2 The Context

Key Principles

1. Promote "upstream" solutions which treat causes of construction waste and avoid "end of pipe" solutions which only treat the symptoms.

2. Aim to design out construction waste in the first place, then re-use construction elements and only resort to recycling them if re-use cannot be achieved efficiently.

3. Follow the five key principles promoted by the EU: the proximity principle; regional self sufficiency; the precautionary principle; the polluter pays; and best practicable environmental option (BPEO).

4. Aim to demonstrate a cost saving through the use of reclaimed materials, where possible, taking all costs into account including storage and double handling.

2.1 Aims of this Guide

- To highlight benefits of deconstruction which can minimise construction waste, cost, aid the local economy, reduce transport (if done on regional basis), reduce CO_2 emissions by avoiding new materials, retain cultural value of existing materials and reduce demand on natural and virgin resources, thus minimising pollution
- To promote "upstream" solutions which treat the causes of construction waste and avoid "end of pipe" solutions which only treat the symptoms
- To promote Design and Detailing for Deconstruction as everyday activity in the construction industry

Obtain re-used materials locally in order to reduce transportation impacts.
Source: F. Stevenson

2.2 Target audience

This Guide will help all those who wish to improve the resource efficiency of buildings through their construction, e.g:

- clients –building owners and users,
- principal and specialist contractors,
- interior designers
- architects
- technicians
- structural engineers
- building service engineers
- building surveyors
- quantity surveyors/ cost consultants
- maintenance and facilities managers
- project managers
- planning officers
- building control officers
- funding bodies and their professional advisors
- government agencies,
- Non-governmental organisations

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2.3 How to use this Guide

This Guide is divided into six sections. The first three sections provide an overview of resource efficiency. While sections Four and Five describe the approach and principles involved in designing for deconstruction. Section Six provides a number of key details which have been optimised in terms of deconstruction. These are compared with standard details for a variety of construction types, and costed. This section will be primarily of interest to the design team. It should always be read in conjunction with sections Four and Five, as the details cannot be simply "lifted" from this Guide; they must be placed in a suitable context.

At the end of this Guide there is an annotated list for further reading, as well as a list of useful contacts and websites.

Architectural salvage yards provide a variety of reclamed building materials.

2.4 Scope and definitions

This guide focuses on the design for deconstruction (DfD) of building projects which are based on Scottish building practice and climate for appropriate detailing.

Deconstruction: the dismantling of a building in such a manner that its component parts can be re-used.

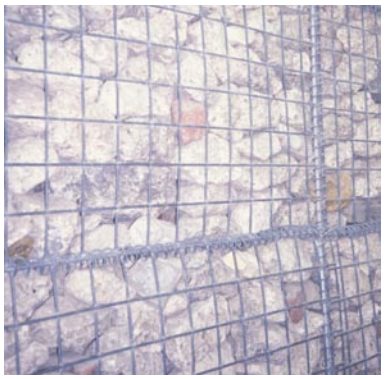
Reclamation and *reclaimed*: material is set aside from the waste stream for future reuse with minimal processing.

Reuse: the use of reclaimed materials for their original purpose.

Recycling and *recycled*: the manufacture of a new product using reclaimed materials, scrap or waste as feedstock.

Upcycling: taking a low grade material and turning it into a high grade material, often using human energy.

Downcycling: taking a high grade material and turning into a low grade material, often using fuel energy.



Gabions enable low grade materials to be recycled, but check that wiring will last.
Source: F. Stevenson

2.5 The economics of deconstruction

From the clients' point of view the following are sound economic reasons for using DfD[8]:

- to increase the flexible use and adaptation of property at minimal future cost
- to reduce the whole-life environmental impact of a project
- to maximise the value of a building, or its elements, when it is only required for a short time
- to reduce the quantity of materials going to landfill
- to reduce a future liability to pay higher landfill taxes
- to reduce the risk of financial penalties in the future, due to changing legislation, through easily replaceable building elements
- to minimise maintenance and upgrading costs incurred by replacement requirements

Waste concrete aggregate can be recycled and re-used in numerous ways.

Footnotes:
[8]Costs for deconstruction should always be calculated on a whole life basis, including demolition and the necessary "future-proofing" for the potential upgrading of any building

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A key economic benefit of design for deconstruction is the ability for a client to “future proof” their building, both in terms of maintenance and any necessary upgrading, with minimum disruption and cost. The wider economic benefits to society include minimising waste costs at all levels.

Numerous projects have been costed, and while some have come in on budget[9], others have not. Much depends on the canniness of the design team and contractor, from the outset, with cost savings to be viewed as bonus rather than a given. Design for deconstruction should always be adopted for its wider economic, social and environmental benefits rather than any initial cost saving[10].

