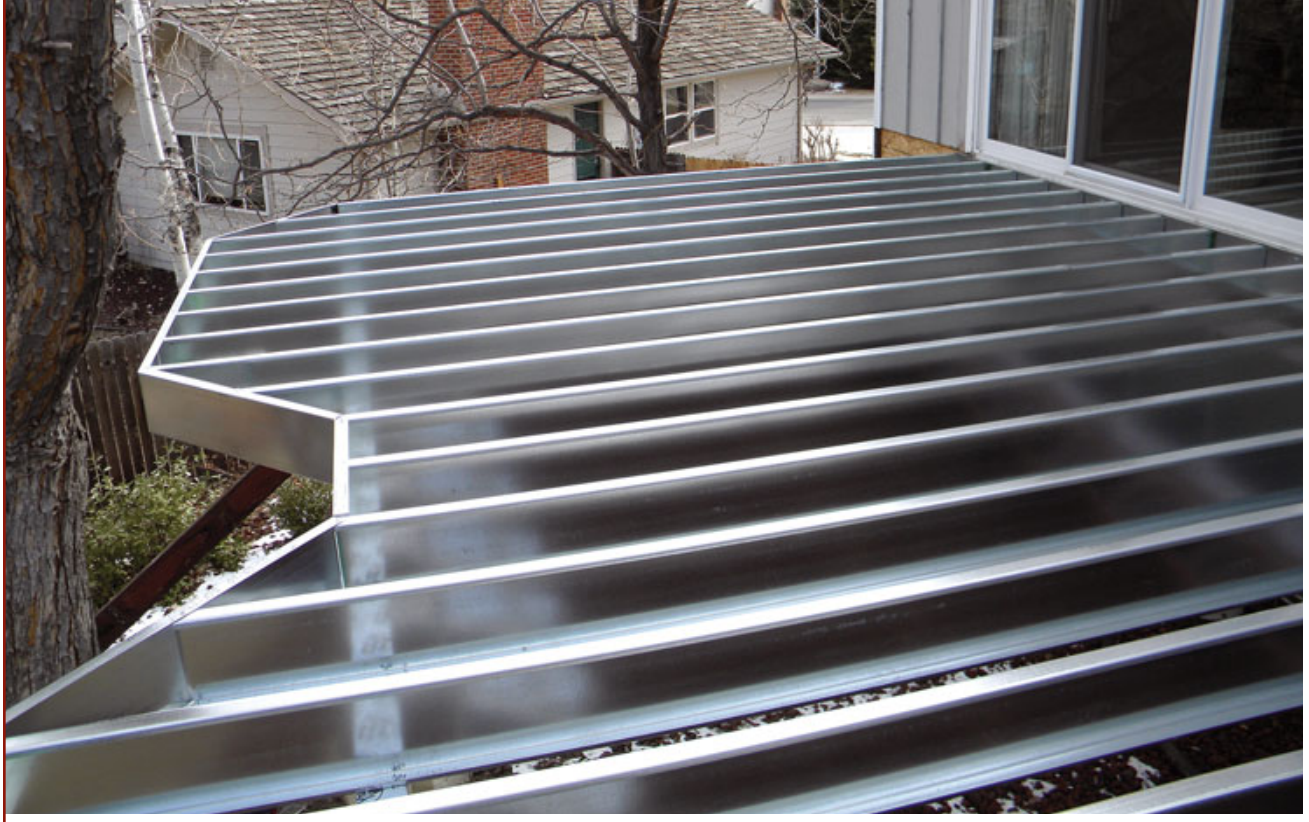

# Building With Steel Joists

## Straight, light, and cost competitive — should you consider steel?

by Robert Shaw

Synthetic decking products such as Fiberon, TimberTech, and Azek have come a long way in recent years. In general, though, I don't think the quality of framing materials has kept up, and it seems silly to put decking with a 20-year (or longer) warranty onto a wood frame that I doubt will last that long. Because of this, I've begun building decks using cold-rolled light-gauge (LG) galvanized steel joists that allow me to offer customers a frame that will last as long as the decking I put on it.

### Getting the Permit

Before jumping on the steel bandwagon, call your local building department and find out its requirements for steel-framed decks. The IRC covers steel joists extensively, and it's a good starting point for speccing steel joists. However, it does not discuss using steel in an outdoor application, which may be why my building department requires an engineer's stamp for steel-framed decks. That sets me back $400 to $600 per project, but having the stamp is reassuring for me and helps customers accept what in their mind is an unconventional system. If your building department also requires an engineer, look for one with commercial construction experience — he or she will be familiar with steel framing and should understand the concept of using it for a deck.

One objection that crops up with steel joists is their shiny look — it's just not what people expect to see. Most customers end up being fine with it, particularly when I show them photos of steel decks with a nice fascia (**Figure 1, next page**). Screw through the outer joists into the fascia from behind and even the fasteners become invisible. It is also possible to order the steel powder-coated, for looks and additional protection.

