

UPDATED
AND
EXPANDED
SECOND
EDITION



COMPLETE BOOK OF
FRAMING

An Illustrated Guide for Residential Construction

Scot Simpson

RSMeans
FROM THE GORDIAN GROUP®

WILEY

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ABOUT THE AUTHOR

Scot Simpson has recently retired from a lifetime of framing houses, schools, and commercial buildings for 41 years. He owned a construction firm for 36 years. His firm, S.S. Framing, Inc., was based in Edmonds, WA. He developed and refined the methods in this book and used them to train his crews. Scot is the author of two other construction books and many articles for construction magazines, such as *Fine Homebuilding* and the *Journal of Light Construction*. He developed and hosted the video “Resisting the Forces of Earthquakes” with the Earthquake Engineering Research Institute and the International Conference of Building Officials.

Scot is a member of the International Code Council (ICC), the Construction Specifications Institute (CSI), and the Associated General Contractors of America (AGC), and was 2006 Chairman of the ABC Framers Council. He has presented training and seminars for the National Association of Homebuilders, the American Forest and Paper Association, and the International Conference of Building Officials, among others, in the U.S., Japan, Korea, the Czech Republic, Bulgaria, Spain, Greece, and Mexico.

Scot holds an MBA from Kent State University, as well as a BA and technical certificates in carpentry instruction, lumber grading, and industrial first aid.

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INTRODUCTION

I was a framing contractor for 36 years. I've spent most of my career as a lead framer, directing my framing crews and training workers to become framers. In my teaching, I found that much of the information I needed was not available in a good book, so I wrote one, *Framing & Rough Carpentry*. As I started spending more of my time training and working with lead framers, I again looked for a good, easy-to-understand reference. I didn't find what I needed, so I wrote another book, *Advanced Framing Methods*, that provides all the information a framer needs to move up to the next level—becoming a lead framer. *The Complete Book of Framing* is the combination of those two books, updated with full-color illustrations and photographs, plus additional information—all presented in what I've come to think of as a “framer-friendly” format.

Now, as a retired framer, I realize how much I abused my body during a lifetime of framing. While updating this book I added a section on “Healthy Framing”—what you need to know about how framing affects your body; and what you can do to minimize those effects.

If you're a novice with no framing experience, you'll see the basics of framing shown in a simple, step-by-step style that makes it easy to learn. Where possible, I included both photographs and drawings

for each step—for quick and complete learning. The advanced information will be more difficult for a novice to understand, but getting a good feel for the framing basics that come before it will help. The more advanced tasks are also explained with photos and clear drawings.

If you're already an experienced framer, the book gives you some unique tools that you won't find anywhere else. For example, after struggling with rafters and rake walls for years, I developed a diagonal percent system that makes it easier. I use this for finding rafter lengths and rake wall stud heights. The book also explains all the “classic” methods for doing these tasks, but once you try the diagonal percent system, I doubt you'll go back to the old methods. Another example of the book's unique style of presentation is the layout language, which I developed for my first book.

If you're a lead framer, all the basic framing steps presented are important for reference and to help you teach and train crews. Most valuable, however, will be the guidance on managing a framing crew. Once you become a lead framer, your productivity is defined by the productivity of your crew. You'll need to think about the information they need and how to teach and manage them most effectively. Chapter 14 of this book is like a mini framer management course.

The charts and graphs in the book present information that is needed to manage a framing crew, but is not readily available. For example, the *International Building Code* chart makes it easy to reference the latest information governing framing. The Standard Framing Dimensions chart gathers the information that you “sort-of” remember, but it helps to have it handy for quick reference.

This book covers all the major topics related to framing. Each is presented in the easiest learning method. Because the framing tasks are diverse and vary in complexity, the format also varies a little throughout the book. All of the topics are covered in a framer-friendly way.

Framing is very rewarding work, both physically and mentally. One of the biggest challenges, however, is getting accurate information every time so that your framing is structurally sound, and provides the frame for a beautiful building. This book will assist you in that task.

Happy Framing,
Scot

Note: This book is intended to provide useful information for understanding residential framing, but it is not a substitute for professional construction, engineering, or repair evaluations, recommendations, or services. Readers should obtain assistance from appropriate experts, as needed.

Chapter One

INTRODUCTION TO FRAMING



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Chapter One

INTRODUCTION TO FRAMING

The trade of wood framing comprises the rough carpentry skills needed to produce the “skeleton” of a building and its first layer of “skin.” The skeleton consists of the structural lumber forming the floors, walls, and roof. The skin consists of the lumber that encloses the skeleton and provides a surface for subsequent layers of protective and decorative finish materials.

This chapter is an illustrated review of a framer’s most basic tools, materials, and terminology. This basic information is often not even taught on the job site, so if you don’t know it when you arrive for work, you will have to play a guessing game or ask a lot of questions.

