

From The Castle

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Self Supporting Roofs

It is possible to design and build roofs with minimal bracing. There are a few tricks that allow us to do this. First, you need to have a steep slope—6:12 pitch minimum. Also, keep the flat areas at the top of the roofs to a minimum, and if you can make the roofline fairly simple, avoiding complex intersections of hips, ridges and valleys.

We have found that it is necessary to use double LVL (Laminated Veneer Lumber—a type of plywood) beams (3 1/2" thick) in the hips and valleys to carry the loads, singles don't work in the calculations. Also, for longer spans of ridges, we can end up with some fairly deep beams.

As an experiment, we attempted to design a couple of roofs with no bracing at all. You can make it

work, but its not advisable. We ended up with triple LVL beams at the hips, and I don't think erecting 5 1/4" thick LVL beams on a roof would be an easy task. Also, at the intersections of the hips and ridges you would have to have custom made hangers, which wouldn't be cheap and would take some time to purchase.

Another attempt at the self-supporting roofs we tried extreme minimal bracing, but we ended up with having to use 3 1/2" x 9 1/2" LVL beams for roof braces. I'd be afraid to go on the job site and face a framer with a nail gun if I released a design like that.

So, as a compromise, we are designing roofs with 2x6 T bracing at the intersections where possible. In some cases we're finding we need double bracing to provide the stability needed.

We're coordinating these designs with the lumber suppliers and builders to make sure they make sense and are cost effective.

Architecturally, our designs are allowing a lot of open space under the roofs, however it is a trade off with time and cost. I don't want to give you architects out there any ideas—remember, we can engineer anything, it's how much you want to pay for it.

From an engineer's standpoint, there is very little leeway in a minimally supported roof. The plans are not suggestions, they must be followed. It's important to use good framing crews for these designs and to keep communication open with us during the erection.

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FRAMING PET PEEVES

We all see on job sites things that are really bad. This past week I had a long discussion a lumber supplier about how much it drives us crazy when shop drawings aren't followed for framing. Often you can see a TJI rafter being used as a foot path across mud puddles, or LVLs used as elevated walkways. That's not what the lumber company provided them for.

Generally, when you get a framing package from the lumber company, there isn't any excess stuff, and its all cut pretty much to length. Still, we'll see framers cut up longer LVLs and use them for headers, or not put in all the beams and joists that are called for.

The lumber company provides a pretty good set of shop drawings showing where everything goes, and how its to be erected. Yet, many jobsites I've been to don't have those drawings on site, and the framers put the stuff up without even seeing the drawing.

For a fairly conventional house, the damage from this might not be so

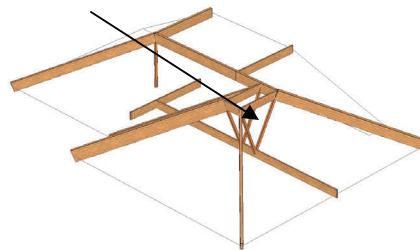
bad. Fortunately, wood is very forgiving. However, houses are getting more and more complex. We're seeing wide open floor plans, bearing walls that don't stack, long spans in floor joists, and some very heavy loads on beams.

In a more complex floor plan, there isn't much room for error. If you don't put the beams in the right place, the joists aren't doubled where called for in the plans, or worse, you put the wrong joists in the wrong place, you will have serious problems. In time the house will start to deflect, and fixing framing problems after the fact is very expensive. Worse, in severe cases you may end up with a lawsuit, which compounds the pain as you pay attorney's fees, spend hours in depositions, arbitrations, mediations, and court hearings.

All of this can be avoided fairly easily.

- Make sure the engineered lumber shop drawings are on site
- Make sure your framer understands the drawings

2 x 6 T Braces



In this roof, we were able to make it support itself without bracing in the first run, but the LVL beams were too large—we put in 4 braces as a compromise.

- Check on your framer during erection
- Spend some time to find a competent framer that understands engineered lumber and can read plans

A bit of prevention is always better than the cure, which in this business can be expensive and painful.



More than likely the TJI Joists here were supposed to go somewhere other than the front yard at this house.

OSB—BETTER THAN DUCT TAPE

They say that the wonder invention of the 20th Century is duct tape. Oddly, it's really not good for ducts, but I know I've used it for everything else. My '72 Capri was upholstered with it, as well as a couple of my pickups, the soldiers in Iraq use it for all sorts of stuff (labeling things, a hand guard to keep you from burning your hands on hot metal, patching stuff), it's a good temporary repair for just about anything, its use is pretty much only limited by your imagination.

