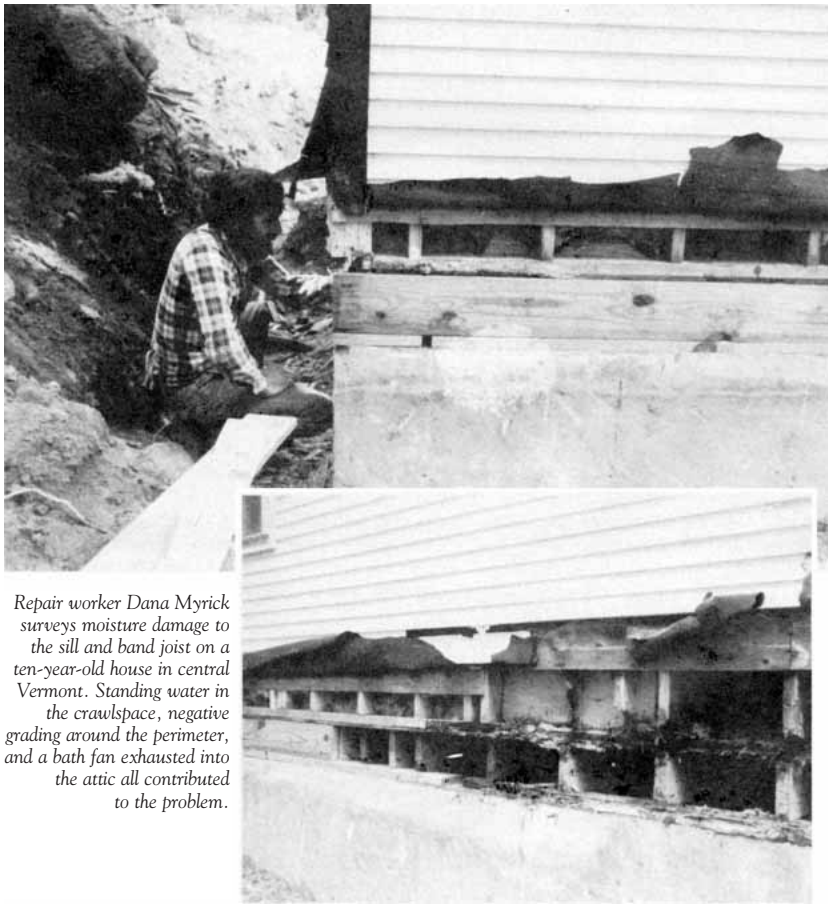
SILL REPAIR & JACKING

BY ROGER DESAUTELS

USING THE PROPER TOOLS AND A LITTLE COMMON SENSE MAKE LIGHT WORK OF STRUCTURAL REPAIRS

In old-house remodeling projects, owners are usually too preoccupied with the new living space to be concerned with the structural integrity of the building. Foundation problems and rotted sills, however, are common in older buildings and should be repaired before renovations begin upstairs. It's the contractor's responsibility to protect the homeowner's investment and his own reputation by examining the foundation and sills and making any necessary repairs.



Repair worker Dana Myrick surveys moisture damage to the sill and band joist on a ten-year-old house in central Vermont. Standing water in the crawlspace, negative grading around the perimeter, and a bath fan exhausted into the attic all contributed to the problem.

Inspecting the Sills

To inspect the sills, start by walking through the interior of the house, taking note of any humps or sags in the floor that are within 3 feet of the exterior wall. Also look for cracks where interior partitions join exterior walls. These cracks can indicate settlement of the exterior wall, which is often caused by advanced sill rot.

Next, jump on the floor near the exterior wall to feel if the floor is springy. Flexing next to an outside wall may indicate that the joists are no longer secured to the sill because of rot in the beam pockets. Looking at the house from the outside, sight along the clapboards, looking for gradual sags. Also look for peeling paint, mold, or dampness, which indicates moisture problems in the lower section of the wall. Pay particular attention to areas of poor drainage, dense foundation plantings, extreme shade, stagnant air, and where rain gutters are missing.

