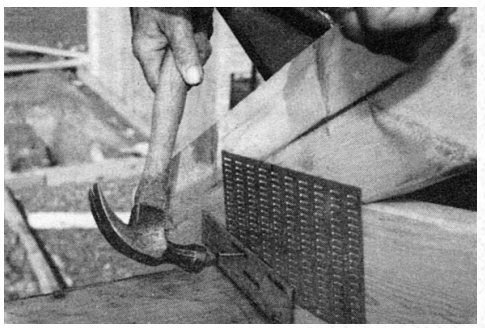
NEW MEMBERS, NEW CONNECTORS

A guide to the new generation of hangers and anchors designed for trusses, LVL, and wood I-beams

by William Loeffler



Up on the top plate, a worker sets a scissors truss into a specially designed anchor. The anchor (inset) prevents uplift while allowing the truss to slide back and forth as it deflects.

The days are waning when a crew setting roof trusses sent a young, agile member skyward to walk the plate and toe-nail them on the layout. Plated trusses, wood-web I-beams, and other manufactured structural members have become sophisticated components capable of generating tremendous forces at bearing points and demanding creative solutions where they intersect. All of this puts a real emphasis on the connecting hardware - and your familiarity with the new generation of hangers and anchors designed for these members.

Why Not Just Toenail 'Em?

Builders have worked with trusses for years without metal hardware, so why the emphasis on connectors now? Especially with roof systems, where computers are making truss design more and more complex, metal hardware provides an inherently stronger connection that doesn't rely as heavily on the installer as does toenailing. I have a lot of respect for the care used by most builders, but structural hardware provides greater strength with less demand for judgment and precision. I'm not being critical about the amount of care and skill used by most builders, but when you look at the numbers, it just isn't worth taking the risk.

Here is what I mean. A perfectly executed toe-nail is driven at an angle of 30 degrees to the face of the wood, at one-third the nail's length from the end of the member. Under ideal conditions, the nail has five-sixths its normal lateral load value: 78 pounds for a 10d common nail. This same nail installed in a steel hanger has 118 pounds of lateral strength - a 50 percent increase.

The Right Stuff

In come parts of the country, truss fabricators are supplying hangers with each job, or at least marking plans with part numbers. Wood I-beam and LVL (laminated veneer lumber) suppliers commonly stock the popular hangers and can order specials. But in many cases, you're still on your own.

The temptation is to grab something off the shelf at the lumberyard. That works fine for joists - a 2x joist hanger can generally carry all the load the joist can carry.

