

RESEARCH AND IDEAS

The Little House That Could

The newly completed Carborne prototype, built by Ryan Homes in Rochester, New York, proves that good things really do come in small packages. It also proves that existing house designs — even those already considered to be energy efficient — can be cost-effectively redesigned to improve their performance.

As shown in Figure 2, the Carborne is a two-story, 1,244-square-foot house with a full basement and attached garage. It's located in the Beaver Creek community, and was built with design and research assistance from the Consortium for Advanced Residential Buildings (CARB), one of four Building America teams sponsored by the US Department of Energy.

The challenge presented to the design team was to redesign an existing Ryan model — called the Hathaway — into a slightly downsized starter home that would sell to first-time buyers in the \$80,000 to \$110,000 market. More comfort and more energy efficiency were the design goals, to be achieved without adding any costs. From a marketing and mortgage financing standpoint, Ryan Homes was also hopeful that the new design would qualify for a five-star Energy Star rating.

"Our problem," says lead designer Don Clem, a senior architect with Steven Winter Associates (SWA — Norwalk, Connecticut), "was that our starting point, the Hathaway model, was already tightly built and fairly energy efficient — meeting the 1995 Model Energy Code and New York State Energy Code — so there weren't any giants left to kill. Happily, we were able to combine a number of modest but measurable improvements to reach our goals and ended up with a nice house that qualifies for a five-star rating."

So pleased was Ryan Homes with the final design that the company — one of the largest production builders in the US — has decided to offer it nationwide.

"When a production builder of its size adopts these kinds of changes nationally, it really makes a big impact," says Ren Anderson, of the National Renewable Energy Laboratory (NREL) team that ran performance tests on the Carborne house. "The whole point of the Building America program is to get these technologies out into the world, being used by builders."

How Little Things Add Up

As shown in Tables 2 and 3, the designers met their goal by beefing up the insulation in the attic, walls, and foundation, lowering the infiltration rate (using taped Energy Brace sheathing), and specifying

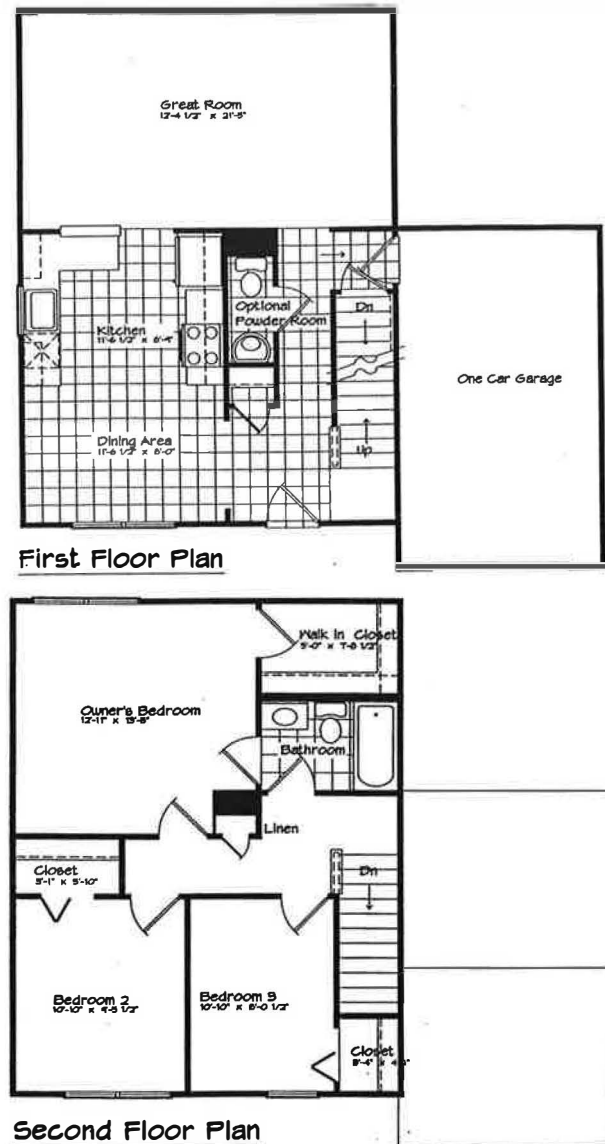


Figure 2 — Carborne floor plan. The house has 1,244 ft² (1,844 ft² if basement is included).

