

Practical solutions for sustainable construction

Reclaimed building products guide

A guide to procuring reclaimed building products and materials
for use in construction projects



WRAP helps individuals, businesses and local authorities to reduce waste and recycle more, making better use of resources and helping to tackle climate change.

In our work on construction procurement, we:

- provide **standards for good practice** in the efficient use of materials, including higher recycled content, waste reduction and recovery;
- help clients and contractors **introduce requirements** for good practice on their projects, through on-the-ground assistance and practical tools; and
- support sector leaders and exemplar organisations in **making commitments** to standards and targets.

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Reclaimed building products guide

Introduction

This guide is aimed at construction professionals including:

- clients and developers;
- architects and designers;
- staff responsible for specification and procurement; and
- main and specialist contractors.

The document covers a range of products and materials commonly used in new build and refurbishment for housing, commercial and public sector projects. Its purpose is to help identify how to substitute new products with reclaimed alternatives.

Increasingly construction clients are setting requirements such as:

'At least 10% of the total value of materials used in the construction project must be derived from recycled and reused content in the products and materials selected.'

As a result, clients, design teams and contractors need information to make choices on opportunities to incorporate reused (i.e. reclaimed) options.

There are a number of real and perceived barriers to using reclaimed building materials such as supply availability and failure to allocate design responsibility. This guide goes some way to address these issues and provides examples of how barriers have been overcome.

Definition of terms

Reclaimed (or reused) products and materials are those that have been taken from the waste stream and reused in their original form with minimal reprocessing. Examples include steel beams and whole bricks.

Recycled materials and products with recycled content use materials taken from the waste stream which are reprocessed or remanufactured to form a new product. This includes bulk materials such as recycled aggregates made from demolition materials, and newly manufactured products such as fibre insulation made with 80% recovered glass cullet.

This guide focuses on reclaimed products. For more information on products and materials with recycled content, visit:

- www.wrap.org.uk/rcproducts (online product guide);
- www.aggregain.org.uk (for aggregates); and
- www.wrap.org.uk/construction (for procurement guidance, case studies and measurement tools).

How to use the guide

This guide begins by presenting the case for using reclaimed products in construction, and addresses the key challenges and opportunities that reclaimed materials present. The introductory Section ends with a summary of the top 'quick win' materials.

The guide is then broken into three further Sections that should help you to answer the following:

- Product Pages – What reclaimed products can I use?
- Case studies – What examples can I follow?
- Supplier Directory – Where can I get these reclaimed construction products?

What reclaimed products can I use?

The Product Pages provide tabulated information on what can be achieved in each of the main product categories. Use the Product Pages either for inspiration, or for guidance on using a specific material.

The Product Pages are organised by material streams such as metal or stone. Specific materials within each stream are allocated a Product Page e.g. granite setts.

The Product Pages contain information on the following:

- the product;
- applications;
- cost of both reclaimed and comparable new product;
- if applicable, any embodied CO₂¹ saving by using reclaimed in place of a comparable new product; and
- guidance on key issues, for material streams and specific materials.

Where can I get these products?

Use the Supplier Directory and materials information exchanges Section to find this information.

1. Embodied CO₂ data obtained from Inventory of Carbon & Energy Version 1.5 Beta, G Hammond and C Jones, University of Bath, 2006. This dataset has been used as it is up to date, comprehensive and publicly available in the UK

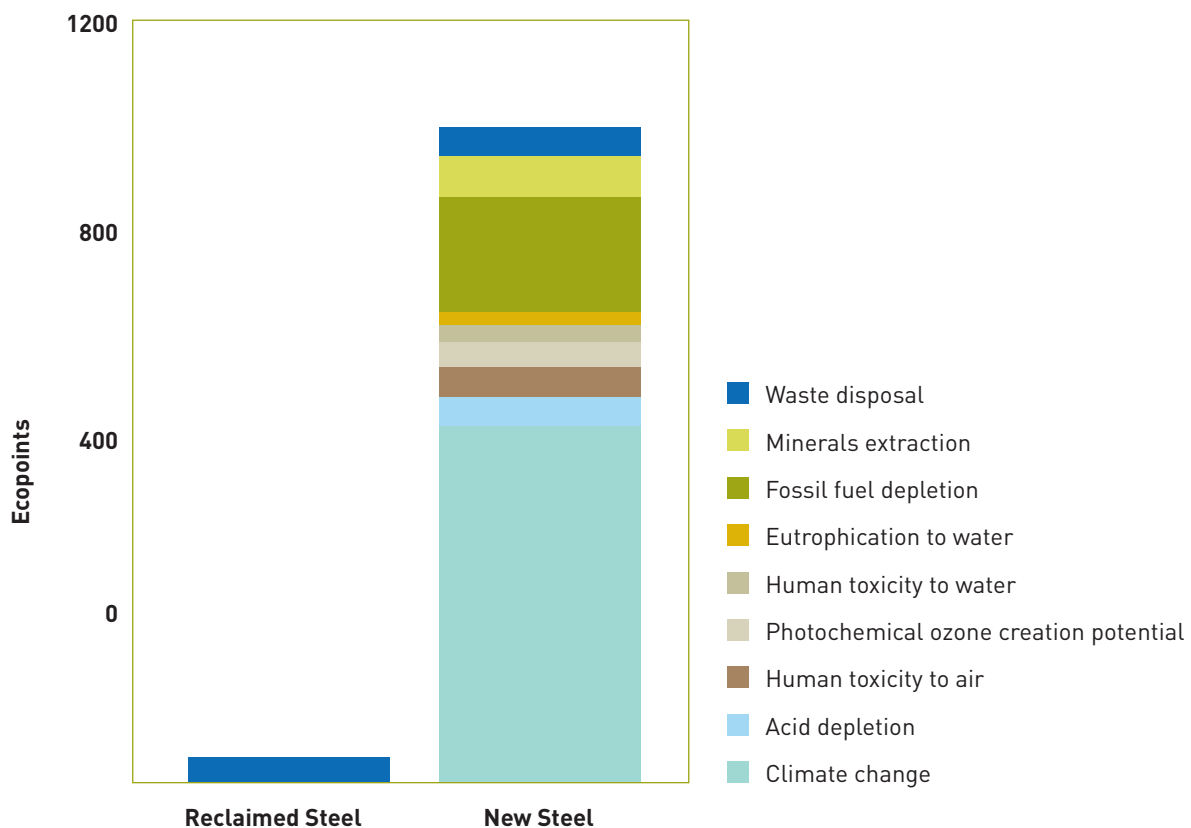
Why use reclaimed?

Use of construction materials has a significant impact on UK sustainability. In the UK, they annually account for:

- 19% of the total national ecological footprint;²
- 23% of the total national greenhouse gas emissions;²
- 420 million tonnes of material consumption (7 tonnes per person);³ and
- 30% of all road freight on UK roads.⁴

Substitution of a few well chosen, locally sourced reclaimed materials can reduce the environmental impact and the embodied carbon of a project significantly. For example, comparing the impacts of reclaimed and new materials shows a reduction of 96% for reclaimed steel and 79% for reclaimed timber.⁵ These savings can sometimes be achieved with little or no additional expense, making reclaimed an extremely cost-effective way of cutting carbon emissions.

Figure 1: BRE Environmental Profiling⁶ showing 96% environmental impact saving by reclaiming and reusing 99 tonnes of structural steel.⁵ Although new steel sections have 60% recycled content on average, they still have 25 times the environmental impact of reclaimed and reused steel sections.



2. Stockholm Environment Institute

3. Biffaward Mass Balance of the Construction Sector

4. Freight Transport Association

5. Source: BRE lifecycle analysis, cited in Construction Materials Report Toolkit for Carbon Neutral Developments – Part 1, BioRegional Development Group, 2003

6. BRE Environmental Profiling metric of life-cycle impact, where 100 Ecopoints is equivalent to the environmental impact of the average UK citizen over one year

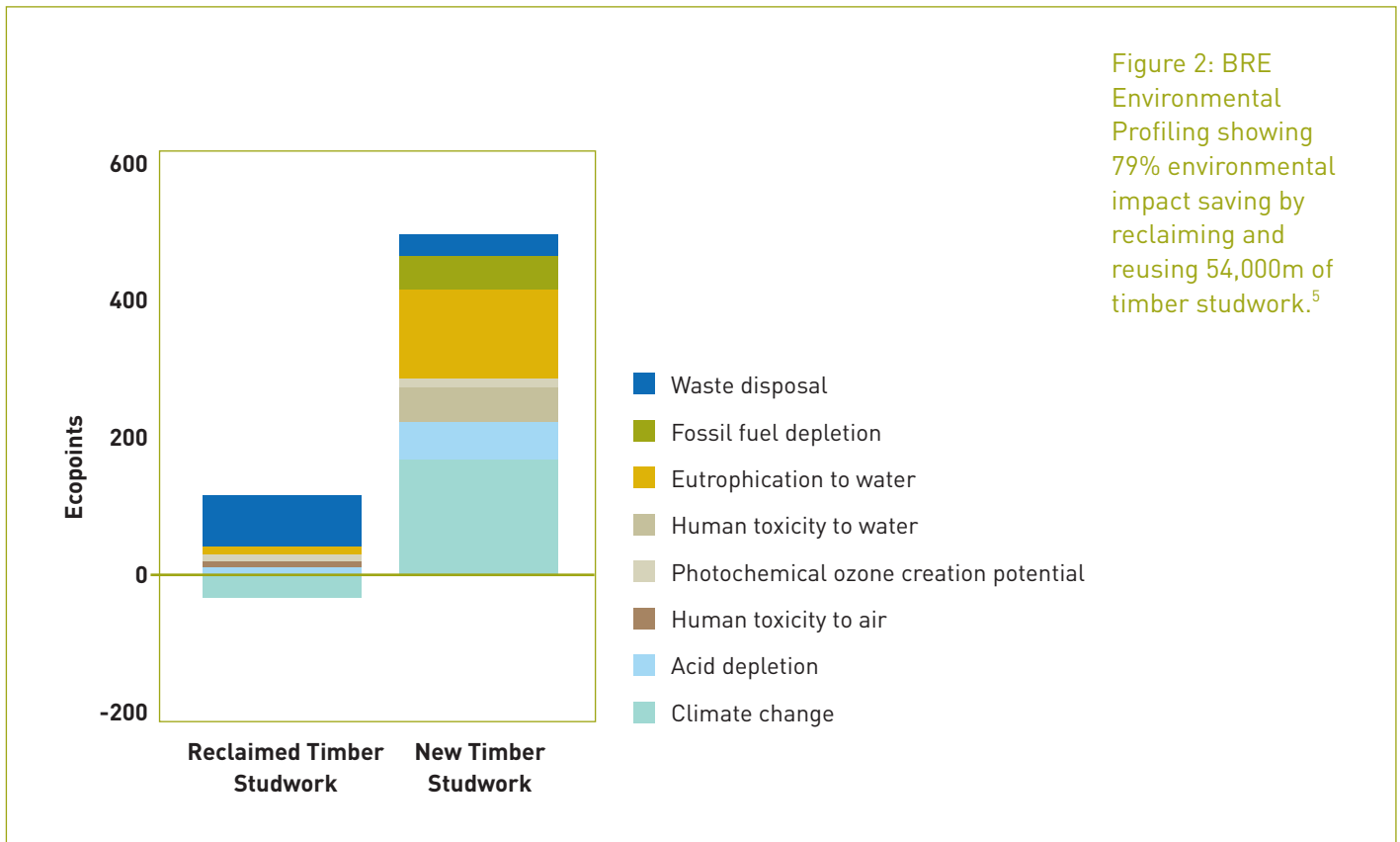


Figure 2: BRE Environmental Profiling showing 79% environmental impact saving by reclaiming and reusing 54,000m of timber studwork.⁵

For the range of reclaimed products covered in this guide, the cost comparison with new product ranges from 80% savings through to 200% cost premiums. Even where there is a cost premium, there is often added value in the provenance of the material. Perhaps the material has been salvaged onsite and tells a story about the history of the site. Perhaps it has been salvaged from another building of interest. Many tropical hardwoods are no longer available new but can be reclaimed and reused to aesthetic advantage.

Alternatively, where there is no historic or aesthetic added value, e.g. for reclaimed studwork that is not even seen, the embodied carbon savings are worth consideration – as illustrated in Figure 4.



So, if there is a cost premium on a reclaimed product and it cannot be justified on historic interest or aesthetic value, then carbon savings may justify its use. When the carbon savings are compared with the expense of other typical carbon saving measures, reclaim becomes a positive option in most cases. It is for this reason that this guide includes embodied CO₂ savings as well as cost commentary in the Product Pages to follow.

Figure 3: Reclaimed parquet flooring, extracted during one of Bovis Lend Lease's projects and used to make desks in the Head Office.

5. Source: BRE lifecycle analysis, cited in Construction Materials Report Toolkit for Carbon Neutral Developments – Part 1, BioRegional Development Group, 2003

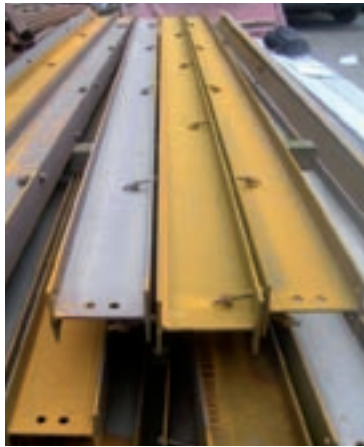


Figure 4: 1 tonne of reclaimed steel saves the same amount of CO₂ as 2m² of photovoltaic panels for their typical 20 year design life, but the upfront costs are very different. 1 tonne of reclaimed steel saves 1.8 tonnes of CO₂ emissions.⁷ Reclaimed steel is usually cheaper than new, but even with a 20% cost premium, the extra cost would be around £140 per tonne. 2m² of photovoltaic panels running at optimum performance for their typical design life of 20 years will save the same 1.8 tonnes of CO₂,⁸ but their cost is £500 - £1,000/m².

Green Guide to Housing Specification and the Code for Sustainable Homes

BRE's Green Guide to Housing Specification⁹ (Green Guide) is an environmental assessment system for building materials and components used in housing, rating materials from A+ to E. The 2007 version contains, for the first time, construction systems that include four reclaimed products, all of which are rated A+:

- timber floorboards;
- bricks (used for internal walls);
- roof slates; and
- clay roof tiles.

Specifying and using A+ rated systems, including reclaimed products, will enable house builders to achieve higher ratings on the Code for Sustainable Homes.¹⁰

Overview of possibilities

With imagination, creative design and a flexible design specification, the opportunities to incorporate reclaimed materials into building projects are wide and diverse.

