Deconstruction, Salvage and Reuse Policies

Reusing buildings and materials reduces ***embodied carbon*** and waste while promoting environmental and human health. ***Deconstruction*** is the process of disassembling buildings to allow for the salvage of building materials for reuse. ***Building reuse***, also called adaptive reuse or renovation, describes a process wherein the structure, envelope, or other portions of an existing building are retained and utilized during a renovation project. If the existing building hadn't been reused, it would have been fully demolished and replaced with a newly constructed building on the same site.

This factsheet provides an overview of reuse concepts and how government policies and programs can contribute to a circular building and material reuse ecosystem.

Shifting towards a Reuse Economy

Current disposal practices of construction and demolition debris contribute to the loss of valuable resources, which leads to an increased demand for virgin raw materials and the subsequent greenhouse gas emissions associated with manufacturing new products. Reuse helps keep material resources in circulation and has a wide range of potential benefits depending on how that material is processed and its final end use. Reuse has even larger benefits than material recycling by extending the life of a material or building with fewer resource inputs, which can have environmental, health, and community benefits. These include but are not limited to:

- Largely avoids the cradle-to-gate embodied carbon from the process of extracting and manufacturing new materials.
- Avoids materials ending up in landfills. According to the EPA, an estimated 600 million tons of construction and demolition (C&D) waste are generated in the U.S. each year. C&D waste is the largest single-stream source of refuse in the United States - more than double the amount thrown into household trash bins (EPA, 2018).
- Contributes to investment in existing communities, historic and culturally significant buildings, and high-priority development areas.

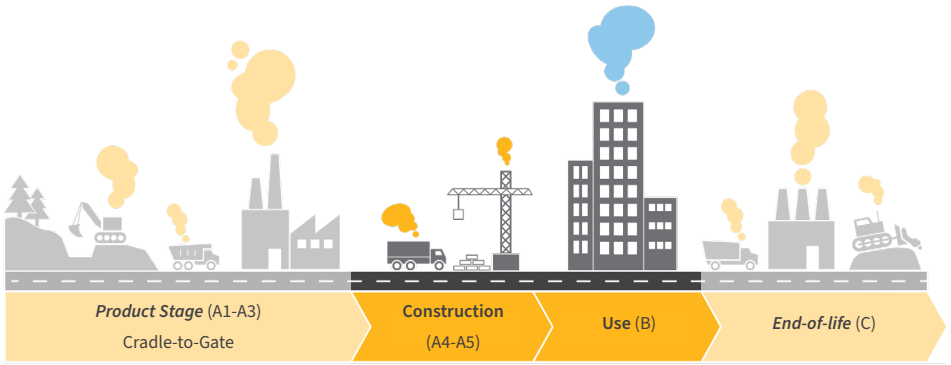

Figure 1. Reusing buildings and products reduces product extraction and manufacturing emissions (due to producing fewer new materials) and results in fewer end-of-life emissions (through avoiding landfill or downcycling emissions).

Reuse reinvests local resources into local economies

Reuse and ***deconstruction*** have many co-benefits such as creating jobs and adding new regional markets for the removal, sale, and distribution of salvaged materials. Deconstruction requires more skilled contractors than demolition, thereby creating new training opportunities and jobs.

The storage, refurbishment, and resale of salvaged materials require the development of new markets, reuse warehouses, and local community hubs. Many of these organizations prioritize community as a part of their mission. For example, the ReUse Center in Cincinnati has a youth training program targeted towards at-risk youth to teach basic work and life skills that will set them on a successful path.

KEY TERMS

Embodied carbon

The greenhouse gas (GHG) emissions are generated by the manufacturing, transportation, installation, maintenance, and disposal of construction materials used in buildings, roads, and other infrastructure.

C&D Waste

Construction and Demolition (C&D) debris is a type of waste that is typically not included in municipal solid waste. Materials included in the C&D debris generation estimates are steel, wood products, drywall and plaster, brick and clay tile, asphalt shingles, concrete, and asphalt (EPA).

Cradle-to-Gate

Environmental impacts of the product life cycle stages from resource extraction (cradle) to manufacturing (gate).

