Overcoming the barriers to steel reuse within construction

Gary Newman
Executive Chair
Alliance for Sustainable Building Products
OUR MEMBERS

PRODUCT MANUFACTURERS, ARCHITECTS, DISTRIBUTORS, CONTRACTORS, SPECIFIERS, DESIGNERS, UNIVERSITIES, SUSTAINABILITY ORGANISATIONS
Why Steel as a material?

- Primary construction resource
- High embodied carbon
- Surge in supply
- Inherently durable for reuse
- Reuse lessons will apply to other materials
Why reuse steel?

What are the benefits?

• Reuse should offer capital cost savings
• Reused steel has 4% of the embodied impact of new steel (BRE 2002)
• Reuse avoids energy intensive recycling
• Social value; jobs, skills, keeping material flows local
• Enabling the circular economy
What are the barriers?

- Cost (deconstruction, shot-blasting, re-certification, fabrication)
- Availability and storage
- Lack of client demand or negative client perceptions
- Quality assurance and traceability
- Lack of supply chain integration

Densley-Tingley et al (in press)
Two current Innovate UK projects to overcome these barriers

ASBP lead:

**Circular Economy Business Models**
Reuse of Structural Steel within Construction

SCI lead:

**Supply Chain Integration**
Supporting the supply chain for steel reuse
Reconfiguring the supply chain

Old building

Identify source building

Deconstruction

Strip building and deconstruct frame

Design

Design around available stock to minimize overuse

Recondition/Certification

Clean, remove fixings; coupon (or other) test; negotiate insurance

Fabricate

Cut and weld

Construction

As normal

New building

Share messages
Examples of steel reuse

Car dismantlers break up damaged or old vehicles to resell components as low price spare parts.

Scalable business, internet to reach a larger market, no steel certification or quality guarantee, niche for heritage cars

Rail track is regularly reused by:
1) swapping over left and right rails to avoid wear on the inside edge
2) cascading main-line tracks to secondary lines with less traffic.

Requires ultrasound testing, cutting and welding

Half the world's retired ships are beached and manually dismantled on the shore at Alang, India. Steel plate is routinely cut from the ship and later heated and rerolled into reinforcing bar for construction.

Unregulated industry, poor quality rebar, no steel certification

James Dunkerley Steel: 3,000 t/yr of used steel beams (20% of stock). Portal Power: 2,000 t/yr of refurbished portal frame buildings.

Small scale unregulated industry (UK=~800kt/yr), no testing or certification, pay premium for quality discarded steel, very profitable
Potential for reuse in construction

Steel use in UK construction and reuse potential

UK demand for steel in construction grew rapidly from 1950 onwards, and scrap supply lags about 50 years behind demand, meaning steel is now available for reuse.
UK Steel prices (2001 to 2016)

The cost-margin between new and scrap steel ranges from £200 to £400. Steel reuse is profitable if the cost of recovering structural steel is below this margin.
And yet ...

<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>Reuse</th>
<th>Recycle</th>
<th>Landfill</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>Steel Construction Institute</td>
<td>12% (*)</td>
<td>93%</td>
<td>5%</td>
<td>(*) Heavy sections</td>
</tr>
<tr>
<td>2006</td>
<td>Gorgolewski <em>et al.</em></td>
<td>10%</td>
<td>90%</td>
<td>nil</td>
<td>All</td>
</tr>
<tr>
<td>2012</td>
<td>EUROFER</td>
<td>7% (*)</td>
<td>96%</td>
<td>2%</td>
<td>(*) Heavy sections</td>
</tr>
</tbody>
</table>
What is the practical and economic feasibility of an on-line information portal matching supply and demand of reused steel to stimulate this market?

Collaboration between academic and industrial partners

1 Nov 2015 – 31 Aug 2016

Part of the Supply Chain Integration in Construction funded by Innovate UK (Technology Strategy Board)
Small-scale local reuse
Reuse happens when the buyer and seller can easily communicate, or are the same entity.

