

# Steel Framed Houses

## Across the Country & Around the World

*When most people think of house building, they don't immediately picture the bright glint of steel studs and joists sparkling in the sunlight. But steel has so many advantages that homeowners, builders and architects are choosing it more and more frequently.*

*Here are just a few projects that show why.*

### Durability

In the prestigious Southland area of Vancouver, a brand new 9,000 square foot mansion is under construction near the golf club. Already, you can see where the long drive will circle under the covered entrance to this multi-million dollar home. To the right is the wing that will house the exercise facilities and master bedroom suite. To the left is the wing with media room, billiard room, four additional bedrooms, kitchen and dining areas, and an attached coachhouse/garage. Straight ahead, the entry leads to a magnificent living room with a soaring 30' high cathedral ceiling. When everything is finished, the imposing granite walls will give a sense of eternity.

Behind those walls there is a steel framing system which combines a heavy structural steel skeleton with lighter gauge steel wall studs, floor system and roof rafters.

"We decided to use structural steel for things like the roof ridge and bracing, mainly because of the weight of the exterior granite, which is three inches thick," says Denis Arseneau, project architect with Stuart Howard architects, Vancouver. "Then, we filled in with conventional residential steel framing members. With steel, we could get the strength we required, without having to worry about shrinkage or twisting. It would have been very difficult to meet those requirements with conventional wood frame construction."

Wood framing members are often flawed -- they are warped or have knots. They can compress and shrink. Steel, on the other hand, remains constant. It can resist earthquakes -- an

important consideration in Vancouver. It can support greater loads, and it can do it over greater distances, with less deflection or movement.

For the owners of this house, durability was one of the most important considerations, Arseneau says. "They want this home to last for generations."

### Better Quality

But it's not just mansions that are built with steel framing. And it's not just millionaires who want quality materials.

Elton and Nina Culpeper started looking for a new home when their twin daughters were getting ready to start university. They wanted a house to retire into -- a low maintenance bungalow with plenty of space for entertaining, and quality construction for the long term. When they saw the lightweight steel framing in Monarch Construction Ltd.'s model homes in Burlington, Ontario, the Culpepers recognized the technical advantages immediately. And they both knew they didn't want the problems that can come with wood.

"In a wood house, if you start looking down the walls, you're bound to see some kinking and bulging," Elton says. "That's because the wood studs and joists can shrink and twist as they dry out. Some change quite a lot, so corners tend not to be square -- and you get cracks and nail heads popping out of the drywall."

"That's what we had in our previous house (a two-storey unit built in the early 1980s)," Nina adds. "And everything squeaked. The kitchen was terrible. In the winter when things dried out it was really bad."

Elton laughs. "Here, the only thing that squeaked was the staircase going down to the basement -- which is made out of wood. And we have had no nail pops."

Mike Bryan, Monarch vice president, says this experience is typical for the company's steel-framed homes. "The end product is better, and the after-sales service calls are less. There are fewer nail pops and drywall repairs to do, which are two of the main repairs in single family homes. The walls are straight, because the material doesn't vary in quality the way wood does. And the floors don't move as much, which is why there are fewer squeaks."

Monarch has been offering steel as an option on its homes in the Burlington project for the past two years. They have had as many as five on the go at one time.

### Burlington

*(Photo: B. Poole)*  
Nina and Elton Culpeper wanted long-term quality and straight walls -- so they chose steel framing for their new bungalow in Burlington, Ontario.

### Vancouver

*(Illustration: Stuart Howard Architects)*  
This 6,000 square foot Vancouver mansion will use steel's durability and strength to support massive granite walls.



## Energy Efficiency

New Brunswick builder Dwayne Fairweather recently completed his first steel home -- a 2,700 square foot house overlooking the river just outside of Fredericton. Fairweather had been active in commercial building for some time -- where steel framing is common. So when friends wanted to move up from their 14' x 55' modular home and asked him to give them an estimate, he gathered all the latest research on how to use steel framing systems for housing.

One of the early problems had been energy efficiency. If builders put up steel framing and then just insulated between the studs, heat could escape to the outside through the metal.

"Some people think the 'thermal break' is still a major problem," Fairweather says. "But steel building technology has solved that issue."

The trick is to insulate the house on the outside as well as between the studs, completely covering the steel framing with rigid insulation boards or one of the new sheet products. Then, the siding or brick is installed over top. Adding this layer of exterior insulation stops the heat transfer and significantly improves the thermal performance of the whole wall.

