

SOLID SAWN LUMBER AWARENESS GUIDE



**American
Forest &
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Association**

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The purpose of this informational guide is to provide awareness to the fire service on the types and properties of solid sawn lumber and how they are used in the construction of residential buildings. This publication is one in a series of eight Awareness Guides developed under a cooperative agreement between the [Department of Homeland Security's United States Fire Administration](#) and the [American Forest & Paper Association](#).

Solid Sawn Lumber

PURPOSE OF THIS GUIDE

The purpose of this Awareness Guide is to provide the fire service with information on the types and properties of solid sawn lumber and how it is used in residential construction (Figure 1).

Figure 1 Solid Sawn Lumber



Solid sawn, dimension lumber is used in many aspects of today's house construction. Lumber is used almost exclusively for wall framing. It is still common in floor construction, but less so as roof framing.

SOLID SAWN LUMBER—TRADITION MEETS TECHNOLOGY

Wood has been and continues to be one of the most widely used building materials in the world. Wood products are strong, lightweight, easy to work with, and environmentally friendly since they are obtained from a renewable resource—trees. Wood products are very cost-effective, manufactured from a natural material that requires very little manufacturing energy. This Awareness Guide describes one of these wood products—lumber.

Brief History

Lumber has been used in building construction for centuries. In the 1700s, lumber in the United States was produced from logs that were hand-hewn or hand-sawn into rectangular lumber members. In the mid-1800s, steam and water-powered sawmilling operations were constructed. These operations used powerful circular saws to cut logs into lumber. In the early 1900s, sawmilling operations began to plane rough sawn lumber into “dressed” lumber, which made it easier to handle and grade for structural applications (see Figure 1). Today, most lumber used in structural applications is dressed lumber.

Methods of Wood Construction

Western Platform

In platform-frame construction, floor joists are sheathed with sub-flooring, such as plywood or oriented strand board. Prior to volume production of plywood, most floor and roof sheathing consisted of diagonal wood boards. Although still uncommon, some new construction uses tongue and groove solid or laminated decking. This creates a “platform” upon which exterior walls and interior partitions are constructed (see Figures 2 and 3).

In platform systems, it is common practice to assemble wall framing flat on the floor and tilt the wall section into place. The sole plate of the wall is fastened through the subfloor into the framing beneath. Today this is the most popular type of construction used in home building. It provides a work surface at each floor level and is readily adapted to various methods of prefabrication. Further, worker safety is improved, since the use of ladders is reduced and the work surface is secure.

For the fire service, platform construction provides a structural frame that is fire blocked by virtue of the style of construction—the wall sole plates and top plates isolate the horizontal floor cavity from the vertical wall cavity, as required by building codes.

Figure 2 Platform Construction



Platform construction is today's most common method of construction. It combines safety for framers while the building is under construction, with inherent firestopping once the walls are sheathed.

Figure 3 Integrated Fire Blocking



Platform construction provides a structural frame that is fire blocked by virtue of the style of construction—the wall sole plates and top plates isolate the horizontal floor cavity from the vertical wall cavity, as required by building codes. The top plates of the wall prevent movement of fire into the floor cavity. Similarly, the top and sole plates of the wall above prevent fire spread from the floor joist cavity into the walls.

Balloon Framing

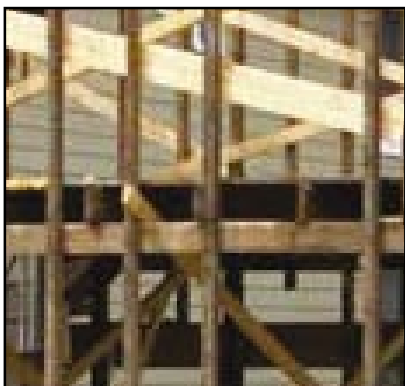
In older style balloon-frame construction, exterior wall studs are continuous from the foundation to the roof (see Figure 4). First floor joists and exterior wall studs both bear on the anchored sill. Second-floor joists bear on a minimum 1x4-inch ribbon strip, which has been let-in to the inside edges of exterior wall studs. In two-story buildings with brick or stone veneer exteriors, balloon framing reduces variations in settlement of framing and the masonry veneer. Where exterior walls are solid masonry, balloon framing of interior bearing partitions also reduces distortions in door and closet openings in crosswalls. The requirement for longer studs, and the difficulty in accommodating current erection practices and fire blocking (see Figure 5), has reduced the popularity of this system.

Figure 4 Balloon Framing



Early house construction was “balloon” framed. This house, undergoing major renovation, is a good example of balloon framing. Unless firestopping is added, fire within the wall can easily spread vertically, since there are no top plates. Fire originating in the floor/ceiling assembly can spread horizontally and eventually vertically through the walls.

Figure 5 Firestopping in Balloon Framing



In accordance with the recommendations of the American Forest & Paper Association and building codes, firestopping will be installed in this balloon framing at the ceiling line and floor line.

Types and Characteristics of Lumber Today

Note: All dimensions referring to lumber (e.g. 2x4) are “nominal” dimensions, not exact ones. This is because after the rough sawn lumber is planed (“dressed”) and dried, the resulting actual dimensions are slightly smaller.

