Decking and Sheathing

How one production carpenter puts the skin on wood-frame houses

by Jud Peake

The skin that knits together a building's bones and provides a base for the finish materials is the sheathing, and in contemporary wood-frame construction that usually means plywood. Sheathing a building isn't a fussy or complicated operation. Thousands of square feet of plywood have to be secured with tens of thousands of nails, and a lot of odd-sized pieces of plywood (specials) have to be cut to fit the parts of the building that don't conform to a 4-ft. by 8-ft. module. Fortunately, a skillsaw makes short work of the cuts, a nail gun takes the pressure off your forearm and at 32 sq. ft. per sheet, plywood covers big chunks of a building all at once. Given the simplicity of the task and the capabilities of the tools, clearly the thing to learn about sheathing is how to do it fast.

Subfloor—I use T&G plywood almost exclusively for subfloors because it eliminates the need for blocking under the long edges of the plywood, and so cuts joisting time in half. A plywood subfloor should start on a side of a building that is perpendicular to the joists. It's nice to have a straight side to begin the plywood; if the building has projections for bays and rooms, 1 begin with the side that has the fewest jogs. 1 snap a chalkline across the joists 4 ft. in from the edge of the building and lay down a bead of construction adhesive on the tops of the joists that will fall under the first course. 1 align the plywood so that its groove side butts the chalkline, facing the bulk of the building, and I make sure I've got about a 1/16-in. gap between the ends of the neighboring plywood panels to allow for expansion. Then 1 nail off this first course, but I don't put any nails within 6 in. or so of the grooves. This allows me some wiggle room to install the next course of plywood.

If you are working on a second floor and a forklift is available, now is a good time to land a stack of plywood on the deck. Let the stack hang a little over the edge of the building so that you'll have room to work the next course into the first course of grooves. As an alternative you can land your plywood stack on the side of the building that you are working toward.

Sheathers generally work in pairs—one carpenter spreads the plywood and nails it off, while the other one does any necessary cutting, applies the construction adhesive to the joists and fits the T&G edges of the plywood together with a bump-stick. The bump-stick eliminates the need for another carpenter and a sledgehammer. To make a bump-stick, simply lap and nail two 2x4s together in the shape of a T. A 4-ft. crosspiece will do, and the handle should be about 5 ft. long with about a 20° bevel on the end that is attached to the crosspiece. To use the bump-stick, stand with your feet on the joint between the plywood sheets to align the tongues and grooves, then pull and bump the plywood together with the stick (photo below).

Four sheets of plywood should never come together at one corner, so the second course of subfloor should be staggered by starting it with a half-sheet of plywood. This ensures that the end joints of two sheets are aligned at the corners by the tongue or groove of the neighboring sheet of plywood, and strengthens the overall floor diaphragm by reducing long seams between adjoining materials. If your layout allows you to use the same size pieces to start staggered rows, precut them on the stack. To speed things up, I use a T-square designed for marking drywall to lay out the cutlines on plywood sheathing.

To get the best value for your money, get the big glue gun and the 32-oz. tubes of construction adhesive. Although the American Plywood Association recommends putting adhesive in the T&G joint, I've never met anyone who has done it with success. The proper size bead of adhesive for the joist tops (about 1/4 in.) is far too much glue to fit in the T&G joint.

Along the leading edge of each course of plywood mark the centerline of each joist as a guide to help the nailer. If you're using a nail gun and are new to production sheathing, a 4-ft. 2x4 can be a fence for positioning the nails. (With practice you won't need it.) Line up the 2x4 with the joist marks on the plywood, then stand on the 2x while you use its edge to guide the tip of the gun. For subfloors, the perimeter of the plywood sheets needs nails 6 in. o. c.; the field nails fall at 10-in. intervals. Use 6d nails to secure floors less than % in. thick. Floors that are 5/8 in. or 3/4 in. thick need 8d nails.

The subfloor should be nailed off while the glue is still wet, but don't nail off the edges around the perimeter of the building until the very end because nail heads here may be in the line of cut. Instead, let the plywood overhang the framing, snap a chalkline to indicate the line of the floor, cut off the overhang with one pass of the saw and add the missing nails. If you have

The bump-stick is a T-shaped tool made of framing lumber that can help when you're installing T&G plywood. Align the tongue on the workpiece with the grooves in the installed sheets by standing on them. Then pull on the bump-stick to drive the sheets together.

any interior stairwells, be sure to leave sufficient subfloor overhang for the top nosing.

