

SPECIAL REPORT

Construction's Dirty Secret

Environmentally friendly buildings still send a ton of waste to the landfill, but deconstruction and reclaiming building materials are on the rise.

by Joe Bousquin



George Berghorn would like builders to consider a simple fact the next time they pull a brand new 2x4 off the pile and start cutting or hammering it into place.

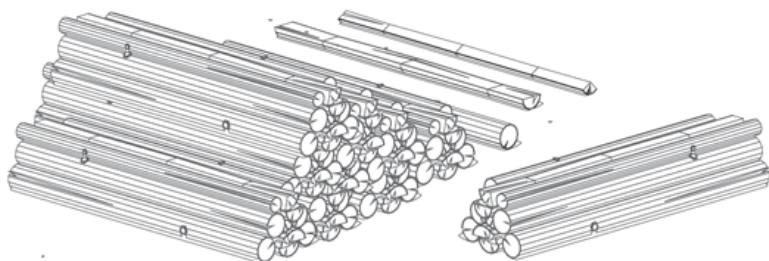
In 2015, as a country, we threw away more lumber than loggers harvested from the nation's forests. According to the U.S. Environmental Protection Agency, 11.1 million tons of wood ended up in the nation's landfills in 2015, 30% more than the 8.8 million tons of virgin timber that were felled to produce new wood.

For Berghorn, who worked in the field as a site superintendent and project manager before becoming assistant professor of construction management at Michigan State University, that statistic exposes an ugly truth about construction today: Namely, while green building and energy efficiency have been a rallying cry of the construction industry for nearly two decades, the amount of waste that's produced at construction sites to build these more environmentally friendly structures has only continued to rise, as builders still simply throw out materials on-site that could be recycled or reused in future projects.

"When LEED first came out in 1998, I remember my co-workers and I would roll our eyes at the thought of having to separate different bins for waste on the job," Berghorn says, referring to the U.S. Green Building Council's LEED rating system for projects. "Fast forward 20 years, and as an industry we're just now beginning to actually implement that practice on-site."

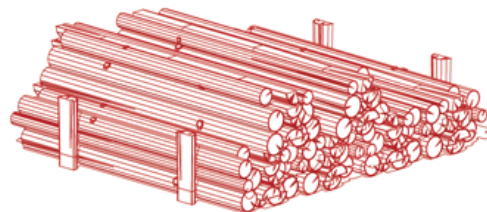
Wasted Wood

Each year, the United States sends more wood to the landfill than it harvests from the national forest system.



11.1 million tons

Wood Sent to Landfills



8.3 million tons

Wood Harvested from
National Forest System

Source: U.S. Environmental Protection Agency; U.S. Forest Service; George Berghorn, assistant professor of construction management at Michigan State University

Indeed, while an oft-cited statistic from the National Association of Home Builders (NAHB) says the construction of a 2,000-square-foot home generates 8,000 pounds of waste, or 4 pounds per square foot, researchers now say that statistic is woefully inaccurate and out of date.

“It’s probably more than 15 pounds per square foot,” says G. Bradley Guy, clinical associate professor at Catholic University, who studied the waste generated from 3,000 LEED-accredited projects between 2008 and 2016 in commercial construction to arrive at that number. Since residential home building, as an industry, is generally more fragmented than commercial construction, Guy thinks the waste metric from residential home building is likely to be even higher. “Commercial construction, in general, is going to be more efficient.”

