Q&A

Q. Wood-Steel Composite Beam?

We're considering through-bolting LVL lumber to both sides of a steel I-beam. We'd install the resulting composite beam flush at midspan in an existing floor system, with the LVL providing convenient nailing for joist hangers. Can we assume that the combined load-bearing values for LVL and steel will produce a stronger, stiffer beam than either material on its own?

A. *John Bologna, P.E., of Coastal Engineering, in Orleans, Mass., responds:* It's not that simple, because the two materials have widely different mechanical properties. Simply stated, the stiffer member will always carry the greater percentage of the load. Given both the high modular value of steel over wood and the engineering effort required to analyze and detail a properly connected composite section, I typically wouldn't attribute any value to the wood section and would count on the steel alone to do the work.

To determine the share of load carried by each member, you have to take the relative stiffness of each into account. "Stiffness" is defined as the ratio of a given material's properties in the form of EI/L, where "E" is the elastic modulus, "I" is the member's moment of inertia, and "L" is the span length. To carry a load in unison, sufficient connectors would be required to transfer static shear between each member. Then, you'd have to calculate the resulting composite section using a modular ratio to convert a wood section to an equivalent steel section (or vice versa). The modular ratio is the relationship between the elastic moduli of both materials and has a nondimensional value on the order of 14.5 for steel over wood. In other words, steel is about 14.5 times stronger than wood.

Depending upon the specific application, you may need to fabricate an all-steel composite section to achieve the desired properties. But in a flush framing situation, I would suggest considering the LVL as merely a nailer for hanging the floor joists.

Q. Wrong-Side Housewrap

While preparing for an extensive remodeling project, we discovered that the housewrap was installed underneath the exterior 7/16-inch plywood rather than on top. According to the scope of work, we are supposed to install 1/2-inch foam board with taped seams over the entire exterior. Will the plywood sandwiched between the housewrap and foam cause a problem with moisture buildup or anything else?

A. *Paul Fisette, director of Building Materials and Wood Technology at the University of Massachusetts Amherst and a* JLC *contributing editor, responds:* The short answer is no, it won't cause a problem. But it's worth noting that whoever installed the wrap there to begin with didn't do the wall system much good, either. The primary function of correctly applied housewrap is to provide a water-resistant surface behind the siding, which is why all good housewraps share the ability to shed liquid water while allowing water vapor to pass through. In other words, it works something like a Gore-Tex jacket, which is breathable yet waterproof. (Interestingly enough, Gore-Tex developer Bill Gore once worked for DuPont — the manufacturer of Tyvek — as an engineer.) Encasing the plywood between the existing layer of housewrap and insulating foam isn't a problem because the housewrap allows diffusion of vapor through and will not trap it at that plane.

The encased housewrap might have some limited value as an air barrier, but I'm not impressed with housewraps in that role because they're not rigid and they're rarely continuous. They tend to tear during or after installation and have thousands of air-leaking fasteners holding the fabric in place. Installing a continuous layer

of insulating foam over the outside of the structure, taping the seams with compatible tape, and implementing proper flashing techniques will provide a superior air and weather barrier with no need for housewrap at all. You might also consider investing in a thicker layer of foam insulation if the budget allows.

Q. Best Mix for Pumped Concrete

Plans for an infill project call for a poured stem-wall foundation, but the urban site has limited access for a regular concrete truck. A pumper truck would be ideal, but I'm concerned that the pumped mix won't provide the required 4,000-psi concrete. Is this a legitimate concern?

A. *Bill Palmer, president of Complete Construction Consultants in Lyons, Colo., responds:* If your pumping contractor is planning on increasing the amount of water in the concrete mix to increase its "pumpability," you have reason to be concerned, since this would lower the cured concrete's compressive strength. But most specifications prohibit adding water at the job site, and this isn't the best approach for producing a pumpable mix anyway. In fact, a wet, high-slump mix often won't pump as well as a stiffer one because the coarse aggregate will separate from the mix and clog the pump hose. Generally speaking, the maximum slump for a pumped mix is about 6 inches.

The ideal concrete mix for pumping typically contains air-entraining agents, a little extra sand (compared with a standard concrete mix), often some fly ash, and a well-graded aggregate blend. To make the concrete easier to pump and place as it comes out of the hose, many batch plants also add water-reducing admixtures — known as superplasticizers — to their concrete. But you don't have to spell the mix out to your ready-mix supplier, since most suppliers have experience with concrete for pumping. Just be prepared to tell him the size of your pumping contractor's pump and diameter of his hose, how far and how high the concrete will be pumped, the total quantity of concrete needed, and the placement rate.

To avoid delays that can lead to the concrete stiffening in the hose, be sure to coordinate timing between the pumping contractor and the ready-mix producer so there's a steady supply of concrete. Also, some grout slurry should be available before starting to pump so it can be run through the hose to slick the line. Have a plan for dealing with the concrete remaining in the hose and pump hopper when you're done. The best solution is often to dump it back into a ready-mix truck.

Finally, make sure your crew knows proper safety procedures for concrete pumping, including the hand signals needed for communication between the placing crew and the pump operator. You can find the signals on the American Concrete Pumping Association's Web site (concretepumpers.com), in the downloadable guide "Checklist for Pumping Ready Mixed Concrete."

GOT A QUESTION?

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