Floor joists often lap one another in the center of a floor. Where this happens, you should nail a block to the joist to pick up the unsupported edge of the plywood (middle photo below). Also, when a sheet of plywood lies over the lapped joints, you should make V-shaped marks along the edge of the plywood to denote the centers of the joists and the direction they run to make sure your nails end up in the right place.

Plywood sheathing, be it subfloor, roof or wall sheathing, should have at least ½ in. of bearing on the. framing members. But sometimes a bowed joist will leave a sheet a bit shy of the necessary purchase. When this happens, push the joist into alignment and angle an 8d toenail upward to grab the ply (drawing A, below). A layout mistake may place a joist just beyond the edge of the plywood. If this happens, it's usually best to cut the plywood back to the center of the previous joist. These fixes also apply to bowed or misplaced rafters or studs.

If the kitchen and bathroom plumbing have been roughed in, you'll have to contend with all the pipes that penetrate the subfloor in these areas. This is a good time to work with your helper—one person calling out the locations of the pipes while the other marks them down on the plywood (photo below right). Just measure the two coordinates for the centerline of a pipe—this cuts in half the numbers you have to remember. I drill holes for pipes up to 1 in. in diameter. I make the holes ¼ in. oversize to allow for maneuvering the plywood into place. For larger holes I use a skillsaw or a jigsaw.

Wall sheathing—Plywood's tremendous shear values make it especially good for rough sheathing on walls. And just as T&G plywood eliminates the need for subfloor edge blocking, oversize plywood can save you the trouble of blocking the walls. You can get square-edged sheets of CDX that are 4 ft. wide, and 9 ft. or 10 ft. long. The extra material gives you plenty of overlap to pick up mudsill, joists and top plates on a building with 8-ft. ceilings.

If it is to be covered with siding, ⅜in. CDX is the typical sheathing. Secure it with 6d nails, 6 in. o. c. around panel perimeters and 12 in. o. c. in the field. In earthquake-prone areas, engineers will often specify nails at closer intervals.

Although it isn't required by code, I like to use ⅜-in. CDX behind stucco, especially in any area subject to contact with baseballs or bicycles. If the sheathing is also going to serve as a nailing surface for sidewall shingles, it should be at least ½ in. thick, secured with 8d nails.

To allow for moisture-induced expansion, you should leave ⅛-in. gaps between the plywood panels, especially those parallel to the face grain. This presents a problem with conventional stud layout. Every sixth sheet will completely miss the stud. I deal with this by ripping ⅜ in. off every third or fourth sheet.

Typically, wall-sheathing end joints will fall on the rim joists of multi-story buildings. As you sheathe the upper stories, snap a chalkline onto the rim joists ½ in. above the first-floor wall sheathing. Then tack nails into the line to give yourself a ledge to rest your panels on. This gap allows for the shrinkage of plates and joists.

Sheathe all the walls without regard for doors or windows. Come back when the building is completely sheathed and cut out the window and door openings with a chainsaw or a Sawzall from inside. Be sure to keep nails away from the rough openings until you've made your cutouts.

