Annex 2 – Summaries of evidence gap projects

As part of the work undertaken during the BREW pilot project 'Developing a Strategic Approach to Construction Waste', five evidence gap projects were carried out:

A2.1 Construction products data (conducted by AMA Research)
A2.2 Site waste management plans (SWMPs) and waste prevention
A2.3 BigREc – reclamation industry survey
A2.4 Whole life costing and resource efficiency
A2.5 Future legislation and forward look

This Annex presents summaries of the projects; the final reports will be accessible from the Construction Resources and Waste Platform website (www.crwplatform.co.uk) during 2008/09.

The information presented in this Annex is based on research completed before August 2007. Some of this information may, therefore, have been superseded.

For definitions of terms and abbreviations used in this Annex, please see the main CRW roadmap document.

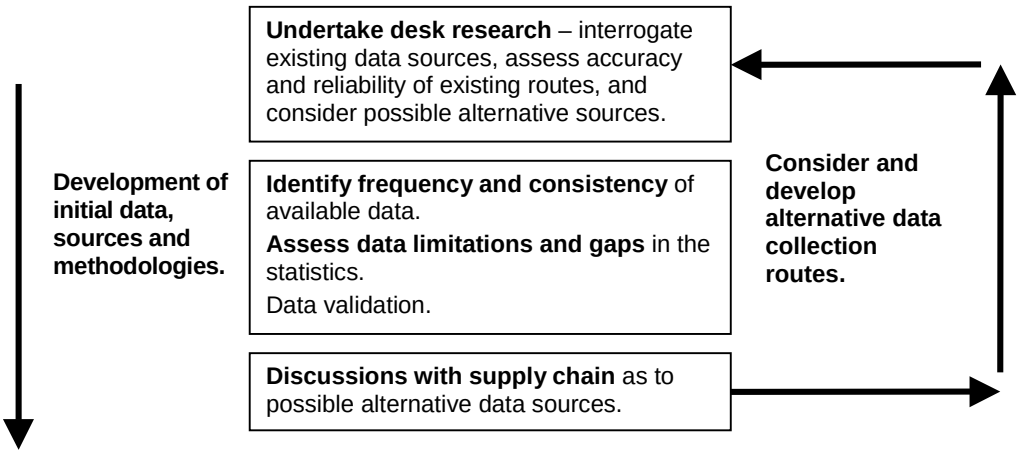
A2.1. Construction products data – conducted by AMA Research

The overall objective of the research was to develop detailed and robust research processes and quantitative data output on the **total value of construction products and materials**, and **the proportion of recycled content** being used in the construction industry.

Key objectives included:

- **Agree the construction products and materials** to be included in the project.
- **Develop statistics for sales value, tonnages and the recycled content proportion of these figures** across the range of construction products and materials, identify data sources and indicate a level of confidence in data accuracy. Data to be for the UK market, excluding exports, but including imports.
- **Identify frequency and consistency of data availability** and ease of accessibility.
- **Identify limitations and gaps in the statistics** available on the agreed range of construction products and materials.
- **Suggest alternative methods of collecting the data or improving** the quality of the data and the key organisations and contacts that may be involved in this process.
- Propose methods of implementing the ongoing collection of the data.

The process adopted for each product/material area was as follows:



The headline figures have been quoted in the Construction Resources and Waste roadmap, in terms of current construction products used in the UK. Table 1 summarises these results, and also illustrates where there are gaps in the available data (i.e. no data entered in the table).

Products	Value (£million)	Volume (000 tonnes)	Recycled volume (000 tonnes)
Ceramics	426		10
Chemicals	1,167		
Clay	636.5	5,752	
Concrete products	3,193	62,343	8,022
Electrical and lighting	2,180		
Glazed systems	4,953		

Hardware metal products	741		
Heating products	2,323		
Insulation	661	655	197.8
Other cement	1,678	18,902	2062
Plastic	1,679	771	
Plumbing and sanitaryware	928		
Raw materials	2,184	277,300	68,300
Rubber	32	168	168
Security, fire protection	1,284		
Slate	112	156.5	30
Steel	671	3,120	485
Timber	2,803	6,511	444
Total	27,651.2	375,678.5	79,718.8

***Table** 1 Overview of UK construction products (most data is from 2005)*

The most apparent omissions are the volume data for many products and the absence of recycling data for certain products (for example, plastics, where it is known that recycled content exists). There are also products that might not be accounted for or double counted (for example, offsite fabricated buildings and products).

The biggest category is that of raw materials, which includes:

- Primary aggregates - crushed rock, sand & gravel
- Reclaimed/secondary aggregates – construction demo waste, blast furnace slag, basic oxygen furnace steel slag, electric arc furnace slag, china clay and ball clay overburden, slate overburden, colliery spoil, shales and clay, fired ceramic waste, FBA, IBA, PFA, FDG gypsum, spent foundry sands, spent railway track ballast, used tyres, waste glass cullet
- Growing media – compost, mulch, soil improvers and so on
- Materials used in bulk fill (not included in calculations) – fill for construction sites, road building, asphalt, Tarmacadam,

Across the construction industry as a whole, there are a number of sources which are widely used in the research and these are listed below. Generally, data is based on reliable, consistent and frequently updated sources. However, this was not always possible.

Widely used, ‘official’ sources; frequently produced data:

- DTI Monthly Building Products Statistics
- Prodcom - ONS compiled survey on PRODucts of the European COMmunity (PRODCOM), a harmonised system across the European Community for the collection and publication of product statistics
- DTI Annual Construction Statistics.

Other ‘official’ sources, with less frequently produced data:

- British Glass
- Composting Association State of Composting in the UK

- ODPM Survey 2003
- Quarry Products Association
- UK Quality Ash Association
- Used Tyres Working Group/Tyre Recovery Association
- Iron and Steel Statistics Bureau
- Trussed Rafter Association
- Forestry Commission
- Wood Panels Industry Federation (WPIF)
- WRAP Aggregain Aggregates Report.

Other sources:

- BRE
- British Plastic Federation
- AMA Research Report Data.

In many cases there are established routes for developing overall market size data, but this is less apparent for recycled content. Recycled content data is often produced on an ad hoc basis by organisations such as WRAP or BRE. This is changing, albeit slowly, and the development of the Aggregain website is an example of this progress.

Nevertheless in this research programme, much of the recycled content data is established through primary research rather than available from off-the-shelf reports.

Alternative collection ideas

Identification of key organisations

Key organisations could form part of the regular assessment. There are probably a number of key organisations that could be useful in generating more frequent and reliable data, including CPA, ProdCom, BERR, CLG, EA, BRE, WRAP and trade associations. With a reduced list of organisations, there could be a greater focus on accuracy and yet the process should be far more streamlined.

