

## 4 Design Approach

### Key Principles

1. Re-use and recycling are not interchangeable strategies; re-use is almost always environmentally preferable.
2. Design for maximum flexibility of spatial configuration within a structure, as this preserves the building as a whole.
3. Develop a comprehensive Deconstruction Plan early on - otherwise re-usable building elements may be destroyed unnecessarily.
4. Allow extra time from the beginning of the project to ensure that DfD is fully incorporated.
5. Aim to bring the whole project team and the client on board with the idea of DfD from the beginning of the project.
6. Audit contractors and ensure that initial briefing and training for DfD has taken place -this will pay dividends later on.
7. Carefully add all alterations to drawings and specifications so that there is an *integrated* set of “as built” drawings for maintenance and deconstruction purposes.

### 4.1 Strategy: re-use or recycle?

**Re-use and recycling are not interchangeable strategies** because design for re-use is almost always preferable to design for recycling only in terms of overall environmental impact, providing that transportation is not excessive, and that re-usable products are still recyclable at the end of their life.

When considering the brief for a new project as a designer, there is a natural hierarchy of waste minimisation to consider<sup>17</sup>:

1. adaptive re-use of existing building
2. design for adaptability and longevity of new buildings
3. re-use of building elements/assemblies
4. re-use of building components
5. recycling of materials
6. reclamation of energy from building elements, components or materials
7. landfill.

Design for deconstruction is most effective when it allows for maximum flexibility of spatial configuration within a given structure, as this preserves the building structure as a whole. Beyond this, designers need to think about “future-proofing” their details in such a way that maximises the possibilities for both building assemblies and their sub-components to be re-used in other buildings as far as practicable. Only if neither of these strategies is established as practical, following a cost-benefit analysis, should designers resort to a recycling-only strategy.

Footnotes:

<sup>17</sup> This hierarchy is based on the EU waste hierarchy described in chapter 2



Re-usable products should be recyclable at the end of their lifespan.  
Source: Zedcore.



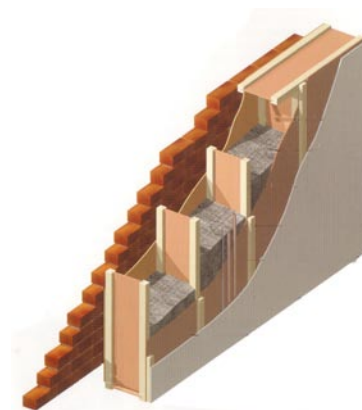
Design for deconstruction is most effective when it allows for maximum flexibility of spatial configuration.  
Source: F. Stevenson

Building elements, such as a wall or floor, are often designed with highly interdependent components. This means that it is virtually impossible to take one part of the assembly apart without affecting everything else. There is a pressing need today to design assemblies with connections that allow each part to be replaced discretely, recognising the very different time spans that different components have.

Although CDM regulations and practice helpfully cover a number of issue relating to DfD, until it becomes a standard construction procedure **extra time will have to be allowed from the beginning of the project to ensure that DfD is fully incorporated.**

## 4.2 Team Approach

If DfD is to succeed, it is vital that the whole project team and client are brought on board from the beginning of the project. Different stakeholders in the team will have different objectives and it is important to identify how far DfD can satisfy these and to establish priorities, procedures and lines of communication relating to DfD throughout the construction, maintenance and deconstruction phase of the building's lifespan. Table 1 over the page illustrates the tasks that various team members should undertake to maximise the potential of DfD.



Design assemblies with independent components whenever possible.