### Steel Joist Basics

LG steel framing comes in numerous depths (analogous to 2x4, 2x6, 2x8, and so on), gauges (the thickness of the metal), and flange sizes (the width of the top of the joist, like lumber's 2-by dimension). All play a role in determining the capacity of the joist; the size joist you must use will depend

Figure 1. Once wrapped in finish material, lightweight steel-framed decks look pretty much like any other deck.

on the loading requirements in your local code. Steel suppliers such as Cemco (cemcosteel.com) provide span charts to aid in specifying joist size.

Typically, LG steel comes as joists (or studs) and track. If you've ever built a steel stud wall, you're probably familiar with the difference. Track is sized so that the studs or joists fit inside it. For walls, track is used for the plates; for deck framing, it's used as the ledger and the rim joist.

Joists come either unpunched or pre-punched for running utilities inside a house. For decks, unpunched joists make for a cleaner project.

I make most attachments using #10-16 by 3/4-inch galvanized screws; welding is not typically a part of LG framing. I use Simpson Strong-Tie L and LS reinforcing angles (800/999-5099, strongtie.com) as "hangers" to attach joists to the track ledger and any flush beams (**Figure 2**). Simpson H2.5 hurricane ties can be used to attach joists to a dropped beam.

Most lumberyards don't stock steel framing members. Around here, drywall supply houses handle LG steel studs and track. Drywall suppliers might not have the sizes you need in stock, but they're used to dealing with steel wholesalers. Be sure what you buy has the same depth and gauge as on the plans.

You might be surprised at the cost — I pay only a little more per lineal foot than I do for wood joists with similar span capabilities, and I can order exact lengths so, for example, I don't waste 1 foot to 3 feet of material for each joist on a 13-foot deck. Ordering to length can also limit the number of cuts required for a project and save some time. Plus whatever scrap is generated on site is completely recyclable — in fact, you may be able to get a few bucks for it at a scrap yard.

Steel joists have other advantages over wood. They weigh roughly half what an equivalent wood joist does, making them a lot easier to maneuver. And you don't have to cull through or crown joist material — steel joists are flat and consistently dimensioned.

Depending upon the manufacturer, you will see different levels of recycled content.

Steel joists come in various thicknesses of galvanization. G90 is the

Figure 2. Standard framing hardware and galvanized sheet-metal screws join the members.

## For More Information

**Steel Stud Manufacturers Association**
Engineering information, list of manufacturers
***ssma.com***

**Cemco**
Supplier, span tables
***cemcosteel.com***

**The Steel Network**
Supplier, free steel-deck software
***steelnetwork.com***

Figure 3. Use a locking C-clamp to position steel members and predrill for screws.

Figure 4. Full face and hearing protection and a special blade for ferrous metals are needed to cut steel joists.

Figure 5. Attach the steel ledger to the house as you would a wood one, with 1/2-inch lag bolts and standard flashing details.

minimum I use in Colorado; you may need to specify a higher level in wetter environments.

The material is fairly flexible, and if it gets creased in handling it should not be used. I always order an extra joist or two to be safe, though damage is rare; when it does occur, it's usually from mishandling by the supplier. Pieces over 20 feet long should be handled by two people to prevent bending and creasing. Hand unloading from the delivery truck is also advised if a fork truck is not provided.

### Putting It Together

Steel framing tends to take more time to assemble than wood framing, primarily since instead of using pneumatic nailers, you use drills and impact drivers. It takes quite a bit longer to drive eight #10-16 by 3/4-inch self-tapping screws into an LS70 than to nail up a joist and hanger with a nail gun. Clamping the LS clips in place with Vise-Grip C-clamps makes the job go a little quicker (**Figure 3**).

I cut the steel with a standard circular saw and a special blade designed for cutting LG steel. Freud Diablo blades (800/334-4107, freudtools.com) perform well and cost roughly $40. They last one to two projects, depending on the gauge of the steel and the quantity of cuts. Cheaper blades are available, but I've found they perform poorly. Don't use abrasive blades, as they heat up the galvanization, which affects its quality and durability. While the steel blades aren't supposed to affect the galvanization, it doesn't hurt to hit the ends with some zinc paint.

Full protection — particularly eye and face protection — when cutting is a requirement . I use a flip-down face mask (**Figure 4**). Long sleeves, pants, and gloves minimize cuts and small burns from the hot metal. Also, cutting steel sends small bits of metal some distance. Think about this when setting up a cut station — small bits of metal that land on your decking pile can cause stains.

Start installation by attaching a ledger of track pretty much as you would a wood ledger (**Figure 5**). Flash the ledger just as you would a wood ledger, using bituminous membrane, vinyl, or galvanized steel flashing to avoid any corrosion problems. I fasten the ledger to the house with two 1/2-inch-by-2 1/2-inch lags every 16 inches.

Figure 6. Predrill the ledger for the 1/2-inch lags using a step drill.