In terms of using reclaimed materials, it is important that the cost of using virgin products and materials, as well as their transportation and disposal costs are offset against the cost of the reclaimed materials and any additional labour cost for installing these. It *may* then be possible when all costs are taken into account, to make a cost saving[11] through the use of reclaimed materials, although this is not usually the cheapest option.

Current economic barriers to design for deconstruction and re-use of reclaimed materials and products include: the additional time involved for deconstruction and the difficulty of costing this against re-used materials which will be used on a different project, the damage caused by poorly designed assemblies and connectors as well as the limited flexibility of reclaimed elements. Reuse is not subsidised in the same way that manufacture is in terms of energy, infrastructure, transportation, and economies of scale, all of which have hidden environmental costs.

Although the reclamation of construction materials and products can represent up to 40% of some demolition companies’ revenues[12], the problems of storage and double handling materials between sites can increase the cost of re-use considerably. The ideal use of reclaimed materials is either on the same site, or one very near by, to avoid excessive transport costs.

Poorly detailed connectors can prevent effective re-use of timber.
Source: F. Stevenson

There was no additional cost for recycling or re-use in the BRE Office of the Future.
Source: F. Stevenson

Using reclaimed timber at BedZed, made an overall cost saving.
Source: F Stevenson

Footnotes:

[9] BRE’s Office for the Future is an example of reuse and recycling with no additional cost overall on the contract, as detailed in Hobbs, G and Collins, R (1997) Information Paper 3/97: “Demonstration of reuse and recycling of materials: BRE energy efficient office of the future”, BRE, Watford

[10] The CIB Task Group 39 has spent several years considering this and produced a number of conference proceedings relating to Deconstruction and Material Use: http//www/cce.ufl.edu/affiliations/cib

11 A good case in point is the BedZed project in England where the use of reclaimed timber made an overall cost saving. See “Building For a Future”, Vol 13, No.4, p.61.

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2.6 Responsibilities, roles and principles

Under the Environment Act 1995, The Scottish Environment Protection Agency (SEPA) is responsible for national waste regulation and strategy in Scotland. Domestic waste collection and disposal remain the responsibility of the local authorities while commercial/industrial waste is the responsibility of the producer. Planning authorities are obliged to consult SEPA on development plans to forge a relationship between development plans and the waste strategy.

Waste hierarchy

The waste hierarchy adopted by SEPA [13] encourages the adoption of options for managing waste in the following order of priority:

1. Waste should be prevented or reduced at source as far as possible;
2. Where waste cannot be prevented, waste materials or products should be reused directly, or refurbished before reuse;
3. Waste materials should then be recycled or reprocessed into a form that allows them to be reclaimed as a secondary raw material;
4. Where useful secondary materials cannot be reclaimed, the energy content of waste should be recovered and used as a substitute for non-renewable energy resources;
5. Only if waste cannot be prevented, reclaimed or recovered, it should be disposed of into the environment by landfilling, and this should only be undertaken in a controlled manner.

Construction waste management should move increasingly towards the first of these options, using a framework governed by five key principles promoted by the EU:

- the proximity principle;
- regional self sufficiency;
- the precautionary principle;
- the polluter pays; and
- best practicable environmental option (BPEO).

Clearly, reuse of building elements should take priority over their recycling, wherever practicable, to help satisfy the first priority of waste prevention *at source*.

Reuse of building elements should take priority over their recycling where practical.
Source: Edward Cullinan Architects

Proximity and self-sufficiency

The proximity and self-sufficiency principles require waste to be dealt with as close as possible to where it is produced.

Precautionary principle

Wherever there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In practice it has proved notoriously difficult to implement this principle.

Footnotes:

13 SEPA, The National Waste Plan, 2003

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Polluter pays

The 'polluter pays' principle requires producers of construction waste to bear the costs imposed by those wastes. The current Landfill Tax reflects some of these costs, but there is still no direct relationship between manufacturing costs and disposal costs for construction products and materials.

Re-using materials and products cuts out pollution produced by manufacturing processes.
Source: F. Stevenson

Best practicable environmental option

For any given set of objectives, BPEO identifies the option that provides the most benefits or the least damage to the environment as a whole, at acceptable cost, in the long term and the short term. Thus construction waste must be evaluated in terms of environmental, social and economic consequences.

Scottish building regulations and standards

The consideration of recycling is now a part of the Scottish Building Regulations[14] although there are no actual requirements in place to date. As such these regulations do little to promote design for deconstruction in themselves, but neither do they particularly hinder matters. It is the British Standards and European Codes which largely dictate whether or not reclaimed materials can be specified easily. To date there is no code for reclaimed materials, although there is now a code for recycled building aggregates.

Footnotes:

[14] The Building Act 2003 (Scotland)

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