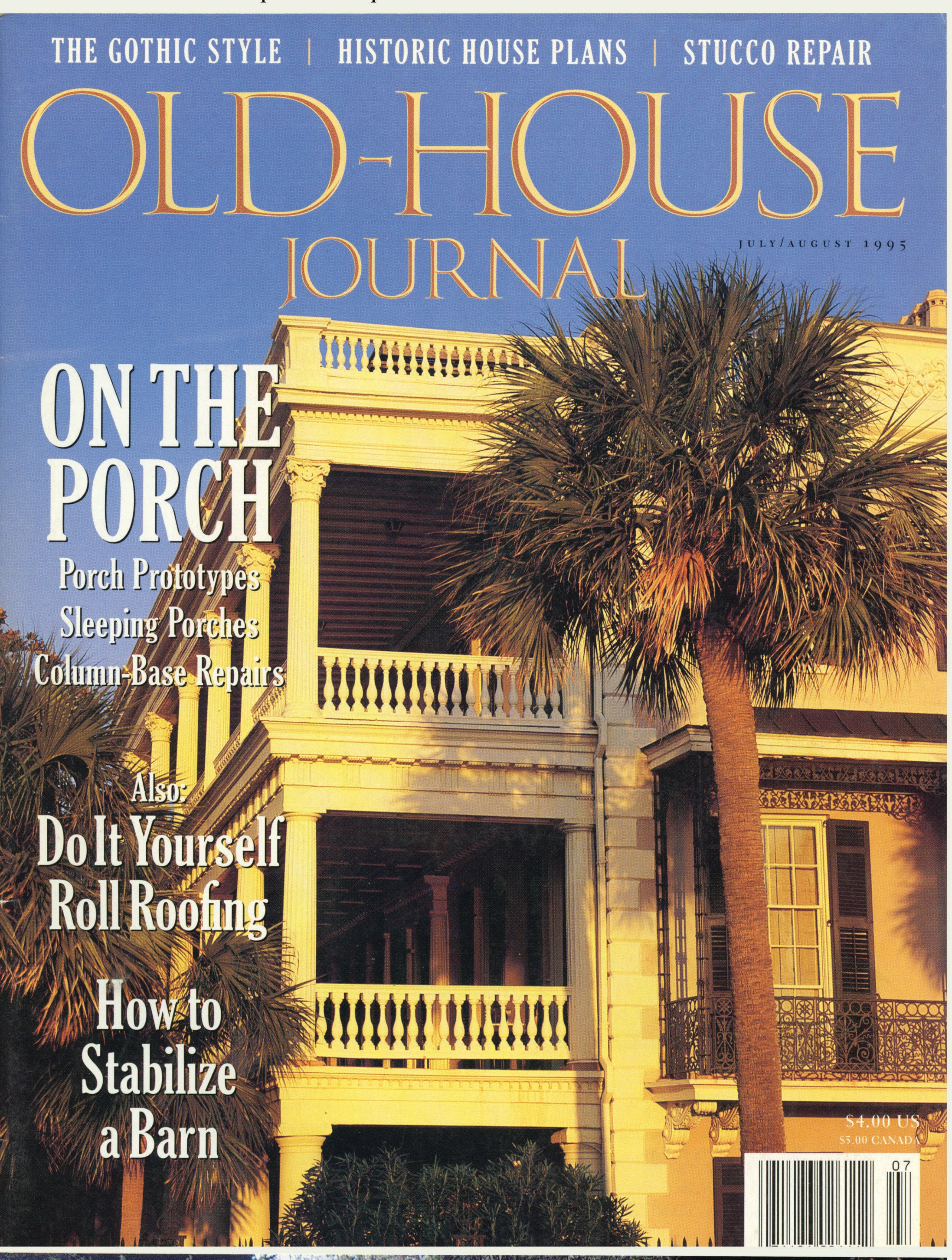