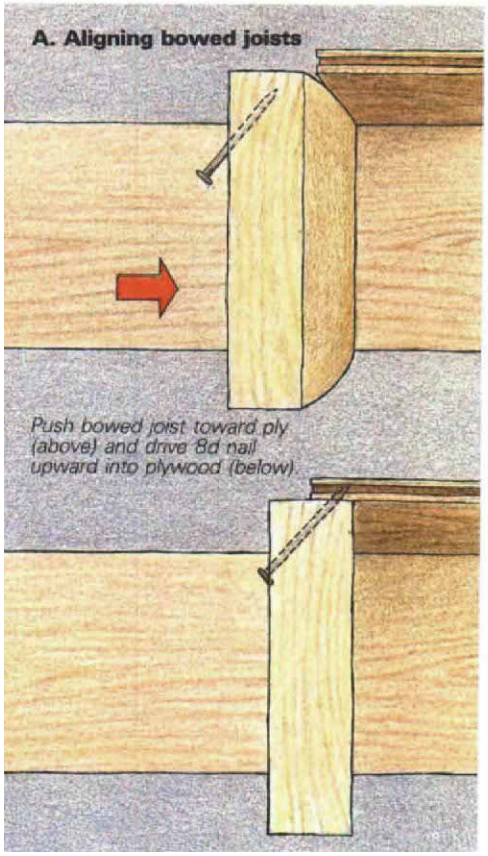
For me, the scariest moment that I commonly face in construction is raising pre-sheathed walls, two or three floors up, on a windy day. Under these conditions walls want to become hang gliders, taking reluctant carpenters for short but memorable rides. Consequently, I much prefer to affix plywood to plumbed and aligned stud walls from a scaffold. But sometimes walls must be sheathed before they are raised—for instance, a blind wall hard against a neighboring house on a zero-setback lot.

When I have to raise a pre-sheathed wall, I snap a line on the subfloor to register the inside edge of the plate. Then before raising the wall I toenail the plate to the subfloor with 16d nails on 4-ft. centers. As the wall is raised, the nails work as a hinge to keep the plate from moving beyond the layout line. If I need to bring the wall back a bit, I dig my hammer claws into a stud for purchase.

Although pre-sheathed walls are squared before raising, they rarely stand perfectly plumb. Since you have to get on a ladder anyway to nail off the plywood lap from the butt-wall to the by-wall (see *FHB* #22, pp. 31-39), leave out the corner framing members on both walls until you've checked the walls for plumb. This strategy makes it easier to adjust the walls, and all the corner framing and sheathing can be nailed off at the same time.

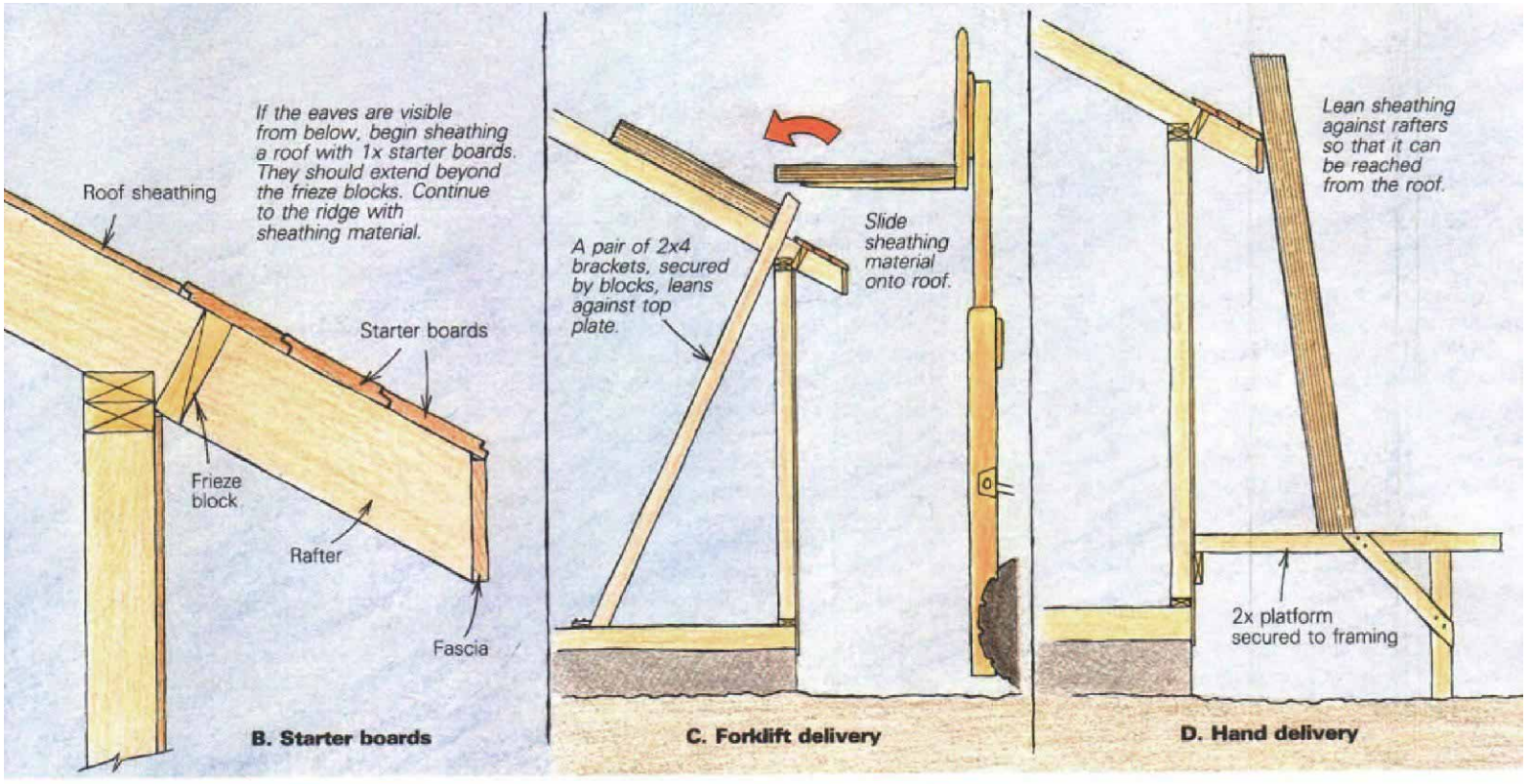
Roofs—If a roof has eaves, the sheathing begins with the starter boards. These are usually 1x6 or 1x8 shiplap boards that show on the underside of the eaves. On tract work the starter boards are often the responsibility of the same two-man crew that installs the barge rafters and fascia, while another crew nails down the rest of the roof sheathing.

