Laying a Plank Floor

Economical and good looking, single-layer flooring is also easy to put down

by Paul Hanke

Plank flooring is becoming more popular these days. In the northwestern U. S., many contractors use 2x6 T&G planks as a subfloor, and it's known as "car decking." Now that builders and home owners in many parts of the country are interested in post-and-beam construction, plank floors are chosen more frequently. In a floor that's framed with dimensioned 2x lumber, the floor joists are usually hidden above a drywall ceiling. But in timber-frame and post-and-beam construction, large wood structural members remain exposed in the finished house. Plank floors and widely spaced ceiling joists are a natural combination.

Plank-and-beam floors differ from conventional joisted plywood floors in several ways. The structural support in a plank-and-beam system is provided by relatively large beams that are spaced farther apart than joists. The second major difference is that the nominal 2x6 T&G planks (actual dimensions are 1½ in. thick by 5⅜ in. wide) form a single-layer floor that can be the finished ceiling when viewed from below. This is quite different from the multi-layer subfloor/underlayment/finish-floor system that's supported by closely spaced joists.

Plank floors can be less expensive than multi-layer flooring because you have fewer framing members to cut and assemble and because there's no need to install a drywall ceiling beneath a planked second floor.

There are some disadvantages to plank floors, however. Because the exposed plank floor will also be the finish ceiling of the room below, the quality of the material is important. Surface defects in the planks will be seen on both sides. Job-site damage is another potential problem. Once the floor is down, it has to be protected while the rest of the house is finished. If you're accustomed to tramping around on underlayment in the later stages of house construction, your work habits will need some adjustment.

Plank floors don't give you flexibility in locating wiring and plumbing because they don't provide hidden chases the way joisted floors do. Electrical and plumbing lines need to run in chases or wall cavities, or remain exposed in approved surface-mounted wiring channels. And in a finished house, many people feel that single-layer floors allow more noise transmission between floors. Also, some home owners (especially those with children) have noted that liquid spills upstairs quickly drip into the room below, despite the T&G feature.

In cases where you need to insulate beneath a plank floor, the insulation (fiberglass batts or rigid foam) can't be friction-fit between floor beams. Builders fasten twine, wire or 1x strapping across the bottom edges of floor beams to hold insulation. Other techniques for holding insulation include galvanized metal darts available from Insul-Mold (Civic Center Drive, Augusta, Maine 04330) and waxed cardboard trays from Insul-Tray (4985 North Cascade Place, Oak Arbor, Wash. 98277).

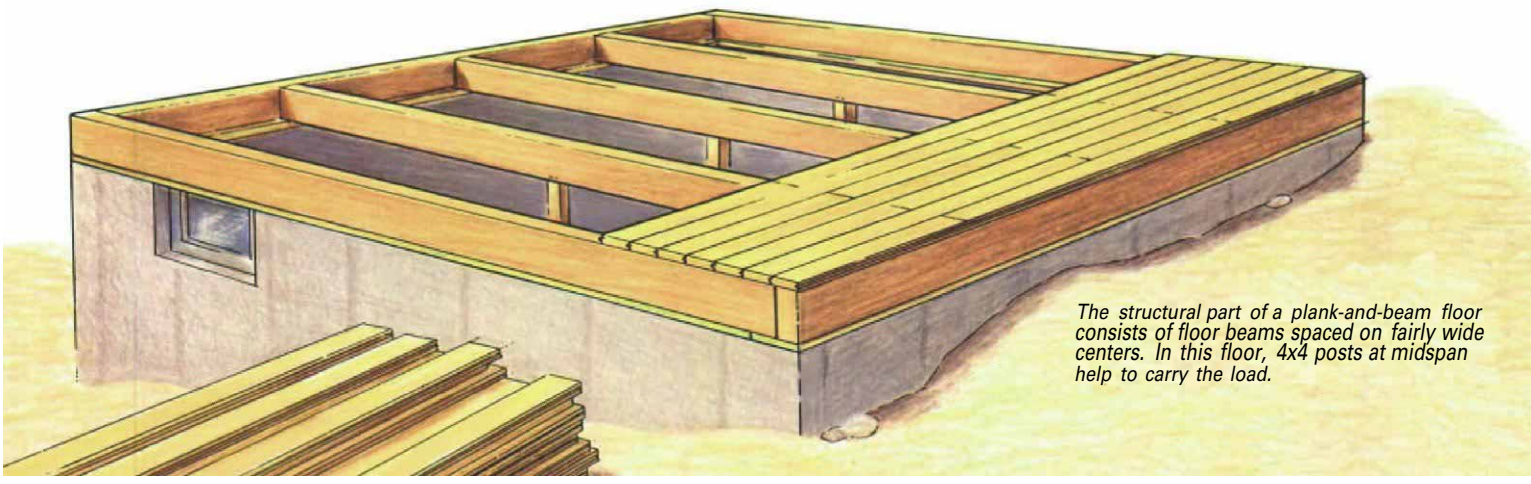
Design factors—The spacing between beams in a plank floor depends on the length of the planks and their deflection characteristics. Using 4-ft. centers for beam spacing is a safe, conservative approach if you're not sure of the deflection characteristics of your planks. Wider centers can be used for wood species and grades that are especially stiff, like Select Douglas fir (see the sidebar on p. 43).

