

[LOGIN/SIGN UP TO SAVE](#)

Implementation Guides June 2024

How to start deconstructing and stop demolishing your city's built assets

[Adapting to Climate Change](#)[Buildings and Construction](#)[Spotlight On: Sustainable Consumption](#)[Waste](#)Originally Published: **January 2021**Author(s): **C40 Cities Climate Leadership Group, C40 Knowledge Hub**

Globally, the construction industry consumes over a third of all extracted resources each year. When buildings and other built assets are demolished, most of their materials go straight to landfill, wasting vast quantities of valuable resources and driving up financial and environmental costs. Deconstruction offers a means of salvaging materials for reuse. It also creates more jobs than demolition, spurs local innovation and industry, preserves local character and heritage, reduces landfilled waste and landfill costs, and limits the need for virgin (and often carbon-intensive) materials. This article explains how.



Only deconstruct if necessary: prolong the life of existing buildings and assets wherever possible

Refurbishing buildings and assets, or repurposing them for new uses (adaptive reuse), avoids the need for removal and is the most sustainable, least disruptive and often cheapest way of responding to evolving needs while preserving character and heritage. Removal should only be considered where buildings or infrastructure are too derelict, pose irreparable structural dangers or present other challenges that cannot be addressed. [How to reduce embodied emissions in municipal construction and lead by example](#) and [How to reduce embodied emissions in private and residential buildings](#) give guidance on how to adapt municipal and private buildings, respectively, in line with circular economy principles and the ‘clean construction hierarchy’ of priority actions.

Set targets and priorities for demolition waste, deconstruction and material reuse

Where structures must be removed, establish targets and strategies to:

- Promote deconstruction over demolition for existing buildings and new buildings.
- Minimise construction and demolition (C&D) waste.
- Divert C&D waste from landfill, including by promoting material reuse and creating a secondary market for these materials.

Targets and strategies should be informed by evidence of local deconstruction opportunities and costs. They may prioritise certain types of structure, establish a number or percentage of buildings to be deconstructed, and/or a quantity or types of material that should be recovered from deconstructed buildings, for instance. These targets and strategies should be embedded in relevant city plans, such as climate action, waste management and urban development plans.

Good examples include:

- The [Amsterdam Circular Economy Implementation Plan 2023–2026](#) sets out how the city is changing patterns of material use and stimulating the use of circular and bio-based construction materials. Key measures include extending the lifespan of buildings and infrastructural assets, ensuring urban planning projects conform with circular design principles and circular procurement criteria for all municipal assets, renovations and maintenance.
- [Vancouver’s Zero Waste 2040](#) plan establishes the reduction of waste from construction and demolition as a priority action. This is integrated into the city’s [demolition permitting process](#) with deconstruction and recycling requirements and [Green Demolition By-Law](#).

- **Johannesburg's Green Building Policy** aims to achieve low to net-zero carbon performance on all new buildings by 2030. Connected to this, its **Waste Management Plan** commits to diverting at least 30% of construction waste (by mass) from landfill by recycling or reusing materials and to reusing or recycling at least 50% of demolition waste.
- **Boulder City Council** approved mandates, effective 2020, requiring deconstruction in all full-structure removal and major remodelling projects and the diversion of at least 75% of removal waste from landfill.
- The **Paris Climate Action Plan** sets a target of 30% of office space construction to be reversible (adaptable or easy to deconstruct) by 2030, rising to 50% by 2050.
- The **Portland and Multnomah County Climate Action Plan** incorporates actions to: promote alternatives to traditional building demolition, such as relocation, deconstruction and salvage, and removing barriers and disincentives; provide technical assistance and resources to contractors to meet construction and demolition debris requirements, giving priority to salvage and reuse activities; increase material salvage for city-owned building demolition; and support the use of regional, sustainably sourced wood products for city-owned building and landscape projects.
- The **Oakland 2030 Equitable Climate Action Plan** includes actions to: establish a deconstruction requirement; support the reuse, repair, recovery and refurbishment economy; and reduce lifecycle emissions from building materials.
- The **St. Paul Climate Action & Resilience Plan** includes the adoption of a deconstruction/diversion ordinance requiring the reuse/recycling of construction materials.

Undertake a cost-benefit analysis of deconstruction, building material reuse and design for disassembly in the city

Such an analysis is useful to inform locally relevant policy development and public and private investment, particularly if targets are being set. Good examples include:

- Auckland's Cost Benefit Analysis of Construction and Demolition Waste Diversion from Landfill, led by Auckland Council.
- The Economics of Residential Building Deconstruction in Portland, OR, led by Portland State University.
- The business case for deconstruction in Baltimore, Maryland, led by the US Forest Service.
- Treasure in the walls: Reclaiming value through material reuse in San Antonio, commissioned by the City of San Antonio Office of Historic Preservation.