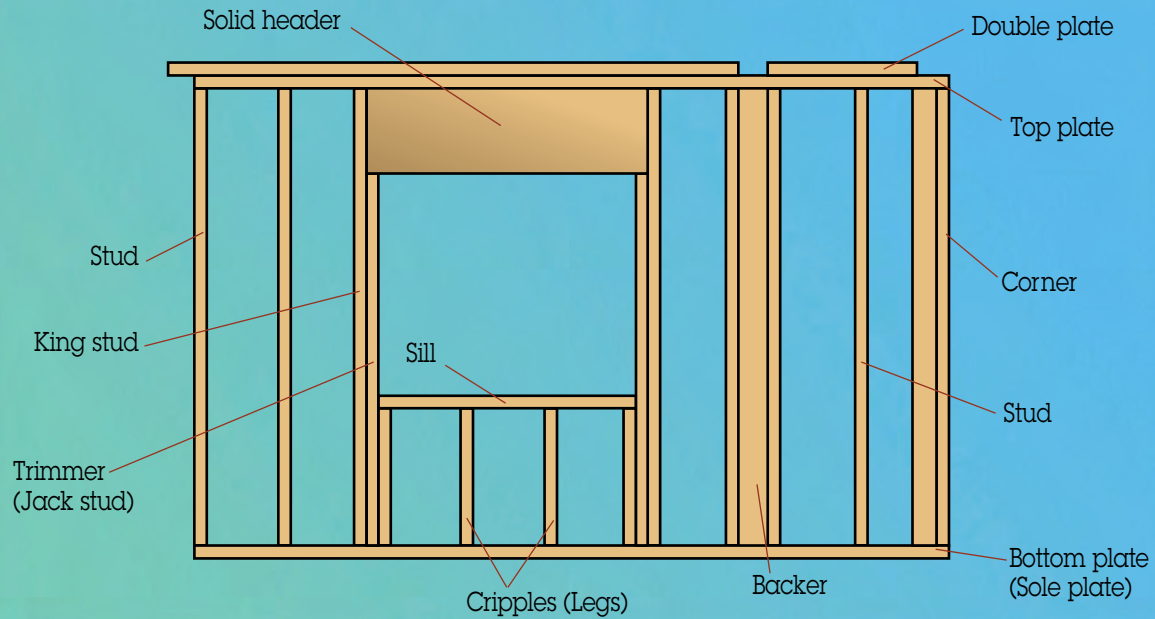
The detailed illustrations serve as a handy reference and help to reduce confusion when different words are used for the same item. Confusion can arise when framers move from job site to job site and work with different people. For example, bottom plates are often known as *sole plates*, backers as

partitions, and trimmers as *jack studs*. But it doesn’t matter what they are called as long as you know what they are. There is also a more detailed list of framing terms with definitions at the back of the book.

The suggested organization for a framing tool truck presented in this chapter is just an example of how a truck might be set up for tool storage. Its purpose is, once again, to reduce confusion and make the job easier. It is amazing how much time can be spent looking for tools and nails if they aren’t put where you expect them to be.

