

Reuse of building products and materials – barriers and opportunities

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Abstract

BRE have been working with the reclamation sector in the UK for around 20 years to promote the reuse of end-of-life building products and materials in preference to recycling and recovery. Much of this has been dedicated to the promotion of pre-demolition and pre-refurbishment audits to facilitate targets being set and markets for reusable resources sourced prior to work commencing. Against this backdrop the surveys undertaken to measure levels of reclamation in the UK over a 15 year period showed a significant decline. The cause of this decline was investigated and revealed a number of challenges which were affecting both the supply and demand for reclaimed products and materials. Many of the challenges to reuse are connected to the availability and robustness of data. Therefore, the work currently being undertaken as part of the H2020 funded project BAMB (Building As Material Banks) provides a great opportunity to address such gaps in buildings of the future. However, since the existing built environment will have a major impact on resource flows for many years, it is also important to consider approaches to improve data in this context also. Therefore, this presentation will summarise the challenges for reuse of building products and materials in existing and future buildings. It will then briefly describe the opportunities and solutions to address these challenges in the context of improved data access, management and evaluation. Finally, the BAMB research which should contribute to providing solutions will be explored.

Keywords: reuse, pre-demolition audit, circular economy, deconstruction, end of life.

Introduction

Reuse should be considered as a priority compared to recycling but this option increasingly does not occur. Reuse typically requires minimal processing before reapplication in a similar application, whereas recycling typically requires breaking down waste into a homogeneous material for a lesser value application or introduction as replacement feedstock for manufactured components. A common misunderstanding lies between the realms of reuse and recycling of old buildings; they are often considered together when they are actually competing choices for the continuing use of resources.

Historically, the reuse of building materials and products has been high, with the building blocks of old structures typically used to form new ones, and old materials repurposed until no longer fit for use; however this has decreased in the last 70 years. What are the factors behind this shift in behavior and how can we reverse the continuing decline in the reuse of products and materials? To this end, BRE have been working with the reclamation sector in the UK for around 20 years to promote the reuse of end-of-life building products and materials in preference to recycling and recovery. Much of this has been dedicated to the promotion of pre-demolition and pre-refurbishment audits to facilitate reuse through setting targets and identifying markets for reusable resources prior to work commencing. Against this backdrop, surveys undertaken to measure levels of reclamation in the UK over a 15 year period have shown a significant decline¹.

¹ BigREc survey 2007 <http://www.wrap.org.uk/sites/files/wrap/BigREc%20Survey%20report.pdf>

Challenges to increasing reuse

There are a number of challenges affecting reuse. Depending on national and local circumstances, these can include:

- Mismatch of supply and demand – both in terms of quantity and quality. If heavy materials need to be moved long distances to reach their markets, this can increase costs and environmental impact significantly.
- Insufficient time allowed for deconstruction and careful packing of reusable items – the length of time needed to deconstruct can be unappealing where extra costs are incurred through having a building (such as local property taxes) or loss of revenue on a replacement building owing to an extended scheduling of works. There can also be a time constraint linked to planning permission expiration.
- Lack of facilities locally – some countries, such as the UK, have a good spread of reclamation facilities, although space is limited and expensive in highly built up areas. This can cause a disparity between the location of the stocks of reclaimed items and the market for such items. The third party costs will need to be added to the purchase price, which can diminish the attractiveness of reclaimed products compared to new. This is particularly key when matched against possible risks associated with reuse.
- Reluctance to use products without certification of tested performance is one of the biggest barriers to reuse, particularly in a structural capacity. Often there is very little information on where the product has come from and its length of use in a particular application. This means that the ‘worst case scenario’ is normally applied to the potential reuse applications. Testing of performance can be expensive and require destruction of samples to mitigate possible risks of further use. These costs will be added to the cost of the product/material and may override savings from reuse.
- Health and safety risks of manual deconstruction are considered to be a key reason for the move to mechanical demolition techniques. Whilst these risks can be mitigated through improved data on the building design and composition, such information is often not available.
- Building technology is a mixture of traditional and rapidly changing techniques. Both can cause challenges in further reuse, such as cement mortar used in brick and block construction, through to rapid fix, prefabricated panelized systems which are multi-material composites.
- Value of products and materials can be an opportunity or a barrier. In case of low value/cheap products and materials, the incentive to reuse versus the cost of careful removal can be low or negative.

