FRAMING

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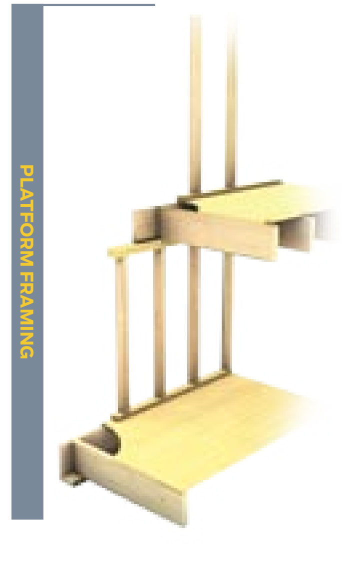
Building homes with wood is a particularly North American thing; most of the other developed countries build with concrete, steel and stone. We do it because we have the forests—and because wood-frame construction remains the easiest, most affordable and most familiar method. And it's adaptable. Wood framing suits our desire for homes that are easy to expand and modify. Today, American homes are typically stick built. That is, framed with lumber sawn from evergreen trees—spruce, hemlock, pine and fir. The wood is called dimensional lumber and is produced in standard sizes such as 2 x 4 or 2 x 6. Compared to post-and-beam construction—a system of widely spaced, heavy timbers—stick framing looks almost fragile. Yet, by following recognized construction practices, builders can deliver a strong shell that lasts for generations.

FRAMING VARIATIONS



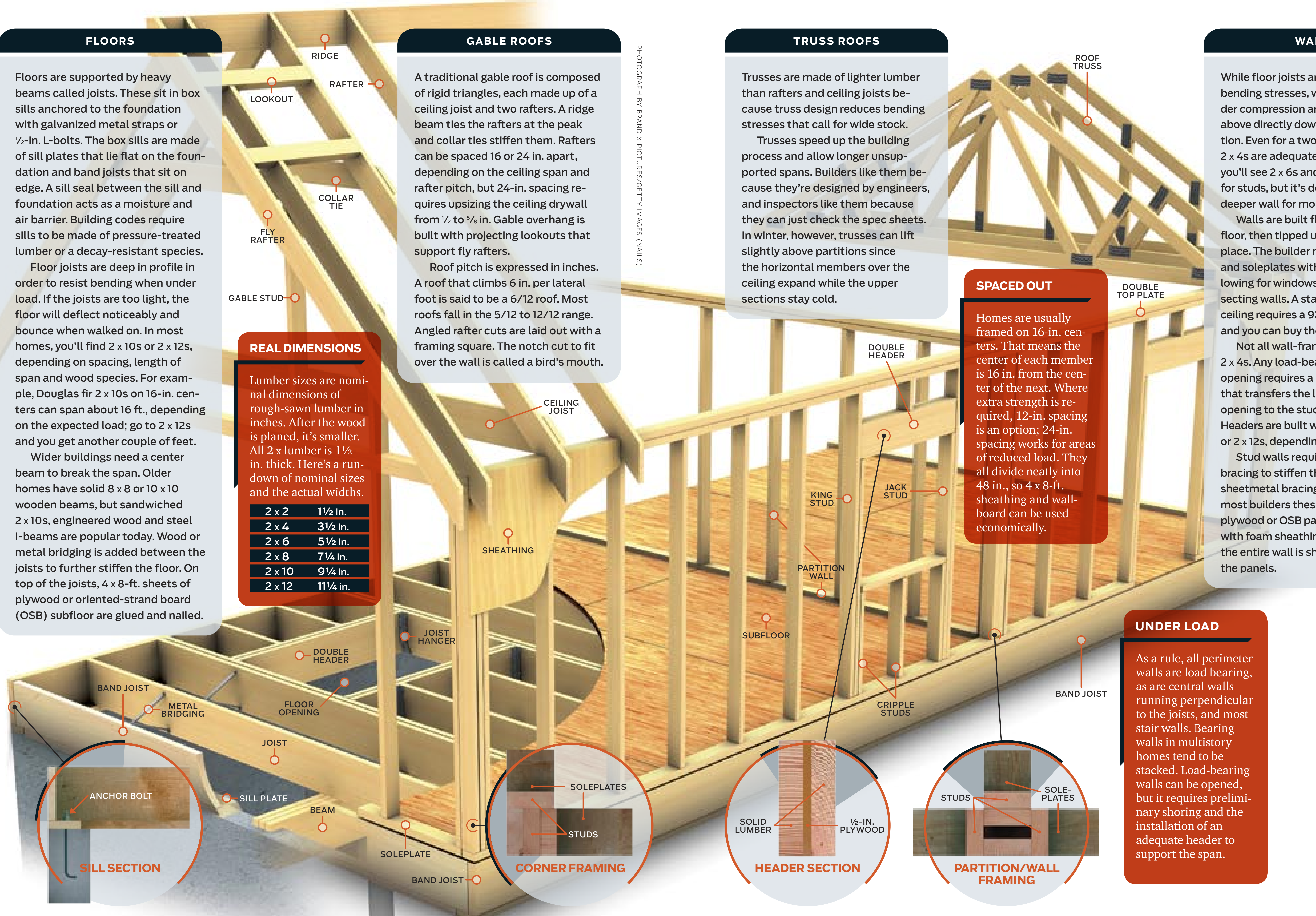
There are two stick framing systems: balloon and platform. Balloon framing became popular in the mid-19th century because it was a simple alternative to post-and-beam construction. It used nails instead of pegged joints, and the lighter lumber was easier to handle. In this approach, the perimeter studs rest on a sill at the foundation and extend all the way to the roof. The second floor rests on ledger boards notched into the stud edges. Fire stops, short horizontal members between studs, are added to help prevent fires from rapidly moving up the wall.

