Recycling Building Materials at Scale -- What Will It Take?

BY KAREN SHAPIRO

A large scale building demolition can have all the components of a blockbuster action film. There's excitement as crowds gather to watch. There's drama as we anticipate the countdown. There's the thrill of the big boom as the backhoe takes down the roof or explosives ignite. Then there's the earthshaking rumble and the huge clouds of dust rising as the walls and everything they contained come down, often accompanied by cheers and applause.

At that point, spectators usually go their separate ways.

But one of the biggest parts of the building demolition has yet to be dealt with.

That would be the enormous pile of debris remaining where the building once stood. In the case of a high rise building, that pile could be more than fifty feet tall.

In too many cases, the debris will be hauled away to a landfill[1], where it will remain until the end of time.

In 2018, construction and demolition (C&D) in the United States was responsible for creating 600 million tons of debris. For some perspective, that's more than twice the amount generated by regular old solid municipal waste.[2] C&D is one of the biggest industries contributing to the creation of waste.

It's in our best interest to reduce these numbers, to keep carbon sequestered and to cut back on the amount of mining and extraction necessary to manufacture new materials.

Toward this end, designers, builders and demolition contractors are moving away from working within a linear economy, choosing instead to favor a circular economy.

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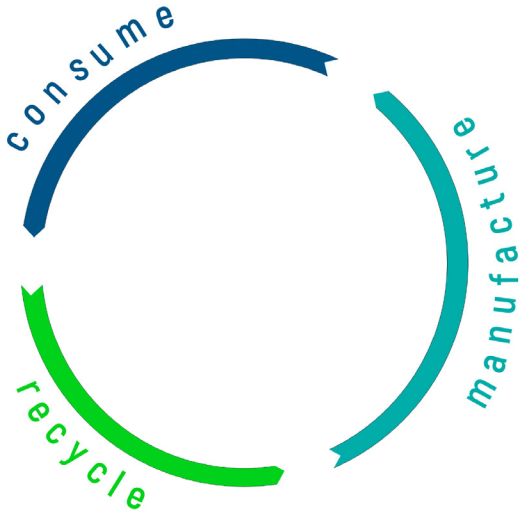
1 https://www.epa.gov/sites/default/files/2021-01/documents/2018_ff_fact_sheet_dec_2020_fnl_508.pdf

2 https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/construction-and-demolition-debris-material

linear economy



circular economy

In the linear economy, raw materials are extracted from the earth and manufactured into products that are then sold and used. When the product is no longer needed, it's thrown away. The only problem is that there's no such place as "away" to throw it. It'll either wind up in a landfill, or it will pollute the land or seas.

In the circular economy, raw materials come from older products that have been recycled. A new product is designed and installed with thought given to its later removal, or the end of life of the building. At that point, the product can either be removed from the building for use elsewhere. Or it can reformed into a new material without the need for additional extraction.

A large percentage of existing demolition debris can be useful somewhere else. It does not have to be relegated to a landfill.

As buildings are tending to have shorter and shorter life spans[3] with some barely surviving for forty years, and others nearly impossible to repurpose for new use, the need to prevent the proliferation of C&D landfills is crucial.

How can this be achieved?

Commonly used materials are already recyclable

Concrete from a demolition site can be taken to a separate recycling plant. It can be crushed into smaller pieces. It can be separated from any metal that winds up tangled with it or embedded in it. Then it can be reduced to small rocks which can be used as bedding stone or backfill. Or it can be taken down to the consistency of sand, which can be used for roadbeds.

Wood is a great candidate for recycling. Nearly every wood member from a tear down can be stripped of nails and other hardware, then processed into new material.

High grade woods in excellent condition are popular and coveted for their patina. They can be given new life as flooring, paneling or furniture. They're also commonly used in exteriors. Mid-grade wood can be made into goods like chip board and pallets. Low grade wood can become firewood, bio-fuel, mulch or pulp for paper.

In spite of this, huge amounts of wood continue to go to waste. In 2018, while 3.1 million tons of wood were recycled, 12.1 million tons wound up in landfills.[4]

Many new **steel and metal** goods on the market are already made from recycled materials. Scrap metals are easily recycled.

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3 https://www.nytimes.com/2021/09/01/business/waste-salvage-deconstruction-sustainability.html

4 https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/wood-material-specific-data

Glass represents a small percentage of C&D waste, but does lend itself to recycling into new glass. Given its fragility, it requires careful removal before the beginning of demolition. It has to remain separated from the rest of the building's demo debris.

Asphalt shingles can be recycled into an additive for hot-mix asphalt or cold patch, to fill cracks and potholes in roads.

Drywall is a major problem in landfills. As drywall decomposes, it can form hydrogen sulfide gas, which gives off the smell of rotten eggs. Exposure to this gas can cause irritation or the eyes, nose and throat, among other things. To compound the problem, the gas doesn't just remain in the landfill. It can migrate beyond the landfill and into nearby buildings.[5] Sulfate from the gypsum can also wind up in groundwater.

Drywall from demos can be recycled into new drywall, in some cases by the same manufacturers who created the original.