Begin the starter-board installation by checking the alignment of the rafter tails with a string line. If any of them are out (a common problem



When joists are lapped, you have to add a block to pick up the unsupported edge of a piece of subfloor. There's a V-shaped mark on the plywood to the right of the hammer. It tells the person nailing where the centerline of the joist lies, and the direction it runs.

Try to work in pairs when laying out the bathroom subfloor. One calls out pipe centerlines while another marks their locations.



Cutting two pieces of roof sheathing at once eliminates tedious measuring and unwieldy rooftop cutting setups. Workers below should be warned about falling offcuts.

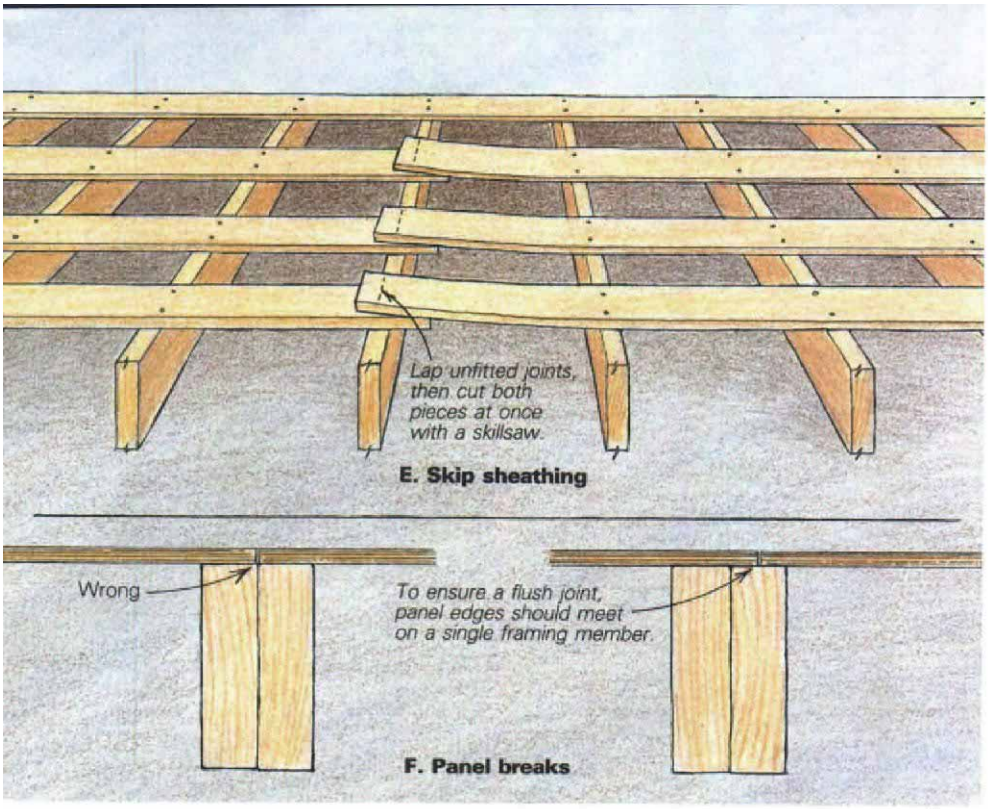
with roof trusses), snap a chalkline and make the necessary plumb cuts. While you are at it, snap another chalkline to show where the frieze blocks go, and a third to locate the line of the starter boards. The line for the starter boards will be a distance that is a multiple of their widths, and it will fall on the ridge side of the frieze block (drawing B, above left). I begin my starter boards on this chalkline because rafter tails are too awkward to use as a register mark when working from above.