See Product Stages A1-A3 in Figure 1.

Opportunities for Policy and Government-led Programs

There are a variety of opportunities for policy and government-led programs across the design, construction, use, and end-of-life of a project to contribute to the circular economy.

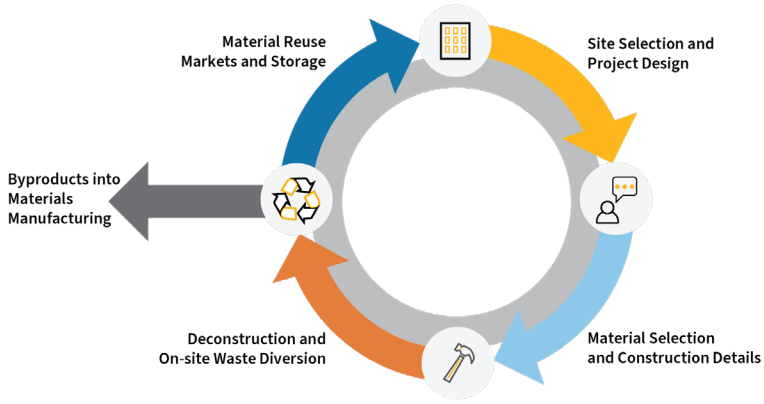

Figure 2. Key intervention points for promoting reuse across the design, construction, and eventual end-of-life of a building

Site Selection & Project Design : Policies that Incentivize Building Reuse

Building reuse has the most significant opportunity for carbon reductions and co-benefits. Zoning, land use policies, and historic preservation policies can influence owners towards building reuse. Policies that limit the embodied carbon on a project can also directly or indirectly encourage reuse over demolition and new construction because reusing an existing building preserves the embodied carbon in those materials.

Precedents:

- Los Angeles Adaptive Reuse Ordinance provides developers with density and other bonuses for adaptive reuse in a specific region.
- Pittsburgh's Zoning Performance Points provide density bonuses for building reuse.
- LEED v4.1 awards points for teams that maintain existing building structure, envelope, and interior nonstructural elements.
- California Green Building Standards Code (CALGreen) requirement allows eligible projects to comply with one of three pathways, including the reuse of at least 45% of an existing structure.

Material Selection & Construction Details : Policies that Include Salvaged Materials in Design and Procurement

Procurement policies like 'Buy Clean' can include salvaged materials as additional compliance pathways and support creating *demand* for salvaged materials. This complements the creation of *supply*, referenced under deconstruction policies below. During design, projects can specify salvaged materials (from on-site or off-site, like a reuse warehouse) and use design for disassembly principles to increase the future supply.

Precedents:

- LEED v4.1 Sourcing of Raw Materials awards points for material reuse.
- Inflation Reduction Act: EPA determined that salvaged and reused materials from onsite and/or within the project region qualify as having substantially lower levels of embodied GHG emissions under the requirements of the Inflation Reduction Act.

KEY TERMS

Building Reuse

Repurposing an existing building (or portion, such as structure or envelope) rather than demolition and new construction. When a building is reused in a different capacity, this is referred to as *adaptive reuse*.

Material Reuse

Installation of a previously used material or product that requires limited to no processing for reinstallation and use on a different project. (EPA)

This category of materials does *not* refer to recycled content in manufactured materials/products. Some level of processing (e.g., resawing salvaged lumber) would still be considered a minimally processed salvaged and reused material. (EPA)

Salvage

The deliberate reclamation of reusable materials from the disassembly, deconstruction, or demolition of buildings or structures. (EPA)

Design for disassembly

The design of buildings to facilitate future change and the eventual dismantlement (in part or whole) for recovery of systems, components, and materials.

Deconstruction

The systematic dismantling of a structure, typically in the opposite order it was constructed, to maximize the salvage of materials for reuse, in preference over salvaging materials for recycling, energy recovery, or sending the materials to the landfill. (City of Portland (OR) City Code 17.106.020)

Deconstruction & On-site Waste Diversion : **Deconstruction Policies**

Requiring or incentivizing deconstruction (rather than demolition) is critical for creating a supply of quality salvaged materials for reuse on projects. Deconstruction policy examples include ordinances/ requirements, and incentives, including financial, technical assistance or permitting.

