

The reuse of structural components and materials

The construction industry disposes of 120Mt¹ of construction 'waste' per year, though it is often possible to recover these materials for reuse and recycling. Much progress has been made in the recycling of construction materials and this will be dealt with in separate sustainability briefings. This briefing however, is aimed at providing an overview of the reuse of structural materials and what it means to structural engineers.

It may be prudent to clarify what is meant by the reuse of structural materials as opposed to recycling them. Fig 1 gives an annotated version of the material use hierarchy agreed by the EU in directive 2008/98/EC².

For the structural engineer, arguably, the greatest scope to influence the sustainability of a scheme is found in the choice and specification of the structural components and materials. Which materials then, can a structural engineer specify as reused?

Examples, with estimated UK reclamation volumes where known³ include:

- Hot rolled and cold formed steel sections – 20 000t/y
- Structural timber, timber sheet products and studwork – 50 000t/y
- masonry (brick and stone) – 1 400 000t/y
- precast concrete units
- sheet piling
- entire portal frame buildings
- foundations

There are also many opportunities to reuse structure *in situ* – not a modern idea – as indicated in Fig 2, a 'modern' dwelling constructed in a former arch of the 12th century Abbey of St Edmunds.

Currently the reclaimed structural components market is small and poorly integrated into supplier networks. However, with perseverance, it is possible to specify and procure these items. The Beddington Zero Energy Development (BedZED) design team procured and reused a number of materials including structural steel beams and columns⁴ (see Fig 3). In addition, a project was undertaken in Berlin where precast concrete elements from a former apartment block were reclaimed and reused in the construction of a new house⁵ (Fig 4).

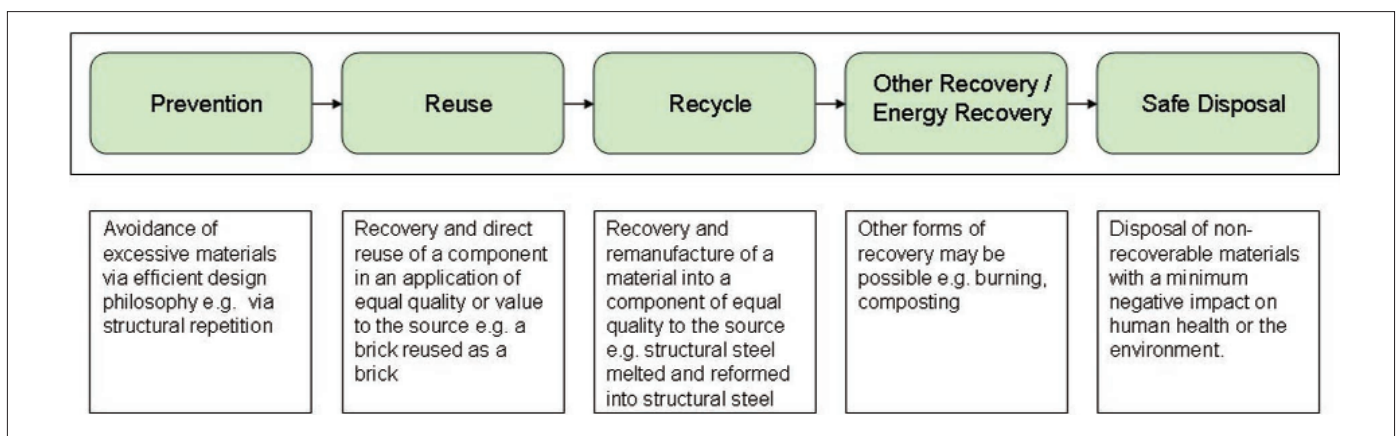
It is also possible to avoid the need to go to a market and instead identify components that may be directly used onsite. If a



2 Dwelling constructed in the former Abbey of St Edmunds, Suffolk

new building is to be constructed on the site of an existing structure, or perhaps within close proximity, an alternative approach may be to consider how the old structural components could be integrated or reused in the new structure. In other words, instead of designing a structure and procuring the materials, consider identifying reusable components first and then developing a design to make use of them. This is particularly relevant in urban centres where there is a constant level of renewal of the building stock. This principle is exemplified in the Reuse of Foundations for Urban Sites (RuFUS) Project, which has produced a best practice handbook to aid designers⁶.

By reusing components and materials the structural engineer can directly achieve a reduction in the embodied energy of the structure, and possibly the financial cost, as well as additional advantages associated with a reduced demand on finite resources.



1 Material use hierarchy (with annotations)



3 BedZED steelwork



4 Precast panels of the Berlin house

Challenges facing an increase in the reuse of structural components include the lack of a mature secondary market, health and safety issues surrounding the dismantling of buildings, as well as problems with the processing and assurance of the components before reuse. In addition, UK and EU legislation has tended to place more emphasis on the recycling of materials rather than component reuse which has further hampered the development of this market. Guidance in designing for deconstruction as well as research and guidance on the properties of reclaimed materials will greatly assist in addressing these challenges. A forthcoming sustainability briefing will set out the principles of designing for deconstruction.

Despite the challenges to reuse, it is possible to procure and use reclaimed structural components in new projects, and there are clear environmental, and possibly financial, benefits in doing so. It is hoped that engineers reading this briefing sheet may wish to consider if there are reuse opportunities within their projects and an increased demand can be created in this sector. WRAP have prepared a 'Reclaimed Building Products Guide'⁴ which offers further information as to the procurement of reused building components.

References

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- 6 Butcher, A. P. et al. 2006. *Reuse of Foundations for Urban Sites – A Best Practice Handbook*, IHS BRE Press, Berkshire, UK

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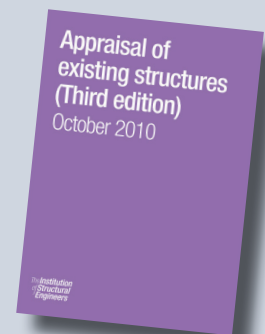
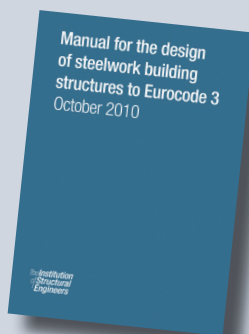
Further Information

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