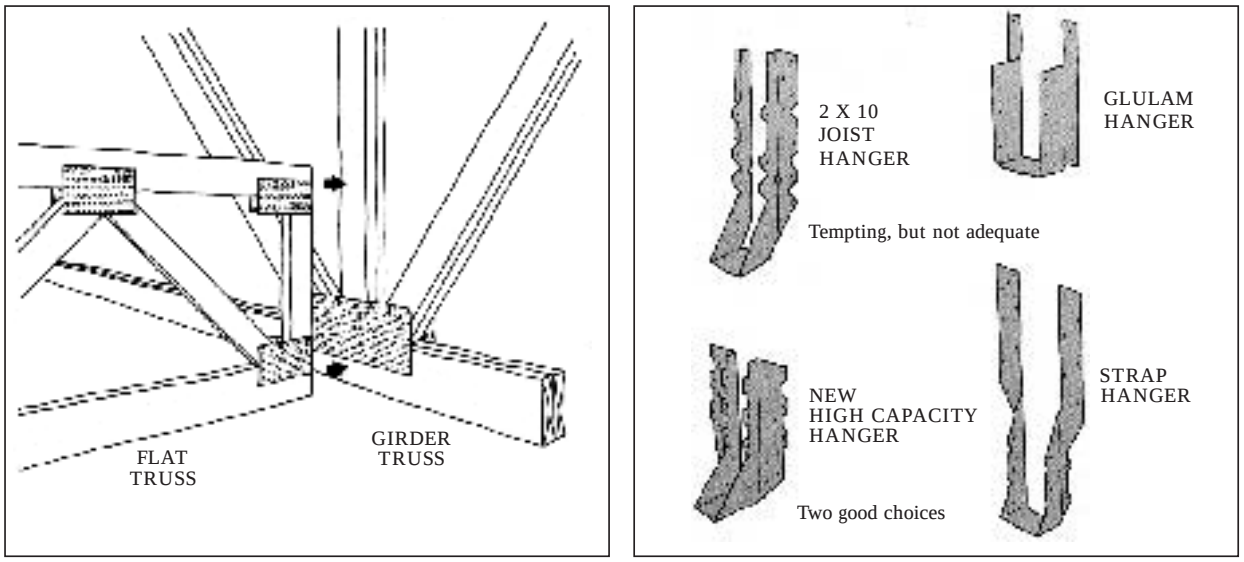


Figure 1. *Choosing a hanger for engineered members can be tricky. For example, in hanging a single truss from the center of a girder truss (left), neither a 2x10 hanger nor the glulam hanger shown at right will work, even though they are rated to carry the 1,200-pound load. The reason: The bottom chord and vertical web of the girder truss doesn't provide the right nailing.*

But plated trusses, wood-web I-beams and LVL are wolves in sheeps' clothing - the strength engineered into them far exceeds what you're used to for the dimensions involved. (And even the dimensions are different from nominal lumber when it comes to smaller wood I-beams and LVL.)

This means you have to pay attention to the loads these members will have to satisfy and their connection points. Here's an example.

Let's say you need to hang a truss with an end reaction (load) of 1,200 pounds from a girder truss (typically two or more trusses ganged together) whose bottom chord is a 2x6. A 2x6 joist hanger off the lumberyard shelf can only handle about 700 pounds - well short of capacity. How about a 2x10 joist hanger? This can carry 1,200 pounds and could be nailed to the vertical web on the girder truss (see Figure 1).

The 2x10 joist hanger is also a bad choice however, because at least two of the hanger nails would have no support value. Here's why. When nails are loaded parallel to the grain as would be in the case of nailing to a web, the nails have to be spaced 15 to 20 times their diameter from the end of the member and from each other. That means a 10d nail would have to be at least 2 1/4 inches from the web end.

Two hangers that would work well are a 2x6 hanger that has a double row of nails in each flange (giving it a capacity well beyond the 1,200 pound requirement), or a strap hanger that would provide nailing further up the web.

Another tempting, but mistaken, application is the use of glulam hardware to hang one truss from another. Glulam hangers will meet the load requirements, but they generally use 20d or 40d nails on close centers. This is no problem for a meaty glulam, but you're likely to split the 2x bottom chord or webs of a truss with this nailing schedule.

Ordering Connectors

Most major manufacturers of metal connectors (see "Sources of Supply" below) print separate catalogues that feature hardware for engineered wood products. It makes sense to pick one up and get familiar with what's available. If you're having trouble figuring out your needs, call one of the manufacturers listed in the sidebar for advice.

When it comes to ordering for special situations, be specific. Here's what a hanger salesman will need:

- end reaction requirements
- uplift requirements, if any
- a description of the member
- a description of the header

The header (used to denote whatever the hanger attaches to) description is particularly important in the case of trusses hanging on trusses. the size and number of webs at the panel point (intersection of webs) of the girder truss determines the style of hanger that will work.

The type of wood in the header member should be mentioned, too. Most hanger load ratings are based on nails or bolts into southern yellow pine or Douglas fir. The hanger rating must be reduced to 80 percent if spruce-pine-fir is used. On the other hand, header material like LVL or glulam beams can accept heavier shank nails with less chance of splitting.

Also consider the depth of your header member and the carried member. Describing both members is the only way to be certain your hardware will work.

Hangers For All Seasons

Manufacturers have developed a wide range of hangers and anchors to handle the special needs of engineered wood products. Some of the more common applications and hardware solutions are described below.

Floor trusses. Strap hangers up to 22 inches long are the most popular connectors for floor trusses. The 16-gauge steel straps are formed in the field over the top of the carrying member and give these hangers a rating of about 2000 pounds. Strap hangers for floor trusses cost about $3.00 apiece when bought in volume.

Be ware of strap hangers touting 3000 to 4000 pound loads because they may require a 22-inch high solid header to obtain the nailing required.

Topmount hangers (see Figure 2) cost a bit less, but because the straps that lip over the header are factory-formed, you have to order different hangers for trusses of different depths.

Floor openings framed with nominal lumber are often two-ply (3 inches wide), which means you can use either a two-ply hanger or a 3 1/2 inch hanger with a 1/2 inch shim.

Wood I-beam joists. The first caution is that wood I-beams in small residential sizes won't fit a 2x (1 1/2 inch) hanger. Depending on the beam manufacturer you're using, you'll need widths of 1.6 or 1.75 (1 1/4) inches.

