Support for Sagging Trusses

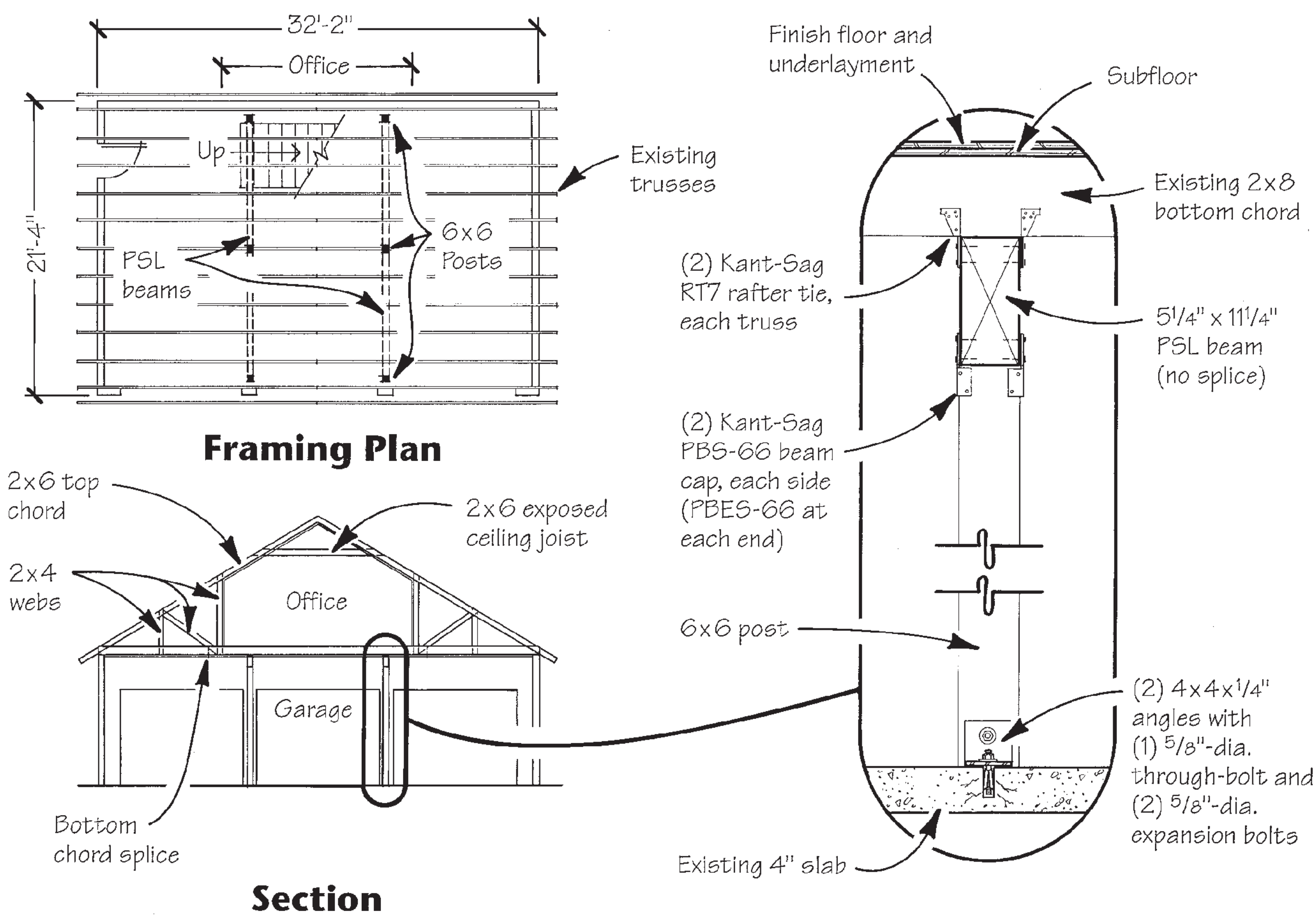
by Patricia Hamilton

A business associate phoned me recently, concerned that her home office, located in a converted attic, seemed to be sinking into the garage below. I drove over, expecting to find some undersized, overloaded floor joists that I could fix with a simple beam underneath to take the springiness out of the floor. Instead, I found that the room had been created within the storage area of very large roof trusses. The floor was visibly — and disconcertingly — sagging under the weight of file cabinets and office equipment.