If your supplier can bring along a forklift when he delivers the roof sheathing, build a 2x bracket to cradle the sheathing pile near the eave line (drawing C). Lacking a forklift, build a staging platform that is high enough for a vertical stack of sheathing to be accessible from the roof (drawing D).

If the pitch is flat enough to need a tar-and-gravel roof or some other type of membrane waterproofing, use T&G plywood sheathing. A roof that is steep enough to use shingles doesn't need T&G plywood. T&G sheathing is difficult to install properly on a slope, and it adds nothing to the durability of the finish roofing.

I have occasionally seen flat roofs that have been specified to have ½-in. square-edged sheathing supported at the unblocked edges by ply-clips. Ply-clips are H-shaped aluminum extrusions that fit over adjoining pieces of plywood, linking the two. Because ½-in. plywood isn't available in T&G, the ply-clips are a cost-cutting strategy. Considering the time and effort it takes to install the clips, I say skip the clips and pay for ⅝-in. T&G sheathing.

With square-edge plywood roof sheathing, you can make sheathing cuts similar to skip sheathing (photo left). To note nailing centers, mark the rafter or truss locations on the edge of the plywood as you go. Standard nailing for ½-in. to ¾-in. sheathing is with 8d nails, 6 in. o. c. around the perimeter of panels and at 12-in. intervals in the field.



Skip sheathing—Wood shingle and shake roofs remain the last refuge of lumber (board) rough sheathing. When I first started as a production carpenter 14 years ago, we used to cover the rafters about halfway up the roof with 1x4 and nail every other one. Then we would pull out the alternating 1x4s, which had served their jobs as spacers, and move them uphill where the process would be repeated. Hence the name skip sheathing. Wood shingles and shakes are applied over skip sheathing because the gaps between the boards allow air circulation to keep the roofing dry.

Nowadays it's more common to see 1x6 skip sheathing laid center to center (with a gauge mark on the hammer) to a measurement that corresponds to the exposure of the shingle, shake or even tile.

Long boards are best for simple gable roofs, but they can be a nuisance on roofs with a lot of hips and valleys. Consequently, lean the long stuff around the house against the eaves where you can reach it from the uncomplicated parts of the roof, and save the short pieces for the complex areas.

As you lay up the 1xs, using either the skip sheathing method or a gauge-mark on your hammer, don't stop to cut the material to length. Instead, let the pieces lap over one another for the time being. Make sure each 1x spans at least two rafter bays, and you can lap up to three butt joints in a row on the same rafter (drawing E, above).

Use 8d nails for 1x skip sheathing—two at each rafter for 1x4s and 1x6s; 1x6s and up get three. Keep the nails out of the way of the future line of cut. After you get the whole roof laid up, grab your saw, set its depth to cut two thicknesses of skip sheathing, and do all the fitting by cutting through both the over and underlapped piece at the same time. Sheathe solid the last three courses at the ridge.

