Toward Building Sustainable Communities and Circular Economies:

A Local Government Policy Guide to Alternatives to Demolition through Deconstruction and Building Material Reuse

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This report was collaboratively co-produced by the Circularity, Reuse, and Zero Waste Development (CR0WD) network. CR0WD network partners include (in alphabetical order) Diane Cohen, Finger Lakes ReUse; Felix Heisel, Circular Construction Lab (CCL), Department of Architecture, Cornell University; Susan Holland, Historic Ithaca; Bryan McCracken, City of Ithaca; Jennifer Minner, Just Places Lab (JPL), Department of City and Regional Planning, Cornell University; Christine O'Malley, Historic Ithaca; Andy Roblee, Preservation Association of Central New York; and Gretchen Worth, Susan Christopherson Center for Community Planning (SCCCP).

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Front cover image credit: Felix Heisel, 2022

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Introduction to This Document

This document is intended to be an initial resource for local government elected officials, staff, and other community leaders about the adoption of policies that support salvage, deconstruction, and reuse. This document was produced by the Circularity, Reuse, and Zero Waste Development (CR0WD) network to aid in the adoption of ground-breaking policies to achieve sustainability, economic development, and climate resiliency goals.

The CR0WD network was established in 2020 to strive toward the adoption of innovative approaches to achieve a full spectrum of sustainable reuse practices in the built environment—from the preservation of existing buildings to the salvage, deconstruction, and reuse of building materials within the Finger Lakes Region and New York State. CR0WD partners include the Cornell University Circular Construction Lab, the Cornell University Just Places Lab, Finger Lakes ReUse, Historic Ithaca, the Preservation Association of Central New York, and the Susan Christopherson Center for Community Planning, among many others.

Members of CR0WD believe the adoption of salvage, reuse, and deconstruction policies is an important step toward achieving carbon neutrality and an equitable future. This recommendation guide is informed by a review of leading local government policies across North America, input from focus groups, ongoing interactions with local officials, conversations with national-level and state-level experts, pilot projects, hosted information sessions, and meetings with local developers, architects, and contractors.

Key Terms

Circular Economy: In contrast to a linear, take-make-waste economy, this focuses on economic, social, and environmental sustainability through an emphasis on system-wide responsibility for materials, components, and products.[1]

Deconstruction: The careful and systematic dismantling of a building or structure to maximize the recovery of valuable materials and architectural components for reuse, resale, and recycling.

Demolition: The partial or complete destroying, tearing down, or wrecking of any building or structure.[2]

Embodied carbon: Refers to the greenhouse gas emissions arising from the manufacturing, transportation, installation, maintenance, and disposal of building materials.

Operational carbon: In contrast to embodied carbon, this comprises the greenhouse gas emissions associated with the energy required to operate a building throughout its service time.

Preservation: The practice of protecting, maintaining, and conserving the built environment.

Reuse: The process of using a pre-existing component, product, or material for a new project or purpose while maintaining the original composition and shape.

Recycle: An umbrella term referring to processes that convert waste into usable products, materials, or substances with the goal of reintroducing them into the marketplace. In contrast to reuse which tends to be more labor-intensive, recycling processes are more energy-intensive and generally change the physiognomy or composition of the resource. Recycling processes divert materials from the landfill or incinerator.

Salvage: A systematic and careful intervention to extract valuable building materials, components, and products before demolition. The salvaged materials usually retain their original form with light reprocessing before being re-installed into a building.

[1] Heisel, F., & Hebel, D. E. (2022). Building Better - Less - Different: Circular Construction and Circular Economy: Fundamentals, Case Studies, Strategies. Basel: Birkhäuser. https://doi.org/10.1515/9783035626353.
[2] Definition from the City of Palo Alto

Section 1 | Executive Summary and Overview of Recommendations

The Problem

The waste streams associated with new construction, renovation, and demolition are substantial. The United States alone generates more than **600 million tons of construction and demolition waste annually**, **90% of which comes from demolition.**[3] This is double the tonnage generated through municipal solid waste. Globally, buildings account for 39% of annual greenhouse gas emissions and more than 50% of resource extraction and solid waste production.[4]

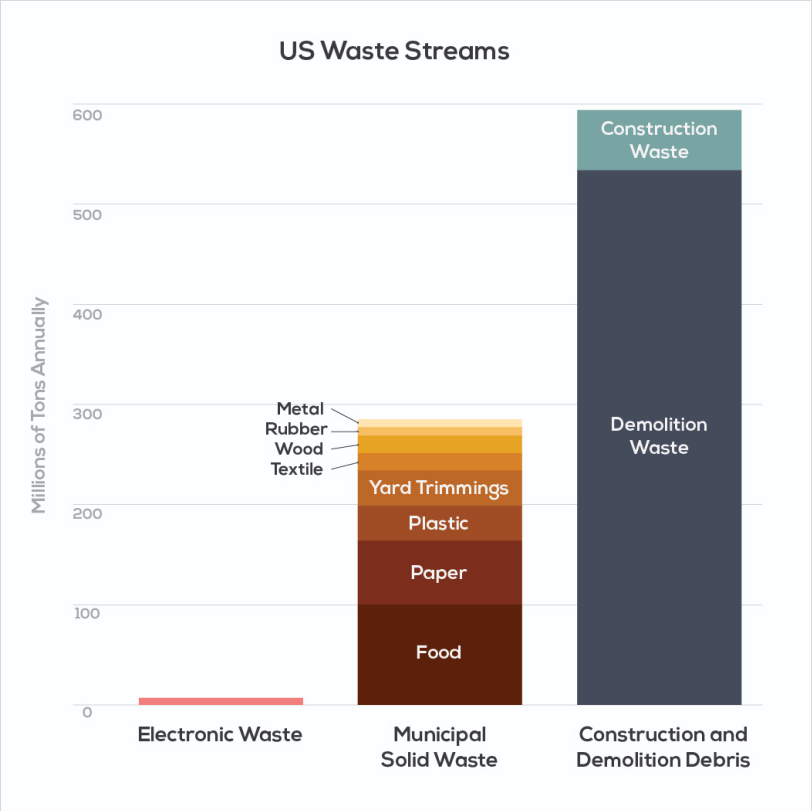


Figure 1: Annual US Waste Sources (Millions of Tons). Source: US EPA. Graphic by Wyeth Augustine-Marceil, Just Places Lab and Annie Stewart, the Susan Christopherson Center.

The Opportunity

In diverting building materials from landfills to preserve their embodied energy, there is a significant opportunity for any local government to join the growing list of cities and counties—from Portland, Oregon to Palo Alto, California—in the effort to create and adopt policies that support salvage, deconstruction, and reuse to address climate resilience while producing significant local economic benefits by way of the creation of green jobs.

Proposed Solutions

CR0WD recommends the adoption of incentives and regulations to support the transition from "business as usual" demolition to a thriving, building material circular economy. What follows is a non-exhaustive list of incentives, regulations, and additional actions that a municipality could adopt to support a circular economy of deconstruction, salvage, and reuse.

[3] That is 188.8 million tons from buildings, 275.3 from bridges and roads, and 136.2 from other sources. From EPA Fact Sheet, 2018.
[4] Heisel, Felix, Dirk E. Hebel, and Ken Webster. 2022. Circular Construction and Circular Economy: Building Better - Less - Different. Basel: Birkhäuser.

Regulations

- Pass a version of the proposed "Model Deconstruction, Salvage, and Reuse Ordinance" (pages 35–43).
- Require the use of more data-generating pre–building removal assessments to gain information on salvage and deconstruction potential (pages 23 and 51).

Incentives

- Provide grants to property owners to encourage deconstruction (see page 20).
- Lower the cost and expedite the processing of deconstruction permits to discourage the pursuit of demolition permits (page 21).
- Provide grants to property owners to incentivize wider adoption of reused construction materials (page 21).

Additional Actions

- Pass a form of the "Sustainable Deconstruction Resolution" (pages 33–34) to demonstrate a commitment to a more sustainable built environment.
- Provide assistance with facilities, job training, online marketplace infrastructure, or other activities to foster a circular economy of building materials (pages 12–15 and 23–24).
- Create a mandatory training process for contractors to be licensed as "certified deconstruction contractors" to establish a city standard (page 36-37).

Implementation Approach

The above recommendations to support deconstruction, salvage, and reuse are described throughout this document. These actions do not need to be implemented simultaneously or immediately to contribute to a more sustainable built environment. Instead, CR0WD recommends communities assess their specific needs and capacity to adopt new policies. Often local governments may need to take a phased approach, beginning with the above-mentioned data-generating assessments, adoption of incentives, and finally leading to the passage of a more expansive deconstruction ordinance after local deconstruction and reuse capacity has been further established.

Additionally, CR0WD recommends that local governments consider legislation that extends the lifespan and adaptation of existing buildings. This may come in the form of a climate justice program that is guided and informed by an advisory council on building repair, retrofitting, and deconstruction.

Section 2 | Introduction to Deconstruction and Circular Economy

This section provides an introduction to a building treatment hierarchy that encourages the reduction, reuse, and when necessary the recycling of building materials. This section also contrasts demolition and deconstruction and discusses the transition from a linear to circular economy.

Building Reuse to Waste Hierarchy

The construction industry is responsible for generating a significant amount of waste each year, contributing to environmental degradation, greenhouse gas emissions, and resource depletion. According to the United Nations Environment Programme, the construction and demolition sector generates around 40% of the world's total waste, equivalent to approximately 1.3 billion tons per year. To address this issue, a building reuse to waste hierarchy (Figure 2) has been developed as a conceptual guide to the sustainable management of building materials in the construction industry.

The following diagram represents a summary of many of the insights that CR0WD has gathered in its research. It draws from an initial diagram developed by Wyeth Augustine-Marceil and refined by researchers in the Just Places Lab in dialogue with CR0WD to represent best cases in the built environment. It draws from a series of zero waste and recycling hierarchy diagrams.[5] We acknowledge that this is an initial representation, and further research may lead to additional refinements.

The building reuse to waste hierarchy is a framework that prioritizes the most preferred methods of managing waste generated during the construction, renovation, and demolition of buildings. The hierarchy is presented as an inverted pyramid with the most preferred building treatments at the top and least preferred methods at the bottom. The hierarchy segments into two sections: building life extension processes and end-of-life processes. The goal of the hierarchy is to minimize waste generation, maximize resource efficiency, and reduce the environmental impact of building activities.

[5] A hierarchy specifically for management of building materials was first produced by Crowther (2001) acting within a task group for the International Council for Research and Innovation in Building Construction (CIB).

Crowther, P. (2001). Developing an Inclusive Model for Design for Disassembly. Deconstruction and Materials Reuse: Technology, Economic, and Policy, CIB Publication 266, 1–26.

