The steel industry is on the verge of a meteoric rise in production to satisfy the demand for steel frame homes. You wouldn’t believe it, though, looking at the confusions and difficulties for steel framing in the residential market right now. It makes the distance that has to be traveled between today and the future seem like crossing Texas on I-10 in a rickety pick-up during August.

Cold-formed steel is a product that many contractors work with, in the commercial sector that is, where codes demand its use in multi-occupancy buildings.

Although it seems hard to credit, given its low market penetration, steel has been used in the residential construction industry, off and on, for half a century now. After World War II, there was a drive to use steel for homes, but the availability of inexpensive lumber had cut across any demand by the 1950s.

"US Steel completed its research on cold-formed C-Section in the 1960s," says Al La Place, executive vice president of The Steel Network, a company that specializes in solving critical problems relating to steel framing. "US Steel saw clearly that timber was not a renewable resource and believed steel would replace it in residential construction. They bought real estate companies and made studs in an effort to prove their theory, and it never worked. They were just too far ahead of their time."
“United States Gypsum then introduced non-combustible steel framing, with their gypsum board, into the commercial markets in the early 1970s, in answer to the ‘towering inferno’ problem. The major companies such as Dietrich Industries, USG and National Gypsum, then brought the product to market for load-bearing applications during the mid-1980s.

“It’s ironic that the initial steel studs were designed for houses,” La Place says. “But it’s appropriate that John Hewing at US Steel reinvigorated the whole process in the early 1990s, when timber prices began to peak. Learning from US Steel’s earlier mistakes, he gathered the support of all the different types of industries that feed the residential market.”

With the lumber market affected by environmental restrictions on logging today, price volatility and quality issues, steel is on the fast track to becoming and staying a viable option in the housing market.

Outside the residential field, steel framing has made some significant advances since the 1960s, such as the introduction of electrified floor decks for easier wiring of high-rises; and the use of prismatic-shaped material whose profile exactly matches the force it is going to experience.

Additionally, steel prices have been flat for almost two decades as a result of increased recycling—an average pound of steel product today contains between 64 percent and 68 percent by weight of recycled material—a major benefit to the environment and the economy. It is of note that timber products take up 45 percent of landfills today. As one New York contractor put it, “Metal can be recycled, but once it’s pulled out, there is nothing you can do with wood.”

Finally, the steel industry has put $50 billion into capital investment over the last 20 years. In the process, it has turned itself from what people used to perceive as a dinosaur industry with belching smokestacks, into a high-tech industry that is the most productive, cost-competitive and efficient in the world. Man-hours per ton have dropped from 11 to less than four— even below one in some plants.

Scott Coila, general manager at Knorr, one of the smaller of the nation’s 100 or so steel manufacturers, comments on some of the upgrades made by the industry, “Improvements over the last two decades in manufacturing methods and equipment have resulted in consistent links and dimensions with much tighter tolerances. In the past five years, the introduction of computerized controls has also ensured consistent quality throughout. Also, we used to operate pneumatic equipment, which was both noisy and unreliable. We’ve since moved to hydraulics, which are very low maintenance, very reliable, far more productive and very quiet.

Garen Smith, president of one of the largest manufacturers and distributors of light steel framing, describes how Unimast’s product range has expanded. “In the last three decades, we’ve gone from a functional need that was met, to 400 different sections that we offer to meet the engineering requirements of any project.”

Those who use steel swear by it, and the reasons are not hard to understand.

You Can Huff and Puff

Residential steel framing members are cheaper, lighter, straighter, and easier to handle than wood, as well as termite proof, non-combustible and strong.
enough to stand when earthquakes and winds have long since blown over a wooden house. They also won’t crack, shrink, splinter, creep, split, warp, swell or rot.

As one New York contractor put it, “Steel is straight and it’s strong. You don’t have to look through a pile of wood to find straight sections, or finding 10, discover they all have dry rot.”

With the highest strength-to-weight ratio of any residential building material, less product is required to frame a home while increasing design flexibility.

While few contractors are known to be tree huggers, some of their customers are, and a general deteriorating lumber resource means that 50 mature trees on four acres of land are saved each time a 2,000 square foot steel-framed home is built out of six scrapped cars.

