InFutUReWood: The past, present and future of timber reuse

Marlene Cramer on a project that investigates how we can reintroduce circularity into modern timber construction

The original Globe Theatre was built using timber that Shakespeare and others of the Lord Chamberlain's Men allegedly stole from another nearby theatre. Some say they dismantled the building and removed the timber overnight. While the story might have been romanticised, it is certainly true that it had long been common practice to reuse timber from one building in another. But a lot changed in our building styles and methods: Safety standards and building regulations have become more stringent, cross sections smaller and times for construction and demolition shorter. In our ambition to make construction safer, faster, and more efficient, we lost the ability to reuse structural timber. But wood is, in many ways, valuable and should not be overlooked as a material for reuse even though it is renewable. The InFuTUReWood project (infuturewood.info) investigates how we could reintroduce circularity into modern timber construction and asks: How should we build today to be able to circulate tomorrow?

Within work package 2 of the project, we are conducting case studies on the design for deconstruction and reuse (DfDR) of building systems in four partner countries (Sweden, Ireland, Spain and the UK). The case studies investigate how well contemporary timber buildings could be deconstructed and reused after their first life, and aim to improve existing designs to facilitate reuse. The Swedish case study between RISE and Derome is the first one in the series and looks at a two-storey detached house, the Villa Anneberg. In addition to the design evaluation, work package 6 at Technical University Munich is performing Life Cycle Assessment and Life Cycle Cost on the current and proposed designs, to analyse the environmental and economic viability of the DfDR concept.

In the Scottish case study, Edinburgh Napier University is working with Offsite Solutions Scotland and Robertson Timber Engineering to assess the design of a five-bedroom timber frame house. The building is manufactured offsite and assembled using open-panel wall elements and floor cassettes. In a thought experiment we go on a journey into the future to when the building has to be moved to a new site. We analyse how well the building could be deconstructed, how much timber could be reused and which challenges we would encounter. Afterwards, we improve critical design details to increase the deconstructability and the amount of timber that can be recovered without damage. Preliminary results show that components manufactured offsite don't only have advantages in the assembly, but are likely to facilitate deconstruction and reuse as well. The manufacturers are confident that, with small changes in the design, they could extract large elements, for example the whole roof structure, with minimal damage.

Offsite building systems are the centre of all our case studies since they are gaining popularity in all partner countries. Yet the advanced offsite timber building systems, as we see them in the case studies, are a relatively modern development and these buildings do not usually come to the end of their life yet. More traditional building systems (including masonry construction) are producing large amounts of wood waste in their construction and demolition. Other work packages in the project are therefore more focused on the present, investigating the properties and reuse potential of recovered timber.

Work package 4, led by Aalto University Finland, and work package 3 at National University Ireland Galway assessed current demolition techniques and the condition of demolition timber in an extensive survey, including a case study from the UK (presented here: **https://youtu.be/xZWIecjxmN8**).

In addition, work package 4 analysed the amount of wood in today's building stock and is now characterising quality criteria for sorting demolition timber. The mechanical properties of recovered timber are characterised in work package 5 at Ljubljana University and Edinburgh Napier University, as part of the work to develop and test new grading approaches for recovered wood. Work package 3 is designing new construction products from secondary timber and is currently manufacturing and testing CLT panels and glulam beams at NUI Galway and Polytechnical University of Madrid, which are also being assessed for environmental impact in work package 6.

The InFutUReWood project offers various approaches for the circular use of structural timber, from reusing single members to moving whole buildings, just as it used to be in Shakespeare's time, only without the drama, and all the required safety and efficiency of modern timber construction. The project is running until February 2022 and all results, including the DfDR case study reports, are published on our website **infuturewood.info**.