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PHOTO: RAY NG

Dynamic Conditions

Performance requirements for wood-framed wall systems have changed considerably. Here's how to meet today's conditions and set new standards.

When engineers and architects specify wall systems for a given project, they must account for a wide range of conditions, from loads and longevity to regional climate and site concerns to timing and financial constraints. In a high-performance home, you must consider carefully the interaction between these dynamic components. While this article focuses on wood-framed wall systems, the same thinking applies to all types of construction.

At first glance, walls are simply a sandwich of bricks and sticks, insulation, some cladding for aesthetics, interior coverings, and a few coats of paint. That seems fairly simple, but we need to carefully consider the selection and assembly of each layer. Every region of the country has climate and seismic conditions that will define the proper wall section, including structural needs, insulation levels, moisture control, weather management techniques, and air-quality requirements. To add further complexity, many of these layers will interact with one another in ways that may not be evident. For example, in some climates HVAC system components alone could cause an otherwise well-thought-out wall system to fail.

WOOD-FRAMED WALLS

We know wood framing requires careful design and construction, and that wood-framed structures can be susceptible to premature failure when we ignore the basics. But because projects rely on multiple trade contractors, each one narrowly focused on a specific task, breakdowns in overall building performance are bound to occur.

All wall systems have multidimensional factors at play: materials, environmental conditions (inside and out), and construction quality, to name just three. Figure 1 (page 18) shows what I would consider the fundamental components for a high-performance wall section. Compare them to your own techniques, and make sure you're covering these basics before you move into more advanced green building systems. Here are five techniques you can employ immediately that will make a significant difference in the performance of your wall systems:

1. Use blown-in insulation systems on every new building. Select blown fiberglass, cellulose, or spray-in-place foam. I believe we need to move away from poorly installed fiberglass batts.

2. Detail the air-barrier system you will use. If you use spray foam, caulk your bottom and top plates, and the job is done. If you install fibrous insulation, ensure bottom and top plates are sealed using high-quality caulks or gaskets. Increase insulation levels by providing rigid foam blocking behind tub decks, shower stalls, soffitted framing, and any other complex framing areas.

3. Use advanced framing techniques whenever possible. Design for 24-inch on-center 2x6 walls with wood sheathing or proper bracing with a combination of wood and foam sheathing. This will ensure the wall system is ready to accept more insulation. Foam sheathing also can address the dew-point issues that can affect many climate regions. Just remember, more insulation is good. It reduces equipment size, uses less energy, and keeps homeowners comfortable.

4. Use significant care and attention when detailing the weather management system. Panflash every window and door. Seal all penetrations in the wall with products that integrate completely with the weather barrier system. In climate regions that exceed 25 inches of rain annually, use a system that creates an air space between the cladding and the sheathing. Use products with properties that are compatible, as some sealants don't work well with others.

5. Use paperless gypsum in areas prone to excess moisture exposure. Use cement-based tile-backer products that are specifically designed for moisture-prone applications. Do not rely on green-colored gypsum to prevent moisture problems in bathrooms.