Dimension Lumber

—Products of rectangular cross-section that are from 2" to 4" (nominal) in thickness and 2" or more (nominal) in width. Categories and grades of dimension lumber are standardized under the *National Grading Rule for Softwood Dimension Lumber*, which provides standard use categories, grade names, and grade descriptions. These products are sorted and graded as either *visually-graded dimension lumber* or *mechanically-graded dimension lumber*.

■ VISUALLY-GRADED DIMENSION LUMBER

—Dimension lumber that has been graded and sorted by visual inspection. It is primarily intended for conventional and engineered applications (see Figure 6). Visual grading is the oldest stress-grading method. Stress grading determines strength and structural capacity. Skilled graders examine the lumber for defects, and grade it in comparison to clear wood with a straight grain. Tree growth characteristics, that affect lumber properties and can be seen and judged by eye, are used to sort the lumber into stress grades. Typical visual sorting criteria include density, decay, heartwood and sapwood, slope of grain, knots, shake, checks and splits, wane, and pitch pockets.

Visually-graded dimension lumber is further separated into four categories:

- Structural Light Framing (2" to 4" thick, 2" to 4" wide)
- Light Framing (2" to 4" thick, 2" to 4" wide)
- Studs (2" to 4" thick, 2" or wider)
- Structural Joists & Planks (2" to 4" thick, 5" or wider).

Figure 6 Wall & Roof Framing



Dimension lumber is used for wall and roof framing. When lumber is used for roof framing, it is referred to as rafters. This complex rafter framing will be extremely difficult to detect once the sheathing and drywall are installed.

■ MECHANICALLY-GRADED DIMENSION LUMBER

—Dimension lumber that has been evaluated and sorted by mechanical stress-rating equipment that involves non-destructive testing of individual pieces. It is primarily intended for engineered applications. Mechanically-graded dimension lumber is itself divided into two categories:

- *Machine evaluated lumber (MEL)*
 - Dimension lumber that has been evaluated by calibrated mechanical grading equipment, which measures certain properties and sorts the lumber into various strength classifications. MEL lumber is also required to meet certain visual grading requirements. Machine evaluated lumber is typically 2" or less thick and 2" or more wide.
- *Machine stress rated (MSR) lumber*
 - Dimension lumber that has been evaluated by mechanical stress-rating equipment to measure and sort the lumber according to its stiffness (which

correlates with strength). It is intended for any engineered application where strength and stiffness are important, such as trusses, floor or ceiling joists, or rafters. MSR lumber is also required to meet certain visual grading requirements. Machine stress rated lumber is typically 2" or less thick and 2" or more wide.

Beams and Stringers

—Products of rectangular cross section that are 5" or more in thickness with the width more than 2" greater than the thickness. These members, such as 6x10s, 6x12s, 8x12s, 8x16s, and 10x14s, are intended primarily to resist bending loads applied to the narrow face.

Figure 7 Post Frame Construction



Post frame construction is used widely in the construction of agricultural buildings. Tall columns are embedded in the ground and are braced from buckling by horizontal pur-lins. Roof trusses are supported along the length of the wall by headers attached to the tops of the columns.

Posts and Timbers

—Products of square or rectangular cross section that are 5" (nominal) or more in thickness, but with width not more than 2" greater than the thickness. These columns, such as 6x6s, 6x8s, 8x10s, and 12x12s, are intended primarily to resist axial loads (see Figure 7).

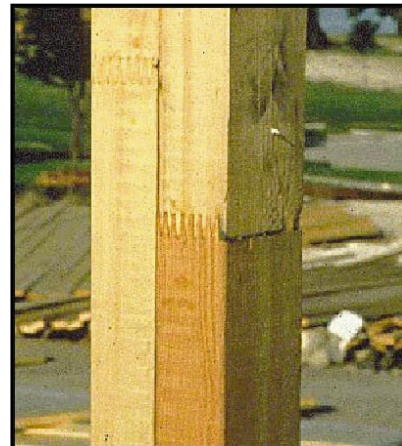
Decking

—Lumber from 2" to 4" thick, intended for use as floor, roof, or wall sheathing. Decking is primarily applied in the flat-wise direction with the wide face of the decking in contact with supporting members. The narrow face of decking may be flat, tongue-and-grooved, or spline-and-grooved for interconnection of the decking members.

Finger-Jointed Lumber

—Dimensional lumber made of short pieces cut from traditional lumber stock. The ends of each small piece are machined in a finger profile and glued together. Because structural finger-jointed lumber products are graded using the same rules that are applied to solid-sawn dimension lumber, they bear the same grademarks as may be found on solid-sawn lumber (see Figure 8). There are a number of adhesives used in the fabrication of finger-jointed lumber. For more information, see the *Adhesives Awareness Guide*.

Figure 8 Finger-jointed Lumber



Finger-jointed lumber is made up of short pieces with the ends machined in a finger profile and glued together. The adhesive used varies based on the application.

FIRE INCIDENTS

The National Institute of Occupational Safety and Health (NIOSH) maintains a database of firefighter fatalities. Each fire is reported separately with details on the fire and circumstances leading to the fatality. Additionally, the reports provide a summary of fire ground management and command activities upon which improvement could be made. This information is extremely valuable to the fire service as a learning aid.

You are encouraged to access the reports at the NIOSH website and make them part of your training curriculum. For more information, visit:

<http://www.cdc.gov/niosh/firehome.html>

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