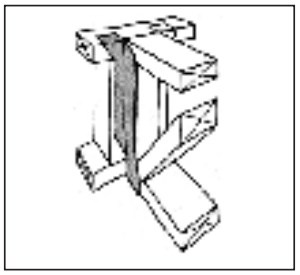


Figure 2. *Topmount hanger.*

The most popular I-beam hangers by far are topmount hangers. they install quickly because the top flanges set the depth and provide hanger beating, cutting down on the number of nails to be driven. The joist flanges extend high enough to trap the top chord of the I-beam from rotating, and eliminate the need to add web fillers. Topmount hangers for 10-inch and 12-inch I-beams run about $1.50 each.

Facemount hangers (se Figure 3) cost a little less than topmount hangers, but are a bit more labor intensive to set at the correct height. They work well if the header extends above the I-beam, and two-ply I-beams work nicely with facemounts because they fit standard 4x (3 1/2 inch) hangers. In all cases, if the side flanges do not reach the top chord, you'll need to add web fillers to

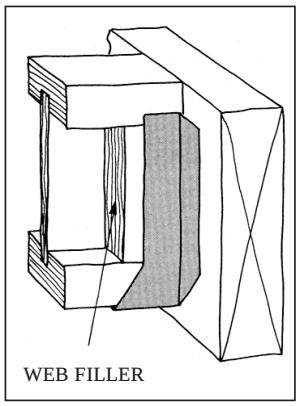


Figure 3. *Facemount hanger.*

Sources of Supply

Cleveland Steel Specialty Co.
14430 South Industrial Avenue
Cleveland, OH 44137
800/251-8351; 800/686-8351
(in Ohio)

Lumberlok
1029 Whipple Road
Hayward, CA 94544
800/221-7905; 800/221-7906
(in California)

Simpson Strong-Tie Co., Inc.
1450 Doolittle Drive
San Leandro, CA 94577
415/562-7775

Teco Products Co.
12401 Middlebrook Road
Germantown, MD 20874
800/438-8326

United Steel Products Co.
703 Rogers Drive
Montgomery, MN 56069
800/328-5934; 800/642-4762
(in Minnesota)

prevent rotation.

Facemount hangers also have an advantage over topmounts in situations where there are uplift requirements of over 200 pounds because they rely on nails driven into the face of the header. Web fillers would be needed, though, to accept the extra joist flange nails.

Dealing with masonry construction. If you have used some of the new masonry hangers, you'll be amazed at how easily they're installed and at the cost savings available on townhouse construction with masonry firewalls.

Saddle-style hangers (see Figure 4) straddle a wall and are merely placed on centers by the masonry crew. end walls require a hookover style, which is essentially half of a saddle-style hanger. The hangers can be made to carry floor and roof trusses, or wood I-beams.

Top-chord-bearing truss hangers (see Figure 5) are also available in both saddle and hookover styles. Some planning is required since two to three week delivery is common for most masonry hangers.

Laminated veneer lumber. LVL is so strong it presents a challenge in selecting the right hanger. The key is the end reaction number for your LVL beam. An 18-gauge stamped hanger made for wood I-beams will bow, sag, and could fail under LVL load conditions. With a lot of LVL being doubled up (two-ply) for headers and beams, matching the capacity of the hanger to the beam becomes even more critical.

Facemount hangers can carry 2000 to 3000 pounds depending upon their size and nailing schedule. Twelve-gauge topmount hangers with a deep seat bearing surface (see Figure 6) can handle 3000 to 5000 pound loads. For heavy two-ply loads, or three-ply loads and ledger plate applications, a welded hanger (the masonry hanger in Figure 4 uses a welded seat) is necessary.