After World War II, platform framing became popular. Here, the second story is framed on top of a completed first story. Because the house is built in stages, it's less labor-intensive. The shorter lumber is cheaper and readily available, and the design doesn't require fire stops.

But, there is a downside. As wood dries, it shrinks more across the grain than along it. Framing lumber is kiln-dried to a moisture level of 19 percent; it dries to 8 or 9 percent once in place. Platform framing, with its hefty 2 x 10 or 2 x 12 joists, allows more vertical shrinkage, which can crack plaster and stucco, and even buckle vinyl siding.

BUILDING TO CODE

Typically, code authorities and lending institutions require an approved house plan before you break ground, so for new construction you'll need to take your plans in for the city official's stamp. Manufactured roof and floor trusses come with their own engineer's stamp, but you'll need to keep the manufacturer's spec sheet on the job for the inspector. For smaller jobs, don't forget to contact your local codes office to find out if you need a permit.



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FLOORS

Floors are supported by heavy beams called joists. These sit in box sills anchored to the foundation with galvanized metal straps or ½-in. L-bolts. The box sills are made of sill plates that lie flat on the foundation and band joists that sit on edge. A sill seal between the sill and foundation acts as a moisture and air barrier. Building codes require sills to be made of pressure-treated lumber or a decay-resistant species.

Floor joists are deep in profile in order to resist bending when under load. If the joists are too light, the floor will deflect noticeably and bounce when walked on. In most homes, you'll find 2 x 10s or 2 x 12s, depending on spacing, length of span and wood species. For example, Douglas fir 2 x 10s on 16-in. centers can span about 16 ft., depending on the expected load; go to 2 x 12s and you get another couple of feet.

Wider buildings need a center beam to break the span. Older homes have solid 8 x 8 or 10 x 10 wooden beams, but sandwiched 2 x 10s, engineered wood and steel I-beams are popular today. Wood or metal bridging is added between the joists to further stiffen the floor. On top of the joists, 4 x 8-ft. sheets of plywood or oriented-strand board (OSB) subfloor are glued and nailed.

REAL DIMENSIONS

Lumber sizes are nominal dimensions of rough-sawn lumber in inches. After the wood is planed, it's smaller. All 2 x lumber is 1½ in. thick. Here's a rundown of nominal sizes and the actual widths.

2 x 2	1½ in.
2 x 4	3½ in.
2 x 6	5½ in.
2 x 8	7¼ in.
2 x 10	9¼ in.
2 x 12	11¼ in.

GABLE ROOFS

A traditional gable roof is composed of rigid triangles, each made up of a ceiling joist and two rafters. A ridge beam ties the rafters at the peak and collar ties stiffen them. Rafters can be spaced 16 or 24 in. apart, depending on the ceiling span and rafter pitch, but 24-in. spacing requires upsizing the ceiling drywall from ½ to ⅝ in. Gable overhang is built with projecting lookouts that support fly rafters.

Roof pitch is expressed in inches. A roof that climbs 6 in. per lateral foot is said to be a 6/12 roof. Most roofs fall in the 5/12 to 12/12 range. Angled rafter cuts are laid out with a framing square. The notch cut to fit over the wall is called a bird's mouth.

TRUSS ROOFS

Trusses are made of lighter lumber than rafters and ceiling joists because they're designed so the load stresses that call for wide stock.

Trusses speed up the building process and allow longer unsupported spans. Builders like them because they're designed by engineers, and inspectors like them because they can just check the spec sheets. In winter, however, trusses can lift slightly above partitions since the horizontal members over the ceiling expand while the upper sections stay cold.