Involve a wide range of stakeholders in the planning and implementation of deconstruction policies

A deconstruction advisory group might include, for example, representatives from builders and developers, neighbourhood groups, urban development, historical preservation, salvage/deconstruction (non-profit and retailers), waste, recycling and permitting.

Develop the local deconstruction market with municipal procurement and training

Cities can use their purchasing power to advance their capacity for deconstruction and stimulate materials reuse, both directly and indirectly, developing a local deconstruction industry.

- **Require pre-demolition audits and salvage assessments.** Salvage assessments identify the quantities and types of reuseable material in a building, raising awareness and providing an incentive to deconstruct rather than demolish. Salvage assessments also help to build an understanding of the secondary materials that may soon be on the market. Pre-demolition audits are broader, identifying types and volumes of all materials that will arise from the structure's removal and how these will be dealt with.
 - Copenhagen requires an analysis of building elements suitable for reuse before any city-owned building is demolished or renovated.
 - Seattle requires that construction and demolition permit applicants complete a salvage assessment for whole-building demolition projects, as well as projects that involve alterations valued at more than US\$75,000 and/or where the area of work is greater than 750 square feet.
 - The London Plan 2021 requires circular economy statements to be submitted for all referable planning applications. The statement should demonstrate how the construction materials and components will be disassembled, describe the opportunities for managing waste on site and include an estimate of the waste to be generated.
- **Intercept the municipal waste stream to salvage reusable materials.** Salvaging reusable materials before they go to landfill can be cost-neutral for cities, as in the case of Berkley, California. Berkley pays local reuse company Urban Ore a salvage service fee, which matches the landfill waste fee, to extract reusable items and materials from the city-owned transfer station before they are taken to landfill. Read the contract or watch Urban Ore's operations manager explain the arrangement. San Diego's Sustainable Building Policy establishes measures for city-owned, occupied or leased new construction and major renovations. The measures focus on incorporating recycled building products,

using local materials and reducing the use of finite raw and long-cycle renewable materials by replacing them with rapidly renewable materials.



- **Support workforce deconstruction training.** To this end, consider partnering with local non- or for-profit organisations, such as salvage operations, motivated construction companies and neighbourhood groups. Training, coupled with certification schemes and requirements to use certified contractors, can help to ensure high standards.

- San Mateo County in California offers deconstruction training and contracts a building-materials reuse warehouse to support reuse in the San Francisco Bay Area.
- Portland, Oregon requires work to be done by certified deconstruction contractors and provides workforce training and certification grants, working with national membership organisation Build Reuse.
- Vienna is training long-term unemployed people and other disadvantaged workers in deconstructing large industrial buildings.
- San Antonio, Texas, which requires deconstruction for priority building types, provides training for contractors to qualify as certified deconstruction contractors.
- Baltimore, Maryland has teamed up with local non-profits to invest in its deconstruction industry as a means of generating employment and managing its abandoned buildings. This 15-minute video explains more.

2018 • Baltimore City Deconstruction Project





Harness neighbourhood activism and partner with heritage organisations

Collaborate with any neighbourhood groups working to prevent the demolition of places they care about to inform, build support for and raise awareness of deconstruction policies. These groups typically focus on older structures with historical value or character, which are often a rich source of reusable material and easier to demolish than newer structures, depending on the city's building traditions. For the same reason, city departments and/or non-profits concerned with historical preservation and heritage also make good partners. [Stop Demolishing Portland](#) is one example.

Establish or support local marketplaces for material reuse

Material reuse works most effectively when there is a local second-hand market, be it physical and/or digital, and deconstruction specialists that can provide usable construction materials. Marketplaces could be part of broader [repair and re-use facilities](#) that offer salvaged goods and construction materials.

Examples include:

- The award-winning [Materials Marketplace](#) established by **Austin, Texas** connects businesses and organisations so that they can identify reuse and recycling opportunities. It is an online platform that enables businesses and organisations to connect and find reuse and recycling solutions for waste and by-product materials. It is part of Austin's plan to reach [zero waste by 2040](#).
- **Vancouver** has a [rebuild hub](#) that takes and resells donated materials. The hub has seen greatest demand for used timber.
- **Oslo** opened [a hub for the reuse of building materials in 2023](#). It is geared towards professionals in the construction sector, aiming to build a business model for reused building materials (it does not take donations). It also includes a knowledge centre on reuse in the construction sector.
- **San Antonio** launched the city-run [Material Innovation Center](#), a partnership between the Office for Historic Preservation and Port San Antonio, to find the next-best use for salvaged materials, including construction materials and features such as bus shelters.