Source: Tradis

**TABLE 1: Strategic Action to Promote Deconstruction**

<b>RIBA Plan of Work Stages</b>	<b>Client</b>	<b>Design Team</b>	<b>Contractor</b>
A to B – Planning and Feasibility	<ul style="list-style-type: none"> <li>–appoint design team members who are sympathetic to DfD</li> <li>–ensure appropriate clauses inserted into appointment documentation</li> <li>–appoint contractor as early as possible to identify DfD opportunities, ideally through partnering agreements</li> </ul>	<ul style="list-style-type: none"> <li>–brief client on DfD</li> <li>–demonstrate best practice of DfD to client</li> <li>–ascertain the degree to which DfD can be applied in the project and develop initial DfD strategic plan</li> <li>–assess which building elements are most cost effective to DfD</li> </ul>	<ul style="list-style-type: none"> <li>–provide audit demonstrating waste minimisation strategies</li> <li>–obtain initial briefing and training on DfD</li> </ul>
C to E – Proposals	<ul style="list-style-type: none"> <li>–brief design team to ensure that DfD proposals fit in with requirements for upgrading, adaptability and flexibility in use</li> </ul>	<ul style="list-style-type: none"> <li>–organise pre-site meetings with contractor (where possible) to identify reused materials and construction processes which support DfD</li> </ul>	<ul style="list-style-type: none"> <li>–attend pre-site meetings with design team and client (where possible)</li> <li>–advise design team on deconstruction processes and potential salvage</li> </ul>
F – Detail Design and Production Drawings	<ul style="list-style-type: none"> <li>–check with design team that key elements and details still enable upgrading, adaptability and flexibility in use</li> </ul>	<ul style="list-style-type: none"> <li>–aim to cover as many of the DfD principles as possible</li> <li>–carry out a design check by producing a detailed plan for the deconstruction of the building and ensuring that the design proposals match this</li> </ul>	<ul style="list-style-type: none"> <li>–advise design team on implications for deconstruction in relation to design and detailing (where possible)</li> </ul>
G to L – Contract	<ul style="list-style-type: none"> <li>–allow for additional time in contract period to promote DfD through careful construction practices</li> <li>–insist on integrated drawings and specifications “as built” as per CDM requirements</li> </ul>	<ul style="list-style-type: none"> <li>–make sure that contractors invited to tender are made fully aware of the commitment to DfD through the detailed DfD plan and briefed accordingly to allow for this in the tender</li> <li>–make DfD requirements explicit in tender documents</li> </ul>	<ul style="list-style-type: none"> <li>–identify good construction practice to promote DfD and advise design team accordingly</li> <li>–train sub-contractors as necessary</li> </ul>
M - Maintenance	<ul style="list-style-type: none"> <li>–ensure that ALL maintenance staff and future contractors are fully briefed on DfD strategy</li> <li>–instigate feedback strategy on building performance</li> </ul>	<ul style="list-style-type: none"> <li>–monitor performance of project over time (where possible) and build in the evaluation into future DfD</li> </ul>	

Where the knowledge in DfD does not exist for the tasks outlined in this chapter, it may be appropriate to employ suitable expertise and training, which can be provided either through SEDA<sup>18</sup> or BRE<sup>19</sup>.

Footnotes:

<sup>18</sup> see [www.seda2.org](http://www.seda2.org)

<sup>19</sup> see [www.bre.co.uk](http://www.bre.co.uk)

A major cultural shift is needed in all trades, which recognises the need for construction elements to be more separable. This means balancing the need for quick construction against the future requirements of DfD, such as avoiding excessive mechanical demolition techniques.

The contractor can add considerable insight into the construction process required to fulfil the requirements of the deconstruction plan, particularly if a partnering process is instigated to ensure their involvement with the design team at an early stage.

### 4.3 Deconstruction in detail

The following more detailed tasks should be carried out at each stage of the RIBA Plan of Works to ensure that the DfD strategy is carried through at all levels:

#### Planning and Feasibility (RIBA work stage A-B):

- the lead person in the team should provide a full briefing on DfD to each team member and discusses their role both at collective team meetings and on an individual appointment basis
- Quantity Surveyors need careful briefing on the cost-benefit implications of DfD both in terms of initial construction costs and future maintenance costs
- Mechanical Engineers should be encouraged, in consultation with the rest of the design team, to design out as much as possible of the active servicing elements in a building and replace these with passive measures that have a longer life span
- Structural Engineers should ensure that their structural systems are easy to deconstruct and designed for maximum re-use possibilities
- other specialists should be briefed and consulted on DfD strategies as necessary
- establish DfD targets and benchmarks in terms of the percentage of the building that can be re-used as well as the number of potential re-uses for each existing element
- evaluate site constraints, project budget, the purpose of the building, its lifespan and the contract period as crucial determinants of DfD benchmarking
- it is vital that an accurate survey is carried out for existing buildings to identify existing DfD opportunities e.g. preserving the ability to remove existing joists easily
- ensure that the new design does not compromise the deconstructability of the existing building
- once all these tasks have been achieved the results should be fed into an overall DfD strategic plan for the project.



