

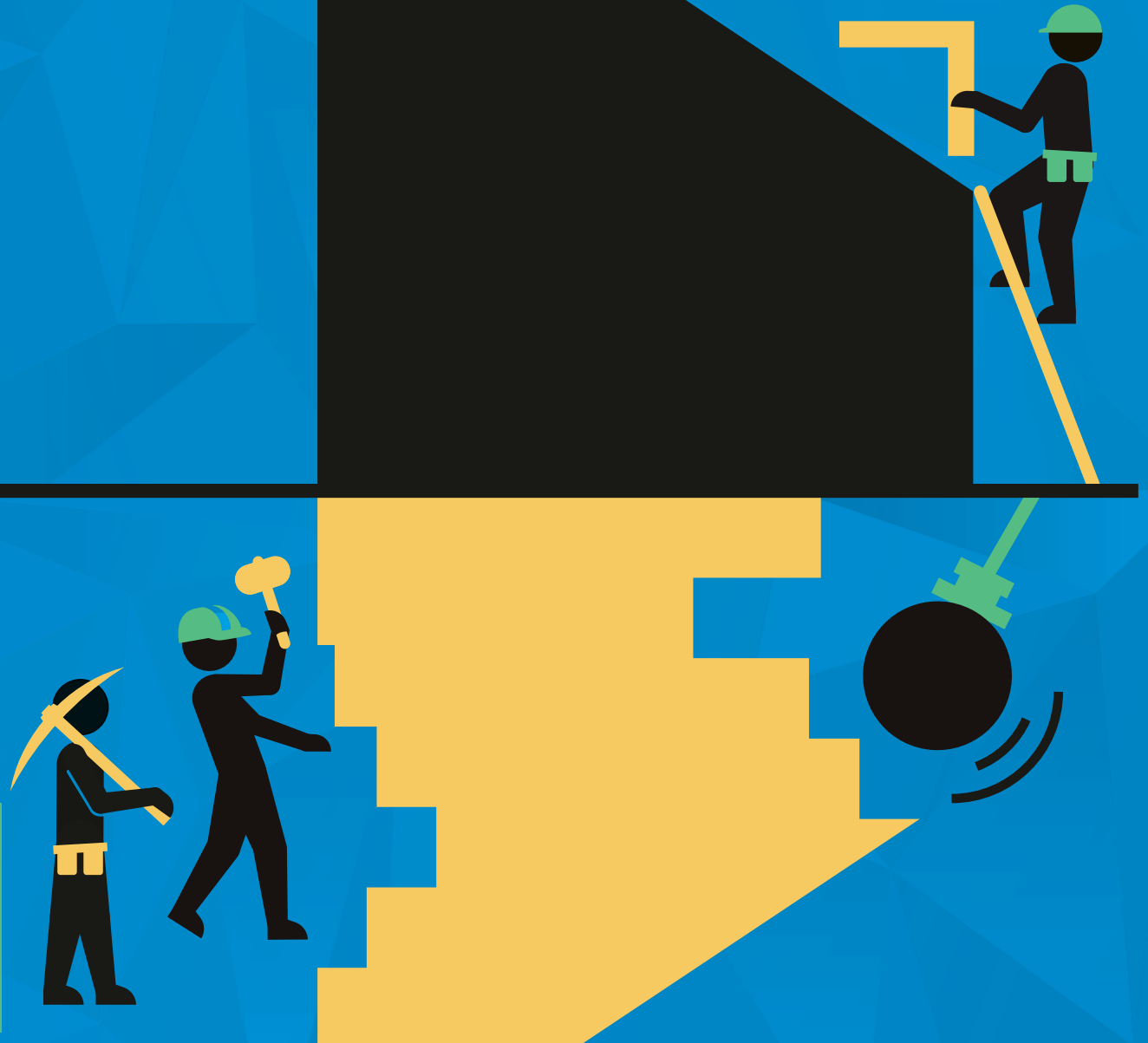


× City of
× Amsterdam

Copper

Circular demolition

The circular
tool box

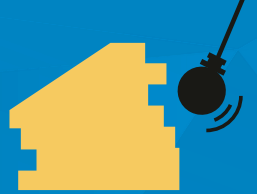


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After reading this article, you will:

- understand what circular demolition means.
- be familiar with the main challenges of circular demolition and their solutions.
- as a municipal client, construction manager, and purchasing advisor, understand the implications of circular demolition for working methods and the process





Summary

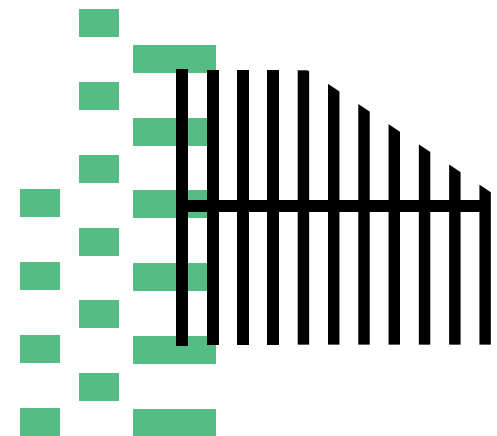
In the current linear construction chain, raw materials are extracted, converted into building materials and products, used, and demolished and considered waste at the end of their lives. This is a model based on “take-make-waste” principles, in which the demolition of buildings at the end of the chain mainly means a loss of raw materials, a low-value form of recycling for materials at best, and a loss of value. Meanwhile, circular demolition differs from traditional demolition because of its focus on harvesting materials (thus the retention of value), instead of removing a structure at the lowest possible cost within a tight schedule. By taking the time and space to dismantle buildings and remove and dispose of waste streams separately, circular demolition and high-value reuse can make a positive contribution to a circular construction and the circular economy.

To boost circular demolition in Amsterdam and elsewhere, we propose a five-step process that will enable the transition from a linear to a circular demolition process for buildings, infrastructure, and public spaces. The steps are: (1) signaling demolition projects timely and making the details available, (2) making an inventory of the products and materials that will be released to the market, (3) valuing and prioritizing the inventoried products and materials, (4) offering and repurposing recovered materials and products, and lastly, (5) the actual disassembly of the products and materials.

Definition:

“Circular demolition is the demolition, dismantling, disassembly, and removal of materials in such a way that the raw materials that are released become available again for high-value reuse in other projects. This makes circular demolition a vital link in the Circular Economy.”¹

(VERAS; trade association for demolition contractors and asbestos removal companies)





Recommendations

→ Identify demolition projects in a timely manner in order to reserve space in plans for the municipality and other parties involved to ensure circular demolition.

→ Value the inventoried products and materials, starting with maximum value retention for a possible new purpose.

→ Disassemble the products and materials, in which the municipality can provide guidance by setting disassembly and reuse requirements for the demolition specifications.

→ Make an inventory of the products and materials in the structure to be demolished to gain insight into the quantities, the condition, the remaining technical life, and the detachability of connections.

→ Use the products and materials in other municipal projects, or promote the demand for secondary materials in other projects using, for example, basic principles in municipal plot allocations.





Substantive deepening

The importance of circular demolition

Out of the 6,000,000 tons of materials released in the Netherlands in 2014 through demolition of residential and non-residential buildings, the majority was recycled (88%). However, this material is mostly reused in a low-value form, such as filling under buildings or in civil and hydraulic engineering projects. Only 0.2% was in fact reused at product-level.² Low-value recycling means that the value accrued during original manufacturing and assembly is lost, as shown graphically in the figure below.

