# Sustainable Deconstruction and End of Life

## Practical Guide

This Practical Guide covers key principles of sustainable deconstruction and end of life in the built environment

### IN A SNAPSHOT

**End of life** refers to the demolition or deconstruction stage of a building and includes any material recovery for reuse and waste disposal. In the internationally accepted standard for calculating a building's lifecycle stages (EN15978), the End of Life stage is known as 'Module C'.

The current approach to building design and demolition results in unsustainable levels of carbon emissions, material depletion, waste and pollution. It can also negatively impact nature and biodiversity and health and wellbeing. This linear model needs to be replaced by a circular approach to design, material recovery and reuse.

A key way of enabling this is through deconstruction. **Deconstruction** refers to the method of taking apart or removing building components for re-use. This is in contrast to demolition, where buildings are knocked down and materials are either sent to landfill or recycled.

### WHY IS IT IMPORTANT?

When we think about designing and constructing a building or infrastructure project, we rarely imagine what will happen at the end of its life. Yet, the typical design life of a modern commercial building is only around 30 years, with many set to be demolished even before that point.

It is widely recognised that this linear model of material extraction, construction, demolition and waste disposal is entirely unsustainable. In the UK, it accounts for a massive 60% of material use and waste generation and around a third of carbon emissions.

There is a clear need to re-think the way in which we approach the end of a building or infrastructure project's life. We need to move away from 'business as usual' towards a more sustainable system of re-use and deconstruction.

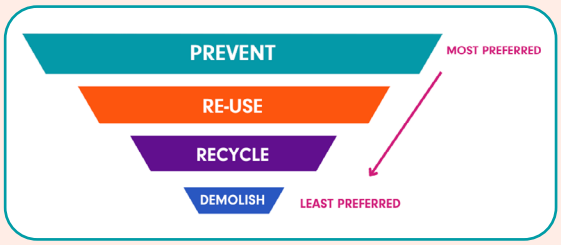
To enable this, we need to consider the end of life from the planning and design stage. It starts with targeting a longer building life and integrating Design for Dissasembly, a strategy that enables future changes and dismantlement of building parts, materials and systems for recovery and reuse.

Detailed information on how the building was designed and constructed, and any alterations made over its lifetime should be produced and kept up to date.


Photo: PBC Today

### PRINCIPLES OF SUSTAINABLE DECONSTRUCTION AND END OF LIFE IN THE BUILT ENVIRONMENT

The waste hierarchy is a tool that ranks waste management options from most to least preferred in terms of sustainability. Its principles can also be usefully adapted to understand how to sustainably manage the end of a building's life.




**Prevent**
Preventing the need to stop using a building or infrastructure in the first place is the most sustainable option. The lifecycle of a building or infrastructure can be extended by implementing high quality retrofit, upgrade, and maintainence schemes.

**Re-use**
Buildings and infrasturcture (or parts of them) can be deconstructed and re-used. For example, steel beams can be deconstructed, tested, remanufactured and reused.

**Recycle**
If the materials on a building or infrastructure cannot be re-used, they can be recycled. For example, aluminium can be recycled at the same quality.

**Demolish**
Demolishing a building is the least sustainable option and should be avoided wherever possible.

**The Buildings as Material Banks** project implements the principles of the waste hierarchy for the built environment. In particular, it focuses on improving the value of materials used in buildings for recovery.

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## HOW CAN IT BE DONE?

At each project stage there are actions that should be taken to help achieve sustainable deconstruction and end of life:

### Before building (developers and design teams)

- **Design for longevity, flexibility, and adaptability** to ensure projects stand the test of time. Consider the need for future adaptations including climate change risks.
- **Design for deconstruction and disassembly** to ensure building elements can easily be taken apart and re-used without reducing their value.
- **Key strategies for deconstruction** include the separation of systems to ensure services can be upgraded or removed easily; the use of high-quality and non-toxic materials to maintain re-use value and reduce occupational hazards; a simplified palette of materials and components; mechanical fasteners instead of glues.
- **Consider designing for prefabrication, pre-assembly and modular construction.** Modular construction supports standardisation and allows for better control of the construction process. Care should be taken to observe other reuse requirements set out above.
- **Safeguard the original construction drawings** and consider commissioning a deconstruction manual.

### Whilst building (construction teams)

- **Use fittings and fasteners** that can be easily disassembled.
- **Bring prefabrication and standardisation** expertise to the construction process.
- **Document materials used in a Material Passport.** This is a tool to gather and organise information about materials and components in a building. Collecting this information supports future recovery and reuse.
- **Document any changes made on site** if these diverge from the original construction drawings.

### Once built (occupiers and building management)

- **Implement proactive maintenance regimes** to keep the building in use for longer, for example through condition based maintenance management.
- If **retrofits, upgrades or significant maintenance works** are undertaken, document any changes to the building fabric to inform future deconstruction and reuse.
- Be mindful to follow the same strategies for deconstruction set out above if **commissioning retrofits.**

### End of life (deconstruction teams)

- **Request or supply the original construction drawings,** a Deconstruction Manual and Material Passport if available, to see how the building was put together and what it contains.
- **Develop a deconstruction strategy,** taking care to recover the greatest amount of materials and components at the highest level of quality.
- **Re-sell materials and components** so that they can be used again and to generate financial value.

### CASE STUDY: TRITON SQUARE (ARUP)

Triton Square is an example of re-using and updating a building structure to avoid the need to demolish. The original 1998 structure required updating as it was no longer fit for purpose. By retaining the original structure, a significant upfront embodied carbon saving was made. Find some facts on the project below:

**Reuse of the existing asset:** A substantial amount of the existing structure was retained, including 88% of the substructure; by removing the thermal cores of the building to exclude the staircases on each corner, operational energy efficiency has also increased.

**Recovering materials and products on site or from another site:** 3000m$^2$ of the panelised façade was reused.

**Design for assembly, disassembly and recoverability, and Use standardisation:** the new extension includes a demountable M&E kit and standardised products enable disassembly and recoverability.

**Use of recycled content or secondary materials:** An average of 65% cement was replaced with GGBS.

Find out more about this case study here in the How Circular Economy Principles can impact carbon and value report.

### IN SUMMARY...

The end of life phase of a building or infrastructure contributes a large amount to the overall impact of a project. The sustainability of the end of life of a project should be considered at all phases of a project, from design through to construction, operation and and maintenance. Where possible, demolition should be avoided and more sustainable methods of deconstruction and re-use prioritised.

## READ MORE ABOUT SUSTAINABLE END OF LIFE AND DECONSTRUCTION

UKGBC: System Enablers for a Circular Economy
UKGBC: The Do's and Don'ts for Deconstructability
UKGBC: Circular economy guidance for construction clients