SPACED OUT

Homes are usually framed on 16-in. centers. That means the center of each member is 16 in. from the center of the next. Where extra strength is required, 12-in. spacing is an option; 24-in. spacing works for areas of reduced load. They all divide neatly into 48 in., so a 4 x 8-ft. sheathing and wallboard can be used economically.

WALLS

While floor joists and rafters handle bending stresses, wall studs are under compression and carry the load above directly down to the foundation. Even for a two-story house, 2 x 4s are adequate. These days, you'll see 2 x 6s and even 2 x 8s used for studs, but it's done to create a deeper wall for more insulation.

Walls are built flat on the subfloor, then tipped up and nailed in place. The builder marks out the top and soleplates with stud spacing, allowing for windows, doors and intersecting walls. A standard 8-ft.-high ceiling requires a 92⅝-in. long stud, and you can buy these precut.

Not all wall-framing members are 2 x 4s. Any load-bearing wall with an opening requires a header—a beam that transfers the load above the opening to the studs on the sides. Headers are built with 2 x 8s, 2 x 10s or 2 x 12s, depending on span length.

Stud walls require diagonal bracing to stiffen them. Galvanized sheetmetal bracing is available, but most builders these days use ½-in. plywood or OSB panels at the corners with foam sheathing elsewhere, or the entire wall is sheathed with the panels.

UNDER LOAD

As a rule, all perimeter walls are load bearing, as are central walls running perpendicular to the joists, and most stair walls. Bearing walls in multistory homes tend to be stacked. Load-bearing walls can be opened, but it requires preliminary shoring and the installation of an adequate header to support the span.

ENGINEERED LUMBER

With fewer old-growth trees, lumber quality has become a real issue—particularly for wide beams. Manufactured substitutes are made from smaller, second-growth trees. They cost 20 to 30 percent more, but they're straight and flat, allow longer spans and come with warranties.

The most common for floor and roof applications are I-joists. They consist of a plywood or OSB web and a top and bottom cord of solid or laminated wood.

For heavier applications, laminated-veneer lumber is a good choice. It's available in 1¾- and 3½-in. widths and 9½- to 18-in. depths. Standard lengths go to 48 ft., with a 60-ft. custom option.

Glue-laminated beams stack layers of 2 x 4s or 2 x 6s to form a structural beam. They're used in prefab arches, exposed ceilings and post-and-beam structures.

A final option for floors are trusses. These are made of 2 x 4s, nailed like roof trusses. They make a strong, flat floor and have space for heating ducts and plumbing pipes.

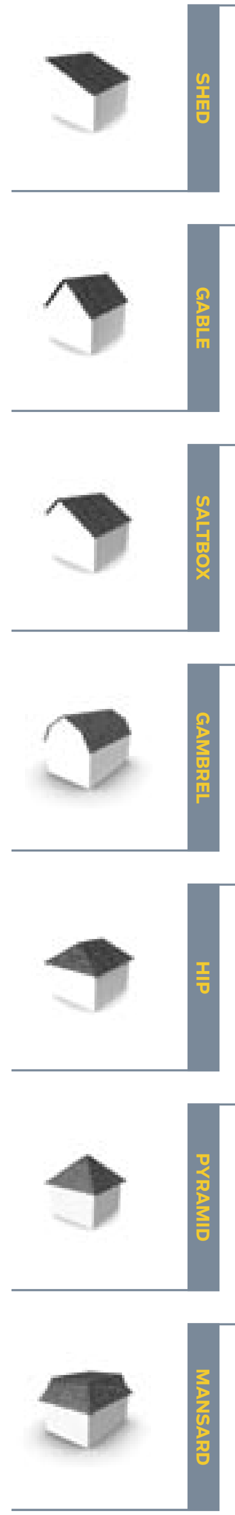
SPECIAL HARDWARE

Galvanized-steel brackets strengthen homes and lower costs by simplifying construction. They come in many designs, from rafter tiedowns and joist hangers to specialty pieces for engineered lumber.

Many regions now require some form of sill-to-rafter tiedown system that resists hurricanes and tornadoes. With tiedown brackets running as little as $200 for a modest house, they're a great buy.

ROOF STYLES

A roof does more than keep out the rain; it often defines the architectural style of your home. Below are the basic styles.



SHED It's the simplest to build and has a modern, utilitarian feel.

GABLE Here's the classic Cape Cod look. Ranches have a shallower pitch.

SALTBOX Like a Cape, but one wall is higher than the other for more upstairs space.

GAMBREL Some folks call it Dutch Colonial. It's a standard for barns.

HIP A strong roof with no gable siding to paint, but framing it is tricky.

PYRAMID It's the strongest, with triangles on every face. The building must be square.

MANSARD A popular Victorian style with European flavor. The attic has usable space.

Look for PART 4 of HOW YOUR HOUSE WORKS, Home Insulation, in April.