

How to Build with CLT

Cross laminated timber is an innovative build material that can produce airtight, well-insulated homes that can be erected and made weathertight in days. So why, asks Allan Corfield, aren't more UK self-builders using it?



Allan Corfield

Allan runs Allan Corfield Architects, which he set up in 2009. He is an expert in designing high-performing, energy-efficient homes.

Cross laminated timber, commonly known as CLT or crosslam, is a precision engineered building material that, despite a raft of practical and ecological benefits, is yet to be widely adopted by the UK self-build market. Growth has, however, been strong in the commercial sector, and it is likely that you have seen a building that features CLT: many modern schools, supermarkets, galleries and residential blocks use CLT for the superstructure.

A Solution for a Tight Site

This award-winning 75m² self-build, designed by the architect/owner Hugh Strange of Strange Architects for a tight London plot, was built using CLT. The panels, from Eurban, have been exposed internally and given a whitewash finish.

Developers here recognise CLT's weight-to-strength ratio, low carbon footprint, speed and ease of construction — all features that should appeal to the self-builder, yet take up in the residential market has been comparably slow. However, there have been a number of award-winning self-builds in the UK featuring CLT — including Adam Knibb Architects' Hurdle House, which won Best Contemporary Renovation/Extension in The Daily Telegraph Homebuilding & Renovating Awards 2017, and the RIBA Award-winning Strange House (BELOW).

What is CLT?

The idea of stacking timber planks (known as lamellas) together to create a construction system can be traced back to German engineer Julius Natterer. He developed a system known as Brettstapel, which originally used nails to secure the wood in place (and now uses wooden dowels). This is still widely used in Austria and Germany and can be seen as a precursor to CLT, which developed out of academic and industrial efforts in the 1990s.

It differs from Brettstapel in that it uses high grade timber stacked in a cross pattern to provide structural strength across two axis, rather than stacking in a single direction.

CLT is formed of kiln-dried spruce or pine boards which are laid on top of each other at 90° (three, five, seven or nine layers depending on structural requirements), coated with a layer of polyurethane adhesive and subjected to immense hydraulic pressure to create large, stiff, dimensionally stable panels. ➤



IMAGE: DARREN CHUNG

A CLT Extension

This contemporary take on a traditional barn conversion, designed by Micah T. Jones Architect (micahtjones.com), features a one-storey CLT structure, built above a restored stone agricultural building. Stora Enso (storaenso.com), who manufactured the panels, put the architect in touch with G-Frame Structures, who handled the installation. This was the first completed CLT building in Northern Ireland.



Watertight in Days

Adam Knibb Architects (adamknibbarchitects.com) designed this pool house near Winchester, which featured a prefabricated timber structure. The CLT panels were manufactured in Austria and delivered in a single load to site. It took two days for the structure to be erected, with the windows (which had been ordered off the plans) installed in the days that followed.





An Airtight Build

Tigh Beag is situated in the Scottish Highlands and is a new build house featuring CLT. Glulam Solutions (glulamsolutions.co.uk) handled the supply, delivery and installation of the prefabricated panels, creating a home with high levels of insulation and airtightness and low running costs. The house also features balconies to the front and rear, providing views of the landscaped ground and the forest.



These timber panels, which can measure up to 3.5m in width and 20m in length, depending on specification, can be used to create the complete superstructure of a building. CLT panels are precision cut by CNC machines (from 3D CAD drawings) and delivered to site to be installed by specialist CLT installers.

Window and door openings are created during manufacture to such high degrees of accuracy that glazing can be ordered from the initial drawings. The high tolerances involved greatly improve airtightness and thermal performance and mean that CLT can be used in Passivhaus designs.

Currently, the majority of CLT is manufactured in Austria. Major players include Binderholz, KLH, Stora Enso and Mayr-Melnhof, with Euro-

pean production volume estimated to be around 610,000m³ in 2015, a figure that is growing year-on-year. There are currently no CLT manufacturers in the UK, which means all CLT builds here will import directly from Europe, though many of the key CLT producers work, own or partner with UK-based CLT installers who provide services such as consultation, design, supply and installation.