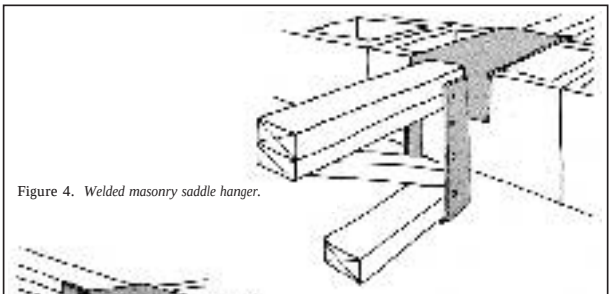


Figure 4. *Welded masonry saddle hanger.*

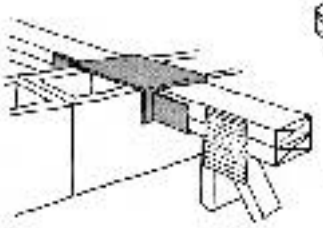


Figure 5. *Top-chord-bearing hanger.*

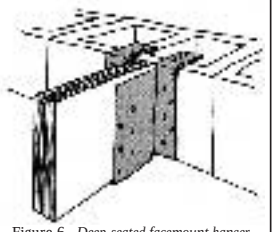


Figure 6. *Deep-seated facemount hanger.*

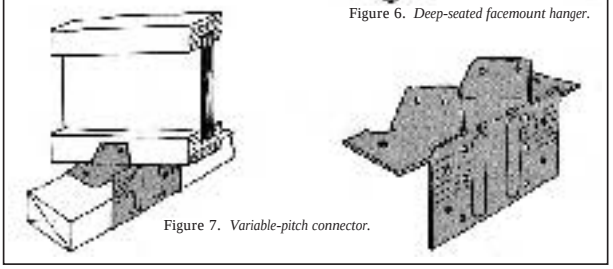


Figure 7. *Variable-pitch connector.*

Wood I-beams as roof rafters. This application of I-beams has special hardware requirements. At the bottom end of a sloping rafter, variable pitch connectors (see Figure 7) provide bearing and anchorage to the wall; the pitch is determined by the elevation at which the connector is nailed to the plate.

At the ridge, consider a light-sloped U connector (see Figure 8). At about $3.00, they are less expensive than pitched seat hangers and can be adjusted to the slope on the job site; some can be site-adjusted for skew as well, if that is needed.

Most of the connectors require a web filler with wood I-beams, and you may also need cross-bridging to prevent rotation. Metal bridging is available in longer lengths like 30 inches, 36 inches, 42 inches and 56 inches for this application.

Roof trusses. Hanger manufacturers are literally unveiling new alternatives each month, and it's now possible to purchase plated truss hangers with 10,000 pound capacities from stock.

At the low end, a 16-gauge, facemount hanger can handle less than 1000 pound reactions but do it for less than a dollar.

DEALING WITH METAL CONNECTORS ON SITE

by Jack Stuart

When a job calls for nothing more complicated than joist hangers, a builder can have a couple of boxes thrown on the truck with his lumber order and not give the whole thing too much more thought. But heavier connectors – which cost more and are a lot harder to get – require careful planning to ensure that they end up at the right place at the right time.

So if you have large interest in seeing the job run smoothly and economically, it is imperative that you have a hand in the take off, ordering, and supervision of installation. Here is the take-off system I use and some thoughts on the management and installation of different kinds of connectors.

Take offs. The key is producing a master print and take-off list that can be distributed to the related trades and suppliers. Then if changes have to be made, an amended plan and list can be sent out so that everyone is working with the same specs.

I assign each connector a four-part identifying number that gives me the location on the plan, a description of the connector (the manufacturer's or engineer's designation), which one in a series of like connectors it is, and any special context in which it will be installed (corner assembly, door trimmer, etc).

If there are special conditions or manufacturer's specifications that are often ignored by installers, take the time when you're doing the take off to draw a detail of how things should be handled. These drawings are vital when two or more trades are involved.

Light wood-to-wood connections. These 12- to 20-gauge, stamped-steel connectors – joist haners, post bases and caps, framing anchors, wall braces, and straps – are pretty straightforward, but you still need to make sure that they are installed with the right number and kind of fasteners. It is not uncommon for a sharp inspector to check the nailing, because if this condition isn't met, the hardware can't handle the load for which it was engineered.

Heavier wood-to-wood connections. These stamped or welded connectors for posts, beams, and trusses are commonly used in light industrial and commercial buildings that have large open areas. Because of the many different configurations available and their size and cost, most suppliers don't carry them in inventory. This means a careful take off to ensure that you'll have what you need when you start setting beams, because much of this hardware has a top flange that means you can't go back later to install it.

These connectors are usually detailed on the structural plans and care must be taken to get the right connector with the right nails or bolts in the right spot. As a superintendent on commercial jobs I always tried to get the engineer to do a walk-through at some point after the framing was up (but still exposed) to take a look at all the heavy connections. In my experience, they have always been happy to do it even though it wasn't always required.

Wood-to-concrete connections. These connections – embedded beam seats, post bases, holdowns, etc. – are critical because the tolerances for error are a lot tighter and mistakes are a lot costlier to fix.

Although some people advocate "wetsticking" – embedding the hardware as the concrete is being screeded – I've learned the hard way that is worth taking the time to fasten all embedded hardware to templates. This braces them securely before the pour.

