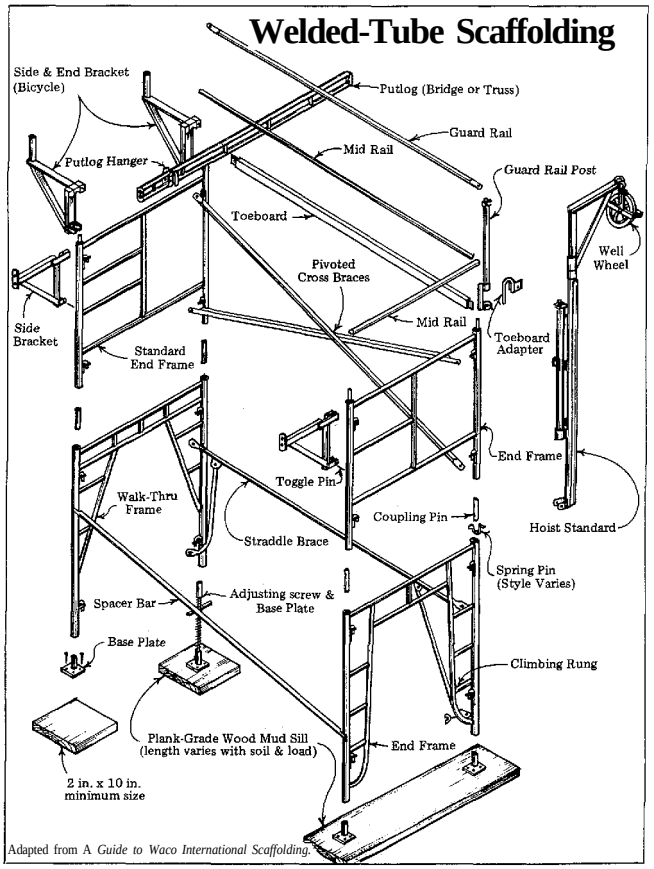
A Guide to Scaffolding Systems



Adapted from A *Guide to Waco International Scaffolding.*

by The Old-House Journal *Technical Staff*

Sometimes you have to tackle a job that you can't do from the ground and shouldn't do from a ladder. Cornice restoration is an example: it requires access to the whole cornice; tools and materials have to be handy; workers need both hands free to do the work. Scaffolding fits the bill.

In addition to new construction, a number of old-house jobs often require scaffolding. These include masonry repointing, major repairs to gutters and soffits, re-siding and reshingling, whole-house painting and paint stripping, and building a porch or addition.

Scaffolding Types

There are several types of scaffolding, each of which is right for some jobs and inappropriate or dangerous for others. "Built up" scaffolding—a temporary platform built from the ground up, as its name implies—is used most often and comes in several forms.

Here's a brief guide to this and other types of scaffolding:

• *Welded tubular-frame scaffolding:* Built-up scaffolding consisting of metal frames with braces and various accessories, this is the most common type of scaffolding used by contractors.

• *Tube-and-coupler scaffolding:* Another type of built-up scaffolding, this consists of tubing that serves as posts and beams, with special couplers that join the various members. This type of scaffolding, quite popular in Europe, is more complicated to erect than tubular-frame scaffolding.

• *Systems scaffolding:* An American hybrid similar to tube-and-coupler scaffolding, systems scaffolding employs parts that are field-assembled by the use of proprietary pipes, wedges, etc. Useful on complicated jobs, where it can be built to conform to odd shapes, it's easier to erect than tube-and-coupler systems but still requires an experienced hand.

• *Shoring:* A common type of scaffolding, shoring is similar to welded tubular-frame scaffolding. It's not really scaffolding, but rather temporary support and bracing that holds up structural members (instead of workers and materials) during construction or repair.

• *Pole scaffolding:* This is built-up scaffolding made of wood—the "original" scaffolding before welded-tube types came along. It still is used today by contractors whose crews understand how to put it up. It can be used for carpentry, painting or masonry work.

• *Rolling scaffolding:* This is built-up scaffolding on wheels that usually is used indoors. It should be used outdoors only on fully paved, flat areas for work at low heights.

• *Built-out scaffolding:* This type of scaffolding is built out from the wall instead of up from the ground or suspended from above. It is used more in new construction than in repair work, and usually at greater heights than what is involved in residential construction and remodeling.

