WHITTLING DOWN WOOD WASTE

From design to dumpster, residential construction offers us opportunities to make more efficient use of our wood resources and products, as well as other construction material.

BY PETER YOST, STEVE BACZEK, AND STEPHANIE FINEGAN

PACKER INDUSTRIES

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Americans have been building homes with wood—shaping logs, joining timbers, nailing studs—for almost 400 years. Our current approach—stickframing—grew popular in the mid-1800s (particularly in the rapidly growing West) because it took less skill, required simpler tools, and took fewer people than timber framing. We apparently really like waste haulers, too. The National Association of Home Builders (NAHB) Research Center reports that the "typical" home generates about 3,500 lb of wood waste during its construction, about half of which is solid-sawn lumber.

From design to dumpster, residential construction offers us opportunities to make more efficient use of our wood resources and products, as well as other construction material. Most of those opportunities are cost competitive and then some—besides delivering a higher-performance home. Few systems in home building offer such clear win-win propositions as the efficient use of wood.

Before Peter and Steve left the Building Science Corporation to become principals of 3-D Building Solutions, a high-performance buildings consulting firm, the three of us studied the problem of wood waste and prepared the report, *Using Wood Efficiently: From Optimizing Design to Minimizing the Dumpster*, upon which this article is based. Here are some of our more general recommendations:

- When building or retrofitting a home, builders and contractors should always make up detailed framing plans—to inform the design process and to inform the framing crew how they are to use wood on the job site.
- Use engineered wood and certified sustainably harvested wood products whenever possible (see "Making Sense of Green Lumber," *HE* Mar/Apr '06, p. 36).
- Use structural-grade materials to their fully approved capacity.
- Don't use structural-grade materials in nonstructural applications if other materials can do the job just as well.
- Hone down your waste factor in your lumber takeoff, and treat lumber deliveries as product—stick and cover the loads when they are delivered.
- Use wood waste in on-site applications, such as site-engineered studs and erosion control material.

The rest of this article focuses on the efficient and sustainable use of wood waste.

Waste: The Construction Tailpipe

Builders and contractors know that you always need to pad the lumber takeoff with a waste factor, to account for bad stock and labor errors on the job site. The question is: what waste factor is reasonable—is it 5% or 15% of the takeoff? One job site proverb applies here: You send it, and we will use it. Only you know just how closely you can set this factor, but detailed framing plans can work well with a honed-down waste factor. And some builders are experimenting with colorcoding or some other way of designating stock so that everyone, from the site super to the