Also check to see if any exterior steps are trapping moisture against the sill. Leaky thresholds or windowsills can also allow water to reach the sill from above. Any suspect areas should be inspected more closely by probing with an ice pick. (An ice pick is much better than a screwdriver or an awl because of its smaller diameter and sharp point.) Although it is sometimes necessary to remove a skirtboard or clapboard, probing with the ice pick from the outside where the masonry meets the wood is usually sufficient. It is also important to probe in the basement or crawlspace. Sometimes sill rot is caused by interior dampness or plumbing leaks, so every section of the sill should be checked, no matter how difficult or unpleasant the access.

Once you've determined the amount of decay, you can plan the method of repair. Be sure to consider the type of framing system, the foundation type, access to the repair area, the owner's budget, and the type of jacking equipment available.

Although every repair job is different, the following basic principles apply to all:

- Do not allow the house to settle as a result of the work
- Replace the sill with the longest new pieces possible
- Do not skimp on splices and fasteners
- Remove the cause of the rot to protect your new work
- Be very safety conscious

Removing the Sill

Start the job by removing the bottom 2 feet of siding to expose the frame. Then remove any insulation, dirt, and obviously rotted wood. Be sure to check for electrical wires and plumbing, and, if necessary, make arrangements with other tradesmen to have them removed.

Replace the most rotted section of the sill first. Often this area has settled enough so that the studs exert very little weight on it, and the sill can be removed without any jacking. If there is still obvious weight here, it may be necessary to set one or more jacks under the sill on either side of the area to be repaired (see "Jacking Tips"). When the weight is relieved in the repair area, remove some of the stone or block foundation material under the sill to provide working room. If the

Jacking Tips

I use three kinds of jacks in sill repair: screw, hydraulic, and mechanical (see Figure A). A fourth type, the adjustable floor post, can also be used when working in full basements. The traditional screw jack is very dependable although slow to use in tight places. Keeping it well oiled will make its operation much easier. Hydraulic jacks in 12-ton and 20-ton capacities are easier to use and, in most cases, they will provide more lifting power than screw jacks. In most situations, screw and hydraulic jacks can be used interchangeably. Mechanical jacks were originally used by railroads and are commonly called railroad jacks. They have two main advantages over the other jacks. They will provide more vertical lift in one setup and, because of their toe-lift, you can set them up in a smaller working space.

When jacking the sill of a house, the most important step is to build a good level base for the jack to rest on. If you don't, the jack is likely to tilt, causing it to stress the house and become dangerous. When you place screw or hydraulic jacks between the foundation and the sill, you should roughly level the foundation wall at the jack point and set a well-shimmed plank over the stone at right angles to the sill. Place the jack so it is centered on the outer edge of the sill, where the studs exert the most weight (see Figure B). This placement is particularly important in cases where the house is sagging.

You can also use a railroad jack to lift directly on the sill (see Figure C). By using the toe-lift feature, less foundation needs to be removed and the jack is quite stable due to a low center of gravity. After establishing a good stable base, slide the railroad jack tightly against the sill. Often, the upper portion of the jack will hit the remaining upper sheathing boards, and it may be necessary to shim the toe of the jack to provide clearance. This slightly off-level placement is not a problem as long as you use the jack in the lower half of its operating range. When the jack is centered on its base, tight against the sill and clear of the sheathing boards, place a steel angle plate between the toe-lift and the sill to spread the pressure over a wider area. You are now ready to jack.

Usually, you should jack in several places at the same time. This is to keep from applying all the pressure to one spot, which can be hard on the building. When your jacks are set to lift, apply pressure to the lowest jack point first and then follow with the others, always avoiding too much pressure on one spot. You may find that you need to set an extra jack or that you have one too many. Experimenting, noticing how the building acts, and changing your jacking positions are best done early in the process — before you have engaged the full load. Always check to make sure that your jack bases are not settling, and always keep the sill blocked with wood shims as you go up so that the building won't come down even if you have a jack failure.

