A CASE STUDY OF TIMBER DEMOLITION RECYCLING IN THE UK

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BACKGROUND

"How should we build today to be able to circulate tomorrow?" This is one of the main questions the InFutUReWood Project (Innovative Design for the Future – Use and Reuse of Wood (Building) Components) tries to answer. But to find answers we need to step back and ask: "How did we build yesterday and what prevents reuse of building components at the moment?"

This case study looks at the condition of recovered timber from the demolition of a relatively modern light timber frame building in the UK. We evaluate the chances and barriers for the reuse of demolition timber and discuss which measures in the design and planning of buildings would be most influential in the transition towards a more circular economy for construction timber.

MATERIALS AND METHODS

An interview was conducted with Michael Hunter, Demolition Manager of Chamic Demolitions in Edinburgh in February 2020. During the interview Mr. Hunter agreed to let us observe the demolition of a building that would serve as a case study.

The demolition activities on the building started in August 2020 and an inventory visit during the soft strip phase could be arranged on the 21st of August. The original condition of the building and materials was documented, where visible.

The site was visited again after the demolition process had started and the demolition techniques as well as the waste management on site was observed. The condition of the recovered timber was visually analysed.

RESULTS AND DISCUSSION

The two-storey building that served as the case study was built after 1988 with parts of it added as late as 2010 (Edinburgh Council n.d.). A significant extension was commissioned in 2004, which means that parts of the timber structure served a life of merely 15 years.

The building is mostly built in light timber frame of the type typical in the UK, with an outer shell made from concrete. The main timber elements in the building are stud walls, floor joists, trussed rafters and panel products. As is common practice in Scotland, there are timber boards (sarking) over the rafters. Compared to construction today there is more solid wood and less engineered wood product, but there is still a mix of wood-based materials, especially when considering the skirting boards, door frames and other non-structural parts. The demolition company only salvaged items that could be sold for a profit before demolition. This includes some natural stone and older wooden doors. Other items that would be hard to separate using machines were removed manually (soft strip) but without the intention to keep them intact, examples are handrails and door frames. The company can send approximately 99% of all stone, concrete and timber that arise in any demolition to recycling, due to their effective segregation. In times of rising landfill costs and gate fees, this is a cost saver for the company, but this recovery and recycling is almost all at a basic material

The visual inspection presented the building in a good condition. No decay or damage to any timber level.members was visible and especially the timber in the 2004 extension looked as good as new. The reason for the demolition of this building was purely economic, as it will be replaced by new construction with a different purpose. According to Michael Hunter, buildings are often demolished because their use or tenancy chances, but in other cases, especially in concrete blocks from the 1960s, material deterioration is the reason for demolition. For this reason, the age of buildings that are being demolished varies. Buildings from the 1950s and 60s as well as the 2010s are coming to the end of their useful life, but older buildings from before 1900 are not demolished anymore, because of their historic value.

The demolition of the case study building started in September 2020. Excavators with specialised hand-like tools were used to grab and tear apart building parts. They can separate different materials very effectively, but the components are usually damaged in the process. Metals, wood and non-recyclable waste are sorted into skips, and concrete, stone and gypsum board are collected into piles in the yard. While there is a need to segregate materials for recycling, there is no necessity to keep them intact since the current recycling processes for all materials from demolition sites include their disintegration. Indeed, the breaking up of materials on site helps with the transportation. At the recycling facilities timber is usually chipped for animal bedding, particleboard manufacture and biomass incineration (Cramer and Ridley-Ellis 2020).

It would not be impossible to extract timber and other materials in a more intact condition, but Michael Hunter describes this as being unrealistic under current conditions. He mentions that the industry used to work like this and that most materials were sold for reuse after demolition, but that a market for reclaimed resources does not exist anymore, since new materials are available for a similar price. He says that the machines would be capable of extracting certain parts more carefully to keep them intact, but there is no financial incentive for doing so and it would require more time. Also, the workforce nowadays is not trained for deconstruction activities. In certain scenarios, health and safety regulations would additionally complicate the use of the dismantling approach. Still, at least some building parts could be extracted, damage free, if monetary incentives outweighed the time increase. It has been shown that dismantling could be economically feasible compared to demolition in the USA (Davies 2012; Cruz Rios, Chong, and Grau 2015).

The extracted timber is freed from adjunct materials like roof felt, cables or large metal parts, either by hand or using the excavator. Fasteners like nail plates, nails and screws are left in the timber, since these material contaminations can be easily removed after chipping. However, when we imagine that the timber could be extracted in a good enough state for higher cascading steps, these material contaminations would pose a problem for reuse and reprocessing. Most timber members were littered with different kinds of fasteners, and it would be a challenge to even find 1m of clear wood in most of them. Many of these fasteners were for attaching the buildings electrical wires and other non-structural parts. Despite everything being in excellent condition, because of their variety and number it is hard to imagine that these fasteners could be removed in an automated way, so this would be a time intensive and therefore costly operation. This means, even though nail holes might not necessarily limit the strength of timber beams (Rose and Stegemann 2018; Falk et al. 2008), nails are a problem for the reuse of timber. A design for timber structures that relies more on reversible connections like form-fitting joints would facilitate reuse and remanufacturing as well as disassembly but would still not solve the problem of the non-structural fasteners. Design for deconstruction solutions proposed within the InFutUReWood project could therefore have a large impact on the circularity of building elements.

CONCLUSIONS

Wood from demolition is not currently retrieved in a condition that would allow high level reuse. It is to assume, however, that increasing material scarcity will change the economic factors and that modern buildings should be designed and constructed to avoid any unnecessary barriers to circularity. Our paper looks into the potential, and the motivations.

ACKNOWLEDGEMENTS

Our special Thanks goes to Michael Hunter from Chamic Demolition, who generously offered his time and knowledge for our study.

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