Framing Terms

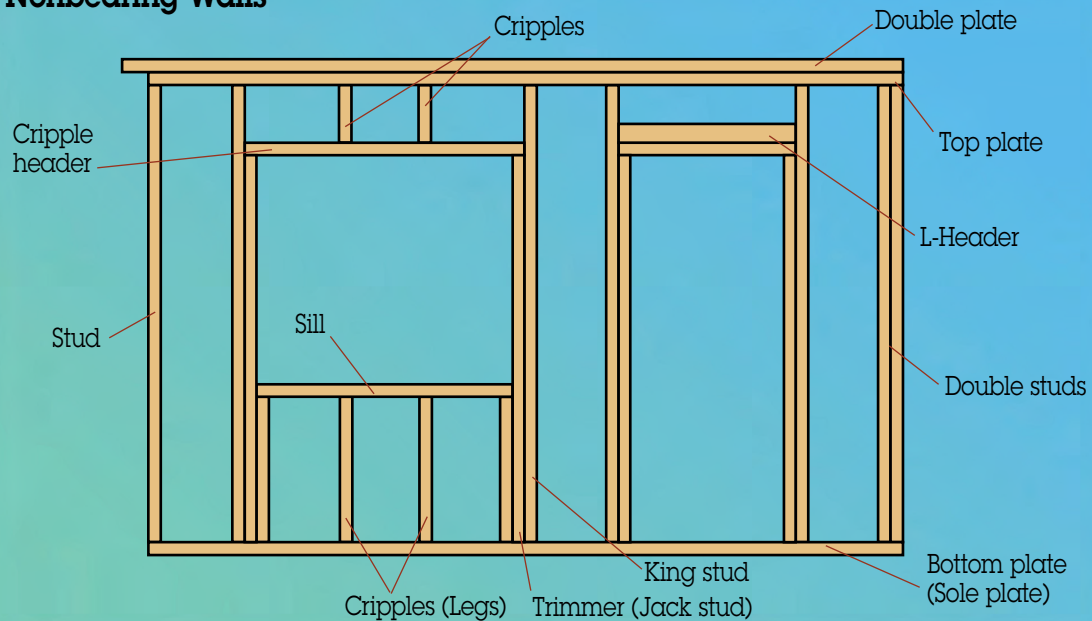
Bearing Walls



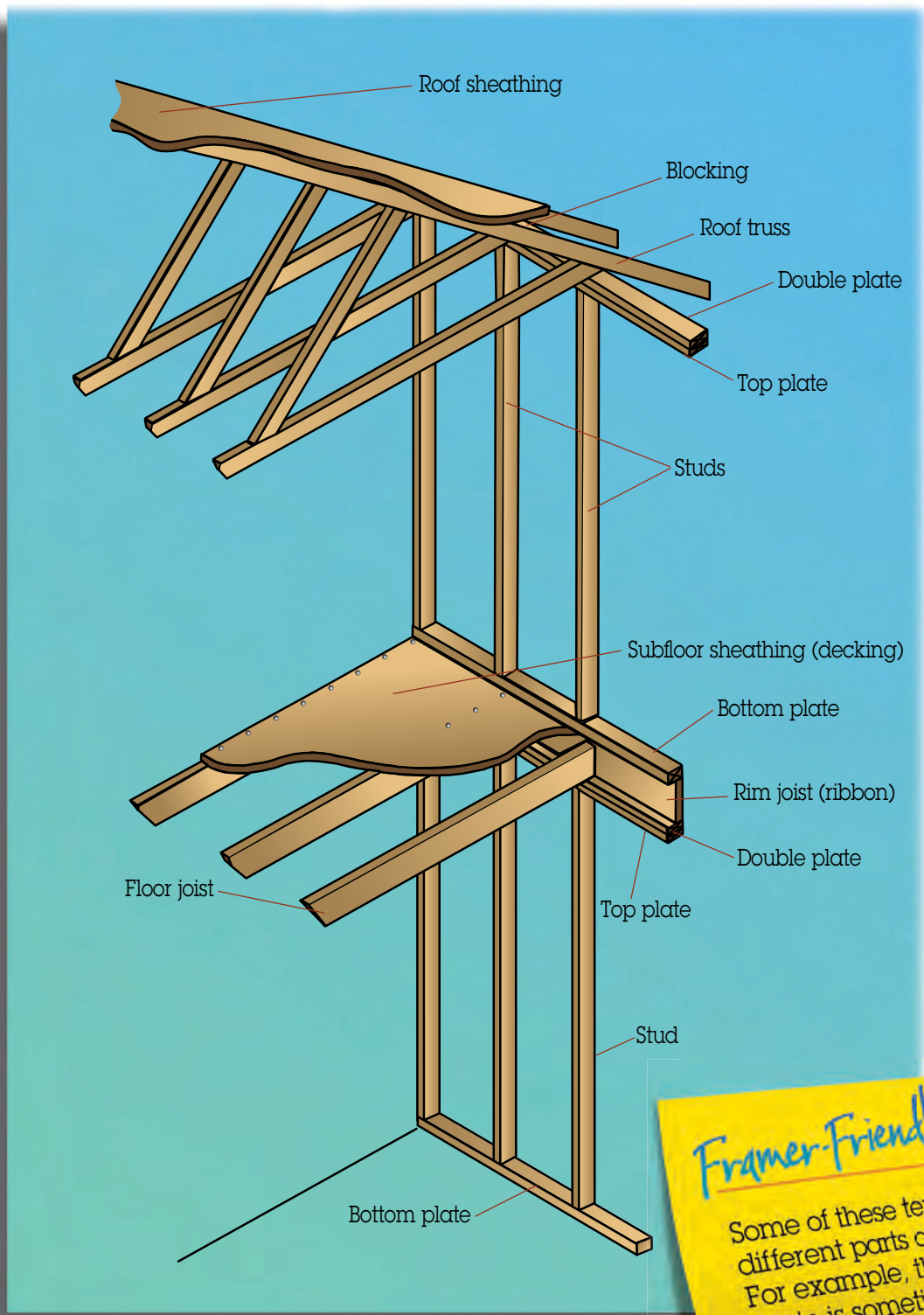
Bearing walls support the main weight of an upper portion of a building, such as a ceiling, floor, or roof. Nonbearing walls provide little or no support

to those upper portions. Remove nonbearing walls, and the upper portions will stand; remove bearing walls, and the upper portions will fall.

Nonbearing Walls



Framing Terms (continued)



Framer-Friendly Tips

Some of these terms vary in different parts of the country. For example, the bottom plate is sometimes called the sole plate.

Framing Lumber

Lumber is sized in “nominal,” as opposed to “actual,” dimensions. A nominal dimension rounds off the actual dimension to the next highest whole

number. For example, a piece of lumber that actually measures 1-1/2" x 3-1/2" is rounded off to the nominal 2" x 4".

