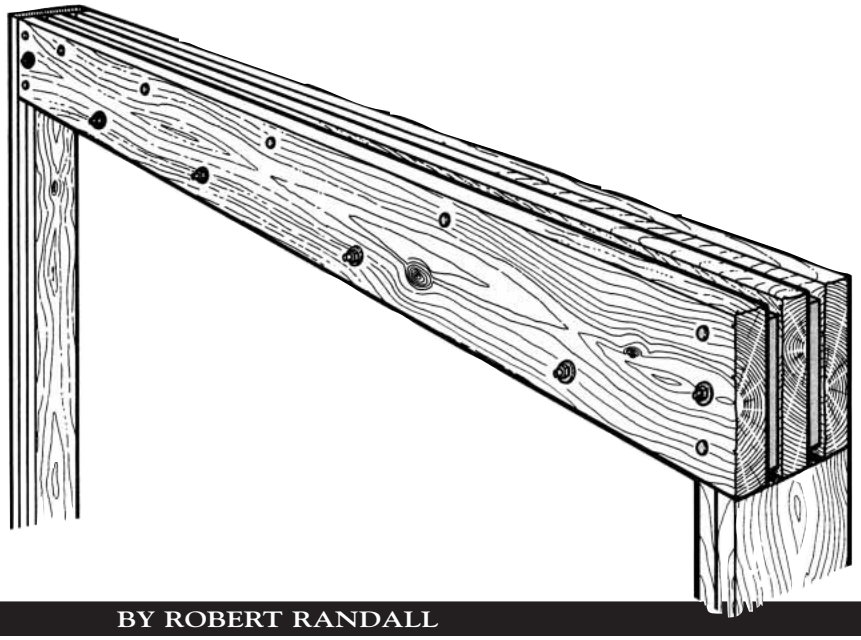
FLITCHPLATES

THE TIME-HONORED FLITCH-PLATE IS STILL A GOOD CHOICE FOR BEEFING UP WOOD



BY ROBERT RANDALL

Flitchplates (sometimes mistakenly called fish plates, or flinch plates) are steel plates sandwiched between wooden members to provide increased strength or stiffness. Flitchplates are primarily used in header assemblies when common framing lumber is not strong enough or stiff enough to carry the loads. In such cases, steel beams, laminated veneer lumber (such as Microlams), or glue-laminated beams can also be considered. But in some situations, flitchplates can offer some advantages over these materials:

- Because the steel in a flitch beam is sandwiched between wood framing lumber, the beam can be readily connected to other wood framing with nails and lag screws.
- As headers over multiple doors, wide sliders, or window assemblies, flitchplates are pretty much free of "creep," or the slow sagging that often affects wooden headers and results in doors and windows binding or finish materials cracking. This is the most common reason I choose flitch beams.
- Flitchplates can be assembled in place, reducing the lifting weight of individual beams.
- Flitch beams can be easily retrofitted into existing wood-framed structures to solve problems, such as large notches left in the framing by a plumber (see Figure 1) or sagging members.
- The fire resistance of a flitchplate is generally high.

There are also some disadvantages:

- The cost of flitchplates is usually higher than the cost of most alternatives. Steel is sold by weight, which is often substantially greater in a flitchplate than in a wide-flange beam of equal capacity. Typically the weight of a flitchplate will be 50% to 100% greater than a wide-flange beam.
- Flitchplates are typically thicker than the web of a wide-flange beam, so it is harder to cut holes for pipes and wires.
- When floor framing connects to the side of a flush-framed flitch beam, you may have to use joist hangers, whereas if you are connecting to a flush-set wide-flange steel beam, the loads can be carried directly by the bottom flange.
- End connections of flitch beams require special attention (and lots of bolts!) to properly distribute the load into the fibers of the wood members.

Repair With Flitchplates

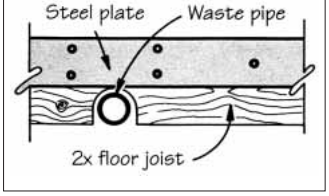


Figure 1. *Flitchplates are useful for repairing existing wood beams, like this floor joist that has been poorly notched for a plumbing pipe.*