In summary, there are multiple and inter-related reasons for the fall in reuse, making it inevitable. The main challenge is to consider how to overcome these barriers in the forthcoming and existing built environment.

Opportunities to increasing reuse

There are many opportunities to reuse materials, from all stages of the supply chain, including procurement, design, construction, refurbishment and demolition. Some high level strategies include:

- Reuse of offcuts and surplus materials within the construction project (or exchanged with nearby projects)
- Design for deconstruction and adaptability
- Pre-demolition audits, on-site sorting and separate collection

- Waste exchanges and industrial symbiosis
- Standards and testing of products to promote reuse
- Planning and procurement practices which promote incorporation of reclaimed products and materials
- Involvement of the community sector to maximize local benefits

The Waste Framework Directive² (WFD) considers reuse to be any operation by which products or components that are not waste are used again for the same purpose for which they were conceived. When in compliance with the WFD, reuse can effectively remove materials and products from the wastestream and allow for further application without the regulatory restrictions that can accompany recycled material application.

The EU policy on Construction Product Regulation (CPR)³ and its Basic Requirement of Construction Works (BRCW) 7 Sustainable use of natural resource could provide a good basis for optimizing resources, including reuse. The inclusion of this requirement will allow Member States to regulate for the use of sustainable products and for a sustainability characteristic to be included in the DoP (Declaration of performance) and the CE marking. However, this is yet to be defined and needs a method for describing the products performance.

Pre-development audits include demolition and refurbishment assessments of what can be reused from deconstruction and strip out respectively. These should also inform the potential to reuse products and materials in subsequent construction and/or fitout (of refurbishment). A recent EU project has developed further guidance relating to pre-demolition audits⁴.

Certification is not always required to enable reuse, even in structural applications. For example, the Steel Construction Institute in the UK recommends the following for reuse of structural steel⁵: *For example, deconstructed sections are inspected to verify their dimensional properties; tested to confirm their strength properties and the section is then shot or sand blasted to remove any coatings and refabricated and primed to the requirements of the new project. This will usually involve cutting the ends of the beams and columns to the required length.*

However, the absence of warranties and manufacturing data can severely hamper future reuse, so a significant opportunity exists around improved data management at the point of design and throughout an asset's life cycle. This is a key area of work within the Building as Material Bank (BAMB)⁶ project, where Building Information Modelling (BIM) is being linked to aspects of Reversible Building Design and improved product data (Material Passports) to facilitate future reuse at building, system, product and material levels.

Greater promotion of the benefits of reuse compared to recycling could encourage more clients and designers to spend time and energy to increase reuse, often with a cost benefit attached. For example, there can be great community benefits in reuse, as demonstrated by

² <http://ec.europa.eu/environment/waste/framework/>

³ <http://ec.europa.eu/growth/sectors/construction/product-regulation/>

⁴ http://www.construction-products.eu//documents/document/20161123090156-2016_11_22_resource_efficiency_workshop_1_dg_growth.pdf

⁵ http://www.steelconstruction.info/Recycling_and_reuse

⁶ Buildings as Material Banks - <http://www.bamb2020.eu/>

the Community Wood Recycling group in the UK, whom also undertake reuse activities. In 2015 they obtained over 17,000 tonnes of waste wood, nearly half of which was reused and provided training and work experience places for more than 600 unemployed people⁷.