Unintended Uses, Unforeseen Consequences

Truss manufacturers commonly create a storage area within a truss by "boxing" out the middle section. These are referred to as attic or storage trusses, and are an inexpensive way to create extra storage space. The space can sometimes be used as living space — as long as the truss is designed for the live loads (see the feature article on storage trusses, "Making Room at the Top," 11/95). Clearly that wasn't the case with these trusses.

These trusses spanned 32 feet and were spaced 2 feet on-center above a 21x32-foot three-car garage. The roof pitch was 8/12. The room above was centered in the gable, and measured 14x21 feet. My initial thought was to add two beams below the panel points of the trusses, splitting the truss into three spans. I did a quick calculation to see how much weight the beams would carry. Since the areas behind the knee-walls were stuffed with stored belongings, I counted the entire floor area at 50 psf, plus the entire roof area at 30 psf. This came to 53,760 pounds over the



A pair of Parallam PSL beams increased the floor load capacity of these attic trusses from 20 psf to 50 psf. Engineered connections at top and bottom of the posts ensured proper load transfer.

672-square-foot footprint area of the garage (672 x 80 = 53,760). Since the beams would pick up around three-fourths of this load, I figured each beam might carry around 20,000 pounds over the 21-foot span. Worse than that, one end of each beam would fall right above the garage doors, placing a large point load on the headers.

Help From a Truss Maker

At this point I called an engineer. Being a conservative fellow, he wanted more information, so back I went to the site to carefully measure the size and locations of all the truss members and plate connections. I also checked for the location of the bottom chord splice plates, since the bottom chord would still need to act in tension even after we supported the floor loads.

With some help from a local truss manufacturer, we were able to determine the likely design capacity of the trusses: 20 psf live load in the "attic" area. The truss manufacturer then used a truss design program to analyze the trusses, making the assumption that the two reinforcing beams were located not below the kneewall panel points, but more conveniently between the garage door openings. This strategy increased the allowable loading in the attic area to 50 psf live load.

Using this information, the engineer recommended two scenarios: 5 1/4x18-inch Parallam beams supported by posts at each end or 5 1/4x11 1/4-inch Parallams supported by posts at the ends and one in the middle of the span.

The larger-size Parallam would drive the cost up about $800 for the two beams — far more than the cost of a couple of 6x6 midspan posts. None of the posts would require footings as long as we could verify that the slab was a full 4 inches thick.

To minimize fussing with the overhead doors and the end wall finishes, we decided to place the end posts inside the garage next to the wall, rather than reframe a post inside the end walls. We were able to do this because the trusses at each end were about a foot off the wall. The beam would stop just short of the end walls, but would directly support every truss except the rake trusses. This saved us from somehow having to wrestle a 21-foot beam into a 20-foot space.

Installation by Mechanical Muscle

Before installing the beams, we removed a 1-foot-wide section of drywall from the ceiling at each beam location, snapped a line, and nailed a rafter tie to each truss. We then lifted the beam into position with the help of a rented duct lift — a mobile hand-crank forklift that hvac contractors use. The duct lift raised the beam into position, but we needed to use a hydraulic jack to lift the 5/8-inch sag out of the trusses. We supported the beam at each end while jacking at the center.

We set a stringline to verify that the trusses were level. When all the floor joists were at or above the level line, we tapped the permanent 6x6 posts into position. We then nailed the rafter ties to each side of the beam, and tacked the posts in place at the bottom of the beam. Before installing the hardware that permanently fastens the posts to the beam above and the floor below, we double-checked the location of the middle posts for interference with car doors. We ended up moving the posts about a foot.

Connectors

The engineer specified that every truss be fastened to each beam with a Kant-Sag (USP) RT7 rafter tie and that Kant-Sag PBS-66 post caps (PBES-66s at each end) be used to connect the beams to each post. At the beam-to-floor connection we bolted two 4x4x1/4-inch-thick steel angles to the base of each post and used Hilti epoxy anchors to fasten the angles to the floor. We confirmed the slab thickness as we drilled for the anchors.

Once the beams were installed, we patched the drywall and reinstalled the bracing on the overhead door tracks. Installing the beams took us about two days, plus the time it took the drywall crew to patch the ceiling.

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