The easiest way to prep the ledger is to lay out for the joists first, then lay out

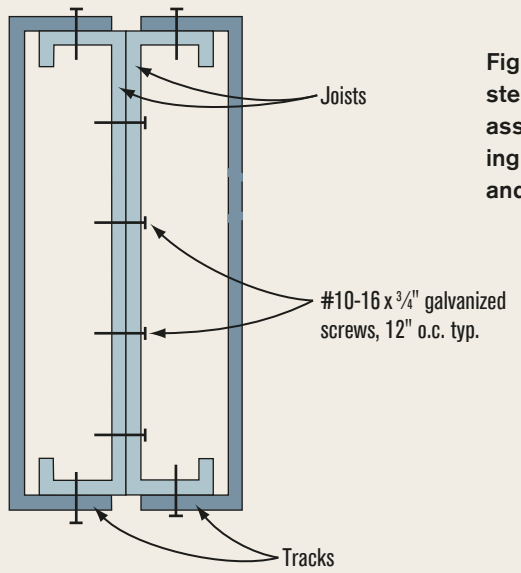


**Figure 7. Light-gauge steel beams are assembled by screwing together joists and tracks.**

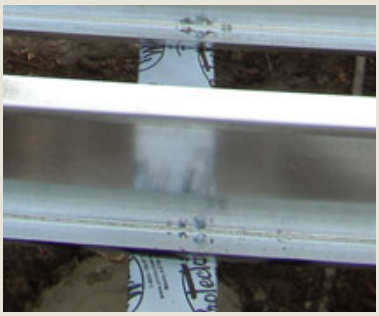

**Figure 8. Protect the tops of beams from water with a layer of flashing membrane.**

**Figure 9. Blocking is required between joists where they bear on the beam.**

**Figure 10. Longer spans require midspan blocking.**

for the lags, using a permanent marker on the steel. Predrilling the holes for the lags with a step drill (**Figure 6, previous page**) is much faster than using a ½-inch twist bit. I usually start with a ⅛-inch pilot bit, opening the hole to ½ inch with the step bit. Touch up the holes and cuts with zinc paint. While I'm there with the tools and maybe the ladder, I attach the Simpson angle brackets at the joist locations on the ledger.

In wetter climates, it might be a good idea to pitch the deck slightly away from the house to prevent water from collecting in the rolled edge of the flange, though that's not a big issue in Colorado with our dry climate.

Next, I build and install the beam. The beam is built up from joist and track material (**Figure 7**), either as a single beam or a double beam, depending on the spans and loads. The single is one piece of joist and one piece of track screwed together every 12 inches; the double beam is two pieces of joist and two pieces of track, also screwed together on 12-inch centers. I cover the top of the beam with adhesive membrane to keep out water (**Figure 8**). Screws through the joist flanges will secure them to the beam.

There are several instances where blocking is required. If you're using a drop beam, you'll need blocking on top of the beam at every other joist to prevent the joists from rolling (**Figure 9**). Cut blocking from joist material and fasten it with LS brackets. Also, midspan blocking is a good idea on spans greater than 10 feet. To make installing it easier, I usually order some material that's not as deep as the joists — an 8-inch frame gets 6-inch midspan blocking, for example (**Figure 10**).

I often use wood posts, as standard framing hardware fits them better

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Figure 11. Wood posts can be joined to steel beams with regular hardware.

Figure 12. A short piece of track bolted to the footing serves as the post base for a steel post.

Figure 13. Attach newel posts to steel framing with two 1/2-inch bolts. If the posts are pressure treated, separate them from the steel with flashing membrane.

than it does steel posts (**Figure 11**). It is possible to build posts from 14-gauge, 4-inch studs and tracks, but since those posts end up 4¼ inches square, conventional post bases don't fit well. Instead, my engineer approves the use of a piece of 4¼-inch track secured to the pier with four ¼-inch concrete anchors as a post base (**Figure 12**). The post sits inside this track, and screws through the sides of the track complete the connection. For post caps, Simpson's AC4R hardware fits with a little bit of work.

Figure 14. Stairs can be built from steel, but the process is time-consuming. Because of this, the author generally uses wood stringers.

Figure 15. Decking can be fastened to steel joists with screws from below.

Once the beam and ledger are up, I install the joists. Clamp them with Vise-Grip C-clamps to the angles on the ledger (and the beam, if it's a flush beam). Predrill and screw them together.

For rail posts, I usually use redwood (it's stable and readily available in Colorado, and it's not likely to have a corrosive reaction with the galvanized steel). I bolt the posts to the frame in a similar manner as to a wood frame, using two ½-inch-by-6-inch bolts (**Figure 13**).

On most of my decks, I build the stairs with traditional pressure-treated-wood stringers (be sure to fully isolate the PT from the galvanized steel), hung with Simpson bulk roll strapping. Steel stringers can be built, but they are much more complicated and expensive (**Figure 14**).

The C-shape of the joists allows for screws to be driven through the flange and into the bottom of the decking for a fastener-free surface with all the benefits of face screwing (**Figure 15**). Predrill the joists from above before placing the decking and fasten from below with #8 by 1-inch galvanized screws. ❖

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