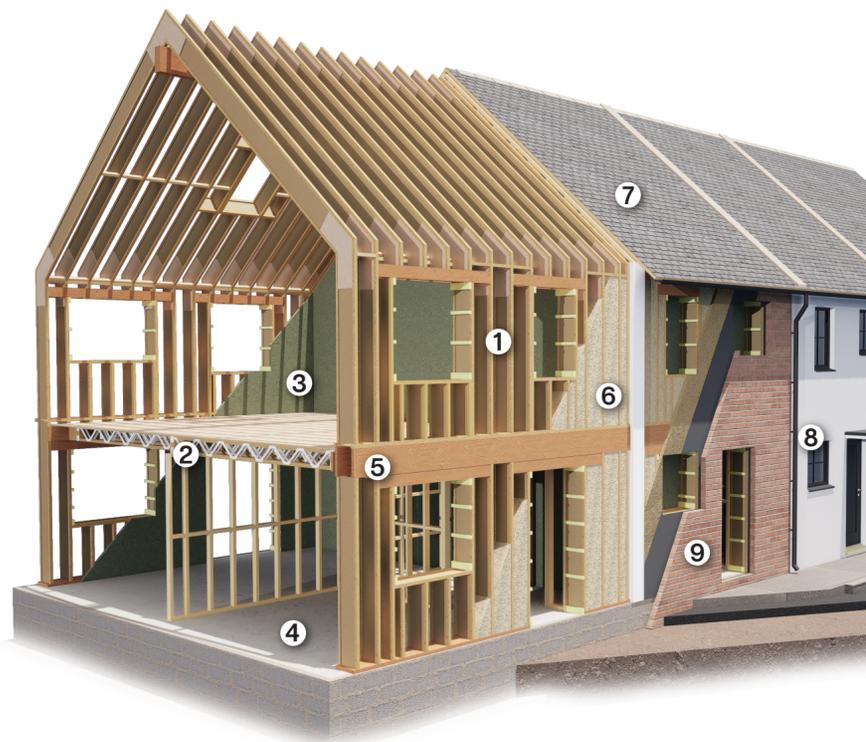


Reimagining Timber Construction



PH15 System

PH15 is a construction system that delivers Passivhaus levels of operational energy performance alongside **radically reducing upfront carbon** to meet new 'net zero' housing standards. PH15 uses the best in **contemporary timber products** alongside **modern methods of construction (MMC)** to provide a **buildable solution** for new housing. Timber frame should be used wherever feasible for UK new-build housing, and there are built examples of 'Passivhaus Plus' certified houses in the UK using PH15.



1. Pre-cut timber portal frame
2. Webbed floor joists
3. Robust and simple airtight layer
4. Raft slab using recycled glass blocks
5. Thermal bridge free junctions
6. Vapour open natural insulations
7. Mechanical ventilation with heat recovery
8. Triple glazed windows
9. Wide choice of external finishes

Circular Economy

To maximise the use of UK **lower grade timber (C16+)**, structural timber products that are **efficient in design and in the use of the log** are critical. This requires research into the feasibility of using UK timber for I-joists (with LVL/solid section flanges). This research should assess dimensional stability to ensure suitability for offsite manufacturing techniques, from pre-cutting to full panellising. A linked focus on the production of **wood fibre-based insulations** (loose and boarded) to minimise waste and maximize circularity and replace the common use of high upfront carbon insulations. A timber structural frame should ideally be combined with **wood-based insulations**, and this is best suited to **I-joist frames**. I-Joist frames are a natural solution to climate change mitigation for new houses. We are proposing research and development to enable UK grown and manufactured I-joists combined with wood fibre insulation products as a circular economy system.

LVL and Solid Section I-joists

The PH15 I-joist frame uses European higher grade softwood timber in the form of laminated veneer lumber (LVL) that is both strong and dimensionally stable. The factory is sited within the forest and the entire log is made into a selection of timber products including:

- LVL I-joists with a hardboard web
- LVL beams
- Woodfibre insulation boards and loose wood fibre insulation

This multi-product approach utilizes **100% of the log** with minimum waste. With the use of LVL flanges in the I-joist, **35-50% less raw material is used**. The **dimensional stability** of LVL is also well matched for offsite manufacturing techniques. Pre-cut packs can go to site for erection by local UK carpentry teams, without undue swelling risks to manage. There is no I-joist manufactured in the UK (2022) that uses UK grown timber. Solid section I-joists made in the UK, use European raw timber for the flanges.

The UK climate produces lower grade timber. Scotland has been researching producing a better grade timber (C16+). The supplied strength of the LVL I-joists from Europe is not always needed in the domestic setting. If proven feasible, a UK grown and manufactured, lower grade LVL or solid section I-joist, would extend the efficient use of UK timber significantly and open up the UK market for affordable timber frames, using off-site technologies.

I-joists vs. CLT

Scotland now has a factory using Scottish raw timber to produce CLT. For a typical house a CLT panel would be 100mm thick. For four terrace houses:

- Using 100mm CLT panels. Structural timber **53m³**.
- Using PH15 System with a 360mm I-joist frame. Structural timber maximum **30m³**
- **Approx 44% timber saving using LVL I-joist vs CLT panel**

As a limited resource, the efficient use of the timber we grow is critical – focusing on small section timber, in I-joist format, is the optimal solution for material efficiency. It is also significantly more affordable than CLT. UK sourced solid section I-joists would be viable for PH15, although less ideal than LVL for efficiency and dimensional stability. Either would be significantly more efficient than CLT. CLT panels are less ideally suited to use with wood insulations, at Passivhaus levels requiring 360mm of wood-based insulation depth to be fixed to the panel, creating structural challenges usually resolved with thinner depths of high embodied carbon insulations.

