Framing Decks With Steel

Light-gauge steel framing requires fewer footings and stays straight and flat

by Greg DiBernardo

Steel Framing Nomenclature

In deck building, two steel shapes are used: joists (or studs) and track (see illustration, below). Track is sized slightly larger so that joists fit inside it, and it's used like a rim joist or ledger at the ends of joists.

The strength of a steel member varies depending on its web depth, its flange width, and its gauge, or thickness. These characteristics are described with what at first appears to be a confusing nomenclature — what is an 800S162-54, for example? It's pretty easy, though:

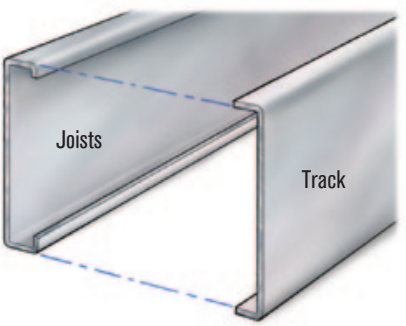
800 = web depth in 1/100-inch increments; in this case, 8.00 inches

S = the shape of the member: "S" indicates a stud (or a joist), track is designated with a "T"

162 = flange depth in 1/100-inch increments; 1.62 (actually 1.625), or 1 5/8, inches

54 = mil thickness; 54 mils = 16 gauge, 43 mils = 18 gauge

Once you have this information down, using steel-joist span tables as found in the IRC or in the Steel Stud Manufacturers Association *Product Technical Guide* (ssma.com) isn't much different from using span tables for wood joists.



Joists (or studs) have flanges whose edges turn inward, whereas track's flanges are straight. Track is sized so that the joists fit between its flanges.

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My deck business operates in the northern New Jersey suburbs of New York City. Over the years, the quality and stability of the pressure-treated lumber I've been getting for framing decks seems to have gotten progressively worse. More than once, I've seen adjacent southern pine 2x10s — that had been planed to a string line during construction — end up being nearly 1/2 inch out of plane six months later. Not only was this sort of problem causing time-consuming callbacks, it was disheartening to see a beautifully crafted deck deteriorate as the lumber shrank, warped, and twisted, creating uneven surfaces, lippage at joints, and sloppy-looking miters.

Meanwhile, for about three years, I'd been following Robert Shaw of Colorado Deck and Framing and his work with light-gauge steel (LGS) framing ("Building With Steel Joists," March/April 2011; deckmagazine.com). Robert personally helped me go from thinking about framing with steel to actually doing it. When I visited him two years ago and saw one of his steel-framed decks, I immediately knew he was on the right track.

LGS is pretty common in the commercial world. Still, the main roadblock I had converting to steel was not learning how to build with it, but finding a source for materials. When I called commercial drywall and steel-stud yards — the kind of business that typically supplies LGS — and told the salespeople I wanted to build a deck with LGS, I had two suppliers blow me off as a kook before I finally found one I could work with. The "aha" moment was when I explained I had everything figured out and just needed the supplier to place the order and deliver it to the site. Your local supplier may well be like mine — familiar with LGS for interior floor and wall systems, but not able to offer any hand-holding to a residential deck builder. My supplier is to this day just my order-taker.

Advantages of Light-Gauge Steel Framing

The name of the game with LGS is precision. Every joist is cold-rolled (a galvanized steel sheet is pulled through a die that gives the joist its shape) perfectly straight and to the exact dimension you specify (see sidebar, above). No more crowning wet, heavy treated lumber, measuring joist depths, or planing

Galvanization

LGS framing for decks is typically galvanized to the G90 standard (0.9 ounces of zinc coating per square foot of steel sheet). Deck builders and building officials occasionally react to this by asking why G90 is okay for framing, while G185 (1.85 ounces of zinc per square foot) is required for framing hardware. It's because framing hardware is expected to be in contact with ACQ preservatives, the copper in which may accelerate corrosion. Unless you're decking with treated lumber — not likely with steel framing — that's not an issue. Back in the days of CCA preservatives, the galvanization standard for framing hardware was G60.

According to information published by the American Galvanizers Association (galvanizeit.org), the zinc on G90 steel should last over 30 years in rural environments, about 20 years in suburban use, and 15 years or so in marine environments before surface rust starts to form.