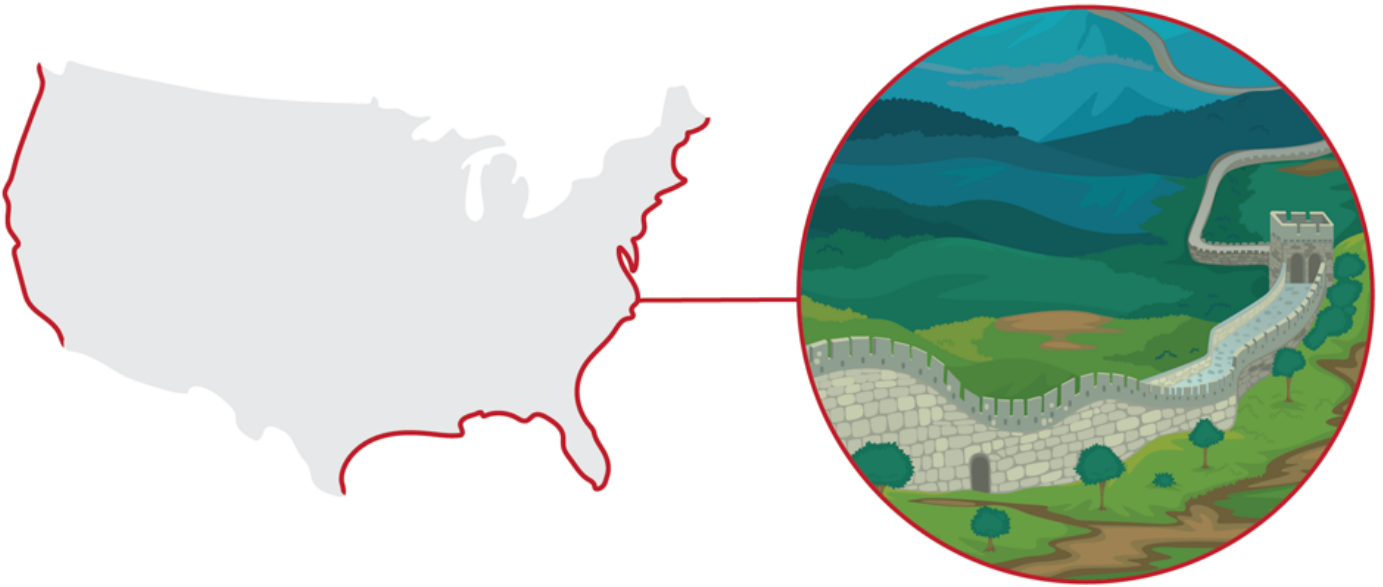
(For its part, the NAHB says the 4 pounds of waste per square foot metric for new home construction, which is likely from the 1990s, has taken on a life of its own in media articles; the association can’t actually find the source report from which the statistic supposedly originated.)

Construction creates a Great Wall of waste.

To illustrate how much waste is actually generated from construction and demolition (C&D) sites per year today, both commercial and residential, Guy created a graphic with a wall of waste on the entire coastline of the continental United States that’s as wide as a two-lane road, about 36 feet high, and 4,500 miles long. “That’s about the same volume of material in the Great Wall of China,” Guy says. “We create a Great Wall of China every year from what’s wasted in construction and demolition.”

Great Wall of Waste

The waste generated from construction and demolition sites each year would fit into a wall as wide as a two-lane road, 36 feet high, and 4,500 miles long—about the equivalent of the Great Wall of China on the entire U.S. coastline.



Source: Analysis from G. Bradley Guy, clinical associate professor at Catholic University

According to the U.S. Environmental Protection Agency, there were 548 million tons of construction and demolition waste generated in the U.S. in 2015, the latest period for which data is available. That's more than twice the 262 million tons generated by household waste.

When road and bridge construction is removed from the overall 2015 number, however, buildings accounted for 169 million tons of C&D waste, or about 30% of the total. But according to the Chicago-based Construction and Demolition Recyclers Association, a trade group of C&D haulers and processors, just 38% of debris from building construction and demolition was recovered for recycling, compared to 73% for all C&D waste.

A focus on waste reduction has led to the rise of deconstruction.

To combat that trend, a small cohort of construction professionals has emerged in recent decades to stem the stream of waste flowing from construction and demolition sites. By engaging in “deconstruction,” the process of taking existing buildings apart, piece by piece, and reusing as much of the material as practical, these pros are saving material, energy, and, indeed, even money on the jobsite.

“Deconstruction is the very conscious dismantling, in reverse, of how a building was built to save the optimum amount of material for reuse,” says Ted Reiff, founder of Oakland, Calif.-based The ReUse People of America, one of the largest deconstruction firms in the country with 18 offices nationally that run retail locations to resell its reclaimed materials at discount prices.

Deconstruction grows bigger by taking buildings down.

While still a nascent portion of the overall construction industry—Reiff says that as one of the largest purveyors of deconstruction in the country, his organization still only performs 200 to 300 residential projects a year, often for homeowners who can write off the dismantling of the house as a non-cash donation to the nonprofit—deconstruction has experienced steady growth in recent years. It's been spurred not only by higher environmental awareness and construction firms seeking green building program credits but also by new laws that are starting to require deconstruction, rather than demolition, for certain structures within cities.

Portland, Ore.; Palo Alto, Calif.; Austin, Texas; Seattle; Milwaukee, Wisc.; and other cities across the country have all passed some form of deconstruction ordinance, usually based on when the structure being removed was originally built. In Portland, for example, any home built in 1916 or before must be deconstructed. Against that backdrop, the deconstruction and materials re-use sector has more than doubled since 2005, growing from 779 companies or organizations to 1,820 in 2018, according to data Guy compiled for the Bay Area Deconstruction Working Group. The nonprofit re-use sector, of which Reiff's The ReUse People is a part, grew by 433% during that period, compared with 51% growth in the for-profit sector. For-profit firms focused specifically on lumber now represent 26% of the deconstruction market, according to Guy's data.

While some deconstruction firms see growth, the industry is still swimming upstream.