In fact, Leo De Meo, projects manager for construction and manufacturing market development for Dofasco, Inc., says recent research found that three properly insulated steel homes used approximately seven per cent LESS natural gas for heating than three equivalent homes built by the same builder to the same high standards, using wood framing.

Fairweather's 30' x 30', chalet-style house has a preserved wood basement with steel framing, steel frame walls with plywood sheathing, and 8' wide steel roof panels. By pre-assembling

foundation, wall, floor and roof panels and then shipping them to the site, he was able to cut both costs and construction time. His estimate was 18 per cent lower than the closest competitor using wood framing. Once the reinforced concrete slab for the basement floor had been completed, "the house was erected in 11 hours."

He has already been asked by seven other families to give them estimates on a new steel-framed home, there's a possibility of working on a new subdivision, and he started steel framing for a three-storey mid- to upper-income apartment building in the spring of 1998.

## Ease of Construction

Panelization has also been the key to Alberta builder Wayne Barry's highly successful housing project for the Broman Lake native band council 200 km west of Prince George, B.C..

Five years ago, Barry's company, Metallic Homes Inc. of St. Albert, developed an all-steel engineered structural building package, which combines lightweight strength with ease of construction. Since then, he has built a number of custom houses in the Edmonton area.

This project was something new. The band wanted to build its first social housing units: six bungalows of just over 1,000 square feet; two of them designed as duplexes. Construction wouldn't start until late October of 1997, and all the homes had to be finished by the end of February, so speed was important. So was cost -- and it would have to include all freight costs from Edmonton.

In Barry's system, basement and wall panels are completely made out of steel -- they use sheet steel sheathing as well as steel framing. The floor system combines steel joists with poured concrete or plywood composite. The roof supports (called "trusses") are steel as well. The roofing material laid over the plywood base can be asphalt shingles, tile or --

as in this project -- steel. While one of these homes is under construction, the whole thing shines like a spaceship.

All steel for the Broman Lake houses was manufactured in Edmonton, and then trucked 1,000 km in to the B.C. interior. It's lucky steel is only 60% of the weight of its equivalent in lumber. "That means freight charges are lower," Barry says.

Part of the project involved training four band members in the assembly process. At Broman Lake, they helped as the sites were excavated, concrete slabs were poured and then the steel packages were erected. Roof trusses were assembled on site from pre-cut pieces. Before the siding was attached, the homes were insulated on the exterior with rigid foam insulation and a "wrap" insulation made of bubble-pack plastic that also acts as a vapour barrier and air seal.

"It took us just six weeks from when the hoe hit the ground to complete closing in, ready for interior finishes," Barry says, proudly.

Maureen Luggi, band chief, says the project started on time and showed "overwhelming progress" from there on. "Metallic Homes delivered the keys to these homes on February 6, 1998 -- three weeks ahead of schedule."

"And," says Barry, "we were one of the few projects of this kind to come in under budget."

It's not surprising he now has orders for another 12 units.



### Fredericton

(Photo: Dwayne Fairweather)  
Applying exterior insulation right over steel framing members provides excellent energy efficiency for this house just outside of Fredericton, New Brunswick.



### Broman Lake

(Photo: Metallic Homes)  
Components for all-steel homes were trucked almost 1,000 km into the B.C. interior, and erected in record time.

## Environmental Impacts

Don Cardill's company, Donwel Construction, has become known in the Ottawa Valley area for his semi-custom homes designed for energy efficiency and environmental sensitivity.



## Ottawa Valley

(Photo: Donwel Construction)

*This Ottawa valley home fits beautifully into its environment — especially because there is very little waste with steel framing, and what is left over can be recycled instead of going to the dump.*

He offers ground source heat pumps -- which use the earth's own heating and cooling energy, extracted from water in pipe systems below ground. He is just introducing a new septic system which uses natural peat beds to treat waste water. Steel framing fits right

company will be offering semi-detached houses and townhomes as well as single detached -- all using steel.

## Healthier Homes

In 1994, Fifthshire Homes of Concord, Ontario, built the first steel-framed home to meet the exacting criteria for energy conservation and ventilation set out in the industry/government R-2000 program. It was publicity for that home that first attracted the attention of Cathy and Dave Mathewson.