Actual dimensions	1-1/2" 3-1/2"	1-1/2" 5-1/2"	1-1/2" 7-1/4"	1-1/2" 9-1/4"	1-1/2" 11-1/4"
Nominal dimensions	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12

Actual	3/4" 3-1/2"	2-1/2" 3-1/2"	3-1/2" 3-1/2"
Nominal	1 x 4	3 x 4	4 x 4

Framer-Friendly Tips
 At the mill, this lumber starts out as the actual dimensions, but after it has been surfaced and dried, it is reduced to the nominal dimension.

Actual	3-1/2" 5-1/2"	3-1/2" 7-1/2"	3-1/2" 9-1/2"	3-1/2" 11-1/2"
Nominal	4 x 6	4 x 8	4 x 10	4 x 12

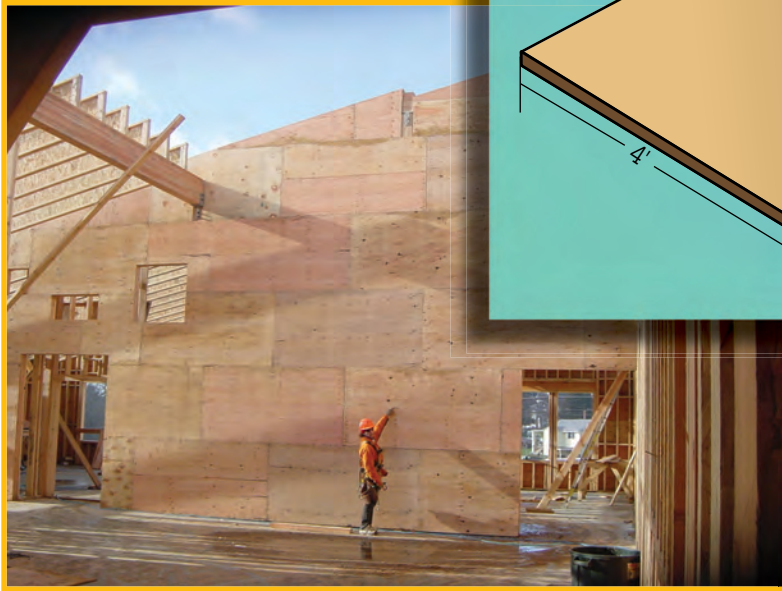
Actual	5-1/2" 5-1/2"	5-1/2" 7-1/2"	5-1/2" 9-1/2"	5-1/2" 11-1/2"
Nominal	6 x 6	6 x 8	6 x 10	6 x 12



Framing Sheathing

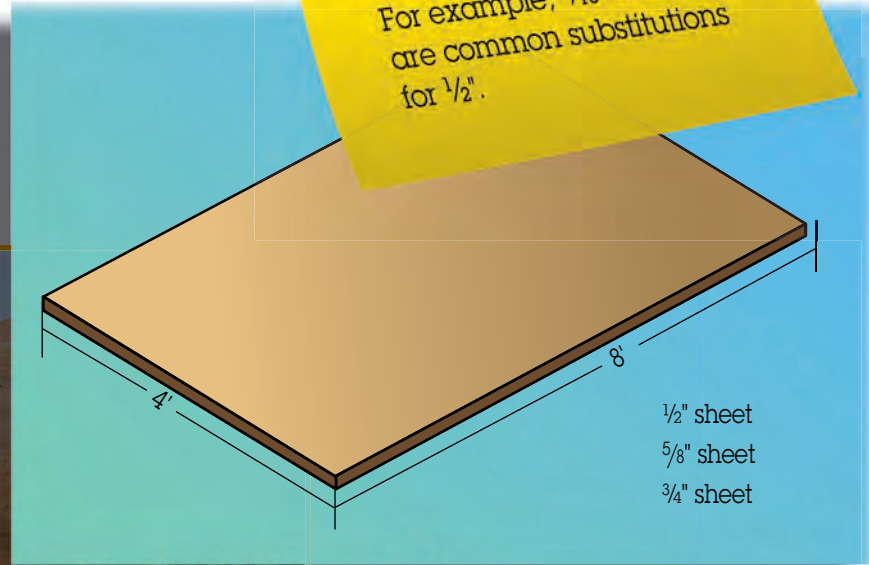
Engineered Panel Products

Sheathing comes in 4' x 8' sheets. The thicknesses most commonly used in framing are 1/2", 5/8", and 3/4".