The dimensions of the house have a lot to do with beam spacing beneath the planks. For example, a 36-ft. long house divides nicely into 4-ft. or 6-ft. bays. A 38-ft. long house would divide up into awkward 6-ft. 4-in. centers for beams. With this spacing, you'd have a lot of unnecessary cutting, since 2x6 planks typically come in 12, 14 and 16-ft. lengths. If you have specially milled ***end-matched planks*** (planks milled with a tongue-and-groove on ends as well as edges), the ends of some planks do not have to be supported from below, so joist spacing is less important. But this "random lay-up" technique has its own limitations and isn't widely used. For one thing, end-matched planks are more expensive.

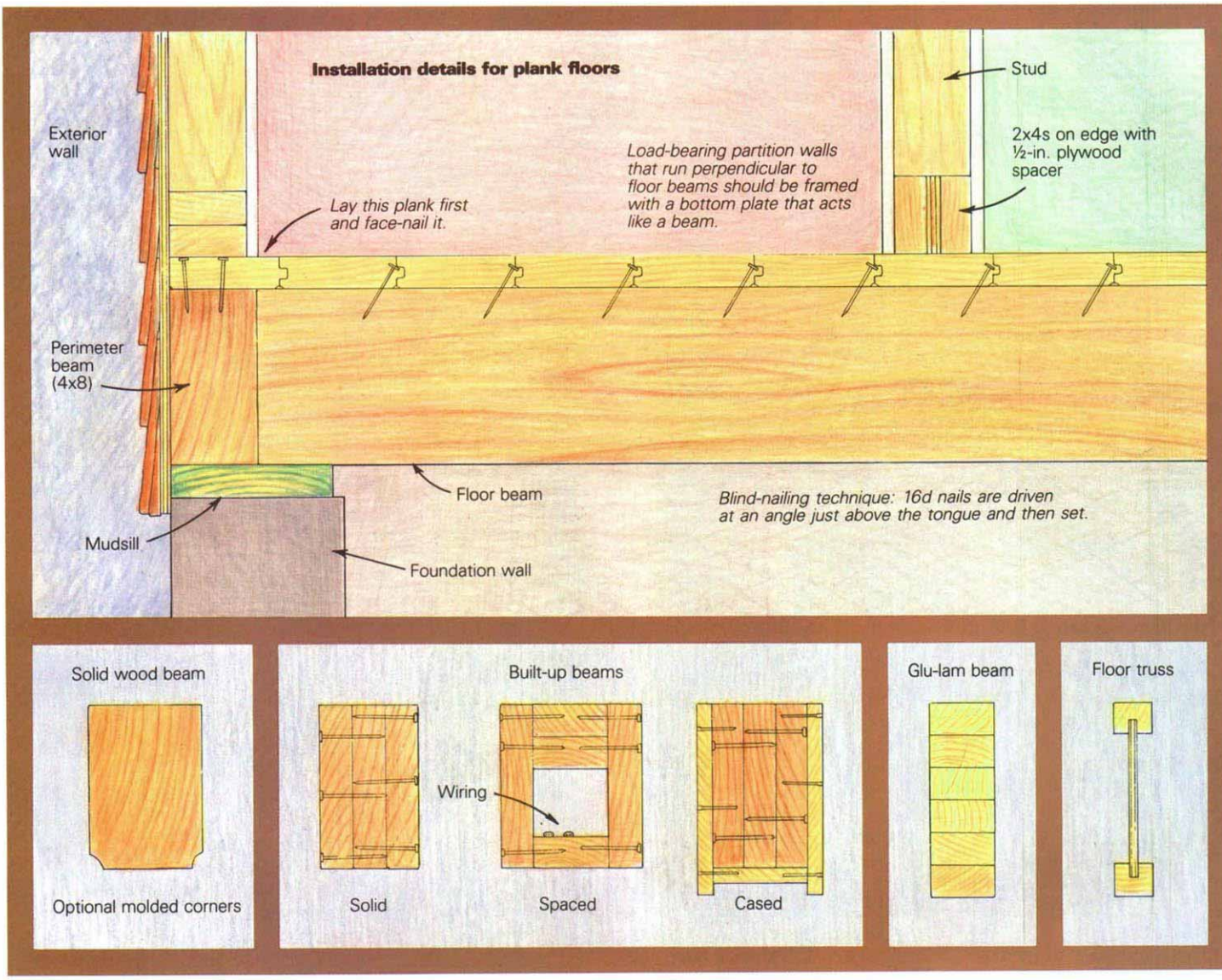
Concentrated loads can pose problems in plank-and-beam floors, and this is an important design consideration. If properly sized, a plank-and-beam floor will adequately support normal design loads. But items like bathtubs, refrigerators and waterbeds can cause excessive deflection. At the design stage, it's important to determine where concentrated loading will occur and either reduce spacing between beams or add blocking where necessary. This extra structural support can be attached to beams with standard steel hangers, or with timber-frame style joinery.

