Reuse of steel structures and the circular economy

Tuesday 8th October 2019
Steel already has good recycling credentials
Steel recycling

- Versatile 3,500 different grades
- Durable and strong
- Infinitely recycled
- No loss of properties
- Magnetic properties assist recovery & sorting
- Economic value ensures recovery
- Global infrastructure for trading scrap steel
Going beyond recycling to reuse

Recycling  ➔  Reuse

500m tonnes pa ≈ 30% global production

£974 per tonne
Steel construction products
Context

- 50% of all resources attributable to construction
- Global floor area predicted to double by 2060
- 2°C scenario requires steel sector to reduce GHG emissions by 65% by 2050
- Current consumption patterns are unsustainable
Steel is strong and lightweight

One Kingdom Street, London:

1. Steel frame 32.3kt

2. PT concrete frame 55.4kt

• 72% (23kt) more materials!

Frame and upper floors only:
• PT has 142% (23kt) more materials
Carbon intensive steel

- Steel is currently carbon intensive in (primary) production
- Steel-making accounts for 7% of global CO₂ emissions
- But steel is highly recycled and 100% recyclable
  - And some constructional steel is reusable
Steelmaking and carbon

BOS steelmaking: $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$

Energy per tonne: Index 1970=100

Limit of current Technology?

Tata Steel data
Supply side measures

Steel producers have ambitious plans for low and zero carbons steel:

- Tata Steel - Hisarna
- Arcelor Mittal
- SSAB – HYBRIT initiative

- But we also need to implement demand-side measures
End-of-life scenarios

Deconstruction and reuse

Demolition and crushing (downcycling)
Many reusable steel systems
Although steel reuse does happen
We know there are barriers

- Extra cost – perception or reality?
- Availability of suitable sections
- Lack of demand/incentive
- Traceability, certification and quality
- Programme constraints (automation)
- Lack of supply chain integration
- Uncommon practice – lack of skills and experience in how to do it
Two reuse scenarios

Reuse today

Future reuse
Reuse today

Problems:
• Traceability, certification and quality
• Availability
• Lack of expertise

Solutions:
• NDT
• Remote/drone surveys
• Better supply chain integration
• Bespoke material exchange
• Provision of guidance
• Fiscal incentives
Future reuse

Solutions:
• Digital information
• Design for deconstruction and reuse
• Standardisation
CE theory vs reality
Delivering **real** solutions

**REDUCE**

- Reuse and Demountability using Steel Structures and the Circular Economy
- To provide practical tools and steel-based technologies to be able to design steel and **composite structures** for deconstruction and reuse

**PROGRESS**

- Provisions for Greater Reuse of Steel Structures
- Reuse of existing and new **single-storey buildings**
- Primary, secondary structure and envelope
**Reuse of steel structures and the circular economy**

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| 10.40-12.45 | Reuse of single-storey steel framed buildings  
*Findings from the EU project PROGRESS* |
<p>| 12.45-13.45 | Lunch                                                                   |
| 13.45-14.00 | Launch of the SCI structural steel reuse protocol                       |
| 14.00-15.05 | Findings from the EU project REDUCE                                     |
| 15.05-15.15 | Break                                                                   |
| 15.15-16.20 | More findings from the EU project REDUCE                                 |
| 16.20-16.40 | Overview of the EPSRC REUSE project                                    |
| 16.40     | Close                                                                   |</p>
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<td>Overview of the EU project PROGRESS</td>
<td>Dr Petr Hradil</td>
<td>VTT, Finland</td>
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<td>1100-1120</td>
<td>Reusability of existing structural steel</td>
<td>Dr Ana Girao Coelho</td>
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<td>1120-1140</td>
<td>Design of new single-storey steel buildings for reuse</td>
<td>Ricardo Pimentel</td>
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<td>1140-1200</td>
<td>Reuse of steel cladding systems</td>
<td>Prof Markus Kuhnhenne</td>
<td>RWTH Aachen University, Germany</td>
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<td>Environmental assessment of steel recycling and reuse</td>
<td>Dr Michael Sansom</td>
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<td>Evaluation of single-storey building design using reclaimed steel</td>
<td>Prof Daniel Viorel Ungureanu</td>
<td>University of Timisoara, Romania</td>
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<td>Q&amp;A and discussion</td>
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“Escher! Get your ass up here.”