Steel framing is also energy efficient because it prevents air leaks resulting from shrinkage and warping, thus keeping down heating and air-conditioning bills.

Before we look into the reasons why a commodity with this many advantages is still at the starting gate after being in the residential market after 50 years, let’s review the industry’s score card as a whole by consulting the people on the sites who use steel.

***Picking Your Steel***

Contractors around the country use a variety of brands of steel, with no real consensus on one manufacturer over another. There was more agreement on why they chose the brand(s) that they did (see Chart A, page 41).

One contractor from Alabama spoke for those who felt quality was an issue: “Some manufacturers are a little bit cheaper, but you don’t always get quality steel from them. There will be some
A general deteriorating lumber resource means that 50 mature trees on four acres of land are saved each time a 2,000-square-foot, steel-framed home is built out of six scrapped cars.

Connections for trusses is the biggest problem for jack rafters and connecting to the garters,” an Alabama contractor notes. “Multiple hip roofs are the worst. You have to be creative when making a connection on a valley or a ridge as they don’t mesh together properly. You can’t cut a compound angle as with wood. The way we handle it is by having a metal-flashing company bend pieces of metal flashing to our specifications for our ridges and valleys.”

Another contractor, from Florida, has been equally inventive in solving problems encountered: “There should be some research into the connections

Doesn’t It Get Better Than This?

While steel may be steel, the industry as a whole has a few areas where some improvement could be made—13 of the 23 contractors surveyed around the country thought so. The remaining 10 felt nothing needed to be improved. Their thoughts were voiced by one contractor from California who said, “It’s a good system that I’ve been working with for 30 years.”

Those who had specific requests for improvements had obviously run into trouble at some point, and their thoughts could be tomorrow’s breakthroughs.

Coila provides the manufacturer’s perspective on quality: “There is some variety among the different manufacturers. The only way to ensure a quality product is to start with quality raw material. All the steel that we use is mill-certified, which costs a little extra. Some manufacturers use secondary steel, and you’re not always guaranteed a consistent quality.”

For the majority who didn’t feel quality was an issue, a contractor from Indiana summed up the overall view when he said: “It’s a pretty generic market at this point. Price is naturally an important component, but there is no noticeable difference in the quality.” His words were echoed by the immortal words of another from Florida who pointed out, “When it comes down to it, steel is steel.”

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While the industry has good reason to be happy with its progress, it still has a major challenge ahead in the residential market.

between track and studs, clips and edge-laps, and steel stud and I-beams or edge angles. The major manufacturers ought to develop slide clips that are economically priced. The studs of smaller manufacturers don’t quite meet the different loading needs of a commercial building. We’ve hired an independent structural engineer who has researched and designed a better clip. We bought a press and we’re punching clips. We can do that more economically than buying them, and they do meet the design load, unlike most of the independents.”

“They could come up with more advances in fastening systems,” echoes a contractor from Ohio, “to make it easier to frame out of steel than wood.”

A North Carolina contractor adds, “There needs to be some method in residential, for a regular trim carpenter to install his trim items, outlet boxes and any mechanical devices, without having to do something special.”

On a more mundane level, a Floridian asks for “shallower screws—the pan heads stick out too much, which keeps the drywall from being tight to the metal studs.”

Meanwhile, two contractors have complaints of rusting: “Improve the tendency to rust,” says a Virginian. “There obviously isn’t enough coating on the steel.”

“The coatings could be a little thicker,” agrees a contractor from South Carolina, “especially in the thinner, more heavily stretched pieces. Variations in color and some rusting concern the owners and architects, even if the rust seldom goes into the steel. The attachment points for G60s or G90s,” he continues, “could also be explained better by the manufacturers in terms requirements for wind loads.”
Lastly, one contractor from Tennessee sees only one problem with the steel he gets: “It takes longer to ship than wood and tends to bend during shipment. It has improved over the years, though, with companies taking more precautions and achieving better shipping times.”

**Time to Roll ‘em Wheels**

While the industry has good reason to be happy with its progress and overall customer satisfaction, it has a major challenge ahead in terms of opening up the residential market to steel framing. This is not earth-shattering news to anyone familiar with the industry, but let’s look at what’s going on from the wood-framers’ and contractors’ perspective—How come they haven’t climbed onto the steel-framing wagon? The survey found that most don’t think the wagon is going any place soon, but would like it to (see Chart B, page 49).