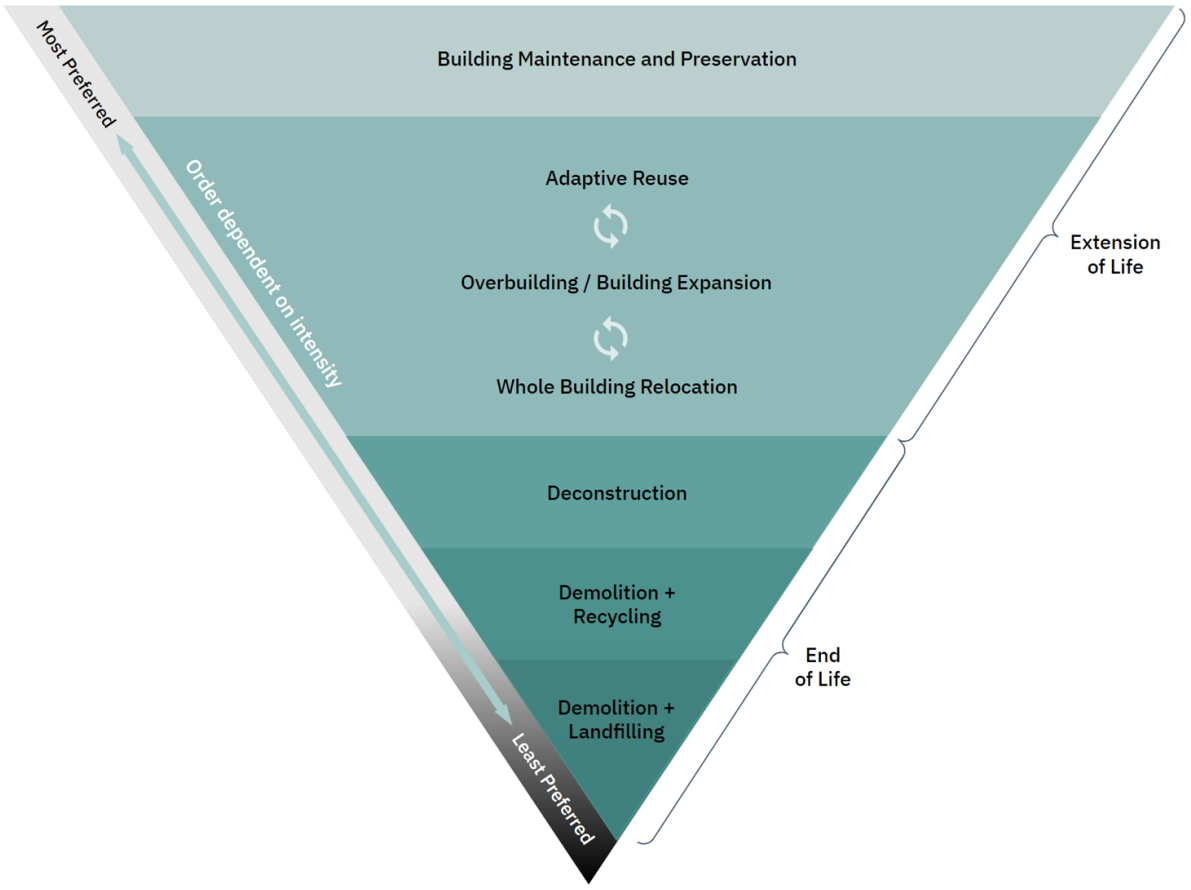


Figure 2: Building Reuse to Waste Hierarchy. Graphic: Wyeth Augustine-Marceil, Just Places Lab.

Building maintenance and preservation is often the most sustainable means of managing building material by extending the life of a building in place and minimizing the need for new materials.[6] This involves the regular upkeep and repair of buildings to extend their lifespan and minimize the need for demolition or renovation. This set of actions conserves the greatest amount of embodied carbon and is more likely to be in alignment with Certified Local Government regulations for historic properties and the *Secretary of the Interior's Standards for the Treatment of Historic Properties.* Even when a property is not a designated historic resource, care of all buildings can increase the lifespan and utilization of the building stock while minimizing the use of new materials.

The following three sets of options represent additional methods to extend the life of a structure. These options are visualized together because the range of resource intensity and amount of material reuse may vary substantially according to specific plans. **Adaptive reuse** is a process of repurposing an existing building for a new use or program. This option can offer significant environmental and cultural benefits by reducing waste and preserving a sense of place.

[6] In this section, we use terms such as preservation and adaptive reuse broadly and are not specifically referencing treatments as they are used in the *Secretary of the Interior's Standards for Historic Properties.*

Overbuilding and building extension can involve a variety of steps to retain a large proportion of existing materials in place, even as the structure is expanded or the site around it redeveloped. An example is overbuilding, in which an entire existing building is retained and additional construction occurs above (or around) the building. In this case, new development should incorporate reclaimed materials as much as possible. Another option includes **retention of large elements of a building,** such as the foundation or structural elements, even as a new building is constructed around those existing elements. **Whole building relocation** is moving an intact building from one location to another. This can be beneficial because it involves repurposing all or most of the original materials associated with the building. Moving the building shorter distances will reduce the energy costs associated with its transport.

Deconstruction and salvage is the next step in the hierarchy and involves the careful dismantling of a building with the aim of maximizing the recovery of valuable materials for reuse, which is a higher and better use than recycling. Deconstruction can be more labor-intensive than demolition, but it can offer significant economic and environmental benefits by reducing waste and promoting resource efficiency.

Demolition and recycling involves the destruction of a building and the recovery of valuable materials for reuse. Materials such as concrete, brick, and metal can be recycled and used in new construction projects, reducing the demand for virgin materials and the associated environmental impacts. Typically demolition materials are mixed on site and require separation at a C&D recycling facility, which dramatically lowers recovery rates. Rates range between 60% and 85% depending on the quality of the facility and material separation on the job site. The remainder is landfilled.

At the base of the building waste hierarchy is **demolition and landfilling.** This involves demolishing a building and sending the waste to a landfill site, where it is buried and left to decompose over time. This is the least preferred method of treating building waste because it does not promote the recovery of valuable resources or reduce the environmental impact of construction activities.

By prioritizing the most preferred methods of building treatment and building material management, the hierarchy promotes resource efficiency, reduces waste generation, and minimizes the environmental impact of building activities. Understanding and implementing the building treatment hierarchy can help to promote sustainable building practices and reduce the environmental impact of the construction industry.

Demolition vs. Deconstruction

Demolition, which is the partial or complete destroying, tearing down, or wrecking of any building or structure, is currently the standard method of building removal in most

municipalities. Demolition produces a staggering amount of mixed material waste that is typically buried in a landfill, where it will continue to produce greenhouse gasses for years after the building is removed. Alternatively, ***deconstruction*** is the careful and systematic dismantling of a building or structure to maximize the recovery of valuable materials and architectural components for reuse, resale, and recycling. Deconstruction has been shown to effectively save a substantial proportion of construction and demolition that would otherwise be sent to a landfill.

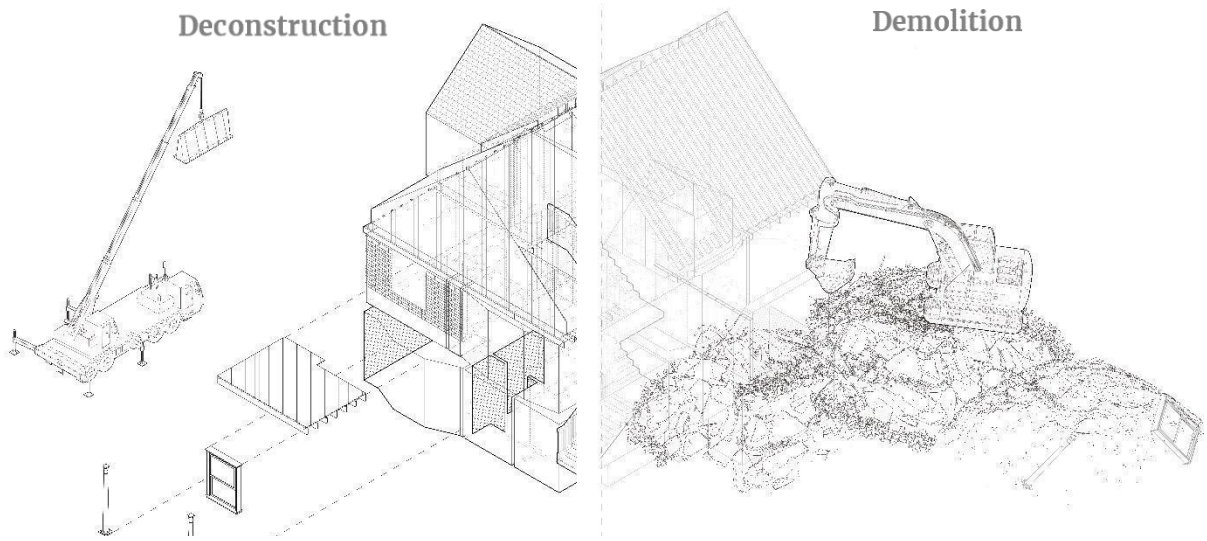


Figure 3: Illustration by Allexxus Farley-Thomas, Circular Construction Lab

Figure 4: Photos by Joseph McGranahan (left), Melody Chen (right), Circular Construction Lab
A visual to contrast the process (top) and aftermath (bottom) of deconstruction (left) and demolition (right)

The Case for Deconstruction

In addition to diverting waste, deconstruction has many advantages over demolition. Such advantages involve material preservation, cost reduction, job creation, and public health.

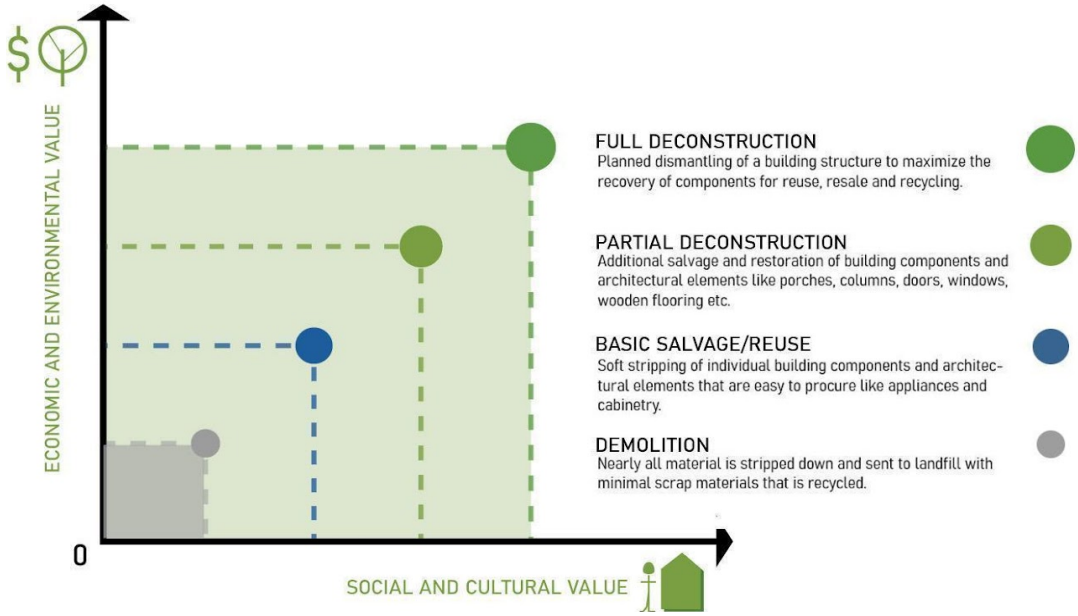
Material Preservation: Deconstruction can retain elements from culturally important structures and repurpose scarce materials, such as old-growth timber.

Low-Cost Construction Materials: Diverting building materials from landfill enables them to be recirculated as low-cost alternatives to new materials, which have become prohibitively expensive.

Creation of Green Jobs: Deconstructing buildings and processing the resultant material could create new jobs in the green economy across a variety of skills and experience levels.

Public Health: Mechanical demolition showers surrounding areas with harmful "fugitive dust," which can contain lead and other heavy metals.[7] Deconstruction mitigates the escape of fugitive dust because building components remain largely intact.

Figure 4: Deconstruction has many advantages over demolition. Graphic by Anthea Fernandes, Just Places Lab



[7] Jacobs DE, Cali S, Welch A, Catalin B, Dixon SL, Evens A, Mucha AP, Vahl N, Erdal S, Bartlett J. Lead and other heavy metals in dust fall from single-family housing demolition. Public Health Rep. 2013 Nov-Dec;128(6):454-62. doi: 10.1177/003335491312800605. PMID: 24179257; PMCID: PMC3804089.

Figure 5: This diagram illustrates how the closer one gets to the full deconstruction of a building, the greater the alignment with economic, environmental, social, and cultural values. Graphic by Anthea Fernandes, Just Places Lab

The Benefits of Deconstruction

Environmental

- Reduces the waste sent to landfills;
- Conserves the natural resources needed to make new construction materials;
- Lowers emissions by decreasing the energy use in the construction sectors;
- Retains embodied carbon in the built environment;
- Improves worker health and safety by reducing injuries associated with mechanical demolition;
- Improves public health and safety by reducing airborne toxic pollutants and heavy metal soil leaching.