A number of limitations within this approach would still apply – in particular that the recycled data would probably not be available through these sources and other routes would still need to be followed; and that this approach would not generate a comprehensive review of the data in the construction sector, but would provide a sample base.

Expert panel or intermediate organisations

Set up an expert panel of advisers or stakeholders. This may only be relevant for certain sectors, for example, where a number of organisations would be highly influential in pulling together the relevant data.

It could be possible to identify certain sectors and build similar organisations, or at least identify a number of organisations to set up a ‘virtual stakeholder’ group, maybe driven by the CPA. Given the nature of this approach it would need to be done on a sector-by-sector basis, but potentially there may only be eight to ten key sectors where this would be needed. It would be very useful in sectors such as plastic building products, or timber building products, where there is little good data at the moment.

This approach would need to be coordinated at a top level where the template for data gathering could be established, such that it would be feasible to aggregate all of the data across the construction industry as a whole at the end of the process. One of the disadvantages of this approach would be that these kinds of stakeholder

groups tend to operate at their own pace and may not be willing to fall in with the timescales provided at the overall level.

Data collection process

Could Prodcom and other similar organisations be encouraged to gather data on recycled content? This would be a good idea, because most of the data we have become aware of in this area has arisen from once-off studies, or from a sampling of major companies in a given sector. This would apply to trade associations as well as organisations such as Prodcom.

However, this would still be subject to a number of limitations, in terms of definition of recycled content, company confidentiality, availability of data from the relevant companies, and so on. Nevertheless, this is worth following through because it would provide a sustainable longer term source for recycled data content. In a sense this is the most attractive route because it links into systems and processes which are already established and would be applicable across Europe.

Base data for recycled content

It is very important to set up alternative methods of collecting the data on recycled content because the current methods are likely to remain fragmented, while they depend on the cooperation of the major manufacturers in the industry concerned.

This is an important issue because the amount of recycled content is changing in many industries, with the actual content in many industries also changing as companies develop alternative means of using the different recycled materials.

These alternative approaches will be explored further, and one trialled, as part of the Construction Resources and Waste Platform 2007/08.

A2.2. Site waste management plans (SWMPs) and waste prevention

Overview

It is likely that site waste management plans (SWMPs) will be implemented for projects over £250,000 in value in April 2008, subject to consultation and resulting regulations. It is also likely that, as a bare minimum, data will have to be collected on the type and amount of waste created, and the setting of targets (to encourage continuous improvement) will be encouraged. This will therefore provide a large dataset on construction waste which could be an important tool in the development and setting of benchmarks. In parallel with this, SWMPs are a useful framework for planners, clients and contractors to provide focus on the top end of the hierarchy (i.e. waste prevention) and the setting of waste prevention targets.

There are three types of waste prevention targets that could be set using SWMPs:

- waste generation targets
- wastage rates
- material usage targets.

Waste generation targets have been used mostly at a project level; notably as part of the seven Millennium Communities developments, with a target to reduce average construction waste (excluding ground work) to a maximum of 25 m^3 per dwelling (waste totals reported will exclude any waste segregated at source on site); this was based on a baseline of 50 m^3/dwelling. This target is included within a suite of other targets, and an overall rating of BREEAM 'excellent' is required. Other metrics could include measuring the amount of waste by floor area (for buildings), area or length (for civils) and/or project value. Tonnage could also be used. These waste generation targets could also be used for waste type (although this would require a clear understanding of the packages creating the waste) and applied at a company level.

Targets on wastage rates relate to setting a percentage reduction on the amount of waste created by a particular work package. For instance, the drylining package may provide estimates of waste generation at 10%, and a percentage reduction could then be agreed. Defined wastage rates are the norm within the construction industry and are costed for within work packages. BRE has developed generic wastage rates for a variety of products and specifications for the Green Guide to Specification based on cost book data. This data is related to estimates for costing purposes (not to amounts or actuals) and has undergone industry consultation. Therefore, if wastage rates are to be used widely, better data is required on both the products/materials coming in and waste being generated. SWMPs should provide a mechanism for this, especially when comparing estimated waste arisings with actual waste arisings. A number of major contractors are beginning to set wastage targets for their trade contractors.

The opposite approach, which would also encourage waste prevention, is the setting of targets related to the amount of material/products that are used, i.e. a maximum material purchase target which should factor in low wastage rates. Obviously, this type of target requires a good understanding of the materials requirement. Both the wastage rate and material usage targets require commitment from buyers/purchasers and quantity surveyors – currently a significant gap within construction resource efficiency.

With the setting of any targets a baseline (or a benchmark) is required whereby a realistic reduction target can be set. BRE are producing benchmarks (see CRW roadmap) for different types of projects and construction types based on cost, amount, type and management. Constructing Excellence also produces an overall key performance indicator for waste generation.

Project undertaken

A number of surveys were carried out to determine the current use of waste prevention targets and the willingness to set any such targets. In addition, a review of international practice related to waste prevention (and related data collection) was undertaken.

A review of the websites of 100 contractors revealed that 37 have evidence of CSR policies on their websites; with 30 of these 37 having commitments and policies related to waste. However, only three contractors had set targets related to waste, although the others were planning to implement targets in the near future. Only one contractor had set a waste prevention target based on reducing the amount of waste produced by the company year on year. Other commitments related to diverting waste from landfill, increasing recovery, and reducing the cost of waste. It should be noted that the survey reflects what is available on the website and this will usually relate to the previous year's reporting.

In terms of willingness to set waste prevention targets, a selection of local authorities and construction companies (know to be using SWMPs) were asked a number of questions related to the use of waste prevention targets within SWMPs. Both groups had majorities in favour of the introduction of targets in SWMPs. However, when asked about the specific level at which the targets should be set there was variation between the two stakeholder groups, with LAs identifying a higher figure on average than contractors. Figure 1 shows a comparison of the realistically achievable targets identified by the two stakeholder groups.