One-third of the people surveyed had done some steel framing in the residential market at one time or another, with less than a tenth actively pursuing ground-up construction. As the comments below show, the majority of contractors listed as working with cold-formed steel do so exclusively in the commercial sector.

Reasons vary, but the major ones are higher costs and a lack of a market and infrastructure.

“The residential steel framing market hasn’t really blossomed in this area,” says a Californian contractor. “Cost and design are still prohibitive. One of our top coordinators did his own house out of steel studs. The engineering costs for a custom-built house are still prohibitive, unless you know what you’re doing. The problem is mostly with engineering roof design and joist trussing for the roof loading.”

“Labor costs are maybe 15 percent higher,” says an Ohian. “Steel framing is more labor intensive because there are more parts than in a wood house. There’s no way to get around it. Wood prices have gone so far down while steel prices haven’t. Right now, it’s a bit of a no-brainer.”

Costs bugged other contractors from Texas to Illinois, while one from Tennessee said there was simply no demand for steel-framed houses in his area. A Floridian agreed: “Forty-nine out of 50 houses are wood framed. Builders think it’s cheaper to use wood, but it isn’t, it’s about the same price.”

A commercial contractor from Florida pointed out what may be a key driver for many in his trade: “The commercial side is so good that there is really no need for us to venture into residential; there is enough volume to satisfy anyone’s growth pattern.”

A telling subcategory, however, is the number of contractors who said they don’t use steel-framing in the residential market, but they would like to, even if only to build their own house. It reminds one of the question, “Who does your dentist go to when he wants his teeth done?” Maybe the industry should pursue an ad campaign to this effect, because contractors seem to consider steel-framed houses as the best form of construction.

“I understand steel framing is the new hot item,” says a Texan. “If I were to build my own house, it would definitely be out of steel.”
“I have built a steel-framed home on my own,” admits a contractor from North Carolina. “The reason others don’t is their inability to understand the superiority of the product and that, once passed the learning curve, it won’t be any more difficult than wood. Business is good with wood, so why change?”

A Floridian contractor says he is “building a home of my own here in the next six months, and I want to steel-stud-frame it. I think prefabricated walls are a big deal because they’re lightweight and straight. I’d rather work with steel than wood. It requires different equipment, but it’s a lot less tedious, and it’s easier to work with. I see a big market emerging, but right now, steel-stud-frame houses are being overlooked.”

Then there are those who worked on steel framing in earlier years, and didn’t come away from the experience too happy. “We were among the pioneers 10 years ago,” says a South Carolinian, “but now we’re into the commercial end. We prefer to deal with an architect and a precise set of plans and architectural-type documents. It will eventually get to that in the residential market. When you’re dealing with a medical college, it’s just a matter of doing the work and being paid. If you do residential, it’s more trouble than it’s worth.”

A New Yorker, who does renovations with steel, says that “homeowners are still apprehensive about metal because stick framers have never looked at a piece of metal. If you’re not diversified as a contractor, you don’t even think about steel framing. It takes a contractor who does commercial and residential to get metal frame residential work.”

“In a former life we did one steel frame home,” adds a Missouri contractor, “when lumber prices were way up. We had done numerous load-bearing systems, so we knew about all the detailing that had to be done: the bridging, the web stiffeners, etc. There’s really not a market for it here at the moment, but when there is, we’ll be interested.”

“Field employees aren’t as familiar with steel framing as they are with wood,” says a contractor from Tennessee, “So, it’s a slow process. But it’s becoming increasingly popular in residential as time goes on. If I ever build a house, it will be out of steel. It’s much better than wood—you don’t have to worry about infestations, swelling and buckling. Steel costs a bit more and unfortunately, when people look at a steel house, instead of saying ‘Well, it’s going to cost me more money to make it out of steel but it’s going to last 50 years longer,’ they’d rather not spend the extra money. As society becomes more environmentally conscious, people are going realize that they’re better off with steel. Steel prices will drop, and wood prices will continue to rise until the two meet.”

