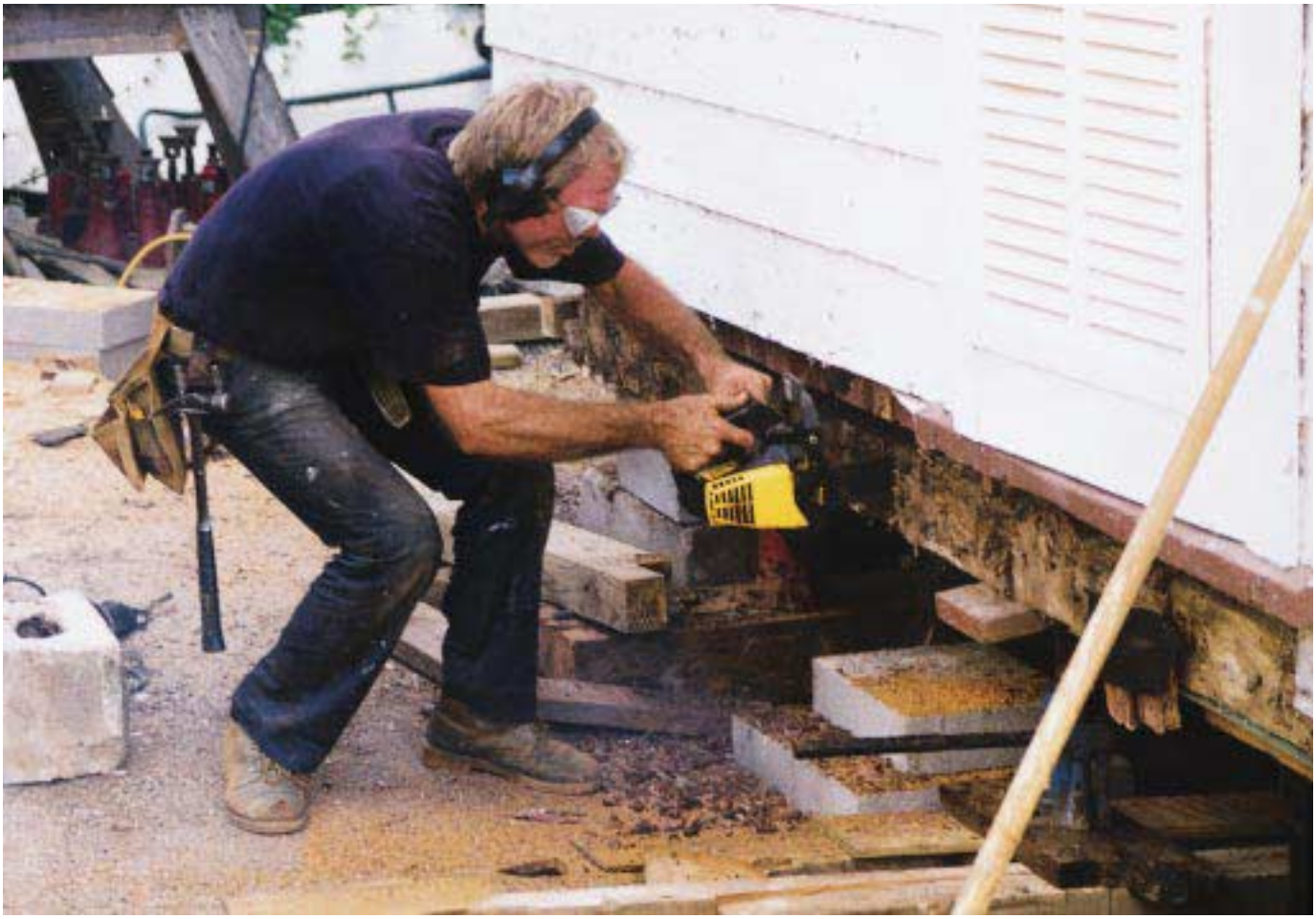
JACKING *Old Houses*



Lifting an old house out of the mud and providing solid support are the underpinnings of a good restoration job

by Mike Shannahan

My company specializes in restoring turn-of-the-century and older homes in the Galveston Bay area of Texas. Period restoration may conjure up the image of an old man in a leather apron, spectacles, and visor, painstakingly refinishing gold striping on a fireplace pilaster. Since most stereotypes have a basis in fact, I won't try to debunk this one, but I will say that a whole lot must happen before this fellow arrives on site.

Many of the structures we work on have been neglected for years in a very unforgiving climate. On this end of the Gulf Coast, we have very damp, cool winters and hot, dry summers punctuated by torrential rain showers and occasional hurricanes or tropical storms. Humidity hovers around 90% at night, and by midday it drops to around 50%. Intense sun

and salty air also come into play.