**Buyer**
wants reused steel for new building

**Seller**
wants to sell a property or building

**Designer**
(engineer /architect) designs building

**Fabricator**
frames incorporate reused steel sections

Reused steel sourced directly

Design with reused sections in mind
Long-term objective

**Client**
Wants reused steel for new building

Shows interest in reused steel

**Designer**
(Engineer/architect) designs building

Generic design for new or reused steel

**Developer**
Wants to sell a property or building

Sees value in extracting steel from building

**Demolition contractor**
Deconstructs building to recover steel

Delivers reused steel to stockist

**Fabricator**
Frames incorporate reused steel sections

**Full-scale reuse market**
Steel stockist holds certified reused steel. Clients/designers not part of decision-making

**Stockist**
Holds new and certified reused steel
Client wants reused steel for new building

Shows interest in reused steel

Designer (engineer/architect) designs building

Generic design for new or reused steel

Supply—demand website
Linking demand and supply for reuse steel
Regular updates of quantities and timing

Developer wants to sell a property or building

Sees value in extracting steel from building

Demolition contractor deconstructs building to recover steel

delivers reused steel to stockist

Full-scale reuse market
Steel stockist holds certified reused steel
Clients / designers not part of decision-making

Fabricator frames incorporate reused steel sections

Stockist holds new and certified reused steel
We’d like to hear your thoughts on structural steel reuse...

www.surveymonkey.co.uk/r/36DJFYK
Supply chain integration for structural steel reuse

Michael Sansom
Steel’s current credentials

**Steel recycling**
- Infinitely recycled (multicycled)
- 100% recyclable
- No loss of properties
- Economic value ensures recovery
- Global infrastructure for scrap steel
- Certain products also reusable
Steel construction products
Many reusable steel systems
# Reuse and recycling rates

<table>
<thead>
<tr>
<th>Product</th>
<th>% Reused</th>
<th>% Recycled</th>
<th>% Lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy structural sections/tubes</td>
<td>7</td>
<td>93</td>
<td>0</td>
</tr>
<tr>
<td>Rebar (in concrete superstructures)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rebar (in concrete sub-structure or foundations)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel piles (sheet and bearing)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light structural steel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profile steel cladding (roof/facade)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal light steel (e.g. plaster profiles, door frames)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (e.g. stainless steel)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Average (across all products)</strong></td>
<td><strong>5</strong></td>
<td><strong>91</strong></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>

Survey of NFDC members, 2013
SEGRO relocation case study

- 3,180m² office and warehouse (2000)
- Relocated 1 mile away
- Slough trading estate
SEGRO relocation case study

Reused elements:
- Steel structure
- Plant/MEP
- Precast planks
- Curtain walling
- Raised access floor
SEGRO relocation case study

56% lower embodied carbon compared to an equivalent new build (Sturgis cp)
From niche to mainstream
Supply chain integration for structural steel reuse

- Innovate UK funded feasibility study
  - Supply chain integration competition
- Supply-demand co-ordination tool for steel reuse
  - One of the key barriers to steel reuse
Construction supply chains

- Traditionally long and linear
- Often end at completion/handover
- Long in-use phase
- Designers disconnected from demolition contractors
On-line portal

Designer requirements:
- Member size & grade
- Age and origin
- Location & availability

Demolition contractor:
- Pre-demolition audit
- Weight & value
Supporting guidance

- Specification and design of reused steel
- CE marking and other regulatory requirements for reused steel
- Pre-demolition surveys and audits
- Testing
- Contractual arrangements for sourcing and using reused steel
- Insurance and warranties
- Case studies of successful projects and quantification of the carbon savings
Steel reuse and BIM

- BIM theoretically overcomes many problems of traceability
- Steelwork contractors already BIM proficient
- Prototype will explore this
SCI is the leading, independent provider of technical expertise and disseminator of best practice to the steel construction sector. We work in partnership with clients, members and industry peers to help build businesses and provide competitive advantage through the commercial application of our knowledge. We are committed to offering and promoting sustainable and environmentally responsible solutions.
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Realities of supplying the construction industry with re-used steel

Opportunities & Threats

Roy Fishwick, MD, Cleveland Steel and Tubes Ltd
Introducing Cleveland Steel and Tubes

• We specialise in the reuse of oil pipe and mill surplus and down grades
• Quality has ramped up dramatically in 20 years
• Surpluses are significant – 36,000T on one contract
• Sizes are bespoke so storage can be a long term necessity
OPPORTUNITY

- LOWER SCRAP PRICES
- DECLINE OF GB STEEL
- SUSTAINABILITY – INNOVATION
- INCREASING SCRAPPING COSTS
- IMPROVED TESTING/INFORMATION

THREATS

- MARKETING
- SCRAP REPUTATION
- THE BIG ONE: CE MARKING

RECESSION

REGULATION
OPPORTUNITIES

• **Low Scrap Prices**: Lower scrap prices act as an incentive for the industry to develop new income streams.