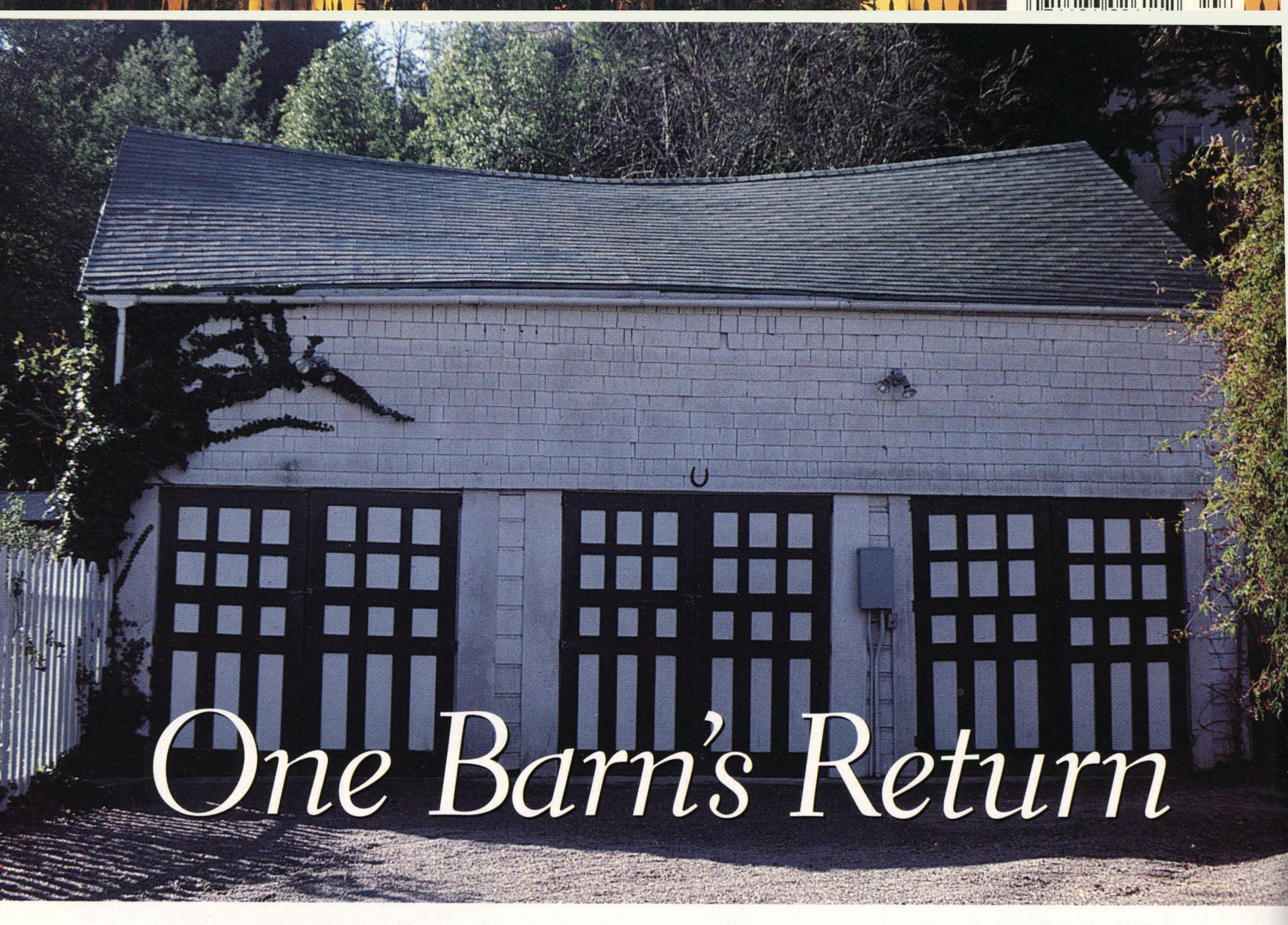


