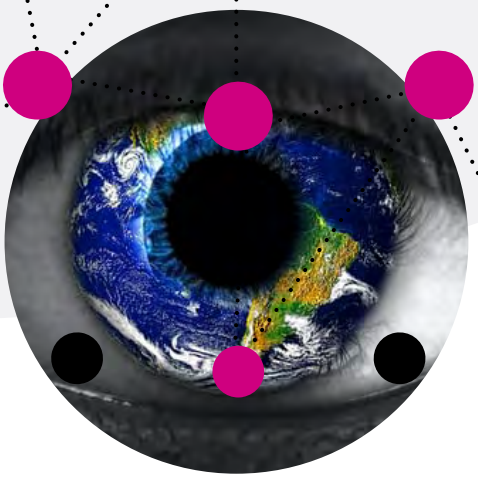

NICER PROGRAMME & INNOVATE UK

CIRCULAR ECONOMY FOR SMEs

Heyne Tillett Steel

UKRI Interdisciplinary Centre for Circular Metals

NICER PROGRAMME

UKRI Innovate UK

TESTING CONCRETE-ENCASED STEEL FROM THE 1950S FOR DIRECT REUSE

The Challenge: What We Were Trying to Achieve

When a steel building is demolished, the steel is salvaged, melted down and recycled into new steel elements. While this avoids steel entering the waste stream, it is still extremely energy-intensive and far from the most efficient path for this durable, robust material. A much more circular path is possible: reusing the steel directly. This keeps material in use for longer, is far less energy intensive, avoids repeated imports and exports, and has a carbon footprint eight times smaller than traditional steel.

Reusing steel involves dismantling it from a donor building, testing it and confirming its quality, and then simply reusing it in another building. The industry currently has a clear testing protocol for this, but it only applies to steel erected from 1970 onward. Since modern steelmaking started in 1855, this leaves out a significant proportion of existing steel. This date threshold is currently a significant barrier to the wider adoption of reused steel across the industry.

This project applied the standard testing protocol to concrete-encased steel from 1950, from a deconstructed building in London, as well as carefully measuring the condition of the recovered elements to evaluate the impact of any damage sustained during the process. The aim was to extend the scope of knowledge and practical experience to a stock of materials not covered by current methods, as a pilot study that might facilitate the reuse of a larger proportion of existing steel in buildings.

The Approach: How We Tackled the Challenge

We asked around our company and found a team working on a redevelopment project with the right type of structure and the right age, with a programme that aligned with the funding period and crucially with a client with strong sustainability aspirations who were willing to provide us with the steel elements for testing and evaluation. The project is the redevelopment of Cundy Street Quarter in Belgravia, London, with client Grosvenor.

The approach was split into two phases:

1. Materials-testing the steel to verify its microscopic metallurgical properties
2. Remove the steel beams from the building, remove the concrete encasement and assess the condition and any damage.

When delays started to impact the wider Cundy Street redevelopment programme, we switched the order of some of the steps to keep the project on track, reduced the volume of the steel to be reclaimed and tested to keep the project feasible. The programme delays meant that we were unable to complete the second phase of the project within the funding period. However, we will see this project completed with the support of Grosvenor in the next few months.

This project would not have been possible without the support of Grosvenor, as well as the demolition contractor JF Hunt and materials testing company Sandberg.

Unexpected Outcomes: What We Learned Along the Way

Although it was not entirely unexpected, the delays to

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the wider project programme mean we have not yet completed the second phase of the project, in which the steel beams are extracted from the building and concrete encasement removed. This will be completed in the next few months with the support of Grosvenor.

The first phase of the project, getting the steel samples materials tested to understand the steel's material properties, has yielded results which are to be expected for that material and the age of construction. There were no significant outliers, which means reliability can be placed on the elements being designed in conformance to the standards applicable at the time.

One coincidence is that the Steel Construction Institute has published a draft addendum to the Structural Steel Reuse protocol which will allow reuse of steel back to 1932. The full protocol has since been published, and our project serves as a relevant case study to support this new technical guidance.

Key Learning: What We Would Do Differently Next Time

Salvaging steel for reuse is still a niche undertaking and requires site and client teams' buy-in to achieve. The technical issues are minimal. Most of the issues are logistical and impact program, so being very clear about this is important for the possibility of salvaging steel for reuse. Testing requirements and methodologies are clearly set out and materials testing laboratories are well set up to provide these.

Once we have results from the second phase, we will be in a better place to elaborate on the insights applicable to similar buildings and wider industry applications.

The Outcome: What We Achieved and How It Has Impacted the Business, Society and Key Stakeholders

The results for the first phase – materials testing – show that the steelwork sampled has appropriate properties to be reused. Since the second phase – removing the encasement and assessing damage – has not been completed yet we are unable to share results (but keep an eye out in the coming months). We will be testing two different methods for concrete encasement removal to understand the tradeoff between site practicalities, speed and resulting condition of the steelwork. This should help inform whether reusing concrete-encased steel is technically and financially viable and practical.

Looking Forward: Next Steps and Future Directions

The second phase of the project will be completed with the support of Grosvenor. While the project has been ongoing, the Steel Construction Institute's draft addendum to the Steel Reuse protocol has been published, extending the scope of permissible steel age to 1932. It does not change the process that we undertook to verify these steel beams, however it does provide a framework under which we would design the elements for reuse. Having this document bolsters the position of pre-1970 reused steel, but our project will also provide a relevant case study particularly in relation to removing concrete encasement.

As a business we have learned more about how to specify materials testing for steel reuse and interpret the results, as well as gaining a better understanding of de-casing methods and how to interpret the resulting condition of the steelwork once the second phase is completed.

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