It helps to have a concrete subcontractor with an appreciation of what these framing connectors do. The sub needs to know how to install them so that the next trade can deal with them properly. I've had problems in the past because I didn't check with the concrete guy to make sure he knew what the connectors were and how to install them properly. Sometimes it works better if you hire someone other than the foundation sub for this job.

However, even when the foundation sub is well informed, someone needs to check his layout (location, alignment, and elevation) before the concrete is placed. Depending on the job size, this could be the owners' representative, the superintendent or a surveyor hired for the purpose. I also typically invite the engineer to take a look, and have found it advantageous, when possible, to have the framer check things out. All of this takes time and careful coordination, but it's worth the effort.

Steel-to-concrete or steel. These connections involve a weld plate or bolts that are used to mount beams and columns (fabricators typically supply templates for column base plates). Embedding these kinds of connectors requires the same precautions described above, but there are several things to be aware of when it comes to welding.

On-site welding usually must be done by a certified welder, and there is usually a torquing requirement on a bolted, steel-to-steel connection. An independent inspector is sometimes required on a bolted, steel-to-steel connection. An independent inspector is sometimes required on site while the welding is going on. It gets expensive to have this inspector on site. It helps to schedule the welding or bolting for a specific time frame.

Some thoughts on bolts. Most of the heavier connectors require either bolts, or lengths of threaded rod, and washers and nuts. Take care to double-check the various lengths and sizes for each connector. Although the company that supplies your connectors will typically carry bolts, you can often save a buck on large orders if you shop around.

Bolts have a tendency to get scattered and lost unless they are in someone's charge. And because it's easy to mistake bolts of similar size and length, particular care should be taken during installation to make sure that the right bolts are getting used in the right places. Although some bolts can be added later, it's often more difficult and less efficient, or in the case of a column-to-beam connection, just plain dangerous. ■

Jack Stuart has been a superintendent of medium-sized medical office buildings for ten years, and is based in Bedminster, N.J.