Establish benchmarks and targets for the number of potential re-uses for each existing element.

Source: F. Stevenson



In-situ concrete can be an "immovable construction", which is hard to deconstruct.

Source: N.Verow



Structural engineers should ensure that their structural systems are easy to deconstruct and designed for maximum re-use possibilities.

Source: Trada

### Outline Proposals and Scheme Design (RIBA work stage C-E)

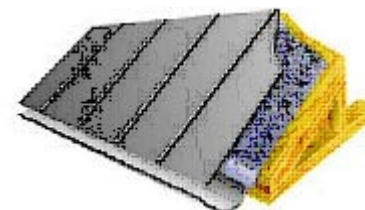
- adopt the detailing principles for DfD outlined in Section 5 of this guide as well as other guidance on sustainable design as far as possible; aim to prioritise key principles
- QS to undertake a detailed cost-benefit analysis of low-cost DfD options, taking account of any identified sources of reclamation and offsetting them against the cost of virgin construction resources. For example, if a source of re-usable steel beams of a particular span and size is identified, then the QS and design team should take into account, at the earliest opportunity, how this resource can be “designed into” the building. Priorities should be identified at this stage.
- evaluate the structural and service options which can maximise DfD within the given constraints
- agree a list of reductions, which take DfD into account, should the project costs exceed the budget
- make sure the aesthetics for the project, which are clearly defined at this stage, take account of the agreed DfD strategic plan; sometimes an image can overrule the process!



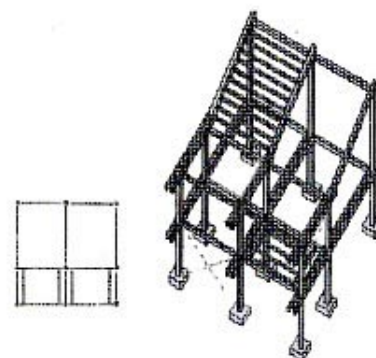
This aesthetic prohibits DfD through use of continuous hard render.  
Source: F. Stevenson

### Detail Design and Production Drawings (RIBA work stage F)

- use the DfD strategic plan from stage A-B as a framework to develop the details and specifications in tandem with CDM requirements
- seek advice from manufacturers on whether, and how, product value can best be maintained through re-use and how products can be certified for re-use
- where it has been possible to identify re-usable elements from other buildings, incorporate these in the detailing, provided they do not violate the overall DfD strategy
- develop the strategic DfD plan to a more detailed level to take account of drawings, specifications and costs, as part of an iterative process of design
- carefully scrutinise standard specifications, such as the NBS, to ensure that the DfD is not compromised particularly by poor specification of materials, finishes, joints and connections
- use three dimensional drawing to aid the understanding of the process of DfD - it reveals hidden aspects of two dimensional drawing in terms of the construction/deconstruction process
- fully detail service drawings rather than specifying in outline to ensure full co-ordination for DfD



Seek advice from manufacturer on how to maintain and re-used products.  
Source: F. Stevenson



A 3-D drawing is often more informative about the process of DfD than a 2-D one.  
Source: N. Mills

### Going to Tender and Completing the Contract (RIBA work stage G-L)

- once the contract has been agreed, ensure that pre-site start meetings allow time for a thorough briefing and negotiation on the objectives of DfD as part of the project and the most effective means for achieving this
- encourage the design team and contractor to use BRE's SmartWaste website to source reclaimed materials locally.<sup>4</sup>
- ensure any alterations to the digital drawings and specification are *carefully integrated* into a revised set of drawings so that a genuine set of "as built" digital drawings is available for maintenance and deconstruction purposes - don't just add to the drawing pile, create a comprehensive digital archive!
- provide a comprehensive and digital operating and maintenance manual for the building, complete with logbook to record future maintenance, carefully cross-indexed to aid rapid information retrieval
- ensure the manual contains a complete section on the DfD strategy as well as the revised "as built" deconstruction plan and drawings.