Economic

- Lowers public and private sector costs of maintaining landfills;
- Reduces expenses associated with landfill disposal fees;
- Offers tax deductions from material donation;
- Keeps scarce materials, like old-growth wood, in economy;
- Produces quality, affordable building materials;
- Contributes to emerging circular economy;
- Helps augment supply of quality building materials and offsets costs of new materials;
- Creates green jobs for the deconstruction, processing, and resale of materials and job training opportunities for those with barriers to employment or who want to build skills in the trades.

Social and Cultural

- Honors the history and craftsmanship of materials;
- Develops trade skills that are being lost generationally;
- Helps preserve historic architectural styles in neighborhoods;
- Improves future building material design and manufacturing practices;
- Preserves a sense of place and community in existing neighborhoods.

A Snapshot of a Circular Construction Economy

The existing construction and demolition processes in most municipalities can be described as part of a linear economy. Most often, building construction and renovation exclusively use new materials, and when a building is demolished, most of its materials—often still usable—are discarded into a landfill. CR0WD imagines a circular economy that values used materials, provides green jobs, and reduces the carbon produced by the building and un-building of physical structures. The Ellen MacArthur Foundation defines a circular economy as "a systemic approach to economic development designed to benefit businesses, society, and the environment.

In contrast to the ‘take-make-waste’ linear model, a circular economy is regenerative by design and aims to gradually decouple growth from the consumption of finite resources.”[8]

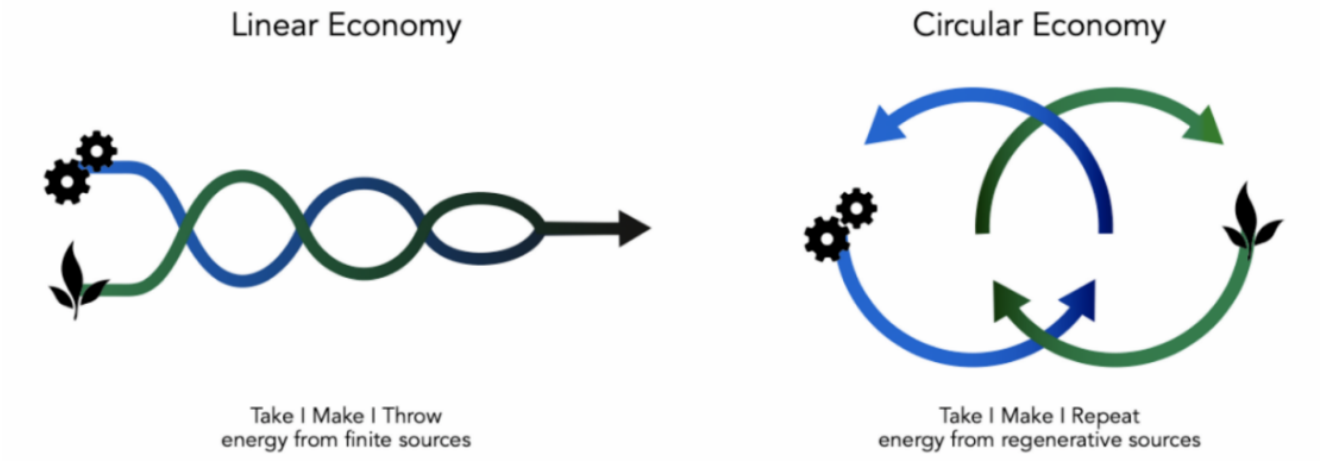


Figure 6: A diagram to contrast a traditional linear economy and a transformative circular economy. Credit: Felix Heisel, Circular Construction Lab

A circular construction economy requires reimagining how resources are managed, as well as what parties may be involved in this management. Local governments across North America have demonstrated that a transition to a circular construction economy requires new jobs, training, infrastructure, and political support. CR0WD envisions the eventual need for certified deconstruction contractors, a larger warehousing and inventory capability to handle reusable materials, and green job training programs. Case studies demonstrate that political intervention in the form of incentives and regulations are key catalysts to increasing the speed and scale of a transition to a circular construction economy.

[8] “The Circular Economy in Detail” The Ellen MacArthur Foundation, accessed August 31, 2022, https://archive.ellenmacarthurfoundation.org/explore/the-circular-economy-in-detail.

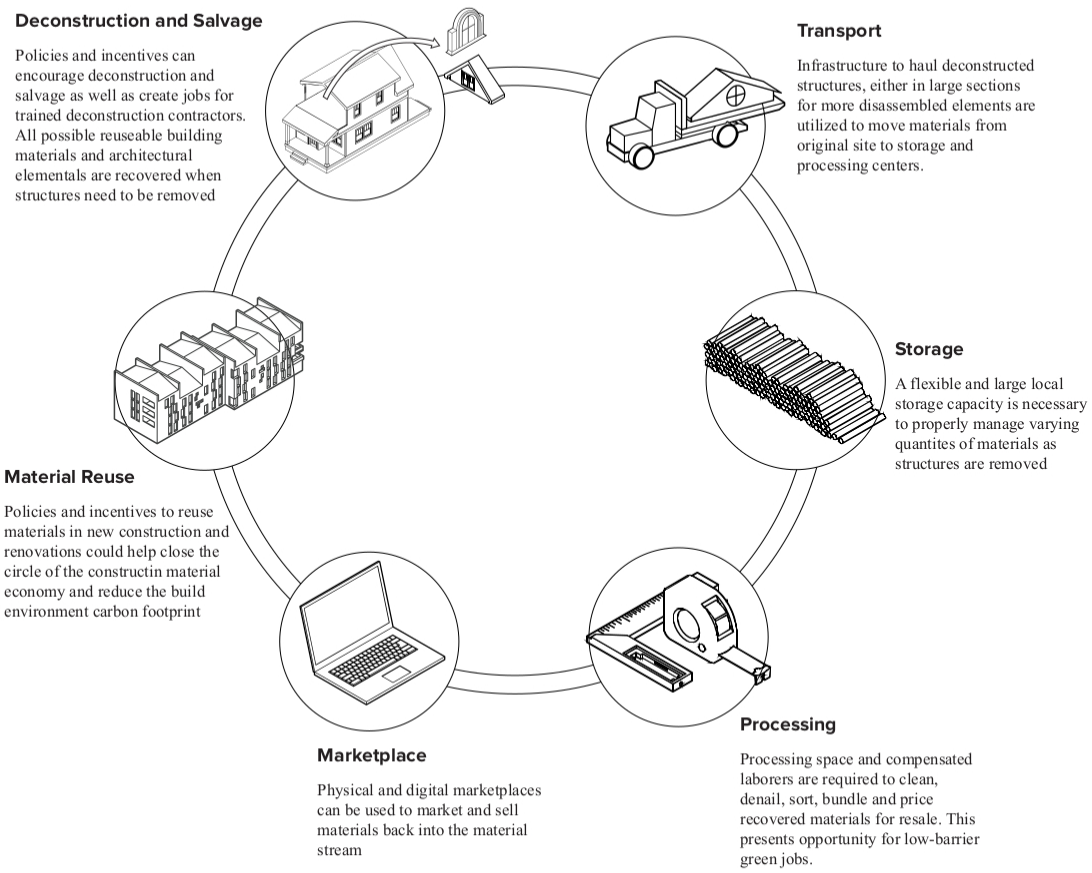


Figure 7: Infrastructure necessary to support a circular construction economy, with identified actions a city could undertake (in teal). Graphic: Wyeth Augustine-Marceil, Just Places Lab.

Reuse as Common Practice

Reuse is a common practice in many communities. With the growing popularity of consignment shops, thrift stores, and fixer collectives, there is potential for a thriving reuse economy in many areas. To transition to a circular construction economy that prioritizes reuse, a similar infrastructure is necessary. Collaborating with local reuse organizations that have experience in construction, deconstruction, inventory management, and job training can help establish a favorable position when legislation supporting deconstruction, salvage, and reuse is enacted. By adopting supportive policies, local governments can demonstrate leadership in sustainability while further building on established reuse practices, aiding in the development of a circular economy, and implementing environmentally sustainable practices.

Section 3 | Recommendations to Support Deconstruction

Transforming our linear building and construction economy into a circular, regenerative process can be challenging—especially in places where deconstruction is not currently practiced, such as New York State.

For municipalities just starting to pursue deconstruction, the following are some of the challenges that may be faced when launching deconstruction practices:

- Lack of state policy to encourage or require construction and demolition debris (CDD) diversion and reuse;
- Lack of skilled deconstruction workforce;
- Lack of storage and processing facilities;
- Cost to deconstruct is more expensive than demolition in many communities;
- Deconstruction can take more time than demolition.

An increasing number of communities throughout North America (and on other continents) have addressed these common challenges and are now home to growing deconstruction and material reuse activities, which bring economic, environmental, and cultural benefits. Many have found success through a phased approach.

The following three phases of (1) debris data collection and community conversations, (2) introduction of incentives and recommendations, and (3) measures ensuring policy success are recommendations for building a robust and sustainable deconstruction program in addition to the adoption of new legislation through phased adoption of salvage and deconstruction requirements (see Sections 4–6).

Phasing that demonstrates a local government's commitment to its constituents can allow for a smoother transition to full deconstruction. With the help of a phased approach, a local government may eventually successfully set up a deconstruction ordinance that can meet varying degrees of regulation over time. An ordinance may require full deconstruction of all municipal-owned properties slated for demolition, followed by the deconstruction of residential buildings designated as historic resources. Over time, local governments may move on to requirements based on when a building was completed (e.g., Portland's Deconstruction Ordinance).

It is crucial to recognize that deconstruction efforts can be made regardless of whether or not a deconstruction ordinance is passed; however, such legislation can be essential to successfully

passing a larger-scale ordinance. It is further worth noting that the establishment of a deconstruction ordinance can happen at any point of the mentioned phases (e.g., at any point deemed suitable and necessary between or after the adoption of incentives and regulations). Such efforts supporting deconstruction do not necessarily have to occur in a step-by-step manner and should be adopted on a timeline that is most suitable for each local government.

The roadmap presented on the following page (Figure 8) can be used as a reference to visualize the three phases in assisting local governments in eventual policy adoption.