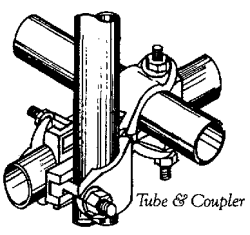
• *Swing staging*: Also known as suspended scaffolding, this is a scaffold platform suspended by wires or ropes from an overhead support system. It's useful for repair work that requires a short stay in a location before moving to another, such as window washing, painting a cornice or window trim, or minor masonry work. Most cities and towns require users of swing staging to have a rigger's license, because it's dangerous for inexperienced workers and, sometimes, for people below.

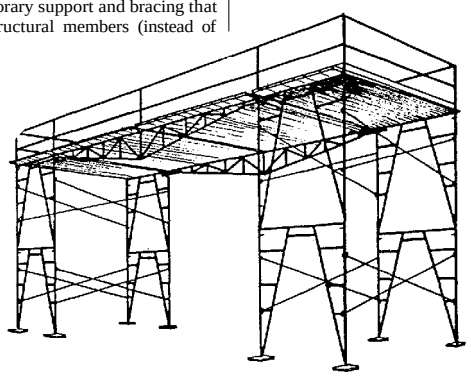
• *Ladder jacks:* Made up of metal jacks that attach to the rungs or side rails of an extension ladder to hold a work platform, this type of scaffolding must be tied into the building. Ladder jacks are not suitable for heavy work, such as masonry or carpentry, or for heights above one story, but they're fine for such jobs as painting and window repair at about 10 feet or so from the ground.

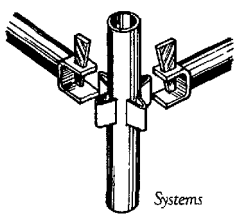
• *Trestle-ladder scaffold:* This system uses specially designed stepladders that extend to hold a platform. It is used for the same kinds of jobs as the ladder jack, but it's self-supporting.

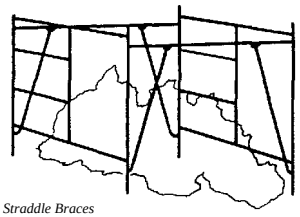
• *Pump jacks:* This is a popular form of scaffolding that uses spiked 2x4s, foot-operated

Within each type of scaffolding, different brands are not compatible. You can't interchange parts because fastening devices and accessories vary from brand to brand.


Tube & Coupler


A welded tubular-frame scaffold assembly, set up with putlogs (trusses) to bridge large obstructions in the ground.


Systems



Straddle Braces used to avoid obstruction

jacks, and planks. It often is used by masons and other workers who need to move up and down a wall surface at short intervals, and who load building materials onto the platform. It is suitable for work at low heights, but it must be braced or anchored to the building or it may buckle even as low as 20 feet. Safety features such as guardrails are often omitted, so only experienced workers should use pump jacks.

• *Power-operated lifts:* Scissor lifts, cherry pickers, hydraulic personnel lifts—these motor-driven lifting devices are designed for specific tasks such as working on electrical lines. They can be expensive to rent because you hire an operator along with the machinery, but their speed and flexibility make them ideal for some jobs.

Safety & Other Considerations

Welded-tube scaffolding, the most common and available type, is relatively simple to understand, assemble and work from safely. However, the system's modular form makes it inflexible when used around highly complex buildings (such as Queen Anne houses, with their projecting bays, oriel windows, turrets and balconies).

If your scaffolding has to reach around tricky projections, you may have to use the more versatile "systems" scaffolding.

Built-up scaffolding has to be erected much like a building: it needs a proper foundation, structural members must be straight and plumb, and the whole construction has to withstand loads and stresses. If it's poorly erected, it is extremely unsafe and may tip, move or buckle.

Unless you have a lot of experience working on scaffolding, consider all of the following to be "complications": scaffolding to higher than the second story; sloping ground; sunken or clay soil; and difficult setups such as over a porch or around a projecting bay.

Before plunging ahead, take into account these sobering thoughts:

• Working from safely erected scaffolding is *much* less dangerous than erecting and dismantling it.

• Mistakes or oversights aren't merely inconvenient or expensive; they can kill you.

• Each scaffolding setup is different. There are lots of considerations, and only experience can indicate when special adaptations, accessories, safety equipment, etc., are required.

• Within each type of scaffolding, different brands are not compatible. You can't interchange parts because fastening devices and accessories vary from brand to brand; as a result, we can't give you all the "how-to" here.

• When the scaffold reaches a height four times its minimum base dimension (20 feet if you're using standard five-foot-deep scaffolding), the scaffolding must be anchored to the building or braced to the ground. If you're going 40 or more feet up, the scaffold must be secured to the building again at the 40-foot level, and at 20-foot increments thereafter.