Amsterdam aims to reduce the amount of primary materials in construction by 50% by 2030 and to be waste-free by 2050. Dismantling and reusing materials from the demolition of structures and processing them in new structures is a crucial part of achieving this objective. By 2030, up to 58% of the primary materials required for Dutch residential and non-residential construction could be theoretically replaced by secondary materials. However, we are currently at 7% in practice,² so there is still a long way to go.

Obstacles to circular demolition

The use of secondary materials is still insufficient for a number of reasons. For example, the demand for secondary materials is still relatively limited, the price of circular building materials is often higher than their linear alternatives, the physical facilities for storage and reprocessing are not always adequate, and the quantity and quality of materials from demolition projects offered for reuse are still unsatisfactory.

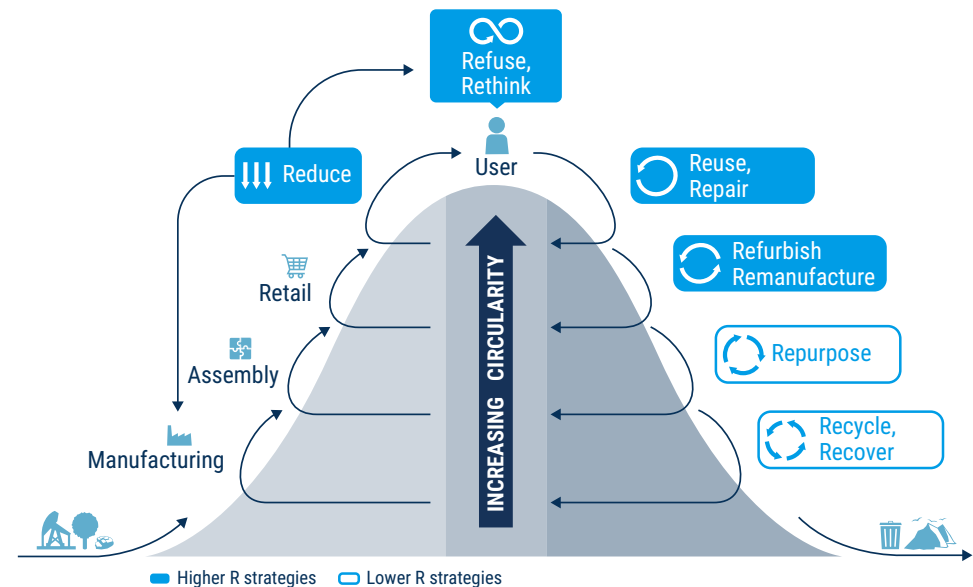
In addition, there is still a lack of incentives or obligations for circular demolition, resulting in a market that has not yet fully embraced circular demolition. Take practical obstacles: there is no time devoted to planning for inventories and disassembly, and opportunities for repurposing materials are not yet clear enough for many demolition workers and builders. It is vital to promote the demand for secondary materials from demolition in order to combat these issues.

Shifting toward a circular demolition process in 5 steps

To boost circular demolition in Amsterdam and elsewhere, we propose a five-step process that will enable the transition from linear to the circular demolition of buildings, infrastructure, and public space:

1. The timely signaling of demolition projects and making details about them available;
2. Making an inventory of products and materials;

Figure 1: Adapted from 'Circle Economy - Master Circular Business with the Value Hill (2016).³





3. Valuing and prioritizing the inventoried products and materials;
4. Offering and repurposing;
5. Disassembly of the products and materials.

1. Timely signaling of demolition projects and making their details available

By being involved early on in the process, there is more potential to reserve space in the plans of the municipality, demolition companies, and other parties involved to ensure circular demolition. This is because circular demolition takes more time than conventional demolition. Therefore, to maintain some grip on the process as a municipality (whether in the form of control, guidance, or influencing), it is important to keep a timely overview of upcoming demolition projects and their timelines. Ideally, this information would reach relevant parties in the market in good time, as they can use these potential “donor buildings” to purchase circular building materials (see Step 4, “Offering and repurposing”).