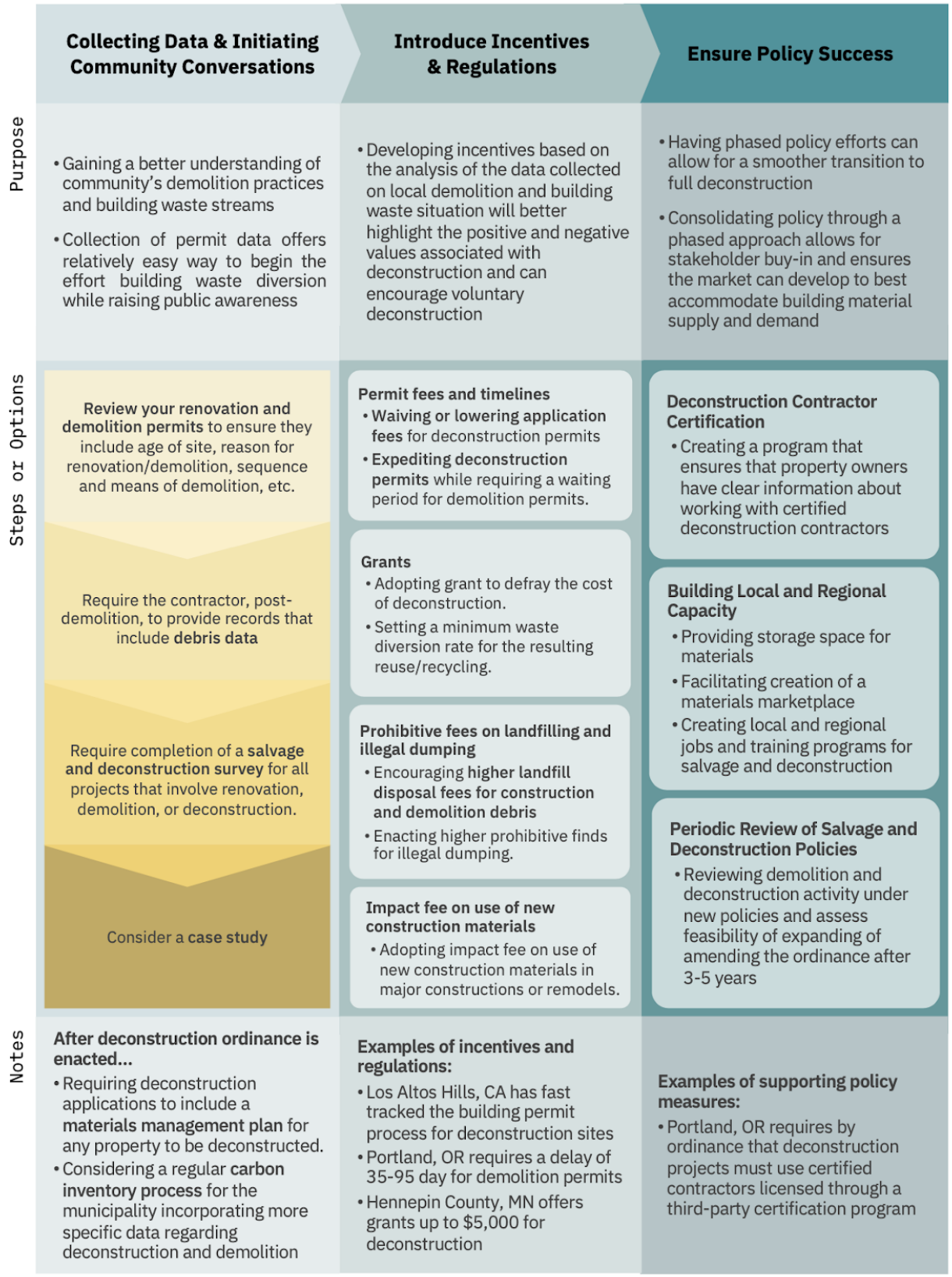


Figure 8: Roadmap. Graphic: Kathy Lim, Just Places Lab.

Subsection 3.1 | Collecting Construction and Demolition Debris Data and Initiating Community Conversations

Prior to incentives and regulations, it is important for local governments to collect construction and demolition debris data as well as begin to hold active conversations on deconstruction in their communities.

A. Collection of Construction and Demolition Debris Data

Useful construction and demolition debris data is limited at both state and local levels. In order to gain a better understanding of their community's demolition practices and building waste streams, local governments have embedded data requirements into their permitting practices. Even before introducing deconstruction incentives or ordinances, the collection of permit data offers a relatively easy way to begin the effort of building waste diversion while raising public awareness. CR0WD structures this process into four steps.

Step 1: Review renovation and demolition permits

CR0WD recommends that a local government reviews its renovation and demolition permits to ensure they include:

- Age of building/site;
- Any national, state, or local historic designations;
- Building classification (commercial, residential, etc.);
- Construction method and materials (timber frame, cinderblock, brick, etc.);
- Why the building is being renovated and/or demolished;
- The sequence, means, and methods of demolition.

Step 2: Require the contractor, post-demolition, to provide records

A local government can then require contractors, post-demolition, to provide records that include:

- Tonnage and location where the debris was sent, including any materials salvaged for reuse and recycling;
- Where possible, a breakdown of the tonnage by specific material.

Step 3: Require completion of a salvage and deconstruction survey

Requiring the completion of a salvage and deconstruction survey for all projects that involve renovation, demolition, or deconstruction can demonstrate to the building owner the opportunities for salvage and raise awareness. CR0WD recommends the integration of the Salvage and Deconstruction Survey and walk-through inspections for all projects that seek permits for either demolition or deconstruction.

- For example, Seattle, WA requires a Deconstruction and Salvage Assessment for all projects greater than 750 sf. requiring demolition.

- See Sections 4.4 and 4.5 that include example tools, such as a Salvage and Deconstruction Assessment/Survey and Deconstruction Request for Proposals that could aid developers.

Step 4: Consider a pilot project

A publicly-owned property or a sympathetic owner (ideally one whose structure typifies what your community aims to deconstruct) provides the opportunity for a pilot project or case study. Through this process, a local government can gain a better understanding of the deconstruction process (total cost, labor hours and cost, amount and types of materials salvaged/recycled, storage requirements). It is also a chance to gather stakeholders, such as workforce training organizations, reuse and salvage professionals, contractors, local sustainability experts, and community volunteers. Funding may be available through state grant programs or local organizations.

Then, assess the outcome by considering the following:

- What is needed to accomplish this work on a larger scale?
- What private market requirements are needed to ensure success and how can they be incentivized?
- What other stakeholders can become part of the process?

B. Creation of an Advisory Council

CR0WD recommends local governments create and maintain an Advisory Council to guide movement toward adoption of new policies. This should be composed of experts and stakeholders who are knowledgeable and will remain engaged in discussions around alternatives to demolition. These may consist of leadership from municipal staff; preservation, reuse, and climate justice organizations; developers and contractors; university experts; among others.

Subsection 3.2 | Recommended Incentives & Regulations for Deconstruction

3.2.1 Recommended Incentives to Support Deconstruction

An analysis of the data collected by local governments can provide a snapshot of the local demolition and building waste situation. Based on this information, local governments can develop incentives that can encourage voluntary deconstruction. These can include favorable permitting terms as well as monetary incentives to cover the gap between demolition and deconstruction costs.

A. Permit Fee Incentives

Decreasing the Cost of Deconstruction Relative to Demolition

CR0WD recommends that a local government adopt permit prices that reflect the positive values associated with deconstruction. The following are ideas that a local government may consider:

- Within a defined pilot period, the cost of applying for a deconstruction permit could be $0, while the cost to apply for a demolition permit might be increased.
- Charge low fees for deconstruction permits (e.g., $75) and high fees for demolition permits (e.g., $5,000–$10,000). Fees could be placed in a fund to pay for workforce development (e.g., the local government funds half of workforce on-the-job training, with the contractor paying the balance).
- Alternatively, the fee could be waived entirely when a deconstruction contract is attached to the permit application (as has been done in Los Altos Hills, CA).

Expediting Permit Timelines for Deconstruction
Expedited permit timelines can further incentivize deconstruction while disincentivizing demolition. This can be done through the following approaches:

- A local government can expedite deconstruction permits by awarding deconstruction permits within a shorter timeframe (7-10 days) than demolition permits (14-30 days).
- Requiring a stay of demolition or a waiting period (e.g., 90 days) for demolition permits can disincentivize demolition while allowing for time to find parties interested in reusing a building rather than demolishing it. During this delay, local businesses, nonprofits, and individuals can document and soft-strip the site and arrange with the contractor for the removal of salvaged structural members. This delay also allows historic sites to be documented, if desired. Post notices prominently at the site to explain the delay, as well as door hangers on adjoining properties and information in the media and on city websites.
- Permit applicants who agree to deconstruct rather than demolish have their building plans for new construction go to the head of the queue rather than reviewed in the order they're received (Los Altos Hills, CA).

B. Grant Incentives

Deconstruction Grant Program

A local government could adopt a grant program to defray some of the cost of deconstruction. For instance, the local government could provide grants to encourage the deconstruction of buildings and set a minimum waste diversion rate for the resulting reuse and recycling; a percentage of the grant would be forfeited if the rate is not reached. The grant program could be funded through a fee or tax, as discussed above, or it could be a private fund from state or federal sources or private foundations.

- For example, Hennepin County, MN, offers grants of up to $5,000 for the deconstruction of residential buildings with less than four units and built before 1970. Portland, OR, offered $3,000 in its pilot program.
- A local government could work with an economic development or urban renewal authority to develop an incentive program.

- The local government should take advantage of any State of New York incentives, programs, and policies that support deconstruction and reuse, waste diversion, and circular economy within the built environment.

3.2.2 Recommended Regulations to Support Deconstruction

Material Management Plan Requirements for Deconstructed Properties

- A materials management plan could be required for any property to be deconstructed. This information will be used to ensure that the applicant has a plan for the deconstruction, recovery, and sale or donation of the materials.
- Deconstruction applications that are complete, with both a salvage and deconstruction assessment and a materials management plan, would then be reviewed and approved in a timely (or expedited) manner that is consistently applied by city staff.
- In addition, CR0WD recommends a regular carbon inventory process for the municipality incorporating more specific data regarding deconstruction and demolition.

Prohibitive Fees on Landfilling and Illegal Dumping

- The local government could work with New York State to encourage higher disposal fees for construction and demolition debris at landfills where CDD waste from the municipality is regularly dumped.
- A local government could enact high (i.e., prohibitive) fines for illegal dumping or demolition.

Requirements for Use of Reclaimed Materials and/or Impact Fees on New Construction Materials

Local governments could consider adopting requirements to use a certain percentage of reclaimed materials in local government capital projects or in a new construction. Additionally they could consider an impact fee on the use of new construction material in new construction and, potentially, major remodels. The impact fee would be based on the environmental impacts of using new building materials instead of retaining materials in place or using reclaimed materials.

- Information about an impact fee could be given to property owners and developers at the beginning of the development design process to provide guidance on adaptive reuse, reuse of reclaimed materials in situ, and taking advantage of more reused or recycled building materials.
- The fee could be exacted at the point of building occupancy after a new development is constructed. It could be based on the amount or proportion of new or non-recycled materials that were used. The materials that are reused in place (as in the retention of facades or forms of adaptive reuse) would not have any fees associated with them. In addition, other reused or recycled materials would reduce the impact fee.

- By exacting a fee at the point of building occupancy, regional and national developers who are more likely to purchase from outside the county will still be liable, whereas they may avoid a local or county tax on new building materials. This could benefit small-scale developers and local, low- and moderate-income property owners (or property owners who serve those income groups) who opt to preserve more materials in place.

Subsection 3.3 | Ensuring Policy Success

CR0WD has observed that successful policy efforts are often phased, taking into account the data gathered. They incorporate stakeholder engagement and education and provide easily accessible public-facing resources. A phased approach to policy requirements–from data collection to incentives and then regulations supporting deconstruction– allows for stakeholder buy-in and ensures the market can develop to best accommodate the building material supply and demand.

There are important aspects that local governments can put in place to help ensure policy success. This may include the following:

Deconstruction Contractor Certification

CR0WD recommends that local governments create a program that ensures that property owners have clear information about working with certified deconstruction contractors. To be licensed, a contractor could be required to go through a mandatory training process, which would define the guidelines for source separation streams. The licensing process may need to be updated periodically or if deconstruction ordinances change. See the Model Deconstruction Ordinance for more discussion.

Building Local and Regional Capacity

There are other ways in which a local government can support salvage, deconstruction, and reuse. Some promising examples include providing storage space for materials, facilitating the creation of a materials marketplace, establishing incentives for the use of reclaimed building materials, and creating local and regional jobs and training programs.

Beyond Salvage and Deconstruction: Land Clearance and Building Lifespan

CR0WD recommends a deep analysis of the process of clearing land in preparation for new development. Just as building materials at deconstruction sites should be considered a resource rather than waste, additional legislation could be considered to require tree preservation or moving them (rather than simple removal) from deconstruction and construction sites.

Periodic Review of Salvage and Deconstruction Policies

After a period of 3–5 years, CR0WD recommends that local governments review demolition and deconstruction activity under the new policies and assess the feasibility of expanding or amending the ordinance.

Support Good Stewardship

A local government could provide deconstruction projects with city-generated signage in front of the site to raise awareness of the benefits and opportunities of salvage and waste diversion. Additionally, the local government could provide information about the use of charitable donations of building materials and architectural salvage to not-for-profit reuse centers, which can result in tax deductions for building owners.

Section 4 | Best Practices in Salvage, Reuse, and Deconstruction

Subsection 4.1 | Case Studies From North America

An increasing number of local governments are adopting deconstruction ordinances or building waste diversion requirements. Below are examples of some of the best-known, successful initiatives from cities around the US and Canada and their unique approaches.

Most Regulatory Control

Less Regulatory Control

Photo by Jason Tester.

Palo Alto, CA | All full building removals

Deconstruction is required for any residential or commercial project in which the structure is being completely removed, regardless of year built and project value. Accessory dwelling units (ADUs), structurally unsound buildings, remodels, and additions are excluded.

