



CLT is the sustainably responsible and non-disruptive building solution for residential areas and will contribute to the wellbeing of those using the building.

Cross Laminated Timber

A fast, clean & quiet, building solution

James Sweet – Laminated Timber Solutions

Forward & General introduction to Cross-Laminated Timber

WHAT IS CLT?

CLT or Cross Laminated Timber also sometimes referred to generically as “Mass Timber” is gaining rapid acknowledgement as the next mainstream building material behind Concrete and Steel.

Unlike light weight timber frame which has its place, Mass Timber or CLT is classified as a heavy building medium and competes, not with other light frame solutions in timber or light gauge steel but with it's heavy weight peers in concrete, steel and cementitious block. It is however very light in comparison to these building media and unlike all three presents a carbon *store* versus a carbon deficit – more on this to follow.

Why called “Mass” Timber? The product is literally made as a solid sheet or panel by laying up structural timber boards called lamellas in a number of layers (ranging from 3 to 12 layers) with each layer arranged at right angles to its adjacent layer in a “cross laminated” configuration; hence “Cross Laminated Timber”.

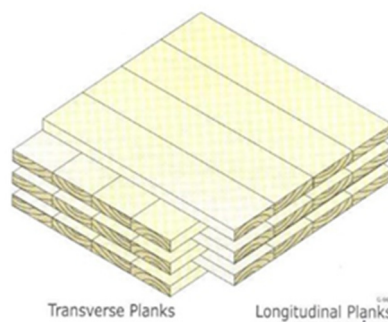


Figure 1
CLT panel configuration

IS CLT A TRUSTWORTHY PRODUCT?

The engineering nature of the cross laminated configuration with the grain of each layer working *against* yet, from a strength perspective, with the grain of the adjacent layer, delivers a phenomenally strong and dimensionally stable element and it is this which gives it its orthotropic qualities, meaning that it delivers strength in every dimension enabling it to be used as a wall, floor, roof or a beam. This quality provides tremendous design scope for not only the architect but the engineer as well. The ability to create complete buildings from exactly the same building element (medium) is to some degree unique and being timber it is easy to machine in any direction with Computer numerical control (CNC) Computer aided design (CAD) Computer aided manufacturing (CAM) software interfacing with 5 axis cutting machines. This is a sophisticated high quality-controlled production process. This enables CLT buildings comprising of offsite precision cut elements to come to the site as a complete “kit” ready to install.

Panel dimensions can range from 60mm to 360mm thick, 3.5 metres wide and 16.5 metres long.

In very simple terms CLT can form a whole wall, ceiling or floor from one single panel element and this is very often how a CLT building is designed and built with the openings for doors, windows, stair well and service runs precision cut at the factory and delivered to site as a ready to install “whole wall or floor / roof element”.

The CLT supplied to the UK is currently manufactured in Europe and the major volume comes from Austria, Germany and Scandinavia. The main reason for this is that in the UK we do not have the strength grade of timber to manufacture CLT to the same performance standards to allow compliance with the European Technical Approvals. It is important to note that all CLT coming into the UK comes from sustainably managed forests third party certified by either FSC or PEFC.

CLT is rapidly becoming the build method of choice for Schools, medium rise residential, municipal, healthcare buildings and offices where speed of build, overall project cost and user wellbeing is at the heart of the design brief. By Googling CLT buildings you will see a great many reference projects in London and around the world.

This forward and general introduction has set out to quickly explain what CLT is so that we can move to the specific benefits of using it in the **XUL** school project.



Google **CLT element** and go to images to see many examples of CLT panels and buildings.

SPEED, CLEANLINESS & QUIETNESS OF CONSTRUCTION OF THE SUPERSTRUCTURE

WALLS AND ROOF ELEMENTS

As described above most of the machining work for the CLT building elements is undertaken in a factory controlled environment on large panels which will form in one or a small number of large elements the wall and roof/floor components. Being large components, very often a whole wall is lifted into place in one movement and swiftly fixed to the timber sole plate. Subsequent wall elements are then lifted into place and fixed together using specific CLT screws and connectors which are installed with hand power tools used for timber – there is no heavy duty equipment used even the use of circular saws* is kept to a minimum as 95%* of the cutting has been done off site.

Benefits from Speed

FEATURE	BENEFIT
Rapid Build	Massively increased project completion time
Large plant away from the site sooner	Massively reduced road obstruction or closure
Less material to install	Less deliveries & reduced site traffic

- **What inconvenience will the local area experience?**

- Being large elements there will be the need for a very short period for the use of a crane and depending on the element sizes this could range in size from 20 to 60 Tonnes depending on the reach required. Typically, when the CLT main elements start to be installed each lift is around 45 minutes. The complexity of each project determines the time needed for the crane but typically it can range from 3-5 days then it is off site.
- Reduced sales in Cups of Tea and bacon sandwiches in the nearby cafes as the site operatives are fewer and on site for less time.

Benefits from Cleanliness

As mentioned the elements are already cut to size so there is virtually no waste from the CLT components themselves. Unlike cement-based construction there is also no dust or cementitious waste matter that gets carried by foot & road vehicles and distributed onto adjacent roads and paths and no airborne dust.

The waste will be formed mainly of light weight protective packaging some timber dunnages that the CLT was packed on and possibly some small CLT sections* where partially pre-cut openings need to remain in place for transportation and lifting purposes and then cut out on site. Previous school projects have often re utilised these as tables or benches.