Figure 1. One big advantage steel framing has over wood is that its greater spans allow the use of fewer footings.

Figure 2. The author buys steel framing members precut to the exact length needed.

after installation to flatten the deck framing.

Because the end joists are always straight, whether they are 8 feet long or 22 feet long, squaring a steel frame is child's play. The rim (or band) joists are easy to install dead plumb, which makes installing the railing posts that much easier, too. All the corners will be exactly 90 degrees, 45 degrees, or whatever degree or radius you want them to be.

Even better, I'm not handcuffed by the span limitations of wood joists (**Figure 1**). Steel is able to span mind-blowing distances compared with wood. To stretch the span of wood joists, you might reduce the spacing from 16 inches on-center to 12 inches on-center, jump up to 2x12 framing, or double some members, but there's only so much that wood allows you to do. On the other hand, to increase a span with LGS, I can change the gauge of the steel, widen the flanges, or change the web depth to suit the design requirements of the project.

For instance, for a rectangular deck that's 24 feet deep, 16 feet wide, and 11 inches off the ground, I would use 24-foot-long-by-8-inch-deep 16-gauge (54 mil) joists with a 2-inch-wide flange, and space them 16 inches on-center. The 8-inch joists would allow for air circulation below the deck. I would install a single flush beam 24 feet from the house bearing on two footings or, in my case, helical piers. Designing that same deck with wood would require at least one, if not two, midspan flush beams, a plethora of joist hangers, and four times as many footings.

Another huge perk of LGS is that I can order nearly every piece cut to the precise length needed. Not having to cut material on site saves substantial time. My supplier labels every piece of steel with its cut dimension, so assembling a deck frame amounts to pulling material off the pile and installing it in one movement (**Figure 2**). The only time my crews cut materials on a job is when creating

Figure 3. Although steel can span considerably longer distances than wood, it's only about one-third the weight.

Figure 4. Complex framing can take longer with steel than with wood. For decks like the one pictured above, the steel has to be cut to length on site. Plus, complicated designs have a lot of screwed connections, which take longer than gun-nailed wood connections.

angles or clipped corners, because in those cases it's easier to run the joists a little long and cut them to length after installation. Using mostly precut framing materials results in essentially zero framing waste, very little clean-up, and reduced debris-removal costs.

Compared with wood, steel framing is lightweight, so it's also far less tiring to work with. For example, a 20-foot-long, 10-inch-deep 16-gauge steel joist weighs a little over 40 pounds. For reference, though it won't span anywhere near as far as the steel, a similarly sized piece of wet southern pine weighs around 100 pounds (**Figure 3**). A wood member that could span 20 feet — if you could find one — would be even heavier in comparison.

Steel is so light that my crews can prebuild small structures like intermediate stair landings on the ground and simply lift them onto the support posts. Steel can also be ordered in long lengths; given its light weight, it's not uncommon to see a 28- or 30-foot girder being placed by only two people. An entire 500-square-foot deck frame can be shifted, racked, and squared effortlessly.

What to Watch Out For

Cost is a big hang-up for many of the contractors who have asked me about framing decks with steel. In most cases, steel framing material is going to cost more than wood. However, I end up using less material and fewer footings for a steel-framed deck than for a similar wood-framed deck, so depending on the design, the overall cost often ends up about even.

The labor cost to build a steel frame can be more or less than a wood frame, depending on several factors. For simple designs, steel is faster because there is no cutting whatsoever on the job site. Once the ledger is installed, the deck goes up like an Erector Set. The only tools needed are a cordless drill and an impact driver — no compressor, no air hoses, no saws. On more complex designs with borders,

seam boards, and a lot of angles, framing can be slower compared with wood. This is primarily because more complex designs tend to require more screwing, and screwing steel together takes longer than gun-nailing wood (**Figure 4, page 22**).

Depending on the LGS framing system you use, there may be more cutting, and more framing hardware (such as framing angles) and screws required (**Figure 5**).

Figure 5. Some steel framing systems require the use of framing hardware to make connections.

Working With Trex Elevations

Elevations may be a good option if you are a new steel framer, because of the support and documentation provided by Trex. It's also a complete framing system, which simplifies logistics.