There are three visual qualities of CLT that are similar across all suppliers: non-visual, industrial visual and high-grade visual. Non-visual CLT is designed to be plasterboarded over, and industrial and high-grade visual are intended to be left exposed — typically the former for exposed soffits and the latter for walls. Visual grade CLT is made from a higher grade of timber ➤

The Benefits of CLT

- Precision made by CNC machines to factory tolerances
- Quick, clean and easy to assemble on site
- Reduced foundation designs compared to some other build methods
- High levels of airtightness with limited (or few) coldbridges due to the additional wrapping of insulation
- Eco-friendly construction method from a managed sustainable source, giving a positive CO₂ balance
- Increased quality of air if the internal timber surface is left exposed

which is planed, sanded and dried to a lower moisture content to ensure less movement and cracking in the future and with wider lamellas to reduce the number of boards on a visual surface. Leaving the timber exposed on the internal face is one of the key design advantages of CLT, giving a striking contemporary timber interior.

Once the CLT panels are delivered to site they can be installed quickly – for example, Stora Enso estimates that a detached three bedroom house can be constructed in five to eight days. As getting wind and watertight is usually one of the key milestones for mortgage payments, you could also see your mortgage stage payment releases arrive sooner.

How to Build with CLT

Like any building project you want to get the design right and frozen before you break ground. Making changes to drawings is far easier and cheaper than making changes on site. However, if the alterations are carefully considered and your design team is consulted, then changes are possible with CLT. As each wall has an associated drawing, it can often be easier to complete a change to a prefabricated building than a traditional site-built home.

You won't need any proprietary cladding either – a CLT build can be clad with the same external materials as any other build method. As most CLT residential buildings will be wrapped in insulation (up to 200mm depending on the desired U value), this needs to be considered when choosing the fixing method for the cladding.

The most efficient systems to install are rainscreen cladding or lightweight cladding systems (smooth render, cementitious boards or stone slips, for example), which can be fixed directly into the CLT via fixing clips or battens. But there's no reason why traditional brickwork cannot be used. Remember too that after the CLT superstructure has been installed you will need to employ another trade or company to fit external insulation.

As with any off-site manufacturing method, you will need to ensure that there is access for an artic lorry and mobile crane. The panels are delivered on lorries from Europe and then craned into place. It is also worth considering the transport costs when designing with CLT – an average small house would use 40-50m³ of CLT, which equates to one full truck-load.

What's the Future for CLT?

It's difficult to provide an accurate estimate for a CLT build here – a lot depends on the design – but expect to pay between £350-£500/m² of gross internal floor area for a CLT-built house. Don't forget, the upfront costs may appear high, but you will make savings through the speed of the build compared to some other build methods. CLT companies will be able to provide an estimate, which will usually take between two to six weeks (and can be done from your drawings). This figure will be for the supply, design and installation of the CLT structural frame and not the whole house.

Without a UK-based CLT manufacturing facility it is unlikely that prices will change dramatically in the near future. Napier University's Centre for Offsite Construction + Innovative Structures examined the viability of manufacturing CLT from UK resources and found that it could be a viable proposition using sitka spruce (which accounts for around 50% of the UK's softwood resource). But there were challenges, including that the UK's spruce performed differently to the softwoods on the continent under structural testing and would need to be kiln-dried to a lower moisture content than current UK standards to match European CLT's material properties.

CLT's popularity in the commercial sector, which continues to grow in the UK, could be a factor in raising its profile. And I can also see there being a strong case for using CLT in the custom build sector or with low-energy modular homes, where buildings of a similar design can take advantage

Mortgaging a CLT Self-build

Tom McSherry of self-build mortgage specialists BuildStore discusses how to mortgage a CLT project:

CLT is classed as a modern method of construction and as such it is possible to get mortgages on CLT homes. As an off-site manufactured timber frame system, mortgaging a CLT build will attract a number of specialist self-build lenders offering mortgage support.

With off-site systems, one of the key areas to focus on is the payments terms for the system, as much (if not all) of the costs will require paying in advance. It is essential that the mortgage product used can provide the cashflow at the correct time to ensure these payment terms can be met.

Make sure to provide full system details along with any BBA Certifications which may be needed by the mortgage provider – also make sure that the latent defects insurance policy covers off-site construction.

of economies of scale. Indeed, social housing builder Swan Housing opened a new CLT factory in Basildon in 2017 that can produce around 300 modular houses a year, while Scotland's Carbon Dynamic are leading the way for off-site timber construction in modular housing and Legal & General, a major investor in the modular market, have opened a modular factory near Leeds where they aim to produce 3,000 new homes a year.

As for the self-builder, CLT is currently a seemingly underexposed option for creating highly efficient, design-led and structurally stable homes that can benefit from reduced foundation costs compared to a traditional brick and block build, reduced construction time and a safer construction environment when compared to some other build methods. **H**