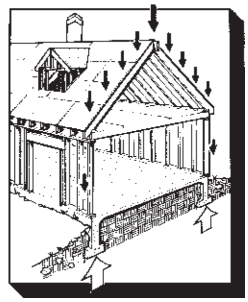


Overhanging Decks: How Far Can You Go?

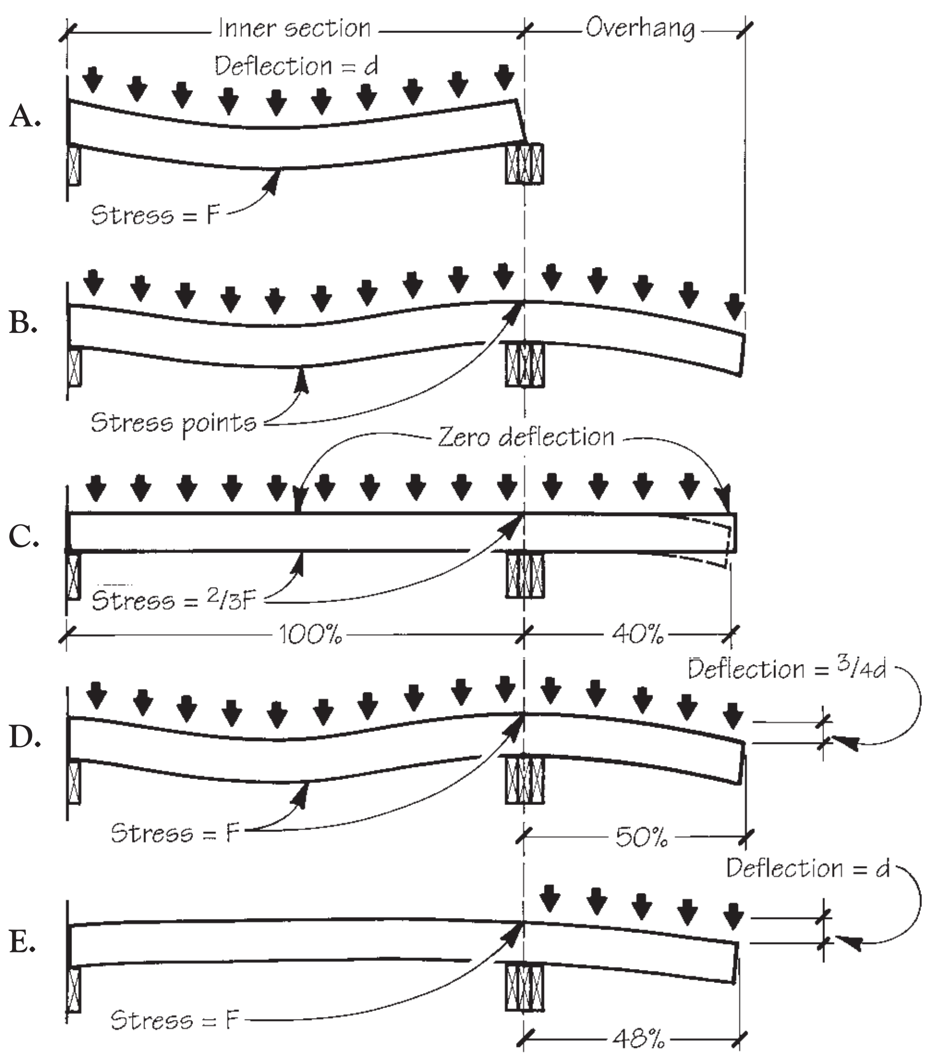
by Harris Hyman, P.E.

Though out here on the West Coast we're running out of nice, flat building sites, homeowners still need some level outdoor space. Where there's no hope for a backyard, the solution is often a deck. Even on flat sites, a deck provides a civilized separation between the building and the grass.

When the outer edge of the deck is supported by a girder, the joists are ordinary beams (Sketch A). They follow the expected laws for simple beams with uniform loading, so you can select the proper joist sizes by looking them up in the tables. A simply supported beam has a single point of maximum bending stress, right at the center of the span. This is also the point of maximum deflection.

To design the deck shown in Sketch A, you would pull out a span table, look up the right joist size and species, and have at it. Many codes require a 40-psf live load, 10-psf dead load, and a deflection limit of 1/360th the span, so you would choose the span table accordingly.