The railroad jack is very versatile and can safely be used to jack a building from points other than the sill. You can suspend the wall of a post-and-beam building from above by gaining access to the upper plate and pushing on it at an angle with a push pole set up on the toe-lift of the jack (see Figure D). The timber plate must be in good condition, and the push pole should be a straight 6x6 with no serious defects. The jack base should be dug into the earth at a slight angle on firm soil. Cut the 6x6 to the exact length needed, use a steel plate on the toe-lift, and adjust the angle of the jack so that it is parallel to the pole. You adjust the angle of the jack by shimming the heel or toe of the jack with a good wood shim. Apply jack pressure and readjust your jack base if it shows uneven settlement. When you jack the wall this way you have the opportunity to replace the sill in fairly long lengths, although you will probably use other jacks to adjust the sill to level once it's in place.

Some people use a push pole on top of a hydraulic jack to jack from above. However, this practice is dangerous and should only be done on a very good jack base and when the push pole is heavily braced to the building. I personally have never used this technique and do not recommend it.

Jacking can be a safe procedure or a dangerous one. It is your attention to the details that makes the difference. Always keep an eye on your jack base to note settlement. If your jack starts to tip, stop and correct the problem immediately — it won't fix itself! Most importantly, always keep your sill blocked and shimmed tight. Never allow more than a 3/4-inch space between your blocking and the sill.

— *R. D.*

Figure A. *Shown left to right are a railroad jack, a screw jack, and a hydraulic jack. A fourth kind — the adjustable floor post — is shown in Figure 4 (last page).*

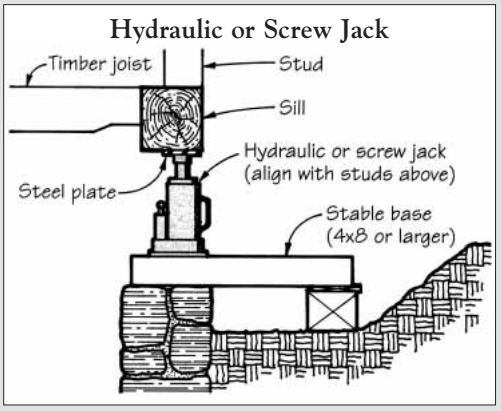


Figure B. *To jack up the sill in post-and-beam construction, set a screw or hydraulic jack on a large, solidly shimmed plank placed at right angles to the sill.*

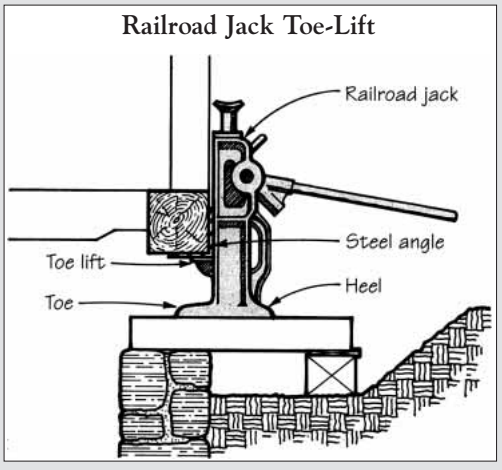


Figure C. *The toe-lift feature of a railroad jack requires less clearance between the jacking block and the sill.*

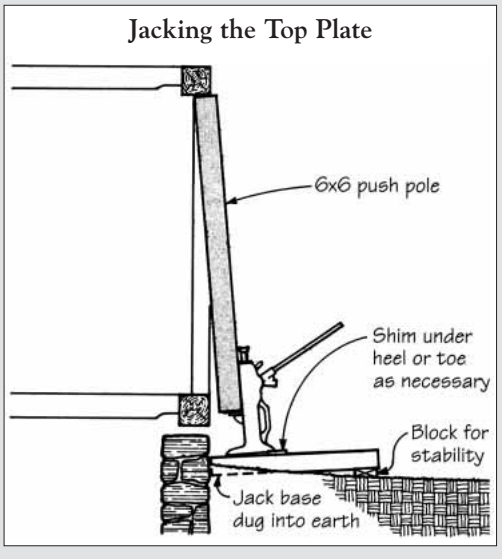


Figure D. *In some cases, you can jack a post-and-beam wall from above to work on the sill below. Use a railroad jack with a 6x6 push pole to lift the wall by its top plate. Keep the push plate as close to plumb as possible.*