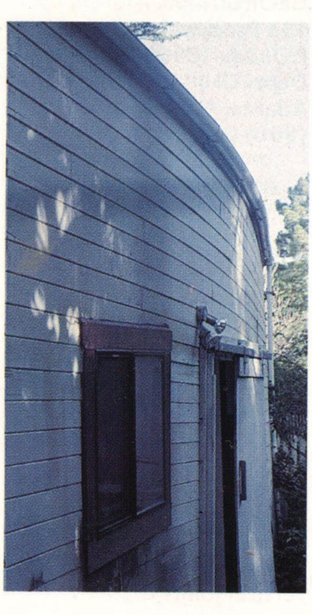


One Barn's Return

THREE FIXES FOR BULGING OUTBUILDINGS

BY CHARLES PROWELL

Corners cut in construction 120 years ago come back now as a "washline" roof ridge (above) and spreading walls (below) — structural defects that are dramatic in the King barn, but by no means unique.



I'M A CARPENTER'S SON, AND I'VE REHABBED MANY PRE-1906 EARTHquake Victorian houses in San Francisco, yet I have never seen an outbuilding like the one on the old King estate. Built in 1868 from first-growth redwood, "The Barn" as the owners called it, was an old carriage house divided into three bays. The structure almost defied gravity. The wall above the doors tilted way out of plumb; the ridge line drooped like the spine of an old mare. The decent thing to do, I suggested to the owners, would be to put it to rest. They decided otherwise, however, because the barn was an original outbuilding, with significance for the early main house and for them personally. So it became my job to stabilize the structurally sagging building. ■ Outbuildings seldom share the same quality of construction as living quarters, and their repair can often involve unorthodox carpentry and seat-of-the-pants engineering. You can use the methods I adapted for the King barn to stabilize many a neglected outbuilding — though hopefully not as swaybacked as this one.

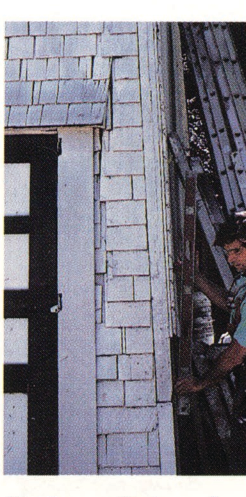
PHOTROGRAPHY BY CHARLES PROWELL

Shear-Walling the Frame

LIKE MANY OUTBUILDINGS, THE BARN'S FRAMing was rudimentary, almost nonexistent. In a phrase, it came closest to box-frame construction. The height of each gable-end wall was framed by nothing more than two horizontal 4x4s — three if you include the mud sill. This "frame" was sheathed with vertical planks and batten boards, a method used well into the mid-20th century. Amazingly, these vertical redwood planks were single lengths of wood, some of them running the full 22' from the slab to the ridge. Although the north and west walls of the barn were sided this way, the east gable and the long south wall had shingles over planks — about as load-bearing as duck feathers. I hired a structural engineer for a one-hour consultation, and we both agreed that the first order of business was to add some much-needed lateral support.

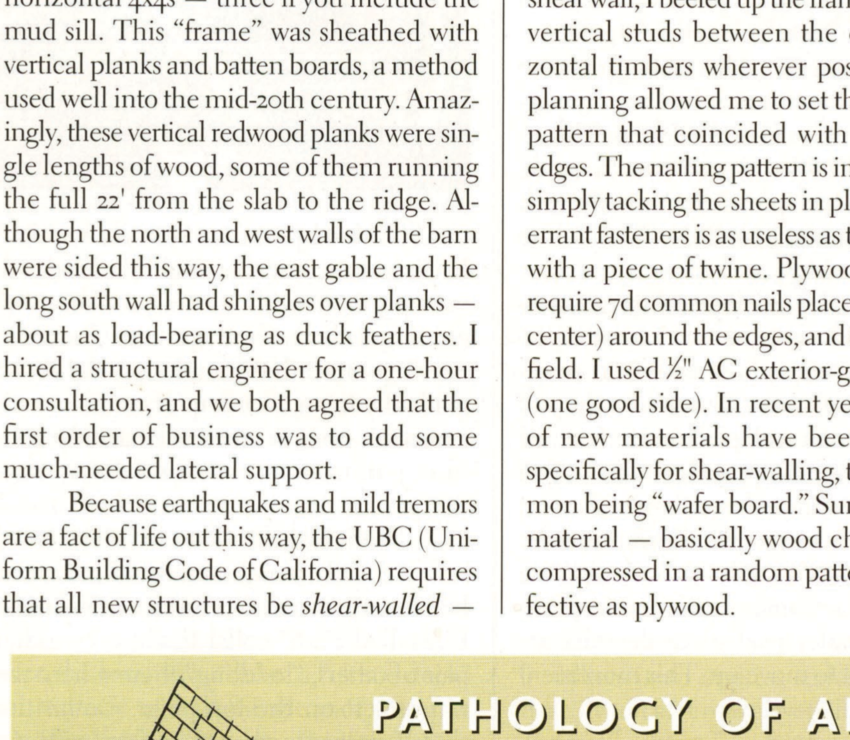
Because earthquakes and mild tremors are a fact of life out this way, the UBC (Uniform Building Code of California) requires that all new structures be *shear-walled* — that is, wrapped outside the frame, and beneath the finish siding, with ½" plywood. A shear wall is a panel that stiffens a wood-frame building so it resists seismic movements, particularly long periods of shaking that can literally wiggle its members apart. (In many cases shear walls also help tie the building to the mud sill so it doesn't hop off the foundation.) I gained nearly the same results by wrapping the interior walls — an option that often presents itself with outbuildings.