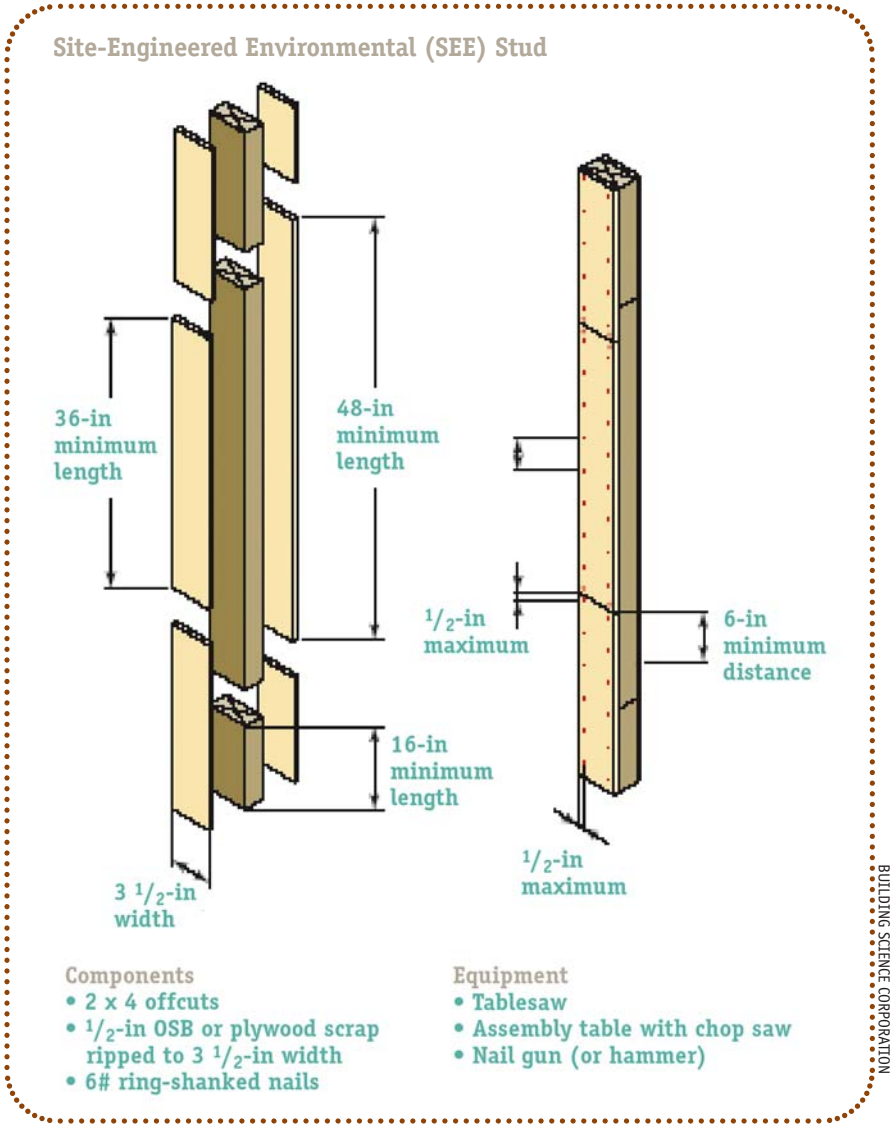

Figure 1. You can make studs stiff enough for interior non-load bearing walls with 3 1/2-inch OSB strips that are at least 36 inches long and 2 x 4 off-cuts that are at least 16 inches long.

carpenter's helper, can tell what use each stick was intended for.

It's pretty amazing to see how disrespectfully lumber packages can be treated on the job site—lifts sitting in mud or puddles of water with no top cover. Why pay for kiln-dried stock and then treat it like landscaping material once it gets to the job site? The performance of wood products—particularly sheet goods—can suffer if they are left exposed. Protecting wood products on the job site is cheap and simple—stick the load to keep it up off the ground and top cover. This will remind your framing crew that they work with valuable product and show your potential home buyers how you manage what could soon be their materials.

At the end of the day, no matter how efficient our use of wood, there will be some waste—off-cuts from both solid-sawn lumber and sheathing. Even for the most efficiently framed buildings, wood waste is one of the largest components of the new-construction waste stream.

There is some good news and some bad news about new-construction wood waste. The good news is that it tends to be relatively clean, dry, and homogeneous. (On the typical job site, it's about half solid-sawn and half sheet goods, usually OSB.) These attributes usually make it good for recycling. The bad news is that markets that might make good use of this material—mulch for landscapers, hog fuel for industrial boilers and wood-fired electric utility plants, and bulking agents for composting operations—are generally poorly developed.

When all three of us were with the Building Science Corporation, we studied two alternatives to landfilling wood waste. Both involved keeping the material on the job site and turning it into a resource.

The Site-Engineered Environmental Stud

Consider that about 100 2 x 4s used on a typical residential job site are for non-load-bearing interior partitions. Regardless of the residential building code under which you are operating, using structural-grade stock in this application makes no sense. Take a look at the wood waste in your pile or dumpster. We will bet that a lot of the OSB is in relatively big pieces from window and door cutouts and roof off-cuts. And quite a bit of the solid-sawn will be 2 x 4 off-cuts 16 inches or longer. You can make a stud with these scraps (see Figure 1).

With strips of 3 1/2-inch OSB that are at least 36 inches long and the 2 x 4 off-cuts, you can make studs stiff enough to frame interior non-load-bearing walls quite satisfactorily. With nails every 4–6 inches and clustered around any OSB and 2-by joint, the length of the stud core scraps does not seem to matter much. Although site-engineered environmental (SEE) studs are heavier (and wider) than a regular stud, they are always straight and can be nailed and drilled, and take fasteners, just like a regular stud. All that from wood waste out of your dumpster! And rest assured, there is enough OSB and stud scrap generated in the United States for every non-load-bearing stud to be a SEE stud.

On-Site Grinding

If you can grind your wood waste into 2 1/2-inch "minus" (meaning less than or equal to) wood chips, it makes a great soil erosion control mat at the entrances to

the job site, or bermed at the base of silt fences in areas where significant surface flow is likely. Turns out that there are now at least two commercially available grinders that are appropriate for residential job sites—grinders that handle drywall as well as wood waste.

A new Building America partner is Packer Industries of Atlanta, Georgia, manufacturer of one of these low-speed, mobile grinders (see "Comparing the Costs of Dumpster Use Versus Grinding and Recycling"). Building America production builders in Albuquerque, New Mexico, and Minneapolis, Minnesota, are finding this approach to dealing with their wood and drywall waste competitive with traditional disposal. Research done at the University of Georgia looked at the impact of adhesives from engineered-wood products on soil and groundwater when construction wood waste is ground and used as a topical material. Laboratory tests and field study showed few potential problems.

Use More On-Site, Dump Less

We still like building homes with wood. The NAHB Research Center estimated in 1999 that more than 85% of the 1.7 million homes built that year, single family and multifamily, were stickframed. We also like building with lots of wood. A typical home built in 1999 used over 13,100 board ft of lumber. That's about $^{3}/_{4}$ acre of forest just for framing lumber.

So let's do the math for U.S. home building just at the beginning of the housing boom (given that 1999 was a representative year, at slightly above the average for the previous five years). Just fewer than 1.5 million homes were stick framed. These homes consumed just fewer than 2 billion board ft of framing lumber and generated just under 1.3 million tons of solid-sawn wood waste. (Throw in another million-plus tons of engineered-wood waste—mostly plywood and OSB—for good measure.)