These numbers are just guidelines; refer to local codes or the Occupational Safety and Health Administration (OSHA) standards. Keep in mind that only experienced workers should work at heights above 20 or 25 feet.

When the scaffold reaches a height four times its minimum base dimension, the scaffolding must be anchored to the building or braced to the ground. If you're going 40 or more feet up, the scaffold must be secured to the building again at the 40-foot level, and at 20-foot increments thereafter.

Basic Components

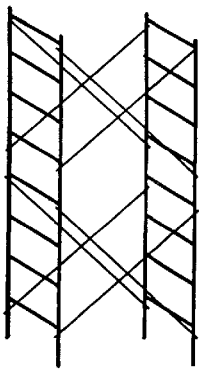
In welded tubular-frame scaffolding, which is modular, the length of a section is determined by the diagonal brace that spans between the two end frames.

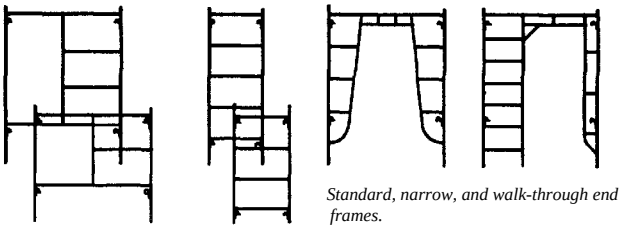
The frame sections can be tied together to make any *run* length. A greater run means more scaffolding—but don't fall into the trap of not erecting enough. You'll waste time and money moving the scaffold from place to place. Every time a scaffold is moved, it has to be largely disassembled.

Narrower sections are stronger, so they are used for heavier loads such as bricks. Section lengths of about eight feet are for medium-duty loads such as lumber. Ten-foot spacing is light duty—for jobs that don't require significant loading beyond the weight of the workers.

Metal frames come in varying heights to allow fine-tuning the height of the "towers." Taller frames usually are used at the bottom of the tower (they're easier to walk under); shorter ones usually at the top. (The opposite is true if the terrain is extreme in slope.)

Generally, it's better to build a scaffold a little short than a little tall: stretching is less tiring than stooping—stretching *up*, that is; stretching *out* is dangerous.



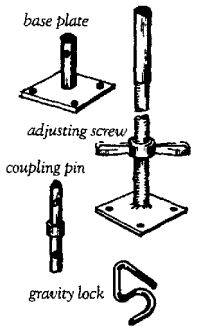


Standard, narrow, and walk-through end frames.

Some newer scaffolding frames have an integral ladder—convenient, but hard to climb because it's plumb vertical. An access ladder tied to the scaffolding is a better way to go—and it's easier and safer to climb than the widely spaced rungs of the scaffold itself.

Parts & Accessories

Each time you set up scaffolding on a job, inspect all the components carefully. Make sure all locking devices work properly. Inspect the welds for failure. Reject badly rusted or bent metal parts. Also reject planks with warps, splits or unsound knots.



Wooden mudsills are used to support scaffolding on soft ground. The scaffold legs should have base plates, which must be securely fastened to the sills. *Do not* use swivel bases to correct major out-of-level conditions.

Although many codes do not require the use of uplift (locking) pins to lock the frames together vertically, they are *not* optional. They must always be used.

And don't erect support "sandwiches" of concrete block, boards and shims.

Each leg also has an adjustable screw jack, which is used to keep the whole scaffold plumb and level. After each tier of scaffolding is assembled, check the assembly for plumb (in both directions) and level, and correct discrepancies before moving on to the next tier. Out-of-plumb or out-of-level scaffolding is subject to uneven loading and instability, and the higher the scaffold, the more dangerous this is.

Although many codes do not require the use of uplift (locking) pins to lock the frames together vertically, *they are not optional. Always use uplift pins.* You never know when or why you might have an unexpected need for protection against uplift—uneven loading on the platform and wind are but two of the more obvious reasons.

Guardrails, mid-rails, toe boards, screening, and all other safety features required by local codes or useful on your job must be installed on *every* work platform. They are *not* optional.

Some setups require additional parts. Side or end brackets (called "bicycles") extend the work platforms (and novices shouldn't work on extended scaffolding more than 10 feet high). Hoists safely lift materials to the platform, but working with a hoist from heights is tricky and requires experience. Bridges (called "putlogs") are used for reaching over obstructions or projections.

Be sure each working platform is fully "floored" without gaps in the planking. If you need to work at several levels simultaneously, cross-bracing can get in the way. In these cases, use straddle braces.