Cathy suffers from chronic fatigue, headaches, congestion, and interrupted sleep -- all caused by environmental toxins. The Mathewsons were looking for a house she could live in: a house designed to avoid harmful chemicals, molds, and dust.

"The steel framing was what first attracted us,"

Cathy says. "We've lived in a lot of different houses, and we knew that you can get molds on wood. I'm very sensitive to them. You don't get molds on steel."

John DiCarlo, Fifthshire president, says there were a lot of changes to conventional construction in the Mathewsons' house. For example, chemical additives were avoided in the concrete used for the basement. Glued products like particleboard, which give off a lot of toxins (a process referred to as "offgassing") were avoided. Hardwood and ceramic floors were used instead of carpets, which trap dust and often contribute to offgassing. Special paints were used. Cabinets were made from solid wood wherever possible.

The airtight construction of R-2000 houses helps to keep dust and pollutants out of the

home, while the special attention paid to ventilation ensures stale air gets exhausted, and fresh air is brought in. This house has a special cut-off switch, DiCarlo says, so that all openings can be shut tight if neighbours are spraying their yards. It also has extra exhaust fans.

The house certainly hasn't solved all of Cathy's problems. But it helps. "I couldn't cope if I was in another house," she says. "I'm still coping here."

Fifthshire is committed to housing research and improvement. It has investigated new approaches to problems, and has conducted research into energy use in steel-framed homes (the study with Dofasco mentioned above).

Since building the Mathewsons' house, Fifthshire has offered "healthy" features on all its new homes. Twenty eight have been built in its subdivision in Sharon, Ontario. The company is also building a number of very large steel homes in and around Toronto.

Fifthshire Homes were recognized for outstanding service and quality of construction by the Ontario New Home Warranty Program. They received the 1998 "Ernest Assaly Central Ontario Regional Builder of the Year" award.

## "A Hand Up"

Over the 1990s, steel construction has become more common in Canada's private sector housing market. Now, it's making its way into the voluntary sector as well.

In January, 1998, the Hamilton Habitat for Humanity group started building a steel bungalow for Hung Huynh and Thuy Kim Bui, and their sons Kevin (3) and Tony (2). Habitat for Humanity is an international non-profit, non-government Christian housing ministry, which tries to provide families in need with "a hand up, not a hand out". Working through a partnership of volunteers, homeowners, businesses, churches and community groups, local affiliates assemble donations of materials, land and funds, through volunteer labour and the homeowners' "sweat equity" to produce low cost housing. A new Habitat for Humanity home is dedicated somewhere in the world every 48 minutes.

in to that sensibility, because it's also good for the environment.

"When you build in wood, there's a lot of waste," Cardill says. "You can easily fill a whole bin for every house. Then, to see that all get burned or hauled away -- it's just terrible."

With steel, contractors can order all the pieces cut to the length they need -- so there's very little waste. "What's left over couldn't even fill up a wheelbarrow."

And everything in that wheelbarrow can be recycled. All steel products are 100% recyclable, and two thirds of all steel products from cans to cars actually do get recycled -- the highest rate of any material. The steel framing used in

houses contains a large percentage of recycled metal. "I gather even my old Ford's in there," Cardill laughs.

His company builds 10 to 20 of these homes a year, from 1,250 square feet up to much larger sizes. Most of his customers are professionals - many are buying their second or third home, and they know what they want.

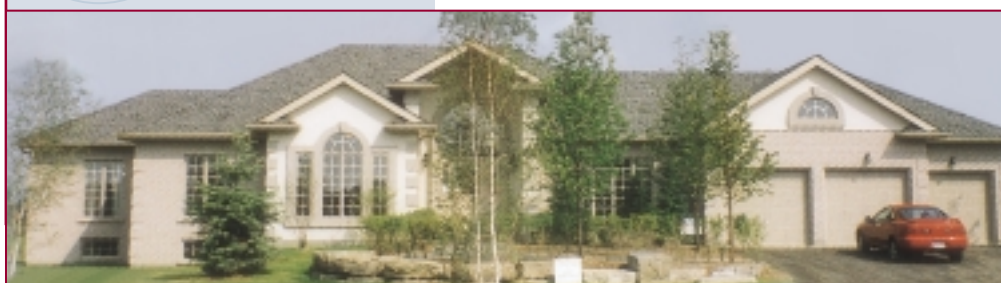
Of the last 40 customers to buy a home from Donwel, only one has chosen wood framing. The rest have all gone for steel. In 1998, the