Promote voluntary deconstruction with grants and permitting incentives

Grants and incentives that increase the voluntary use of deconstruction as an alternative to demolition reduce the cost of establishing a deconstruction industry and secondary material market in the city. They also enable the collection of local data and good-practice examples, build industry capacity and raise

awareness of the benefits and opportunities. Voluntary programmes are a useful first step on the path to a mandatory deconstruction ordinance.



on the path to English

The main approaches are:

- **Building-scale grants.** Portland's deconstruction grant programme provided up to US\$3,000 for deconstruction projects from 2015 to 2016, ahead of the mandatory ordinance (see box). In Hennepin, Ramsey and Washington counties, Minnesota, homeowners and developers of residential properties can apply for grants of up to US\$5,000 (US\$2 per square foot) to offset any additional time and labour costs involved in deconstruction, and up to US\$10,000 for commercial and multi-unit residential properties.
- **Grants for businesses and non-profits to incorporate waste reduction into their operations.** In Alameda County, California, non-profit and for-profit organisations can apply for reuse and repair grants of up to US\$20,000 from county agency StopWaste to fund projects that incorporate reuse, repair, deconstruction and other waste-reduction activities.
- **Requiring an analysis of deconstruction opportunities or a salvage assessment as part of permit applications for removal projects.** This analysis will show the asset owner and the city which building elements are suitable for reuse, raising awareness of deconstruction opportunities and enabling cities to encourage or require their uptake. Singapore's Demolition Protocol helps contractors better plan demolition procedures to maximise the recovery of waste materials for reuse or recycling, and has been incorporated into the SS 557 Code of Practice for Demolition. The protocol includes a pre-demolition audit, sequential demolition and site waste management. It has led to the development of new materials such as recycled concrete aggregate (RCA), which comprises more than 70% demolition waste.
- **Expedited and/or reduced costs for permitting.** Expediting permitting for deconstruction encourages deconstruction and offsets any additional time involved relative to demolition. Cities can also refund initial costs for permitting once a predetermined threshold of salvaged material has been achieved, potentially connected to landfill diversion thresholds.¹ The Canadian cities of Victoria and Vancouver passed bylaws that establish high costs for demolition permits and refunds if a minimum weight of wood/lumber is salvaged per square metre of floor area through deconstruction, targeting pre-1960 and -1950 homes respectively.² Both were informed by assessments of the local construction material salvage and recycling market.

Cities can also encourage or require deconstruction projects to **place signage with positive messaging** about deconstruction on the site to raise awareness about the local benefits and opportunities.



Promote ‘design for disassembly’ to make future deconstruction projects easier

Design for disassembly (DfD) (or ‘reversible construction’) facilitates the recovery of products, parts and materials from buildings and other built assets constructed today when the structure is renovated, repurposed or deconstructed in future. It involves developing the assemblies, components, materials, construction techniques and information and management systems required. This [guide](#) explains what DfD means in practice.

City governments can promote the adoption of these practices by providing locally appropriate guidance on DfD, requiring DfD for public projects and through permitting incentives, for example.

Adopt a mandatory deconstruction ordinance

A deconstruction ordinance should specify the types of asset or sector affected and establish a timeline for an incremental increase in requirements. It is important to have a consultation process prior to developing an ordinance to understand the concerns of key actors and to develop appropriate support and incentives.

- **Require deconstruction for priority segments of the city’s built stock.** The building types prioritised should be based on an assessment of those most likely to yield reusable materials and other local priorities, such as the preservation of historical features. This is the approach that Portland, Oregon has taken (see box below). Requirements can be expanded to additional segments later.
- **Ban demolition entirely for all built assets.** Palo Alto, California’s [ordinance](#), effective 2020, bans demolition and requires deconstruction for all commercial and residential buildings identified for removal. The ordinance is part of the city’s Climate Action Plan and subsequent [Zero Waste Plan](#), which aim for 95% of waste to be diverted from landfill by 2030. Approximately 40% of Palo Alto’s waste is from construction and demolition projects.³ San Francisco’s 2006 C&D ordinance banned the direct disposal of any such material to landfill. The regulation was updated in 2018 to mandate third-party verification of facilities receiving C&D materials for maximising recovery, and again in 2021 to tighten regulations by improving the tracking of material haulers. The city worked with a climate technology company to launch an online marketplace for reclaimed and surplus building materials for the Bay Area in 2023.

Portland, OR – the first city in the United States to adopt a mandatory deconstruction ordinance



There is strong demand for salvaged material in Portland, Oregon, thanks to a robust reuse culture and a local design aesthetic that favours salvaged materials (especially timber). The city has established for- and non-profit retail marketplaces, including the [ReBuilding Center](#) and [Salvage Works](#).