Carborne Prototype "Flexes" Its Muscle with CSST

Almost since time began — well, for a hundred years, anyway — plumbing contractors in the Rochester, New York, area have been installing gas lines made of black iron pipe, laboriously threaded and fitted together using Ts, unions, and elbows. No wonder, then, there was a bit of a stir — and maybe a little grumbling — when Ryan Homes decided to try flexible gas piping in its new Carborne prototype.

More precisely, the product used in the Carborne is known as corrugated stainless steel tubing, or CSST. Long used in industrial settings to transport chlorine and compressed air, the residential version is wrapped in a polyethylene jacket (instead of wire braid) and comes in 0.38-, 0.50-, 0.75-, and 1.00-inch diameters. Since CSST was first introduced for residential gas lines in 1990, its use has grown 20% a year and now accounts for about 10% of the 150 million feet of residential gas piping installed each year.

"Though CSST costs more per foot than black iron, a contractor can complete the job in one-half to one-fourth the time," says Bill Rich, director of marketing with Mestek, Inc. "In other words, the savings in labor more than offsets the material costs." Mestek's Omega Flex subsidiary, in Exton, Pennsylvania, manufactures the TracPipe CSST used in the Carborne house. Several other companies in the US — including Titeflex Corp. (Springfield, Massachusetts), Parker Hannifin Corp. (Cleveland, Ohio), and Tru-Flex Metal Hose (West Lebanon, Indiana) — manufacture competing products.

CSST can be bent by hand and snaked through walls and floor cavities in much the same way that electrical wire is pulled. Only a few common hand

tools are required for installation. CSST weighs substantially less than black iron pipe and requires less setup time, less assembly, and less tear-down time, says Rich. "It also allows you to easily add a gas line for a new addition or appliance later on, which would be very difficult and expensive to retrofit with black iron."

Rich tells **EDU** that CSST becomes especially competitive in larger custom homes that have island ranges, gas fireplaces in the bedrooms, and perhaps multiple water heaters. Another important cost determinant is the diameter of CSST used. "Where gas utilities provide high-pressure residential service (2 psi), you can use ½-inch CSST, which isn't much more expensive than 1-inch diameter black iron," explains Rich. "In areas where there's low-pressure service (0.25 psi), 1-inch CSST has to be used, so you lose some of your cost advantage."

As shown in Figure 4, CSST can be installed to a central manifold or hub, creating a gas service panel that is analogous to an electric service panel. Thus, a plugged outlet on the manifold could be left for future expansion in much the same way that a new electrical circuit might be added. But it's not clear that home buyers are much interested in a central service panel or willing to pay for it (see **EDU**, November 1997).

The Carborne prototype also features a quick-connect gas outlet manufactured by M.B. Sturgis (see Figure 5). The Sturgis Convenience Outlet was installed adjacent to the Carborne's deck, enabling the homeowner to quickly connect (or disconnect) a gas barbecue grill.



Figure 4 — CSST is installed to a service panel with central manifold.



Figure 5 — The Gas Convenience Outlet, from M.B. Sturgis (Maryland Heights, Missouri), makes it safe and easy to connect and disconnect gas ranges, clothes dryers, outdoor grills, etc. Manual on-off and automatic shut-off valves with a safety interlock prevent connection or disconnection of an appliance when the outlet is in the "on" position. Built-in thermal protection prevents gas flow if the outlet is exposed to temperatures in excess of 200°F.