Other benefits include the heritage value of the products which stay in circulation, as demonstrated in a market assessment of Truly Reclaimed Wood in the UK⁸. BRE worked with Salvo on this Innovate UK funded project to understand the main drivers for decorative reuse that could be used to move the market away from reproduction towards genuine reuse. A surprising conclusion to this market study of architects and clients revealed that access to the reclaimed product/material's history was deemed more important than environmental benefits.

In terms of environmental benefits, the evidence is difficult to access in a way that is meaningful to those seeking to justify end-of-life reuse. In Life Cycle Assessment terms, the main benefit of reuse, in terms of displaced embodied impact, will be accounted for in the subsequent application. This approach does not translate into benefits to those responsible for enabling such reuse, through careful deconstruction or designing for high reuse potential. The work in BAMB should allow for environmental benefits to be more transparent to such decision makers and therefore promote activities which support future reuse.

Recommendations to Increase Reuse

In a recent project, BRE worked with other partners to identify best practices across the EU, which included increasing the level of reuse⁹. The results from evaluating Member States policies, practices, performance and stakeholder viewpoints were used to develop a series of recommendations. In terms of reuse, these recommendations included:

- Mandatory pre-demolition and renovation audits with promotion of reuse – as currently in place in Hungary & Finland. Ideally, these would be undertaken by an independent party and the actual performance (in terms of levels of reuse) compared to the suggested levels of reuse proposed in the audit
- Managing supply and demand – where products and materials cannot be used again on the same site, there should be mechanisms to match supply and demand (linked to clear traceability to promote best use options). This could be through stockholding facilities, such as reclamation yards, and material exchanges/reuse platforms, which directly connect those with surplus materials/products to those who might want them.
- Innovation in reuse – some of the issues preventing reuse, such as time consuming manual labour needed to separate products, can be alleviating through new technologies. For example, the REBRICK¹⁰ mechanical brick cleaning system in Denmark.
- Support for the reclamation sector – both in terms of R&D and business support. There are new start ups and longstanding enterprises in this space, though the demand for the 'reclaimed aesthetic' can lead to the stocking of reproduction items, which should be discouraged.

⁷ <http://www.communitywoodrecycling.org.uk/about-us/our-impact/>

⁸ <http://www.salvonews.com/story/truly-reclaimed-wood-x92406x9.html>

⁹ Resource Efficient Use of Mixed Wastes - Improving management of construction and demolition waste. Report due for publication 2017 -

http://ec.europa.eu/environment/waste/studies/mixed_waste.htm

¹⁰ <https://ec.europa.eu/easme/en/news/new-old-bricks-construction-industry>

- Construction product declaration and recertification to address a key barrier to reuse. This is challenging in existing buildings where the data link to the past, in terms of manufacturing information, are often severed through periods of multiple ownership and management.
- Better impact data – especially in the context of life cycle assessment. There is currently little distinction between reuse and recycle in calculating impacts, although this is under review in a number of projects, including BAMB, Holistic Innovative Solutions for an Efficient Recycling and Recovery of Valuable Raw Materials from Complex Construction and Demolition Waste (HISER) and FISSAC¹¹.
- Data management, including BIM, could be improved and manipulated to give much better understanding of the reuse potential of new developments, prior to construction. This could facilitate a much better end of life outcome in terms of future reuse. This is a key outcome from the BAMB project, which is also looking to adapt to existing buildings to influence refurbishment options.

Conclusions

Many of the challenges to reuse are connected to the availability and robustness of data. Therefore, the work currently being undertaken as part of the H2020 funded BAMB project provides a great opportunity to address such gaps in buildings of the future. However, since the existing built environment will have a major impact on resource flows for many years, it is also important to consider approaches to improve data in this context also. This is where projects such as HISER and BAMB can also contribute valuable knowledge and support to provide decision makers with the relevant tools and techniques to enable greater reuse.

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¹¹ HISER www.hiserproject.eu/; FISSAC <https://fissacproject.eu>