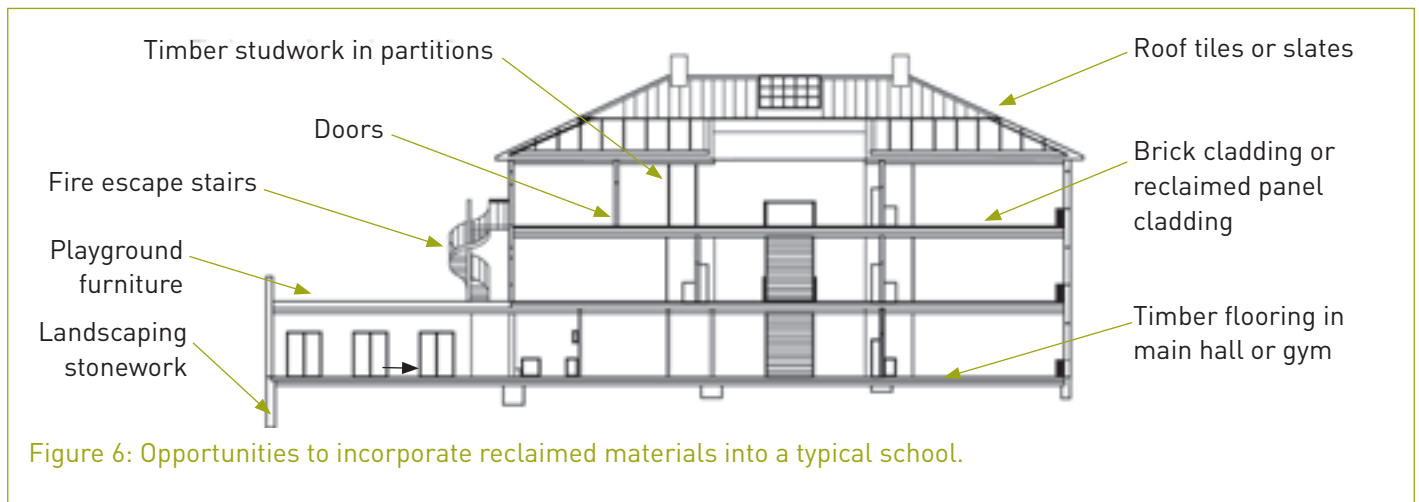
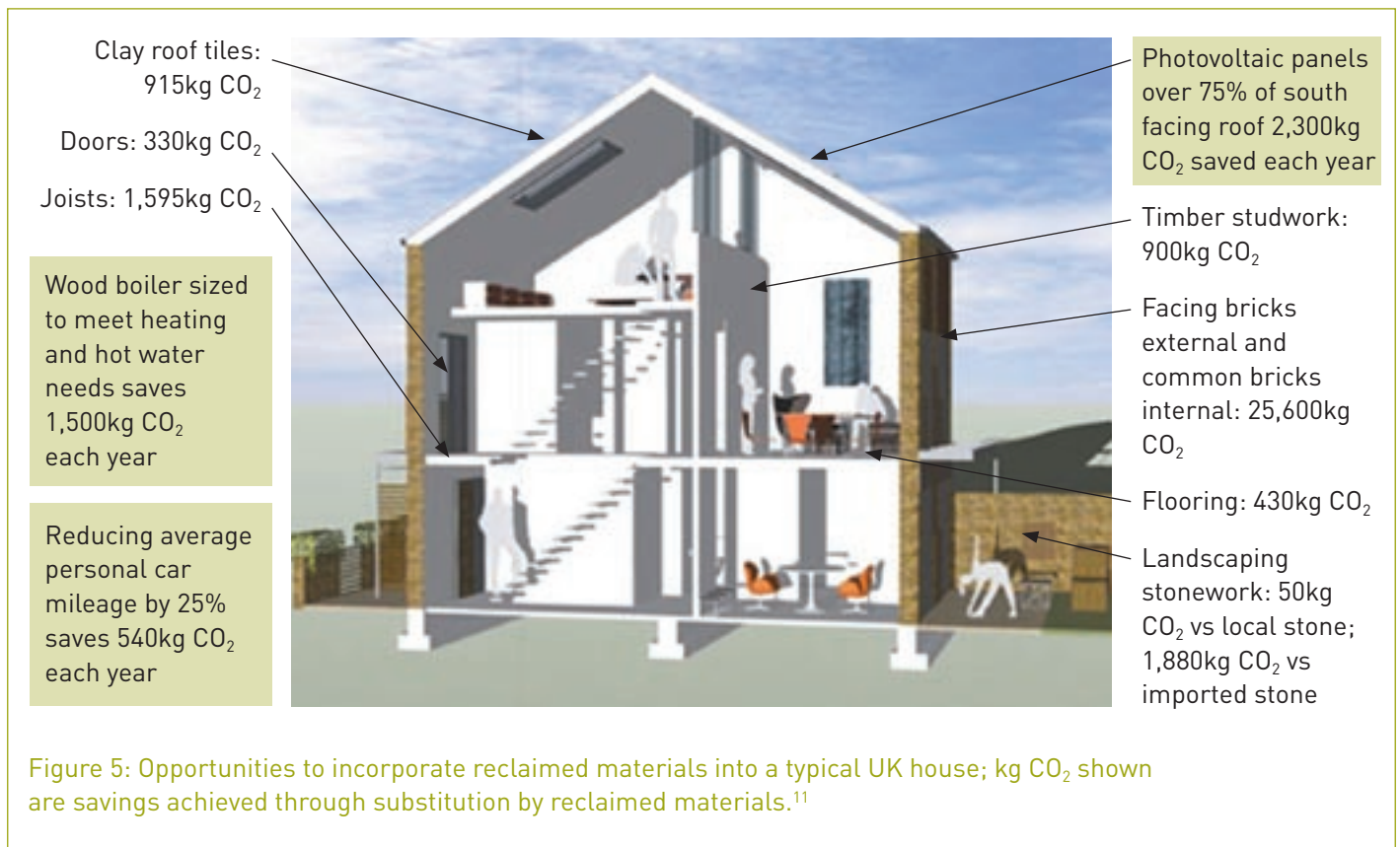
Figures 5, 6 and 7 show some of the most common opportunities in a typical new or refurbished house, office or school in the UK. For the typical house, Figure 5 shows typical embodied CO₂ savings for a range of reclaimed options. To put the benefits of reclaimed into perspective, the diagram also shows some CO₂ savings from other common carbon-cutting measures.

7. Source: Inventory of Carbon & Energy Version 1.5 Beta, G Hammond and C Jones, University of Bath, 2006

8. This CO₂ saving allows for payback of the embodied CO₂ of the manufacture of the panels; data provided by BRE for BedZED Construction Materials Report, 2001

9. Published by the Building Research Establishment (BRE)

10. The Code for Sustainable Homes is a voluntary national standard for sustainable design and construction of new homes, see www.planningportal.gov.uk/uploads/code_for_sust_homes.pdf



11. CO₂ savings are for a typical 3 bedroom house built to 2002 Building Regulations standard with floor area of 100m², constructed with brick cavity walls with 9" x 2" timber joists at 300mm centres, timber studwork and clay tiles. Image credit: www.thisismoney.co.uk

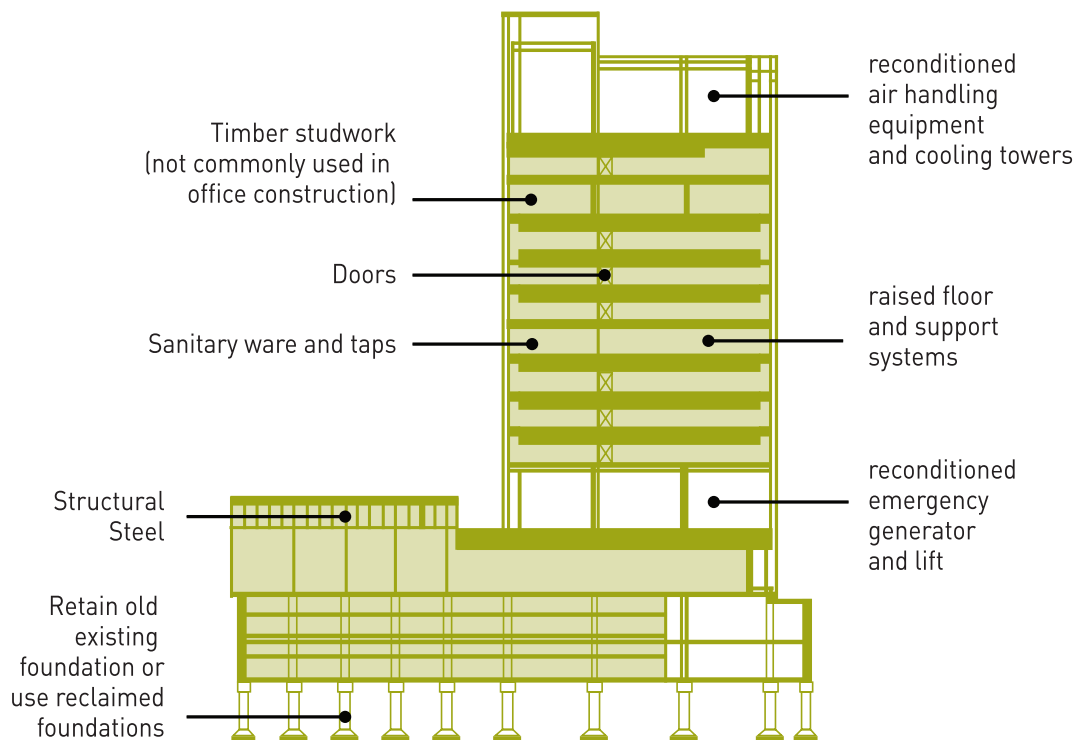


Figure 7: Opportunities to incorporate reclaimed materials into a typical office building.

What to get right

Getting the items discussed in this Section correct, from the beginning, will help to deliver a successful project with the desired reclaimed content.

Procurement method: There are a number of models that can be used for procuring reclaimed materials that have worked successfully in the past:

- *Client buys*; materials are then either free issued or sold to the contractor.
- *Contractor buys*; all risk is with the contractor.
- *Contractor and Client buy*; hybrid approach whereby bulk, easy-to-source materials are purchased by the contractor with the client purchasing specialist materials.

Project reclamation target: The intention to use reclaimed should be built into the project brief as early as possible and a target for reclaimed content agreed.¹² This target

may be location-specific to take account of materials available locally or on site.

Contractor buy-in: Successful use of reclaimed materials requires all members of the team to buy in to the idea and the process. It is crucial that the contractor fully understands the implications during tendering to ensure that warranties will be provided, risk pricing is minimised and lead times for materials sourcing factored in. This requires the client to be flexible.

Similarly the sub-contractors need an equal level of buy-in and they need to agree to work with any reclaimed materials provided.

Design: Using common sense is crucial when designing with reclaimed materials, through identifying realistic and achievable opportunities for a given project. Examples include designing to use reclaimed parquet flooring in the entrance lobby of a hotel, office or apartment building, or using structural steel for small and discrete areas of a project such as balconies.

12. See WRAP's procurement guidance for help in setting contract requirements: www.wrap.org.uk/construction

Designers and clients should investigate budget implications and cost-competitive options for reclaimed products early in the design stage.

Designers need to fix certain elements of the design early so that quantities can be estimated to allow longer lead times for material sourcing.

Designers should also consider designing for deconstruction or reclamation, for example using lime mortar for brick and blockwork (since the use of a high cement mortar will usually prevent the bricks' future reclamation), and bolting steel sections rather than welding them.

Specification: There are two routes:

1. The project reclamation target is built into all contracts. Contractors are given the flexibility to meet that target as they see fit. Performance specifications are written.
2. Reclaimed products are specified for certain elements.

Sensible, good quality workmanship is an obvious requirement for any successful project, but especially so with unusual building materials or reclaimed products. Reclaimed products can look and perform as well as new and often better than new, generally with minimal additional work. However, some products such as reclaimed timber flooring may require more skill to lay.

Lead time: Reclaimed materials cannot always be bought 'off-the-shelf'. For large quantities, longer procurement times are required or additional space must be found to store and accumulate materials as they become available. Lead times can be directly related to a demolition project programme.

Suppliers and supply chain: The UK reclamation industry, as it is, is well established and longstanding. In 1998 the total size of the reclaimed market, comprising salvaged materials, reclaimed materials and architectural antiques was £389million represented by businesses with an average sales turnover of £400,000¹³ and 40,000 employees.

Much of the reclamation industry is generally set up to meet the needs of homeowners and small to medium sized builders. Other market segments supply niche items such as portal frame buildings or reconditioned boilers. For medium to large scale projects, there is no established supply chain offering the level of service and reliability that contractors have come to expect. However the materials are there. Construction industry professionals innovate on a continual basis. There are no technical barriers to using reclaimed, and the successful use of reclaimed has been due to well managed processes, creativity and persistence.

It will be necessary for contractors to engage with additional new suppliers to source reclaimed materials. Reclaimed suppliers mainly supply locally. Many work together as a network, especially for larger orders. A national contractor may have to use different companies for each new project in a new area.

Clients and designers have the opportunity to influence the choice of suppliers through framework or preferred supplier arrangements and by nominating suppliers in a contract. Framework supply contracts could be developed for reclaimed product suppliers, similar to new materials.

Storage: To obtain large quantities of reclaimed materials can take months to build up stock, especially for large projects requiring large quantities of materials. Some reclamation yards may be able to store the materials prior to selling, others may not. Provision of space on site, or close to site, to store reclaimed materials as they become available will overcome this problem and enable storage of one-off reclaimed opportunities.

Health and safety: Issues around health and safety during reclamation have been touched on in the product pages. For projects reclaiming on site, health and safety considerations tend to discourage deconstruction. So for some materials, particularly construction materials, specialist reclaimers should be involved.

In most cases for installation of a reclaimed product, the health and safety considerations are the same for reclaimed products as they are for new.

Warranties, Insurance, Building Regulations and British Standards: Both the project team and the building owner will require that the equipment, components and materials used in the buildings have some sort of guarantee as to their performance, durability and quality. Reclaimed products will be required to conform to Building Regulations, British Standards and Agrément Certificates where appropriate, just like new materials and products. All items where possible should be bought within the current standards so that they can be readily accepted by clients and contractors. This can be achieved through a combination of design, good workmanship and off-site certification.

Most publicly funded work will require Collateral Warranties, so agreement to use reclaimed materials in place of new would have to be discussed and included in these documents.

Many insurance companies that provide cover for building developments recognize that reused goods and reclaimed materials can be used. In such cases it will be necessary to discuss proposals with the insurance company as early as possible. It is likely that insurance will be given as long as prior agreement has been obtained and appropriate and independent assessment and/or certification is provided.

Where to source reclaimed materials from

The following methods are most common for sourcing reclaimed materials:

- **On-site demolition:**¹⁴ On projects involving demolition, opportunities for on-site reuse of building materials should be considered. Reuse on site provides opportunities for cheap (or free) materials, and enables control of the supply of materials. Gauging external interest in on-site materials prior to demolition can be done via Salvo's demolition alert facility. To establish materials available on site, the client should commission a reclamation survey.¹⁵
- **On-site construction:** Over-ordered or unused materials on construction projects provide a significant resource¹⁶ of free materials, as well as an opportunity for contractors to save money through avoiding haulage and landfill taxes. WhatDoIDoWithThis.com has recently launched a new secure online stock sharing facility which allows large businesses with multiple sites to redistribute their reusable resources within their own company.
- **Reclamation outlets:** These are listed at the end of this guide; many are also web listed or listed on www.bremap.co.uk/bremap (and select 'reclaim and reuse').
- **On line:** Websites such as www.salvo.co.uk and www.ebay.co.uk list reclaimed products for sale; Salvo also lists wanted items.
- **Material Information Exchange websites:** These websites generally list low value and free items that would not be sold through Salvo or Ebay; national websites include www.whatdoidowiththis.com; www.salvomie.co.uk; www.eastex.org.uk; www.freecycle.org; www.architrader.com or local websites.

14. Further information on steps to achieving a reclamation led approach to demolition can be found at www.bioregional-reclaimed.com/Case%20study%20files/BRJuly07.pdf

15. BioRegional, BRE and Salvo all carry out these surveys; www.bioregional-reclaimed.com, www.bre.co.uk, www.salvo.co.uk

16. Estimates vary

- **Yellow Pages:** Local small reclamation outlets and demolition contractors that are not listed elsewhere can be found in the Yellow Pages or local directories.
- **Reclaimed materials trade association:** This organisation is in its infancy and to date has a steering committee with representatives from Mongers, Robert Mills Ltd, Lassco, Drew Pritchard Ltd and Masco. The trade association will represent companies who are dealing in or supplying reclaimed materials.

Many suppliers source new and reclaimed items from around the world and sell them side by side. It is important to specify UK or local origin to achieve environmental savings. Figure 8 shows the maximum distance a reclaimed material can be transported by road before it will have greater impact than a new material manufactured locally.

Material	Distance (miles)
Reclaimed tile	100
Reclaimed slate	300
Reclaimed bricks	250
Reclaimed timber	1,000
Reclaimed steel	2,500

Figure 8: Maximum transport distances for reclaimed materials.¹⁷



BedZed Development, Surrey.

Procurement guidance

Project Requirement: responsibility of all, and set by the Client

- To exceed a % reused and recycled content and adopt the top opportunities for good practice.

Client

- States in the initial **Project Brief** their intention to use a proportion of recovered materials (reused and recycled content, including site-won materials where appropriate). **Client** includes the Project Requirement at all stages of **project procurement**.
- Uses pre-qualification stage to check that the design team and contractor have the skills, experience and enthusiasm to use reclaimed materials.

Design Team

- Quantifies potential reused and recycled content and focuses attention on top opportunities for improvement.
- Investigates key materials available either on-site or from other reclaimed sources that can be incorporated into the design from the outset (as well as manufactured products with higher recycled content). Talks to reclamation yards and other local demolition projects to confirm availability, quality and cost.
- Where necessary, investigates and obtains quotes for any extra work to be carried out on the materials or any certification requirements such as structural certification.
- Fixes certain design details as early as possible to place orders for reclaimed materials.

Project Team (Client, Design Team, Contractors)

- Seeks advice from reclamation specialists where appropriate, including at **Outline** and **Detailed Design** stages and during construction.
- Engages with project insurers at Outline and Detailed Design stages to work through concerns about use of specific reclaimed components.
- Ensures all contracts and subcontracts specify **Project Requirement**; suggests ways to achieve that outcome, including potential suppliers, stress graders etc.
- Commissions a reclamation survey, at **Outline Design** stage, of any existing materials and structures on site.
- Ensures that the tender list for the demolition contract includes specialist reclaimers e.g. steel frame dismantlers or brick reclaimers, as appropriate.

Construction (or demolition) Management Team

- Specifies in demolition contract which materials are to be reclaimed for reuse on site. Also specifies maximum wastage levels and establishes inspection and audit trail for on-site materials.
- Responds to **Design/Project Brief and Invitation to Tender** with a proposal of how they intend to meet the **Project Requirement**.
- Establishes critical path for ordering reclaimed materials, allowing for longer lead times and audit trail.

Quick wins

The Quick Wins have been separated into three categories; reuse on site, most commonly traded and most cost effective.