Photo by San Antonio Reuse

San Antonio, TX | Time phased + city buildings

The City of San Antonio passed a deconstruction ordinance on Sept. 8, 2022. The first phase began Oct. 1, 2022, with city buildings and expanded in January 2023 to include single-family and multi-family housing built no later than Dec. 31, 1945. A third and final phase beginning Jan. 1, 2025, will affect housing built no later than Dec. 31, 1960.

Photo by ReBuilding Center

Portland, OR | Time phased + historic buildings

An initial 2016 ordinance required the deconstruction of residential properties built before 1916 and all residential historic residences. A 2020 amendment requires the deconstruction of residential properties built before 1940.

Less Regulatory Control

Least Regulatory Control

Photo by Unbuilders

Vancouver, BC | Time phased + material weight

Deconstruction is required for one- and two-family homes built before 1910 or any heritage-listed house. Homes built after 1910 but before 1950 have minimum reuse and recycling requirements that apply to demolition waste.

Photo by William Real

Pittsburgh, PA | Condemned city buildings

A 2021 executive order requires the deconstruction of city-owned properties that are condemned but not yet slated for demolition. The order also created a Deconstruction Action Council to study deconstruction of privately-owned buildings.

Photo by Demolition Deconstruction

Nashville, TN | Permit delays + management plans

Structures with a construction value of at least $50,000 require an approved management plan to gain a permit for demolition. Historic building demolition permits can be delayed for 90 days to document, dismantle, and salvage historic materials.

Photo by Minnesota Pollution Control Agency

Hennepin County, MN | Individual grants

The county provides grants of up to $5,000 for residential deconstruction, $10,000 for commercial deconstruction, $15,000 for full structural move projects, and $5,000 for projects that incorporate used building materials into renovation or new construction.

Expanded case studies of deconstruction salvage, reuse, and initiatives (alphabetical order, as listed above)

Palo Alto, CA

Ordinance: Deconstruction and Construction Materials Management Ordinance

Date: Adopted Summer 2019; effective July 1, 2020.

Overview: Deconstruction is required for *any* residential or commercial project in which the structure is being completely removed. Accessory dwelling units (ADUs), structurally unsound buildings, and remodeling or addition projects are excluded.

Requirements:

- Before applying for a building permit, a salvage survey by a city-approved reuse organization must be completed and become part of the permit application.
- Source separation is required on site, and the materials are delivered to a city-approved materials recovery facility. Source separation ensures that a larger amount of reusable and recyclable materials is salvaged (mixed CDD waste lowers the "capture" rate).
- Before final inspection for the building permit, documentation must show that all materials indicated on the salvage survey were properly salvaged by a city-approved reuse organization, with their weight included. This information is uploaded to an online waste recovery and recycling tracking system for verification.

Additional notes

- Prior to the adoption of the ordinance, the City of Palo Alto piloted the deconstruction of a city-owned commercial building (2,850 sq. ft, circa 1950, wood frame with concrete foundation) to gather information and understand practices.
- City building permits and other data were assessed to understand optimum phasing of requirements.
- The State of California requires 75% of CDD be diverted from all construction projects.

Further information

- Ordinance text: Palo Alto Municipal Code Chapter 5.24
- Zero Waste Palo Alto website: www.zerowastepaloalto.org

Pittsburgh, PA

Ordinance: Executive Order of (former) Mayor William Peduto

Date: October 20, 2021; effective immediately.

Overview: In addition to the deconstruction of city-owned properties, the order aims to create a unified, City-led deconstruction policy that will require the deconstruction of abandoned private homes. This will be achieved through the creation of a Deconstruction Action Council that includes heads of five city departments and other agencies, professionals working in construction, waste, sustainability, and workforce development, labor union representatives, and real estate developers.

Purpose: The order seeks to remediate abandoned buildings in poor condition in city neighborhoods while diverting building materials from landfills, advancing climate action goals, promoting equity, and creating job training opportunities.

Additional notes: The City of Pittsburgh website includes an online public survey and wide selection of resources.

Portland, OR

Ordinance: Deconstruction of Building Laws (Chapter 17.106)

Date: October 2016; expanded January 2020

Overview: Residential properties built before 1940 (according to building permit records) and any residential historic resource, regardless of year built, must be deconstructed. (The initial ordinance required the deconstruction of residential properties built before 1916 and any residential historic resource, regardless of year built.) Salvaged material may be sold, donated, or reused on site.

Requirements:

- Must use certified deconstruction contractors licensed through a third-party certification program.
- Deconstruction must be by hand, with no machinery; machines can be used to move materials once removed.
- Contractors must keep receipts showing the donation, sale, recycling, or disposal of all materials.

Results/Implications: Prior to the ordinance, three firms focused on deconstruction. However, there were no special certification requirements for these firms. Within the first year of the ordinance, the city registered 17 certified deconstruction contractors—half specialize in deconstruction, and half focus on new construction and remodeling.

Portland's Bureau of Planning and Sustainability partnered with local pre-apprenticeship programs to recruit students for a free 12-day training program. Fifteen students, more than half of whom were women, worked at a series of active deconstruction sites to gain hands-on experience in the field, with 13 then securing positions with deconstruction firms.

Additional notes:

- As of mid-2021, more than 300 homes had been deconstructed.

- For a year prior to the passage of the ordinance, the Oregon Department of Environmental Quality (DEQ) offered grants of approximately $3,000 to property owners to promote deconstruction, build capacity within the salvage industry, and collect data.
- A total of 36 houses were deconstructed under the pilot project overseen by DEQ; the data garnered can be seen in this report comparing demolition and deconstruction.

San Antonio, TX

Program: Deconstruction & Reuse Program

Date: September 8, 2022

Overview: A Deconstruction Advisory Committee (DAC) began meeting in May 2018 as a technical advisory committee when a former council member submitted a council consideration request to explore a deconstruction policy. The City Council passed a three-phase ordinance in September 2022, with Phase 1 beginning October 1, 2022, with city-owned buildings. Phase 2 took effect January 2023 and applies to single-family and multi-family housing built no later than December 31, 1945. The third and final phase of ordinance implementation, beginning January 1, 2025, will affect housing built no later than December 31, 1960. There are currently no plans to expand the ordinance to apply to commercial properties.

Goals:

- Develop and sustain a local workforce in construction, heritage trades, and deconstruction.
- Increase the availability of high-quality and affordable salvaged materials.
- Address important environmental considerations, including the reduction of carbon emissions, raw material and water consumption, airborne pollutants associated with demolition, and construction waste.
- Encourage neighborhood continuity and develop a local circular economy.
- Achieve citywide sustainability goals as outlined in the adopted Climate Action and Adaptation Plan (CAAP).

Further information

- A result of this effort is the February 2021 publication, Treasure in the Walls, which is a valuable deconstruction resource that suggests that over 80% of deconstructed materials can be reused.
- This ordinance coincided with the passage of the Vacant Building Program (VBP) to maintain minimal maintenance for vacant buildings.
- San Antonio Reuse website: https://www.sareuse.com
- Adopted deconstruction ordinance: https://www.sanantonio.gov/LinkClick.aspx?fileticket=Qck9XLxHGhY%3d&portalid=0

Vancouver, BC, Canada

Ordinance: Green Demolition By-law No 11023

Date: July 22, 2014; amended in February 2016 and May 2018

Overview: Deconstruction is required for one- and two-family homes built before 1910 and any heritage-listed house. Homes built after 1910 but before 1950 have minimum reuse and recycling requirements that apply to demolition waste.

Purpose: This by-law was created to support the city's Greenest City Action Plan and Zero Waste 2040 Strategy.

Requirements

- Any deconstruction project must salvage at least three tons of wood.
- The deconstruction of houses built completely or partially before 1950 must result in the reuse or recycling of not less than 75% of all material by weight, excluding hazardous waste.
- The deconstruction of any heritage-listed residential building must result in the reuse or recycling of not less than 90% of all material by weight, excluding hazardous waste.
- Any material that is reused or salvaged, rather than recycled or disposed of, can be credited at a rate of five times its weight
- Contractors must keep original records of the removal, reuse, recycling, salvage, and disposal of building materials governed by the demolition permit, including payment receipts, donation receipts, weigh bills, inspection reports, confirmation letters, and sampling reports. (The Chief Building Official may demand to see these records.) Contractors must create a final compliance report demonstrating that the materials were reused, recycled, or salvaged.
- As part of the demolition permit application, applicants must pay a non-refundable $350 waste compliance fee and a refundable $14,650 green demolition deposit to ensure that environmental standards are met.

Additional notes:

- Currently, the green demolition program applies only to residential buildings, but the government plans to expand it to apply to commercial and industrial buildings.
- Metro Vancouver requires that no drywall or plaster enter the traditional waste stream, which forces it to be removed by hand.

Some local governments that lack deconstruction ordinances are tackling building waste by providing incentives, setting waste diversion targets, providing public education and

engagement resources, and collecting data to inform potential ordinance adoption. See below for examples.

Hennepin County, MN (Minneapolis)

Program: Building Reuse and Deconstruction Grants

Date: January 2020; expanded in 2022

Overview: Hennepin County has funding available for projects that reuse and recycle building materials instead of relying on mechanical demolition in the destruction, alteration, or renovation of a building.

Available grants:

- **Residential deconstruction**: Up to $5,000 is available per project (up to $2 per square foot), based on eligible deconstruction expenses for full residential building removal and renovation or remodeling projects.
- **Commercial deconstruction**: Up to $10,000 is available per project (up to $2 per square foot), based on eligible deconstruction expenses for full commercial building removal and renovation or remodeling projects.
- **Structural move**: Up to $15,000 is available per project (up to $5 per square foot), based on expenses for full structural move projects.
- **Used building material installation**: Up to $5,000 is available for projects (up to $2 per square foot) that incorporate used building materials into renovation or remodeling and new construction designs.

Requirements:

- Applicants must be a homeowner or developer of a property located within Hennepin County. Publicly-owned properties are not eligible for funding.
- Deconstruction of accessory structures (e.g., garages and sheds) are not eligible for funding.
- Grantees must coordinate deconstruction work with contractors or salvage outlets and verify that the project meets reuse and disposal criteria.
- For each grant, there are requirements regarding building age, square footage, and the amount, by weight, of building material reused.

Nashville, TN

Program: Required Construction and Demolition Debris Management Plan

Date: July 1, 2021

Purpose: The plan supports Nashville's Solid Waste Master Plan's goal to send as close to zero waste as possible to landfills by 2050 (currently, 37% of metro waste is categorized as CDD).

Requirements: A management plan approved by the Solid Waste Division is required to gain a building demolition permit for structures with a construction value of at least $50,000. This plan includes the recycling goals of the demolition project, as well as the types and amounts of materials that will be left over.

Delay for historic resources: The Historic Zoning Commission can delay the issuance of a demolition permit for 90 days to slow the planned demolition of historic structures to enable the documentation of the structure and the dismantling and salvaging of its historic materials. A structure cannot be demolished without approval if it was constructed before 1885, is repairable at a reasonable cost, or has historical significance unrelated to the age itself.

Online platforms: The city has created a robust online resource guide to support residents in CDD reduction and reuse. Organized by materials, it includes a chart that provides recycling and reuse options and service providers (including those who pay for scrap material).

The Tennessee Materials Marketplace is a transaction platform for reuse and recycling opportunities that can lead to a circular economy that generates cost and energy savings and new jobs. It can be used as a tool for deconstruction companies to find data on waste materials and a solution for difficult-to-recycle items.

Section 5 | Draft Sustainable Deconstruction Resolution

The following are draft elements of a resolution to support deconstruction, salvage, and reuse in municipalities.

An Ordinance Amending the Municipal Code of the City of ____, Chapter ____, Entitled _____, In Order to Establish Regulations for Sustainable Deconstruction, Salvage and Reuse.

