



PRINT & ONLINE

PENINSULA PUBLISHING

# BUILDER AND DEVELOPER™

*The Management Resource for Professional Homebuilders Nationwide*

Volume 30, Number 1



Issue No. 338



**BUILDER.MEDIA**

February 2020 \$10.00

## BUILDING IN CALIFORNIA AND TEXAS

### HOW DO THEY COMPARE?





## CONSTRUCTION

# Structural Design for Today's Homes

Builders should embrace new engineering practices to improve product offerings — and curb appeal

By Wayne Thompson



I have been doing structural design on single-family and multifamily structures for over 20 years, and I still get a kick out of one type of builder. Let's call him "30-year guy," or TYG for short. TYG loves to push back and believes all of our team's recommendations are "over-engineered." His argument is always the same: "We've been building this way for 30 years; why change now?"

At the risk of offending TYG and his band of brothers, a lot has changed in 30 years, and most of the changes increase the need for thoughtful structural design.

In the mid-1990s, the housing industry in most of the country began moving away from the design philosophy that had persisted since post-WWII. We all recognize the prescriptive design of those 20th-century production homes, because many of us grew up in them. Structurally, the homes' design included common bearing walls, which supported floor joists, ceiling joists and roof rafters. Room sizes were dictated by the span capability of a 2x10 floor joist or a 2x4 ceiling joist. "Open" rooms had a 6-foot-wide archway leading to the adjacent area. An entry-level house had 4x4 windows in each bedroom and a modest 6x4 picture window in the living room or great room. Mom and Dad fought over parking in front of the one-car storage garage.

As America got richer, homebuyers' tastes changed. They wanted homes that didn't look like the one they grew up in. They wanted bigger homes, with more complex floor plans, bigger garages, and more windows.

Engineering practices changed, too, driven partially by changing homebuyer demand and partially as a result of advancements in technology. Overall, the evolutions are positive, but they still present design hurdles that builders need to address. Readers not named TYG have likely incorporated new practices into their building techniques. The changes are worth noting, however, to remind us of where we were and how far we've come. TYG, consider this a primer.

**Taller Walls.** Thirty years ago, the standard ceiling height was eight feet. Today heights

average 9-10 feet. Increased heights mean that stresses due to wind loads increase exponentially. As a result, 2x4 exterior walls have become less common due to a combination of insulation and structural requirements.

**More and/or Bigger Windows.** Decades ago, people stored their "treasures" at home and needed wall space to stack against. Today's homeowner wants lots of windows, with windows in between. "Treasures" are stored in storage units across town. Natural light is a big seller, but using too many windows changes the stability of the house. Engineers are needed to provide shear wall designs to keep window walls from racking in wind or seismic events, as well as to provide proper studs between the windows.

**Bigger garages.** Mom and Dad don't want to fight for parking anymore, and ownership rates for cars and light trucks continue to rise. Besides, not everyone wants a storage unit across town. The answer? Bigger garages. But those massive garage doors leave little room to create an effective shear wall. Engineers can assist the builder in finding cost-effective methods of designing shear walls at garage

*Engineering practices changed, too, driven partially by changing homebuyer demand and partially as a result of advancements in technology.*

door openings. If the door takes too much wall space, steel or concrete structural elements may also be required.

**Open floor plans.** The open floor plan concept is great for the flow of the household. Now, parents can easily watch their teenagers play on their phones at the end of one large room. However, those walls that have been forsaken in favor of open floor plans may have also been structural support walls, meaning today's beams need to be hidden in floor systems. In addition, those old walls were good at stiffening the floor and preventing some of the bounce that often irritates homeowners. As a result, builders and engineers are now charged with examining the performance of

floor systems, and minimizing the bounce or vibrations that seem to rattle every dish in the china cabinet. In recent years, the industry has been studying the performance of manufactured wood I-joists, which can mitigate some of the issues. Structural engineers can assist with meeting the new performance criteria.

**Offset upper floors.** As homes have increasingly become investments and sources of personal pride, the architectural façade is much more of a focus. Homeowners gravitate toward houses with second floors that are stepped back from the main floor to create some interest. However, that interest comes at a price. Engineers will typically need to support the inset floor with one or more beams, and potentially steel columns in the walls. The aesthetic value of the house will usually support the extra cost for the beams, but it is always good to discuss with an engineer to see if there are other options.

To TYG's credit, he usually comes around (although reluctantly) to reacting to the changes that have happened over the years. But why go kicking and screaming into the new decade? With this list, and the help of a

structural engineer, a builder can ask intelligent questions that lead to quicker and better solutions. As for TYG, I can't wait to see what he thinks in 30 more years. **BD**

**Wayne Thompson** is Fort Collins Division Manager and Structural Engineering Department Head for CTL/Thompson, a full-service geotechnical, structural, environmental and materials engineering firm headquartered in Denver with offices throughout Colorado, and in Wyoming and Montana. For more information, please visit [www.cctl.com](http://www.cctl.com) or email Wayne at [wthompson@cctlthompson.com](mailto:wthompson@cctlthompson.com).