"In our business, year-over-year revenue has increased significantly," says Pete Theodore, marketing manager of Baltimore-based nonprofit re-use reseller Second Chance, which deconstructs homes nationally and runs a 200,000-square-foot retail center for reclaimed building materials south of the city. Reclaimed lumber at the center can be had for 40% less than at the big box stores. In the first half of 2019 alone, the organization diverted 6,098,004 pounds of construction waste from landfills. "We find that more and more builders, as well as consumers, are trying to be more responsible with their material selection," Theodore says.

For its part, Reiff says The Reuse People grew by 25% between 2014 and 2016.

Despite that growth, deconstruction still faces strong headwinds in the industry. The process, which requires hard-to-find labor to dismantle a building, can take two weeks to complete for a 2,000-square-foot house, versus a day or two for demolition. Deconstruction also costs more, around \$15 per square foot, according to Reiff, versus just \$11.50 for demolition, though many building owners can recoup that differential through the non-cash, tax-deductible contributions of materials they make to nonprofit re-use resellers. "Sometimes, it can even put money in their pockets, depending on the quality of lumber and components," Reiff says.



Material reuse has profit potential.

But just in case you think deconstruction and reusing reclaimed materials is only for altruistic, nonprofit idealists, there are also examples of for-profit businesses in the space. For instance, Guy tracked 51% growth of for-profit firms in deconstruction from 2005 to 2013 and says 98% of lumber-focused deconstruction firms are for-profit enterprises.

The top 12 lumber reclaimers grew revenue from \$39.5 million in 2010 to \$127.2 million in 2018, a 220% uptick, according to the Chicago-based nonprofit environmental group Delta Institute, which consults on deconstruction projects. Those numbers make sense for Reiff, who has watched the metrics of the industry change since founding The ReUse People in 1995.

“In the Midwest, a lot of people are taking down barns, which they used to be able to get for free because the owners just wanted them gone,” Reiff says. “But now, those farmers have gotten smart, and if you’re a deconstructor in Ohio, Indiana, or Kentucky, you’ve got to buy the barn from the owner first, because they know there’s value in the lumber.” For instance, wormy chestnut, which many barns were built from in the 1930s, now runs \$20 to \$25 per board foot.

Suppliers of reclaimed materials have opened the door to a profitable niche.

The for-profit, reclaimed materials industry also goes beyond straight lumber. In Pittsburgh, Andrew Ellsworth is building a for-profit, business-to-business reclaimed building material supplies company, one door at a time. Called Doors Unhinged, the startup seeks to reclaim and provide used office doors in the commercial construction space. Its motto? “Used doors are better.”

“The premise of my business is that the construction, demolition, and commercial redevelopment industries take a lot of really nice stuff and just throw it out in order to buy new stuff that costs more,” Ellsworth says. “We try to capture those materials and then charge our customers less, with a far smaller environmental footprint.”

But while the concept of buying “used” building materials is still a hurdle for many of the contractors and architects Ellsworth approaches, the back-of-the-envelope economics of his business model are compelling enough for him to get his foot in the door.

“I just came from an office that’s getting a new tenant who wanted everything done their own way,” Ellsworth explains. “There were about 150 really nice, 8-foot-tall hardwood maple doors with expensive hardware packages on them that were all going to be thrown away. So we came in and saved the contractor the effort and cost of disposing of those materials.”

Ellsworth is now betting he’ll save another contractor or designer a fair bit of money when he resells those doors on a future project. “Our business model is that I can get each of those doors for about \$25 dollars, all in,” Ellsworth says. “Retail, those would probably be \$600. But we’ll sell them for \$300, our clients will get a really good deal, and we’ll make money.”

Because doors are fairly standardized products throughout the industry that also tend to age well with use, Ellsworth can provide a wide range of packages to clients at discounted prices and fill in any inventory shortfalls by buying directly from new-door suppliers. While he’s currently just salvaging existing doors for re-use, his future plans include refurbishing the doors he reclaims to match any style and finish his clients desire.

In the meantime, he’s working with architects to give them options at the drawing phase from what he already has in stock, so new doors don’t need to be manufactured.

“It’s a slightly different design process when you’re trying to incorporate remanufactured or reclaimed materials,” Ellsworth says. “You really need to start with the materials palette and design with that in mind, versus getting through a project and hoping someone has exactly what you want. We’ll bid a project and say, ‘I see you wanted birch, but how about maple instead, for a fraction of the cost?’”

At Warwick, R.I.-based CME Corp., which reclaims used medical equipment from hospitals that are being decommissioned, remodeled, or set for demolition, the firm’s strategy is similar. “We’ll go in to a hospital that’s being decommissioned or renovated, and they’ll have examination tables that might go for \$2,000 to \$3,000 new,” explains Cindy Juhas, chief strategy officer at CME. “We’ll turn around and resell that same table for \$800 to \$1,000, save the next user a lot of money, and keep 60% to 70% of what would have been thrown away out of the landfill.”