The opportunities to save are equally large. As you would expect, when you use wood efficiently, you buy less wood

Comparing the Costs of Dumpster Use Versus Grinding and Recycling

A common barrier to adopting green building practices is the perception that they are costly. On the contrary, John Wieland Homes and Neighborhoods, an Atlanta-based builder that I work for, has found that aiding the environment can also boost the bottom line. Several Wieland subdivisions use Packer Industries equipment to grind excess wood, drywall, and brick for reuse onsite. At Wieland's Providence neighborhood, we compared the costs of recycling to what we had spent hauling such waste away and it turns out that we are saving more than landfill space. We looked at two samples of approximately 35 lots each, the first built while using our company-owned dumpster service, and the second while grinding and reusing construction waste.

We found a clearly demonstrable average savings of $410 per lot for two activities: the cost of trash removal and the cost of gravel (see Table A). These particular costs are easy to track because they are shown in separate line items on the budget of each house. For trash removal alone, the samples show an average savings of $265 per lot. Possibly more important than the reduced cost is the increased predictability of the budget. Costs for grinding and hauling do not vary from one lot to the next. We pay a set bid price per lot based on the average floor area of homes in the subdivision. In the past, we had anywhere from four

Table A. Savings Per Lot

Average Cost per Lot	Using Dumpsters ($)	Recycling ($)	Savings ($)
Waste removal(actual)*	-	-	264.89
Gravel (actual)	558.08	413.88	144.20
Form boards(potential)	256.91	64.23	192.68
Other (estimated)	105.00	n/a	105.00
Total per lot	**814.99**	**478.11**	**706.78**

*Bids prices for waste grinding and hauling withheld.

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to seven dumpster pulls, at $300 each, on a given lot.

As for gravel, we average a savings of $144 per lot. The biggest reason for this cost reduction is that instead of ordering 9–18 tons of gravel for CO pads, we use mulch produced on-site. Other applications where gravel orders have been reduced or eliminated include gravel fill behind retaining walls, where we now reuse crushed brick, and gravel gabion bags at storm inlets, where we now use "log rolls" filled with recycled wood.

There are also potential savings from reduced orders for concrete form boards. The contractor returns lumber longer than 6 ft to the cull pile. In theory, reusing this lumber should reduce our form board orders by about 75% ($190 per lot). In practice we have yet to fully realize these savings, but we hope to do so with increased awareness on the part of the builders, framers, grinding sub, and other trades.

Other savings, less easy to isolate in budget reports, add up to approximately $100 per lot. This figure is based on the cost of three bales of wheat straw per lot, where we now use wood chips to fulfill our ground cover requirement during construction, plus one hour each of Bobcat time and dump truck time to remove gravel from CO pads. Mulch naturally degrades during construction and need not be removed. That brings our total savings to as much as $35,000 for a 50-lot subdivision.

In addition to saving us money, recycling these materials improves the presentation of the lots. Customers visiting the neighborhood see houses, not dumpsters.

—Vanessa Aguinaga

Vanessa Aguinaga is a neighborhood production coordinator at John Wieland Homes and Neighborhoods' Providence subdivision in Atlanta, Georgia.

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and save on the cost of materials. Several Building America builders have saved from $450 to over $1,100 per house in lumber and sheathing purchases, through the smart use of wood. Greater efficiency means less waste and lower disposal costs. And finally, the fewer trees cut, homes that use less energy and last longer, and fewer materials sent to local landfills all translate into greener homes and significant benefit to the environment.

Peter Yost and Steve Baczek are principals of 3-D Building Solutions, a high-performance buildings consulting firm in Brattleboro, Vermont. Stephanie Finnegan is an associate at the Building Science Corporation in Westford, Massachusetts.

This article is based on a report by Steve Baczek, Peter Yost, and Stephanie Finegan, (Joseph Lstiburek and Betsy Pettit, editors), ***Using Wood Efficiently: From Optimizing Design to Minimizing the Dumpster****. The report was written for the Building Science Corporation, with support from DOE's Office of Building Technologies, State and Community Programs, and the Building America program.*

FOR MORE INFORMATION:

For a copy of the Building Science Corporation report *Using Wood Efficiently: From Optimizing Design to Minimizing the Dumpster*, go to
www.buildingscience.com/resources/misc/default.htm.

For a copy of *Guidelines for On-Site Use of New Scrap Wallboard in Georgia Residential Construction*, go to
www.eere.energy.gov/buildings/building_america/pdfs/db/33988.pdf.

For a copy of *On-Site Reuse Of Ground Wood Waste From Georgia Residential Construction*, go to
www.engr.uga.edu/service/extension/agp2/resources/publication/N-T/On-Site%20Reuse%20of%20Groun217.pdf.

For information on Packer Industries grinding machines, go to
www.packer2000.com, or call (800)818-2899.