## Toronto & Area

(Photo: Dofasco)

*Fifthshire build high quality energy efficient homes in and around Toronto. This home from their Sharon Hill Estates is typical of many beautiful designs they have built.*





### Hamilton

*Hamilton Habitat for Humanity (Photo: Stelco Hilton Works)*

*Hung Huynh holds his son Kevin (3) as Hamilton Habitat for Humanity building chair Terry Charters (left) and Stelco Hilton Works vice president Paul Paciocco help the little boy fasten part of the family's new steel home.*

Norm Westbury, chairman of Hamilton Habitat for Humanity, says the steel home idea got rolling through a combination of factors. Members of Local 1005 of the United Steel Workers of America volunteered for the group's earlier conventionally framed house -- and then got Stelco enthused about the idea as well. The local and its parent union are major sponsors. Stelco Hilton Works donated all of the steel for the whole house, including framing, siding and roof. John Bruzzese, president of Armour Steel Framing Systems, who sits on the Hamilton Habitat board, got his company involved. Dozens of other companies, individuals and service groups helped to make the house come into reality.

"We did the panelizing in the plant," Bruzzese says. "Then it was erected on site, with the framing crews volunteering their time. Other volunteers helped to unload the panels off the truck, carry trusses and floor joists and hold pieces in place as they were joined together."

Westbury says they would like to do this kind of home again. And if they do, volunteers will be invited out to the plant, to help put panels together as well. The speed with which this

home went up was incredible, he says. "The materials may be a higher cost, but you save so much time, it ends up saving money. And you can get clear spans right across the basement without having to have any supports."

Habitat for Humanity representatives were very impressed with the steel home. "It's caught on to such a degree that Regina already has plans to build an all-steel home this summer," Westbury says.

## Around the World

Canadian companies are not just building steel homes here; they're also beginning to export them around the world. Projects range from low cost housing in developing countries, to high end homes in quality conscious markets such as Japan and Europe.

Andy Hébert of EXL Contracting Ltd. in Halifax, N.S., has been using steel framing in commercial construction for 30 years. Four years ago, he got into residential construction in the rural and suburban areas around Halifax, where he rapidly became the industry leader. In the fall of 1997, he did his first export project -- building one model home for a housing company in Germany.

"When I came back, I don't think the plane had touched down before the calls started," Hébert says. "I got home and there were calls from several countries already."

Hébert is working on plans for two more houses in Germany now and there is plenty of potential. But, he says, "we're not the only ones chasing this market. I'll take these one deal at a time."

Steel framing systems really lend themselves to the export market because they are so lightweight, and can easily be shipped in containers. Steel can be pre-cut by Canadian manufacturers with most of the assembly left for overseas, or entire wall and floor modules can be completed here -- with insulation, sheathing, plumbing, electricity and sometimes even windows, doors and cabinets in place -- and shipped out needing only minimal assembly. How much prefabrication is done will depend availability and cost of labour and materials in the foreign market.

Bruzzese, who did the Hamilton Habitat for

Humanity project, has recently finished four model homes of 500 to 1,000 square feet in Tijuana, Mexico. The company is actively pursuing projects in several other countries as well, including Russia, Ecuador and Peru.

Their Mexico project used a system not seen here in Canada. Houses are built with steel framing, which is covered with a wire mesh, then a coat of cement is applied, to create the exterior shell. Insulation is added inside -- more for keeping the house cool in summer than for winter heating -- and roofing is either



### Mexico

*(Photo: Armour Steel Framing) Steel-framed bungalows like these were erected at a Tijuana site in four days.*

steel or cement tile. Once erected, the panels are covered in a stucco finish.

For the model homes, all components were sent in containers from Canada. "The

containers arrived on a Saturday, and we had the houses finished -- walls, roof, plumbing, electrical system and drywall -- on the following Tuesday," Bruzzese says.

*With their impressive list of advantages -- they're durable, high quality, easy to construct, energy efficient, healthy, suitable for everything from mansions to charitable projects, across Canada and around the world -- steel framed houses are likely to become more and more popular in the future.*

*Keep your sunglasses handy if you're driving past a new home construction site. You can expect to see more bright glints of house framing, sparkling in the sunlight.*

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### Mexico

*(Photo: Armour Steel Framing) Workers unload pre-assembled panels for model homes in Tijuana, Mexico.*