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## Using plywood in built-up beams

**Q:** The traditional carpenters I learned from insist on ripping a sheet of 1/2-in. CDX plywood into 9-1/4 in. strips and sandwiching these strips between the three 2x10s that make up a beam. I've always maintained that the plywood strips add little to the strength of the beam, but the guys will have none of it and continue with their plywood sandwiches, both in beams and in 2x10 headers. They also use construction adhesive when building up beams and headers. Is either practice worth the time and trouble it takes to execute it?

David Carse , Hinesburg, VT

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**A:** *Jim Thompson, a former framing carpenter and currently a structural engineer with McCormac Engineering Associates in Ellicott City, Maryland, replies:* Let's look at what the additional plywood buys you, and then you can answer the question yourself. To compare the stiffness of wood beams, multiply beam width by beam depth cubed and divide the product by 12. A built-up beam of three 2x10s has a relative stiffness of 297. Add 1/2-in. plywood between the 2x10s, and the relative stiffness jumps 15% to 341. An assumption I have made for the plywood is that only two of the three plies have the grain oriented along the length of the beam, so only two of the three plies contribute to the strength of the beam. This may be a little conservative, but not much.

If you use four 2x10s and no plywood, the relative stiffness is 18% more than three 2x10s with plywood spacers. Make the beam from a pair of 2x12s only and you get 5% more stiffness than three 2x10s with plywood. Three 2x12s yields 65% more stiffness.

Another consideration to keep in mind when you are specifying a beam is its resistance to bending. To compare built-up wood beams, I multiply beam width by beam depth squared, and then I divide the product by 6. A triple 2x10 beam has a bending-resistance factor of 64.2; add plywood between the 2x10s, and the factor increases 15% to 73.7. A beam of four 2x10s and no plywood has 18% more bending resistance than three 2x10s with plywood, but a beam of two 2x12s has 1.5% less bending resistance than the triple 2x10 beam with no plywood. Finally, three 2x12s offer 48% more bending resistance than three 2x10s.

Now let's look at how much material comprises each beam. If we consider the triple 2x10 beam as a reference point, adding plywood between the 2x10s increases its area by 22%. A fourth 2x10 adds 33% more area to the triple 2x10 beam. Switching to a pair of 2x12s reduces area by 19%; three 2x12s increases area by 2%.

After comparing these beams, you have to wonder if a 22% increase in material, with its associated increase in material and labor costs and in weight, is worth an extra 15% in stiffness and strength. Using four 2x10s seems like a better answer for beams if you need additional strength; for headers, two 2x12 are stiffer than a pair of 2x10s padded with plywood.

The only reason I can see for packing a beam out with 1/2-in. plywood is to make the beam match the width of the dimension lumber it's sitting on, in the case of a wall, or to fill the opening fully in the case of a header.

If the plans call for a beam made up of three 2x10s, that's what I would install. The same applies for headers of two 2x10s. If you don't need the extra material, why bother? If you doubt the adequacy of a beam in a house you are building, you should consult a structural engineer. The engineer can specify beam that will satisfy all applicable code criteria, and you'll sleep better knowing the beam is adequately sized.

Regarding the use of construction adhesive between layers of a built-up beam: If the practice does not cost you much time or money, it's probably a good idea for nailed built-up beams.

Because construction adhesive serves to bond the parts together better, it can't hurt. Again, if the architects or engineers who designed the house do not specify the construction adhesive, they are not counting on it for the additional strength, so the adhesive would be only for your own satisfaction. I just hop

that you never have to take one of those beams apart after the adhesive has set.

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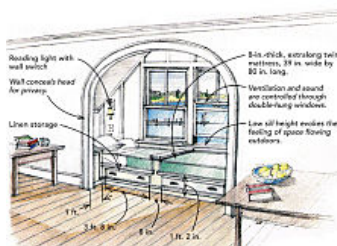
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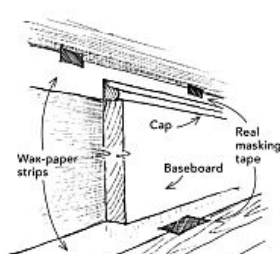
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