Business models for steel reuse and the prototype steel reuse

Michael Sansom

The Circular Economy

Ellen MacArthur foundation
The economic opportunity of the circular economy

- $4.5 trillion globally next 15 years
- UK NMR £10 billion profit increase
- $380 billion pa EU material cost savings
- Europe net economic benefit €1.8 trillion by 2030

- Accenture Waste to wealth: creating advantage in a circular economy
- Next manufacturing revolution (2013)

Going beyond recycling to reuse

Recycling

500m tonnes pa ≈ 30% global production
> 95% structural steel is recycled
Going beyond recycling to reuse

Recycling  \[ \approx 5\% \text{ structural steel is reused} \]  Reuse  \[ \approx 5\% \text{ structural steel is reused} \]

500m tonnes pa \( \approx 30\% \text{ global production} \)

> 95\% structural steel is recycled

\[ \text{€1130 per tonne} \]

Although steel reuse does happen
We know there are barriers

- Extra cost
- Availability of suitable sections
- Lack of demand/incentive
- Traceability, certification and quality
- Programme constraints
- Automated fabrication lines
- Lack of supply chain integration
- Uncommon practice – lack of skills and experience in how to do it

Constructional steel has good recycling credentials

No drivers for steel reuse therefore viable business models required
Circular economy business models

- Product as a service
- Hire & leasing
- Incentivised return
- Reuse
- Long life
  - Design for deconstruction and reuse
Model variants for steel reuse

- Reuse today
  - Existing buildings

- Future reuse
  - Design for deconstruction and reuse

Model variants for steel reuse

- Reuse today
  - Existing buildings

- Future reuse
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- Building level
- Component level
Hire and leasing

- Leasing of buildings is common practice
- Many examples of temporary, reusable buildings
- Benefits:
  - No capital outlay
  - Generally no maintenance
  - Flexible terms

Hire and leasing

- Many examples of temporary, reusable buildings
- Product level
  - Road plates
  - Sheet piles
  - Props & formwork
Product as a service or servitisation

- Examples:
  - Rolls Royce jet engines (power by the hour)
  - Xerox, HP managed print services
- Construction
  - Limited to building services
  - Philips – ‘pay-per-lux’ model

Incentivised return

- Take-back or buy-back schemes
- Retail sector and WEEE
- Construction examples:
  - Rockwool
  - Plasterboard
  - Ceiling tiles
- Limited to:
  - Construction waste & off-cuts
  - Uncontaminated waste
Incentivised return for steel products

- Value of scrap ensures recycling
- Requirement for packaging waste
- Buy-back scheme potentially attractive to steel producers
  - Certainty of future supply
  - Certainty of price (carbon taxation, clean technologies)
  - Encourages extended producer responsibility and traceability
  - Encourages standardisation and development of systems that are reusable

Reuse
Many reusable steel systems

…..in temporary works

Many reusable buildings

…..in temporary applications
Existing steel reuse business models (UK)

Building level reuse

- Niche markets in certain sectors
  - Agricultural & industrial
- Costs are project specific
  - Location
  - Scrap price
  - Suitability of building
- Many technically and commercially viable cases
Component level reuse

- Construction material exchanges
- ebay – small-scale
- Some stockists sell reclaimed sections alongside new sections

Profit opportunity £313 per tonne (UK)

But additional cost for:
- Deconstruction
- Testing
- Storage
- Transport
- Refabrication
Predicting future availability of structural steel UK

Cost assessment of component reuse (UK, 2017)
Cost assessment of component reuse (UK, 2017)

Supply chain reconfiguration
A possible model

- Large on-line inventory of stock
- Cost savings
- Reduced lead-in times
- On-site fabrication, testing and painting

Steel reuse supporting services

- On-line trading portal for reclaimed steelwork and building scheduled for demolition
- Guidance and information
- Pre-deconstruction auditing
- Material testing
- Reused product certification
Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>Existing</th>
<th>Future measures</th>
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</thead>
<tbody>
<tr>
<td>Hire &amp; Leasing</td>
<td>Market for relocatable buildings in many sectors (temporary applications) Many temporary works component examples</td>
<td>Challenging longer-life buildings Possible model for retail/distribution sectors Not viable for permanent works components</td>
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<tr>
<td>Servitisation</td>
<td>Some building services models</td>
<td>Possible for whole buildings but not building ub-systems, e.g. structure</td>
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<tr>
<td>Incentivised return</td>
<td>Increasing uptake but generally limited to uncontaminated construction waste No requirement for steel products which are already highly recycled</td>
<td>Buy-back scheme to guarantee future supply for steel makers Incentivises traceability and product development to facilitate future reuse</td>
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<tr>
<td>Reuse</td>
<td>Small-scale, niche markets at both building and product level</td>
<td>Need to increase demand (supply will follow) [Legislation would help] Reconfigure supply chain</td>
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<tr>
<td>Supporting services</td>
<td>Limited available information and support Limited trading via material exchanges</td>
<td>Designers need skills and support Testing and certification Secure capture and storage of BIM data</td>
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</tbody>
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Prototype steel reuse portal

- Website for trading reclaimed structural steel
- Online search
- Register to upload information and transact
- Existing buildings
  - Buildings scheduled for demolition
  - Reclaimed sections
- New buildings repository
  - Uploaded IFC files
Existing building search

Pre-demolition – building scheduled for demolition

Post-demolition – inventory of sections

Specific section search

Find reclaimed sections

Select section required

Enter postcode to search a specific area:

Available sections:

- Beam (£/m): 533 x 216 x 82
  - Quantity: 2
  - Length: 24m
  - Grade: C82

- Beam (£/m): 533 x 216 x 82
  - Quantity: 4
  - Length: 18m
  - Grade: C82
Specific section search

New buildings and future reuse

- IFC files of new building uploaded to website
- To facilitate future:
  - Refurbishment and extension
  - Reuse
  - Traceability and properties for optimising recycling
- At end-of-life building and sections become available/searchable
IFC structural model

Component level information
Component level information

Securely stored to facilitate future reuse
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