Many post-and-beam or timber-frame structures are designed without interior bearing walls. Nevertheless, non-bearing partition walls that run parallel with the planks should be framed up slightly differently. The bottom plate of a stud-wall partition should be built with the double 2x4s on edge, rather than face down (top drawings, next page). Use the same detail on interior bearing walls that run perpendicular to the planks. If a continuous bottom plate in such a partition wall is interrupted by a doorway, blocking should be installed beneath the floor between beams where the interruption occurs.

In addition to beam sizing and spacing, you



The structural part of a plank-and-beam floor consists of floor beams spaced on fairly wide centers. In this floor, 4x4 posts at midspan help to carry the load.



have to decide on what type of beam to use: solid wood, beams built up from 2x lumber, cased beams, floor trusses or glue-laminated structural members (drawings, above). Cost, appearance, availability, load capacity and ease of handling are the factors to consider when making a choice. Solid wood beams are probably the most difficult to muscle into place, but they're also very attractive in the finished house. Built-up beams are a popular choice if they're spanning a crawl space or basement, where looks aren't important. Glue-laminated beams are expensive but very reliable in terms of span capabilities over long distances. Because they are engineered at the plant, you don't have to second-guess your calculations.

If a beam is to be exposed in the ceiling over living space, 1 like to give it a decorative bevel or bead along its bottom edges (drawing, above left). Apart from enhancing the ceiling's appearance, the rounder edge won't ignite in a fire as fast as a hard edge will.

Material and layout–The most common residential flooring planks are kiln-dried, T&G 2x6s. There are quite a few different wood species that are used to make T&G planks. Douglas fir is common on the West Coast; northern white pine is popular in the Northeast; in the southern states, you'll find yellow pine. In terms of economy, you're usually better off using a local species. Regardless of species, there are two principal grades used in residential flooring: Select and Commercial.

Plank layout is important because it affects the overall strength and rigidity of the floor. The strongest layout (sometimes called a type D span) calls for the butt joints of the planks to be staggered from one course to the next, with each joint occurring over a beam. A plank that is long enough to span four beams (a 16-ft. plank over beams spaced 4 ft. o. c.) will be stiffer than the same species and grade of plank that spans only two or three beams.

In addition to designing for strength, you also want to minimize waste. As an example, let's suppose you want to build a 36-ft. by 24-ft. house with a plank-and-beam floor. You'll use 12-ft. long 2x6 T&G planks over floor beams spaced on 6-ft. centers so that planks will be stiffened by spanning three beams. In addition, joints in alternate courses should be staggered. In other words, the first course begins with a 12-ft. plank, the second course begins with a 6-ft. plank, and so on. This will minimize cutting and waste.