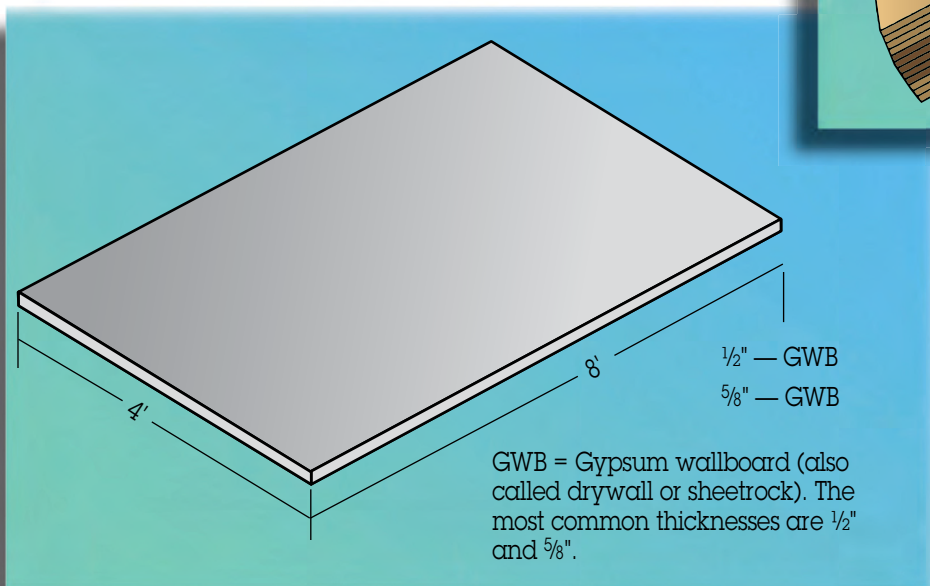
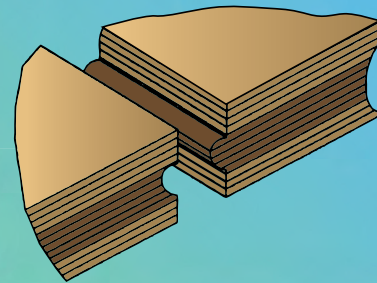


The engineered panel products on this wall provide the strength needed for the high ceiling of this elementary school.

Framer-Friendly Tips
There are substitutions for these standard sizes. For example, 7/16" and 15/32" are common substitutions for 1/2".



T&G Wood Structural Panels (tongue and groove)



Although not as common in house framing, gypsum wallboard can be used on exterior walls, such as for apartments and condos, and commercial buildings for fire protection.

Dens Glass® gypsum sheathing is a brand that has fiberglass mat, which provides mold and moisture resistance and is gold in color.

Engineered Wood Products

Engineered wood products are becoming more and more a part of our everyday framing. The strengths of these different products vary. Whenever you use engineered wood, it is important that you understand the qualities of the specific product you are planning to use, as well as structural considerations and any restrictions on cutting and installation.



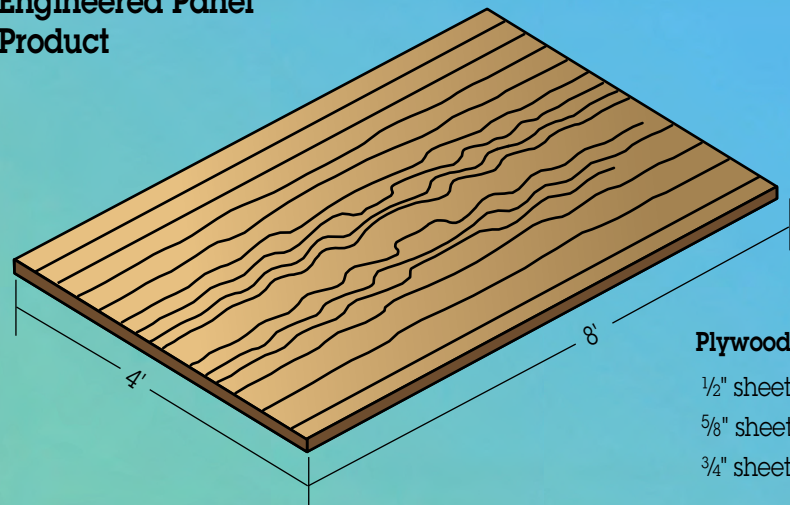
I-joists are engineered lumber products that provide consistency and fewer floor squeaks.

Engineered wood products can be divided into two categories: **engineered panel products** and **engineered lumber products**. Engineered panel products include plywood, oriented strand board (OSB), waferboard, composite, and structural particleboard. Engineered lumber products include I-joists, glu-lam beams, LVLs (laminated veneer lumber), PSLs (parallel strand lumber), LSLs (laminated strand lumber), OSL (oriented strand lumber), and CLT (cross-laminated timber.)

Engineered wood products have structural qualities different than those of traditional wood, so they must be used within the specification set by the manufacturer. When these products are specified on the plans, the architect or engineer who specified them will have checked with the structural engineer to ensure proper use.