Before fitting the interior plywood shear wall, I beefed up the framing by adding vertical studs between the existing horizontal timbers wherever possible. A little planning allowed me to set these studs in a pattern that coincided with the plywood edges. The nailing pattern is important here; simply tacking the sheets in place with a few errant fasteners is as useless as tying up a boat with a piece of twine. Plywood shear walls require 7d common nails placed 4" O.C. (on-center) around the edges, and 8" O.C. in the field. I used ½" AC exterior-grade plywood (one good side). In recent years a number of new materials have been developed specifically for shear-walling, the most common being "wafer board." Surprisingly, this material — basically wood chips and glue, compressed in a random pattern — is as effective as plywood.



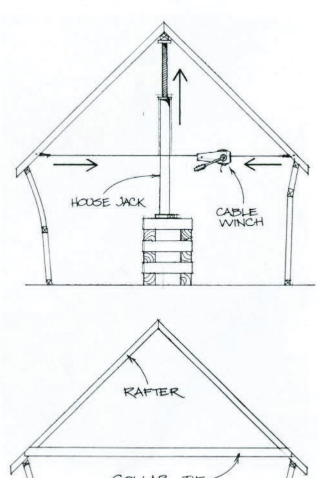
Setting realistic goals — I call them "outbuilding allowances" — is an essential part of working on old service buildings. Walls this far out of plumb will get better, but never perfect.

PATHOLOGY OF AN OUTBUILDING



Under the clapboard and shingle siding, the barn's major walls were supported by little more than vertical planks (see gable end on drawing). Joined with two or three horizontal members, there was no bracing to keep this "box frame" from twisting out of shape — a common outbuilding mutation. Adding plywood shear walls stiffened the structure. Open skip-sheathing on the roof offered no support and was unsuitable for asphalt shingles. A tightly nailed plywood deck added integrity here, too.

ILLUSTRATIONS BY ROBERT LEANNA



TOP: Rafter spread in a simple building can be corrected. A series of winches draws the tails together while jacks raise the ridge.
ABOVE: The permanent fix is adding collar ties (above), which create triangles that stabilize the roof framing.
OPPOSITE: Lacking bracing of any kind, the Barn had racked and twisted in several directions, most visible from inside.

Stabilizing Spread

CEILING JOISTS ARE ESSENTIAL TO THE STRUCtural stability of any building. They serve as anchor points for the top plates of the interior walls, framing for the ceiling and, most importantly, tie beams that keep rafters or outer walls from spreading out. Where there is no true ceiling, as is the case in many garages, stables, and small outbuildings, ceiling joists are eliminated in lieu of collar ties. The collar tie (also called a collar beam) is simply a horizontal member fastened to two common rafters, no closer to the peak than half the length of the rafter.

This barn had neither ceiling joists nor collar ties — a structural deformity surprisingly common in outbuildings. The result was predictable. Viewed from the gable end, the barn had spread dramatically, with one wall migrating towards Canada, the other towards Mexico.

