Flitch-plate Girders
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April 14, 2008

A flitch-plate girder is a composite beam—a plate of steel sandwiched between two wood joists. Usually, they are held together with bolts arranged in a triangular pattern on the face of the girder. Sometimes, when less strength is needed than is provided by the steel plate but more than is provided by a doubled joist, plywood is used in place of the steel plate.

The flitch-plate girder was first used in the 1880s. It can carry a larger load than a solid wood beam with the same depth and span. If a structure limited the depth of the girders and joists, they were often used because a comparatively shallow flitch-plate girder could carry the same load as a solid wood beam of greater depth. It provided most of the strength of a steel I-beam at a lower cost and allowed attachment of other structural members using ordinary wood-framing methods.

The flitch-plate girder, shown in Photo 1 at left, is made of a ½-inch steel plate sandwiched between two 2 x 10s and is held together by bolts with washers and nuts. It is located in a 1980s’ addition to a large lake-front home originally built in the 1930s. It has much greater strength than the tripled joists attached to it by galvanized steel stirrups. It is carried on a tripled 2 x 4 wood plate at the top of a wall about 20 feet to the left of this photo and on tripled 2 x 4 wood studs between that top plate and the wood sill on top of the concrete foundation. On the right, the galvanized steel stirrup connecting it to a “laminated veneer lumber” (LVL) beam is visible. This 4.5-inch by 10-inch LVL replaced the original tripled 2 x 10 beam late in 2007, which was sagging and cracking. (More on LVLs another time.)
Photo 2 (right) is a close-up of one of the flitch-plate’s bolts and a tripped joist in its stirrup. Note that the stirrup and tripped joist are attached to the flitch-plate girder with ordinary nails. This would not have been possible if a steel I-beam had been used. Also note that the nearer 2 x 10 has a split knot in the edge and that the bolt hole was drilled through the edge of a loose knot. Although these would be significant concerns if this were an ordinary 2 x 10 wood joist, they are lesser concerns because of the strength of the steel plate in this composite girder.

Firefighters should be concerned with the heavy loads usually carried by flitch-plate girders, the possibility of the steel plate being weakened by heat and failing in a structure fire, and the probability that fire will burrow between the wood joists and the steel plate.

Although flitch-plate girders are used less frequently in this century than they were in the previous century, they are still being installed in new construction and remodeled buildings. They are still being used for the same reasons: the strength of steel at lower cost, greater strength with less depth than a wood beam, and the ease in making connections.

A 21st-century variation of the flitch-plate girder uses a steel plate sandwiched between two LVLs that are the same size as ordinary 2 x 10s or 2 x 12s. The LVLs have greater strength than sawn lumber joists of the same size, and their strength is not reduced by knots and splits in the edge, because there are none. They can be assembled using bolts, washers, and nuts, as in the past. Or, they can be assembled using a powder-actuated tool that uses blank pistol cartridges to drive steel pins with heads, like nails, through the LVL and the steel plate from both sides.

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