### Maintenance/Upgrading (RIBA work stage M)

**The client and all parties should make a clear commitment to obtaining feedback from the outset of the project.** The following tasks will assist with this:

- provide a contingency budget for changes which occur during commissioning and future maintenance, and the recording of these in the logbook, the deconstruction plan and on drawings
- provide for continuing dissemination and transfer of DfD related information during the lifespan of the building to all parties concerned which takes account of any transfer of ownership or upgrading of the building
- training for both the users and maintenance team on the DfD aspects of the building will help to prevent maintenance choices which disable the DfD function; this is vital if the DfD strategy is going to work effectively.

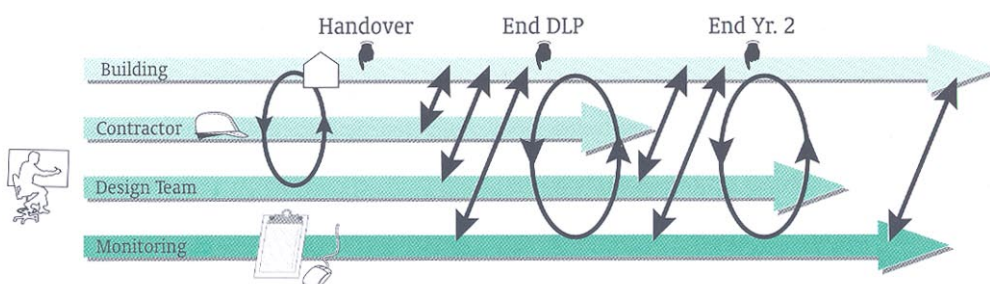


Diagram showing feedback loops required during all stages of a project.  
Source: Howard Liddell and Sandy Halliday

#### Footnotes:

<sup>4</sup> <http://www.bremap.co.uk>

- undertaking post-occupancy evaluations and post-project appraisals to learn if aims of project have been met.

## 4.4 The Deconstruction Plan

Without a comprehensive Deconstruction Plan for the future, it is almost certain that designed re-usable building elements will be destroyed unnecessarily. The Plan should be issued to all parties at the outset of the contract to ensure a construction process that enables the deconstruction plan to operate.

For a successful Deconstruction Plan, which is a part of the overall DfD detailed plan, make sure the following tasks are undertaken:

### 1. Statement of strategy for DfD relating to the building

- Demonstrate the strategy behind the designed re-usable elements and describe best practice to ensure they are handled in a way which preserves maximum re-usability

### 2. List building elements

- Provide an inventory of all materials and components used in the project together with all full specifications and all warranties, including details of manufacturers
- Describe the design life and/or service life of materials and components
- Identify best options for reuse, reclamation, recycling and waste to energy for all building element

### 3. Provide instructions on how to deconstruct elements

- Provide up-to-date location plans for identifying information on how to deconstruct buildings.
- Where necessary add additional information to the “as built” set of drawings to demonstrate the optimum technique for removal of specific elements.
- Describe the equipment required to dismantle the building, the sequential processes involved and the implications for health and safety as part of the CDM requirements.
- Ensure that the plan advises the future demolition contractor on the best means of categorising, recording and storing dismantled elements.

### 4. Distribution of DfD Plan

- Revise the plan as necessary and re-issue to all parties at the handover stage, so that there is maximum awareness of the DfD requirements for the future, including building owner, architects and builder.
- Place copies of the revised Deconstruction Plan with the legal deeds of the building, the Health and Safety file and the maintenance file.

## 4.5 Moving on –ownership and responsibilities

Underlying the diversity of building procurement strategies is one key imperative to ensure successful DfD – ***a sense of continuing “ownership” of the resources by the original designer and contractor.***

There are real and demonstrable economic benefits to Design for Deconstruction. However, until we re-orientate our attitudes towards buildings and view them as a repository of highly valuable resources, rather than just a container for the functions of ever changing clients, there will be no real incentive to ensure that the knowledge about the building, and the changes it undergoes, remains coherent over its complete lifespan and facilitates intelligent resource use.

We need to view buildings and their inherent resources as a “service provided”. This provides an incentive for all parties to make sure maximum value is derived from the building both during maintenance and at the end of its life.



Think of this building as a providing a service rather than being just a product.  
Source: F. Stevenson