Soil is also a big variable: It ranges from fairly stable sand at water's edge to a hard clay silt just a few feet inland. We have a heavy black humus known as gumbo, which is very unstable: It shrinks and heaves, turning from a soupy mess when saturated to a rock-hard mass when baked dry. Building movement on this type of ground is a given, so structural repairs must always be addressed before other work can begin.

Most of the houses I work on were built before ready-mix concrete was available. Many are supported on a grid of short brick piers spanned by 6x6 or 8x8 sills. In many cases, however, the sills were set directly on the ground. Even though they are made of bald cypress — a naturally decay-resistant wood — or creosoted yellow pine, after 50 or 60 years these timbers have rotted or been eaten by termites to the point of nonexistence.

Using the Right Jack

The first step in a structural overhaul is to raise the house up above grade. This allows air circulation underneath, which in turn alleviates many moisture-related problems and also makes access to plumbing and other house systems easier.

I use three types of jacks: hydraulic bottle jacks, screw jacks, and hypoid gear jacks (see Figure 1). Most of my hydraulic jacks are rated at 10, 12, or 15 tons; the screw jacks I use have a 10-ton rating. I use the hydraulic jacks for lifting, backed up by the screw jacks for holding things up while I reblock the hydraulics. I have about 30 of each type.

The hypoid gear jacks have either a 25- or 35-ton rating; they raise and lower with a 1-inch socket wrench. I have only a few of these, and use them at the heaviest points — usually at interior loadbearing partitions. The hypoid jacks are heavy and turn very slowly, so I use them only where I need their load capacity.

In very tight locations — behind a masonry fireplace, for example — where there's not enough room to operate a screw or hydraulic bottle jack, I'll use a Porta-Power Ram Pump (available for about $165 from Northern Hydraulics, 800/556-7885). This is a small hydraulic ram used in auto shops that has a pump chamber like the one on a grease gun. You pump the hydraulic fluid through a hose to the ram piston, which may be set up a few feet away. I'll use the Porta-Power to lift until there is enough clearance to allow me to get cribbing and a standard jack underneath.

Setting Up

We start by distributing jacks around the perimeter of the house at intervals determined by the size of the structure. There are no real rules of thumb; you just have to properly estimate the weight of the building and place jacks accordingly. Obviously, a two-story structure will have jacks at tighter intervals than a single story. The corners usually hold themselves up pretty well, providing the framing is sound; most of the weight is in the middle of the building.

We usually place jacks alongside existing piers, if there are any, since these are already supporting the structure and provide a place for shims and blocking as the house goes up.

As we distribute jacks, we scope out the areas where we'll have to excavate. Since the jacks must bear directly underneath the sills, we usually have to do a fair amount of digging to accommodate both the jacks and the cribbing they rest on.

We take care not to position jacks or cribbing over any septic lines, gas pipes, water supplies, and so forth. When we're working on an unoccupied house, it's an easy matter to disconnect the plumbing and electrical before the job starts. If the house is occupied, we provide temporary wiring and plumbing to ensure uninterrupted service to the home while we work. We've learned by experience to watch out for live electrical wires lying in the dirt.

Figure 1. The author uses three types of jacks (from left in top photo): hydraulic, screw, and hypoid gear. Steel angle slips, predrilled for attaching with duplex nails, spread the load over a larger bearing surface (bottom photo).

Figure 2. After decades of settling into the ground, this house (top) is showing serious moisture damage. New floor joists (middle) provide a sound structure for jacking. The framing nailed to the wall helps to pick up individual studs and the corner post. Note the new elevation of the porch rail relative to the concrete porch (bottom) as the house comes up.

While setting out the jacks, we also look for rotted sills and joists — places where we'll have to scab on new framing or install "needle beams" (Figure 2). Needle beams are temporary wood beams set in from the edge of the house underneath and perpendicular to the joists. The needle beams stay in place for the duration of the job and are used for jacking until the house is high enough so that the sills can be replaced.

Once set up, the jacks stay in place throughout the job. Though it isn't a problem with hypoid and screw jacks, the hydraulic jacks can punch through a sill when pressure is applied because of their small bearing surface. To prevent this, I use 4-by, 6-by, and 8-by angle-iron "slips," predrilled for attaching to the bottom of sills with duplex nails. These also help prevent sills from twisting as uneven pressures build up when we initially lift the house, before we get a feel for how the structure is going to behave. The slips, too, stay in place throughout the job. I've painted these pieces of steel bright green so they show up well under the house when we're cleaning up the job.

Heave Ho

When all the jacks are in position with solid cribbing beneath, we first extend them until they are fully loaded — to the point where the cribbing stops pushing down into the soil. At this point, lifting can begin.

I prefer to work down the long side of the house — the eaves side of a typical gable house, for example. By sighting down the long sills and the center girder, I get a good idea of how the house is behaving as it is lifted.