2. Making an inventory of products and materials

As soon as a demolition project has been identified, it is important to map the building's products and materials, by means of a building materials inventory and drawing up a Materials Passport. This details the quantities of recyclable materials, such as kilograms of concrete and wood and cubic meters of sand. Yet this also provides insight into reusable products, such as the number of interior doors, square meters of wall cladding, or meters of copper pipes. It is also important to use the inventory to investigate the condition and remaining technical life of the products and materials, as well as the detachability of the connections that mounted them. After all, less value is lost during demolition when materials can be disassembled and are not attached by means of “wet” fasteners such as glue. This offers a basis for identifying potentially interesting materials and products for reuse.

Gaining insight into demolition projects

Unlike new construction, planned demolition projects are not always monitored. From a current policy point of view, there has often been little need for more proper insight. Moreover, the responsibilities within demolition projects are often divided among different parties.

Yet there are a number of sources from which to gather such insights. For one, the planned demolition of municipal property, infrastructure, and redevelopment of public space is stated in various municipal plans. Second, transformation areas often provide an overview of which plots will be redeveloped in certain periods, which often involves the demolition of buildings. Some of the demolition projects also require an environmental permit from the municipality or a demolition notification from the initiator, which information is received by the Omgevingsloket (Service Counter) for environmental and planning permits. Finally, regional collaboration over planning capacity for housing development is in place among municipalities and housing associations, which illuminate the withdrawals from the housing stock via demolition. An example is this [planning capacity](#) tool from the MRA and province of North-Holland.

Bringing together information about future demolition projects at the municipal or regional level creates an overview of the demolition materials released per project, which can be used to identify opportunities for circular demolition. Examples include creating “demolition calendars” and maps, [something Rotterdam is implementing as well](#).



3. Valuing and prioritizing the inventoried products and materials

A clear insight into the condition and detachability of inventoried materials makes it possible to determine their potential purpose in the next life cycle and residual value. Prioritize the maximization of value retention and minimizing environmental impacts when determining this potential new purpose. Exploring the different reuse, refurbishing, remanufacturing, and recycling options can help with prioritization.

Residual value of building materials

The financial value of building materials can be significant. The materials released from an average project usually cover 15-25% of the demolition costs. In the case of the Hilton Hotel at Schiphol Airport, the value of material released even reached 50% of the demolition costs initially budgeted.⁴

4. Offering and repurposing

The reuse of materials is closely related to finding their new purpose, in which there must be a match among the functional requirements, logistical movement, and timing (in connection with possible storage of the acquired materials). Generating the supply is important, but opportunities are only really capitalized upon by linking this supply to demand. Repurposing can take place within, for example, the same client's projects, the contractor's own projects, or by offering materials via marketplaces (such as [Insert](#) or [Oogstkaart](#)). The Buiksloterham district's municipality is developing a digital marketplace for materials released from public spaces, for example.⁵

The municipality can therefore directly generate demand for secondary materials with the development of infrastructure, municipal property, and public space. It can also indirectly set requirements and criteria for the use of secondary materials and products (such as in plot allocations). In the Buiksloterham district, municipal plot allocations already include basic principles and objectives regarding the share of secondary materials.

5. Disassembly of the products and materials

As soon as the most promising scenarios for repurposing have been determined, proceed to setting requirements and criteria for the demolition (as part of demolition specifications, for example). These manage the level of reuse and the environmental impact, among other things. The Municipality of Amsterdam applied the high-value reuse of released concrete rubble as a provision in the specifications for the redevelopment of plot 18/19 in Buiksloterham.

Preventing demolition is often the most circular option

The partial preservation and modification of structures can in many cases turn out to be financially more advantageous than complete demolition and new construction. In addition to the financial added value, preservation often also has an added value from an environmental point of view. It is therefore recommended to carefully weigh the circular and financial advantages and disadvantages of demolition in relation to preservation or transformation, before proceeding with demolition.