Ordinance No. _____

1. WHEREAS, the City of ____ understands the benefits of deconstruction and building material reuse; and

2. WHEREAS, the City of ____ will be amongst a small number of innovative municipalities nationwide that are adopting these measures; and

3. WHEREAS, the City of ____ recognizes the value of reuse and preserving its cultural heritage by prolonging the lifespan of current building stock, its architectural features, and building material as much as possible; and

4. WHEREAS, globally, buildings account for 39% of annual greenhouse gas emissions and more than 50% of resource extraction and solid waste production; and

5. WHEREAS, the City of ____ is to adopt a circular economy approach to construction and deconstruction in the built environment; and

6. WHEREAS, the City of ____ will reduce landfill waste by requiring careful deconstruction of buildings that have run their full course of use; and

7. WHEREAS, the City of ____ will require as much material as possible to be reused in the community; and

8. WHEREAS, the City of ____ will require as much material as possible to be recycled that cannot be easily reused; and

9. WHEREAS, the City of ____, through the process of deconstruction and not mechanical demolition, will reduce the release of hazardous dust from the site; and

10. WHEREAS, the City of ____ will thus reduce the carbon emissions associated with the extraction and transportation of raw materials that make up the built environment; and

11. WHEREAS, the City of ____ will thus create more green jobs in deconstruction, reuse, and recycling sectors by creating value out of reused and recycled materials, which are subsequently used again in new construction and remodeling, contributing to circularity in the continual building, care, and maintenance of the city; and

12. WHEREAS, the City of ____ will thus ensure that the benefits of deconstruction, salvage, and reuse are shared among all local communities to reduce historical social and economic inequities.

Section 6 | Model Deconstruction, Salvage, and Reuse Ordinance

The following are draft elements of a deconstruction ordinance for deconstruction, salvage, and reuse. After review of ordinances from other leading municipalities across North America, it is noted that there are many choices that would need to be made in adopting the final text of an ordinance. The following section is intended as an aid in the development of potential language for municipalities.

Contents of Model Deconstruction Ordinance:

Part 1 | Legislative Purpose and Intent

A. This chapter shall be known and may be cited as "The Deconstruction, Salvage, and Reuse Ordinance of the City of ____."

B. The purpose of this chapter is to provide the procedures for salvage and deconstruction to maximize the salvage and reuse of valuable building materials, reduce carbon emissions associated with demolition and new construction, reduce the amount of building materials that are disposed of in landfills, and minimize the adverse impacts associated with building removal in the community.[9] The proposed Deconstruction Ordinance promotes the careful deconstruction of existing buildings to promote the reuse of building materials. Existing buildings should also be addressed, especially when they are proposed to be removed. Deconstruction should be

[9] Language used is similar to the Portland Deconstruction Ordinance.

required when buildings cannot be reused. By promoting the reuse of building materials, the proposed Deconstruction Ordinance helps conserve embodied carbon. Deconstruction has social, economic, and environmental benefits. It honors the craftsmanship and value of the original materials, contributes to the circular economy, lowers emissions by decreasing the energy used in producing construction materials, and reduces the amount of waste going to landfills.

Part 2 | **Glossary**

Approved Facility: A reuse, recycling, composting, or materials recovery facility that the Planning Director has determined can accept diverted materials, has obtained all applicable federal, state, and local permits, and is in full compliance with all applicable regulations for reuse, recycling, composting, and materials recovery.[10]

***Architectural Components*:** Architectural components are generally defined as, but are not limited to, culturally or aesthetically important material components, such as stained and leaded glass windows within their frames, finished or exposed structural members, custom-crafted staircases, molding, and other hand-crafted items.

Building Components: Building components are essential building systems, such as air conditioning, heating systems, plumbing, electrical, and structural systems.

***Certified Deconstruction Contractor*:** A certified deconstruction contractor is insured and has successfully completed a deconstruction certification recognized by the Building Division.

Certified Deconstruction Contractor Best Practice:

The following is information from the City of Portland, Oregon. Portland's deconstruction ordinance defines a Certified Deconstruction Contractor as "a contractor licensed with the Oregon Construction Contractors Board (CCB) that has successfully completed a deconstruction certification program recognized by the Bureau of Planning and Sustainability. A firm will be considered certified if at least one person currently employed by the firm is certified."

Administrative rules have been adopted that enable Portland's Planning Director to implement the ordinance. (Note: Specific language about training may not need to be included in the deconstruction ordinance, but it could be defined by the municipality's planning department if they are granted the authority to do so.)

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At least one person employed by the company must be certified by completing the four steps below:

1. Complete BMRA's three-day Project Management Training Course.

[10] This definition is from the Palo Alto Municipal Code.

Continued from the last page

2. Pass a skills assessment conducted by a BMRA proctor. This is a one-hour assessment of one's knowledge and skills in deconstruction. It is conducted at an actual job site where one can demonstrate proficiency in salvaging certain materials to maximize their value for reuse.
3. Pass a written exam taken online.
4. Track 2,000 hours of experience online in accordance with the BMRA's core competency requirements for the Designated Deconstructor Credential—past experience counts.

Construction and Demolition Debris or Construction and Deconstruction Materials: These materials are discarded materials that are generally considered to be non-water soluble and non-hazardous in nature (as defined by New York State Code)—including metal, glass, brick, concrete, porcelain, ceramics, asphalt, pipe, gypsum wallboard, and lumber—that come from the construction or destruction of a structure as part of a construction or demolition project. They may also include materials from the renovation of a structure or landscaping, such as rocks, soil, trees, and other vegetative matter that normally results from land clearing and landscaping and development operations for a construction project. Finally, these materials may be remnants of new materials, including cardboard, paper, plastic, wood, glass, and metal from any construction, renovation or landscape project.[11]

***Deconstruction*:** This is the careful and systematic dismantling of a building or structure to maximize the recovery of valuable materials and architectural components for reuse, resale, and recycling.

Demolition: This is the partial or complete destroying, tearing down, dismantling, or wrecking of any building or structure.

***Recycling (or Source Separation Stream Recycling)*:** This is the sorting of building construction materials that *cannot* be salvaged into different raw material streams, which are then processed to be used in the marketplace; the goal is to activate available building materials and divert them from landfills.

***Reuse*:** This process involves using an architectural or building component or material in the same way that it was previously used to extend its lifespan. More broadly, reuse in the built environment can refer to prolonging the lifespan of existing building stock through maintenance, preservation, deconstruction, and material reuse.[12]

***Reuse Organization*:** A reuse organization is approved by the city and actively harvests, accepts, and resells sorted architectural or building components.

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[11] This definition is from the Palo Alto Municipal Code.

[12] Portland, Oregon's definition: '***Reuse***' means the utilization of a product or material that was previously installed for the same or similar function to extend its life cycle. Materials salvageable for reuse include but are not limited to cabinets, doors, hardware, fixtures, flooring, siding, and framing lumber.

***Salvage*:** This is the non-structural removal of materials that are easy to procure from a building, such as doors, windows, and finishes.

***Salvage and Deconstruction Survey*:** This is a building analysis conducted by an Approved Deconstruction Contractor (or Reuse Organization or Appraiser) that accounts for the amount and type of material that can be salvaged and recycled.

***Soft Stripping*:** Soft stripping is the initial removal of non-structural elements in the process of salvaging materials (e.g., prying apart boards, unscrewing fixtures and doors).

Menu of Potential Choices

Wood-Framed Buildings or Structures: The scope could be narrowed by referring to the 2020 NYS Residential Building Code, which defines specific details of all types of wood-framed construction, such as platform framing, balloon framing, and advanced framing. What is generally understood as wood-framed construction falls into the category Type VB of the 2020 NYS Building Code.

The ordinance could refer to "one- and two-family light wood-frame constructions" or "light wood-frame constructions with no more than 2 dwelling units" (which would speak to size and material) and cite Chapter 3, occupancy level R-3 of the NYS Building Code for more details.

Occupancy Levels: Another way to narrow the scope could be to refer to occupancy. Chapter 3 of the NYS Building Code classifies different occupancy levels. The most relevant might be R-3, which refers to residential structures with not more than two dwelling units (i.e., one- and two-family homes).

Part 3 | **Applicability**

**Note: This section outlines options for the city to determine the suitability and applicability of different properties as candidates for salvage, deconstruction, and reuse. Suitability criteria can range from very broad (e.g., all buildings that require removal) to more targeted (e.g., light wood-frame construction). The options presented enable the city to choose from several courses of action. Some of the options below may be combined.*

Menu of potential options

Option 1 | All Complete Removals: From Palo Alto: "This chapter shall be applicable to all residential and commercial projects that include a whole structure demolition requiring a demolition permit. However, this chapter shall not apply to those projects comprised solely of the demolition of an accessory dwelling unit, or to any project for which the completed demolition permit application was submitted to the city prior to [*pick date*]."

Option 2A | Square Footage: This ordinance applies to all residential and commercial projects that include a whole or partial demolition, including remodeling projects where renovations affect at least 20% of the total building square footage or 500 square feet, whichever is smaller. This ordinance will apply completely to renovations that do not affect square footage, such as siding or roofing.

Option 2B | Square Footage, IECS Terminology: The Ithaca Energy Code Supplement (IECS) defines square footage as follows: Major Renovation – Construction or renovation to an existing structure other than a repair or addition, where (a) the Work Area exceeds 75% of the floor area, and (b) two or more of the following occur:

1. Replacement or new installation of a heating plant or system (e.g., boiler, furnace, or other major system). Changes to ventilation and air conditioning systems are not considered renovations of the heating system.

2. Construction that involves disassembly of greater than 50% of the area of the above-grade portion(s) of the building thermal envelope.

3. Changes, including but not limited to new installation, replacement, relocation, or removal of lamps, lighting, or other illumination fixtures in greater than 50% of the building floor area. Space within a building that is not currently lit, and is not proposed to be lit, shall not count toward the 50% calculation.

Option 3 | Construction Date Threshold: This ordinance applies to every residential house [or structure / or structure of any kind] in whole or part built before 1950 [or other threshold date.]

- Thresholds can begin with a threshold date and over time continue to add more recent threshold dates (e.g., start with all buildings constructed before 1950 and, after a two-year pilot, amend the threshold to all building constructed before 1970, and then eventually expand threshold to apply to all buildings)

Option 4 | Building Construction Type: This ordinance applies to one- and two-family *light wood-frame* constructions or "light wood-frame constructions with no more than 2 dwelling units" (which would speak to size and material) and cite Chapter 3, occupancy level R-3 of the NYS Building Code for more details.

Option 5 | Value of Project: Requirements in this ordinance apply to projects [over $500,000 or some other threshold].

Option 6 | Historic Resources: In combination with other criteria, requirements in this ordinance apply to all surveyed historic resources.

Part 4 | **Building Reuse and Deconstruction Delays**

A 30-day delay that can be extended to a further 120 days is for the purpose of finding parties interested in reusing the building or deconstructing it. The requirement may also be used to give potential parties interested in reusing building components time to come forward to make arrangements to remove the items or plan with the contractor if items are linked to structural members or are in any way deemed important to keep intact until they can be safely removed as determined by the city Code Inspector.

Part 5 | **Salvage Survey and Reuse Requirements**

Any Site Plan approval for *new construction* would require a **Salvage and Deconstruction (S&D) Survey** and would need to have an approved S&D Plan for any and all buildings to be removed.

Any person or entity seeking to remove a building must complete a Salvage and Deconstruction Survey prior to the issuance of a demolition or deconstruction permit. The survey shall be completed by a reuse organization, approved deconstruction contractor, or an appraiser.

The S&D Survey must include an inventory and estimated weight of all materials on the site that can be salvaged, recycled, or otherwise diverted from the landfill. A Materials Management Plan is a second step that includes details about how materials will be deconstructed or otherwise recovered by an approved deconstruction contractor and then sold, donated, or reused.

Once deconstruction is completed and the materials are separated, the applicant shall attest through documentation and receipts to the municipality or his/her designee that the salvaged materials for reuse and recycling have been gathered by, turned over to, or received by a recycling facility or reuse organization.

Part 6 | **Landfill Diversion Requirements**

[Note: Not all ordinances include landfill diversion requirements by weight. This is an option for phased-in requirements.]