That's fine, but OSB is even more useful in home construction. In the past few months we've been doing some really long drawn out analysis of wood structures with finite element software. One of the surprising things we found out is how much strength OSB adds to a structure.

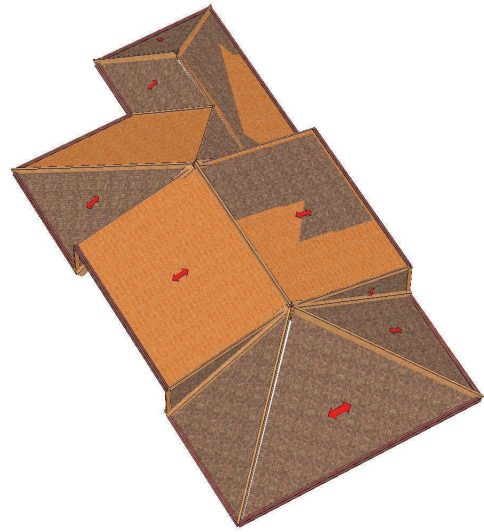
If you completely sheath a house in OSB, you not only add an amazing amount of lateral stability, it ties all the structural members together. All of a sudden you get an extreme amount of redundancy. Floors, walls, and roofs get much stiffer. It

can help compensate for undersized or improperly placed beams, studs, joists, and rafters. All of a sudden, with a house that is 100% sheathed, everything becomes much more stable.

There are also a number of other benefits that don't require extreme analysis to discover. In this area, the biggest damage that you will get from wind storms is from flying stuff (branches, trees, trash). OSB sheathing along the side of the house will provide a stronger barrier to these missiles, protecting the house many times more when thunderstorms strike, and maybe saving the house if a tornado passes by (even if the house isn't saved, it just might save the occupants).

The other advantage of putting up OSB is for security. I've seen houses that you can break into from the side by hand by simply pulling back the siding. In houses with foam board sheathing, all it would take is a screwdriver for an enterprising burglar to get in and take everything not held down.

So, for the minor additional cost of 100% OSB sheathing, a significant benefit is added in stability, resistance to damage, and security.



In this 3d Model, we found by adding OSB sheathing that much less bracing was required and stability increased.

THE DEAL WITH DEAL BREAKERS

In the world of Real Estate sales, there is one type of home inspector that is called a "deal breaker", and many of them promote themselves as such. Supposedly, if you are a buyer, this is your best friend. This type of home inspector will say that without him or her, you are swimming in a sea of sharks, all determined to eat you alive. Only that individual can help you.

Yeah, right. In practice, when I've seen these guys operate, it's always the same pattern. They walk into a house, write up pages upon pages of junk, almost all unsubstantiated and every item makes it sound like the house is going to fall down. Some of the stuff I've seen them write would be funny if it wasn't for the amount they are costing everyone. Here's some examples:

- Demanded "50lb roof felt" in the valleys of the roof. I've never seen "50 lb roof felt", and since that inspection have never been able to find it. Roofing contractors and suppliers I've talked to haven't seen
- Stated the "floor was out of level" - it wasn't. It was deflecting because it wasn't supported by a beam. The "deal breaker" had pages of garbage on that house, but missed the load bearing wall was unsupported and the house was sagging.
- Wrote that the deck had to be rebuilt because the heads of the nails penetrated the surface, "ruining the pressure treatment". Pressure treated wood is just that—the preservatives are forced into the timber under high pressure to penetrate the entire depth. Nails penetrating the surface don't hurt it.
- Demanded a house be strapped down from ceiling to floor. This is a requirement in hurricane prone areas like Florida. Not in Georgia, and unless you specify it in your contract, a builder is not required to put it in. In my

opinion, in this area that type of strapping is a waste, because of the trees. In a high wind-storm houses tend to get destroyed by flying debris instead of pushed over by the wind.

The deal breaker will generate lots of money for him or her by a number of methods. There'll be multiple inspections for you as you go look at house after house after house. When you do find a house that you want to buy, Mr. Deal Breaker will want to do reinspections to "check work that is done", will want to have meetings with you, the real estate agent, the builder, county inspector, and anyone else he can think of, generating hourly fees.

In the end, you won't get a better house, you will have just spent more money than necessary for home inspection fees, and wasted a lot of time.

To summarize, you need a good home inspector whose agenda isn't to "deal break", (or conversely help the real estate agent make a sale), but to help you find a decent house.