There are a couple of key differences from the LGS I generally use. Elevations joists and tracks come only in predetermined lengths, much like lumber, and you have to cut all material on site. Because the Elevations ledger is just a piece of track, unlike the Trade Ready ledger I use, you have to lay out the joist locations and install an L70 framing angle in each, with eight screws per joist — four to connect the L70 to the track and four to connect the joist to the L70. I have been told, though, that Trex plans to change this in the future.

Elevations is painted brown at the factory. Some clients are willing to pay extra to have brown framing, some don't care about the color, and others like the metal look of generic LGS because it's so innovative and they can brag to their guests about it. One of my company's current projects uses both — it's a four-level deck where the upper two decks, whose framing is visible, are fabricated from Elevations and the lower two decks are framed with generic LGS. But whatever route you take, it's wise to let your clients know what the finished product will look like.

An example is the Elevations steel framing system (Trex; 800/289-8739, trex.com). I prefer off-the-shelf LGS framing, mostly because it costs less, but I think Elevations is a good system to use in some special cases or if you're new to steel framing (see sidebar, below).

Although you might expect resistance from the building department about using an unfamiliar material, the fact is that the IRC devotes more pages to steel floor framing than it does to wood floor framing, and much of that information translates directly to deck building. Additionally, the Steel Stud Manufacturers Association (SSMA) publishes span tables, explanations, and details (ssma.com/filebin/pdf/SSMA_Product_Technical_Guide_2012.pdf) that you can provide to the building department with the permit application; I include the SSMA documentation, as well as several pages from the American Galvanization Association regarding the level of galvanization on the steel.

The idea is to give code officials more than enough information to not only understand but have confidence in a steel-frame deck. Even so, some building departments will insist on an engineer's stamp prior to issuing a permit. Engineering fees vary so it pays to call around. Try to find someone knowledgeable about LGS construction. He or she will probably consider any deck project cut and dry compared with a commercial structure and may charge less than engineers who are outside their comfort zone.

Working With Steel

If you have ever framed a wall with steel studs and track, you will feel right at home framing a steel deck. Simply put, it's like framing a wall on the horizontal plane. The track used for the ledger and the rim is like the track that serves as plates in a steel-stud wall. The inside dimension of the track is a little wider than the joists, which just slide into the ledger track on one end and the rim track on the other end (**Figure 6, page 26**). Unlike most steel-stud walls, however, everything in a steel-frame deck is structural, so the steel members are significantly thicker and stiffer.

To cut LGS framing, you can either use your existing circular saw with a steel blade like the Steel Demon (Freud; 800/334-4107, freudtools.com) or upgrade to a dedicated steel-cutting

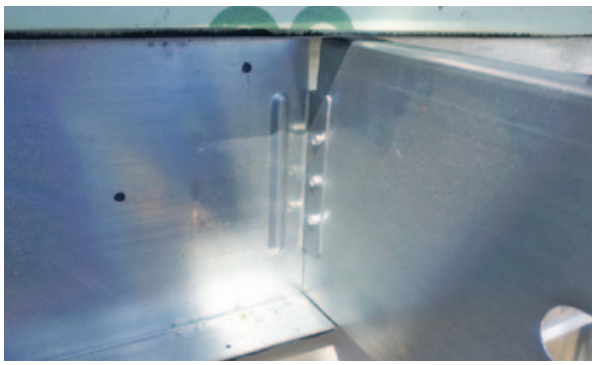

Figure 6. Ledger and rim track is available with tabs punched on standard framing layouts (above). The joists are screwed to these tabs (right).

Figure 7. A specialized steel-cutting saw makes quicker work of cuts and does a better job containing the hot chips of steel from the cuts.

saw like the Milwaukee 6370-20 (Milwaukee Electric Tool Corp.; 800/729-3878, milwaukeetool.com). My crews built about 10 steel-frame decks using circular saws and they worked pretty well, but upgrading to a dedicated steel-cutting saw was well worth the investment (**Figure 7**). The new saw captures most of the hot steel filings that otherwise land on the user, and it cuts faster.

In addition to cutting, you end up drilling a fair number of holes in steel framing. You'll want to purchase high-quality drill bits (**Figure 8, page 28**), and you'll need cold galvanizing spray paint (Rust-Oleum Corp.; rustoleum.com) for coating drilled holes or end cuts. As a deck builder, you undoubtedly have all the other tools required, such as impact drivers and drills.