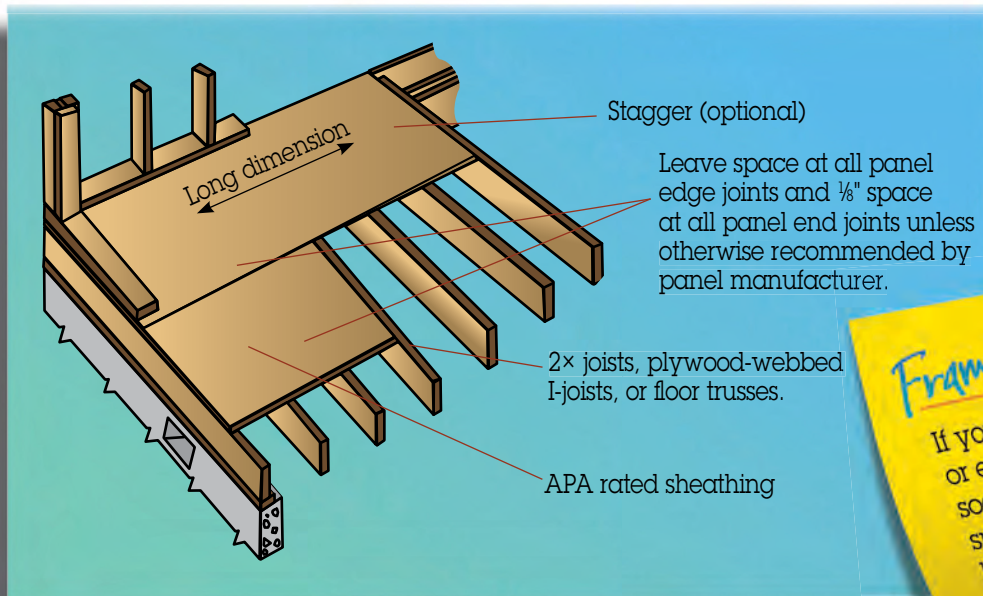
Engineered panel products have been around for years and are treated in a

Engineered Panel Product



Plywood
1/2" sheet
5/8" sheet
3/4" sheet

Engineered Wood Products (continued)



Framer-Friendly Tips
If you are installing in the rain or expect the sheathing to get soaked, allow 3/16" or more space at panel ends. Sheathing has been known to swell and push braced walls out of plumb.

manner similar to engineered wood products. The 4' x 8' typical sheets are strongest in the direction of the grain. For floors and roofs, these sheets should be laid perpendicular to the direction of the supporting members. The strength of the panels comes from the panel cantilevering over the supports—so each piece should be at least as long as two support members.

Glu-lam beams, LVLs, PSLs, and LSLs can be cut to length, but should not be drilled or notched without checking with manufacturers' specifications.

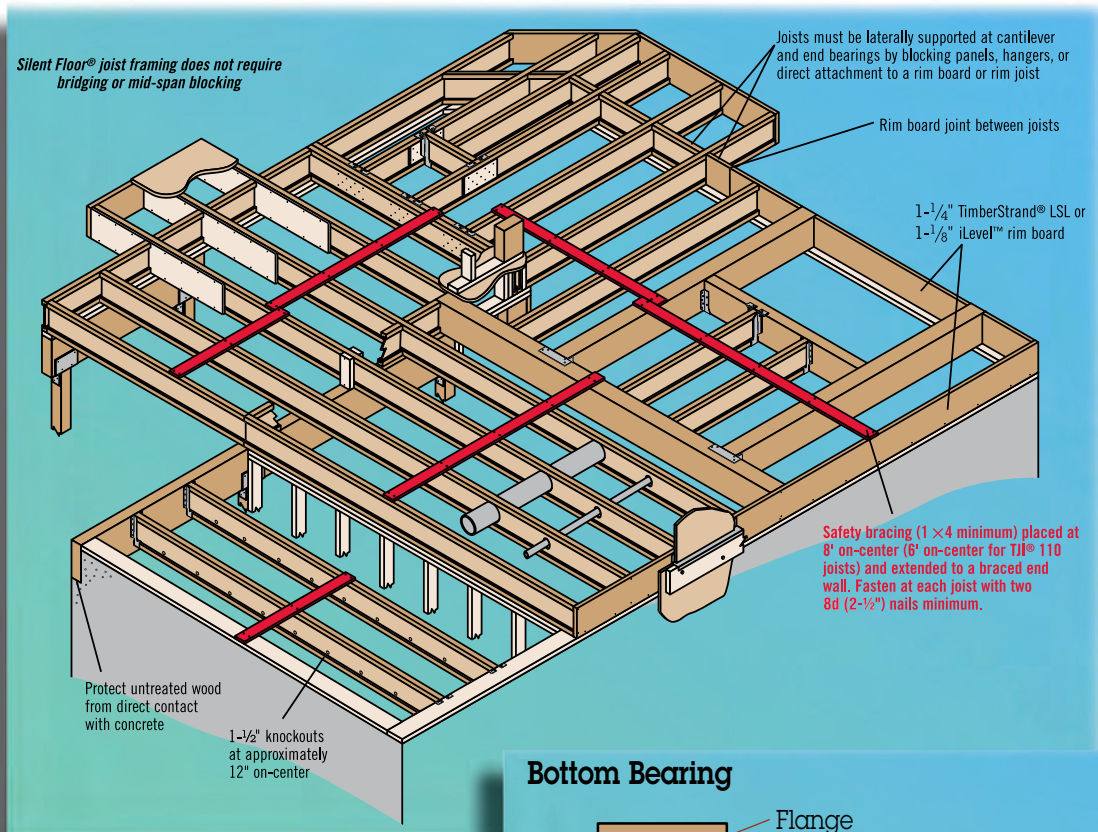
I-joists are becoming more widely used. Although the Engineered Wood Association has a standard for I-joists, not all I-joists manufacturers subscribe to that standard. Consequently, it is important to follow the manufacturer's instructions whenever using I-joists. Installation instructions are usually delivered with the load for each job. The illustration shows some of the typical instructions.