A word of caution about planking: It's not as easy as it used to be to get good scaffolding planks. According to the Scaffold Industry Association Newsletter, "Lumber-grading authorities project a declining supply of lumber...for scaffold-grade planks. This means (you) must be more vigilant in culling out bad planks."

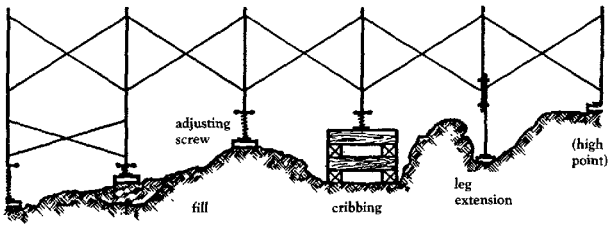
We recommend the use of prefabricated flooring made especially for scaffolding. There are many types—some wood, some metal, some combinations of the two—and all of them have locking devices that fasten securely to the scaffolding frames. Prefabricated flooring systems are generally stronger, lighter and easier to walk on than plain wood planks. Use flooring made by the same manufacturer as the scaffolding.

If you can't get prefabricated flooring, be sure your scaffold is floored with only scaffold-grade planks that are lapped and secured to the scaffold with No. 9 wire. (See OSHA specs.)

Anchoring to an Old Building

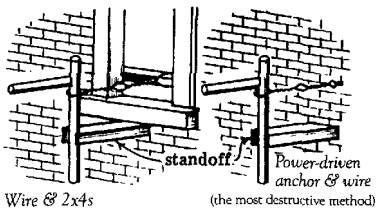
Some common anchoring methods are

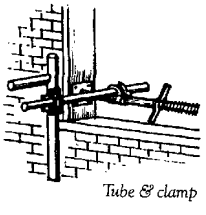
Ways to Level Scaffolding

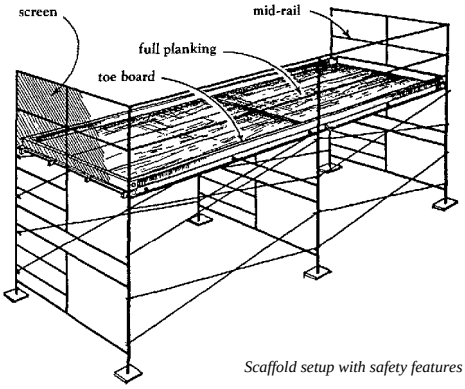


Illustrations by Larry Jones

Anchoring Techniques







Scaffold setup with safety features in place.

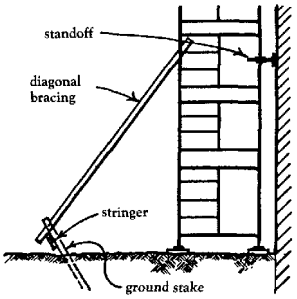
hard on old buildings, and some are downright destructive.

The easiest and least destructive way to tie scaffolding to a house is through window openings, with the tube-and-clamp technique or with wire and 2x4s. But the house may not have enough conveniently located windows to allow enough anchor points.

If you're working on a frame house, the crew can drill through the siding and anchor the scaffolding to wooden framing members with screw eyes. Later, holes can be filled with dowels (glued in place with waterproof glue) and painted.

If it's a brick or stone house, however, it's difficult to make invisible patches in the bricks or stones. So drill holes in the mortar joints and install stainless-steel sinkers to be used as anchor points. When the job is over, point over the sinkers with matching mortar. (Beware that soft lime mortar may not adequately hold anchors.)

If you're dealing with a stucco house



Using stakes and stringers to brace the scaffold.

(where installing sinkers would cause chunks of stucco to fall off) or a museum house (where even minimal damage is taboo), you won't be able to anchor scaffolding to the house at all. In such cases, the scaffold can be braced.

The surest way to brace is to sink multiple stakes into the ground, tying them together with wood stringers and anchoring the scaffold to the stringers.

Since you can't build scaffolding more than four times as high as it is wide without anchoring it, and since you can't anchor the scaffolding to the building in this case, your only choice is to make the base "wider" by using diagonal braces.

The surest way to brace is to sink multiple stakes into the ground, tying them together with wood stringers and anchoring the scaffold to the stringers.

If the scaffold is secured using any of these slightly unusual methods, pay very close attention to the condition of the anchoring system as the job progresses.