• **Decline of GB steel**: Scrap will be shipped longer distances, further reducing scrap price. Designers will have to use European section sizes.

• **Sustainability**: More and more relevant.

• **Better Info**: Non Destructive Testing, records, traceability.

• **Increase scrapping costs**
THREATS

“Marketing”
• Ever increasing grades
• Global players – market control
• Specifiers guides – all prime, new grades

“Scrap industry” reputation/perception:
• Dodgy/dishonest,
• Poor quality
RECESSION

• Cost is key
• Market prices low

• Green is losing
• Less chance of a return
THE
BIG
ONE
REGULATION

E.U.

DANGER

MINEFIELD

- CE marking/ Construction Product Regulations
- Green Regulations & Targets
- Could kill off reuse

ASBP will be leading a campaign
Thanks for listening. Please get in touch
Roy@cleveland-steel.com
Roy Fishwick, MD, Cleveland Steel and Tubes Ltd
info@asbp.org.uk  www.asbp.org.uk
Value Networks

Simon Corbey, MSc, MRICS
Associate Director
Alliance for Sustainable Building Products
Circular Economy Business Models
Reuse of Structural Steel within Construction

- ASBP lead
- Collaborators: Ellis and Moore, Cleveland Steel and Tubes, Steel Construction Institute
- Wider team; UCL, University of Cambridge, Cullinan Studios, NFDC
- In collaboration with Forum for the Future
BedZED – 2002

98 tonnes of steel reused; 81.5 tonnes Co$_{2e}$ saved, cost neutral
Key insights – Enabling the Circular Economy

• Technology and design alone won’t get us there
• There is a need to transition to new business models
• It’s your value network that matters
Value Network

• A **value network** is a business analysis perspective that describes social and technical resources within and between businesses.

• The nodes in a **value network** represent people (or roles). The nodes are connected by interactions that represent tangible and intangible deliverables.
The Brain – the Ultimate Network
You are your connections
Key insights

• Innovating new business models need things you don’t have

• You need access to new capabilities and assets to do things differently.
Value Network

• Aligned interests across all the players because the value networks fulfils a job to be done for the each of them.

• Delivers through competencies that are rare and hard to imitate and/or difficult to replace.
New business models

• UK's first 'pop-up village – PLACE/ Ladywell
New business models
SEGRO – 9, Cambridge Ave
“Remaking, Rethinking, Warehousing”

**Quality**
- New Build Quality reusing existing building components

**Cost**
- 25% Reduction in Capital cost*

**Carbon**
- 56% Reduction in Embodied Carbon* at practical completion

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*Excluding external works
*Reductions compared to a benchmark new build

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<table>
<thead>
<tr>
<th>Embodied carbon (TCO2e)</th>
<th>Cost in £/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark (Part L Compliant New Build)</td>
<td>1400</td>
</tr>
<tr>
<td>9 Cambridge Avenue (As built)</td>
<td>700</td>
</tr>
</tbody>
</table>
New business models

- Philips/NUS Pay per Lux
New business models

Peterborough is initiating an ambitious line of work seeking to create a pioneering Circular City; embedding an innovative citywide circular economy approach.

Helping Peterborough to efficiently manage the numerous flows of resources coming in and out of its geographical boundaries.
Values

• Reuse should offer capital cost savings
• Reuse has 4% of the embodied impact of new steel
• Reuse avoids energy intensive recycling
• Social value; jobs, skills, keeping material flows local
• Knowledge
The Linear Supply Chain

Client/Developer → Designers → Contractors → Sub Contractors → Users → Demolition
The ASBP Reusable Building Network