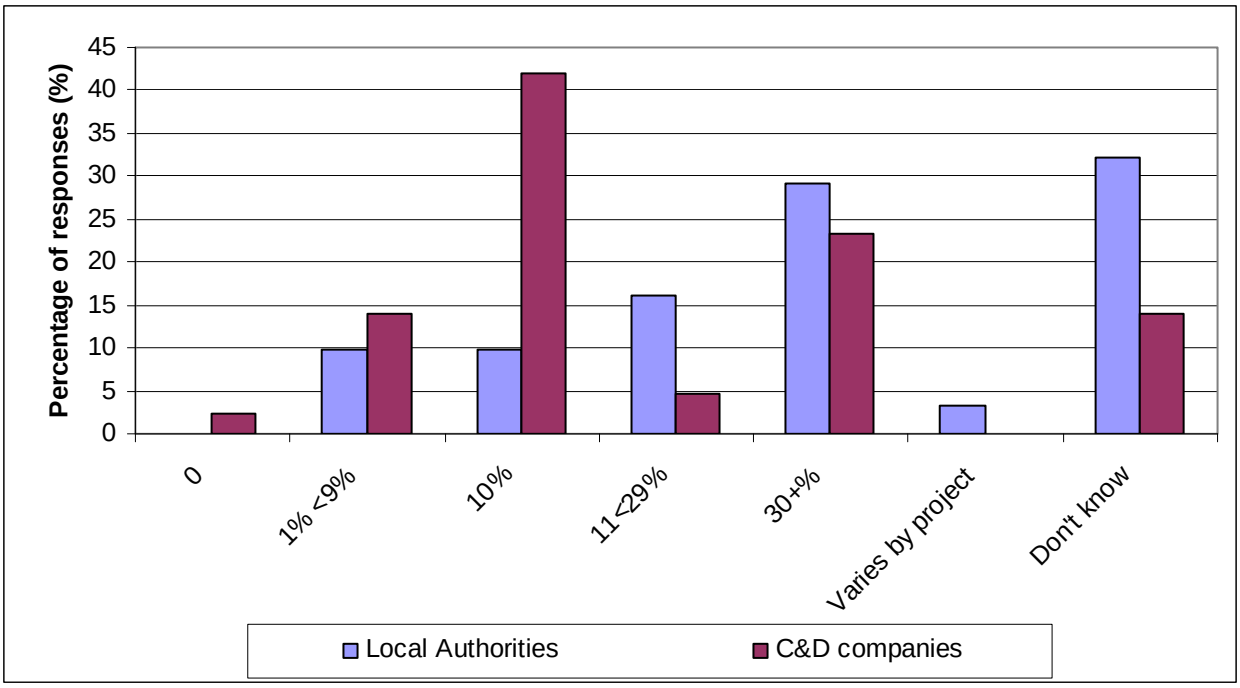


Figure 1 *Comparison of the responses from local authorities and contractors on realistically achievable targets for waste reduction.*

The majority of contractors believed that a 10% waste reduction target was achievable. A number of companies actually believed a higher percentage could be achieved, while seven thought a lower percentage was better. A third of LAs did not respond to the question on targets, the rest, bar four, all thought that 10% or more was an attainable target. This is interesting, because the majority of LAs were not willing to estimate the waste savings a contractor could make; indicating that the answers given are more closely related to what the local authority would want, than what they believe the contractor can realistically achieve. Moreover, the vast majority of construction companies could not give an estimate of cost savings related to waste prevention rather than physical waste management, nor could they give an estimate of the amount of waste likely to be reduced by waste prevention rather than physical waste management.

A number of the construction companies stated that the setting of flat targets would be a problem for them. One issue was that different sized projects and types of work would be able to achieve different levels of reduction. Furthermore, a flat rate would penalise those companies that already achieved high levels of waste reduction, because making further savings would be difficult. Also, a flat rate might reduce innovation in achieving waste reduction, and reward waste recycling rather than waste prevention.

Waste prevention by better design can often be hard to measure whereas recycling volumes are easy to measure. The introduction of targets and their method of use require a large amount of information and understanding of SWMPs. The study found that a lack of data collection by construction companies meant the understanding of the exact impacts and costs of SWMPs was difficult to evaluate. The introduction of an audit process could provide the impetus for companies to collect data, allowing for more in-depth analysis of the impact and cost of SWMP to be achieved.

Standards and codes such as BREEAM and the Code for Sustainable Homes (CSH) could also provide a framework for setting waste prevention targets, and a mechanism for reviewing data and setting appropriate benchmarks. The CSH requires the mandatory use of a SWMP, including the monitoring and setting of targets to promote resource efficiency. If there is evidence for commitments or setting targets for minimising waste then a credit can be awarded. Assessment is both at a design stage and at a post-construction stage. It is anticipated that

the CSH will be revised in 2008 to strengthen the commitments to waste, and use waste benchmarks as a mechanism for setting waste prevention targets. In addition, BREEAM does not currently stipulate the requirement to set waste prevention targets; instead credits are awarded for measuring and segregating/recovering waste, although it is likely that benchmarks will be used when they are available.

Review of international practice

The review of waste prevention within other countries covered Australia, Finland, the Netherlands, New Zealand, Singapore, Japan, Israel and the United States of America.

Overall, there was little being done in terms of actual waste prevention related to construction. The main drivers for reducing the volume of waste going to landfill included:

- a lack of landfill space
- legal requirements
- a lack of raw materials.

Focusing on raw materials encompasses the wider issue of construction resource efficiency and had largely arisen because the countries were reducing their dependence on imports and reducing costs. In terms of promoting waste management there are three methods:

- market mechanism (i.e. promoting the use of recycled materials)
- non-legal agreements
- legal requirements.

In terms of implementation, this could be broken down into eight overarching systems:

- **Financial cost:** This entailed penalising companies that dispose of C&D waste to landfill through financial mechanisms, the most common of which was the use of a landfill tax; also the use of tax credits for owners to deconstruct rather than demolish buildings.
- **Financial benefit:** This ranged from the use of bonuses for companies that utilised recycled material to the provision of contracts to companies that achieved a high level of minimisation or prevention for government building projects.
- **Legal ban:** The use of legislative bans was applied to certain categories of C&D waste. For example, the Netherlands has made it illegal to landfill reusable C&D waste, removing this as an End of Life (EoL) option.
- **Training of the workforce:** This occurs either through the government or by encouragement to companies to train their personnel. Although training is often not done specifically with waste minimisation or prevention in mind, it creates skilled personnel who are more aware of the benefits of good waste management and go o n to produce a higher quality of work, thereby reducing wastage caused by errors.
- **Information dissemination:** The provision of information and guidance to C&D companies on best practice in waste management highlighting the benefits both financially and environmentally.
- **Contractual promotion of practice:** This is where governments tender C&D contracts for building works that required waste minimisation and prevention.
- **Waste champion:** This is a requirement for a person on the site of large projects to champion environmental issues. The environmental champion promotes best practice and ensures it is occurring.
- **Longevity:** Promoting the longevity of buildings occurs either through research into problems that cause building decay or through ensuring buildings retain functionality over time.

England already utilises some of the methods utilised in other countries reviewed, most notably the landfill tax and the dissemination of information through the BREW[1] and Envirowise[2] programmes. The countries reviewed indicate that an integrated approach to waste management and prevention (i.e. the use of incentives and punishments to achieve the countries' goals) is the most successful approach.

