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Better homes through science

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CHAPEL HILL -- Lumber, nails, shingles, Sheetrock and perspiration are common ingredients in home building.

Science doesn't spring to mind as an element in the mixture. But in this age of the Internet and cell phones that can snap and transmit photographs, it should come as no surprise that home construction is evolving as well.

Engineers and contractors are teaming up to create more energy-efficient and less-toxic houses.

Frank Cole Building Company Inc. in Carrboro is one such company. Cole and his partner, Art Kaplan, enjoy working with science to build a better home.

"The only way you can do that is use a lot of quality control and to use building science to create the mechanical approach," Cole said.

The company builds custom homes with the promise of a 50-percent reduction in electric bills and much cleaner air inside the home.

"People are more attuned to pollution, allergies, asthma, and this has led them to scrutinize indoor-air quality," said Kaplan, who received a chemistry degree from UNC and studied botany in graduate school but decided he enjoyed the science of building more.

"The greatest source for indoor air pollutants is a crawl space," Kaplan said. "It's dark. It's a perfect mushroom-growing climate, dark and damp. No one wants to breathe that."

Cole and Kaplan built Holden Richards' 3,000-square-foot house in Hillsborough in 1998. Richards said the builders' words were more than just promises -- they have been fact.

"I'm extremely prone to allergies," Richards said. "Since I've lived here, I've improved dramatically. It does make a difference."

Richards said the monthly electric bills are between \$120 and \$150, regardless of season. "I live in an all-electric house," he said.

The benefits of this type of construction even extend to the wood floors, according to Richards.

"It keeps the floors from getting moisture and buckling. Our wood floors are stable," he said. "We don't see the expanding and contracting nearly as much as you would in a standard wood floor. I'm sure I'll get a lot more life out of my wooden floor."

Cole said it took about 10 months to build Richards' house and the cost was around \$400,000. He said the company builds four to eight houses a year as well as doing two to three major renovation projects, all of the work taking place in Orange, Chatham and Durham counties.

Cole and Kaplan scoff at the notion that today's homes are built too tightly. Cole said the problem is most houses are not sealed well enough from possible contaminants.

"Development-style houses are built to specific marketing standards," Cole said, "and often from a low-bid approach. It's more like mass-produced construction. They don't really try to engineer the approach to heating and cooling, which includes the way you treat the thermal envelope. The thermal envelope includes everything that surrounds your heated and cooled space."

So Cole and Kaplan build integrated systems that provide a steady temperature while generating cleaner air to breathe.

"In a crawl space, we wouldn't use batts (of insulation) between the joists to try to insulate your crawl space," Cole said. "We wrap the interior of the foundation with a material called Reflectix as well as putting a batt-type material at the perimeter only."

Reflectix is a heavy-duty bubble pack with reflective barriers on each side. It was developed by a Swedish company to be the insulator for the Apollo spacecraft.

"Your foundation wall is wrapped with Reflectix, lapped and sealed together," Cole said. "Then on the floor on the crawl space, we would seal to the Reflectix a thick Visqueen vapor barrier. Whatever is under there is going to be sealed from dirt. That is the point, to seal your crawl space away from your exterior air and the dirt."

"The crawl space is about the same humidity and temperature as your house," Cole said. "And it's part of the thermal envelope now, so the air is relatively clean."

There are no foundation vents.

Cole advises his customers to keep the fan running on their heating and cooling units even when the system itself is not operating.

"We recommend you leave the fan on your central-air mover," Cole said. "It is being filtered at all times. It keeps your ducts cleaner and keeps humidity from building up in your ducts. Consequently there is less chance for crap to grow in your ducts."

Cole uses additional materials to create tighter seals around windows and doors as well.

"No house is hermetically sealed," Cole said. "We do our best. We feel like you can't seal a house well enough, no matter how you try. And we try very hard, using nontoxic materials."

Electricity powers these homes, which utilize heat pumps for cooling and heating. Heat pumps have a reputation for failing to keep people warm in the winter.

But once again, Kaplan said, science has made a difference.

"When heat pumps first started, they blew out 98-degree air and everybody was cold and uncomfortable," Kaplan said. "The scientific approach changed that. What they discovered is you take that same air and move it slower, and it didn't feel cold anymore."

Engineers who developed these systems put separate electrical meters on the heating and cooling systems in the early years to test their theories of energy efficiency and found that they really did cut electrical use by 50 percent or more, Kaplan said.

Cole and Kaplan would not guarantee results for their customers if they were not convinced.

"People are ignorant about all the aspects of what a house is and what's in it," Cole said. "I know what I don't know, and I'm willing to research and develop around specific problems that need to be solved for each of our houses."

Richards said that he has been thrilled with the results in his home, both with savings and the quality of the air.

"The environment in our house is exactly what we let in," Richards said. "It's not like we're inviting the whole outside in. With Frank and Art, you get a level of quality on everything that happens. It's done to a higher standard."

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