The first phase of documented recycling or salvage of 75% [or some other percentage as defined] as measured by the weight of all residential and commercial structures is required for all buildings being totally removed.

Whole building | The deconstruction shall be completed by hand or the means of appropriate deconstruction (i.e., using hand tools or minimally destructive tools and methods).The second phase will increase the documented recycling or salvage to 85% [or X% as appropriate] as measured by weight after two years from enforcement, then 90% [or X% as appropriate] after four years from the beginning of enforcement. *[NOTE: This is a best practice from the City of Portland that may or may not be appropriate for other municipalities.]*

Renovations | This shall apply to renovations where 20% or more (or 500 square feet, whichever is smaller) of the total square footage of the structure is being renovated. This type of renovation shall be required to have a documented recycling or salvage rate of 75% [or X% as appropriate] of all residential and commercial structures as measured by weight, then 85% [or X% as

appropriate] after two years, and 90% [or X% as appropriate] after four years as measured by weight. Following deconstruction, the submission of receipts demonstrating the donation, sale, recycling, and disposal of all materials by weight is required.

Part 7 | **Enforcement**

A. The Director of Planning and Economic Development or their designee [alternatively, the Director of the Building Division] may impose penalties on any responsible party who fails to comply with the requirements of this Chapter or who has misrepresented any material fact in a document or piece of evidence required to be prepared or submitted by this Chapter. Violations will be referred to the City Attorney. Financial penalties are imposed for violations to this Chapter.

B. Penalties may be imposed on a per month, per day, per incident, or such other basis as the Director determines to be appropriate based upon criteria in Subsection E below.

C. **Additional Enforcement Actions for Certified Deconstruction Contractors |** The Director of Planning and Economic Development may impose the following additional remedies for Certified Deconstruction Contractors.

   1. A first violation of this Chapter may result in removal from the list of approved Certified Deconstruction Contractors for up to 6 months.

   2. A second violation of this Chapter may result in removal from the list of approved Certified Deconstruction Contractors for up to 12 months.

   3. Third and subsequent violations may result in revocation of certification whereby a contractor may not apply for recertification for a period of 18 months.

   4. Temporary removal from the list of approved Certified Deconstruction Contractors will expire immediately following the term of removal and will not require further action from the Director.

D. **Stop Work Orders |** When necessary to obtain compliance with this Chapter, the Director may issue a stop work order requiring that all work, except work directly related to elimination of the violation, be immediately and completely stopped. If the Director issues a stop work order, activity subject to the order may not be resumed until such time as the Director gives specific approval in writing. The stop work order will be in writing and posted at a conspicuous location at the site. When an emergency condition exists, a stop work order may be issued orally, followed by a written stop work order. It is unlawful for any person to remove, obscure, mutilate, or otherwise damage a stop work order. Any person subject to a stop work order may seek administrative review of the order and may appeal the Director's administrative determination.

E. **Penalty Criteria** | The City Attorney will consider the following criteria in determining the number of penalties or remedies to impose under this Section:

   1. The nature and extent of the person's involvement in the violation;

2. Whether the person was seeking any benefits, economic or otherwise, through the violation;

3. Whether other similar prior violations have occurred with that person;

4. Whether the violation was isolated and temporary, or repeated and continuous;

5. The length of time from any prior violations;

6. The magnitude and severity of the violation;

7. The costs of investigating and remedying the violation;

8. Other relevant, applicable evidence bearing on the nature and severity of the violation.

F. Inspections | The Director of the Building Division or City Attorney may conduct inspections whenever necessary to enforce any provisions of this Chapter and to determine compliance with this Chapter or whenever the Director has reasonable cause to believe that there exists any violation of this Chapter. If the responsible party is at the site when the inspection is occurring, the Director will first present proper credentials to the responsible party and request entry.

Part 8 | **Exclusions or Exemptions**

Note: Some exclusions or exemptions may need to be defined in the Ordinance or in Administrative Rules. The City of Palo Alto and the City of Portland, which have the most stringent requirements, also have clauses related to dangerous structures that require abatement through demolition or that have no suitable material. The Planning Director may waive certain requirements if materials are found not to be reusable or to be too hazardous by law for reuse. Care must be taken to avoid creating the opportunity for systematic loopholes, and appropriate legal language is needed to grant discretion if needed in special cases.

Part 9 | **Governance and Dispute Resolution**

The Director of Planning and Economic Development shall have the primary responsibility of enforcing this chapter. The Director is authorized to make reasonable and necessary determinations as described in this chapter. Any appeal may be brought before the Director [to be determined as applicable], whose determination shall be final.

Alternative Language: Right of Appeal

A. Whenever the responsible party has been given a written notice or order pursuant to this Chapter or has been directed to make any correction, pay a penalty, or perform any act and the responsible party believes that the finding of the notice or order was in error, the responsible party may have the notice or order reviewed by the Director of Planning and Economic Development. If a review is sought, the responsible party will submit a written request to the Director within 10 days of the date of the notice or order. Such a review will be conducted by the Director. The responsible party requesting such a review will be given the

opportunity to present evidence to the Director. Following a review, the Director will issue a written determination. Nothing in this Section shall limit the authority of the Director to initiate a code enforcement proceeding under Title__.

B. A responsible party may appeal the Director's written determination to the Code Hearings Officer in accordance with the City Code Chapter __. The filing of an appeal request will remain the effective date of a penalty until the appeal is determined by the Code Hearings Officer. If, pursuant to said appeal hearing, payment of a penalty is ordered, such payment must be received by the Director or postmarked within 15 calendar days after the order becomes final.

In Addition to a Deconstruction Ordinance: Implementation of the Ordinance

Some communities have specific methods of adopting new rules to implement legislation. Each municipality could consider a process by which the Director of Planning and Economic Development can specifically adopt rules, procedures, and forms to implement the Sustainable Deconstruction Ordinance:

17.106.030 Authority of Director of Planning and Economic Development

A. The Director is hereby authorized to administer and enforce the provisions of this Chapter.

B. The Director is authorized to adopt rules, procedures, and forms to implement the provisions of this Chapter.

1. Any rule adopted pursuant to this Section shall require a public review process. Not less than 10 nor more than 30 days before such a public review process, notice shall be given by publication in a newspaper of general circulation. Such notice shall include the place, time, and purpose of the public review process and the location at which copies of the full set of the proposed rules may be obtained.

2. During the public review, the Director of Planning and Economic Development shall hear testimony or receive written comment concerning the proposed rules. The Director shall review the recommendations, taking into consideration the comments received during the public review process, and shall either adopt, modify, or reject the proposed rules. Unless otherwise stated, all rules shall be effective upon adoption by the Director and shall be filed in the Office of the Director of Planning and Economic Development and with the City Clerk's records.

C. The Director may temporarily suspend or modify the requirements of this Chapter based on a determination that such requirements are temporarily infeasible due to economic or technical circumstances. The Director's determination to temporarily suspend or modify shall be filed as a report with the City Council. The Director's determination shall be effective after the Council has accepted the report.

Section 7 | Sources and Further Reading

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- City of Milwaukee. "Chapter 218: Razing of Buildings." Last modified Dec. 19, 2017. https://city.milwaukee.gov/ImageLibrary/Groups/ccClerk/Ordinances/Volume-2/CH218.pdf.

- City of Palo Alto. "Deconstruction & Construction Materials Management" Last updated Oct. 29, 2020. https://www.cityofpaloalto.org/gov/depts/pwd/zerowaste/projects/deconstruction.asp#Decon,%20survey,%20and%20separation.

- City of Portland. "Certified Deconstruction Contractors." Last updated Oct. 7, 2020. https://www.portland.gov/bps/decon/certified-deconstruction-contractors.

- City of Portland. "Chapter 17.106: Deconstruction of Buildings Law." Accessed April 1, 2021. https://www.portland.gov/code/17/106.

- City of Vancouver. "Green Demolition By-Law No. 11023." Last updated Nov. 24, 2020. https://bylaws.vancouver.ca/11023c.PDF.

- New York State DEC Division of Materials Management Bureau of Solid Waste Management Construction and Demolition Debris Permitted Processing Facilities - must submit annual operating report https://www.dec.ny.gov/chemical/23686.html

- Nunes, Andey; Palmeri, Jordan; Love, Simon. State of Oregon Department of Environmental Quality. "Deconstruction vs. Demolition: An evaluation of carbon and energy impacts from deconstructed homes in the City of Portland." Last updated March 2019. https://www.oregon.gov/deq/FilterDocs/DeconstructionReport.pdf.

- Palo Alto, CA, in-depth guide includes links to municipal code, approved reuse organizations, links to who is affected, what is changing, what is required, and when the new law is effective. FAQs, contact information and other resources. https://www.cityofpaloalto.org/gov/depts/pwd/zerowaste/projects/deconstruction.asp#Decon,%20survey,%20and%20separation

- Pittsburgh, PA. The city recently adopted a Sustainable Deconstruction Executive Order. More information about this and related initiatives here: https://pittsburghpa.gov/mayor/deconstruction.

- Portland, OR,
  - Certified deconstruction contractors: https://www.portland.gov/bps/decon/certified-deconstruction-contractors
  - City code Title 17.106 Deconstruction of Buildings Law: https://www.portland.gov/code/17/106
  - Demolition delay ordinance: https://www.portlandoregon.gov/bds/article/494371
  - Oregon state Department of Environmental Quality: Deconstruction vs. Demolition report: https://www.oregon.gov/deq/FilterDocs/DeconstructionReport.pdf

- Scarlett, Paul. "City of Portland: Demolition Delay Ordinance." Last updated Jan. 16, 2014. https://www.portlandoregon.gov/bds/article/494371.

- Town of Clinton. "Article VII § 250-93: Demolition Permits." Accessed April 1, 2021. https://ecode360.com/11845789.

- United States Environmental Protection Agency. "Sustainable Management of Construction and Demolition Materials." Last updated Nov. 12, 2020. https://www.epa.gov/smm/sustainable-management-construction-and-demolition-materials.

- Vancouver, BC, Canada Green Demolition By-Law No. 11023: https://bylaws.vancouver.ca/11023c.PDF

Appendix A | FAQ

How should we store materials for reuse if we have a small local capacity?

If you have limited storage capacity, the most effective practice is to identify salvage dealers or buyers prior to the deconstruction so that materials go directly to those who will use, process, or sell them. Establish a local network of dealers, buyers, and users who can take materials directly from the site, if possible.

A materials survey performed in a building before its deconstruction can help estimate the types and amounts of materials that will be available, which can assist in identifying next destinations and communicating with interested parties.

The Service Directory in this guide contains salvage retailers who may be able to take materials. Additional local contacts who would take salvaged materials might include the following:

- Stone/brick/masonry companies
- Reuse/upcycle artisans
- Reuse, antique, and architectural salvage stores
- Community organizations
- Schools

Reuse materials provide entrepreneurial opportunities to community members. Consider how the available materials can be advertised to attract local potential entrepreneurs and community organizations in need of building materials.

Who are the people in my community who I should reach out to for support?

A reuse economy engages a number of interested parties in a community. Here are some of the parties that may be interested in supporting deconstruction and reuse efforts:

- Climate/sustainability task forces or committees working at municipal and county levels
- Planning, sustainability, and construction program faculty and students at colleges, universities, and trade schools
- Reuse/salvage dealers, artisans, entrepreneurs, etc.
- NYS Department of Environmental Conservation
- Preservation and historic associations

How do I identify a professional deconstruction contractor?

There currently is not a certification or licensing program for deconstruction contractors in the state of New York. However, many demolition contractors are able to perform deconstruction

services if the RFP is written to require this. Contractors may refer to these services as "dismantling." The Service Directory in this guide provides a list of demolition contractors, many of whom have experience in providing dismantling/deconstruction services.

Appendix B | More About CR0WD

The Circularity, Reuse, and Zero Waste Development (CR0WD) Network developed out of an alliance of community leaders and academics concerned with a vast system of building material waste within New York State. CR0WD seeks to advance sustainability, resilience, and green jobs within the built environment. CR0WD's efforts are aimed at helping communities realize the environmental, cultural, and economic benefits of prolonging the lifespan of buildings and reusing building materials and architectural elements through research, education, policy initiatives, and design that emphasizes deconstruction, salvage, and preservation.

