



5.4.4 Subfloor Design

Typical subfloor sheathing is nominal 5/8- or 3/4-inch-thick 4x8 panels of plywood or oriented strand board (OSB) with tongue-and-groove edges at unsupported joints perpendicular to the floor framing. Sheathing products are generally categorized as wood structural panels and are specified in accordance with the prescriptive span rating tables published in a building code or are made available by the manufacturer. Example 5.5 uses the *Design and Construction Guide: Residential and Commercial* (APA, 1998a) to specify sheathing. The prescriptive tables provide maximum spans (joist spacing) based on sheathing thickness and span rating. It is important to note that the basis for the prescriptive tables is the standard beam calculation. If loads exceed the limits of the prescriptive tables, the designer may be required to perform calculations; however, such calculations are rarely necessary. In addition, the APA offers a plywood floor guide for residential garages that assists in specifying plywood subflooring suitable for heavy concentrated loads from vehicle tire loading (APA, 1980).

The APA also recommends a fastener schedule for connecting sheathing to floor joists. Generally, nails are placed a minimum of 6 inches on center at edges and 12 inches on center along intermediate supports. Refer to Table 5.7 for recommended nail sizes based on sheathing thickness. Nail sizes vary with nail type (e.g., sinkers, box nails, and common nails), and various nail types have different characteristics that affect structural properties (refer to Chapter 7). For information on other types of fasteners, consult the manufacturer. In some cases, shear loads in the floor diaphragm resulting from lateral loads (i.e., wind and earthquake) may require a more stringent fastening schedule; refer to Chapter 6 for a discussion on fastening schedules for lateral load design. Regardless of fastener type, gluing the floor sheathing to the joists increases floor stiffness and strength.

TABLE 5.7 *Fastening Floor Sheathing to Structural Members*¹

Thickness	Size and Type of Fastener
Plywood and wood structural panels, subfloor sheathing to framing	
1/2-inch and less	6d nail
19/32- to 1-inch	8d nail
1-1/8- to 1-1/4-inch	10d nail or 8d deformed shank nail
Plywood and wood structural panels, combination subfloor/underlayment to framing	
3/4-inch and less	8d nail or 6d deformed shank nail
7/8- to -inch	8d nail
1-1/8- to 1-1/4-inch	10d nail or 8d deformed shank nail

Notes:

¹Codes generally require common or box nails; if pneumatic nails are used, as is common, refer to NER-272 (NES, 1997) or the nail manufacturer's data. Screws are also commonly substituted for nails. For more detail on fasteners and connections, refer to Chapter 7.

While not as common today, boards may also be used as a subfloor (i.e., board sheathing). Floor sheathing boards are typically 1x6 or 1x8 material laid flatwise and diagonally (or perpendicular) on the floor joists. They may be designed using the NDS or local accepted practice.



5.5 Wall Framing

The objectives of wall system design are

- to resist snow, live, and dead loads and wind and seismic forces;
- to provide an adequate subsurface for wall finishes and to provide openings for doors and windows;
- to serve as a thermal and weather barrier;
- to provide space and access for electrical and mechanical equipment, where required; and
- to provide a one- to two-hour fire barrier if the wall separates individual dwelling units in attached or multifamily buildings.

5.5.1 General

A wall is a vertical structural system that supports gravity loads from the roof and floors above and transfers the loads to the foundation below. It also resists lateral loads resulting from wind and earthquakes. A typical wood-framed wall is composed of the following elements as shown in Figure 5.5:

- studs, including wall, cripple, jack, and king studs;
- top and bottom (sole) plates;
- headers;
- sheathing; and
- diagonal let-in braces, if used.

Residential wall systems have traditionally been constructed of dimension lumber, usually 2x4s or 2x6s, although engineered wood studs and cold-formed steel studs are now seeing increased use. Wall studs are vertical, repetitive framing members spaced at regular intervals to support the wall sheathing. They span the full height of each story and support the building loads above. King and jack studs (also known as jamb studs) frame openings and support loads from a header. Cripple studs are placed above or below a wall opening and are not full height. Built-up wall studs that are assembled on the jobsite may be used within the wall to support concentrated loads. Top and bottom plates are horizontal members to which studs are fastened. The top and bottom plates are then fastened to the floor or roof above and either to the floor below or directly to the foundation. Headers are beams that transfer the loads above an opening to jack studs at each side of the opening.