Certain features are common among all I-joists. Rim and blocking may be of I-joist or solid rim board. Typical widths are 9-1/2", 11-7/8", 14", 16", and 20".

Web stiffeners are used to add to the strength at bearing points. If the bearing point is at the bottom flange, then the web stiffener, which is the thickness of the flange on one side of the web, is held tight to the bottom. There should be at least a 1/8" space between the top flange and the web stiffener. If the bearing point is at the top flange, then the web stiffener is held tight to the top with at least 1/8" between the bottom flange and the web stiffener.

Framer-Friendly Tips
Special details are needed when attaching heavy weight—such as blocking for hanging cast iron pipes, to the bottom of I-joists—to prevent the bottom flange from breaking the glue that attaches it to the web.

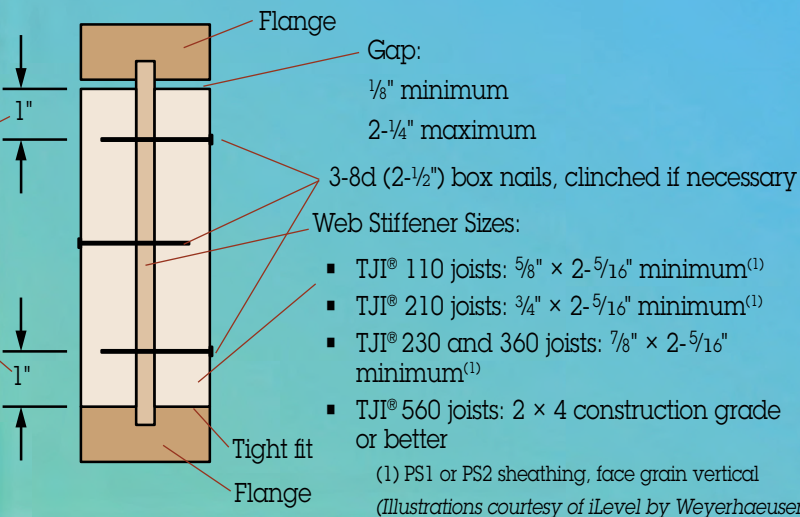
Engineered Wood Products *(continued)*



Common construction details for engineered lumber joists.

1-1/2" for TJI® 560 Joists

Bottom Bearing



Framer-Friendly Tips

Nails that stick through both web stiffeners need to be clinched (bent over).

Section view of I-joist. Please note the components of the joist (darker colors) and the web stiffener (lighter color). Fasteners are shown in black.

Engineered Wood Products (continued)

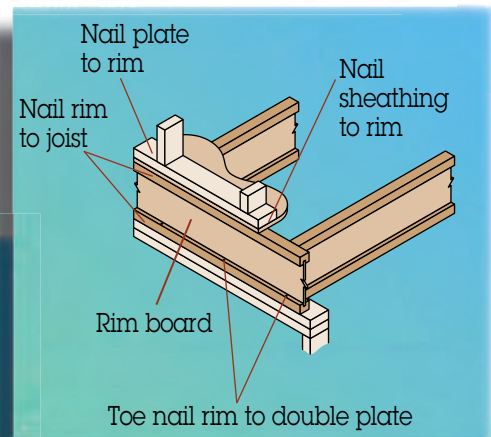
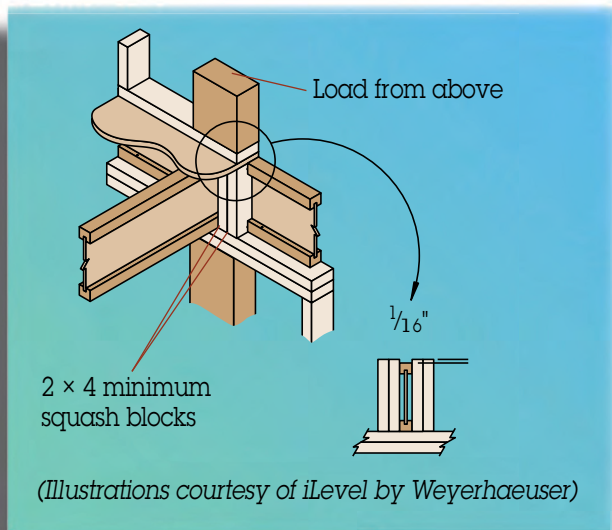
Squash blocks are pieces of lumber installed alongside TJIs at points of heavy loading. They prevent the weight from crushing the TJI. They are typically dimensional lumber like 2 × 4s or 2 × 6s. They should be cut $\frac{1}{16}$ " longer than the I-joist to take the load off the I-joists.