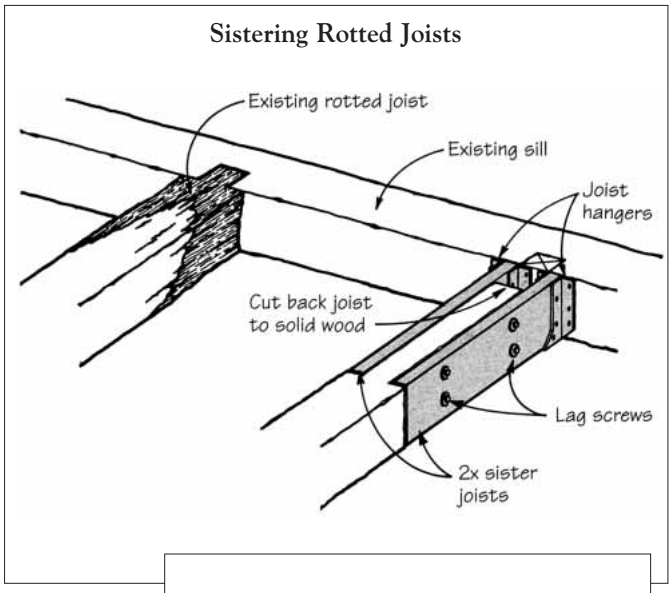
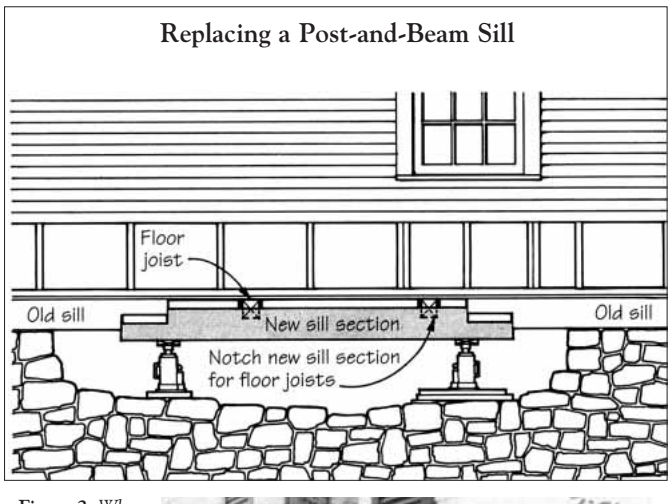


Figure 1. *Severely rotted joist ends may require sistering (above). With less rot, adding a pressure-treated ledger to the new sill may be sufficient (inset).*



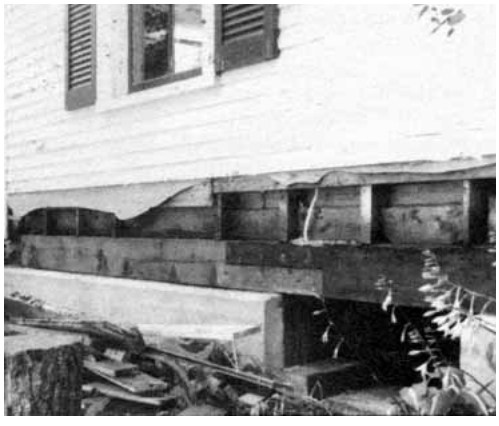


Figure 2. *When replacing a section of the sill in a post-and-beam structure, cut matching half-laps in the old and new sections (above). Force the new section into place with crowbars, sledges, and jacks. When lagged and bolted into place, the half-lap securely ties the new sill section into the old (right).*

foundation is poured concrete, you'll have to use a smaller dimension sill or cut the studs a little short to create working room. At the same time, be sure to shore up any floor joists or cross beams that are supported by the sill section being removed to prevent them from settling.

To remove the old sill, cut it into short sections with a gas or electric chain saw and pry these sections away from the studs. If you find studs or floorboards fastened to the sill, cut the nails with a metal-cutting blade in a reciprocating saw. Where cross beams or posts meet the sill, try to save any unrotted tenons to make the connection with the new sill.