Any method that is used will require a robust system of enforcement. This will provide it with the strength necessary to ensure compliance by the C&D industry. There is also a need for quantified data to be collected to allow analysis of the impact of any legislation, and identification of strengths and weaknesses in achieving the goal of waste minimisation and prevention. There was a consistent lack of evidence relating to the actual effectiveness of these policies of countries reviewed.

Research indicates that countries use an integrated approach to waste minimisation and prevention, using both incentivisation and punishment to achieve their goals. However, there is no clear set method used to achieve waste minimisation and prevention internationally. Identification of the best methods to promote waste minimisation and prevention in England requires further research.

In terms of committing to waste prevention for the future, a useful vehicle maybe the newly established CIB (International Council for Building) working commission on 'Construction Materials Stewardship'. This builds upon the CIB task group on 'Deconstruction and Material Reuse' which ended in 2004. Its Mission Statement is:

> To drastically reduce the deployment and consumption of new non-renewable construction materials, to replace non-renewable materials with renewable materials wherever possible, achieve equilibrium in the demand and production of renewable materials and ultimately to restore the renewable material resource base.

Some of the objectives include:

- determine ways to use construction materials in the most effective and ecologically, environmentally, socially and financially responsible manner
- develop life cycle costing and management mechanisms for materials
- develop systems to mitigate and ultimately avoid construction material waste
- develop ways of using material wastes in construction materials
- design for closed loop materials use and for the effective recovery of materials and components from existing buildings
- develop design and construction methodologies for transformable and adaptable buildings/spaces to extend service life and reduce resource use
- establish strategies to promote whole building, component and materials reuse
- establish ways to regenerate the renewable materials resource base and improve the performance, availability and use of renewable construction materials
- develop information and research outcomes to promote policy and regulatory standards, initiatives and options aimed at optimal resource use.

The first meeting will be in September 2007 in Lisbon, Portugal, where it will be held in conjunction with the CIB Regional Sustainable Construction Conference "Sustainable Construction, Materials and Practice".

[1] The Business Resource Efficiency & Waste programme (BREW) http://www.defra.gov.uk/Environment/waste/brew/ provides advice and support on improving resource efficiency measures, minimising waste production and improving its bottom line through a number of projects that it funds.
[2] Envirowise www.envirowise.go.uk offers UK businesses free, independent, confidential advice and support on practical ways to increase profits, minimise waste and reduce environmental impact.

A2.3. BigREc – reclamation industry survey

The BigREc Survey was a major poll of the UK building materials reclamation trade first undertaken in early 1998 and repeated in 2006–7. Overall, in 2007 the trade shows a large increase in value of sales but a general decrease in the volumes of materials salvaged. There appears to have been a shift in the trade since 1997 from selling entirely reclaimed building materials and architectural salvage to 2007 where sales also include a significant proportion of new and reproduction alternatives to salvaged materials. Interim results shows that while 100% of sales were of salvaged and reclaimed items in 1997, by 2007 this has dropped significantly, perhaps as low as 50% of sales.

> "Lack of space means only a small quantity of stock can be displayed. Items are slow to sell mainly due to lack of vision and foresight by architects etc. Supply of quality items is very slow. A large number of items are found in storage or barns or have been reclaimed many years ago. We need to encourage more architects and planners to consider using reclaimed items at conception of project rather than as an afterthought where, invariably, the size is often an obstacle."
>
> East of England general architectural salvage dealer

The BigREc2 Survey was in two parts. The first part was a returnable postcard asking for a general summary of business type and turnover of which over 2000 were sent. The second part was the main BigREc questionnaire which consisted of a 28-page A4 booklet asking 220 questions covering 19 different sales sectors ranging from demolition salvage such as steel beams, through reclaimed building materials such as timber beams and bricks, architectural fixtures such as Victorian doors, to more ornamental elements such as carved stone reliefs. The main survey asked for information about sources of supply and the distances goods travelled, the type of customers and where they came from, the different kinds of employment created, and how things are reused. It was a very comprehensive survey, and the data collection of this part is ongoing. However, some completed replies have now been analysed, and the interim findings are as follows.

Interim findings

General salvage

In the 'salvaged' sector the good news is that there is more activity than predicted with sales from the postcard survey showing a 400% increase. So far, these figures are not reflected in the BigREc Survey, which shows an overall drop in sales. The most likely explanation for this is that BigREc respondents have dropped out of scrap leaving the field to new small one-man businesses selling scrap U-PVC windows, scrap plasterboard, second-hand but reusable modern plumbing and electrical fittings and so on. The supply of these materials is split between private disposals and direct from demolition. The survey shows an increase in customers who are developers, which could possibly be a result of buy-to-lets mopping up cheaper second-hand materials for refurbishment. There is now stronger demand for reusable steels but the supply does not seem to be feeding through into salvaged stocks from demolition.

Timber

The supply of modern timber and timber fittings from demolition has all but stopped. Ten years ago burning scrap wood by demolition contractors was common; now no wood is burned either on demolition sites or by demolition contractors off site. The amount of reclaimable salvage wood, as opposed to scrap unusable wood, disposed of by demolition contractors has dropped from 800,000 tonnes to 500,000 tonnes a year. Most of this wood seems to be chipped for compost or turned into medium-density fibreboard (MDF).

> "Supply problems continue to worsen. Most large demo contractors do not strip out [reclaimed wood] anymore but simply send in skips for mulch board. I think this is due to extremely harsh time penalties imposed on them by main contractors."
>
> West Midlands dealer and manufacturer making doors exclusively from reclaimed wood

Reclaimed sector

In the 'reclaimed' sector, anecdotal evidence from salvage dealers is that old but reclaimable timber beams are being chipped for MDF or compost and reclaimable second-hand bricks are being crushed by demolition contractors under time pressure. The picture emerging from the BigREc survey seems to reinforce the trade's views about bricks but undermines their views on reclaimed beams. So far, results show an increase in reclaimed beam stocks held and an increase in the percentage coming from demolition. However, reclaimed brick stocks are down from 37 million to 33 million and the amount supplied from demolition sites has dropped. There are more customers for reclaimed bricks from the private sector in 2007 compared with 1997, despite an increase in standards of supply which should, in theory, have attracted more mainstream construction customers.

Reclaimed roofing stocks have dropped by two-thirds, probably a result of difficulties getting access to sites to remove tiles and slates ahead of demolition. Sales have also dropped by two thirds, although the percentage sold to mainstream construction has risen from 8% to 18%. Standards of supply were higher in reclaimed roofing than other sectors in 1997, and have remained so.

Reclaimed stone stocks are down by a half although the amount paid per tonne has risen from £35 in 1997 to £150 in 2007. Most now comes from private sources. Demolition supplied eight times more stone in 1997 than in 2007 despite the quadrupling in prices paid.