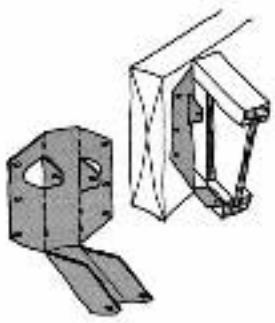


Figure 8. *Light-sloped U connector.*

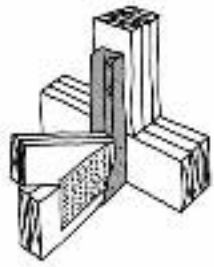


Figure 9. *Bolt-on hanger.*

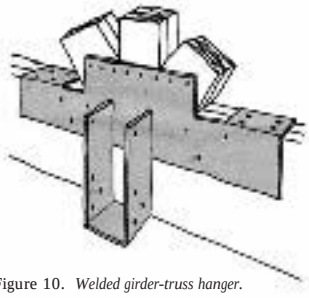


Figure 10. *Welded girder-truss hanger.*

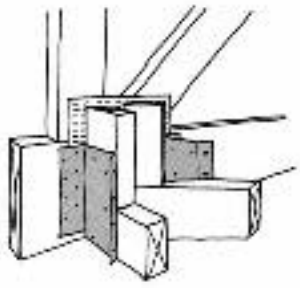


Figure 11. *Facemount hip and jack hanger.*

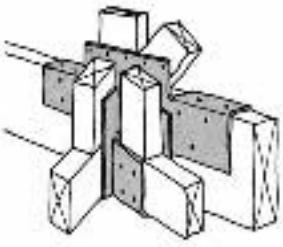


Figure 12. *Welded hip and jack hanger.*

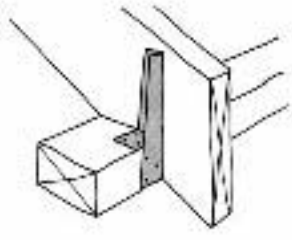


Figure 13. *Truss to single top plate anchor.*

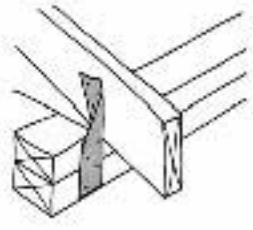


Figure 14. *Truss to double top plate anchor.*

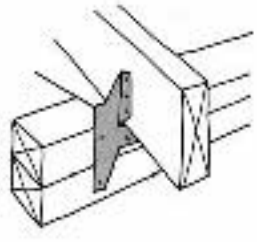


Figure 15. *Straddle-type truss anchor.*

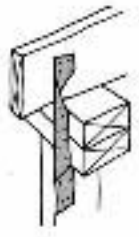


Figure 16. *Extended truss anchor.*

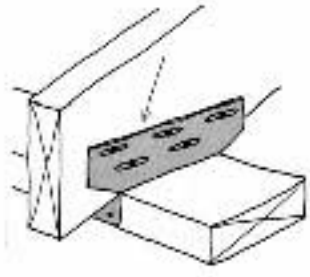


Figure 17. *Scissors-truss connector.*

Newer style facemount hangers with wide flanges of 14-gauge steel that take several rows of nails per flange will get you to the 2,000 pound reaction level at a cost of $3.00. Often a strap hanger at $2.00 can handle about the same capacity.

Above this range, you'll be choosing between a bolt-on girder hanger (see Figure 9) or a welded style with top flanges that straddle the webs. the bolt-on hanger can cover 3,000 to 10,000 pounds depending upon the number of bolts. Expect to pay from $30 to $90 each for these. Be aware of the size of the web required if the bolting face has a double row of bolts.

Welded-style top-flange truss hangers (see figure 10) range in capacity from 3,000 to 5,000 pounds and in price from $15 to $30. The lower the price, the less metal in the hanger and the more restricted you are in application. For instance, some welded hangers with top flanges can only straddle a 2x4 vertical web. A larger web or any diagonal webs precludes its use.

For angled connections, there are several alternatives beginning with the adjustable connectors mentioned under wood I-beam rafters. Most manufacturers also stock a single-ply 45-degree skewed connector, but all other angles and slopes will require special ordering and couple of weeks lead time.

Hips and jacks. A step-down hip roof system with a corner or hip truss hanging from a girder truss is a good hanger candidate. This is one of the connections a building inspector is likely to look at first.

Again, the choice of connector depends on the numbers, and the longer the hip member the greater the end reaction. But one hanger can take care of both the hip and the end jack, since they hang at the same panel point. Some hangers have individual seats for hip and jack, while others have a common pocket that eliminates the need for left and right hangers. Some styles depend on bolting while others lip over the bottom chord of the girder truss.

For short setbacks of 7 inches to 11 feet, a 2,000 pound facemount hip and jack hanger (Figure 11) will run about $10.00.

For end reactions up to 3,300 pounds with single-ply hips and 5,500 pounds with double-ply hips, a heavy-duty hip and jack hanger (Figure 12) that lips over the bottom chord of the girder truss at $40.00 to $50.00 works best.

King-sized skewed hangers that bolt on to webs can handle three-ply hips at 7,500 pounds at a price tag of $100.00 each. They are similar to bolt-on girder hangers as in Figure 9, only their seats are skewed.

Truss anchors. Many builders, particularly on the coasts, are in the habit of anchoring roof trusses to their bearing plates with hardware, and there is a growing demand among building inspectors for these connectors.

Anchors that attach to single plates (Figure 13) and double plates (Figure 14) only cost about $.20 each. Their uplift rating depends upon the number of nails into the plate and into the truss. Generally, three nails is worth a little over 300 pounds and four nails about 400 pounds, but check the manufacturer's rating since the numbers vary widely.

For uplift requirements of 500 pounds, look for a five-nail anchor with a pair of flanges that straddle the truss (Figure 15). At $.30 each, they beat using a pair of the garden variety anchors.

Extended-truss anchors (see Figure 16) tie the truss to a stud. They also have a 300- to 400-pound rating, except they transfer the uplift force directly to the stud and bypass the plate.

Anchoring a scissors truss firmly to a wall may cause the wall to buckle because, by their nature, scissors trusses deflect under load conditions. They push outward and then return when the load is decreased. A scissors-truss connector (see Figure 17 and lead photo) can help reduce the possibility of wall buckle. This connector has slotted holes that permit the truss to move outward as it deflects while still counteracting uplift forces.

The base of the connector reduced the friction between truss and plate which, in turn, reduces the lateral force a wall must exert before static friction is overcome and the truss slides. Available for 4-inch, 6-inch, and 8-inch nominal plates, these scissors-truss connectors cost about $1.50 on the average. ■

Bill Loeffler has been the manager for 20 years at Cleveland Steel Specialty Co., which has manufacturer hangers for 65 years. He is responsible for engineering, testing, tooling, and drawing up new products and special applications.