Deconstruction is still just a trickle of activity compared to the larger industry.

For sure, no one’s claiming deconstruction is going to halt the flood of construction and demolition waste going to the country’s landfills or that construction firms are suddenly going to stop buying new products for old ones. “The dogma in the industry right now is simply, ‘We don’t work with used materials; we only buy new,’” Ellsworth says. “There’s this mindset that reclaimed materials are inferior, which simply isn’t the case.”

Indeed, many building codes prohibit the use of unstamped, reclaimed lumber for structural components of a building. But that requirement actually led to a creative redesign of the Kendeda Building for Innovative Sustainable Design at Georgia Tech, which is being constructed to meet the rigorous Living Building Challenge, a green-building standard that requires projects to send less waste to the landfill than the amount of salvaged material used in the building.



Floor panels at the Kendeda Building for Innovative Sustainable Design consist of FSC-certified two-by-sixes alternating with salvaged two-by-fours, all nailed together by apprentices trained by the nonprofit GeorgiaWorks. The fluted pattern creates an undulating look and is also expected to suppress noise throughout the building. Ken Edelstein/Living Building Chronicle

There, members of the Skanska USA construction team working on nail-laminated floor decks realized they could alternate new, stamped 2x6s with reclaimed 2x4s, used simply as spacers, to create a structurally sound deck that was flat on top, but had an appealing, undulating profile on the bottom when viewed from the floors below.

With the Living Building Challenge's requirement of using at least one salvaged building material per 500 square meters of gross building area, the solution spoke directly to Berghorn's alarming statistic of more lumber being thrown out than is harvested each year.

"For the floor decks at Kendeda, half of that lumber was salvaged, so they have a pretty good story to tell," Berghorn says. "That directly contributed to higher levels of green building certification for the team on the project." Because many of those 2x4s were reclaimed from film sets used throughout Georgia's burgeoning production industry, it also led to a savings of \$50,000 on the project.

Designers are increasingly considering disassembly from the beginning.

With examples like Kendeda coming to the foreground, as well as municipal ordinances requiring more thoughtful re-use and re-claiming on demolition sites, deconstruction is also gaining momentum within the design phase of new buildings, as more and more professionals begin thinking about the ultimate life cycle of structures and how they will be used decades later.

For example, Guy recently attended a conference to help develop International Organization for Standardization (ISO) standards to make buildings easier to take apart in the future.

“We’re developing a standard for design for disassembly and adaptability of buildings,” Guy says. “Everyone adapts their buildings and homes now, and with the idea of aging in place, we’re looking at techniques that allow for the adaptation of buildings going forward so that they can have an intrinsically longer life and won’t need to be demolished to accommodate whatever new set of functional needs are required.”



For Joe Connell, executive director of industry umbrella group Build Reuse, formerly known as the Building Materials Reuse Association, that type of approach just makes sense.

“We all should be thinking about how buildings will be used 50 years from now,” Connell says. “Most cutting-edge designers, especially on commercial projects, are thinking about how that building can be reshaped 20 years from now to meet another need or built in such a way that if it has to come apart, those materials can be salvaged much more easily.” The overuse of adhesives are a case in point, says Connell, who characterizes them as one of the biggest barriers to efficient deconstruction today.

Single-use straws are disappearing, but what about buildings?

Ellsworth says for that kind of thinking to take hold, however, building professionals will need to look at how buildings can better contribute to environmental and community well-being rather than just doing less harm to the environment than ones built a generation ago. “A lot of green building programs strive to just make buildings less bad,” Ellsworth says. “They may require recycling of materials on-site, but they don’t actually require you to produce less waste. That needs to change.”

Before those kinds of changes can happen, professionals who track the amount of waste that goes into landfills from construction and demolition activities say a fundamental shift in how we view buildings, and their disposition at the end of the life cycle, needs to happen as well.

“It’s easy to get mad about a single-use straw, or a single-use paper cup you get from Starbucks, because it’s right in front of your face, and you’re the one throwing it away,” Connell says. “But when you think about the amount of energy and materials that go into the construction of a building, and then throwing that building away at its end of life, it’s just like that paper cup. It’s astounding that we still do that, but I think that’s starting to change.”

Joe Bousquin has been covering construction since 2004. A former reporter for the Wall Street Journal and TheStreet.com, Bousquin focuses on the technology and trends shaping the future of construction, development, and real estate. An honors graduate of Columbia University’s Graduate School of Journalism, he resides in a highly efficient, new construction home designed for multigenerational living with his wife, mother-in-law, and dog in Chico, California.