On roofs above a 6-in-12 pitch skip sheathing is nice because it makes a ladder to work on. A plywood roof at 6-in-12 is only deceptively comfortable—a little sawdust can start you on a slide that will have you using your hammer claws, fingernails and newfound ability at rapid prayer. Roof jacks or rows of 2x4s tacked 4 ft. apart across the roof can help the sheather as much as the shingler.

Engineering—Except in engineered cases (like preframed roof panels), always run the face grain of the plywood perpendicular to the joists or rafters. Most span tables for plywood and other coverings assume that the sheathing will be at least two spans long. For shear walls engineers often specify a minimum size panel. Panel ends and edges should break on a single member—not align with the gap between two pieces nailed together (drawing F). This helps ensure a flush joint and continuity of shear strength.

Unlike floors and roofs, you don't need to stagger the joints in wall sheathing unless specified by the engineer, and the face grain of the plywood can be run parallel to the studs. It is however, especially important to nail wall sheathing properly because it is usually very thin. Nails should be no closer than ⅜ in. to the edge of the sheet, and they should not tear through any of the laminations. I've actually seen some engineers specify hand nailing to avoid this problem. To get a good job without going to such a ridiculous extreme you can shim out the nose of the nail gun to leave the nail head out about ¼ in. Then go back and finish off the nails with a hammer.

A 14-gauge staple will provide almost identical shear strength and greater resistance to withdrawal than an 8d nail, while doing much less damage to the plywood. 1 don't understand why engineers don't specify them more often. □

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Types of sheathing

Plywood is graded by the quality of the face veneers—A through D. An A rating is the most defect-free plywood grade, and D has the most defects. The grade is marked out on the back of each sheet with a stamp that notes the grade of the face veneer, followed by the grade of the back side. For example, a sheet of AD plywood has had all its voids patched with wood plugs on one side (the A side), and then it has been sanded smooth. The back side, or D side, is unsanded and has voids from splinters and knotholes up to 2½ in. in diameter.

Plywood can be made from more than 70 species of wood, all of which have different strength ratings. The ratings are divided into five groups, with the strongest being the group 1 species. Plywood made only from the group 1 species will bear the label "Structural I." It is suitable for use in highly demanding applications such as box-beams or structural diaphragms. Structural II plywood is composed of woods from group 1, 2 or 3. Plywoods that don't have these labels can be made of any of the five groups.

The veneers that make up a piece of plywood can be bonded together with two kinds of glue. Interior plywood is made with water-resistant glue; exterior plywood is made with waterproof glue. Most sheathing plywood is made with exterior glue to hold up while exposed to the weather during construction. The grade of sheathing common to most residential projects, CDX, is actually an interior grade of plywood because exterior grades don't include a D face. The X in the label means the plywood was made with exterior glue.

Plywood that is suitable for sheathing will have a label that notes the span index. This tells you the allowable distances between rafters or joists for the grade and thickness of the plywood. For instance, the stamp 32/16 means that the plywood is acceptable (under most codes) for sheathing roofs with rafters no more than 32 in. o. c., or floors with joists a maximum of 16 in. o. c. The stamp 24/0 means the plywood is good for roofs with rafters no more than 24 in. o. c. but unacceptable for subfloors.

Typically, a house with joists 16 in. o. c. will have a ⅝-in. thick CDX subfloor, and joists 24 in. o. c. will have a ¾-in. thick CDX subfloor. If the floor finish is to be vinyl, the subfloor can be CDX that has been plugged and touch-sanded. But in practice, most builders I know add a ⅜-in. thick underlayment for vinyl floors because it is smoother and less likely to be damaged during construction.

While plywood has been the common rough sheathing on homes built since World War II, two new types of sheathing have recently come on the scene. One is oriented strandboard; the other is oriented waferboard. Both are made by bonding together with phenolic resins flakes or chips of wood from trees that are unsuitable for plywood. Both types come in T&G, and in the standard plywood dimensions. They are manufactured to standards set by the American Plywood Association, with span indexes printed on each panel. If you are close to a mill that produces oriented strandboard or waferboard, chances are they will cost up to 15% less than comparable sheets of plywood. For more information on panel sheathing products such as plywood and waferboard, write the American Plywood Association, P.O. Box 11700, Tacoma, Wash. 98411. —J. P.

Drawings: Chuck Lockhart