A Floridian who is building successfully with steel in the residential market said the real barrier was finding skilled labor.

An Alabama contractor explained how this really wasn’t such
An Alabama contractor said:  
“There are a lot of hard-headed people who don’t even want to talk about a house being built out of metal. But they know they are going to have to learn how to do it sooner or later.”

Bringing Home the Steel

Industry figures have much the same ideas about the market as the folks on the jobsites, but they also have some convincing figures and some very real progress to report.

According to the American Iron and Steel Institute, there were fewer than 1,000 steel home-starts in the United States during 1992; within two years, it was 40,000 starts (with another 60,000 units using steel in interior partition walls or non-load-bearing applications). By 1995, 520,000 tons of steel were used in home construction by only 6 percent of the nation’s home builders.

If 250,000 steel-framed homes were built in a year, or 18 percent of the 1.4 million housing starts annually it would require 1.5 million tons of steel.

“Steel is cheaper than wood from a material-to-material standpoint,” says Don Moody, president of the North American Steel Framing Alliance. “When the Random Lengths Composite Index is at $355 per 1,000 board feet, then steel at today’s prices is about $0.38 a square foot cheaper.

“It’s in the cost of construction that steel loses. The framing labor costs a little bit more, the electrician, the plumber may charge more. Framing costs more because the first time any framing crew constructs a house out of steel, it takes much longer. If it costs more, the probability of doing a second one reduces and the phenomenon of one-time framers is the result.”

“The second major component is fastening,” Moody continued. “Wood members are fastened together with nails applied with a nail gun that shoots up to 40 nails per minute. A screwgun secures maybe six screws in that one minute to steel. A 2,000 square foot house has 23,000 framing connections, so when you do the math, extra labor costs run $1 to $2 per square foot, when all trades are combined. Subtract the cheaper cost of steel over wood, and that figure becomes between 62 cents and $1.62 per square foot extra, or $620 to $1,620 extra for a 2,000-square-foot home.

“Now if contractors could just get over the learning curve and build steel houses fairly fast and smoothly, the overall cost is about level with wood construction costs. One contractor who does more steel framing than anybody in the country is coming in at 40 cents per square foot more for steel, when lower material costs are subtracted from higher labor costs.

“But then there are two other points to factor in. We are working on compiling good numbers, but meanwhile we do have a lot of anecdotal information on the punch-out list the builder has to return to fix up after completing construction. A lot of times that will be nail pops or wallboard seams showing. The average call-back cost for builders is $377, with five call-backs per house. We just don’t have any figures on how much of the call-backs relate to framing, but anecdotaly, it is a big part of the problem and a reason builder after builder eyeballs steel-frame houses and says, ‘Once it’s up, it’s up.’

“In the residential market, most builder call-backs are for nail pops,” Coila con-
“You don’t make money repairing things.”

“On this basis,” says Moody, “if half the call-back tab were attributed to wooden framing, it would equal the same amount that steel-frame houses cost over wooden to build. The problem is the building industry makes decisions on a first-cost basis. As long as there is uncertainty, they just don’t pull the trigger.”

La Place is a bit more outspoken about the reluctance of some builders to use steel-framing in the residential market. “Huge tract-builders construct 1,000 steel homes, find out that they paid $500 more for each one and throw away the program. We say to them, ‘How can you do that? Just the call-backs cost you more than $500!’

“They look you right in the eye and say: ‘That’s not my problem!’ It’s the wood framer they hired and if he goes out of business, they’ll find another guy who can slam a trunk and slap these wood-framed houses together.

“In the old days, they hammered in pegs or nails by hand and didn’t split the wood,” La Place elaborates. “They didn’t sacrifice the integrity of the product. Unless they put the nails in perfectly, marginal labor today fractures the structural members with the pneumatic nail guns they’re using.

“But the federal government is about to tighten up the codes in every area of construction. We’re all going to live on a fault line, in a hurricane zone. When that happens, steel framing will be in a good position. We can build a house to withstand 110-mile-an-hour winds, it won’t rot, and the termites won’t chew it up like they are doing in New Orleans right now.”