Reuse on site

Where possible, reuse of demolition materials on site provides a quick win. The benefits include:

- control over supply;
- labour costs are controlled;
- availability is guaranteed;
- no haulage; and
- a chance to cut construction costs by using down-time and free materials; and by avoiding some waste management costs.

Most commonly traded

The most commonly available materials, both online and through reclamation outlets are listed below.

- bricks;
- roof tiles and slates;
- walling stone; and
- timber floorboards.

Some of these materials also achieve A+ rating from BRE's Green Guide to Specification.

Most cost effective

The following products offer a cost saving in terms of procurement cost of the materials:

- concrete paving;
- doors;
- timber joists and studwork;
- structural steel;
- portal frames and cladding;
- carpet; and
- reconditioned M&E.

Salvo

Salvo is the largest online directory of suppliers of architectural salvage and reclaimed building materials in the UK. Salvo can be used by traders, dealers, builders, construction professionals and individuals to place ads, find materials or find suppliers.

- SalvoWEB: www.salvo.co.uk
Contact lists, dealers, architectural and garden antiques, reclaimed building materials, higher value stock for sale and wanted.
- DIY Wants and Offers: www.wantsandoffers.co.uk
Free ads for people (not businesses) who want to buy or sell low value antique, reclaimed or salvage items.
- SalvoMIE: www.salvomie.co.uk
Encourages reuse of low value salvage by builders, construction professionals and industry. It can also be used by DIYers and trade dealers.



A traditional look can be achieved by using reclaimed materials

Reclaimed building products pages

This section provides a catalogue of Product Pages for 33 common reclaimed materials.

The following Table identifies these products and provides a summary of two key factors: cost and availability.

Key:

Cost

£- cost saving

£0 cost neutral

£+ cost premium

Availability

■■■ widely available

■■ some availability

■ difficult to find




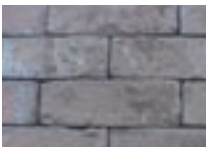



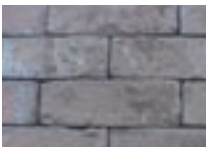



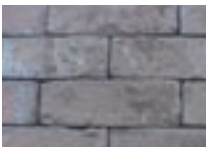
■ Widely available on demolition sites but rarely traded, these materials mostly go to landfill or recycling.

Material stream	Product	Cost	Availability	Available but rarely traded
Bricks	Bricks	£0 - £+	■■■	
Metals	Structural steel	£-	■■	
	Tubes, plates and bars	£-	■■	
	Metal cladding	£-	■■	
	Fencing	£-	■	■
Reuse of buildings	Steel portal frame buildings	£-	■■	
Roofing	Slates	£- - £+	■■	
	Hand made tiles	£0	■	
	Machine made tiles	£0	■■	
	Ridge tiles	£0	■	
	Concrete tiles	£-	■■■	■
Timber	Joists	£-	■■	■
	Beams	£+	■	
	Studwork	£- - £+	■■	■
	Timber floorboards	£0	■	
	Strip floor	£0	■■	
	Parquet floor	£0	■■	
	Timber street furniture	£- - £+	■■	
	Timber used in landscaping	£- - £+	■■	
	Doors	£-	■	■
	Period doors	£-	■■	
	Doors manufactured from reclaimed timber	-	■	
Stone	Granite setts	£+	■■	
	Sandstone setts	£0	■■	
	Yorkstone paving	£+	■■	
	Concrete paving	£-	■■	■
	Crazy paving	£-	■■■	
	Kerbs	£+	■■	
	Walling stone	£0	■■	
Internal and fit out	Carpet	£-	■■	■
	Furniture	£-	■■■	■
	Architectural salvage	£+	■■■	
	Mechanical & electrical items	£-	■■■	■

Reclaimed product costs supplied are quoted from suppliers and include the cost of careful removal and extraction of materials. Additional labour or prelim works associated with using reclaimed materials have not been included.

New product costs have been developed from market research and the generous help of Davis Langdon Cost Consultants.

All cost data are referenced to source and current in October 2007.

Bricks			
Materials stream:	Bricks.		
Product type:	Bricks.		
Applications:	<p>Most common: Traditionally, reclaimed bricks have been used for older or listed buildings where accurate matching is particularly important on extensions and repairs and for whole buildings in historic areas where older bricks are more in keeping.</p> <p>Other applications: Reclaimed bricks are available in sufficient quantities for building multiple houses. Mixed stock bricks can be used for garden walls as opposed to face work.</p>		
Description:	<p>The most common types of reclaimed brick are:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; vertical-align: top;"> <ul style="list-style-type: none"> Yellow Stock Multi Stocks Mixed Stocks Red Stocks Mixed (Pink) Gault Luton Red Pressed Red Soft Reds (Rubbers) Metric Yellow Dark Multi Stocks Plain Gault Staffordshire Blue Luton Grey Wire Cut Flettons (commons) Tudor Reds </td> <td style="width: 50%; vertical-align: top; padding-left: 20px;"> <ul style="list-style-type: none"> Yellow stock  Red stocks  Flettons  Staffordshire Blue  </td> </tr> </table>	<ul style="list-style-type: none"> Yellow Stock Multi Stocks Mixed Stocks Red Stocks Mixed (Pink) Gault Luton Red Pressed Red Soft Reds (Rubbers) Metric Yellow Dark Multi Stocks Plain Gault Staffordshire Blue Luton Grey Wire Cut Flettons (commons) Tudor Reds 	<ul style="list-style-type: none"> Yellow stock  Red stocks  Flettons  Staffordshire Blue 
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Bricks continued

Specification:	<p>Bricks vary in the clay types used and therefore colour depending on region. Most reclaimed bricks are approximately 9" (230mm) in length and 4.5" (110mm) in width. Height dimensions vary between 2" and 3". Typical heights quoted are: 2", 2^{5/8}", 2^{7/8}", 3", 3^{1/4}". This wide variety of sizes introduces problems in specification and use of reclaimed bricks.</p> <p>To enable future reuse of bricks, specifications should demand use of lime or low cement mortars.</p>
Current UK volume reclaimed:	<p>In 1998 the BigREc²⁶ survey showed that of the 2,500m bricks demolished each year, 147m are reclaimed i.e. 6%.</p>
Availability/supply constraints:	<p>Stock levels tend to be anywhere between 10,000 and 50,000 bricks on site depending on the supplier. For larger orders, suppliers need longer lead times to build up stocks.</p> <p>Southern Reclaim Brick Merchants, www.srbm.co.uk, sell 30,000 bricks per week or 1.5 million bricks per year and they sell bricks direct from demolition sites.</p> <p>Ecomerchant, www.ecomerchant.co.uk, had 14,000 bricks in stock on 12 September 2007.</p> <p>While the majority of suppliers source bricks from local demolition contractors, some have also received reclaimed European bricks. Reclamation from Europe introduces significant embodied CO₂ due to the long road haulage distances; procurers looking for the lowest environmental option should look to source local reclaimed bricks.</p>
Potential for reclamation and reuse on site:	<p>There are numerous examples where bricks have been reused on site. Brick walls bound with lime mortar (most commonly pre-1920's) can be deconstructed for reuse. Cement mortar walls are also possible to deconstruct but it depends on the condition of the mortar and the type of brick. There are numerous brick reclamation companies who can advise.</p>

Photos:



Reclaimed brick wall at Heritage Stone, Guisborough North Yorkshire



London Yellow Stock bricks on Ebay, £480 per 500



Staffordshire Blue Bricks on sale at www.source4you.co.uk



Staffordshire Blues and London Yellow Stock bricks due for reclamation on a London regeneration project

Structural steel	
Materials stream:	Metals.
Product type:	Structural steel.
Applications:	Most common: Structural applications such as beams, columns and lintels. Other applications: Universal beams used for edging and retaining walls.
Description:	Universal beams (UBs) and columns, hollow sections, parallel flange channels and other sections listed in the 'Handbook of Structural Steelwork', Steel Construction Institute. UBs available range from 152mm deep at >3m long to 533mm deep at >10m long. Section sizes outside this range are available but may require longer lead times and more of a search effort.
Materials used:	There are two types of 'reclaimed' structural steel available: 1. Second hand steel removed from a previous application for reuse. 2. Stock rusted steel; this is new steel that is either end of line, or steel that has rusted through being left outside.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed steel ²⁷ for new with 40% recycled content: 1.8kgCO ₂ /kg or 1,820kgCO ₂ /tonne. ¹⁹
Typical costs:	Second hand: £350 ²⁸ - £400²⁹/tonne. Stock rusted: £495 ²⁹ - £525³⁰/tonne.
Cost of new:	Typically £800/tonne³¹ or £818/tonne.³²
Cost commentary:	The scrap value of structural steel is typically £100 - £120/tonne; this can be sufficient to encourage demolition contractors to recycle steel rather than reclaim it.
Practice:	Reclaimed structural steel is a cost saving.
Guidance on key issues	
Certification/ accreditation:	Certification can be provided by structural engineers demonstrating that steelwork is capable of complying with the requirements of BS5950 and that the dimensional tolerances comply with BS EN 10034. Holes and fixings should be taken into account for fabrication and calculations. Collateral Warranties must allow for use of specified reclaimed components. ³³ If the material has a coating from its previous use, this can affect its ability to meet British Standards in its new application e.g. intumescent paint, galvanised finish.

27. Reclaimed steel sections are often oversized compared with new

28. Mann and Buck

29. Based on supply of 406 x 178 x 54 UB 5.5 - 10m long from www.ainscoughmetals.com

30. Based on supply of 305 x 305 x 158 UC 5 - 13m long from www.ainscoughmetals.com

31. www.goodsteel.co.uk

32. Spons 2008

33. Ellis & Moore Consulting Engineers

Structural steel continued

Specification:	Steel beams can be shot blasted to as good as new. Holes and plates are commonly visible, but can add character to the beam. Specifying a range of suitable section sizes, or a single section size with range of mass/metre will allow flexibility in sourcing reclaimed sections, but it is not essential.
Current UK volume reclaimed:	In 1998 the BigREc survey showed that 41,000 tonnes of structural steel are reused annually. The survey also showed that 129,000 tonnes of salvaged iron and steel end up being sent for recycling. The initial results of the 2007 BigREc survey show that the total tonnage reclaimed has declined since 1998.
Availability/supply constraints:	<p>Steel section availability is far better in North of England and Scotland than in Southern England and Wales. Most suppliers of reclaimed steel also supply stock rusted and new steel alongside their reclaimed products. To give examples of stock levels:</p> <ul style="list-style-type: none"> ■ EMR Ltd, www.emrltd.com sell 1,500 - 2,000 tonnes/month of structural steel and tubes, plates and bars. ■ Mann and Buck sell 3,000 tonnes/year with a typical lead time of 1 - 7 days. ■ The lead time to source 30 no. UBs 406 x 178 x 54, 5.5 - 10m was 6 - 8 weeks (June 2007) from Ainscough Metals, www.ainscoughmetals.co.uk. <p>Specification of a range of suitable section sizes will reduce the lead time and make sourcing easier.</p>
Potential for reclamation and reuse on site:	Structural steel can be dismantled. Bolted sections can be disassembled by unbolting, or else sections can be cut close to the connections to keep lengths as long as possible. Beams and columns can be extracted in this way but their value must outweigh the added deconstruction costs. Additional health and safety issues must also be considered when deconstructing.

Photos:



Reclaimed steel re-fabricated and reused at no extra cost saving 178 tonnes embodied CO₂



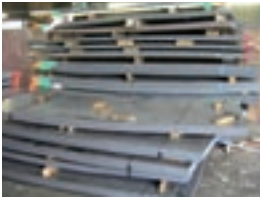


Section sizes up to 533mm deep at Ainscough Metals yard in Lancashire



Ellis & Moore structural certification - checking for straightness and dimensional tolerance



Reclaimed steel beams in Mann & Buck's yard in Birmingham




Tubes, plates and bars	
Materials stream:	Metals.
Product type:	Tubes, plates, purlins and bars.
Applications:	Handrails, decorative features, any other innovative methods of incorporating these materials into construction projects.
Description:	Metals are available in many forms and sizes of tubes, plates, welded hollow sections, seamless steel tubes, bright drawn steel, steel sheets and plates, oilfield casings/tubulars, line pipe, machined turned bars, metal axles. These products are rarely salvaged, however ex-stock and overordered materials are held in reprocessing and recycling yards and could be reused.
Materials used:	Steel.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed steel for new: 1.8kgCO ₂ /kg or 1,820kgCO ₂ /tonne. ¹⁹
Typical costs:	Cost is dependent on source of product; stock rusted material commands higher prices than second hand. ³⁴
Cost of new:	Varies on section size, length and quantity. Burbridge large traditional handrail 2400 x 68x 68 £13.64 each. ³⁵
Cost commentary:	The scrap value of structural steel is typically £100 - £120/tonne; this can be sufficient to encourage demolition contractors to recycle steel rather than reclaim it.
Practice:	No known examples.
Guidance on key issues	
Certification/ accreditation:	Handrails should meet both the requirements of the relevant British Standards and health and safety. Collateral Warranties must allow for use of specified reclaimed components. ³⁶ If the material has a coating from its previous use, this can affect its ability to meet British Standards in its new application e.g. intumescent paint, galvanised finish.
Specification:	Sizes and shapes vary. Specification should be flexible to enable successful reuse.
Current UK volume reclaimed:	Unknown.
Availability/supply constraints:	Scrap metal merchants such as EMR hold large stocks of rods, plates and tubes. Steel reclaimers often have sets of purlins, plates and tubes as ex-stock, over ordered stock or from deconstruction of steel buildings. Quantities are very variable. Project teams should visit suppliers to determine materials available and inspire reuse opportunities.
Potential for reclamation and reuse on site:	Reclamation on site can be simple and economic. Materials should be identified early for imaginative incorporation into the new build.
Photos:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Steel plate seconds</p> </div> <div style="text-align: center;">  <p>Steel rod seconds</p> </div> <div style="text-align: center;">  <p>Tubes</p> </div> </div>

34. www.emrltd.com35. www.trademate.co.uk

36. Ellis & Moore consulting Engineers

Metal cladding	
Materials stream:	Metals.
Product type:	Cladding.
Applications:	Most common: Cladding of buildings. Other applications: Roofing for agricultural buildings.
Description:	<p>Steel sheet cladding is either simple metal sheet, or a composite material sandwiching insulation material between sheets.</p> <p>There are two principal cladding assembly systems available; their use depends on building design:</p> <ul style="list-style-type: none"> ■ Unitized, panel or strong-back; and ■ On-site assembled or stick. <p>Both can be reused, although stick systems tend to be labour-intensive to dismantle.</p>
Materials used:	Metals, various insulation products.
Embodied CO₂ savings¹⁸:	Varies depending on materials.
Typical costs:	<p>Metal top sheets £1.50 - £4/m².³⁷</p> <p>Composite cladding panels £6 - 12/m².³⁷</p>
Cost of new:	<p>Portal frame cladding sheets £3 - £6/m².³⁷</p> <p>Composite cladding panels £18 - £21/m².³⁸</p>
Cost commentary:	Reclaimed sheet metal is predominantly used in agricultural applications, where lower quality cladding panels with attachment holes etc are a bonus. Due to the high cost of new composite cladding panels, these will offer a cost saving if reclaimed in good condition.
Practice:	Reclaimed sheet metal cladding and composite cladding is a cost saving.
Guidance on key issues	
Certification/ accreditation:	Design checks are critical as old cladding was often designed to a lower standard.
Specification:	In most cases it will be necessary to replace the fixings when re-using cladding.
Current UK volume reclaimed:	No available data.
Availability/supply constraints:	<p>Some stone, glazing and composite cladding systems are bespoke to a building – for these materials, supply would be project-specific.</p> <p>A1 steel buildings, www.a1steelbuildingsltd.co.uk, hold approximately 20 portal frame buildings with cladding in their yard (sheet metal and composite cladding panels). This cladding is sometimes sold with the building and sometimes sold separately. In addition to the cladding held in their yard, they sell cladding and buildings from standing.</p>
Potential for reclamation and reuse on site:	Reuse on site can be economic, and profitable depending on the fixings and access considerations. Where possible, refurbishment of existing cladding systems (rather than replacing them) should be considered.

