Material change for a better environment

Halving Waste to Landfill

Assessing the costs and benefits of reducing waste in construction

Cross-sector comparison

Average results from 15 case studies (including housing, public and commercial projects)	Percentage of construction cost
Cost saving potential	0.77%
Additional costs to achieve these savings	0.37%
TOTAL POTENTIAL COST SAVING	0.40%

Introduction

Reducing, reusing and recycling waste can help to reduce costs on construction projects. By asking for good practice from an early stage in the design and planning process, clients and contractors can secure these savings and demonstrate corporate responsibility. Such action lies at the heart of corporate commitments in support of the sector target for halving waste to landfill.

Several case study projects have been analysed to identify, at design stage, the costs and benefits achievable through waste reduction and recovery on a construction project. This report summarises the results of these case studies and draws out the key findings that apply across sectors.

A suite of 15 case studies was analysed to quantify the savings achieved through good practice waste reduction and recovery, the cost of implementing good practice, and the net benefit (savings minus costs). The analysis started at RIBA stages C/D i.e. once the overall design had been selected. The case studies do not include further savings from more fundamental design changes at an earlier stage.

Design potential

Significant savings can be made by targeting good practice wastage rates for the components offering the biggest savings in the value of materials wasted. The following table shows for each of the 15 case study projects; the value of materials that could be saved through reduced wastage allowances on 10 or so components (A), the reduction in disposal costs that could be achieved through reduced waste arisings and waste segregation (B), and the total reduction in the cost of wastage (A+B).

	Value (£m)	Reduction in value of materials (£) (A)	Reduction in disposal cost (£) (B)	Total saving (£) (A + B)	Total saving as % construction value
Housing					
20 masonry houses	1.0	7,600	9,200	16,800	1.68
20 timber-frame houses	1.3	14,400	7,100	21,500	1.58
Small concrete residential block	7.1	26,200	6,100	32,300	0.46
Steel frame halls of residence	9.8	57,800	18,600	76,400	0.78
Commercial					
Supermarket	3.8	20,700	5,800	26,500	0.69
Steel frame distribution centre	11	44,500	28,600	73,100	0.66
Concrete frame office	23	101,700	24,100	125,800	0.55
Public					
In-situ concrete frame hospital	178	446,600	109,100	555,700	0.31
Steel frame secondary school	22.5	125,900	34,700	160,600	0.71
Steel frame primary school	1.5	8,200	2,700	10,900	0.73
Timber frame primary school	4.3	21,100	28,000	49,100	1.15
Pre-cast concrete prison	4.9	8,700	1,200	9,900	0.20
Refurbishment					
Social housing refurb	1.5	3,300	10,300	13,600	0.90
Small office refurb (Cat A)	0.7	2,600	1,300	3,900	0.53
Large office refurb (Cat B)	3.3	12,700	4,400	17,100	0.53
Small retail refurb	1.4	7,300	4,800	12,100	0.86
Average saving					**0.77**

Cost savings can be achieved across sectors and construction methods. For new build projects, the more significant saving potential is the reduction in value of materials wasted (achieved by reducing wastage allowances). For refurbishment projects, the reduction in disposal cost becomes a more significant potential saving, due to the opportunity to segregate or reuse strip-out waste.

In addition to financial benefits, actions to be more resource efficient also deliver changes in environmental performance. The following tables shows the best and worst case improvements for new build projects (12 case studies) and refurbishment (4 case studies).

Improvement over baseline	Total waste arisings (t)	Waste sent to landfill (t)	Recovery rate	Carbon (t)[1] (fit out only)	Recycled content
New Build (12 projects)					
Lowest improvement	25%	58%	25%	24%	1.16%
Highest improvement	60%	85%	30%	57%	6.36%
Refurbishment (4 projects)					
Lowest improvement	0.5%	37%	21%	45%	6.84%
Highest improvement	5.3%	59%	30%	58%	10.41%

Understanding the costs and benefits

WRAP's Net Waste Tool has been used to quantify the extent of the cost savings possible, and to select the top opportunities. Waste reduction and recovery actions needed to deliver these targeted savings were then identified, and their implementation costs estimated. These savings will only be achieved by taking specific management actions to change behaviour during design and site practice. The cost areas that were quantified for each of the case study projects are described below.

[1] Embodied carbon of wasted materials plus carbon impact of disposal route

Investing to save (COSTS)[2]
Develop quality SWMP – Additional time beyond minimum legal compliance (England only) to develop plan with quality forecasts (including using the Net Waste Tool) and robust management actions
Develop site logistics strategy – Planning time required to establish how materials are to be delivered, stored and moved around the site
Site training – Time to provide training, and site operatives' time to receive training (5nr ½hr briefings for 10 operatives per session)
Materials storage – Nominal allowance for construction of hard standing and temporary shelter for materials (or cabin hire)
Management time – Additional time required to ensure SWMP is adhered to, including materials handling, re-use of materials on site, efficient installation and waste segregation (2.5hrs per week for ¾ of the programme)
Updating SWMP – The SWMP needs to be reviewed and updated throughout the project. This cost allows for a 4 hour review every 3 months.
Site segregation – To ensure good segregation, this cost allows for a single individual to sort and move wastes and monitor the re-use of materials on site. (Included part-time for 50% of the programme as reduced demand during early packages.)