Moody adds on the costing issue that, “lumber, of course, keeps trending upward in price and has been for the last seven years. Assuming a current net $2 per square foot disadvantage for steel, then wood would only have to rise $20 per 1,000 board feet (from $390 to $410), for steel to make sense first-cost wise, too.”

While load-bearing steel that has to be fully engineered is more expensive to install at the moment, Smith points out that “the price differential at the moment depends on the design and where it is used. Interior nonload-bearing steel is cheaper to install and buy than wood. You can buy it at Home Depot, Georgia Pacific, drywall distributors. It’s almost a no-brainer to take interior walls and convert them to steel.”

If the market is so close to making steel the best option for residential builders, then those builders have a problem. It is just not as simple to make a steel house as a wooden one. This is something the North American Steel Framing Alliance has recognized, and has started a four-year program, in January 1999, to resolve issues relating to engineering and distribution.

“Building a house out of wood today,”
continues Moody, “is as simple as taking a set of architectural plans to the smallest lumber yard in the smallest town in North Dakota, and they will not only give you a price but deliver the materials the next day. Implicit in that ability are things such as standards, building codes, software, building processes and so on.

“To build a house of steel requires someone to engineer it, which will cost you anywhere from 70 cents to $2 per square foot. Then somebody has to do an estimate, but not many people know how. So it usually goes back to the roll-former—not the stud manufacturer—who is capable of doing it, because he doesn’t have the staff to do it. While this may not add cost directly to the builder, it adds time, frustration and inertia.

“So, while the economic trends are in steel’s favor, and price, supply and quality trends for wood are all unfavorable for the lumber industry, the infrastructure for steel needs to be put into place. That’s our focus, and we have a path to get there.”

In the meantime, residential builders would be smart to use the next four years to become familiar with steel construction, as a market already exists. A third of the market is a homeowner building his own home. A small portion of this market will use steel framing and choose to pay for it. Other right-now applications where steel framing is clearly an advantage include floor joists, which are stronger, straighter and cheaper than wood. There are no thermal properties or diaphragm loads to worry about. Non-load bearing interior studs also make a lot of sense.

**OK, So It Isn’t That Easy!**

In commercial construction, all the structures are engineered. Eighty percent of houses are built prescriptively, having to demonstrate the load and size of the members. In commercial, there are full-blown estimators and building materials available. In the residential market, there is almost nothing.

“A carpenter in the residential market knows he’s going to use a 2-by-4 without having to consult an engineer,” a contractor from Indiana quips.

“A builder puts his trades together a few days before a job starts, continues Moody, “and gives the framer his account at ABC Lumber Co., who provides the wood the next day. The builder didn’t do any take-off or engineering and didn’t have to order anything from the manufacturer. The product is standardized and fits with the building codes.

“With commercial steel-frame construction, you start with the same architectural set of plans, and then a structural engineer has to do a full-blown structural analysis, specifying member sizes and so on. A commercial general contractor then hires a commercial framing contractor weeks before the job starts. He
has a meticulous, materials take-off guy who works with the architect and engineers, and everyone signs off on the final drawings. It’s a full-blown business, not a ‘one-house-man.’

“In the steel-stud business,” adds Coila of Knorr, “not all steel studs are the same. They're not even all called the same thing even when they may have the same dimensions, because manufacturers want to assign their own unique name to a product. For the end-user, it is confusing and restricting—when the architect names a certain product, the contractor is locked into buying it. So the upcoming standardization is perhaps the biggest step forward.”

“Manufacturers should mark the same gauges with the same colors,” says a New York contractor.

“The biggest issue is universal code acceptance,” adds a Missouri contractor, “for some hard and fast rules of thumb. We need to be able to say, ‘3 5/8, 18-gauge, 16 inches on center will work for this situation across the board,’ without having to have everything engineered. It’s going to be hard to get the code bodies to accept it. The other issue is the public perception that they won’t be able to hang a picture in their house without a screw gun. I think the public perception will be much easier to change than getting the code changed!”

Fortunately for everyone, the good news is that not only have the manufacturers agreed to standardize, but the code bodies have accepted the new code, as Moody explains.

“What we have been working on at NASFA is making it as easy to build in steel for residential construction as it is to build in wood for residential construction. We have been working on standardizing the products. Two years of meetings with the manufacturers just short of gunfire, and we’ve now got that done! Step one is done.