A Daily Checklist

Once the scaffolding is erected and the work is under way, don't assume you no longer need to check your system for safety. Every day, check the following things before you climb:

- The sill under each scaffolding leg must be in place and level. Washouts from overnight rain or overloading can make sills unstable.
- All base plates and adjustment screws must be in firm contact with their supports, and the whole assembly must be snug.
- Frames must be plumb in both directions.
- If there is a gap between the lower end of one frame and the upper end of another, adjust the leveling feet to bring the frames in contact. If that doesn't cure the misalignment, the frame is out of square and should be replaced.
- All cross-braces frame-to-frame along the run must be secure.
- All locking devices must be secure, including clamps or wire ties for planks.
- All ties between the scaffolding and the building (or all angle braces between the scaffolding and the ground) must be secure.
- Safety equipment, such as guardrails, mid-rails and toe boards, must be in place.
- Access ladders must be securely fastened to the scaffolding frames. Check out the locking devices before you climb.

Working Safely from a Scaffold

Climb only on the integral ladder or securely fastened access ladders. Don't climb on the braces; they are not designed to bear a person's weight. (Besides, it's easy to fall off them.) And don't hang outside the scaffolding frames.

Wear a hard hat—not just to protect you from falling objects, but even more to keep you from bumping your head on the unfamiliar protrusions of a scaffold.

Pay special attention to housekeeping on the work platform. Accidents happen when people slip or stumble. Common offenders are tools laid on the scaffolding floor, spills and electrical cords. Keep the platforms clear at all times. At the end of each day, clear debris away from the scaffold base.

Wear a hard hat—not just to protect you from falling objects, but even more to keep you from bumping your head on the unfamiliar protrusions of a scaffold.

Have a workbench on the platform to keep tools off the floor. Tools belong on the bench, in your hands or in your tool apron. If you spill something, wipe it up immediately and cover the residue with a nonslip surface if need be. Keep electrical cords out of the way by duct-taping them to the mid-rails or, if absolutely necessary, to the flooring.

Don't use the scaffolding in wet or icy conditions. Rain, dew and ice make ladders and planks slippery. Wear nonskid shoes or boots at *all* times.

Never set planks, ladders or any kind of extension on the guardrails to use them for greater reach. This is just plain stupid.

Burglars may be delighted by the easy access you've provided. And don't forget that a metal scaffold looks like a big jungle gym to kids. Make the scaffold less attractive by removing lower floor planks at the end of the day. ■

Manufacturer Offers Computerized Cost Analysis of Scaffolding Systems

If you're shopping around for the best price on scaffolding, you may want to get in touch with Access Engineering Inc. of Charlotte, N.C. The company has developed a computerized, regionalized cost comparison of conventional scaffolding systems against its own "Satellite Elevated Work Platform," and it offers the service free of charge to qualified contractors.

Based on actual job-site conditions at various projects throughout the U.S., the "Savecost" cost-comparison analysis is "designed to assist contractors in the bidding process on a particular job," according to company president Geoff Raine.

Of course, the free service also gives the company an opportunity to inform contractors about the company's own product, which it says "eliminates all the frames, braces and brackets along with the associated bulk, cost and assembly time." The Access Satellite system, capable of lifting 8,360 pounds of workers and materials at a rate of 24 feet per minute, is suitable for jobs from three stories to 328 feet off the ground.

For more information on the cost comparison, the Satellite system itself or a distributor in your area, contact Access Engineering, 5301 Nations Ford Rd., Charlotte, N.C. 28210; phone 800/438-3656. ■

Resources

For more information on scaffolding dos and don'ts, here are some places to go:

- *Scaffold Industry Association*
  14039 Sherman Way
  Van Nuys, Calif. 91405
  818/782-2012
  Publications: *Membership Directory & Handbook*, $55 (includes just about everything on scaffolding, including standards, definitions, illustrations, OSHA standards, etc). For $85, you can join the association and receive the SIA newsletter.

- *Scaffolding, Shoring & Forming Institute*
  1230 Keith Building
  Cleveland, Ohio 44115
  216/241-7333
  Publications: *Guide to Scaffolding Erection & Dismantling Procedures* (S 101), 50 cents; *Recommended Steel-Frame Shoring Erection Procedure* (SH 304), 50 cents; *Scaffolding Safety Rules* (S 100), 25 cents; *Steel-Frame Shoring Safety Rules* (SH 300), 25 cents. Slide shows also available; free publications brochure.

- *Waco International, Inc.*
  7575 Dillon St.
  Houston, Tex. 77061
  713/641-6558
  Publication: *A Guide to Waco Scaffolding*, $1 (an excellent 23-page booklet that describes this firm's equipment but applies to others as well). ■