In September 2015, Portland's [deconstruction grant programme](#) began to provide up to US\$3,000 to qualifying builders, homeowners and deconstruction contractors. Twenty-four houses were fully deconstructed under the programme, at a total cost to the city of US\$50,000, paving the way for a deconstruction ordinance. The [ordinance](#) was adopted in 2016 through an amendment to the Buildings Law Code. It targeted houses and duplexes built before 1916 and historical buildings, which are a rich source of valuable old-growth lumber and relatively straightforward to deconstruct. Together, such buildings account for a third of the city's housing stock – a sufficiently large segment to develop the market without overwhelming it. Success enabled the city to expand the ordinance in 2019 to include dwellings built before 1940 – an additional third of the city's housing stock. Projects must use a certified deconstruction contractor and now divert over 2,000 tonnes of materials from landfill to reuse annually. Watch Mayor Ted Wheeler introduce this amendment at the City Council [here](#) or learn more from the leader of Portland's Deconstruction Advisory Group [here](#).

Update building codes to allow the use of salvaged and recycled materials

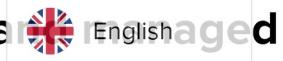
Work with experts and local, regional and national building-code officials to explicitly allow the reuse of materials in the building code, including the reuse of undamaged lumber without costly regrading. The code should also issue clear reuse guidance.

For example, the Washington State Building Code includes explicit support for the use of [used sawn lumber](#) for structural purposes, while the [Oregon Residential Building Code](#) allows lumber reuse without regrading. Updated in 2022, Mexico City's environmental standard [NACDMX-007-RNAT-2019](#) establishes specifications for the management of construction and demolition waste, through which the city requires the use of recycled materials in public works. In 2022, more than 92% of all construction and demolition waste generated was used, a huge increase from 16% in 2021.

Set requirements to address hazardous dust pollution from demolition projects

Requirements that address hazardous dust pollution make demolition projects safer and can increase the allure of deconstruction as an alternative, as they ensure significantly less dust and facilitate the safe disposal of hazardous materials. Requirements should target the hazardous materials that are prevalent locally. For example, to reduce the risks of lead-based paint and asbestos demolition dust, Portland, Oregon passed an [ordinance](#) adopting stringent lead-based paint removal and dust-control best practices for residential demolition.

Include deconstruction in planning for disaster recovery and managed retreat



Deconstruction and materials reuse has been shown to support community rebuilding and create jobs in the aftermath of a disaster. This is particularly important when many people will have lost their livelihoods. It can also support the process of managed retreat from sea-level rise.

Deconstruction enables the recovery of personal belongings, historical artefacts, local resources and other valued elements of a community's collective memory. It also limits further trauma and risk associated with the removal of damaged homes and structures, reduces disaster debris (and substantial landfill costs) and helps to meet demand for construction materials in new structures. For example, the San Mateo County Disaster Debris Management Plan includes detailed guidance prioritising safe reuse and recycling of construction materials instead of landfill disposal.

Large-scale deconstruction following a disaster requires the presence of a local deconstruction industry. Cities at risk from destructive hazards and with emerging or established deconstruction industries should include preparation for the rapid roll-out of deconstruction training for local volunteers and contractors as part of disaster and/or adaptation plans. Cities considering a managed retreat as a means of adapting to rising sea levels should consider developing deconstruction to reduce distress and costs.

Deconstruction brings a ‘dignified end’ to a handful of homes in New Orleans

Large-scale deconstruction was never on the cards in New Orleans following Hurricane Katrina owing to the absence of a deconstruction industry or policy that would have facilitated its development. More than 70% of New Orleans' housing, or 275,000 homes, were destroyed or severely damaged by the hurricane, and the government ordered the demolition of all buildings damaged beyond 51% of their market value. In many cases, homes were demolished against the wishes of their owners and with little prior notice, causing further trauma and anxiety for those trying to rebuild.⁴

Nevertheless, a small Mercy Corps-sponsored project enabled the deconstruction of nine buildings at a cost of US\$6,000 to US\$10,000 per house – in the range of federal payouts for demolition.⁵ Research shows huge benefits for those involved: the process brought relief by facilitating a ‘dignified end’ to people’s homes and, by proxy, to the lives they led before Katrina hit, thanks to positive social interaction in the process of deconstruction and material recovery. It allowed homeowners to reclaim valued objects and materials that would have been sent to landfill by federal mandate. By giving recovered material away, some of the participants reported a positive feeling akin to donating organs, ‘giving life to their critically injured community’ and to low-income residents.⁶



Article Feedback

Please help us improve the relevance and utility of our content by answering the questions below:

Where are you currently employed? *

- By a C40 Member City By a city that is not a member of C40 I do not work for a city

What is your opinion of the quality of this article? *

- Very High High Average Low Very Low

Are you able to take an action* based on this article? *

- Yes No

If you used the translation feature (a machine translation tool), did you find it helpful?

- Not Used Very Helpful Somewhat Helpful Not Helpful

Additional feedback:

Submit

Show References and Credits