37. www.portal-power.co.uk38. www.trademate.co.uk

Fencing	
Materials stream:	Metals.
Product type:	Fencing.
Applications:	Most common: Fencing.
Description:	There are two common types of reclaimed fencing: <ul style="list-style-type: none"> ■ Ornate, architectural fencing used for effect; and ■ Palisade style fencing used as a barrier.
Materials used:	Steel, iron.
Embodied CO₂ savings¹⁸:	Savings for steel: 1.82kgCO ₂ /kg ¹⁹ or approximately 6kgCO ₂ /m run.
Typical costs:	Reuse of palisade fencing on site, may require labour: material costs free . Loop top wrought iron railing 68cm high £33/m . ³⁹ Four bar wrought iron field railing 0.9m high £3.60/m . ²⁵
Cost of new:	Decorative garden railing 450mm high £25/m . ⁴⁰ Wrought iron railings 1m high flat top 12mm round bar railings £38.50/m . ⁴⁰ Palisade fencing £5/m . ⁴¹
Cost commentary:	Ornate fences vary in cost depending on style and material. Reclaimed palisade style fencing is not generally sold, but can be reused on site.
Practice:	Reuse of palisade fencing on site will achieve a cost saving . Reclaimed ornate fencing can be cost saving or a cost premium depending on style, material quantity required and availability.
Guidance on key issues	
Certification/ accreditation:	There is no certification or accreditation for reclaimed fences.
Specification:	Palisade style fencing panels are simple to deconstruct and can be reused with new fence posts.
Current UK volume reclaimed:	No data available.
Availability/supply constraints:	Large quantities widely available but not specifically advertised.
Potential for reclamation and reuse on site:	Palisade fencing can be reused on site to create construction compounds. If the existing posts are set in concrete, the panels can be reclaimed and fixed to new posts. Any fencing can easily be set aside for reuse or sent off site for a respray.
Photos:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Palisade fencing at Brent Cross Cricklewood</p> </div> <div style="text-align: center;">  <p>Fencing available in G O'Briens reclamation yard</p> </div> <div style="text-align: center;">  <p>Palisade fencing at Brent Cross Cricklewood</p> </div> </div>

39. www.salvo.co.uk

40. www.ebay.co.uk

41. Spons Landscaping 2007

Steel portal frame buildings	
Materials stream:	Metals.
Product type:	Steel portal frames.
Applications:	Most common: Portal frames reused as buildings such as factories, retail, warehouses, agricultural, equestrian, schools etc. Other applications: Individual beams can be reused separately.
Description:	Portal frame buildings are sold in two ways: 1. Only the structural steel members used to construct the portal frame, sold without cladding etc required to make a complete building. 2. Whole buildings can be reused including the frame, cladding and good quality roller shutter doors. Roof top sheets can only be reused for agricultural buildings; any other application will require a new top sheet. Roof lights must be new. Flashings, gutterings and cladding fixings are usually new.
Materials used:	Frame: Steel. Cladding: steel, aluminium, composite, fibreglass.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed steel for new: 1.82kgCO ₂ /kg. ¹⁹ Direct substitution of reclaimed aluminium for new: 8.53kgCO ₂ /kg. ¹⁹ Approximate savings for just the portal frame: 45kgCO ₂ /m ² floor area. Approximate savings for a complete reclaimed portal frame building: 100kgCO ₂ /m ² floor area.
Typical costs:	Structural steel frame £20 - £30/m² . ⁴² Portal frame building £270/m² including erection. ⁴²
Cost of new:	Structural steel frame only upwards £42/m² . ¹⁹ 70m ² uninsulated portal frame building £80 - £120/m² or insulated £120 - £190/m² including erection. ⁴³ 3 x 10m shed complete with cladding £67/m² including part erection. ⁴⁴
Cost commentary:	Groundworks and services costs are not included, these are very significant costs to constructing a building regardless of whether it is new or reclaimed.
Practice:	Specifying a reclaimed portal frame structure will achieve a cost saving whereas a reclaimed portal frame building, including cladding, services etc can be a cost saving or a cost premium depending on the age of the building and many other factors.

42. www.potal-power.co.uk43. www.3cb.co.uk44. www.leisurebuildings.com

Steel portal frame buildings continued

Guidance on key issues

Certification/ accreditation:	Portal frames are reused in a variety of applications listed above. Each of these of these applications has different building standards. Design checks are critical as old structures were designed to lower standards, particularly agricultural buildings.
Specification:	Portal frames are generally bespoke sizes. The design and specification for re-use will be dictated by the building availability. Flexibility in design will increase the chances of finding appropriate second hand buildings. Steel sections can be shot blasted and recoated to as good as new.
Current UK volume reclaimed:	No available data, however, it is estimated that there are currently somewhere between 10-30 companies in the UK deconstructing portal frame buildings.
Availability/supply constraints:	<p>Portal frame deconstruction firms operate throughout the UK. Buildings are stored in yards, however, where possible the deconstruction firms look to sell buildings that are standing as the buildings are more sellable and the handling costs are reduced. Approximately 50% of available buildings are supplied as whole buildings with cladding etc, 50% as portal frames.</p> <p>A1 Steel buildings, www.a1steelbuildingsltd.co.uk, tend to hold 20 - 25 buildings in their yard plus they continually advertise to sell buildings from standing.</p> <p>Portal Power, www.portal-power.co.uk, tend to hold 6 - 10 buildings in their yard and trade approximately 20 buildings per year. Most buildings that they deconstruct and sell are between 8,000ft² - 250,000ft² (720m² - 22,500m²).</p>
Potential for reclamation and reuse on site:	Reuse on site is possible, either a new application for the existing building or relocation on site. Specialist portal frame reclaimers can advise.

Photos:



Portal frame building from Reid Reclamation





Portal frame building for sale at £2.50/ft² (£28/m²) on www.salvo.co.uk



Reclaimed 472' building for sale, on www.salvo.co.uk





Portal frame building due to be reclaimed by Portal Power on a London regeneration project

Slates	
Materials stream:	Roofing materials.
Product type:	Slates.
Applications:	Most common: Used on roofs.
Description:	Rectangular roof slates available in a variety of imperial sizes from 13" x 10" (33 x 25cm) up to 24" x 14" (61 x 35cm).
Materials used:	Slate from local slate mines.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed slate for new: 0.05kgCO ₂ /kg. ¹⁹ Approximate savings per m ² : ⁴⁵ 0.9kgCO ₂ /m ² and for 1000 tiles: 58kgCO ₂ .
Typical costs:	£1 - £2.50/slate. ⁴⁶
Cost of new:	400 x 200mm Welsh slate £1.15/slate. ⁴⁷ 600 x 300mm Welsh slate £5.85/slate. ⁴⁷ 400 x 200mm Spanish slate £0.89/slate. ⁴⁸ 600 x 300mm Chinese slate £2.19/slate. ⁴⁸
Cost commentary:	Slates costing £2-£2.50 are generally larger slates and those that are in good condition without defects. Lower cost slates are smaller ones. New Welsh and Vermont slate are the highest quality new slates available, other slates such as Estillo, Franvisa are lower quality and therefore lower cost than Welsh slate. Most reclaimed slates available are high quality Welsh slate. ⁴⁷
Practice:	Use of reclaimed Welsh roof slates is generally a cost saving compared with new Welsh slates. These slates are a cost premium compared with new lower quality slates.
Photos:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Welsh Slate at Cleveland Roofing Centre</p> </div> <div style="text-align: center;">  <p>Welsh Slate available at Romsey Reclamation</p> </div> </div>


45. Assuming 400 x 600mm tiles with 25% overlap

46. www.g-obrien.co.uk47. www.slate.uk.com48. www.trademate.co.uk

Hand made tiles	
Materials stream:	Roofing materials.
Product type:	Hand made tiles.
Applications:	Most common: Roofs. Other applications: Ornamental or habitat features in gardens.
Description:	Hand made tiles were produced by hand in a wooden mould and are usually cambered and vary in size, shape and colour.
Materials used:	Generally made from local clays, there is generally a predominant colour and style to a local area.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed clay tiles for new: 0.43kgCO ₂ /kg. ¹⁹ Approximate savings per m ² ⁴⁹ : 9kgCO ₂ /m ² and for 1000 tiles: 1,050kgCO ₂ .
Typical costs:	£0.65⁵⁰ - £0.85⁵¹/tile.
Cost of new:	250 x 150 Kent peg tile £0.65/tile. ⁵²
Cost commentary:	Costs of tile depends on style, location and availability e.g. handmade peg tiles are available in Dorset and Kent and Coalville handmade and Red handmade are available in Staffordshire.
Practice:	Use of handmade clay tiles is cost neutral.
Photos:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Handmade Warwickshire tiles</p> </div> <div style="text-align: center;">  <p>Handmade roof tiles on sale on Ebay for £380/1000</p> </div> </div>

49. Assuming 400 x 600mm tiles with 25% overlap

50. www.g-obrien.co.uk51. www.slate.uk.com52. www.trademate.co.uk

Machine made tiles	
Materials stream:	Roofing materials.
Product type:	Machine made tiles.
Applications:	Most common: Roofs. Other applications: Floor tiles, ornamental or habitat features in gardens.
Description:	Rectangular clay tiles produced by machine. These tiles are available in a range of colours and sizes and are generally more regular than hand made tiles. Availability of machine made tiles is not dependent on location.
Materials used:	Generally clay.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed clay tiles for new: 0.43kgCO ₂ /kg. ¹⁹ Approximate savings per m ² : ⁵³ 9kgCO ₂ /m ² and for 1000 tiles: 1,050kgCO ₂ .
Typical costs:	£0.27 - £0.60/tile.
Cost of new:	Redland Rosemary clay plain roofing tile red £0.62/tile. ⁵⁵ Marley modern roofing tile smooth grey £2.02/tile. ⁵⁵ Clay roofing tile £0.29/tile. ⁵⁶ Modern grey roofing tile £0.76/tile. ⁵⁶
Cost commentary:	Chipped, discoloured tiles are typically cheaper.
Practice:	Use of reclaimed ridge tiles can be cost neutral.
Photos:	 <p>Machine made tiles available at Cleveland roofing centre</p>


53. Assuming 400 x 300mm tiles with 25% overlap

54. Prices from www.cawardenreclaim.co.uk, www.silversreclamation.com and www.burgessandsons.com55. www.trademate.co.uk

56. Spens 2008

Ridge tiles	
Materials stream:	Roofing materials.
Product type:	Ridge tiles.
Applications:	Most common: Roofs. Other applications: Ornamental or habitat features in gardens.
Description:	Ridge tiles are used on the ridge of a pitched roof, these include ornamental end units and interlocking units across the ridge. Both handmade and machine made ridge tiles are available.
Materials used:	Mainly clay, some available in concrete.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed clay tiles for new: 0.43kgCO ₂ /kg. ¹⁹ Direct substitution of reclaimed concrete tiles for new: 0.215kgCO ₂ /kg. ¹⁹
Typical costs:	Ridge tiles: £2.25 - £5.00/tile. ⁵⁷
Cost of new:	Marley standard fittings modern ridge smooth grey £8.72/tile. ⁵⁸ Spons 2008 price for ridge tiles £2.99 - £3.50/tile.
Cost commentary:	Chipped, discoloured tiles are typically cheaper.
Practice:	Use of reclaimed ridge tiles can be cost neutral.

57. www.dorsetreclamation.co.uk58. www.trademate.co.uk

Concrete tiles	
Materials stream:	Roofing materials.
Product type:	Concrete tiles.
Applications:	Most common: Roofs. Other applications: Ornamental or habitat features in gardens.
Description:	Rectangular concrete roof tiles are available in a variety of sizes.
Materials used:	Concrete.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed concrete tiles for new: 0.2kgCO ₂ /kg. ¹⁹ Approximate savings per m ² : ⁵⁹ 8kgCO ₂ /m ² and for 1000 tiles: 930kgCO ₂ .
Typical costs:	£0.15 - £0.20/tile. ⁶⁰
Cost of new:	Russell concrete roof double roman tile £1.24/tile. ⁶¹ Spons 2008 price £0.74/tile.
Cost commentary:	Reclaimed concrete roof tiles have very little variation in cost, size does not influence the cost. These tiles are not specific to a local area, they are available throughout the country.
Practice:	Reuse of concrete roof tiles can be achieved at a cost saving.
Photos:	 <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;"> <p>Reclaimed concrete tiles available at G O'Briens</p> </div> <div style="text-align: center;"> <p>Reclaimed concrete Redland Delta tiles from www.roofpiles.co.uk</p> </div> <div style="text-align: center;"> <p>Reclaimed concrete tiles – Redland Stonewold from www.roofpiles.co.uk</p> </div> </div>

59. Assuming 400 x 300mm tiles with 25% overlap

60. www.reclaimedbricksandtiles.com and www.burgessandsons.com61. www.trademate.co.uk

Roofing materials	
Guidance on key issues	
Certification/ accreditation:	Reclaimed slates and clay tiles (machine or hand made) achieve A+ rating from BRE's Green Guide to Housing Specification, and maximum points on the Code for Sustainable Homes. Suppliers provide information on provenance; some provide satisfaction/quality guarantees. Generally there is no certification or accreditation and suppliers are not asked for this.
Specification:	Specification should be flexible with regard to size and colour of tile or slate.
Current UK volume reclaimed:	The 1998 Big REc survey indicated that 174m tiles and slates are sold each year. However, the preliminary results from the 2007 survey indicate that over the last 10 years there has been a significant decline in trading of reclaimed tiles and slates, with number of businesses trading down from 710 to 310.
Availability/supply constraints:	<p>Annual volume per supplier ranges from 6,000 to 1,000,000 tiles.</p> <p>Cawarden Brick & Tile Co. Ltd, www.cawardenreclaim.co.uk, sell approximately 20,000/week or 1 million/year.</p> <p>Aspect Roofing, www.aspectroofing.co.uk, sell approximately 6 - 700,000/year.</p> <p>Skyline Roofing, www.skylineroofing.co.uk, sell approximately 500,000/year.</p> <p>According to the 1998 Big REc survey, the average stock for tile and slate dealers was 58,000 tiles.</p> <p>Traditionally the majority of tiles and slates were produced and used locally.</p> <p>Slates are generally only found in the large slate-producing areas of the UK e.g. North Wales and North England.</p> <p>Handmade tiles and natural stone are specific to a local region and generally only found in that region.</p> <p>Machine made clay and concrete tiles are found across the UK, as they are more modern than hand made tiles.</p> <p>Many suppliers of reclaimed tiles and slates also supply new tiles and slates alongside their reclaimed products. These businesses tend to have lead times of 1 - 7 days for reclaimed tiles and slates.</p> <p>MASCo, www.catbrain.com, supply natural Cotswold stone tiles with a typical lead time of 1 - 3 months.</p>
Potential for reclamation and reuse on site:	Slates and tiles are very simple and economic to remove and stack. They can be stored efficiently and neatly in easily moveable crates.

Timber beams	
Materials stream:	Timber.
Product type:	Beams.
Applications:	Most common: Structural beams, non-structural cladding of RSJs. Other applications: Fireplace lintels, garden furniture, embankments etc.
Description:	Beams available vary in size from 6" x 6" (150mm x 150mm) up to 18" x 18" (450 x 450mm).
Materials used:	Most timber beams available in the UK are oak. Occasionally pine, elm or teak are available.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed timber for new: 0.5kgCO ₂ /kg ¹⁹ or 225kgCO ₂ /m ³ .
Typical costs:	Oak £25 - 35/ft ³ or £890 - £1250/m³ . ⁶² Pine £20 - 25/ft ³ or £710 - £890/m³ . ⁶²
Cost of new:	Fresh sawn £780/m³ . ⁶³ Air dried £1170/m³ . ⁶³ Spons 2008 prices for Sapele £836/m³ and for softwood £293/m³ .
Cost commentary:	Lower cost oak beams are available from material exchange websites such as www.salvomie.co.uk . Reclamation outlets charge higher costs.
Practice:	Reclaimed beams are a cost premium , it is often better quality timber.
Guidance on key issues	
Certification/ accreditation:	Visual strength grading can be done to establish grade, disease, infestation and straightness.
Specification:	Flexibility in size and species will enable a design to be achieved using reclaimed. In some cases a smaller beam in a hardwood will meet the structural requirements of a larger beam in softwood. Different species and ages of wood will influence the colour of the reclaimed timber. Reclaimed beams are available in a variety of lengths, longer lengths are harder to source. Strength and species grading will provide a grade that can be used in design.
Current UK volume reclaimed:	The 1998 BigREc survey indicated that annual sales of reclaimed timber beams, which includes beams, joists, trusses, planks, sleepers and baulks totalled £42m divided between 51% softwood, 38% native hardwood (mainly oak) and 11% tropical hardwoods. The initial 2007 results show that the total tonnage is up as well as the total number of businesses trading these materials (from 670 to 860).
Availability/supply constraints:	Reclamation outlets generally hold large stocks of beams and would be able to meet most small to medium sized orders immediately. Very large orders would take time to source the beams, depending on availability. Oak Beam UK, www.oakbeamuk.com hold 3,000 beams in their yard. Many oak beams available in the UK are sourced from France.
Potential for reclamation and reuse on site	Timber joists, beams and studwork can all be salvaged without specialist labour. Denailing activities do have a small space requirement but can be carried out at quiet times. Strength grading, if necessary, requires a specialist or else an engineer on the project team can undertake a stress graders' course with TRADA.
Photos:	 <p>Oak beams available from www.oakbeamuk.com Internal wooden beams prior to deconstruction</p>

62. www.oakbeamuk.com, www.salvo.co.uk63. www.ternex.co.uk based on a 10" x 10" beam 4m long