It's ideal to have three guys jacking and one guy going for material as they need it. The three guys position themselves across the front of the house (if that's where we're starting from), one at each corner and one in the middle. They'll each raise their jack just enough to accommodate a 1/2-inch plywood shim under the adjoining pier. Then they'll move down 6 or 8 feet to the next jacking point and raise that jack 1/2 inch, and so on down the length of the house. A restrained approach like this eliminates a lot of consequential damage to interior plaster, doors, and windows.

We repeat the process until the fourth pass, when we pull out the plywood shims and insert a 2-inch concrete pad. Then the process begins again, adding plywood shims on top of the concrete pad until the seventh or eighth pass, when we insert a 4-inch concrete pad. We continue the process again, inserting an 8-inch pad, and so on, until the house is raised a few inches above the new specified grade, which might be anywhere from several inches to 4 feet, depending on the owner's wishes.

Occasionally an owner will ask me to lift the house just high enough to replace the rotted sills then set it back down only 3 or 4 inches higher than it was previously. That's okay if just one side or section of a house needs work. But if I'm going to overhaul the entire foundation, I prefer to lift the house at least 2 or 3 feet so I have room to work. Usually,

once the house is raised up, I leave it up permanently. It saves me a lot of work, since I don't have to take the house back down, and the plumbers and electricians like it a lot better than swimming in the mud. It's also in the owner's best interest, since there will be fewer termite and moisture problems, as well as easier access. If the house gets set back down close to the ground, it's only a matter of time before the work has to be done again.

New Piers

Once we get the house jacked to where we want it, we pull string lines to lay out the new masonry piers. The piers are built plumb and square from either block or brick and allowed to cure. Then the house is lowered, in a reverse procedure.

Occasionally, if the client requests, we'll excavate down a few feet and put in a half-cellar wall. We build them out of block; they're called chain walls in this area. I leave a ventilation hole by laying every fourth block in the top course on its side. In our damp climate, though, I prefer to leave the house up on pilasters and completely open underneath for good cross-ventilation.

While the house is raised up, I usually spread about a foot of

Figure 3. This turn-of-the-century carriage house was 19 inches out of level and 12 inches out of plumb before renovation. Termites had made mincemeat of much of its wall framing.

Figure 4. Staging made a convenient platform for jacking the carriage house (top), but it had to be thoroughly braced all the way to the ground. In addition to continuous cross-bracing in both directions, the author set 6x6 posts under the critical jacking points (middle), and made stable bases for the scaffold legs (bottom) by drilling holes in 2x6s.

Figure 5. While the second story of the carriage house was suspended, the crew excavated, formed, and poured new footings (top), then repaired the wall framing and lowered the building onto new PT sills.

bank sand underneath to avoid standing water and mosquito problems. I also slope the grade away around the outside.

Using Pipe Staging for Jacking

On a recent job we were able to use our pipe staging as a jacking platform. It was a carriage house with an apartment above, built around 1900 (Figure 3). It had been built on 6x6 sills right on top of unstable soil. A previous owner had placed reinforced concrete, 24 inches thick in some places, on the floor and under the sills to try to stabilize the structure, but to no avail. Termites were eating their way up through the first-story framing to the second story. When we got there, the building was 19 inches out of level and 12 inches out of plumb.

We had to support the second-story apartment while we repaired and replaced the first-story walls. I used my pipe staging as a convenient jacking platform, setting it up two bays wide and three rows deep (Figure 4). Before using the staging for jacking, I called a local scaffolding distributor to find out how much weight it could carry. But rather than rely on the staging to carry the loads, I used 6x6 posts all the way to the existing slab under each jack. I put 2x4 cross-bracing along the top of the staging, connecting all three rows together from the front to the back of the garage. I also stabilized the bottom by making bases out of 2x6s, with holes drilled for the feet. I then connected these bases and the bottoms of the 6x6 posts with double 2x4 braces running across the width of the garage.

In short, I braced the pants off of the staging setup. After all, the entire second story and roof would be essentially suspended for four to six weeks while people worked underneath.

Hanging the Needle Beams

So that we wouldn't have to wrestle with heavy beams high in the air, we hung the needles from the garage ceiling, perpendicular to the joists. We drilled through from the apartment floor above and used all-thread to snug them in place.

We used a transit, stringlines, and plumb bobs to keep track of the building's lateral movement as it was lifted. We also ran strings along the bottoms of the needle beams to ensure that we lifted the building uniformly.

While the building was raised, we excavated a trench for new footings, including jackhammering out the old concrete (Figure 5). We formed and poured a reinforced perimeter footing, with rebar pins sticking out on the inside to tie into the new slab. We poured the new slab on top of the old; its final elevation was 12 inches higher than the original slab.

The extra precautions we took setting up the job meant there were no problems later. Just to be on the safe side, though, I did increase my liability insurance. Because of the height and the extra measures involved, the carriage house job cost three to four times as much as it would have for a similar-sized building on the ground.

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