Flitch Beam Makeup

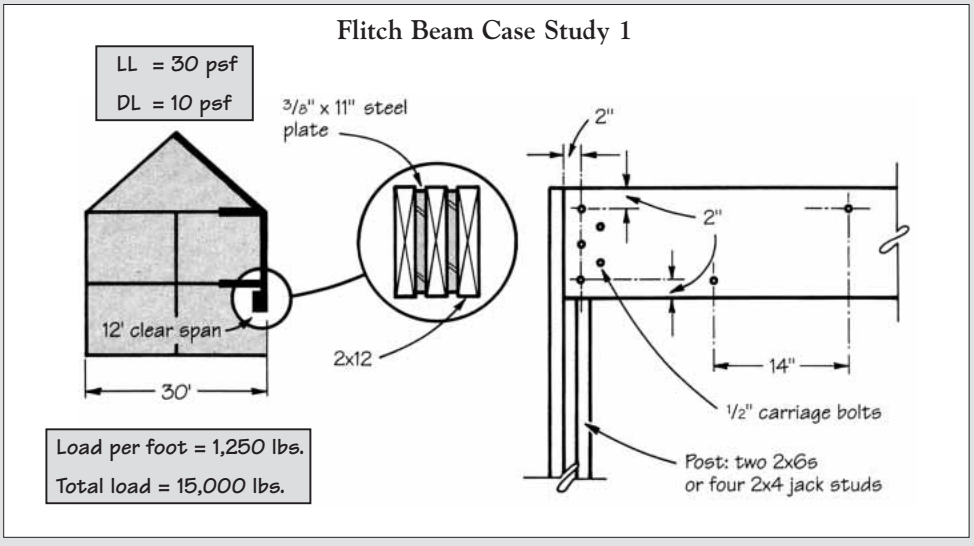
A flitch beam usually consists of two wooden members, one on each side of a single steel plate, or three wooden members with two steel plates, all bolted tightly together. It is seldom necessary to use a torque wrench to bolt the beams together, as long as the bolts are all cinched down snugly.

The steel is put in the middle for two reasons. First, this increases fire resistance. Wood can resist fire

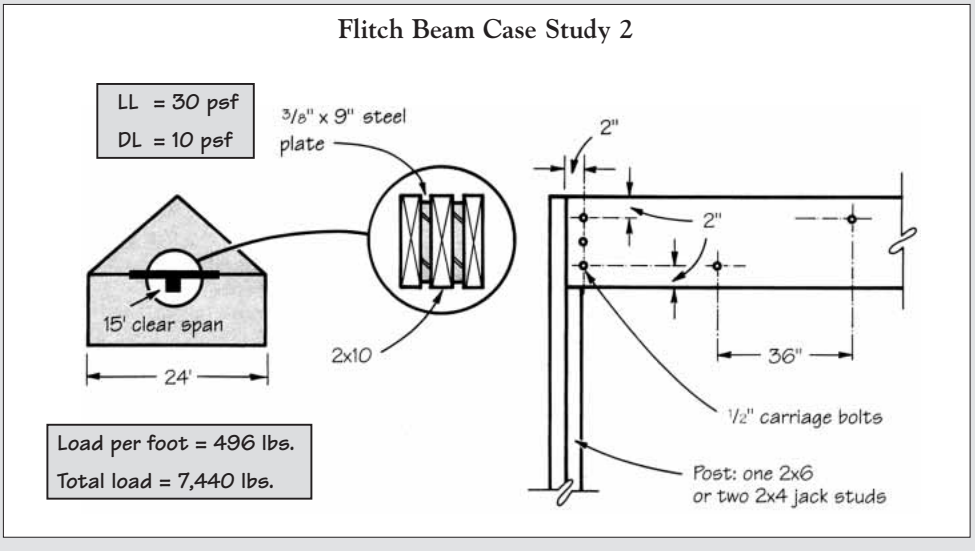
Equivalent Strengths: Flitch Beams vs. Built-Up Wood Beams & Steel I-Beams

Single Steel Flitch Beam		Built-Up Lumber Equivalents*	Steel I-Beam Equivalents	Double Steel Flitch Beam		Built-Up Lumber Equivalents*	Steel I-Beam Equivalents
Wood	Steel			Wood	Steel		
2x6	5" x 1/4"	2.3 - 2x6s	–	2 x 6	5" x 1/4"	4.7 - 2x6s	–
	5 x 3/8	3.5 - 2x6s	–		5 x 3/8	7 - 2x6s	–
	5 x 1/2	4.7 - 2x6s	–		5 x 1/2	9.4 - 2x6s	–
2x8	7 x 1/4	2.8 - 2x8s	–	2 x 8	7 x 1/4	5.6 - 2x8s	W6x9
	7 x 3/8	4.2 - 2x8s	–		7 x 3/8	8.4 - 2x8s	W8x10 or W6x12
	7 x 1/2	5.6 - 2x8s	W6x9		7 x 1/2	11.3 - 2x8s	W8x13
2x10	9 x 1/4	2.9 - 2x10s	–	2x10	9 x 1/4	5.6 - 2x10s	W8x10
	9 x 3/8	4.3 - 2x10s	–		9 x 3/8	8.4 - 2x10s	W8x15
	9 x 1/2	5.8 - 2x10s	W8x10		9 x 1/2	11.5 - 2x10s	W8x18
2x12	11 x 1/4	2.9 - 2x12s	–	2x12	11 x 1/4	5.8 - 2x12s	W10x12
	11 x 3/8	4.4 - 2x12s	–		11 x 3/8	8.8 - 2x12s	W10x17
	11 x 1/2	5.8 - 2x12s	W10x12		11 x 1/2	11.7 - 2x12s	W10x22