Timber joists	
Materials stream:	Timber.
Product type:	Joists.
Applications:	Most common: Suspended floors, purlins, other structural applications. Other applications: Lintels, non structural applications and garden applications such as furniture.
Description:	Timber joists are available in most standard imperial sizes i.e. 4" x 4" (100 x 100mm) up to 9" x 6" (225 x 150mm), used for horizontal supporting members from wall to wall, wall to beam or beam to beam, to support a ceiling, roof or floor.
Materials used:	Most common: Pine, pitch pine, jarrah and oak, other timber species are available, though less common.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed timber for new: 0.5kgCO ₂ /kg. ¹⁹ Approximate savings per m ³ are 225kgCO ₂ /m ³ Savings for 1,000m of 9" x 2" (228 x 50mm) are 2,500kgCO ₂ .
Typical costs:	£0.30/m - £2.60/m. ⁶⁴
Cost of new:	Dry graded C16 reg treated 47x150 £2.79/m ⁶⁵ or £1.84/m. ⁶⁶ Dry graded C16 reg 47 x 225 £3.67/m ⁶⁵ or £3.28/m. ⁶⁶
Cost commentary:	<ul style="list-style-type: none"> ■ Low cost timber (i.e. £0.30/m) available in varying lengths from small yards or private sales or bought from demolition site or reclaimed on site. ■ Most low cost reclaimed timber is cheap pine. ■ High cost timber (i.e. £2.60/m) tends to be larger orders from reclamation outlet, milled to size specially.
Practice:	Reclaimed timber joists are generally a cost saving , it is often better quality timber.
Guidance on key issues	
Certification/ accreditation:	Visual strength grading can be done to establish grade, disease and straightness; 100 no. 3m lengths could be strength graded in 1 person day. Species should be checked to see that it is suitable for a particular use.
Specification:	Flexibility in size and species will enable a design to be achieved using reclaimed. In some cases a smaller beam in a hardwood will meet the structural requirements of a larger beam in softwood. Different species and ages of wood will influence the colour of the reclaimed timber. Reclaimed joists are available in a variety of lengths, longer lengths are harder to source. Strength grading will provide a grade that can be used in design.
Current UK volume reclaimed:	The 1998 BigREc survey indicated that annual sales of reclaimed timber beams, which includes beams, joists, trusses, planks, sleepers and baulks totalled £42m divided between 51% softwood, 38% native hardwood (mainly oak) and 11% tropical hardwoods. The initial 2007 results show that the total tonnage is up as well as the total number of businesses trading these materials (from 670 to 860).
Availability/supply constraints:	Joists are available in salvage yards or direct from demolition sites in large quantities. For example, Reclaimed Timber, www.reclaimed.uk.com have a 1,600m ² warehouse which is filled with artic loads of timber from demolition jobs. Once this material is processed and sold they will refill their supply; they are generally able to supply within a week. Much of the oak available in the UK is sourced from France, this increases the embodied CO ₂ of the reclaimed material due to the long haulage distance.
Potential for reclamation and reuse on site:	Timber joists, beams and studwork can all be salvaged without specialist labour. Denailing activities do have a small space requirement but can be carried out at quiet times. Strength grading, if necessary, requires a specialist or else an engineer on the project team can undertake a stress graders' course with TRADA.

64. Prices from www.radnedge-arch-antiques.co.uk; www.salvo.co.uk; Reclaimed Building Materials in the development of the Thames Gateway, N Lazarus and R Hillary, January 2006. Prices for a variety of joist sizes including 8" x 2", 4" x 3", 5" x 2" etc

65. www.trademate.co.uk

66. Spons 2008

Timber studwork	
Materials stream:	Timber.
Product type:	Studwork.
Applications:	Most common: Studwork. Other applications: Purlins.
Description:	Studwork is commonly 50 x 100mm timber, lengths between 2.4 - 3m. There are two methods of obtaining the correct sized studwork: <ul style="list-style-type: none"> ■ Milling larger joists or beams to size; and ■ Obtaining the correct size from demolition projects.
Materials used:	Softwood, most commonly pine.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed timber studwork for new: 0.5kgCO ₂ /kg. ¹⁹ Saving through using timber studwork rather than aluminium studwork: 8.53kgCO ₂ /kg. ¹⁹
Typical costs:	£0.80 - £2/m⁶⁷ for 50 x 100mm.
Cost of new:	Dry graded C16 reg treated 47 x 150 £2.79/m⁶⁸ 50 x 150mm, 3m length £0.81/m.⁶⁹ Spons 2008 price for 50 x 150mm £1.28 - £1.80/m.
Cost commentary:	<ul style="list-style-type: none"> ■ Studwork sourced from not for profit organisations, such as the National Community Wood Recycling Project, www.communitywoodrecycling.org.uk, is lowest cost, these organisations tend to hold small stocks. ■ Studwork that requires cutting large joists down to the correct size is the highest cost (i.e. £2/m), especially if there is significant wastage involved. ■ Studwork available from demolition projects of the correct size (e.g. roof joists) requires the least labour input and is approximately £1.20/m.
Practice:	<p>Cost Saving for small projects.</p> <p>Cost Neutral for medium projects.</p> <p>Cost Premium for large projects, relative to negotiated trade prices.</p>
Guidance on key issues	
Certification/ accreditation:	Visual strength grading can be done to establish grade, disease and straightness; 100 no. 3m lengths could be strength graded in 1 person day. Studwork can have both structural and non-structural applications depending on the location within a building and what it is supporting. Moisture content of studwork is important for use inside buildings, this can be measured during the strength grading process.

67. www.communitywoodrecycling.org.uk, www.trunkreclaimed.co.uk, www.ashwellrecycling.com68. www.trademate.co.uk

69. Trade price for supply of 56km

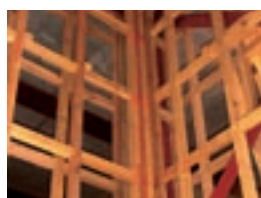
Timber studwork continued

Specification:	Flexibility in specification is crucial; for example, it may be simpler to source 62.5 x 87.5mm timber rather than 50 x 100mm if larger joists are being cut down to size. Designers should establish the optimum length for supply of studwork and ensure that the floor to ceiling height is designed around this length. Generally reclamation outlets prefer to supply 2.4 - 2.8m lengths, rather than 4m lengths as the shorter lengths are easier to source. Studwork is a non-visible element of construction so appearance does not matter. Reclamation outlets supply studwork denailed.
Current UK volume reclaimed:	The 1998 BigREc survey has a classification of 'salvaged timber' which includes "softwood studding, modern staircases, mouldings, thinnings, scrap timber and cheap modern furniture". It is estimated that 336,000 tonnes was salvaged for re-use and that 779,000 tonnes of salvageable wood was not salvaged, i.e. 30% of the salvageable wood available was salvaged. The initial 2007 results show that the tonnage has significantly fallen over the last 10 years.
Availability/supply constraints:	For large jobs (10's of kms) studwork is likely to be sourced from a variety of demolition projects, even if it is delivered through a single yard, hence there will be differences in the colour, size etc of the timber.
Potential for reclamation and reuse on site:	Timber joists, beams and studwork can all be salvaged without specialist labour. Denailing activities do have a small space requirement but can be carried out at quiet times. Strength grading, if necessary, requires a specialist or else an engineer on the project team can undertake a stress graders' course with TRADA.

Photos:



Reclaimed timber studwork delivered to site



54km of reclaimed timber studwork were used on the BedZED project in South London

Timber floorboards	
Materials stream:	Timber.
Product type:	Timber floorboards.
Applications:	Most common: Floors. Other applications: Ceilings, interior cupboards, shelves, radiator covers etc.
Description:	<p>There are two main types of reclaimed flooring:</p> <ul style="list-style-type: none"> ■ re-sawn and re-milled joists, beams and flooring; and ■ flooring lifted and directly reused. <p>Boards are typically 5 - 7" wide, although wider boards up to 12" can be found. Lengths vary. There are two main construction methods:</p> <ul style="list-style-type: none"> ■ Square edged boards – often have one bevelled edge; and ■ Tongue and groove (T&G) boards. <p>Reclaimed T&G can be difficult to re-lay without introducing trip hazards as the old boards will have some warping. It is possible to cut the tongues off to create square edged boards.</p>
Materials used:	Predominantly oak and pine, although jarrah, elm and maple are available.
Embodied CO₂ savings¹⁸:	<p>Direct substitution of reclaimed timber for new: 0.5kgCO₂/kg.¹⁹</p> <p>For hardwood boards, savings of 7.2kgCO₂/m².⁷⁰</p> <p>For softwood boards, savings of 4.3kgCO₂/m².⁷⁰</p>
Typical costs:	Pine floorboards £16 - £45/m² ⁷¹ Oak floorboards £25 - £250/m² ⁷¹ Elm floorboards £300/m² . ⁷¹
Cost of new:	Pine floorboards £10 - £60/m² ⁷² Oak floorboards £25 - £300/m² . ⁷²
Cost commentary:	<ul style="list-style-type: none"> ■ Cost is determined by availability, pine is the most widely available. ■ The typical costs listed are representative of private sales and retailed from reclamation outlets. ■ Timber floorboards reclaimed directly from a demolition site are generally not the re-sawn re-milled joist variety. ■ In a re-development project it may be possible to source reclaimed floorboards from the demolition phase of the work, at very low cost. ■ Laying t&g flooring is a more labour intensive process than laying square edged flooring as tongues and grooves become misshapen over time.
Practice:	Using reclaimed timber floorboards can be cost neutral .

70. Based on 19mm thick floorboards, strip or parquet

71. www.radnedge-arch-antiques.co.uk, www.floorsanddecking.com, www.reclaimed.uk.com, www.salvo.co.uk

72. www.naturalwoodfloor.co.uk

Timber floorboards continued

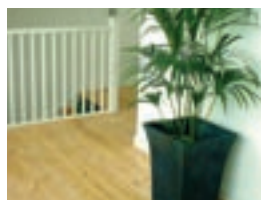
Guidance on key issues

Certification/ accreditation:	Reclaimed timber floorboards achieve A+ rating from the Green Guide to Housing Specification, and maximum points on the Code for Sustainable Homes.
Specification:	Milled joist flooring can be produced with or without knots and nail holes. Directly reused floorboards are likely to have paint or varnish on one side. They may contain knots and nail holes. Species and age of wood will influence the colour of the reclaimed timber. Reclaimed floorboards are available in a variety of lengths, shorter lengths tend to be easier to source.
Current UK volume reclaimed:	The 1998 BigREc survey category for reclaimed flooring includes floorboards, woodblock, wood strip floors and beams resawn for flooring. The total reclaimed was 10.3m yd ² (8.6m m ²), 24% of this is flooring converted from old beams or roof boards. The average sales of a reclaimed flooring dealer were 280yd ² /week (234m ² /week). The initial 2007 results show the total square metres traded have significantly reduced over the last 10 years and the number of traders has reduced from 690 to 470.
Availability/supply constraints:	Suppliers are widespread throughout the country. For small orders (100's m ²) most suppliers could respond in a couple of days. For large orders (1,000's m ²) most suppliers could respond in 2 - 4 weeks. ATC Monmouthshire Ltd, www.floorsanddecking.com , have an annual throughput of £300k from a 325m ² yard, the typical lead time for most orders is 1 month. Reclaimed timber suppliers generally look to source most of their materials locally. A significant quantity of the oak available on the market is French. There are suppliers who source timber from around the world. As customers it is crucial to establish where the material has been supplied from, as many suppliers sell all their floorboards side by side.
Potential for reclamation and reuse on site:	Timber floorboards are likely to be available in redevelopment of Victorian warehouses/ industrial units and housing. Reclaiming timber floorboards is simple and economic but should be done with care to reduce wastage and to avoid damage to tongue and groove. Square edge boards can be lifted very easily with a crowbar. Specialist timber reclaimers will work faster and produce less wastage.

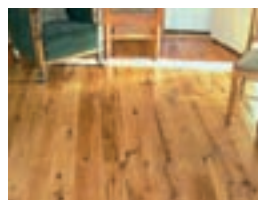
Photos:



Reclaimed hemlock floorboards



Mezzanine floor



Reclaimed oak floor, credit Victorian Woodworks

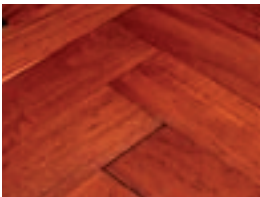



Victorian pine joists being milled into floorboards

Timber strip flooring	
Materials stream:	Timber.
Product type:	Strip flooring.
Applications:	Most common: Floors. Other applications: Ceilings, interior cupboards, shelves, radiator covers etc.
Description:	There are two main types of reclaimed flooring: <ul style="list-style-type: none"> ■ re-sawn and re-milled joists, beams and flooring; and ■ flooring lifted and directly reused. Strip flooring is typically 2 - 3" (50 - 75mm) wide, lengths vary. Most strip flooring available is tongue and groove.
Materials used:	Predominantly oak and pine, although jarrah, elm and maple are available.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed timber for new: 0.5kgCO ₂ /kg. ¹⁹ For hardwood boards, savings of 7.2kgCO ₂ /m ² . ⁷³ For softwood boards, savings of 4.3kgCO ₂ /m ² . ⁷³
Typical costs:	£10 - 25/m². ⁷⁴
Cost of new:	£10 - 40/m². ⁷⁵
Cost commentary:	The cost of reclaimed strip flooring does not depend on the species of timber, the cost of new does.
Practice:	Using reclaimed timber strip flooring can be cost neutral .
Guidance on key issues	
Certification/ accreditation:	Reclaimed timber floorboards achieve A+ rating from the Green Guide to Housing Specification, and maximum points on the Code for Sustainable Homes.
Specification:	Milled joist flooring can be produced with or without knots and nail holes. Directly reused floorboards are likely to have paint or varnish on one side. They may contain knots and nail holes. Species and age of wood will influence the colour of the reclaimed timber. Reclaimed floorboards are available in a variety of lengths, shorter lengths tend to be easier to source.
Current UK volume reclaimed:	The 1998 BigREc survey category for reclaimed flooring includes floorboards, woodblock, wood strip floors and beams resawn for flooring. The total reclaimed was 10.3m yd ² (8.6m m ²), 24% of this is flooring converted from old beams or roof boards. The average sales of a reclaimed flooring dealer were 280yd ² /week (234m ² /week). The initial 2007 results show the total square metres traded have significantly reduced over the last 10 years and the number of traders has reduced from 690 to 470.
Availability/supply constraints:	Suppliers are widespread throughout the country. For small orders (100's m ²) most suppliers could respond in a couple of days. For large orders (1,000's m ²) most suppliers could respond in 2 - 4 weeks. LASSCO, www.lassco.co.uk , source local, national and international reclaimed timber from demolition and building sites and from the general public (mainly via their website). They sell a few thousand m ² of timber flooring annually with lead time from 1 day - 6 months. Reclaimed timber suppliers generally look to source most of their materials locally. A significant quantity of the oak available on the market is French. There are suppliers who source timber from around the world. As customers, it is crucial to establish where the material has been supplied from – as many suppliers sell all their floorboards side by side.
Potential for reclamation and reuse on site:	Timber strip flooring is likely to be available in redevelopment of Victorian warehouses/ industrial units and housing. Strip flooring needs to be taken up with care to avoid damage to tongue and grooves. Specialist timber reclaimers will work faster and produce less wastage.