Precedents:

- Portland, OR Deconstruction of Buildings Law
- Palo Alto, CA Deconstruction Ordinance
- Boston, MA Zero Waste Deconstruction Initiative
- Seattle, WA Deconstruction Incentive Pilot
- Hennepin County, MN Building Reuse Grants
- Victoria, BC offers reimbursement for demolition permits if you ensure deconstruction
- Case study: Deconstruction vs. Demolition: An evaluation of carbon and energy impacts from deconstructed homes in the City of Portland (Nunes, Palmeri, and Love 2019)

Material Reuse Markets & Storage : **Government-supported material reuse markets and storage**

Once materials are salvaged from a project site (rather than being landfilled), they must be transported and stored until they are used by the current building owners or on a new project. Many reuse warehouses today are run by nonprofit organizations or funded by local governments, and serve a relatively small number of projects. Nonprofits like All for Reuse and Build Reuse have directories of local organizations to connect demand for salvaged materials to supply.

In order for material reuse to scale, online platforms are needed to easily connect design teams and contractors with available materials, while also reducing the need for physical space in expensive real estate markets. The technology for building databases and software systems to catalog and advertise salvaged materials to potential owners and buyers for projects is a critical piece of the circularity ecosystem. Tools are available that support the tracking of materials from deconstruction to storage to procurement for new projects. In one example, the City of San Francisco is working with Rheaply intending to connect suppliers to receivers before materials are removed from building sites.

Precedents and Resources:

- City of Houston Reuse Warehouse
- Pennsylvania Recycling Markets Center Incubator
- MassDEP RecyclingWorks C&D Materials Guidance
- City of Seattle EPA SWIFR grant to develop a salvaged wood warehouse
- Washington Materials Marketplace
- Boston Deconstruction and Material Reuse Roadmap

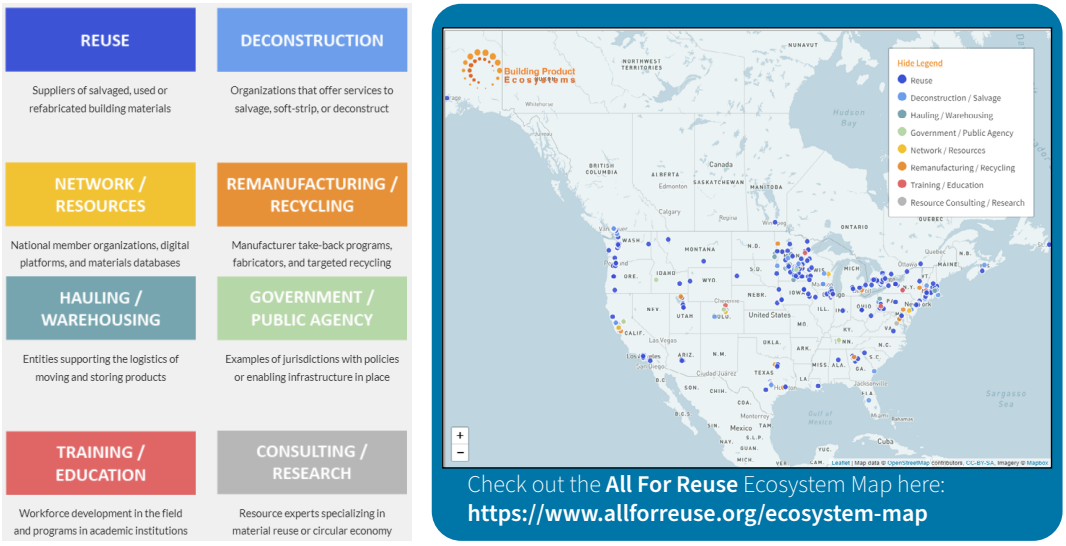

Figure 3. All for Reuse's Reuse Ecosystem Map is connecting the dots across the design and construction industry toward an inclusive circular economy.

