td>
</tr>
<tr>
<td>Handrails and top rails of guards</td>
<td></td>
<td>Concentrated load of 200 lb. applied from any direction</td>
</tr>
<tr>
<td>Guard balusters and infill panels</td>
<td></td>
<td>Horizontally applied load of 50 lb. on an area of 1 sq. ft.</td>
</tr>
</tbody>
</table>
Deflection

Allowable deflection is a measurement of bending under code-prescribed loads to ensure adequate stiffness of structural framing members such as studs, joists, beams, and rafters (table 1.2). Although the prescriptive tables account for deflection in their values, builders must be familiar with deflection limits in order to choose the appropriate table for sizing a framing member. Allowable deflection is measured by dividing the span or length (L) of the member by a prescribed factor, such as 360 for floor joists (L/360). To determine allowable deflection for a certain span, convert feet to inches and divide the

<table>
<thead>
<tr>
<th>Structural member</th>
<th>Allowable deflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rafters, slope &gt; 3/12, no finished ceiling attached to rafters</td>
<td>L/180</td>
</tr>
<tr>
<td>Rafters, slope &gt; 3/12, finished ceiling attached to rafters</td>
<td>L/240</td>
</tr>
<tr>
<td>Ceiling joist</td>
<td>L/240</td>
</tr>
<tr>
<td>Plastered ceilings</td>
<td>L/360</td>
</tr>
<tr>
<td>Floors</td>
<td>L/360</td>
</tr>
<tr>
<td>All other structural members</td>
<td>L/240</td>
</tr>
</tbody>
</table>

Note: Wall deflection and wind load deflections are not shown.
result by 360. The following example is for a floor joist with a 16 ft. span:
L = 16 ft. × 12 in. = 192 in.
Allowable deflection = 192 in. / 360 = 0.53 in.
allowable deflection for this floor joist is approximately ½ in.

*Note:* A 16 ft. span rafter with a 4/12 slope and no ceiling attached has an allowable deflection of L/180, which is twice the deflection allowed for floor joists.

**Calculating Dead Loads**

The prescriptive tables of the IRC detailing continuous footing sizes for conventional frame construction assume average weights of construction materials. Therefore, additional calculations typically are not required. The material and component weights (tables 1.3 and 1.4) may help builders correctly size a post, pad footing, or another element not covered in the IRC tables.

**Wind**

The prescriptive structural provisions of the IRC are limited to those geographical regions with wind speeds less than 110 mph as defined in the IRC.
Table 1.3 Building material weights

<table>
<thead>
<tr>
<th>Materials</th>
<th>Weight (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plywood—(\frac{1}{4}) in.</td>
<td>.8</td>
</tr>
<tr>
<td>Plywood—(\frac{1}{2}) in.</td>
<td>1.6</td>
</tr>
<tr>
<td>Plywood—(\frac{3}{4}) in.</td>
<td>2.4</td>
</tr>
<tr>
<td>4” Brick</td>
<td>35</td>
</tr>
<tr>
<td>Gypsum board—(\frac{1}{2}) in.</td>
<td>2.1</td>
</tr>
<tr>
<td>Gypsum board—(\frac{5}{8}) in.</td>
<td>2.5</td>
</tr>
<tr>
<td>Quarry tile—(\frac{1}{2}) in.</td>
<td>5.8</td>
</tr>
<tr>
<td>Hardwood flooring—(\frac{23}{32}) in.</td>
<td>4</td>
</tr>
<tr>
<td>Built-up roofing</td>
<td>6.5</td>
</tr>
<tr>
<td>Shingles, asphalt</td>
<td>1.7–2.8</td>
</tr>
<tr>
<td>Shingles, wood</td>
<td>2.0–3.0</td>
</tr>
<tr>
<td>Common dimension lumber (lb. per cu. ft.)</td>
<td>27–29 lb. per cu. ft.</td>
</tr>
<tr>
<td>Concrete (lb. per cu. ft.)</td>
<td>150 lb. per cu. ft.</td>
</tr>
</tbody>
</table>

wind maps. Otherwise, the code requires a design in accordance with one of the referenced standards. In addition to an engineered design that complies with the *International Building Code (IBC)*\(^1\) and ASCE 7,\(^2\) the IRC includes references to ICC 600, *Standard for Residential Construction in High Wind Regions*\(^3\) and *AF\&PA Wood Frame Construction Manual (WFCM)*.\(^4\)
Table 1.4 Average weights of building components

<table>
<thead>
<tr>
<th>Description</th>
<th>Weight (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof dead load (framing, sheathing, asphalt shingles, insulation, drywall)</td>
<td>10</td>
</tr>
<tr>
<td>Exterior wall (2 × 4 framing, sheathing, siding, insulation, drywall)</td>
<td>10</td>
</tr>
<tr>
<td>Floor (joist, sheathing, carpeting, drywall)</td>
<td>10</td>
</tr>
<tr>
<td>Concrete wall—8 in. thick</td>
<td>100</td>
</tr>
<tr>
<td>10 in. thick</td>
<td>125</td>
</tr>
<tr>
<td>12 in. thick</td>
<td>150</td>
</tr>
<tr>
<td>Concrete block wall—8 in. thick</td>
<td>60</td>
</tr>
</tbody>
</table>

**Wind Exposure Category**

In addition to the basic wind speeds for a geographic area, ground surface irregularities affect the wind’s impact on a building. The IRC classifies wind exposure into three categories:

1. Exposure B—some wind protection with trees and buildings characteristic of urban and suburban settings
2. Exposure C—open terrain with scattered obstructions and shorelines in hurricane-prone regions
3. Exposure D—adjacent to large bodies of water, such as the Great Lakes, or in western coastal areas
Exposure categories are important design criteria for engineering purposes. For many of the prescriptive methods of wood frame construction in the IRC, wind exposure category is not a factor. However, wind exposure category must be considered when applying the provisions for wall sheathing, wood wall bracing, roof tie-down, and exterior wall and roof coverings. The following components must be listed and installed to resist wind loads based on the wind speed and exposure category:

- Siding
- Roof covering
- Windows
- Skylights
- Exterior doors
- Overhead doors

**Hurricanes**

Hurricane-prone regions are the coastal areas of the Atlantic Ocean and Gulf of Mexico where the basic wind speed is greater than 90 mph. The IRC wind maps identify the portions of hurricane-prone regions that require an engineered design or a design that complies with other referenced standards. Windows and other glazing require additional protection if they are in windborne debris regions—those areas within hurricane-prone regions as specifically identified in the wind maps.
Storm Shelters

Storm shelters, sometimes called safe rooms, are not required by the code. However, they offer added protection from the destructive forces of high winds, hurricanes, and tornadoes. When installed within a dwelling or as a separate structure, storm shelters must conform to the requirements of ICC-500, *Standard on the Design and Construction of Storm Shelters*.

Earthquake

The IRC assigns a seismic design category (SDC) to building sites relative to the anticipated intensity and frequency of earthquakes. (For more details, see the seismic map in the code.) For buildings located in SDC A or B and constructed under the prescriptive methods of the IRC, there are no additional seismic requirements. One- and two-family dwellings in SDC C also are exempt from the seismic requirements. However, specific seismic requirements apply to townhomes sited in SDC C, and to all buildings in SDC D₀, D₁, and D₂.

The higher seismic design categories (SDC D₀, D₁, and D₂) occur predominantly in western parts of the U.S., in the New Madrid area of Missouri, Illinois, Indiana, Tennessee, and Arkansas, and in South Carolina.