If all those materials are recyclable, what's stopping us from recycling at scale now?

Choice of Demolition Method

A major stumbling block to recycling all building materials resulting from a building removal is the method used for taking down the building.

In most standard demolitions, heavy equipment comes on to the site and is used to knock the building down. The remaining building materials wind up in a big pile.

If we intervene at this point, it's expensive, time consuming, unwieldy and just plain difficult to start sorting through the debris piece by piece, so that it can be separated for collection, to be moved on to separate recycling facilities.

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5. https://www.health.ny.gov/environmental/outdoors/air/landfill_gas.htm

The cheapest and easiest way to dispense with all of it is to cart it up and send it to a landfill.

We need to improve coordination of the existing recycling infrastructure.

Different materials require recycling at different facilities.

For successful recycling of the majority of materials from a tear down, contractors have to have access to the different recycling centers for each material.

There are regions in the US where these different facilities don't yet exist. In some cases, recycling centers may not be able to handle the volume of work that would be produced if there was a dramatic increase in recycling from tear downs.

Recycling centers have to be maintained in good working order. Breakdowns could result in bottlenecks and delays in processing, affecting local jurisdictions.

An assessment of needs and availability, and investment across the country is required.[6]

Policy Hangups

Our policies around the end-of-life of buildings and building materials are either non-existent or not helpful. There is a need for increased coordination of policies to facilitate processes around demolition and building materials recycling.

Some of the policies that are being considered by EPA in the case of C&D include taxes on virgin materials, and responsibility requirements on those who manufacture virgin materials. National recycling standards are being examined, as well as incentives and mandates for diverting materials from landfills. Policies which ease red tape are needed when it comes to permitting and regulations.

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6 https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

Building codes have to be revisited to see if they can facilitate a sustainable solution to building removal.[7]

Architects often find themselves bogged down in paperwork and long lead times for permitting. Backlogs like these must be eased. Even with an organization like LEED, which gives third party verification as to the sustainability standards of a building, the volume of paperwork alone could be enough to discourage a building professional from seeking its approval.

What can be done to improve the situation?

In addition to improving recycling infrastructure and policies, we can rethink the end-of-life of buildings. We can have them deconstructed or dismantled, instead of demolished.

Trailblazing companies like **Unbuilders**[8] of British Columbia have shifted the standard when it comes to removal of a building at the end of its life.[9]

Rather than going the route of demolition and disposal, they focus on deconstructing buildings and salvaging their parts for use in manufactured materials.

Because they reverse engineer the building from its roof to its foundation, they are able to separate building materials on site. From there, the materials are delivered to different recycling centers to re-enter the supply chain.

Deconstruction requires more labor and time than a standard demolition, and that drives up the up-front cost of deconstruction. However, Unbuilders has found creative ways to make the cost competitive with standard demolition.

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7 https://www.epa.gov/system/files/documents/2021-11/final-national-recycling-strategy.pdf

8 https://unbuilders.com/

9 https://www.youtube.com/watch?v=SLvYRKw4HHw

Knowing the value of wood, sometimes Unbuilders will purchase the wood for the tear down directly from the client, and deal with recycling it on their own. Their goal is to start remanufacturing wood themselves.

In other cases, they donate materials to charitable organizations, including Habitat for Humanity, which can provide a tax break.

Using this technique, approximately 95% of building materials from a tear down can be diverted from the landfill.

Improve awareness of end-of-life issues when new buildings are being designed and when new materials are being manufactured.

Until recently it was unusual for builders and designers to consider the end of a new building's life.

Now that buildings have shorter life spans, it becomes incumbent upon designers to create buildings that won't go to waste when they've outlived their usefulness.

Consideration is now being given to designing buildings that can be disassembled at the end of life. Denmark's Braunstein Brewery[10] is an example of a building that was designed and built with ease of disassembly in mind. At the end of its life, its components can be made available for use in other new construction and renovation, if building codes allow.

While architects and investors tend to be familiar with this design process, half of building owners tend not to be.[11] When disassembly is considered during the design phase of a new building, it can wind up affecting the layout and appearance of the building. With more collaboration between owners, design professionals and manufacturers, owners will be able to make better decisions which specifically address the building's end-of-life.

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10 https://www.adept.dk/project/the-braunstein-taphouse

11 https://proddrupalcontent.construction.com/s3fs-public/WorldGreen-2021-SMR-29Oct.pdf

The good news

Recycling building materials at scale is already possible, provided the different recycling facilities are available, existing policies permit it, and all the building professionals and owners involved are on board.

Though access to recycling facilities can be limited depending upon location and resources, we know what has to be done to make it the widely available go-to option for building removal.

Going forward, we'll do best if designers consider the end-of-life of every new building built and every new product brought to market. We can no longer afford to ignore it.

We've long ago passed the point where we can believe that waste can be just be dealt with by throwing it "out". We can't continue to pile up discarded materials in landfills without hitting a tipping point.

Innovative designers and builders have already proven that a shift in our habits and methods can mean that materials formerly destined for the landfill, can be put right back into the supply chain.

It's a matter of will.

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