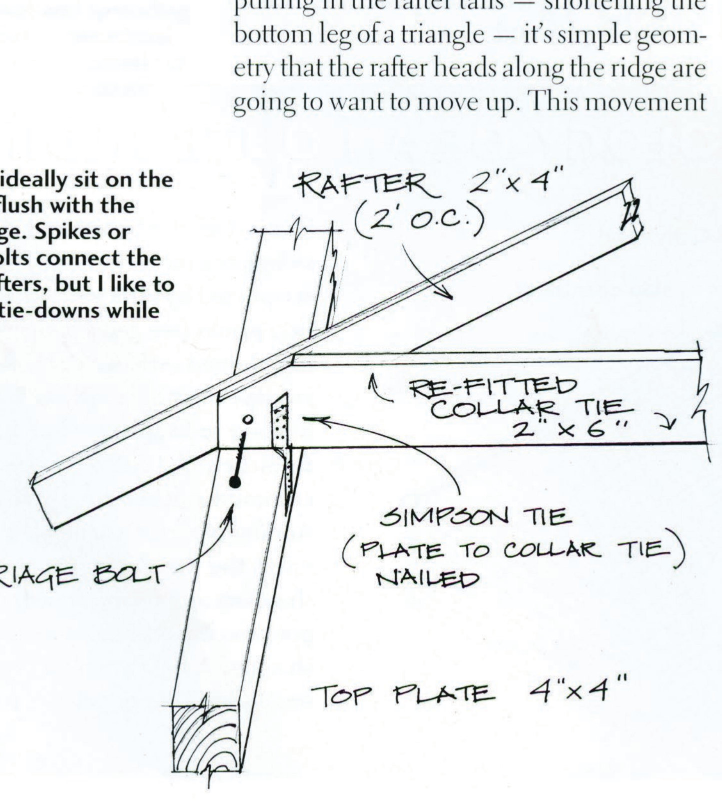
In outbuildings where the spread problem isn't as advanced as this barn, it's possible to use a series of 1 to 1½-ton "come-a-longs" (cable winches) to gradually pull back the walls. The cables should be fastened to the top plate, set approximately two feet apart, and not any closer than eight feet from the gable-end walls. Because you're pulling in the rafter tails — shortening the bottom leg of a triangle — it's simple geometry that the rafter heads along the ridge are going to want to move up. This movement

can be aided by setting a series of standard house jacks beneath the ridge board and connecting them with shoring timbers. Beginning with the center come-a-long and moving outward, the cables are tightened gradually in an even sequence that avoids too much stress in any one area. Take your time, putting just a half-turn a day on each device.

With the barn, however, we decided to leave well enough alone and just stabilize the structure from further movement. I installed 2"x 6" collar ties at every other pair of rafters, "saddling" them where the rafters rest on the top plate. Collar ties should be fastened to the rafters with 16d nails — better yet, carriage bolts — and secured to the top plate with construction fasteners, those twisted metal straps manufactured for tying framing connections together (particularly where natural forces are a threat to the building). They give a roof wind-lift resistance and generally help tighten up an old outbuilding. Because the exposed interiors of most outbuildings provide easy access to their framing, I recommend using metal fasteners (with their seemingly endless applications) whenever possible. Hurricane Hugo proved their effectiveness. In the most seriously damaged Florida homes, "hurricane ties" were nowhere to be found.

One last word about collar ties. They are most effective when set on the top plate,

Collar ties ideally sit on the top plate, flush with the outside edge. Spikes or carriage bolts connect the ties and rafters, but I like to add metal tie-downs while I'm there.



but it is virtually impossible to span this distance with a single length of lumber. Even with 24" spacing, there just isn't enough clearance between the rafters to wedge in a tie that will run from outside wall to outside wall. Therefore, it's necessary to use two lengths that overlap in the middle by approximately four feet, and spliced them with staggered carriage bolts set about 12" apart.

