

BY TED CUSHMAN

Energy Codes Force Framing Evolution

In a world where the bleeding edge gets a lot of press, it's worth pausing occasionally to remember that big production builders still account for a third or more of single-family housing starts in the United States. And if you're not a big production builder (or working for one), you may well be competing against builders in your market who are using mass-production techniques to bang out mass-market homes at a mass-market price. That competition doesn't leave you much wiggle room for experimenting. It's fun to build an ultra-efficient house, but it's hard. Even harder is selling that house at a profit in a competitive market.

Energy efficiency is one way for a small builder to compete effectively with the big guys. But the big guys are competitive too. When it comes to energy efficiency, production builders are also pushing their limits—but they're doing that under the discipline of rigorous cost control. That's why the Department of Energy's Building

America program, whose goal is to change mainstream building practices, focuses on evolving incremental improvements that can boost a home's energy performance without adding too much to the cost—or better yet, improve the energy equation while actually saving money on construction.

One good example of this approach is the research into “advanced framing” that's going on at the Home Innovation Research Labs (formerly known as NAHB Research). Engineer Vladimir Kochkin has been looking into the structural capabilities of advanced framing methods. Kochkin has studied four changes that production builders could make to improve the thermal performance and airtightness of their building shells, without spending a whole lot on the upgrade: two-foot on-center framing for walls; raised-heel trusses for increased attic insulation; continuous drywall where partitions intersect exterior walls; and headers integrated into the rim joist. The point is to boost insulation, improve airtightness, and reduce thermal bridging—all with framing changes that production framers can easily wrap their heads around.

“Advanced framing” has been around a long time. Introduced as “optimum value engineering,” or OVE, by the Department of Housing and Urban Development (HUD) in the 1960s, the concept is simple: Use less wood in the wall so you can use more insulation. For decades, the idea has hung around without really catching on. But in recent years, as government policy has driven a rapid toughening of the energy code, advanced framing has started to emerge as an important strategy for meeting code without pricing your product out of the market.

For builders in milder climate zones, the purest and simplest form of the advanced-framing concept is to switch from walls framed with 2x4s at 16 inches on-center to walls framed with 2x6s at 24 inches on-center. The two versions use roughly the same amount of wood and have roughly the same bearing capacity, but the 2x6 wall has about 30% less thermal bridging. The 2x6 wall's greater stiffness against lateral wind loads on the face of the wall is a freebie, and the reduction in construction labor—fewer pieces to handle, fewer nails to drive—offers a net savings. Other wood-reduction tricks, such as two-stud corners, cut thermal bridging further.

But more-complicated changes, such as rim-joist



Integrating bearing headers into the rim joist—or, in the case of non-load-bearing walls, omitting the header entirely—can reduce thermal bridging and improve wall performance while reducing framing costs.

Photos by Randy Melvin

headers and “energy heel” trusses, raise engineering questions. Can a header integrated into the band joist really carry the required load? Will raised-heel trusses topple if a wind load pushes the roof sideways? As engineers take a closer look at the structural issues involved in meeting the energy code, framing solutions that work are finding their way out of the engineering lab and into the building code.

A January 2013 report from Home Innovation Research Labs, “High-R Walls for New Construction Structural Performance: Integrated Rim Header Testing,” lays out the results of load testing for band-joint headers that need to carry floor loads as well as wall loads. That study helped the officials revising the International Residential Code (IRC) create prescriptive standards for load-bearing rim headers, which have now been written into the 2015 edition of the code.

Another Home Innovation Research Labs investigation, into structural bracing for raised-heel trusses, hasn’t found its way into the code yet. But the observations from that study indicate that raised-heel trusses, which allow for deep insulation levels over the wall plate in a pitched roof, can be effectively braced against toppling just by extending wall sheathing up onto the vertical heel portion of the truss, rather than with complicated solid blocking between trusses. The IRC method is limited to low-wind-speed zones and relatively low truss-heel heights. But builders can push those limits with the help of an engineer.

“In the last few code cycles, more and more of this is showing up in the IRC,” says Randy Melvin. Melvin, who is now an independent building industry consultant, worked until recently as the director of research and standards for Winchester Homes in Virginia and Maryland, and he spearheaded Winchester’s involvement in a field trial of advanced framing methods in cooperation with Home Innovation Research Labs.

“You need to check with your code official,” says Melvin. “There are parts of the country that are still back on the 2000 code. But most jurisdictions—if you reference a section of newer code, even though that jurisdiction is on the older code—will permit you to use the newer section of code.”



Raised-heel trusses allow for deep insulation above exterior wall plates, but complicated blocking between trusses can add labor cost. However, research shows that properly installed sheathing provides sufficient bracing in many cases.

For Winchester Homes, using advanced framing was the most practical approach to meeting the toughening Maryland and Virginia codes—and it positioned the company well for future code advances. At the International Builders’ Show in Las Vegas, Melvin, who was still on Winchester’s payroll at the time, told a seminar group: “We looked at different systems, and we determined that advanced framing made the most sense because of cost and flexibility, and because it’s a limited departure from what we were already doing. It’s not a big change for the trade base, and that’s really critical—because if it doesn’t work with the trade base, it’s not going to work.” After proving the concept in a model home, Winchester moved the methods into production and applied them to all its house plans.

With the advanced framing advantage, Melvin says, builders can reach performance equivalent to R-20 using an R-19 batt,

because of the reduced thermal bridging factor. Switching to R-21 batts instead would have resulted in a marginal improvement at a serious up-charge in price; sticking with R-19 batts and improving the framing system saved more energy while also reducing framing labor. And the method future-proofs builders against the next code change: With Owens Corning ProPink L-77 blown-in fiberglass insulation, a 2x6 wall framed at 24 inches on-center can achieve R-24 with no change in framing.

“So we are good to R-24 right away, no problem,” Melvin told his Builders’ Show audience. “But if it goes up beyond that, maybe we could add a couple of inches of high-density closed-cell polyurethane inside, and then eventually, maybe some additional insulation outside. So this is a very expandable system.”

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