On paper there are significant possible savings for most projects, but to achieve these savings costs must be incurred. For all projects the net benefit (savings minus the cost of achieving good practice) was positive.

Project type	Project Value (£m)	Cost of waste	Total saving (A)	Cost of good practice (B)	Net benefit (A – B)
		% construction value			
Housing					
20 masonry houses	1.0	3.17	1.68	1.07	0.61
20 timber-frame houses	1.3	3.50	1.58	0.79	0.79
Small concrete residential block	7.1	1.29	0.46	0.28	0.18
Steel frame halls of residence	9.8	1.48	0.78	0.25	0.53
Commercial					
Supermarket	3.8	1.35	0.69	0.42	0.27
Steel frame distribution centre	11	1.18	0.66	0.15	0.51
Concrete frame office	23	1.07	0.55	0.13	0.42
Public					
In-situ concrete frame hospital	178	0.67	0.31	0.03	0.28
Steel frame secondary school	22.5	1.54	0.71	0.12	0.59
Steel frame primary school	1.5	1.94	0.73	0.56	0.17
Timber frame primary school	4.3	2.75	1.15	0.46	0.69
Pre-cast concrete prison	4.9	0.44	0.20	0.17	0.03
Refurbishment					
Social housing refurb	1.5	1.50	0.90	0.42	0.48
Small office refurb (Cat A)	0.7	1.54	0.53	0.32	0.21
Large office refurb (Cat B)	3.3	1.63	0.53	0.18	0.35
Small retail refurb	1.4	2.30	0.86	0.62	0.24
Average across projects			**0.77**	**0.37**	**0.40**

Good practice waste reduction and recovery should result in a net benefit for most projects. The following observations can also be made:

- The net benefit is typically a small proportion of construction value, however this can equate to a large saving. For example, the hospital case study achieved a net benefit of £489k (only 0.28%)
- The cost of good practice (as a proportion of project value) decreases as project size increases

[2] These costs are based upon estimated durations, and have been reviewed with selected contractors.

- Good practice should be at least cost neutral even for projects that produce little waste. The prison case study produced very little waste due to its design, yet the net benefit was positive (0.03%)

As a general rule, the more waste that is expected to be generated (as a proportion of project value) the greater the potential savings (as a proportion of project value). However, the cost of achieving good practice (as a proportion of project value) will depend on project size and the opportunities available. For small projects particularly, cost effective opportunities should be prioritised to ensure the net benefit is maximised.

Sharing the costs and benefits

Who saves?

Whoever takes the risk for the supply of materials will see the cost savings. This is normally the trade contractor, or the main contractor for bulk products such as aggregates. To convert this reduction in waste into a reduction in price (for the contractor or client), the trade contractor will need to:

- include a reduced wastage rate in their tender (for more competitive pricing on a lump sum tender); or
- procure less materials, therefore save money, and share this up the supply chain (open book tender).

The main contractor would normally pay for waste disposal on the basis of volume (and type) of waste removed, therefore these savings would normally accrue to the main contractor. The client's ability to share in these savings is determined by the procurement route. Where a form of renegotiated or open book payment structure is used or where waste costs are explicitly considered during tender pricing, there should be an opportunity to share in these cost savings.

The costs

Most of the costs required to reduce waste or increase recovery are borne by the contractor. These costs are divided into two parts: planning costs and management costs.

Planning for waste is a low cost / high impact activity, highlighting the big opportunities such that effort can be focused on these. For example, by planning you might identify that you need better materials storage.

During construction the **management** of wastes is important to ensure that the plan is delivered. This analysis includes an additional amount of management time to oversee the waste management process (including material deliveries, material storage, installation and waste disposal), plus an allowance for a dedicated operative to manage and monitor materials storage and waste segregation.

Conclusion

Both new build and refurbishment are large sources of construction waste. But rather than approaching this as an environmental problem, it should be treated as a commercial opportunity. Contractors are able to readily forecast the types and quantities of waste that they will generate, and with these forecasts, identify the likely cost of disposal. This information can be used by the contractor to help identify which materials to focus upon, and identify alternative (non-landfill) destinations for wastes. If the contractor addresses these issues at a programme level, as opposed to relying upon the waste contractor, then it is likely that new opportunities will be identified and costs can be reduced. Therefore:

- Clients need to instruct contractors to reduce waste wherever possible, and identify non-landfill destinations for each of their waste streams. This information should be presented in the form of a programme-wide SWMP.
- Contractors need to develop a quality SWMP which addresses:
    - materials logistics;
    - packaging reduction;
    - waste forecasts;
    - waste segregation strategy, plus end destinations for waste; and
    - forecast recovery rate for the scheme.

Methodology

This cost benefit analysis has been conducted using data taken from WRAP's Net Waste Tool. The Tool is freely accessible on the web at www.wrap.org.uk/nwtool, and helps project teams to forecast the waste that would be expected on different projects. The Tool works by setting up basic cost plan information to which baseline and good practice industry wastage rates are applied. The analysis identifies which components and specifications offer the greatest opportunities for waste reduction, and proposes a least cost segregation strategy. The Tool forecasts the overall quantities and costs of waste at baseline, good and user-targeted levels of performance, including the value of wasted materials and the cost of waste disposal.