Reclaimed flooring stocks are down and fewer dealers are trading in flooring, possibly a result of cheaper competition from the new laminate wood flooring sector which barely existed in 1997. Customers are down and sales have dropped from £29 million to £12 million. In order to try to compete with new kiln-dried wood the number of dealers able to supply kiln-dried reclaimed flooring has risen from 25% to 80%. The real or perceived additional labour costs of fitting reclaimed wood flooring and the fact that many people cannot see the difference in quality between antiqued new wood and original reclaimed may be to blame. Reclaimed paving stocks are down from 573,000 m^2 to 141,000 m^2, although prices paid for reclaimed flooring stocks have risen from an average of £16 in 1997 to £48 per square metre in 2007.

Architectural salvage

The 'architectural' sector saw an increase in sales from £26 million to £43 million. There seems to have been a shift in appreciation of antique worked stone and wood from earlier times, with more people wanting to fit details back into period property and new properties. The fact that considerably less stocks are carried now than ten years ago means that customers are prepared to act faster when the right item comes up. This can assist in a more rapid demolition-to-end-user transaction.

> In November 2006 when a Victorian hospital with carved decorative stone door and windows surrounds was being demolished in the north of England, a local salvage dealer managed to rescue three lorry loads of the dressed stone, and placed it on the Salvo website from where it was bought speculatively for £17,000 two weeks later by a someone planning to build a new house near London.

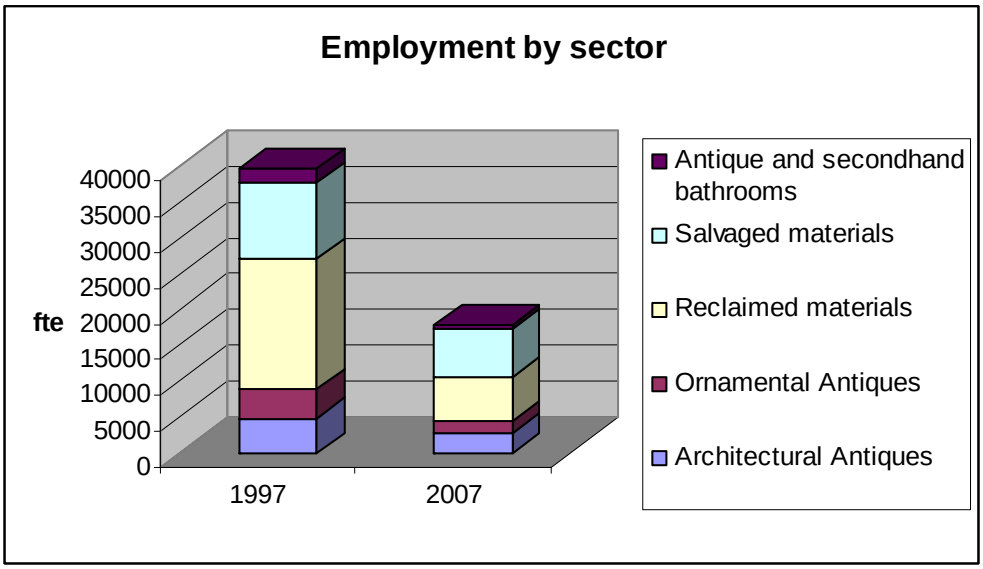
More people are using antique ornamental stone and terracotta – often in gardens or landscape settings – and such material has been getting scarcer and more expensive for years. The salvage trade is unlike others in that old

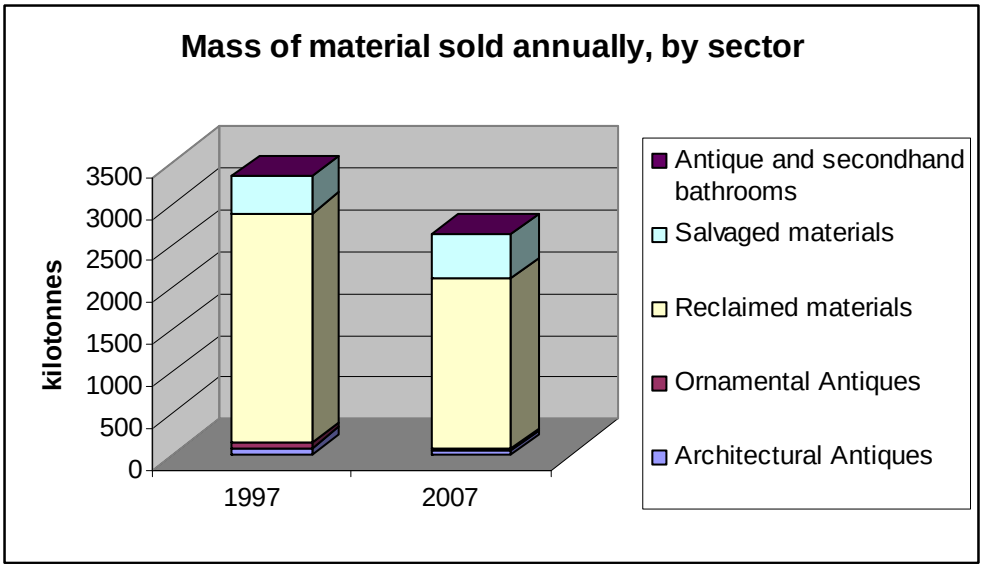
stocks in all sectors of the conventional economy depreciate and must be sold on cheaply to make way for new models. The opposite tends to be true in salvage where stocks appreciate the longer they remain unsold. A south-west business that was trading primarily in ornamental stone for thirty years has seen the value of its old unrestored stock increase by a factor of ten in the past ten years. This material cannot be replaced at the cheaper prices for which it was originally bought, so the business is in no hurry to sell and can hold out for high prices for finished pieces.