A more common deck construction is shown in Sketch B. Here, the inside ends of the deck joists are attached to the house and the outer ends rest on and extend slightly beyond the girder. In fact, many builders take the edge of the deck *way* beyond the girder, to gain an extra 50 or 100 square feet of deck space. But how far should you go? Let's find out.



Sketches B through E show how bending stresses and deflection in a uniformly loaded overhanging beam change relative to the simple-span beam in Sketch A.

Out in Space

When the outer end of deck joists go beyond the girder, the loading situation changes. Instead of a simple sag, the joists take on an "S" curve, as in Sketch B. There is a second point of bending stress directly over the girder. There is also a second potential point of high deflection at the outer edge of the deck. As we extend the deck, the load on the outer end lifts the middle of the span and lessens the bending stress there; but it also increases the bending stress at the girder.

When the overhang is about 40% as long as the inner section (Sketch C), the stress at the girder and the stress at midspan are equal, and at only two-thirds the bending stress that would occur in the middle of the simple span.

How 'bout that! You make the beam 40% longer and the stress goes down! This means we can extend the deck by at least 40% of the inner section without having to increase the strength of the system.

But what about deflection? As it happens, when the overhang is equal to 40% of the inner section, the deflection along the uniformly loaded deck joist becomes *zero!* When the overhang is shorter than 40%, the outer end is actually *lifted* a little by the load on the center span.

Practical limits. When we exceed this 40% overhang, however, things start to change. At 50% overhang (Sketch D), the bending stress at the girder equals the stress that would occur at the middle of the simple span. When the overhang is 70%, the bending stress is double the simple span stress. Stretch the overhang any further and things deteriorate in a hurry.

The situation is a little different for the deflection, but generally in the same order. With a 50% overhang, the deflection at the end is about three-fourths that of the simple span; with a 59% overhang, the deflection of the outer end equals the simple span deflection. With a 68% overhang, the deflection is double that of the simple span.

Moving Loads

Our analysis is not quite complete. What if the deck is loaded *only* outboard of the girder, like a deck I was on this summer? We all moved toward the outside railing to watch the Fourth of July fireworks. When a uniform load is applied only on the overhang (Sketch E), the bending stresses are actually the same as they would be if the entire deck were uniformly loaded.

The deflections are different because there is no inner load to lift the outer end. With a 48% overhang, the deflection of the loaded overhang equals the deflection you would have if only the inner section were loaded. A 60% overhang doubles this deflection.

Back to the Span Tables

Having compared the overhang loads with the simple span loads, we don't really need new formulas; all we need are the tables for simple joists. Then, with data from the tables, we just scale things up. It looks like 50% is our magic number: A 50% overhang has bending stresses equal to the bending stresses of the simple span, and roughly the same deflection (rounding up the 48% number from Sketch E). This means a span table designed for the simple span in Sketch A would actually work for the overhang in Sketch D, as long as the overhang were no longer than 50% of the inner section.

As an example, let's say the girder is 8 feet out from the house but we want to go farther with the deck. Using the *Span Tables for Joists and Rafters* (American Forest and Paper Association; 202/463-2733), the table for 40-psf live load, 10-psf dead, and *L*/360 deflection says I can span 8 feet with 2x6s on 16-inch centers. The required Fb is 855 and the required E is .9 (x 10^6 psi). Here in Oregon, I might use treated No. 2 Hem-Fir for deck joists. It has an Fb of 1,270 and an E value of 1.1, so we're okay.

Based on the discussion above, we can extend the deck beyond the girder 50% with no increase in stress or deflection. So our deck can actually go to 12 feet.

Judgment Call

Some engineering judgments: In keeping with my personal view that floors should be a little overdesigned, I typically use a combined load of 70 psf for residential decks. I would actually use 2x8s in the example above. If you think the deck you're building is going to get heavy use, you too might want to increase the design load. The AFPA span tables make this easy to do — just use the tables for 50- or 60-psf live loads (plus 10-psf dead load).

Finally, with large overhangs and light inside loads, there can be a lifting force at the house end of the joists — a "pry bar" effect. This force is real, but slight, and normal nailing of the ends of the joists to the hangers provides sufficient hold-down.

So, reach out! ■

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