73. Based on 19mm thick floorboards, strip or parquet




74. www.radnedge-arch-antiques.co.uk, www.floorsanddecking.com, www.reclaimed.uk.com, www.salvo.co.uk75. www.naturalwoodfloor.co.uk

Timber parquet (or block) flooring	
Materials stream:	Timber.
Product type:	Parquet (or block) flooring.
Applications:	Most common: Floors. Other applications: No known other applications.
Description:	Parquet (or block) flooring is small blocks of timber, typically 230mm x 70mm x 15 - 20mm. Blocks are laid to form patterns on the floor.
Materials used:	Predominantly oak and pine.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed timber for new: 0.5kgCO ₂ /kg. ¹⁹ For hardwood boards, savings of 7.2kgCO ₂ /m ² . ⁷⁶ For softwood boards, savings of 4.3kgCO ₂ /m ² . ⁷⁶
Typical costs:	£20 - £30/m². ⁷⁷
Cost of new:	230 x 70 x 20mm maple prime block unfinished £29.95/m². ⁷⁸ 230 x 70 x 15mm Merbau block unfinished £16.95/m². ⁷⁸
Cost commentary:	The cost of reclaimed block flooring does not depend on the species of timber, but the cost of new flooring does.
Practice:	Using reclaimed timber parquet flooring can be cost neutral .
Guidance on key issues	
Certification/ accreditation:	Visual inspection will establish disease or contamination with bitumen or paint.
Specification:	Colours vary depending on the species of timber. Block flooring was often laid with bitumen backing, this bitumen can sometimes contaminate the reclaimed block flooring and make it hard to re-lay. Most reclamation outlets will remove the majority of the bitumen prior to sale.
Current UK volume reclaimed:	The 1998 BigREc survey category for reclaimed flooring includes floorboards, woodblock, wood strip floors and beams resawn for flooring. The total reclaimed was 10.3m yd ² (8.6m ²), 24% of this is flooring converted from old beams or roof boards. The average sales of a reclaimed flooring dealer were 280yd ² /week (234m ² /week). The initial 2007 results show the total square metres traded have significantly reduced over the last 10 years and the number of traders has reduced from 690 to 470.
Availability/supply constraints:	Block flooring can be labour intensive to clean, therefore it is not as widely traded as timber floorboards. Procurement of a large quantity (1,000's m ²) of a single colour of block flooring will take longer to source as it is unlikely to be held in stock. Allowing slight variations in colour across the floor will reduce the time taken to source. For small quantities (10's m ²), there is a wide coverage of suppliers across the UK who stock block flooring. Many suppliers source new and reclaimed parquet from around the world and sell them side by side. It is important to specify UK or French origin. Any reclaimed timber that has travelled over 1,000 miles has not made an environmental saving. ⁷⁹
Potential for reclamation and reuse on site:	Block flooring can be easily lifted if not fixed with concrete. Cleaning the undersides can be time consuming but is not always necessary. Timber reclaimers can advise. If resanding is necessary, this can be done more quickly after relaying, with an industrial sander.
Photos:	  <p>Rhodesian teak parquet</p> <p>Panga parquet available from Victorian Woodworks</p>




76. Based on 19mm thick floorboards, strip or parquet

77. www.radnedge-arch-antiques.co.uk, www.floorsanddecking.com and www.salvo.co.uk78. www.hardwoodfloorstore.co.uk

79. BRE Green Guide to Housing Specification

Timber street furniture	
Materials stream:	Timber.
Product type:	Timber street furniture.
Applications:	Bollards, benches, picnic tables, telegraph poles.
Description:	Timber used for street furniture.
Materials used:	Untreated timber sleepers, telegraph poles, joists, beams, off cuts.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed timber for new: 0.5kgCO ₂ /kg or 225kgCO ₂ /m ³ . ¹⁹ Savings from substitution of reclaimed timber for plastics: 2.5 kgCO ₂ /kg. ¹⁹ Savings from substitution of reclaimed timber for steel: 1.8kgCO ₂ /kg. ¹⁹
Typical costs:	150 x 150 x1500mm greenheart bollard £85 each (with quantity discounts). ⁸⁰ Benches made from 350 x 350 x 3000mm piles on 100mm feet £480 each . ⁸⁰ Hardwood flat top tree trunk benches £350 each . ⁸⁰
Cost of new:	Heritage Eco Bollard 150 £115/each . ⁸¹
Cost commentary:	<ul style="list-style-type: none"> ■ Low cost: could be put together for free from off cuts. ■ Medium cost: reclamation outlets supply sleepers, beams etc that could be created into finished product on site. ■ High cost: Reclamation outlets supply manufactured products such as bollards, benches and picnic tables.
Practice:	Cost saving or cost premium depending on application and source.
Guidance on key issues	
Certification/ accreditation:	Strength grading generally not required for these applications. Infestation can be assessed visually or by a grader.
Specification:	Flexibility and creative design will enable interesting end uses for random pieces of timber.
Current UK volume reclaimed:	No data available.
Availability/supply constraints:	Manufactured items from reclamation outlets may be subject to supply constraints due to availability of timber. Items are often made bespoke. Ashwells Recycled Timber Products Ltd had in stock 9 October 2007 600m ³ of hardwood and 200m ³ of softwood including flooring, joists and 300 x 300 baulk timbers, enough to make 12,000 bollards or 1,200 benches. Trackwork, www.trackwork.co.uk , handle approximately 25,000 tonnes of used railway sleepers each year.
Potential for reclamation and reuse on site:	Any hardwoods or untreated timbers that cannot be reincorporated into the new build can still be salvaged and used creatively to make street furniture.
Photo:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Greenheart bollards available from Ashwell Recycled Products Ltd</p> </div> <div style="text-align: center;">  <p>Hardwood flat top tree trunk bench at London Zoo, available from Ashwell Recycled Products Ltd</p> </div> <div style="text-align: center;">  <p>Telegraph poles used in a primary school playground, available from Ashwell Recycled Timber Products Ltd</p> </div> </div>



80. www.ashwellrecycling.com81. www.environmentalbins.co.uk, these bollards are made from 50% MDPE and 50% chipped bottles

Timber used for landscaping	
Materials stream:	Timber.
Product type:	Timber used for landscaping.
Applications:	Steps, pergolas, decking, edging, children's play areas.
Description:	Timber used in any form for landscaping.
Materials used:	Untreated timber (or concrete) sleepers, telegraph poles, joists, beams, off cuts.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed timber for new: 0.5kgCO ₂ /kg or 225kgCO ₂ /m ³ . ¹⁹ Savings from substitution of reclaimed timber for plastics: 2.5 kgCO ₂ /kg. ¹⁹ Savings from substitution of reclaimed timber for steel: 1.8kgCO ₂ /kg. ¹⁹
Typical costs:	Untreated Australian Jarra grade 2 sleeper 250 x 150mm 2.6m long £20 each . ⁸² Grade A railway sleepers 250 x 150mm 2.6m long £12.50 each . ⁸³ Woodlock planter 2500 x 1200 x 675mm £579 each . ⁸⁴ Telegraph poles £8.20/m . ⁸⁵ 7" x 2" (177 x 50mm) timber decking £10.60/m² . ⁸⁶
Cost of new:	Untreated French oak timber sleeper (2.4 - 3.6m long) £22 - 48 each . ⁸⁷ Treated decking timber 38 x 150 £15/m² . ⁸⁷
Cost commentary:	<ul style="list-style-type: none"> ■ Low cost: could be put together for free from off cuts. ■ Medium cost: reclamation outlets supply sleepers, beams etc that could be created into finished product on site. ■ High cost: Reclamation outlets supply manufactured products such as planters.
Practice:	Cost saving or cost premium depending on application and source.
Guidance on key issues	
Certification/ accreditation:	Strength grading generally not required for these applications. Infestation can be assessed visually or by a grader.
Specification:	Flexibility and creative design will enable interesting end uses for random pieces of timber.
Current UK volume reclaimed:	No data available.
Availability/supply constraints:	Manufactured items from reclamation outlets may be subject to supply constraints due to availability of timber. Items are often made bespoke. Romsey Reclamation, www.romseyreclamation.com , had 300 telegraph poles and 10,000 timber sleepers (treated and untreated mostly from Europe) in stock on 9 October 2007.
Potential for reclamation and reuse on site:	Any hardwoods or untreated timbers that cannot be reincorporated into the new build can still be salvaged and used creatively to enhance the public realm or private gardens.
Photos:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Reclaimed timber used as decking by Ashwell Recycled Timber Products Ltd</p> </div> <div style="text-align: center;">  <p>Reclaimed sleepers used for planters, by www.sleeper-supplies.co.uk</p> </div> <div style="text-align: center;">  </div> </div>



82. www.kilgraney.com83. www.simply-stonesupplies.co.uk84. www.ashwellrecycling.com85. www.romseyreclamation.com86. www.truckreclaimed.co.uk87. www.trademate.co.uk

Doors	
Materials stream:	Timber.
Product type:	Doors.
Applications:	Most common: Doors.
Description:	This category covers all doors that do not fall into the other categories in this guide: period doors and doors manufactured from reclaimed timber. These include both interior, exterior and cupboard doors. Doors are available in a range of sizes: heights from 1800 - 2300mm, widths from 300 - 1300mm and thicknesses from 15 - 50mm.
Materials used:	Timber, composites.
Embodied CO₂ savings¹⁸:	Direct substitution of composite timber: 1.16kgCO ₂ /kg. ¹⁹ Substitution of a reclaimed door: 33kgCO ₂ /door (excluding door furniture).
Typical costs:	Free - £600. ⁸⁸
Cost of new:	£50 - £200/door. ⁸⁹
Cost commentary:	<ul style="list-style-type: none"> ■ Reclaimed doors are often listed (for free) on materials exchange websites, such as www.salvomie.co.uk or www.whatdoidowwiththis.com or available direct from demolition sites. ■ Low cost doors (£30 - £150) are generally pine, lower interest doors and interior doors. ■ High cost doors (£400 - £600) are large, intricate, elm or oak doors and exterior doors. ■ Some doors are available stripped, others unstripped.
Practice:	Cost savings can be achieved through reuse.
Guidance on key issues	
Certification/ accreditation:	For reuse in certain applications, doors will be required to have a fire rating; discussion with and approval from the local building control office would be needed. The key components to achieve fire rating include door size, materials, intumescent strip around the door and closer. In these cases fire certification for the original door should be kept with the door in its new location where possible.
Specification:	Reclaimed doors are available in such a wide variety of shapes and sizes that door availability should be checked prior to design and specification, and in some cases it may be necessary to design around the available doors. Where possible, doors should be reclaimed with compatible frame and furniture.
Current UK volume reclaimed:	2,000,000 doors are thrown away each year, 100,000 are rescued, i.e. 5%. ⁹⁰
Availability/supply constraints:	Doors are available for sale at reclamation outlets, are listed on materials exchange websites and can be sourced directly from demolition sites. It is important to ensure that there is no risk of exposure to asbestos during reclamation and reuse of doors that have previously been used as fire doors. The House Hospital, www.thehousehospital.com , hold approximately 300 - 500 doors in stock.
Potential for reclamation and reuse on site:	Most doors are very quick to remove and store. Reuse of doors on redevelopment projects should be highly possible. They need to be of sufficiently good quality aesthetically and they need to be asbestos-free, as well as satisfying fire safety criteria.
Photos:	<div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>Many thousands of fire doors are wasted every year</p> </div> </div> <p style="text-align: center; margin-top: 10px;">Doors prior to reclamation</p>


88. www.mongersofhingham.co.uk, www.salvo.co.uk, www.andythornton.com, www.oldpinecompany.co.uk89. www.directdoors.com90. www.salvo.co.uk

Period doors	
Materials stream:	Timber.
Product type:	Timber used for landscaping.
Applications:	Most common: Doors.
Description:	Period doors include panel doors, glazed doors, ledge & brace etc.
Materials used:	Timber and in some cases glass (although many period doors are available without the panes of glass).
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed timber for new: 0.5kgCO ₂ /kg. ⁹¹ Direct substitution of glass: 0.8 kgCO ₂ /kg. Savings per door: 15kgCO ₂ /door (excluding door furniture).
Typical costs:	£30 - £600.
Cost of new:	Genuine period doors are unavailable new. Reproduction period doors £100 - £800. ⁹²
Cost commentary:	<ul style="list-style-type: none"> ■ Low cost doors (£30 - £150) are generally pine, lower interest doors and interior doors. ■ High cost doors (£400 - £600) are large, intricate, elm or oak doors and exterior doors. ■ Some doors are available stripped others unstripped.
Practice:	Cost savings can be achieved through reuse.
Guidance on key issues	
Certification/ accreditation:	Local building control should be able to advise on specific fire rating requirements for reclaimed doors.
Specification:	Reclaimed period doors are not available in standard sizes, therefore it is important to ensure that the door will fit into the frame. Where possible, doors should be reclaimed with compatible frame and furniture. There is a huge variety of colour, style, size and shape available to specify. For best results, visit yards to view available doors.
Current UK volume reclaimed:	2,000,000 doors are thrown away each year, 100,000 are rescued, i.e. 5%. ⁹³
Availability/ supply constraints:	Suppliers of period doors are located throughout the country. Many suppliers sell new reproductions alongside genuine reclaimed doors. The Old Pine Company, www.oldpinecompany.co.uk , hold 3,500 reclaimed doors in stock. Andy Thornton, www.andythornton.com hold several hundred doors in stock.
Potential for reclamation and reuse on site:	Reuse of timber period doors on redevelopment projects is both possible and desirable. They are easily removed and stored for later use. Doors can be sent off site to be stripped and revarnished if necessary. In some, very rare, cases period doors may contain asbestos and cannot be reused.
Photo:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Reclaimed oak door</p> </div> <div style="text-align: center;">  <p>Group of doors, from Andy Thornton Ltd</p> </div> </div>

91. www.mongersofhingham.co.uk, www.salvo.co.uk, www.andythornton.com, www.oldpinecompany.co.uk92. www.perioddoors.com, www.period-doors.co.uk93. www.salvo.co.uk

Doors manufactured from reclaimed timber	
Materials stream:	Timber.
Product type:	Doors manufactured from reclaimed timber.
Applications:	Most common: Doors.
Description:	Timber joists or beams are milled into boards and constructed into doors. Most commonly 4 or 6 panel doors or ledge and brace doors. However, using this technique it is possible to make any bespoke door styles and sizes.
Materials used:	Pine and oak.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed timber for new: 0.5kgCO ₂ /kg. ¹⁹ Savings per door: 15kgCO ₂ /door (excluding door furniture).
Typical costs:	£150 - £700. ⁹⁴
Cost of new:	Reproduction period doors £100 - £800. ⁹⁵
Cost commentary:	<ul style="list-style-type: none"> ■ Pine doors are lower cost (£150 - £250). ■ Oak doors are higher cost (£400+).
Practice:	No direct comparison can be made.
Guidance on key issues	
Certification/ accreditation:	Local building control should be able to advise on specific fire rating requirements for reclaimed doors.
Specification:	Doors specified to suppliers' "standard" dimensions will be cheaper than a bespoke door, as suppliers have jibs set up to standard sizes and can manufacture these doors more quickly.
Current UK volume reclaimed:	No data available.
Availability/supply constraints:	Pine is the most available material for these types of doors in the UK. Oak used to manufacture these types of doors is mostly sourced from France. MDS Ltd, www.mdsltd.net , can manufacture 100 no. 4 panel pine doors (78 x 30cm, 45mm thick) in 4 weeks.
Potential for reclamation and reuse on site:	Not applicable.
Photo:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Victorian casement door, from MDS Ltd</p> </div> <div style="text-align: center;">  <p>Victorian panel door, from MDS Ltd</p> </div> </div>

94. www.mdsltd.net, www.salvo.co.uk, www.ewstrading.co.uk95. www.perioddoors.com, www.period-doors.co.uk

Granite setts	
Materials stream:	Stone.
Product type:	Granite setts.
Applications:	Common uses: Garden Patios, Driveways, Pathways. Other applications: Edging to retain and complement landscaped areas.
Description:	<p>Granite setts can be grouped loosely into three different size groups.⁹⁶</p> <p>Rectangular Granite Generally between 75mm to 100mm wide in random lengths. The lengths usually vary from around 150mm to 300mm long (6" to 12"). The depth of these setts is usually about 150mm (6").</p> <p>Granite Cubes Granite Cubes are generally about 100mm cubed (4").</p> <p>Misshaped Setts Misshaped setts vary in size and shape. Becoming ever more scarce in recent times. The depth of these setts is usually about 100mm (4").</p> <p>Cobblestones, or cobbles, are naturally water-worn beach or river stones and are therefore more rounded than setts. Not many people use these strict definitions, and many people say cobblestone when they mean sett. The words sett and cobble are used interchangeably to mean a man-made cubic road stone.⁹⁷</p> 
Materials used:	Granite of varying colours; commonly blues, greys and pinks.
Embodied CO₂ savings¹⁸:	Direct substitution of imported granite: 0.7kgCO ₂ /kg or 188kgCO ₂ /m ² . ¹⁹ Savings by substituting reclaimed granite setts for a new 100mm thick asphalt road: 0.14 kgCO ₂ /kg or 20kgCO ₂ /m ² Savings by substituting reclaimed granite setts for new concrete pavers: 0.2kgCO ₂ /kg or 26kgCO ₂ /m ² .
Typical costs:	Granite setts £32 - £45/m² or £60 - £225/tonne. ⁹⁸ Scurrier Cobbles £32.50/m². ⁹⁹ Granite Cobbles: £45 - £75/m². ¹⁰⁰ Whinstone Cobbles £40/m². ⁹⁹
Cost of new:	£40 - £50/m². ¹⁰¹ Spons Landscaping 2007 price £25/m² (likely to be mainly imported setts).
Cost commentary:	Random sized cobbles and setts are at the lower end of the price range (£60 - £100/tonne) while smaller Granite Cubes can cost £225/tonne.
Practice:	Use of reclaimed setts are a cost premium.