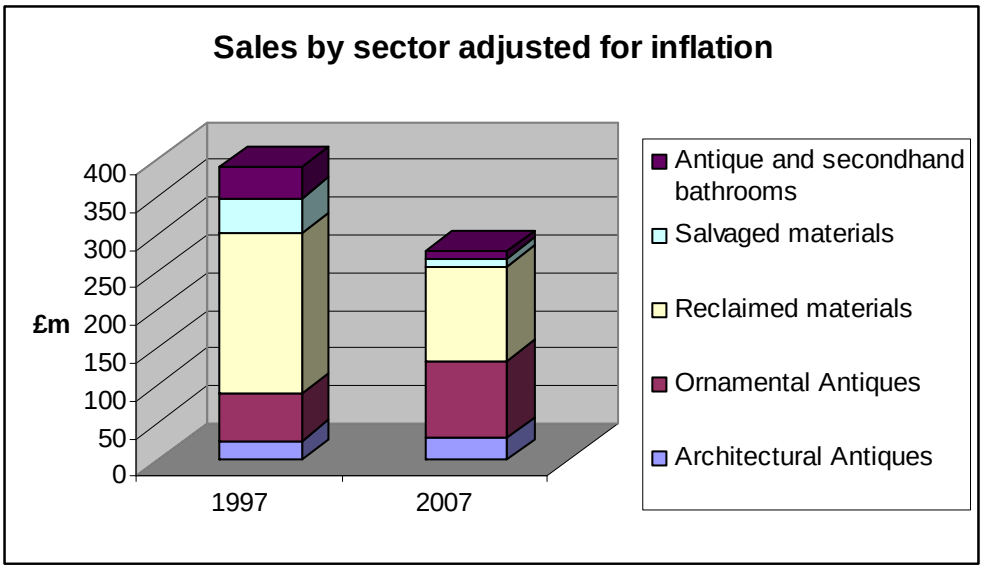
For the reasons given above, and possibly others that will be uncovered when the survey is complete, the overall amount saved for reuse by the architectural salvage sector has dropped from 3.3 million tonnes to 2.6 million tonnes in the past ten years. The trade may have changed from being substantial energy savers to significant carbon producers because when materials have dried up they have moved over to new and reproduction materials, often sourced from far away countries.

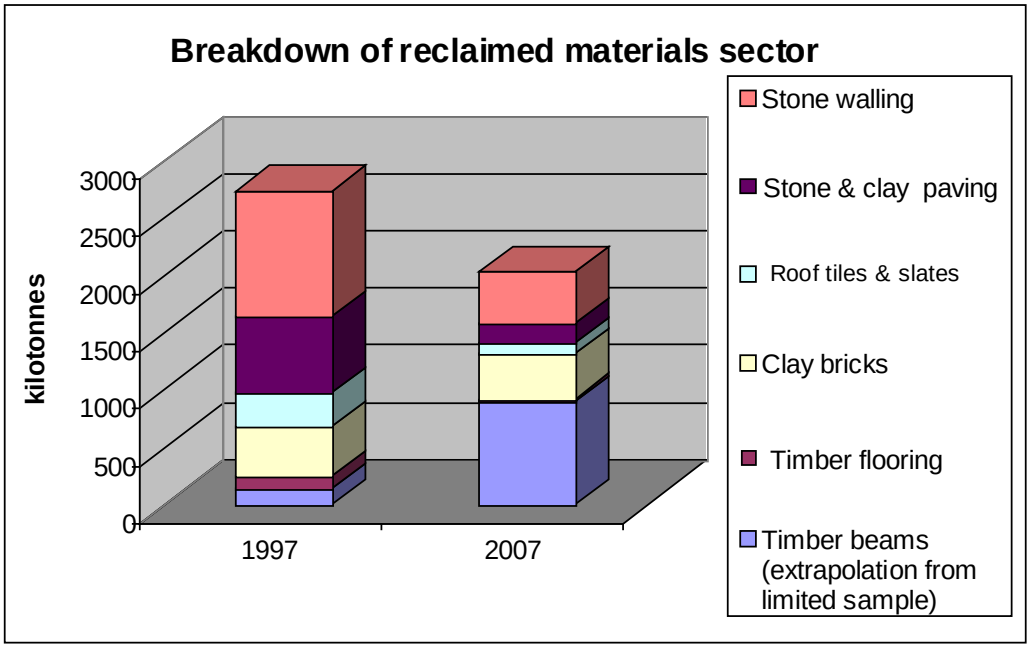
In 1997 most salvage operators were local resources, taking in local materials and reselling them locally. Now they operate regionally, and supplement their reclaimed stocks with 50% new materials. At the same time, far fewer materials are coming to the trade from demolition waste streams than 10 years ago.

> "The demolition industry is incentivised to crush and burn. The reclamation industry needs funding for 'stockholding' to balance the equation.'"
>
> South-west England general architectural salvage dealer




Mass of material sold annually, by sector
kilotonnes
3500
3000
2500
2000
1500
1000
500
0
1997
2007
Antique and secondhand bathrooms
Salvaged materials
Reclaimed materials
Ornamental Antiques
Architectural Antiques


Sales by sector adjusted for inflation
£m
400
350
300
250
200
150
100
50
0
1997
2007
Antique and secondhand bathrooms
Salvaged materials
Reclaimed materials
Ornamental Antiques
Architectural Antiques



A2.4. Whole life costing and resource efficiency

This study considered whether material resource issues are adequately addressed in current whole life costing (WLC) thinking.

A literature review was completed, and this indicated the limited extent to which resource issues (in the context of whole life costing) have been considered by the construction industry. A cost study examining resource issues was completed and among the findings two main themes emerged, namely:

- Lack of clarity in terms of how resource issue are currently costed over the whole life of a structure
- The fact that there is no mechanism for recognising changing trends or values over large periods of time for predicting future costs.

The report proposed a suite of simple numerical multipliers (from graphs/tables) which would allow WLC studies to incorporate the greater-than-inflation cost increases expected in disposal of items in the future. It is proposed that this tool could also include issues such as salvage value, or recyclability of a component, allowing studies to readily include a much more accurate estimate of future costs.