Tools exist to measure the benefits of reuse

Even before design begins, there are tools that can help communicate the benefits of building reuse to the building owners, community members, and other stakeholders, by comparing the carbon impacts of an existing building retrofit vs. demolition and new construction. **The CARE Tool** (**Carbon Avoided Retrofit Estimator**) and the **EPIC Tool** (**Early Phase Integrated Carbon**) can run early building reuse scenarios that assess embodied and operational carbon.

Later in the design process, whole building life cycle assessment tools can help users calculate the avoided carbon from reusing building systems or components. Often, this is calculated by excluding A1-A3 emissions for reused materials— while still accounting for transportation, installation, use, and end-of-life emissions.

Additional data on the emissions associated with deconstruction and re-processing or storage of materials will help advance the data on the emissions impact of reused materials.

Case Studies:

- Sustainable reuse of post-war architecture through life cycle assessment. Ferriss, L. (2021). Journal of Architectural Conservation.
- The Total Carbon Study: Case Study of DPR Construction San Francisco Office Building – Net Positive Existing Building Reuse. (EBNet, 2015).

The future of deconstruction and reuse policies

Policies that encourage building reuse, deconstruction, and material salvage and reuse are evolving quickly in many forms. They are often coupled with historic and cultural preservation, the prioritization of a circular economy, or social and workforce benefits. Some emerging policy approaches include:

- **Design for disassembly (DfD)** is the process of designing buildings with their eventual disassembly in mind allowing for ease of recovering and reusing the materials and products. The EPA published a series of Fact Sheets on Designing for the Disassembly and Deconstruction of Buildings.

- **EPDs for salvaged materials -** The EPA conducted stakeholder engagement related to the IRA funding for reducing the embodied carbon of construction materials, and one theme that emerged was interest in EPDs for salvaged and reused materials.
- **A digital product passport (DPP)** is a tool to create product transparency that shares product information across the entire value chain – including data on raw material extraction, production, recyclability, and more.[1] The European Commission is drafting a regulation on DPP's with an expected approval date in 2024 and implementation starting in 2026.
    - The Palats tool allows for picture tagging and a digital product passport to be created with material data.
- Improved modeling of what happens to building materials at the end of their life is an important component for policies that require WBLCA. In a recent CLF Report: End of Life (EOL) Modeling and Data in North American WBLCA Tools, the researchers conducted interviews, surveys, and a workshop which resulted in a list of challenges faced by projects considering deconstruction and reuse, as well as proposed recommendations. The report recommended that WLBCA tools better incorporate reuse scenarios at the assembly and building scale to aid design decisions. More broadly, the report recommended filling data gaps in the transport and processing of salvaged materials and establishing regional default waste management rates to harmonize modeling for projects and policies.

Circular Buildings: Policy Checklist

- ☐ Establish land use, zoning, and/or building policies that incentivize building reuse through setting building embodied carbon limits and allowing building reuse as a compliance pathway
- ☐ Include salvaged materials as a compliance option in 'Buy Clean' and other material procurement policies
- ☐ Provide developer incentives for building reuse (over new construction)
- ☐ Establish a local deconstruction requirement or grant/incentive program
- ☐ Provide training for contractors on deconstruction and for architects on how to specify salvaged materials and design for disassembly.
- ☐ Integrate these actions and policies into a regional Climate Action Plan
- ☐ Fund local reuse warehouses and markets
- ☐ Support online platforms to connect designers and salvageable materials
- ☐ Use tools like the CARE Tool or the EPIC Tool to educate and advocate for building retrofit over new construction to building owners, municipalities, community members, and other stakeholders.

REFERENCES

1. World Business Council for Sustainable Development. (2022). The EU Digital Product Passport shapes the future of value chains: What it is and how to prepare.

Learn More

- → Zero Net Carbon Collaboration
- → CR0WD, supported by Cornell's circular construction lab, has deconstruction fact sheets and more.
- → Build Reuse Wiki- a website that displays key information and resources produced by the building material reuse community
- → Northeast Recycling Council (NERC) Webinars
- → Build Change 'Saving Embodied Carbon Through Strengthening Existing Housing'

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Last updated June 2024