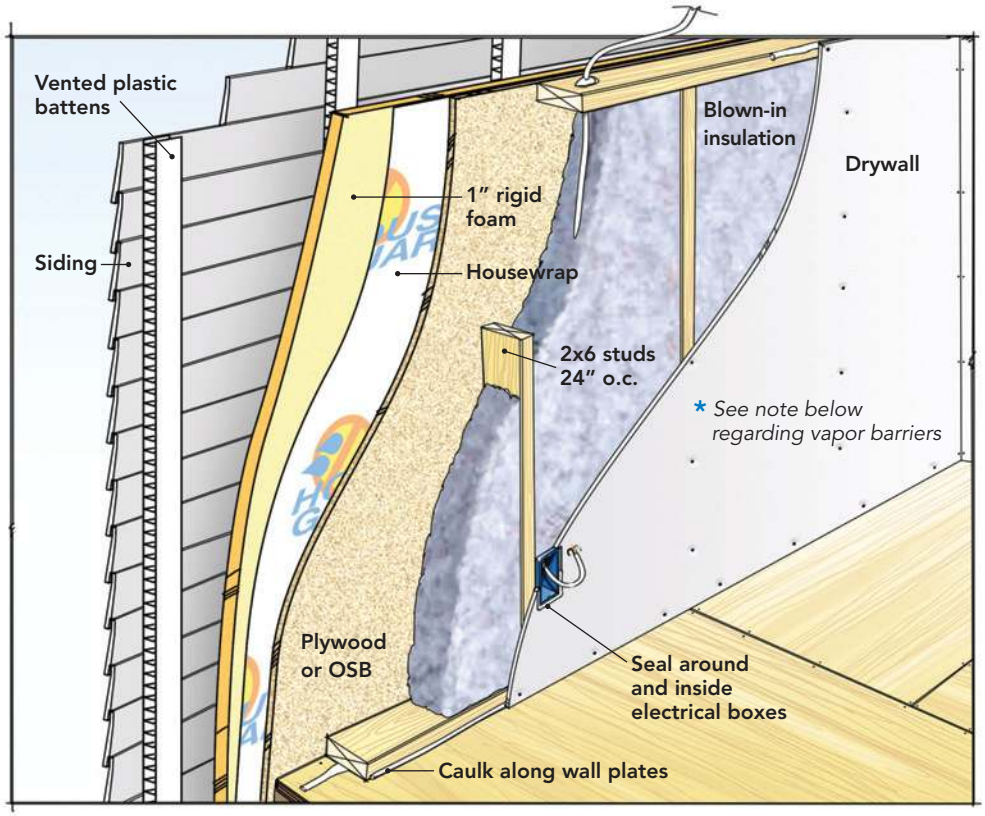

Figure 1: The fundamental components of a well-built wood-framed wall. Combined, these elements provide moisture control, high-R insulation levels, and reduced air leakage. Consider this as the new minimum standard for high-performance homes.

* ***Note:*** *Strategies for addressing moisture vapor movement will vary depending on your climate zone. In most locations, I recommend using a low-perm paint finish on the drywall for the vapor retarder. Only in extremely cold climates (colder than Zone 7) should you consider using a polyethylene vapor barrier.*

The wall section in Figure 1 will be satisfactory in most climate conditions. Exceptions are areas with extreme variations in temperature, rainfall, humidity, snow amounts, and seismic conditions. Though wood-framed walls are the most common wall systems in the country, they have their limitations. With an understanding of the special conditions of your particular environment, you can employ innovative products and techniques that will enhance performance and extend the durability of the wall.

In my travels, I see too many buildings that don't employ these fundamentals, and the range of system failures is increasing. Who have you put in charge of air sealing? Who is testing your buildings for air leakage, thermal integrity, and weather management details? If you can't answer these questions, you can't succeed at building sustainable homes.

TRAINING AND EDUCATION

Unfortunately, many trade contractors are unwilling to apply these advanced framing techniques without charging more for their work to cover their on-the-job training. One builder I know in Austin, Texas, is working with his trades to share the cost of learning new skills. He began the process with a meeting in which he explained his goals for improving his homes and how everyone involved will benefit from learning new techniques. He asked for his trades to try these systems with him, track their time, and share in the cost of learning.

ALTERNATIVE SYSTEMS

You should also consider other wall system alternatives such as structural insulated panels (SIPs). These panelized assemblies, which sandwich rigid insulation between layers of wood sheathing, are a proven system with a fairly long history, but have had limited market share until recently. Now, issues like energy efficiency, structural enhancements, air leakage, and reducing lumber use and jobsite waste are bringing more attention to how SIPs can be put to use in high-performance buildings.

Other systems, such as insulated concrete forms (ICFs), also have a reputation for providing excellent thermal performance, fire protection, structural benefits, and increased moisture tolerance. Six years ago, I used both SIPs and ICFs in building my new home. Both have given me exceptional performance, excellent comfort, and a quieter indoor environment. Like any technique that departs from your usual system, alternative wall sections will present a learning curve at first, but will quickly become the new standard.

I know many of you are making great strides in adopting these green building practices. My hope is that before you add bamboo flooring to a project to gain "green points," you make the building's overall durability the first priority. Integrated thermal performance comes next, along with good indoor air quality. Then you can focus on sustainable materials and more.

RESOURCES

American PolySteel: www.polysteel.com

"The Builders Guide," by Joseph Lstiburek: www.buildingscience.com

Building America: www.buildingamerica.gov

Canadian Mortgage and Housing Corp.: www.cmhc-schl.gc.ca

Structural Insulated Panel Association: www.sips.org

ILLUSTRATION: HARRY WHITVER