

Framing Around Cantilevers

by Glenn Mathewson

Deck builders encounter houses with sections of cantilevered floor all the time. The interface between the cantilevered floor and the deck ledger must be treated differently than any other ledger connection — directly attaching the ledger to a cantilevered rim joist is a really bad idea. It's no trick to find photos and stories online of decks that collapsed with the ledger still bolted to such rim joists.

Most residential floor cantilevers aren't designed to carry any loads beyond those of the floor itself and the outside walls and roof, which bear on the cantilever's rim and the floor joists. Even if the cantilever could take the load from a deck, you would need a sound load path. The obvious one is through the rim joist of the cantilevered floor to its joists.

It might be possible to engineer a hardware connection there, but usually you're stuck with the original load path between the rim and the joists: the nails through the rim into the end grain of the joists. That connection is likely to be inadequate for the purpose of a deck ledger even with solid-lumber joists, and it's worse with I-joists, where there's one nail into each the top and bottom flange — nothing more. Unless you have an engineered design to the contrary, you're probably going to have to open up the existing cantilevered floor and configure a new and different load path from the deck.

The connections between the ledger, rim, and cantilevered joists are only part of the problem. The cantilevered joists must be able to transfer the load



Figure 1. One approach to framing decks around a cantilevered floor is to add posts and a beam, then cantilever the deck itself back toward the cantilevered portion of the house.

to the offset bearing wall beneath them. Many cantilevered floors look exactly the same from the outside, but the internal members, the load path, and the magnitude of the existing load on the cantilever may differ considerably. Some cantilevers support nothing more than a 2-foot-deep roof, for example, while others bear the load from single-span trusses extending the entire width of the house.

In either case, the original designs likely wouldn't have taken into account loads from a future deck. Those additional, unplanned-for loads on the cantilevered floor joists could cause sagging and deflection, which — even without complete structural failure of the floor — could affect the stability of the truss bearing and dry-wall. Also, overloaded cantilevered joists will not only bend down beyond

their bearing wall, they'll also bend upward inside the house. The kids might enjoy rolling toy cars down the new hill in the living room floor, but I doubt their parents, your clients, will find it pleasing.

Alternatives

To avoid the expense of an engineer's evaluation of the existing load path (which might call for reinforcing the floor joists — expensive, interior work most deck builders would want to avoid), you can consider other ways to build decks at cantilevered floors. In short, you can build around a cantilever or within it. Building around the cantilever can be accomplished a number of ways.

One method is to install posts and a beam instead of a ledger (**Figure 1**). The piers supporting the beam must

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Figure 2. Sometimes you can bypass a cantilever by placing the ledger below it.

bear outside the backfill zone of the existing foundation, as foundation systems can bear only on undisturbed soil or engineered fill, something common backfill is not (International Residential Code, R403.1). Typically placed at least 5 feet from the foundation, such piers would support a dropped beam, and the deck joists would cantilever toward the house. Assuming lateral support was handled in some other way, there would be no need to even connect to the cantilever on the house. The maximum cantilever of the deck joists would be limited by the joist size and span.

If digging additional holes isn't to your liking, or additional posts don't fly with your client, the beam could be supported by the joists at the sides of the cantilever. Those joists, likely doubled and now acting as beams, would in turn be supported at non-cantilevered portions of the house. For cantilevered floors up to about 6 feet in width, this method is very common, and design parameters can be found in the IRC to avoid engineering (R502.10).

While this approach has commonly been accepted by building officials and the IRC in the past, the 2009 IRC prohibits any beams (members

carrying other members) from being connected to a deck ledger. A beam imposes a concentrated load on the ledger, and the new ledger connection table, Table R502.2.2.1, is engineered based on a uniformly loaded condition (that is, repetitive joists). You'll have to notch out the ledger and the rim so that the joists at the sides of the cantilever (acting as beams) can bear directly on the wall plate or foundation sill below, instead of bearing on the ledger and rim.

The most recent update to the American Forest & Paper Association's alternative deck code, DCA6, also addresses this issue. It provides a pre-engineered table that limits floor joist layout and requires the use of a beam hanger that bolts through the ledger and into the rim joist. However, since that connection is strictly forbidden by the IRC, it would need to be approved by the local building official as an alternative means and method.

A third option for building around a cantilever is to drop the height of the deck and attach the ledger to the top plates of the wall, wall studs, or the foundation beneath the existing floor (**Figure 2**). Because the deck would then be significantly lower than the



Figure 3. Running the deck joists inside the cantilever to bear on the mudsill is viable. Solid blocking has replaced the original band joist, and the insulation has been replaced. Remaining to be done is replacing the covering below the cantilever and waterproofing the joint between the deck joists and the exterior cladding.

house floor, this connection may require steps or a landing at the entry to the house. Evaluating whether a full landing would be required or if a two-rise stairway could be used is outside the scope of this discussion, as there are many other factors that would have to be considered. Also, connecting a ledger to wall studs is not addressed by the IRC or any pre-engineered literature that I am aware of, so you'd need to seek your local inspector's buy-in.

Building Through the Cantilever

Unfortunately, the three above-mentioned methods for framing around a cantilever have specific difficulties in their application that may preclude their use. However, there is still the other approach: Frame into the cantilever.

To frame into a cantilever, you'll have to first remove the exterior cladding, soffit, rim joist, and blocking from the cantilevered portion of the floor. Then, the deck joists can be placed beside and against the existing floor joists and extended to bear directly on the top plate of the wall or sill below. The deck joists can be secured to the sides of the existing floor joists to provide lateral resistance (**Figure 3**).

Once all the deck joists are installed, blocking between the deck joists and

the house joists should be reinstalled at the bearing locations where it was removed and blocking installed in place of the rim joist that was removed at the end of the cantilever. This blocking should be covered by a water-resistive barrier and sealed to the joists extending through. You'll have to insulate the floor, reinstall the soffit material on the bottoms of the joists, caulk, and paint.

If the deck joists are larger than the house joists, or if your client doesn't want the deck surface flush with the interior floor, this method would appear unacceptable at first glance. For instance, consider a home constructed with 2x10 floor joists or 9½-inch engineered joists. If the deck joists were to be 2x10s as well, it would seem that the deck surface would be at the same height as, if not higher than, the floor surface inside. Conveniently, the IRC allows notching at bearing locations of up to one-quarter the actual depth of the joist (R502.8.1). In the case of a 2x10, the bottom of the joist where it rests on the wall can be notched vertically as much as 2⅜ inches. This notch would drop the deck framing lower than the existing floor framing. ❖

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