Repairing Joist Ends

Once you've removed the sill section, clear away all debris and check to make sure there are no nails sticking down from the floor boards. You should also repair any floor joist ends that have rotted.

How you repair a floor joist end depends on the degree of rot. A small amount of rot on the bottom of an old half-round joist can simply be cut and chiseled away — leaving a slightly smaller joist end.

If the rot is more extensive, a pressure-treated 2x4 ledger lagged to the new sill may be sufficient to catch the joist. If there's extensive decay, complete joist replacement or sistering may be necessary. If you sister, make sure to lap and lag sufficiently to make a rigid splice (see Figure 1).

Replacing the Sill

If you are only replacing a short section of the sill, now is the time to cut half-laps in the remaining sill on either side (see Figure 2).

Next, cut the new sill timber to fit the hole you've just prepared. Notch the new sill section as needed to receive tenons or the ends of floor joists. It helps during installation if these notches are slightly oversized and chamfered at the corners. On some post-and-beam frames, both vertical and horizontal tenons may have been saved when the old sill was cut out. If these are close together, however, you may have to cut off one of the tenons to allow the sill to slip into place.

Install the replacement piece with the aid of crowbars, sledgehammers, battering rams, and jacks. Once the new sill is in place, align the studs with the sill's outer edge, set jacks underneath the sill, and lift it to raise the studs and remove the sag from the building. If the sag is severe, you may need to raise the new sill section quite a bit. This operation will most likely relieve the weight on adjacent sill sections, which can be helpful if you are replacing these as well. If you are not going to replace any more sill, don't worry about the lack of weight in the adjacent area; it can be shimmed when you repair the foundation.

The next step is to fasten the new replacement section to the remaining good sill. You can use white oak pegs, drilled and driven in at an angle. But more commonly, bolts, threaded rods, or large spikes driven in at different angles do the job. After securing the new sill, shim the studs if necessary and renail them. Also, pin or nail any mortise-and-tenon joints in the repair area.

Fasten vertical or horizontal beams that have had their tenons removed with custom-made angle plates, lagged or bolted into intersecting beams (see "Steel: A Problem Solver"). If the new sill is at a corner of the building, a simple half lap is the easiest joint to use (see Figure 3). But sometimes more complex joints are desirable at the corner (for example, if you want to preserve the tenon at the bottom of the corner post). Plywood used as replacement sheathing can also serve as a gusset on the sill splices, as long as it's nailed well.

Platform-Construction Sill Repair

In many respects, it is easier to replace a sill in platform construction than post-and-beam structures. First, remove the bottom 2 feet of siding to expose the framing. If the sheathing is plywood, cut it off in a straight line as far above the top of the foundation as you can without going above the band joist. This allows you to renail the sheathing into the band joist later. If you're also replacing the band joist, cut the sheathing high enough to allow you to toenail the studs later.

Next, remove the nuts from the anchor bolts in and adjacent to the repair area. Then, lift the building slightly by jacking up the floor joists at a point just inside the foundation wall (see Figure 4). As the floor comes up, you can use a metal-cutting blade in a reciprocating saw to cut any nails fastening the joists to the sill. To minimize the stress on the rest of the building, don't jack any more than is necessary to loosen the sill. After the sill is loosened, cut slots with the reciprocating saw on each side of the anchor bolts to allow the sill to slide out from under the joist.

Cut slots in the new sill and slide it in around the anchor bolts. Use oversized washers under the anchor bolt nuts, and lubricate them well before you tighten them down. Then lower the building, fasten the joists with hurricane clips, and replace the exterior sheathing and siding.

Choosing the Materials

Originally, post-and-beam structures were framed with long lengths of 8x8 or larger timbers. The species of wood used were white oak or slow-growth "pumpkin" pine; both of these were naturally very rot resistant. Later, hemlock and spruce were used, although these woods do not tolerate moisture as well. For repair work of the highest quality, white oak is still the first choice, although it is difficult to work with and therefore more expensive to use. Slow-growth pine is no longer available. Hemlock is still available and is a good structural wood, but it is heavy and hard to handle when green from the sawmill. Spruce is readily available in long lengths, and its low moisture content (even when green) makes it relatively light to handle. For special projects, pressure-treated southern yellow pine can be used, although it is expensive and hard to handle because of its weight.