I-joist hardware, such as hangers, is usually delivered with the I-joist package. However, standard I-joist hardware can be purchased separately.

I-joists typically require a 1- $\frac{3}{4}$ " bearing. You can cut the end of an I-joist as long as it is not cut beyond a line straight up from the end of the bearing. However, no cuts should extend beyond a vertical line drawn from the end of the bearing point.

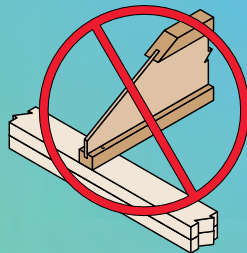
Fraser-Friendly Tips

Check the floor above for posts, columns, or concentrated loads so you can install squash blocks while you are joisting.



Squash blocks should be $\frac{1}{16}$ " greater than the I-joist height.

DO NOT bevel-cut joist beyond inside face of wall.

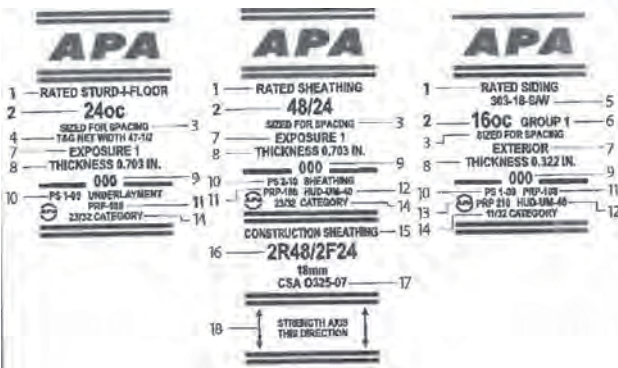


Lumber and Wood Structural Panel Grade Stamps

Lumber and wood structural panels are graded for strength and different uses. Each piece of lumber is stamped for identification before it is shipped.

Architects specify grades of lumber and wood structural panels for various purposes, and framers need to make sure the right wood is used.

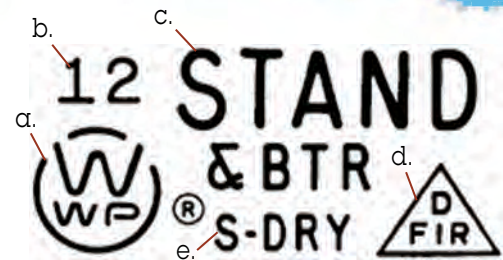
Wood Structural Panels



1. Panel grade
2. Span rating
3. Sized less than full length/width
4. Tongue-and-groove
5. Siding face grade
6. Species group number
7. Bond classification
8. Decimal thickness designation (this value is generally at or near the lower tolerance specified in PS 1 or PS 2)
9. Mill number
10. Product standard
11. APA's performance rated panel standard
12. HUD recognition
13. Referenced product standard
14. Performance category
15. Panel grade, Canadian standard
16. Panel mark—Rating and end-use designation per the Canadian standard
17. Canadian performance rated panel standard
18. Panel face grain orientation indicator

Lumber

Framing	Grade	Use
Light framing 2 × 2 thru 4 × 4	Construction Standard and better Utility	Plates Sills Studs
Stud 2 × 2 thru 4 × 18	Stud	Studs Cripples
Structural framing	Select structural No. 1 and BTR No. 1 No. 2 No. 3	Studs Plates Joists Rafters Headers Posts Beams



- a. **WWPA certification mark** certifies Association Quality standards and is a registered trademark.
- b. **Mill identification** Firm name, brand, or assigned mill number. WWPA can be contacted to identify an individual mill whenever necessary.
- c. **Grade designation** Grade name, number, or abbreviation.
- d. **Species identification** Indicates species by individual species or species combination.
- e. **Condition of seasoning** Indicates condition of seasoning at time of surfacing:
 MC-15 – KD-15: 15% maximum moisture content
 S-DRY – KD: 19% maximum moisture content
 S-GRN: over 19% moisture content (unseasoned)



Images of grade stamps courtesy of APA, The Engineered Wood Association and WWPA, the Western Wood Products Association