96. Credit www.granitesetts.com/GraniteSetts.htm (Information and photos)

97. www.salvoweb.com/dealers/eco-products

98. Heritage Stone, www.brickfind.co.uk, www.g-obrien.co.uk, www.bingleystone.com

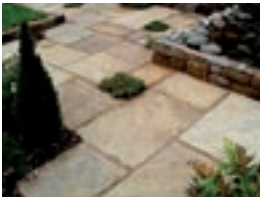

99. www.simply-stonesupplies.co.uk

100. www.architecturalreclaim.com



101. www.architecturalstonesupplies.co.uk and www.naturalstonesales.co.uk/www.agstone.co.uk

Sandstone setts	
Materials stream:	Stone.
Product type:	Sandstone setts.
Applications:	Driveways, courtyards, pathways, public realm.
Description:	Sandstone setts are random in size whereby the length and width will vary and the depth will remain fairly constant. The widths usually vary from 100mm to 200mm (4" to 8") and the lengths will usually vary between about 200mm to 300mm (8" to 12"), ¹⁰² with depths typically 150mm. The most widely available sandstone in the UK is Yorkstone.
Materials used:	Sandstone.
Embodied CO₂ savings¹⁸:	Direct substitution of imported granite: 0.7kgCO ₂ /kg or 188kgCO ₂ /m ² . ¹⁹ Savings by substituting reclaimed sandstone setts for a new 100mm thick asphalt road: 0.14 kgCO ₂ /kg or 20kgCO ₂ /m ² . Savings by substituting reclaimed sandstone setts for new concrete pavers: 0.2kgCO ₂ /kg or 26kgCO ₂ /m ² .
Typical costs:	Yorkstone setts £40 - £50/m² or £200/tonne. ¹⁰³
Cost of new:	Yorkstone setts £40/m². ¹⁰⁴
Cost commentary:	Reclaimed sandstone setts are commonly of random size but similar thickness and colour. Therefore prices are fairly standard across the suppliers.
Practice:	Reclaimed yorkstone setts can be cost neutral.
Photo:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Scurrier cobbles available from Simply Stone Supplies</p> </div> <div style="text-align: center;">  <p>Yorkstone setts, 2.8m²/ tonne, available from Bingley Stone</p> </div> </div>


102. www.stonesetts.com/StoneSetts.htm103. www.bingleystone.com, www.naturalstonesales.co.uk104. www.the-stone-paving-merchant.co.uk and www.bingleystone.com

Yorkstone paving	
Materials stream:	Stone.
Product type:	Yorkstone (or York stone) paving, sometimes called flagstones.
Applications:	The 25 - 60mm thick units are best suited for non-vehicular usage, such as paths and patios, the 50 - 75mm thick for heavier applications such as street works; while the 70 - 150mm thick units are typically reserved for paving that is likely to experience some low-speed vehicular traffic, such as commercial or civic projects and for residential driveways. ¹⁰⁵
Description:	Textures vary from smooth to riven. Colours are typically dark and weathered greys, greens and browns. MILL FLAGS: Describes Yorkstone flags over 75mm thick – priced accordingly due to the extra work involved in handling when laying. BACKED OFF: A description that applies to Yorkstone flags that stonemasons have worked on to reduce the mill flags to a thickness of 75mm or less – to enable easier handling – BUT – leaving the surface untouched.
Materials used:	Sandstone.
Embodied CO₂ savings¹⁸:	Direct substitution of imported granite: 0.7kgCO ₂ /kg or 94kgCO ₂ /m ² . ¹⁹ Savings by substituting reclaimed Yorkstone paving for a new 100mm thick asphalt road: 0.14 kgCO ₂ /kg or 20kgCO ₂ /m ² . Savings by substituting reclaimed Yorkstone paving for new concrete pavers: 0.2kgCO ₂ /kg or 26kgCO ₂ /m ² .
Typical costs:	From £45 to £108/m² . ¹⁰⁶ 100mm thick paving slabs £60/m² . ¹⁰⁶
Cost of new:	Indian Stone – £18 per m² (25mm to 35mm thick). ¹⁰⁷ BSS Pressed Slab 600 x 600 x 50mm Natural £4.30 each or £11/m² . ¹⁰⁷ Perfecta paving square edge Marshalls 450 x 450 x 70mm Buff £11.42 each or £56/m² . ¹⁰⁸
Cost commentary:	For reclaimed stone, thinner stones with a smoother surface are found at the high end of the price range (i.e. £100/m ²), however for new stone thinner stones are cheaper. Thicker, rougher paving slabs are most suited for external use (100 - 150mm thick), and in reclaimed these stones are cheaper (i.e. £60/m ²), however the equivalent new stone tends to be thinner (50 - 75mm thick).
Practice:	Use of reclaimed Yorkstone paving is a cost premium .
Photo:	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Reclaimed Yorkstone paving</p> </div> <div style="text-align: center;">  <p>Reclaimed Yorkstone paving, 8m²/tonne, available from Bingley Stone</p> </div> </div>

105. www.pavingexpert.com/york01.htm106. www.architecturalreclaim.com, www.g-obrien.co.uk, www.simply-stonesupplies.co.uk, Heritage Stone107. www.oldstonematch.com/Indian-stone-in-Yorkshire108. www.trademate.co.uk, note that the thickest paving slab supplied by Travis Perkins is 70mm thick




Concrete paving	
Materials stream:	Stone.
Product type:	Concrete paving slabs.
Applications:	Mainly used for external landscaping including pavements, public squares and gardens.
Description:	Reclaimed concrete paving slabs are available from places where they have been bedded on a material with low or no cement content mortar. Grey, yellow and pink slabs are available, rectangular sizes from 300 - 900mm side and thickness of 35 - 60mm.
Materials used:	Concrete.
Embodied CO₂ savings¹⁸:	Direct substitution of concrete pavers: 0.2kgCO ₂ /kg or 26kgCO ₂ /m ² . Savings by substituting reclaimed concrete paving for a new 100mm thick asphalt road: 0.14 kgCO ₂ /kg or 20kgCO ₂ /m ² .
Typical costs:	600 x 600 x 35mm concrete paving slabs £2.50/each. ¹⁰⁹ Grey, yellow and pink 900 x 600mm concrete paving slabs £2.20/each. ¹⁰⁹
Cost of new:	BSS Pressed slab 600 x 600 x50mm (natural) £4.30/each. ¹¹⁰ Marshalls Regent Paving 600 x 600 x 38mm £4.80/each. ¹¹⁰
Cost commentary:	Concrete paving slabs are often not sold in reclamation outlets as they are a bulk, low interest commodity. However they are widely available direct from demolition projects and through material information exchange networks.
Practice:	Use of reclaimed concrete paving is a cost saving .
Photo:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Concrete paving slabs available on Salvo</p> </div> <div style="text-align: center;">  <p>Garden concrete paving slabs available on Salvo</p> </div> </div>

109. www.salvo.co.uk110. www.trademate.co.uk

Crazy paving	
Materials stream:	Stone.
Product type:	Crazy paving.
Applications:	Most common applications are driveways and patios.
Description:	Usually a sandy buff colour with an average thickness of 50mm. Random dimensions. "Crazy paving" refers to the 'crazed' appearance of the finished surface, although it could equally apply to the notion that this is a cheap or easy form of paving. Far too often, it is undertaken as an allegedly simple alternative to more traditional paving, or because broken flags are free or cheaper than intact units, yet, from a contractor's point of view, it costs more in terms of labour to lay a given area of crazy paving than it does for 'normal' paving. ¹¹¹ Well-laid crazy paving minimises the amount of mortar or jointing visible at the finished surface, the mortar being the structurally weak point of the pavement.
Materials used:	Sandstone.
Embodied CO₂ savings¹⁸:	Direct substitution of imported granite: 0.7kgCO ₂ /kg or 94kgCO ₂ /m ² . Savings by substituting Yorkstone paving for a new 100mm thick asphalt road: 0.14 kgCO ₂ /kg or 20kgCO ₂ /m ² . Savings by substituting Yorkstone paving for new concrete pavers: 0.2kgCO ₂ /kg or 26kgCO ₂ /m ² .
Typical costs:	£16 - £24/m². ¹¹²
Cost of new:	£70 - £80/m². ¹¹³
Cost commentary:	There is very little price variation in reclaimed crazy paving. This is likely to be due to similarity in the product characteristics between suppliers.
Practice:	Use of reclaimed crazy paving is a cost saving .
Photo:	 <p>Yorkstone crazy paving available at Simply Stone Supplies</p>



111. www.yorkstonemerchant.co.uk/layingcrazypaving.html112. www.reclaimed-building-materials.net, www.leavethetrees.co.uk, www.simply-stonesupplies.co.uk

113. Spons Landscaping 2007

Kerbs	
Materials stream:	Stone.
Product type:	Kerbs; granite or concrete.
Applications:	Used to edge roads, paving or setts. Can also be used as garden steps.
Description:	Granite kerbs are most commonly silver/grey in colour, Victorian kerb stones have a pink or silver finish. Granite kerbs were traditionally the most popular choice of natural stone because it is very durable, however, has more recently been replaced by pre cast concrete. Most straight kerbs (granite or concrete) are 915mm in length although some of the kerb-units developed to match block-paving are only 100mm or 200mm long. ¹¹⁴
Materials used:	Granite or pre-cast concrete kerbs.
Embodied CO₂ savings¹⁸:	Savings from substituting reclaimed granite kerbs for new pre-cast concrete kerbs: 0.2 kgCO ₂ /kg or 31kgCO ₂ /m. Savings from substituting reclaimed granite kerbs for imported granite: 0.7kgCO ₂ /kg ¹⁹ or 113kgCO ₂ /m.
Typical costs:	Concrete kerbs are not widely traded, so no cost data available, however, they are available from demolition projects. Granite kerbs: £16 up to £65/m. ¹¹⁵
Cost of new:	BS concrete kerb half battered 125x255x915mm £6/m. ¹¹⁶ Granite kerbs: £38/m. ¹¹⁷ Granite kerbs: £12/m. ¹¹⁸
Cost commentary:	Low end (£16 - £30) – approx 200mm x 100mm x random lengths. High end (£40 - £65) – 100mm x 300mm by lengths of between 800mm to 1000mm.
Practice:	Reclaimed granite kerbs are generally a cost premium.
Photo:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Reclaimed granite kerbs</p> </div> <div style="text-align: center;">  <p>Granite kerbs prior to reclamation from the London Olympic Park</p> </div> <div style="text-align: center;">  <p>Granite kerbs prior to reclamation from the London Olympic Park</p> </div> </div>



114. www.pavingexpert.com/edging5.htm115. www.g-obrien.co.uk, Heritage Stone116. www.trademate.co.uk117. www.agstone.co.uk

118. Spons Landscaping 2007

Walling stone	
Materials stream:	Stone.
Product type:	Some of the more common walling or building stones include: <ul style="list-style-type: none"> ■ Ashlar walling stone; ■ Cotswold Stone; ■ coarse Punched Stone; ■ Derbyshire Gritstone; ■ limestone walling (general) – Peak District; ■ Pennant Stone – fine grained sandstone (West Country and Wales); ■ random backing stone; ■ sandstone (general); ■ Yorkshire Sandstone; and ■ Yorkshire walling stone.
Applications:	Main use: Extensions on period properties, renovations, new house building and dry stone walling. Other uses: dressed walling stone can be used to create fireplaces, rockeries, and other landscaping features.
Description:	Although building stone often has random dimensions, it will still have a decent building face. Sandstones are more commonly used in buildings while limestone is more commonly used in dry stone walling.
Materials used:	Limestone, Sandstone, Gritstone.
Embodied CO₂ savings¹⁸:	Direct substitution of walling stone: 0.02kgCO ₂ /kg ¹⁹ or 13kgCO ₂ /m ² for a 250mm thick wall. Savings from substituting walling stone for new bricks: 0.2kgCO ₂ /kg or 40kgCO ₂ /m ² for a single skin brick wall. Savings from substituting walling stone for imported new stone: 0.7kgCO ₂ /kg or 488kgCO ₂ /m ² for a 250mm thick wall.
Typical costs:	£85/tonne for Pennant Building stone. £150/tonne for Cotswold Stone. ¹¹⁹
Cost of new:	£90 to £165/tonne. ¹²⁰
Cost commentary:	Random walling stone is low end (£85 - £100/tonne). Dressed wall stone such as Ashlar are higher end products (£130+/tonne). High end walling stone is one of the least abundant types of reclaimed stone.
Practice:	Cost neutral practice can be achieved through use of reclaimed building stone.
Photos:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Yorkshire delph sandstone, available from www.oldstonematch.com</p> </div> <div style="text-align: center;">  <p>Yorkshire sandstone wall at Heritage Stone, Guisborough</p> </div> </div>

119. www.burgessandsons.com and www.source4you.co.uk120. www.blackmountainquarries.com and www.brickfind.co.uk

Stone	
Guidance on key issues	
Certification/ accreditation:	Where stone is being used for road or pedestrian traffic, consultation with the Highways Authority or Local Authority is advised on whether a specific stone can be used, with regard to loading and trip hazards. General information on buying and laying reclaimed and new paving is available on www.pavingexpert.com
Specification:	Most reclaimed stone products are available in standard imperial sizes. Designers and specifiers should visit local reclamation outlets to discover the local stones available in the area of the project.
Current UK volume reclaimed:	The 1998 BigREc survey indicated that 1.1m tonnes of walling stone are reclaimed annually, the 2007 results show that this tonnage has gone down and the number of businesses trading walling stone has fallen from 580 to 320. The 1998 survey showed 2.7m yd ² or 2.3m m ² of paving was reclaimed, made up of 47% setts and 26% flagstones. The 2007 results show that this has gone down.
Availability/supply constraints:	Reclaimed stone is predominantly sourced from across the UK. Suppliers have yards typically in the region of 4 to 6 acres and are therefore able to keep certain quantities of stone in stock which is continually replenished. Larger quantities (100's m ²) can generally be obtained for sale within two to six weeks. Materials specified of a high quality take longer to source. Reclaimed Building Materials, www.reclaimed-building-materials.net , sell 700 - 1,000m ² /year.
Potential for reuse on site:	These robust and easily handled materials can be easily deconstructed so long as mortar has not been used to fix them in place. In most cases, stonework can be easily lifted. Paving can be stacked. Storage of large quantities of stone on a small site should be carefully considered, stone can be palletised for storage.
Other useful information:	Some stone is available "backed off" (no mortar), i.e. blasted clean. Some stones come up clean and for others it will be an additional cost to have them cleaned.

Carpet	
Materials stream:	Internal and fit out.
Product type:	Carpet.
Applications:	Reclaimed carpet can be purchased from suppliers. When companies relocate, refurbish or even downsize, hundreds of carpet tiles are ripped up to be thrown away, ahead of their design life. These tiles are often still in good condition as they are hard wearing and built to last. There is great potential for companies to reuse their own products in house.
Description:	All types of carpets and carpet tiles.
Materials used:	Polypropylene, polyester, nylon, wool.
Embodied CO₂ savings¹⁸:	Direct substitution of reclaimed carpet for new: 4kgCO ₂ /kg ¹⁹ or 10kgCO ₂ /m ² .
Typical costs:	Carpets and carpet tiles reused within an organisation: materials cost free . ¹²¹ Purchase of reclaimed from £0.50/tile . ¹²²
Cost of new:	From £1.50/tile . ¹²³
Practice:	Reclaimed carpet tiles offer a cost saving .
Guidance on key issues	
Certification/ accreditation:	Carpets and carpet tiles generally require a deep clean, especially where they have been removed from heavily trafficked areas.
Specification:	Most common sizes of carpet tiles are 45 - 50 cm squares. The degree of wear that is acceptable needs to be established and agreed with the supplier. One way to do this is by using an agreed "quality reference sample".
Current UK volume reclaimed:	No data available.
Availability/supply constraints:	Carpet-tiles-r-us turnover 80 - 100 tonnes of carpet tiles each year. 37,200 carpet tiles are sold annually through one London Green-Works outlet. Interface and Milliken carpets offer reuse schemes for their own carpet.
Potential for reclamation and reuse on site:	Front of house carpets that are being replaced, are likely to be still of high enough quality to be used either in office 'back of house' or perhaps in other departments. Carpets are likely to require a deep clean prior to reuse. In some cases carpet tiles have bitumen backing, which can be removed manually; this is a very labour intensive process and should probably be avoided.
Photos:	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Range of carpet tiles stocked by Green-Works</p> </div> <div style="text-align: center;">  <p>Carpet reclaimed from Wembley Conference centre to the local Hilton hotel</p> </div> </div>

121. For refurbishments there would be no additional labour costs, as existing carpets would need to be lifted and re-laid regardless of whether they were reclaimed or not

122. www.green-works.co.uk and www.carpet-tiles-r-us.co.uk

123. www.carpettilewholesale.co.uk/Store/index.php

Furniture	
Materials stream:	Internal and fit out.
Product type:	Furniture.
Applications:	<p>All types of furniture broadly in three categories:</p> <ul style="list-style-type: none"> ■ office furniture; ■ domestic furniture; and ■ school furniture. <p>Reclaimed furniture includes desks, chairs, tables, cabinets, shelves, sofas, beds, work benches, industrial shelving.</p>
Description:	<p>There are two main categories:</p> <ol style="list-style-type: none"> 1. Reclaimed furniture. 2. Furniture manufactured from reclaimed materials such as wood, glass and metal.
Materials used:	Wood, metal, glass.
Embodied CO₂ savings¹⁸:	Direct savings from substituting reclaimed veneer particle board (used to make furniture) for new: 1.16kgCO ₂ /kg. ¹⁹
Typical costs:	Anything from free to hundreds of pounds .
Cost of new:	Anything from a few pounds to hundreds of pounds .
Cost commentary:	<p>Low quality furniture, or furniture available from an office fit out may be available for free or very low cost (Green-Works sell office chairs from £5).</p> <p>Medium and high quality reused furniture from both domestic and office sectors will offer significant cost savings, e.g. large corporate desks and reception desks.</p> <p>Stylish, attractive tables manufactured from reclaimed timber are available for £200 - £900 from locations such as Desirable Debris, www.desirabledebris.co.uk or Trunk, www.trunk.co.uk.</p>
Practice:	<p>Reclaimed furniture is usually a cost saving.</p> <p>Furniture manufactured from reclaimed materials can be a cost premium.</p>
Guidance on key issues	
Certification/ accreditation:	A visual inspection will enable users to assess whether reclaimed furniture is fit for purpose; criteria are the same as for new furniture.
Specification:	Reclaimed furniture is often used in places where matching furniture is not critical; this could be a barrier to wider reuse of furniture in the commercial sector.
Current UK volume reclaimed:	No data available.
Availability/supply constraints:	<p>Reclaimed furniture is available from a variety of sources including:</p> <ul style="list-style-type: none"> ■ Furniture reuse network, www.frn.org.uk, which is the national co-ordinating body for 400 furniture and appliance reuse and recycling organisations in the UK targeted at supplying furniture to low income households; ■ charity shops; ■ websites such as Ebay, Salvo; and ■ Green-Works www.green-works.co.uk, an organisation which works on redistributing redundant office furniture at a very low cost to charities, schools, community groups and start-up businesses. Through their 2 London outlets they annually sell approximately 18,000 items including 7,200 chairs, 2,500 desks and 2,000 storage units. They also have outlets in East Durham, Wolverhampton, Paisley and Leeds.
Potential for reclamation and reuse on site:	A lot of office waste is generated through new fit-out. However, there is great potential for internal reuse of products and materials.