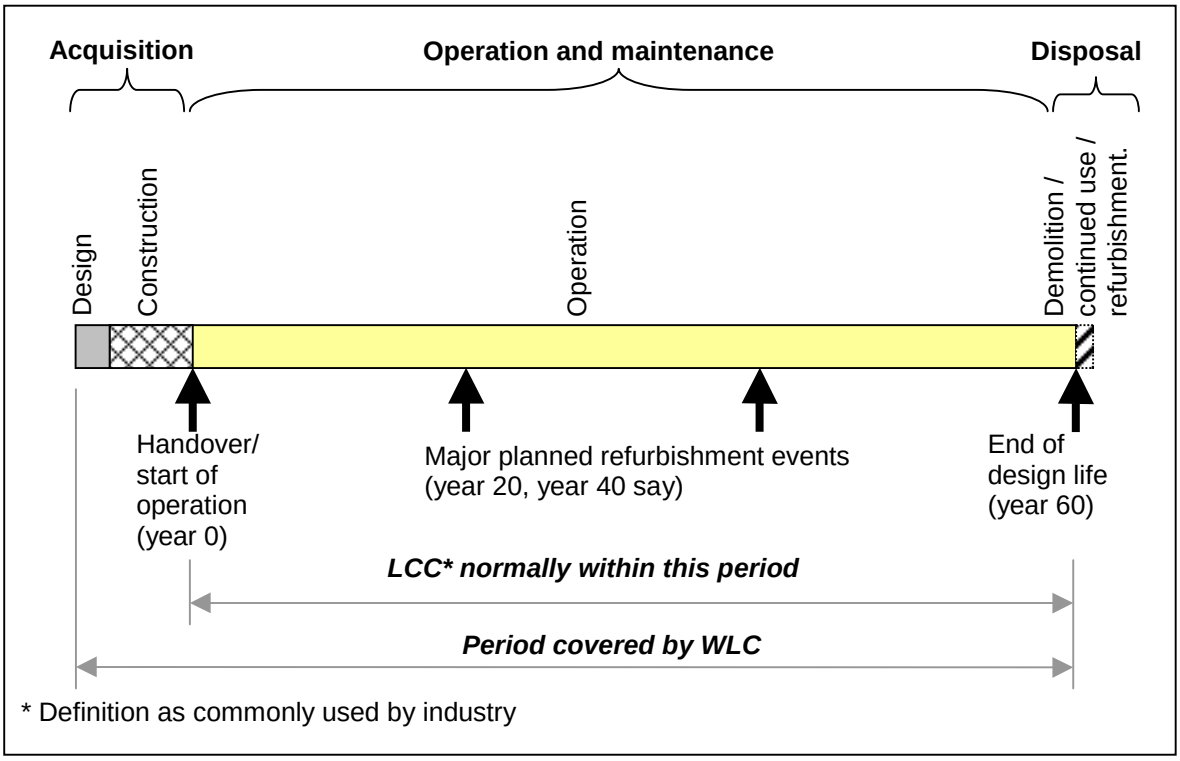


Figure 2 *A simplified timeline of a structure's life*

Definitions of whole life costing

WLC, also referred to as the 'through-life costs', are often described[3] as the sum of (see figure 2):

- **Acquisition costs of the asset:** including consultancy, financing costs, design, construction costs, and sustainability costs
- **Costs of operation of an asset:** including overhead costs, use of internal resources, health and safety costs
- **Costs of maintenance of the asset:** including risk allowances, refurbishment costs, costs associated with the requirement for changing use
- **Disposal of asset costs/income.**

In short, the WLC is meant to represent the total cost of ownership from the 'cradle to the grave'[4].

The objective of a WLC study is to make business decisions on the basis of full knowledge of the cost consequences of different initial options. Long-term costs over the life of the asset are more reliable indicators of value for money than the initial construction costs because:

[3] 'Achieving excellence in construction Procurement guide 07: Whole life costing and cost management' (2003) Office of Government Commerce 21pp. Available from www.ogc.gov.uk.
[4] 'Achieving Whole Life Value in infrastructure and buildings', BRE Report 476, (2005) brebookshop@emap.com. 55pp. ISBN 1 86081 737 8.

- Money spent on a good design can be saved many times over in the construction and maintenance costs by avoiding over-specification, allowing holistic multi-disciplinary design solutions, and so on. An integrated and inclusive approach with the supply chain can improve health and safety, sustainability, design quality; increase buildability, reduce waste, reduce maintenance requirements and hence reduce whole life costs.
- Investment in a well-built project can, in turn, achieve significant savings in running costs.

Definitions of other financial studies

Definitions of other types of financial prediction studies are included here because they are frequently presented as being WLC. Care should always be taken to understand exactly what analysis is being carried out (and for what purpose).

- **Life cycle cost (LCC):** The ISO definition of 'life cycle cost' is given as the "total cost of a building or its parts throughout its life including the costs of planning, design, acquisition, operations, maintenance and disposal less any residual value."[5] In this document, however, it is taken to mean a determination of costs over the operational period. The latter definition is very commonly used by industry (despite the ISO definition).
- **Life cycle assessments (LCA):** "A systematic set of procedures for compiling and examining the inputs and outputs of materials and energy and the associated environmental impacts directly attributable to the functioning of a product or service system throughout its designed life."[6]

WLC comparison/cost study

In order to examine and explore the effect of considering waste as part of a whole life costing forecast, two existing life cycle forecasts on real projects have been re-analysed to show the level of cost included in the forecasts for the disposal of materials or components when repair or replacement works have been carried out. The two projects are:

- a small block of 17 flats
- a hospital block.

Both are new build projects and the main costs used in this study have been provided by the client or approved by them. The original studies were undertaken to assess the future cost of planned major repairs and replacement of end of life components over a 60 period. These original studies split the buildings into elements (using a BCIS – Building Cost Information Service – format) and costed the removal and replacement of materials and components at the end their expected lives during the period of time under study.

This study aimed to further examine the allowances included in the original LCC for removing and disposing of components which had reached the end of their planned life, or waste generated as part of planned maintenance processes. This study considers life cycle replacement works during the maintenance and operation phases of a building's life (see figure 2). The study does not address construction, demolition or end of life of the whole building issues.

Discussion of cost study findings

It was found that concentrating on periodic replacement and disposal of components (rather than the whole structure at the end of the design life) gave a more realistic estimate of the true cost of waste in operation resulting

[5] ISO 15686 Buildings – Service Life Planning – Part 1 – General Principles. ISO/FDIS [2000] Secretariat: BSI.
[6] SO 14040 Life Cycle Assessment.

from design decisions. The table below shows a summary of recycled values and disposal costs in the life cycle assessment of the block of flats project. A similar study on a hospital block gave similar results (shown below).

Block of flats study	60 year cost	% of original	60 year discounted at 3.5% net present value (NPV)	% of original (discounted)
Original life cycle cost	£447,578		£145,210	
Approximate value of recyclable materials in original total	£7,846	1.8%	£2,240	1.5%
Approximate cost for disposal of materials in original total	£37,716	8.4%	£11,436	7.9%
Estimate of cost for disposal of materials in original total assuming real terms cost increase*	£104,957	23.4 %	£26,211	18 %
* Annual increase of 2.5% in the cost of waste disposal over and above general inflationary costs				

Table 2 *Block of flats LCC study findings*

The approximate cost of disposal of materials included in the original total LCC were calculated using current standard techniques. The estimate of cost for disposal of materials included in the LCC assumes annual increases in the price of waste disposal in real terms. As can clearly be seen the WLC is extremely sensitive to real-term increases in disposal

Hospital block study	60 year cost	% of original	60 year discounted at 3.5% net present value (NPV)	% of original (discounted)
Original life cycle cost	£10,384,548		£3,244,053	
Approximate value of recyclable materials in original total	£200,294	1.9%	£61,263	1.9%
Approximate cost for disposal of materials in original total	£792,157	7.6 %	£239,769	7.4%
Estimate of cost for disposal of materials in original total assuming real terms cost increase*	£2,063,880	20%	£556,096	17%
* Annual increase of 2.5% in the cost of waste disposal over and above general inflationary costs				

Table 3 *Hospital block LCC study findings*

Tables 2 and 3 show that, in both of the examples undertaken for this project, LCC and WLC analyses were significantly sensitive to real-terms increases in waste disposal costs.