Any of the woods mentioned can be further protected from rot by applying chemical preservatives. Because the sills are mostly hidden and people do not come into contact with them, use the strongest preservative available.

On major sill repair jobs where there is plenty of jacking equipment available, there are advantages to using long lengths of timber. Using long lengths minimizes the number of splice joints required and helps save time during the leveling process. In most cases, long lengths give the building better structural integrity.

Summing Up

Structural repair work is not something you learn overnight. But even with years of experience, you'll have to experiment with placing your jacks. Make your best guess as to where to place them, then adjust as necessary.

Whatever your level of experience, keep two important safety points in mind:

- Always work off a stable base. If you cheat, it will always work against you.
- Always block and shim as you jack so the building is supported even if the jack fails. Never leave more than about 3/4 inch between your blocking and the sill.

Finally, remember that after straightening a building, secondary stresses will be relieved for a year or two afterward. Tell your clients to expect some plaster to crack over time. A building that took a hundred years to sag isn't going to straighten out in a day. ■

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Steel: A Problem Solver

Although post-and-beam frames were originally built with only wood joints, we usually rely on steel to simplify our repair techniques. Galvanized or stainless-steel nails are necessary when fastening pressure-treated wood. Steel bolts or threaded rods are very useful in bolting together structural half-lapped or scarf joints.

When a tenon has been cut off for access reasons or rot, a heavy steel corner plate can be used to perform the same structural job. The steel plate should be slightly narrower than the beam it is being fastened to and be at least 1/4 inch thick. The length of each leg of the corner plate should be determined by the load it has to carry, the condition of the wood it is fastened to, and the available space. Drill 1/2-inch holes in each leg in a pattern that will allow room to use wrenches and avoid minor rotted areas or splits in the beam. The plates can be fastened to the beams with 1/2-inch through bolts, although 1/2-inch lag bolts in long lengths will do an adequate job. With lag bolts, you should drill a 1/2-inch pilot hole the length of the threaded area to ensure maximum holding power. Be sure to oil the lag before you put it in to ease its installation and provide extra protection against rusting. I drive in lags with a socket driver attached to an electric drill.

— R. D.

Figure 3. *A simple half lap is the easiest joint to use where the new sill reaches the corner of the building. You need to cut a mortise if you want to preserve a tenon at the bottom of the corner post.*

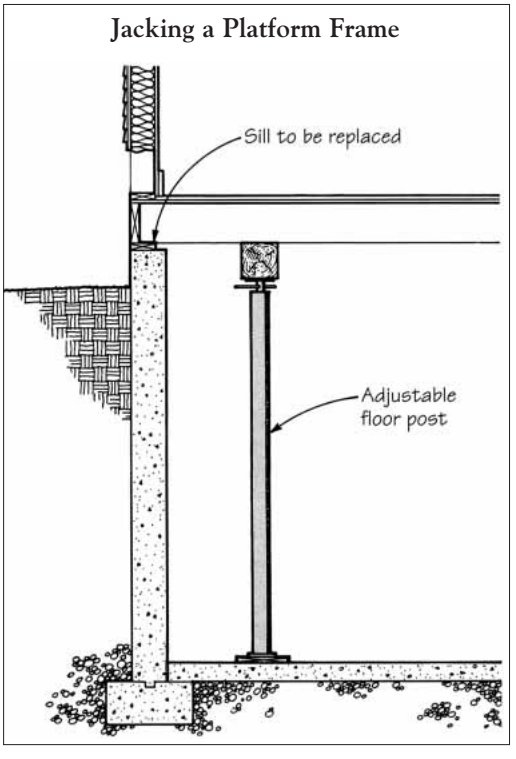

Figure 4. *To repair or replace sills in platform construction, start by lifting the floor joists at a point just inside the foundation wall. Use an adjustable floor post, as shown, or railroad jacks with push poles.*