Architectural salvage	
Materials stream:	Internal and fit out.
Product type:	<p>Architectural salvage covers a large spectrum of materials including the following:</p> <ul style="list-style-type: none"> ■ ornamental stonework; ■ door furniture – handles, locks, door closers, push plates, key hole covers; ■ fireplaces and accessories; ■ garden features – planters, stone troughs, fountains, gates and railings; ■ chimney pots; ■ kitchen items – door knobs, sinks, cabinets, ranges; ■ sanitary ware – baths, washstands, hand basin, toilets, cisterns, accessories; ■ leaded and stained glass; ■ period lighting – hurricane lamps; ■ street furniture – benches, signage, lamp posts; ■ hardware – brackets, curtain poles, window fittings; and ■ church furniture.
Applications:	<p>Architectural salvage can generally be described as high-value, low volume and so features predominantly within privately owned period properties as opposed to new developments. However, there is potential to integrate features within new buildings to recognise local heritage and to support the integration of new developments with existing properties in the immediate area.</p>
Description:	<p>Many architectural salvage items are from the Georgian, Victorian and Edwardian periods, although items could be as 'young' as 1960 - 80's.</p>
Materials used:	A wide range of materials including metals, timber, stone and glass.
Embodied CO₂ savings¹⁸:	Depends on the materials considered.
Typical costs:	Huge variation in costs.
Cost of new:	Not applicable.
Cost commentary:	<p>Architectural salvage items tend to be higher cost than new items; these items are often decorative features and could be classed as an additional cost to the project.</p>
Practice:	<p>Architectural salvage is usually a cost premium as it is an extra or additional cost, rather than a required cost.</p>
Guidance on key issues	
Certification/ accreditation:	<p>Visual inspection will enable users to decide whether an item is fit for purpose.</p>

Architectural salvage continued

Specification:	Architectural salvage items include small items like door handles that can be incorporated without the need for detailed specification and design, right up to whole facades around which whole buildings can be designed.
Current UK volume reclaimed:	<p>Results from the 1998 BigREc survey:</p> <ul style="list-style-type: none"> ■ architectural stone 43,000 tonnes; ■ architectural woodwork 7,000 tonnes; ■ architectural ironwork 4,700 tonnes; ■ architectural terracotta 2,000 tonnes; ■ ornamental woodwork 20,000 tonnes; ■ ornamental metalwork 10,000 tonnes; ■ ornamental terracotta and concrete 1,000 tonnes; and ■ old bathrooms 190,000 items.
Availability/supply constraints:	<p>Architectural salvage yards can be found all over the UK stocking a great range and variety of items of varying quality. There are, however, some suppliers that deal predominantly in one item, for example fireplaces.</p> <p>Many suppliers of architectural salvage sell reproduction items alongside genuine salvaged items. The majority of reclamation companies listed within the Supplier Directory will generally stock a variety of architectural items alongside building materials. However, some of the more specialist architectural salvage dealers include:</p> <ul style="list-style-type: none"> ■ www.bygones.net; ■ www.coxsarchitectural.co.uk; ■ www.redlandssalvage.co.uk; ■ www.mongersofhingham.co.uk; ■ www.lassco.co.uk; and ■ www.catbrain.co.uk. <p>Architectural salvage items are also web listed through www.salvo.co.uk and www.ebay.co.uk.</p>
Potential for reclamation and reuse on site:	During demolition works, most architectural items are likely to be identified early and sold as they are worth money to the demolition contractor. To use the opportunity of integrating architectural features into a new build on the same site, the items should be identified early and salvaged and stored with care.

Photos:




Range of architectural features typically stocked by Bygones



Reclaimed chimney pots



Original Art Nouveau cast iron surround and tiles

Mechanical and electrical	
Materials stream:	Internal and fit out.
Product type:	Mechanical and electrical equipment that is or could be reclaimed include: <ul style="list-style-type: none"> ■ luminaries; ■ electrical switches and sockets; ■ gantry cranes; ■ boilers; ■ generators; ■ compressors; ■ transformers; and ■ lifts.
Applications:	M&E items are reconditioned and reused for their original purpose.
Description:	Mechanical and electrical items cover any item with mechanical or electrical parts. These items are regularly reconditioned and sold.
Materials used:	Timber and in some cases glass (although many period doors are available without the panes of glass).
Embodied CO₂ savings¹⁸:	Embodied CO ₂ savings for specific items are unknown, however the savings made by substituting plastics is 2.5kgCO ₂ /kg and metals 1.8 - 8.5kgCO ₂ /kg; M&E items are often highly manufactured items.
Typical costs:	These items tend to have high resale potential on specialist markets which can offset costs of specialist decommissioning. Gantry cranes are available for less than half of the cost of new.
Practice:	Reclaimed M&E items have the potential to offer significant cost savings if the extraction and reconditioning is carried out in a cost effective manner.
Guidance on key issues	
Certification/ accreditation:	Health and safety, in particular electrical safety, is viewed as perhaps the largest hindrance in the specification and use of reclaimed M&E products. Reconditioned items are often available with warranties.
Current UK volume reclaimed:	No data available.
Availability/supply constraints:	There are a number of companies that recondition plant, including: <ul style="list-style-type: none"> ■ boilers: www.fulton.com; ■ gantry cranes: www.cranehandling.com (sell 8 - 10 cranes/week); ■ shot blasting equipment: Riley Industries; and ■ air conditioning: www.airconditioninginstallations.co.uk (with 1 year parts and labour warranty).
Potential for reclamation and reuse on site:	On-site M&E parts can be sent away for reconditioning and returned with warranties.
Photos:	 <p>Electrical socket available for reclamation at Wembley conference centre</p>

Case studies

This section provides case studies of the use of reclaimed products in building and construction projects.

The following case studies are listed:

- Case study 1: London Zoo;
- Case study 2: Jubilee Wharf, Penryn;
- Case study 3: Tarporley, Cheshire;
- Case study 4: Reclaimed gritstone setts;
- Case study 5: Reclaimed portal frame building, London;
- Case study 6: BedZED, Surrey; and
- Case study 7: Reclamation during regeneration for London Olympic Park.



Case study 1: London Zoo

Ashwell Recycled Products Ltd supplied 320m² of tongue & groove Ekki and Jarrah boarding for the walkway and wall cladding for the new gorilla enclosure at London Zoo opened in 2007. This took 2 months from reclamation to installation and some timbers had steel bolts that had to be removed.

For the tropical bird aviary they supplied reclaimed tropical hardwood for edging, handrails and retaining walls, as well as bridge material, cross beams, decking, posts and piles. All timber was from sleepers, jetty piles and sea groynes.

Handrail detail



Side view of bridge and handrail



Ekki sleepers retaining wall up to the exit



Bridge and path beyond

Case study 2: Jubilee Wharf, Penryn

Jubilee Wharf is a £3.5m ecological development comprising twelve community workshops, six residential units, a community nursery, a café, charity offices and a function hall. It was designed by ZEDfactory Ltd. Reclaimed materials used on the project are shown in the photos,¹²⁴ they included:

- granite setts;
- granite bollards;
- doors;
- pine flooring used for ceiling;
- granite kerbs; and
- maple dance floor.



Path detail



Function hall after completion



Completed cycle path



Stairs to café



Reclaimed bricks used in redevelopment

Case study 3: Tarporley, Cheshire

Tarporley, a village in Cheshire dating from the medieval period, has gradually been changed by numerous developments. The fading commercial centre was redeveloped between 1990 to 2002 by Bell Meadow Pulford Ltd revitalising it with mixed use buildings that retain much of the predominant Victorian and Georgian vernacular.¹²⁵

Cheshire Brick and Slate Company was the main supplier contracted to provide grade 1 reclaimed bricks to Bell Meadow. Cheshire Brick and Slate Company reclaimed bricks over 6 - 7 months from an urban area of Liverpool where housing was being demolished as part of a regeneration programme. 90% of the bricks reclaimed were suitable for use within the Tarporley development, while the remaining 10% consisting of lower grade bricks were crushed for reuse as aggregate. In total, 600,000 bricks were used in the building of 50 homes and shop fronts in the Tarporley area. Bricks were cleaned at the Cheshire Brick and Slate yard and supplied to the site in palettes. In addition, reclaimed slates were used for the roofs of 7 houses to enable a variation in style to be embedded. Reclaimed Yorkstone setts were also supplied by Cheshire Brick and Slate for edging driveways.

Case study 4: Reclaimed gritstone setts

Swinburne Horticultural Services Ltd¹²⁶ deliberately source reclaimed materials for all of their landscaping projects. The photographs below illustrate the use of 600m² of gritstone setts for paving at a private dwelling. These were supplied by Purple Tree¹²⁷ who usually reclaim gritstone setts from the streets of Greater Manchester. They were originally laid on ash from the old railways and pointed with pitch tar, making them easy to reclaim. The gritstones are then griddled in excavator machine buckets to dislodge the tar prior to resale.



Completed areas of gritstone paving



Laying of reclaimed gritstone setts

126. www.shsgardens.co.uk

127. www.purpletree.co.uk

Case study 5: Reclaimed portal frame building, London

Portal Power were contracted to dismantle a number of portal frame buildings during the demolition works for a large regeneration project.

One building due for demolition was a 100m x 32m x 7m 7 year old portal frame building in excellent condition. The building comprised of a structural steel frame made from bolted universal beams (533 x 210mm and 457 x 152mm), composite cladding panels and roof sheets.

The contractor gave Portal Power access to the site and 8 weeks to dismantle the building; they received no payment from the contractor for this work.

The building was carefully dismantled by undoing the fixings for the cladding and unbolting the structural steel members, items were carefully lowered to the ground. Safety was paramount and the labour force of 16 people used mobile elevated work platforms (MEWPS), handrails, harnesses and safety nets.

Materials extracted from the building included:

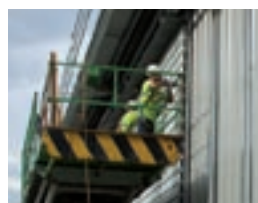
- structural steel members (110 tonnes);
- cladding panels (1,800m²) (9 kg / m²);
- steel purlins and other light steel (10 tonnes);
- fire doors (4 units);
- industrial lighting units (75 units);
- windows and aluminium frames (30 units);
- sprinkler system (250m);
- guttering (260m 25kg / m steel 530 x 300);
- conveyor belt (60m);
- generator (1 unit);
- steel staircases (1 units); and
- gas heaters (4 units).



Steel beams



Building prior to demolition



Careful dismantling and disassembly



Cladding panels

The building was advertised for sale at £148,000 and has been sold directly from the demolition site, enabling the materials to be transported straight to the end use site. An approximate estimate of the embodied CO₂ of the materials that are being re-used is 290 tonnes.

Case study 6: BedZED, Surrey

The Beddington Zero (Fossil) Energy Development is a mixed use development comprising 100 homes and 3,000m² of commercial live/work space.

Reclaimed timber studwork

54km of 50 x 100mm and 75 x 100mm reclaimed timber studwork was used in the internal plasterboard partitions. Ashwells Recycling in Essex, a large reclamation yard with extensive timber stock were able to offer denailing, preservative treatment and milling at their on-site sawmill and delivery at a competitive price.

Reclaimed structural steel

98 tonnes (95% of project requirements) of reclaimed structural steel was used on the project. The sections were retrieved from local demolition sites and reclamation yards.

A range of section sizes were specified, allowing flexibility in sourcing. Long lead times were built into the programme.

Using reclaimed steel was 4% cheaper than using new, but including the additional staff time for sourcing the material and the necessary visual inspections, the use of reclaimed steel was effectively cost neutral.



Timber studwork during construction



Reclaimed steel was used for the structure



Staircase and partition wall

Case study 7: Reclamation during regeneration work for London Olympic Park

The site clearance work for the London Olympic Park involves demolition of over 200 buildings. BioRegional Reclaimed have carried out reclamation surveys to identify all reclaimable building materials available throughout the project. The Olympic Delivery Authority, with their contractors, has developed a database listing all of these reclaimable materials.

Design teams can 'shop' for items and reserve them on the database. In addition, design teams have attended 'shopping trips' to view reclaimed materials available on the site prior to demolition.

Design teams are looking to use:

- weighbridge;
- yellow stock bricks;
- yorkstone paving;
- granite and concrete kerbs; and
- concrete paving slabs.



Yellow stock bricks palletted for storage



Re-use of staircase being investigated

Suppliers directory

The following directory lists suppliers of reclaimed building materials, by region of England, Scotland and Wales.

Key:

Primary materials stocked

Other materials

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Further editions

WRAP plans to publish additional data in further editions, and suppliers are welcome to provide details by e-mail to construction.products@wrap.org.uk

The following people were consulted during production of this document:

Name:	Company:
Gilli Hobbs	BRE
Beatriz Luz	NISP
David Parker	Oakdene Hollins
Dr Dominic Hogg	Eunomia
Louise Farmer	Environment Agency (BREW)
Martin Bolton	SEEDA
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Matthew Browne	Wates
Gary Archer	Denne
George Martin	Willmott Dixon
Michael Sansom	Steel Construction Institute
All Salvo Code Members	
All suppliers entered in the suppliers directory	

Area	Company	Region	Postcode	Telephone	Website	Email	Reclaimed products stocked								
							Brick	Metals	Roofing materials	Stone	Timber	Internal and fit out			
South West	Brian Legge Reclaimed	Herefordshire	HR7 4NJ	01885 410 579											
Wales	Dyfed Antiques and Architectural Salvage	Dyfed	SA61 2JD	01437 760 496											
Wales	Radnedge Architectural Antiques	Dyfed	SA14 8LX	01554 755 790	www.radnedge-arch-antiques.co.uk	rrantiques@radnedge.fsworld.co.uk									
Wales	R M Rees Contractors LTD	Glamorgan	SA11 4DT	01639 711 688	www.welsh-salvage.co.uk	info@welsh-salvage.co.uk									
Wales	ATC LTD	Gwent	NP25 3LX	01600 713 036	www.floorsanddecking.com	info@floorsanddecking.com									
Wales	Drew Pritchard Ltd	North Wales	LL28 5TH	01492 580 890	www.drewpritchard.co.uk	info@drewpritchard.co.uk									
Wales	Natural Stone and Slate	North Wales		07981 391 696											

Further information

For further relevant information, see the following sources:

- Construction Materials Report, Toolkit for Carbon Neutral Developments – Part 1, N Lazarus, BioRegional Development Group.
- Building with Reclaimed Components and Materials, A design handbook for reuse and recycling, Bill Addis.
- Deconstruction and reuse of construction materials, JW Hurley, C McGrath, SL Fletcher and HM Bowes, BRE and DETR.
- Rural Studio, Samuel Mockbee, and an Architecture of Decency, Andrea Oppenheimer Dean and Timothy Hursley.
- A BSRIA Guide; Recycling Building Services, Verena Olnhoff and Andrew Martin.
- Reclaimed Building Materials in the Thames Gateway, N Lazarus and R Hilary, BioRegional, January 2006.
- The Salvo Guide 2000, T Kay in association with Solopark plc.
- SalvoNews, online publication.
- www.bioregional-reclaimed.com.

Written by:

BioRegional

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Waste & Resources
Action Programme

The Old Academy
21 Horse Fair
Banbury, Oxon
OX16 0AH

Tel: 01295 819 900
Fax: 01295 819 911
Email: info@wrap.org.uk

Helpline:
0808 100 2040

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