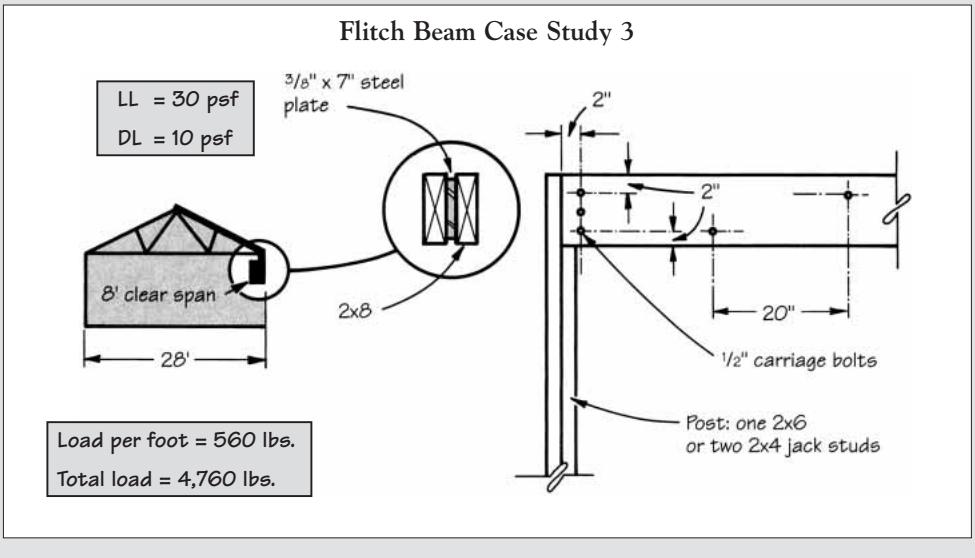
* The strength equivalent shown for built-up lumber beams assumes Doug-fir-larch (E=1.6, Fb=1,200).



Note: *To carry the heavy loads illustrated on the left, the flitchplate must be sized and bolted as shown at right.*



Note: *Although a relatively heavy flitch beam is required due to the large span, the load it carries is relatively small, so the bolting schedule at the ends is not too extreme.*



Note: *In this case, flitchplates would be chosen over other beam materials because of the vertical height restrictions of a large window or a low ceiling. To get the same load-carrying capacity from a built-up lumber beam would require three 2x12s.*

longer than steel, which softens very quickly in a fire. Second, the steel is not likely to buckle if placed between two wood members. A thin plate of steel will wrinkle and buckle under relatively small loads unless stabilized.

I usually specify a flitchplate that is slightly narrower than the lumber in a beam, so if the lumber has a large crown, the steel doesn't overhang the wood and interfere with the drywall. I use an 11-inch flitchplate with 2x12s, a 9-inch plate with 2x10s, etc. However, because the steel is slightly smaller than the wood, the end connections must be engineered to carry specific loads to prevent the wood at the bearing points from crushing.

As the case studies show, three to six bolts are usually required. This calculated bolting schedule is required for the bolts to transmit the load from the plate onto the wood members, which in turn bear on the posts.

As a rule of thumb, the bolt holes should be placed 2 inches from all edges of a beam. Use the flitchplate as a template to precisely align the holes in the wood. Insufficient bolting and poorly sized bolt holes will cause the wood around the bolts to crush and the plates to settle. In extreme cases, the steel can knife into the top of the post.

An alternative to an extreme end-bolting schedule is to hold the flitchplates flush to the bottom of the beam and insert a steel bearing plate on top of the post. In this case, however, you can't toenail the beam into the post. But don't ignore this connection for this reason. Use a steel tie plate or angle bracket to secure the beam to the post.

The steel plate and lumber dimensions for flitch beams are based upon loading. When sizing the flitch beam, I ignore the strength of the wood since it is much less than the strength of the steel. Also, wood is subject to creep, shrinkage, and crushing — problems that steel is not subject to. However, I normally do not include the dead weight of the wall construction in sizing the steel, but assume it to be carried by the wood members while the steel carries the floor and roof loads.

The table shows the equivalent strengths of various flitch beams with conventional built-up wood beams or wide-flange steel beams. I have not attempted to describe how to calculate the sizing and bolting requirements of flitchplates. This involves relatively complex calculations that should not be attempted by a beginner. My advice, as you might have guessed, is to talk to your friendly local P.E. ■

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