“Step two is, we’ve developed prescriptive standards that are now in the...
We have heard that upcoming International Building Code and International Residential Code. They’ve already been adopted and will come out next year.

“Until now,” continues Moody, “everything you ever wanted to know about wood was in the codes, and nothing about steel. That’s why steel has had to be designed at $1.50 per square foot, taking three to six weeks. When the IBC and IRC come out, they will include the exact same data for steel as for wood. The data that exist for wood in the codes now is the basis for the software that sits in every lumberyard today. So, when you walk in with your set of architectural plans, they can tell you in a couple of hours how much wood it will take and the price.

“We are now involved in a grass-roots operation, putting on seminars with code officials to familiarize them with prescriptive metal data; working with and training builders and contractors.

“We are now involved in a grass-roots operation, putting on seminars with code officials to familiarize them with prescriptive metal data; working with and training builders and contractors.

“Another project is working on the lumberyards and supply houses to start stocking standard materials for residential. It won’t be too long before they’ll be called ‘steel and lumber yards.’”

“As wood prices continue to climb, and the infrastructure is put into place, there will come a point of no return. In the meantime, if you’re building a steel-frame house today, you still need to find an engineer, an estimator, somebody to do a material take-off and order that from a supply yard or a manufacturer.

“You can either do it piecemeal for a lot of time and money, or you can go to a one-stop shop like TSN. What that source does is trade on the lack of knowledge that the rest of the market has by putting together everything that’s complicated about getting steel framing done for the builder.

“Our long-term objective is to make steel a mass-market commodity, just like lumber is. We want to reduce steel into a handful of products that are stocked in every lumber yard. If a consumer has a choice and is given that choice with a little education, there’s no question he’ll decide on steel if he doesn’t have to pay more for it. The reason for the contradiction between a better product that a consumer would prefer and having a small market share is a matter of infrastructure and economics. Once in place, residential steel framing will be economically viable and a sustainable product on a large scale.”

There is one other area that needs to be addressed, as Coila explains: “The con-
tractors I have talked with don’t have a trained labor force. The people building houses know how to pound nails and work a circular saw. They’re familiar with their tools, none of which work with steel studs. I think they are embarrassed to say that they don’t know how to build with steel, yet it’s really just a screwgun they have to master. It’s going to take some education, and someone doing the education.”

Smith agrees: “Probably the most important point to address is training field people to frame out houses in steel as opposed to wood. Building a house, framing the walls and putting the floor joists together, requires a few more skills than most people possess.

“We have heard that people who build five or more homes with steel have developed a proficiency that enables them to build them in the same time it takes with wood. Five to eight homes is the learning curve. Using panelization, they can do even better. Costs have typically been the same or slightly more, unless there is something unusual about the design of a custom home.”

It will also take more people in the business, as one contractor from California noted: “The market can stand an influx of young talent as the apprenticeship pool is thinning out. Not as many people want to get into construction as they did in the past.”

While agreeing that training is important, La Place doesn’t think the contractors need to do the training. “The steel industry decided five years ago that not enough people knew how to read a rule and screw studs together. But how much intelligence and training does it take, if the demand is there, to teach people to do that? We say the drive has to come from the design community. We should provide them with tools so they can design quickly with the product and understand what they’re designing. It’s all about continuing education for the architects and engineers, to help them develop a market for their skills.

“If a major contractor has 200 3,000-square-foot houses to build, he can motivate the work force and provide the type of cost needed on the labor side. But no one is going to take their highly paid commercial work force to build two houses, even if they are 10,000 square feet each. They’re busy enough with the commercial work they already have. So we need to create the massive labor force from outside of steel framing to feed the monster called ‘residential and multifamily residential.’”

Just what does all this add up to? “We believe that when all the issues have been fully addressed,” concludes Smith, “a 25 percent market share of new housing starts in steel framing is very possible over the next four or five years.”

That’s a lot of work for any contractors, wood framers, architects or estimators who want to jump on that bandwagon-and it’s about to move on out!

About the Author
Steven Ferry is a free-lance writer for the construction industry. He is based in Dunedin, Fla.