To figure how much material to order, multiply the square footage of your floor area by 1.17, then add 10% for trim and waste. When choosing material, make sure that it's dry, straight and of the quality you're looking for. On one job, we ended up returning about 25% of the planks because of unacceptable defects: split ends, wane, knotholes along the upper groove edge, and excessive bowing. It's best to see the material before you take delivery.

Nailing it down–Installing a plank floor is like installing hardwood strip flooring (see *FHB* #13, pp. 42-45). Like hardwood flooring, planks have an up face and a down face. The down face has milled V-groove that gives an exposed plank ceiling a decorative look. Don't make the mistake of facing the V-grooves up. You may think the floor will look nicer, but these depressions will fill with dirt and debris almost immediately. I've seen more than one builder make this mistake, so watch out. It's a devil of a callback.

You start laying planks at the edge of the building, always running them perpendicular to the floor beams. If your band joist is straight

Drawings: Chuck Lockhart

(you can check it quickly with a string), simply align the groove edge of the planks with the outer face of the band joist. Face-nail through the top of this first plank course into the band joist so that the nails will be concealed beneath the first-floor wall plate.

All remaining courses except the last are blind-nailed, with the nail being driven into the corner where the plank edge meets the tongue. Each plank end should bear on a beam, and galvanized 16d box nails are the best fasteners to use for this job.

Nailing technique can take a little practice. As shown in the drawing at right, you should use two nails when a plank crosses a beam, and the nails should toe inward. This increases their withdrawal resistance and will help to prevent squeaky floors.

Before nailing the plank fast, it has to be snugged up tightly to the previously installed plank. Simply blind nailing and setting the nails will normally pull the plank up tight to its neighbor, just as it does with hardwood strip flooring. Slightly bowed planks (which can be fairly common) might need some extra coaxing. You can sometimes pound the bowed section tight by hammering against a beater board of short plank scrap.

If you've put down only a few courses of planks, bar clamps can be used to snug up a bowed section. Otherwise, you can drive the sharp end of a small prybar (I use a flat bar like the one shown in the drawing above right) into the top of the beam at a slight angle and very close to the edge of the bowed plank. Then pry the recalcitrant plank into place using the bar as a lever; hold it firmly until you drive in the nails.

Drive the nails as close to the edge of the plank as you can, being careful not to dent the exposed edge of the plank with your hammer. Then set the heads with a heavy punch or a drift pin. The heads have to be set far enough into the wood so that the groove in the next plank will seat tightly.

Plank ends and edges along perimeter walls can be face-nailed, but it's still good practice to toe these nails to discourage withdrawal. In theory, you could also face-nail planks that will fall under interior partition walls, but this is chancy. If you misjudge, the nail heads may be visible in the floor later.

Once the deck is down, it needs to be protected until the house is complete. Cardboard offers good temporary protection against dents and abrasion. Water can stain the planks, and even short-term exposure to direct sunlight can start greying the wood. Some surface discoloration can be removed by sanding, but you don't want to rely too heavily on sanding. Make sure that your crew and subcontractors understand that this "subfloor" is actually the finish floor.

Floor finish for T&G planks depends on taste and budget. Some people prefer to stain the wood a darker color before sealing and waxing or coating with polyurethane. Others like the natural appearance, which will darken slightly with age. □