It is proposed that a suite of graphs/or tables of the form shown in figure 3 (below) might be used so that cost studies can be quickly and efficiently include an estimate of the expected increases in waste disposal cost, in order to allow for:

- real term increases in waste costs with time
- the 'recyclability' of different types of materials/components.

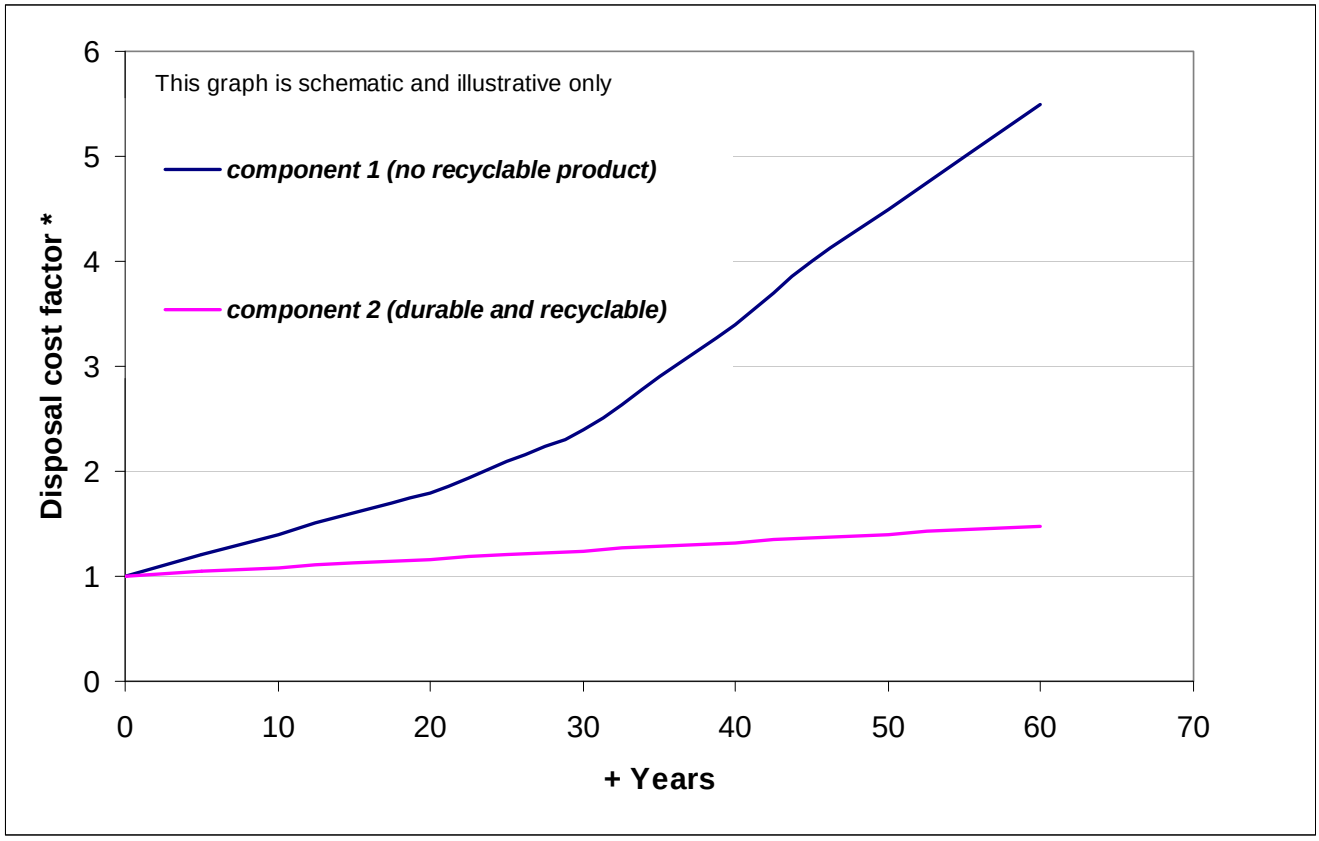


Figure 3 *Nature of proposed cost factor graph*

A2.5 Future legislation and forward look

Overview

Current and proposed EU and English waste legislation affecting the construction industry have been identified in this project and their implications, overlaps and opportunities discussed. These activities highlighted the fact that there were some overlaps in legislation, which came out in the feedback from the industries environmental managers.

The main issues raised by the developers and construction companies consulted during this project are the need for:

- more legislative compliance guidance
- consistency from the EA enforcement teams
- stronger enforcement on SMEs.

This review of legislation and strategy highlights the fact that current and proposed English and EU legislation have covered the current requirements within the construction waste (summarised in the main CRW roadmap document

and detailed in Annex 4). It is now imperative that this legislation is strictly enforced and, where possible, legislation condensed.

Project undertaken

A consultation exercise was undertaken, exploring the construction industries attitudes towards new and existing legislation. Fifty-six large developers, construction companies and planning organisations within the construction industry were approached and 19 respondents answered a short questionnaire.

The gap analysis provided a forward look at English and EU legislation and strategy to identify future drivers for construction (including products), procurement and resource efficiency.

The work highlighted that this is a broad and diverse industry with leaders and laggers, with the leaders striving to improve construction waste minimisation and recycling, and laggers seem to be lacking an understanding of current legislation due to fiscal and time constraints.

Findings in this project highlighted the fact that condensing current legislation should make compliance easier, because: less time will need to be spent keeping up to date with legislative changes; education will mean standard operating procedures are designed, which in time will become second nature to site and environmental managers; and more active enforcement will mean laggers are forced to improve their operating procedures, setting a level playing field.

A meeting with the Confederation of British Industry (CBI) raised an interesting point regarding the proposed legislation revision about ‘Duty of Care’. CBI has considerable problems with this, as they feel the EA are trying to enforce things too heavily. There is also a problem in that some specific wastes (e.g. paint) must be dealt with in a specific way, and many builders will not be aware of the procedures.

Some respondents felt there was a lack in consistency between information provided by Defra, WRAP and EA. Respondents also highlighted several enforcement inconsistencies at a regional basis within enforcement organisations.

Therefore, there is currently sufficient legislation covering all relevant areas of construction waste. However, this needs condensing, education within the sector needs to improve, and enforcement needs to be much stronger.

Looking forwards, the project considered a 10-year scenario; the general conclusion being that current, and proposed, legislation sufficiently covers current construction waste requirements and it is now just the enforcement of the legislation that needs to be improved.