Can AI Help Close the Timber Loop?

Urban Machine developed a machine that can de-nail salvaged wood for reuse onsite.

by Elizabeth Waters

Photo: Urban Machine

The machine operates like an assembly line, moving heavy timber, and glulam through each station.

Demolition activities in the U.S. create 37 million tons of wood debris each year, with the vast majority ending up in landfills, according to a 2018 report from the U.S. Environmental Protection Agency (EPA). Harvesting and processing virgin timber can be energy and water intensive, can cause forest degradation, and comes with unknown levels of emissions that some argue are comparable to emissions from concrete or steel. And disposing of it leads to further emissions as decomposition releases the carbon stored in the wood. "Circularity"—achieved by salvaging and reusing old wood for new construction—is an obvious solution. Reclaimed wood keeps its carbon sequestered, avoids logging, and shortens the supply chain for new construction when processed locally—plus,

using it in construction projects can satisfy green building requirements, like contributing toward LEED's Sourcing of Raw Materials credit and the Responsible Materials and Responsible Sourcing imperatives of the Living Building Challenge. But using reclaimed wood requires the removal of all nails, screws, and other metal fasteners, which is time and labor intensive, and drives up costs.

Photo: Urban Machine

Computer vision AI assigns the appropriate "picker," attached to a robot arm, to remove each nail, screw, and metal fastener.

Innovations in technology might be changing this. Urban Machine, a startup out of Oakland, California, developed a portable, modular machine that uses AI and robotics to remove nails and other metal fasteners from salvaged wood at scale. At 80 feet long, the machine sits on two 40-foot trailers, where it requires 6,000 ft² of space on jobsites and seven or eight operators. "We aim to be able to do 16,000 board feet a day. In relative terms, that's a single-family house," explains Jorie Wisnefski, marketing manager at Urban Machine.

The machine operates like an assembly line, moving dimensional lumber (from 2x4 to 6x18), heavy timber, and glulam through each station. First, a cutting module removes unworkable wood, and a wire brush scrapes off surface contaminants like drywall and rust. Next, computer vision AI uses 3D imaging to identify and classify the type and orientation of metal fasteners in the wood. With this information, it assigns the appropriate "picker," attached to a robot arm, to remove each one. A metal detector performs a final quality check. Urban Machine's CEO and co-founder, Eric Law, noted in an interview on Dave Cooper Live, that with each piece of hardware removed, the AI learns to better classify and direct the removal of the fasteners.

The company currently uses cameras to visually grade its lumber. It plans to make this process more robust by adding an x-ray machine that will enable the AI to identify the grain, species, and other characteristics of the wood. It is also working on technology to mechanically grade the finished lumber and glulam.

Wisnefski explains, “Until the structural grading process is complete, the wood is able to be used for light structural purposes.” Additionally, the company does not yet test the wood for potentially hazardous coatings, such as lead paint. Instead, this type of testing is on project teams to arrange for now.

Urban Machine has two revenue streams. The first is the service fee it will charge to remove fasteners from wood for those who already own it. “Think real estate investors, multifamily, and big companies that own their own buildings,” describes Wisnefski. In this case, the wood will likely be de-nailed and reused on the same site for the new construction. The second stream comes from selling Urban Machine-owned lumber, much of which is donated to the company by demolition crews to avoid trucking and dumping fees—at a price the company will try to keep comparable to virgin lumber. Urban Machine might rent or sell the machine in the future, but this is still a few years away.

For now, the company is processing wood in its warehouse and selling it by the truckload to boutique architecture firms and furniture makers. It plans to begin field testing within the month and hopes to have a second machine built by the end of the year. Both machines will operate out of northern California until 2024, when Wisnefski says Urban Machine expects to have 12 machines across the United States and Canada. Considering the typical multi-year lead time on design projects, the company invites architects across the country to reach out now to begin planning for wood reclamation.

Urban Machine hopes to encourage more architects to update their specifications for reclaimed wood and more demolition contractors to stop sending wood to landfills by default. With increasing pressure on the construction industry to shift away from demolition and toward deconstruction, the company intends to demonstrate that a more circular model is feasible. And that technology can make deconstruction faster, safer, and more cost-effective.

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