The key to circular demolition in the future: detachability and reusability

The reusability of materials is strongly influenced by the method by which they were connected, in which glued, "wet fasteners" can lead to product damage, whereas mechanical, "dry fasteners" are better suited for disassembly. Because products with a long service life and containing no toxic materials are also better suited for reuse, it is important to maximize the focus on reusability and a detachable design in new construction that better facilitates circular demolition in the future. Digitally storing this information in a Materials Passport is as important as the design itself, as it makes it easy to trace the building's materials. For more information about digitally storing information about materials and passports, see the papers [Digitisation in construction](#) and Materials Passports.

Case study 1

SUPERLOCAL - Kerkrade

The Bleijerheide neighborhood (Kerkrade-East) was home to four high-rise flats from the 1960s that no longer met current requirements. Since the number of inhabitants in this neighborhood has been shrinking, one flat was demolished in 2012, and it was decided to redevelop the area. The objective of the circular area development SUPERLOCAL is to reuse materials from the two vacant high-rise flats for the construction of approximately 130 new homes and the development of a public area. These new homes consist of at least 90% recycled materials from the area and are supplemented with new bio-based materials.

The collaboration between HEEMwonen and Dusseldorp concludes that the separation and reuse of construction waste often requires energy-intensive operations, such as transporting and breaking concrete rubble. As a more sustainable alternative, each flat was disassembled by cutting them out, with the shells as a whole being reused on-site. QR codes containing a quality assessment linked to a track-and-trace tool tell the project team which materials are stored where.⁶

Noteworthy points:

- Disassembly and reuse can result in significant value retention, even with fixed concrete connections.
- Using materials that become available within a project offers organizational and logistical advantages because supply and demand are better matched.





Case study 2

Het 4^e Gymnasium

The temporary school building of the 4th Gymnasium was completed in 2008 in a detachable format. Despite the fact that the modular construction was intended to make the building movable and reusable at the end of its life, the building was still demolished in 2016, according to conventional standards. Why?

First, lack of knowledge posed a problem because the systems used at the time cannot be compared with current systems. The system that was applied has been used to a very limited extent in the Netherlands, and the original supplier went bankrupt in 2012. The uncertainty of lost knowledge

would make for unmanageable dismantling costs and planning, and the temporary storage of materials would lead to a significant loss of quality. Leaving the building intact with a new user was also not an option, given the rapid development of the Houthavens area. As a result, the building was

eventually demolished. Small parts, such as frames, doors and furnishings have been reused.⁸

Noteworthy points:

- Modular construction does not guarantee future reuse.
- Accessibility of knowledge about detachability, an early start in dismantling, and clear agreements about the responsibility of the supplier all contribute to value retention.





More information

These publications offer additional background on circular demolition:

→ **Inschrijvingsleidraad Circulair Slopen (BouwCirculair)**: an example of the minimum requirements that can be set to demolition specifications

→ **Beoordelingsrichtlijn Veilig en Milieukundig Slopen (SVMS)**: a guideline against which the building materials' inventory and demolition specifications can be tested

→ **Succesverhalen Circulair Slopen (VERAS)**: an overview of success stories on circular demolition from the market

→ **BREEAM-NL Sloop en Demontage (DGBC)**: the hallmark for assessing the sustainability of a demolition project

Footnotes

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4. Deloitte (2019), From immovable property to movable property, available at: <https://www.bouwinvest.nl/media/4322/van-vastgoed-naar-losgoed.pdf>
5. Municipality of Amsterdam (2020), Approach in Professionalizing the Public Space Circular Method and the Digital Materials Hub
6. Alles over Circulair Slopen (2019), Success Story Dusseldorp ISM - SUPERLOCAL, available at: https://www.allesovercirculairslopen.nl/succesverhalen/-1284-succesverhaal-dusseldorp-ism-superlocal/_ga=2.98472479.1234405794.1614867467-780333677.1603891204
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