The network is sustained through shared leadership between organizations, such as

- Historic Ithaca
- Susan Christopherson Center for Community Planning
- The Preservation Association of Central New York
- Finger Lakes ReUse
- The City of Ithaca
- Cornell Circular Construction Lab
- Cornell Just Places Lab

CR0WD's efforts to elevate deconstruction and reuse policies have engaged an expanding set of participants, including community leaders, advocates, and elected officials. The Susan Christopherson Center for Community Planning and Historic Ithaca are working to develop recommendations for racially equitable green job opportunities in Central New York with deconstruction and building energy retrofits as the centerpiece. CR0WD is also working to develop public educational materials online and displays and presentations within Ithaca and other communities. CR0WD plans to expand its work with local governments to support their efforts to introduce incentives, gather relevant data, and pass deconstruction ordinances. For further information on CR0WD, please see www.cr0wd.org.

Appendix C | Additional Technical Recommendations

Below are recommendations regarding deconstruction surveys and proposals proposed by the Circular Construction Lab at Cornell University, in addition to the recommendations offered in Section 3.

1. ScanR and Deconstruction Surveys

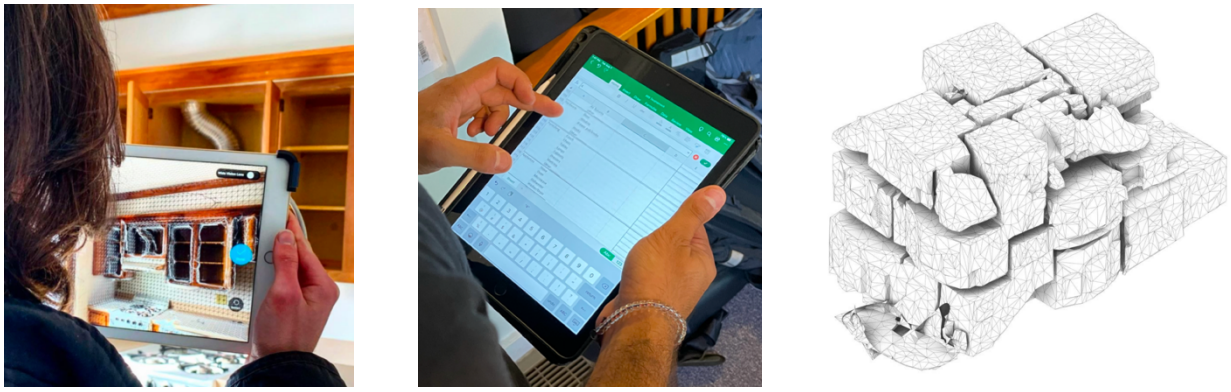


Figure 9:Credit: Felix Heisel (left, right), Joseph McGranahan (middle), Circular Construction Lab

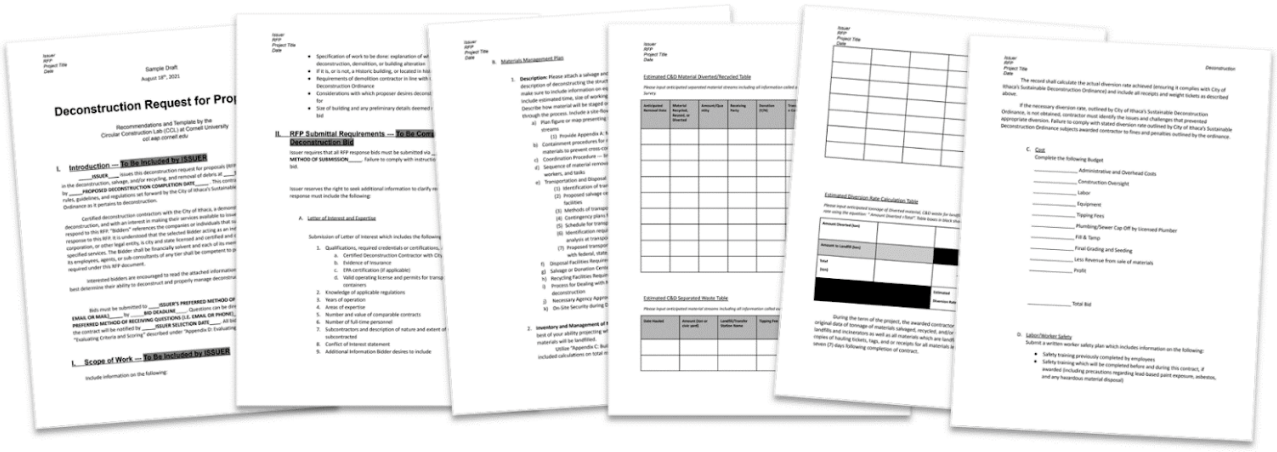
The Circular Construction Lab at Cornell University developed and recommends the use of **ScanR**, a composite method pairing quantitative and qualitative salvage and deconstruction surveying (S&D Survey) with LiDAR and photogrammetry scanning to catalog building materials prior to their removal from a site. ScanR enables data collection and the generation of material databases to link local supply with demand.

A ScanR S&D Survey can be conducted with tools readily available to most contractors and stakeholders, such as the more recent generations of LiDAR equipped mobile devices and spreadsheet software. The survey is conducted onsite, first with a scanning walkthrough to digitally capture the structure, and then with a walkthrough to manually note material quantities, qualities, and locations, providing information on spaces that are inaccessible to the scan. This information is then processed to assess a building's reuse potential.

Using this method of building surveying will enable data collection efforts across a community given its standardization, thereby supporting the management and diversion of local construction material from waste streams and their reintroduction into the marketplace.

A set of manuals and Rhinoceros3D and Grasshopper scripts and components can be found at https://labs.aap.cornell.edu/ccl/resources.

2. Recommended Request for Proposals for Deconstruction



The Circular Construction Lab at Cornell University recommends the adoption of a **Deconstruction Request for Proposals** (D-RFP) to facilitate, organize, and make comparable bids for all proposed deconstruction projects. The attached document can be understood as a template summarizing important aspects of deconstruction projects (especially in comparison to demolition projects), as well as necessary accounting requirements as part of the Materials Management Plan. Working within the regulations set forth by the Deconstruction Ordinance, the D-RFP requires the issuer (owner or owner-representative) to provide certified deconstruction contractors (bidders) with a scope of work and related work requirements. After a set submittal deadline, the issuer then has a period of time to select the preferred contractor to perform the deconstruction.

The issuer's scope of work outlines the extent of work, current structures on site, desired considerations, a summary from the ScanR S&D Survey, and additional preliminary details deemed necessary to produce effective bids. The bidder's submission must outline expertise and qualifications, a Materials Management Plan, bid estimate cost, and a labor safety plan.

While the D-RFP is intended to compare bids on proposed deconstruction projects for the benefit of the issuer, the Materials Management Plan is a source of data in the pre-permitting process that will allow the city and building department to ensure that the deconstruction process aligns with the goals of the city and its deconstruction ordinance.

To review the D-RFP in more depth, please refer to the following link: https://labs.aap.cornell.edu/ccl/resources.

Appendix D | Case Studies in Ithaca – Deconstruction and Reuse Precedents and Pilot Projects

A sustainable built environment must integrate many forms of maintenance, preservation, reuse, care for materials and history, and a commitment to diverting waste from landfill. There are several methods of structural preservation and reuse that CR0WD found to have precedence in Ithaca, New York, which is where CR0WD research efforts were initially focused.

A series of interviews with developers, architects, and salvagers about current demolition practices revealed that it is already common to salvage valuable architectural features and some readily marketable building materials for resale. A marketplace for reused building materials has emerged and centers around Significant Elements and Finger Lakes ReUse, which often have ready buyers for reclaimed materials.

Additionally, the adaptive reuse of buildings, which can preserve much of a structure, has become increasingly common. Several historic structures have been entirely moved to new locations, and the preservation of whole buildings is supported through the designation of the City of Ithaca as a Certified Local Government. The following case studies serve as examples across a spectrum of reuse that have precedence in Ithaca.

Building Deconstruction: Catherine Street Deconstruction

In Collegetown, a neighborhood in Ithaca directly south of Cornell University, the proposed development of 300 new housing units led to the planned demolition of 11 residential structures built in 1910. In close collaboration with the principal developer, the Circular Construction Lab, and students from Cornell's Department of Architecture began documenting and cataloging the existing structures for their reuse and deconstruction potential, using a newly developed Deconstruction and Salvage Survey Toolkit (ScanR S&D Survey). With the help of experts from the Seattle-based Building Deconstruction Institute, the group was then able to convince the building owner to deconstruct—rather than demolish—one of the 11 structures (206 College Avenue).

Figure 10: A material handler removes a panel of 206 College Avenue as it is being deconstructed. Photo by Felix Heisel, Circular Construction Lab

Over the course of five days in January 2022, a crew of workers and volunteers, including some members of the Common Council, methodically carved the 420–square meter, 13-bedroom structure into sections from top to bottom. Panels of roof, walls, and floor as large as 2.5 x 5.5 meters were lifted onto a flatbed truck and hauled to the Finger Lakes ReUse–operated ReDOT warehouse for the materials to be processed, salvaged, and eventually resold.

The Catherine Commons Deconstruction Project allows a side-by-side comparison of demolition and deconstruction processes on almost identical buildings within the same economic and geographic setting. The case study includes comprehensive research on deconstruction's local potential, documenting everything from the quantity and quality of materials saved to the resale market, the time and labor required, and the total cost—including environmental and social costs that are typically not factored into construction and demolition budgets.

Adaptive Reuse of Existing Buildings

Figure 11: Ironworks Building (Credit: Jennifer Minner.)

Figure 12: Carey Building (Credit: Travis Hyde)

The Carey Building at 316 E. State Street serves as an excellent example of preserving a building in situ while increasing the property's footprint. The original building remains largely intact, while the developer (Travis Hyde) was able to successfully add more housing units atop it.

On the other end of the adaptive reuse spectrum is the retention of only the original building's façade while otherwise building an entirely new structure, such as the nearly completed Ironworks development on West State Street. This example of façade retention maintains some of the historic scale and character of the area and diverts some of the remaining architectural brickwork from landfill, but it is more carbon-intensive than the full adaptation of an existing structure.

Structure Relocation

Figure 13: An 1845 farmhouse being moved down Coddington Road in 2016. (Credit: Historic Ithaca)

If a building must be removed from its site, full structure relocation within the community can preserve the building's embodied carbon and history while making way for new uses. One local example of structure relocation occurred in January 2016, when the new owner of an 1845 Greek Revival farmhouse in Ithaca's South Hill neighborhood sought a demolition permit to subdivide the lot and build two duplexes. Historic Ithaca intervened by issuing a letter of concern to the Town of Ithaca and contacting the building owner directly. The owner could not be persuaded to rehabilitate the house in place but eventually agreed to offer the house for free to anyone willing to move it off of the property. Eventually, neighbors down the road agreed to move the structure to their property in December 2016, where it has since been set on new foundations, completely rehabilitated, and returned to use as a residence.

As a result of this move, the Town of Ithaca began to consult with Historic Ithaca and the City of Ithaca to explore becoming a Certified Local Government and adopting a local preservation ordinance.

Codifying a More Sustainable Built Environment

These examples of sustainable construction practices are encouraging, but they also highlight an ongoing need to ensure that buildings do not end up in landfills. In most cases, the above examples are voluntary, even experimental methods of removing and repurposing buildings.

Without intervention, many of these structures would have been demolished and sent to landfill with little social or economic value captured, and carbon would have been unnecessarily emitted. To have a measurable impact on decarbonization and climate resilience in communities, ongoing efforts should be scaled and codified. City-level policy can be a powerful tool to move from a voluntary case-by-case basis to a formal built environmental decarbonization and waste reduction strategy. This could come in the form of incentivizing or requiring deconstruction, as well as adaptively reusing and retrofitting the existing building stock. Section 4 of this guide provides further recommendations to support deconstruction, salvage, and reuse in communities.