Buy High-Quality Screws

All the connections in a steel-frame deck are made using self-tapping screws — typically #10 x 3/4 inch with a 5/16-inch hex head (**Figure 9, page 28**). Sourcing hot-dip galvanized or exterior-rated screws of this size and type can be tricky. Early on, finding screws was probably the most difficult part of building with LGS framing for me and involved a fair amount of frustration as well as trial and error.

The first decent screws I found were Buildex Teks Select screws (Starborn Industries; 800/596-7747, starborn industries.com). They are distributed for use with Trex Elevations and are readily available online (I buy them through DecksDirect.com). They work adequately with Elevations framing members, which are typically 18-gauge steel. However, I normally use thicker, 16-gauge framing members and prefer HWH 3 KS 12-14 x 3/4-inch screws (Hilti Corp.; 800/879-8000, us.hilti.com) because they have sharper self-drilling tips and install faster. The Hilti screws are slightly more expensive, but it's money well-spent. You will find that some screws in a box, regardless of the

Figure 8. Step drills work great on steel and allow one bit to drill holes of several sizes.

Figure 9. Specialty, hot-dipped galvanized, self-drilling screws are used to connect steel framing members.

Figure 10. Screws for attaching steel ledgers are shorter than those used with wood.

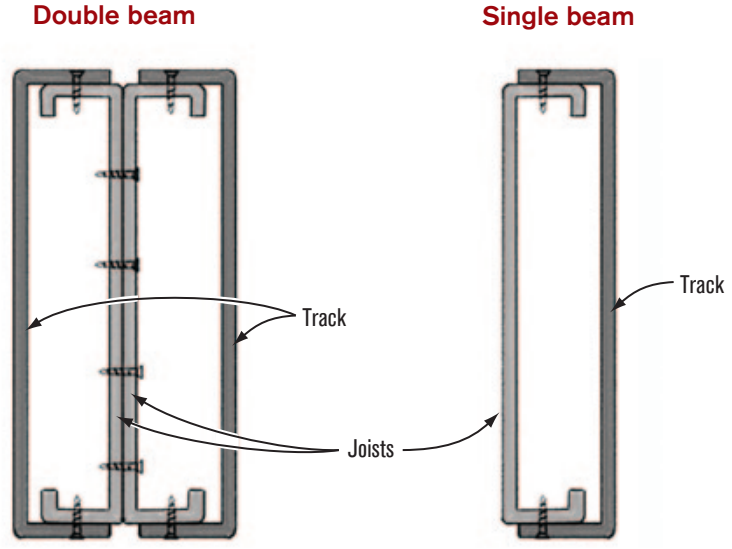

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Figure 11. LGS beams are made by joining a joist and a track. A single beam (right) consists of one joist and one track, while a double beam (left) consists of two single-beam assemblies.

brand, just won't drill — they spin and spin until the tip burns off. I've found this to be less of a problem with the Hilti screws than with other brands.

Framing Details

A steel ledger, or track, installs much like a wood ledger does, and flashing a steel ledger is no different from flashing a wood one. The bolts or screws you are accustomed to using with wood ledgers won't work, though, because the steel is only about 1/16 inch thick. You'll need to use shorter fasteners. My crews use 5/16 x 2 3/4-inch RSS screws (GRK Fasteners; 800/263-0463, grkfasteners.com) to attach steel ledgers (**Figure 10**). Quarter-inch lag screws may also be used, according to the Trex Elevations design manual. For hollow- or solid-masonry connections, my crews use application-specific Hilti chemical anchoring systems. In any case, you should consult a structural engineer to determine the proper screw and fastening pattern for your load application.

Installing steel joists into a ledger track is easier than installing wood joists with a wood ledger. I order Trade Ready Rims (ClarkDietrich Building Systems; 800/543-7140, clarkdietrich.com) for ledger tracks. They come punched and drilled and have bent tabs for attaching the joists at either 12-inch or 16-inch on-center joist spacing. Installing the joists is fast and precise because no measuring is required. Five screws are used per connection — a single screw through each of the top and bottom track legs into the joist flanges, and three through the tab into the joist.