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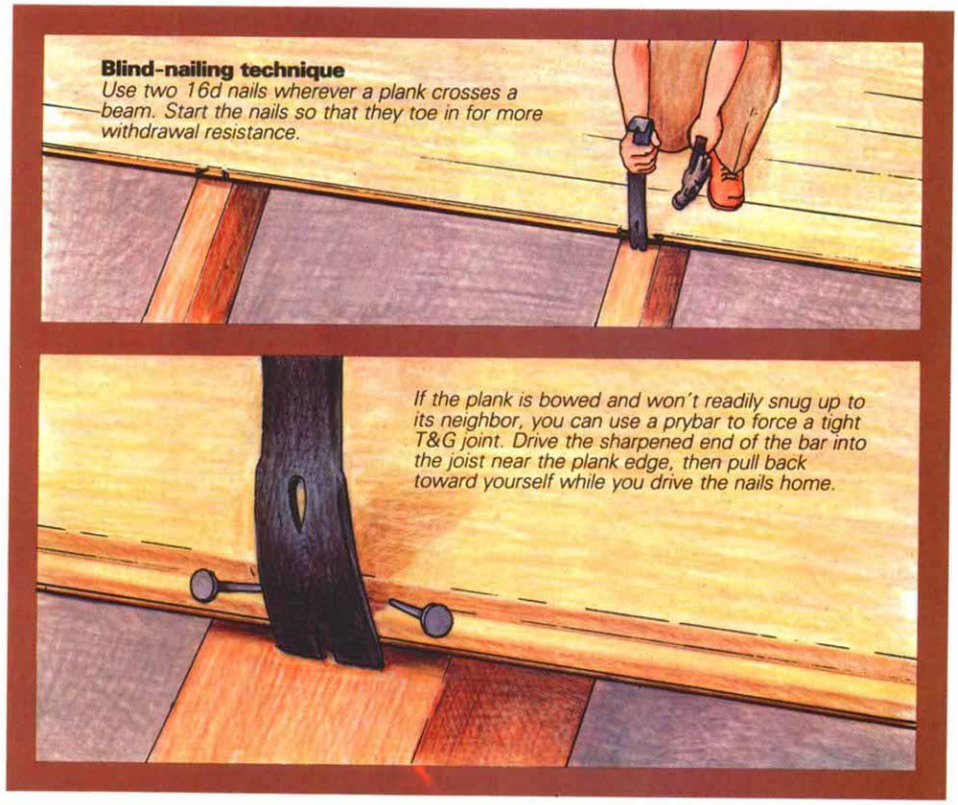

Species, grade and span: an elusive search

Installation simplicity and low cost are major attractions of plank flooring, but determining plank span (the spacing between floor beams) based on lumber species and grade can be frustrating. Though less stringent values have been used in the past, today most floors are designed to support a *dead load* of 10 pounds per square foot (psf) and a *live load* of 40 psf with a deflection limit of L/480, where L is the spacing between floor beams (in inches).

Flooring planks, which the lumber industry refers to as decking, have different span capabilities depending on the species and grade of the wood. Select and Commercial are the two most commonly used flooring grades. As shown in the sample chart below from the Western Wood Products Association (1500 Yeon Building, Portland, Ore. 97204), Select Douglas fir-larch will span 5½ ft. without deflecting over the L/480 limit with 50 psf loading. By contrast, Commercial lodgepole pine will span only 4¾ ft. to meet the same standard.

Search as I might, I couldn't find grade and species-specific plank-floor span charts for non-Western woods like eastern spruce, northern pine, eastern white pine, eastern hemlock and southern yellow pine. These are common decking woods in many parts of the country. Both the Southern Pine Inspection Bureau (4709 Scenic Highway, Pensacola, Fla. 32504) and the Northeastern Lumber Manufacturers Association (4 Fundy Rd., Falmouth, Maine 04105) have booklets that contain grading rules for regional lumber. But you won't find span charts for decking that relate species and grade to span capabilities. In fact, what you're given are engineering figures—specifically the *modulus of elasticity* and *extreme fiber stress in bending*—for different grades and species. These numbers have to be crunched in one or more formulas, depending on what type of span you'll have under your decking. Simple spans (sometimes referred to as *type A spans),* where planks bear on only two beams, aren't as strong as double *(type B)* or triple spans *(type C),* where the planks bear on three or four beams, respectively. *Type D* spans are stronger still, since the butt joints in adjacent courses are staggered.

It's ironic that a floor system that's simple and inexpensive to install should be so quirky to design. This wouldn't be the case if the National Forest Products Association (1619 Massachusetts Ave. N.W., Washington, D. C. 20036) would update their existing plank-and-beam framing manual (Wood Construction Data #4), with some charts like those that the Western Wood Products Association has on species, grade and span for decking. Until such time, you might end up consulting with an engineer to figure out a good marriage between floor-beam spacing and plank species and grade. ***—Tim Snyder***

2x6 plank flooring: span capability based on species and grade*

Species and grade	Select Douglas fir-larch	Select hem-fir	Commercial hern-fir	Select lodgepole pine	Commercial lodgepole pine	Dense Sel. Southern pine
Maximum simple span	5 ft. 6 in.	5 ft. 2 in.	5 ft.	5 ft.	4 ft. 9 in.	5 ft. 5 in.

**Assuming a dead load of 10 psf, a live load of 40 psf and a deflection limit of L/480.*