Roof Reinforcements

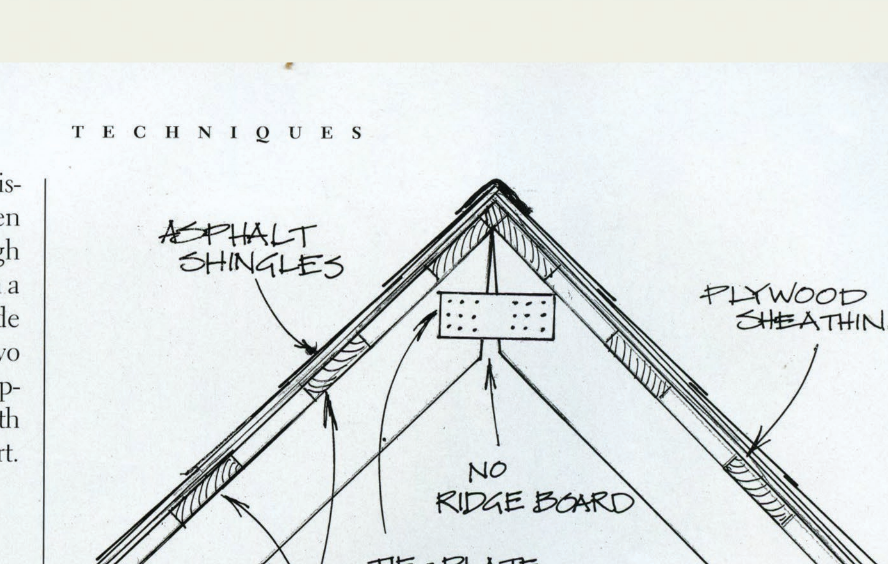
THE BARN NEEDED A NEW ROOF LIKE A sunken galleon needs a new coat of varnish, but that was the job. With the shear-walling finished and the collar ties in place, it was finally safe to go aloft. Out of curiosity, I strung a line from one gable peak to the other and found that, at its lowest point, the ridge dipped a full 14" below my 32' string line. While walls were spreading, the ridge was dropping. The lack of a ridge board didn't help. Neither did the weight of seven layers of old roofing — four over the legal maximum.

Using a shovel, I stripped off the old roofs to find skip-sheathing under the original wood shingles. Skip-sheathing is an "open deck" of 1 x 6 planks running perpendicular to the rafters, spaced 4" to 5" apart. It was common practice for supporting (and ventilating) wood roofs on residences and outbuildings built before the 1920s. However, the barn now needed a "closed deck" for the new asphalt shingle roof, and plywood would add more structural reinforcement as well.

Laying ⅝" tongue & groove plywood on the curved lines of an old barn was a job better suited for a boatbuilder than a house carpenter. Simply put, when an outbuilding roof is way out of plumb and true, I've found it's best to start the sheathing in the middle and along the lowest portion of the eaves. After this, sheathing is as for a normal job. Each plywood sheet is nailed down with 7d coated sinker nails at 4" O.C. along the edge and 8" O.C. in the field. The structural stability of any skip-sheathed roof is tightened considerably with the use of plywood. When the roof is fully sheathed, I simply cut the waste along the curve of the fascia.

Before laying the final course of plywood, I took advantage of the easy access to the rafter heads and fastened all of them with rectangular tie-plates. These plates come perforated for nailing (don't use self-nailing plates). The rafters were only toe-nailed together, so adding plates on both sides considerably reinforced the connection. It's important to use appropriate joist-hanger or truss nails with these plates. They are manufactured with thick shanks that can take the shear load and are coated or barbed to resist pull-out.

Though an extreme case of the "loose framing" often seen in secondary structures, the barn does illustrate the most common problem areas and methods that come up in stabilizing such a structure. Working on outbuildings is an endless series of compromises; you can't make everything as plumb and level as new. Besides, the aging lines of a building like the barn have a certain charm — to my way of thinking, more appealing that the square rigging of a new structure. ■



Connecting rafters with a pair of metal plates is more easy insurance when an outbuilding has no ridge board.

SUPPLIERS

TECO
P.O. Box 203, Dept. OHJ
Colliers Way
Colliers, West Virginia 26035
(800) 638-8989
Manufacturers of structural wood fasteners; contact for nearest dealer.

SIMPSON STRONG-TIE COMPANY, INC.
1450 Dolittle Drive,
Dept. OHJ
San Leandro, CA 94577
(800) 999-5099
Manufacturers of structural timber connectors; contact for nearest dealer.

From under the roof, a view of the metal rafter tie-downs and the plywood shear wall.