LGS beams or girders are typically single or double (**Figure 11**). A single LGS beam is simply a joist with a track nested around it and screwed to it. But because it comprises two pieces of steel, its span is surprisingly long compared with what wood beams can handle. A double steel beam is similar, with the only difference being that two joists are fastened web-to-

Figure 12. It's simpler and cheaper to make support columns and railing posts from wood (top). Once everything is wrapped with finish materials, it's impossible to tell what the underlying material is (bottom).

web prior to track being installed on each joist. Screws are driven through the top and bottom flanges, typically at 12-inch intervals. LGS beams are capable of supporting enormous loads over long spans, so intelligent beam design can reduce the number of footings required.

Support Posts, Railing Posts, and Stringers

While you can frame a deck with no wood whatsoever, I've found that it's not cost effective or desirable (**Figure 12**). I still use 4x4 or 6x6 southern pine MCA-treated lumber for support posts under beams because it is far easier to wrap wood substrates with trim than it is to wrap steel. It's also much simpler to make footing-to-post and post-to-girder connections with wood posts (**Figure 13, page 32**). The hardware is the same as you'd use framing with wood.

My crews typically use composite-railing kits whose post sleeves cover 4x4 wood structural posts. The posts might cost $3.50 each, whereas a tubular steel post would cost 10 to 15 times that (**Figure 14, page 32**). To stiffen the framing and provide a flat surface where a post will be bolted in place, a 6-inch-long piece of track is screwed to the inside of the joist before the post is mounted.

We cut stair stringers out of southern pine simply for aesthetic purposes (**Figure 15, page 32**). While you can fabricate stairs from steel, it requires closed stringers on both sides, which would prove difficult to wrap using matching composite materials, though they could be painted. I'm not sure I could sell the additional cost of labor, time, and materials to my clients when wood stringers do the job.

Fastening Deck Boards and Trim

My crews have used hidden fasteners on all of our decks for years, but as recently as two years ago, there were no decking fasteners designed specifically for steel framing. Now there are several

Figure 13. Wood support posts attach to LGS beams with hardware that's similar to what would be used with wood framing.

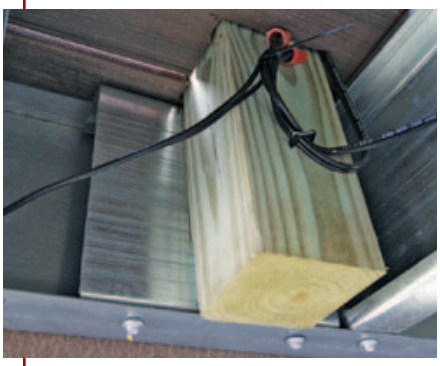

Figure 14. Wood posts are bolted to the steel framing. A short piece of track between the joist and the post stiffens the joist and provides a rigid mounting surface.

Figure 15. Stair stringers are typically made of wood, which is more economical and easier to wrap with finish materials.

fastening systems for steel frames. Every synthetic board I offer is pre-grooved from the factory, and we have been using the Invisi-Fast clip system (M&M Products; 866/766-9427, invisifast.com) with excellent results. A single self-tapping screw goes through the T-shaped clip and into the steel joist. M&M makes dedicated clips for Trex and TimberTech products as well as a generic clip that works with any decking brand, such as Fiberon or Latitudes, that has a centered, 90-degree shouldered groove. Trex offers its branded Universal clip with a self-drilling steel-framing screw, similar to the Invisi-Fast clip.

Alternatively, you can use a steel-frame-compatible Cortex screw-and-plug system (FastenMaster; 800/518-3569, fastenmaster.com) with nongrooved boards. Currently, FastenMaster stocks metal screw-and-plug kits for Trex decking only. However, if you contact the company directly, it will custom-package its steel-frame-compatible screws with any plugs it makes.

Starborn's self-drilling, colored-head screw, the Deckfast Metal, is designed to drill through the deck board and the steel frame. The screws work as advertised, and we use them wherever a face-screw is necessary and for all our fascia attachments. Unfortunately, Starborn does not offer a white screw. When we install white PVC trim and fascia, we use sandstone-color screws and dot the heads with white appliance epoxy paint as a work-around. If I were more industrious, I would stick a few hundred in a piece of rigid insulation and spray-paint them all white in one fell swoop.

For me, the decision to use LGS to frame decks has been a good one. I'm building my decks on stable framing that keeps them looking great long-term, and I have fewer callbacks and more referrals. What more could I ask for? ❖

Greg DiBernardo owns Bergen Decks in Waldwick, N.J.