There is virtually no heavy waste so skips on site and being delivered or collected are reduced

A tidy site is typically a safe site

Benefits from Quietness

Building with timber compared to other build media is very quiet

There is no heavy plant running, or cement mixers or the use of heavy industrial power tools. Typically the noise heard will be hand held power tools and hammers, the occasional circular saw.

Site traffic noise – is massively reduced because there is simply less of it as product deliveries are reduced to a number of large size components often on one or two trucks. Which are then unloaded quickly.

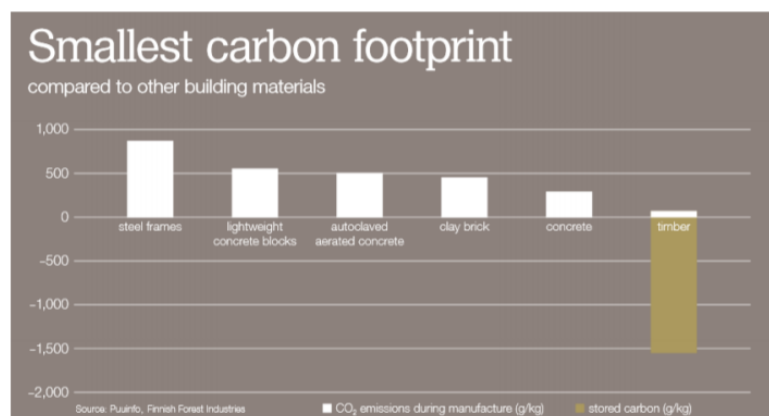
CLT sites utilise very little labour and projects of this size may only have three or four operatives working on it together at any one time. This may change when the superstructure is completed and the internal fit out commences with the mechanical, plumbing, electrical and finishing trades coming in. These however, are all now working in a fully enclosed environment – Inside.

Benefits for choosing TIMBER Construction

Put simply ***“it promotes wellbeing”***. It is now proven via third party medical experiments in controlled like for like environments that “people” working, learning, healing, studying in a Biophilic environment such as timber compared to that of concrete experience less stress, have greater concentration and generally present improved wellbeing. This is why timber is often used in environments where there is usually an elevated stress level in buildings which need to promote calm. You will often find people who have experienced CLT buildings struggle to articulate exactly what they feel when they enter a CLT environment and the calm ambience that prevails – the solution is to visit one for yourself which can be arranged.

Benefits from choosing a sustainable building method

Again put simply it is ***“the right thing to do”***. For every cubic metre of timber, 1 tonne of carbon is stored within it. Trees as we are all aware absorb CO₂ and store it (till such time as the timber is burned) and trees respire oxygen. Buildings constructed from timber are a “Carbon Sink”. Concrete is the third most negatively impactful product on the planet in terms of CO₂ production and the following diagram presents the Carbon story well. There is a plethora of data to back this up.



To Round Up...

Every building system has its advocates.

... So let's let the headteacher of Hampton Vale Primary School have the last word

Ann Neary has very kindly allowed us to use her statement about using advanced timber engineered elements including CLT in her School extension project. This building system was completely new to her and the Superstructure (walls and roof) went up in 2 days delivering 140 m² of extra quality learning space in no time within a very challenging build site environment which was a quadrant and only accessible through the school or over the roof. Through the school was not an option!

Anne Neary - Headteacher...

"The building visually sits well with our school ethos of sustainability and wellbeing and the speed of build and cost has met our very tight timelines and budget perfectly."

Conclusion

Building in advanced engineered timber elements may not be the lowest cost build method when you compare building **material** cost only, but it is certainly the fastest, cleanest, least disruptive and most sustainable building method which benefits the immediate local residents and the users of the building will for many years.

FAQs

Q: How does CLT behave in Fire

A: Solid mass timber is quite difficult to ignite for the simple reason that Timber has a self preserving mechanism called Charring – Timber will Char at 0.676mm per minute the Char layer will then resist further burning and dramatically slow the burn rate down to the above rate. This is a precise rate and enables engineers to calculate exactly how much structural support is left after a specific time. But the most important statement is that CLT naturally will deliver 30 and 60 minutes fire compartmentalisation in accordance with Building Regulations and more if required.

Q: it seems to use a lot of wood ! How sustainable is it to cut down the volume of trees

A: the volume of sawn timber capacity from European and Russian forests is 121,000,000 m3 per annum. CLT at maximum capacity by 2020 will use less than 2% of that – If this is then compared to standing fibre capacity (Trees) we are now looking at 0.009%

Q: The product is not 100% timber it has Glue in it – is this a VOC – (Volatile Organic Compound) and will this acerbate any respiratory problems.

A: The Glueline in CLT is about 6% of the volume of the product and all glues used conform with European E1 regulations in terms of their parts per million off gassing. If anything a CLT building with well manged ventilation will help respiratory problems. Mostly, Glue used in CLT does not have Formaldehyde in it.

Q: CLT needs big plant i.e Cranes to install it how long are they in place

A: the largest piece of equipment is the crane and the truck that delivers the CLT. The crane on a project of this size will be on site for a very brief period after the foundation has been laid usually no more than 5 days probably less. A small project is usually delivered in no more than two loads.

Q: Will The crane demand road Closures?

A: Possibly. To be determined, but will be for a very short period

Q: How much more expensive is it than traditional build

A: Typically More than a traditional brick and block structure but material cost is only one element but speed and less disruption are another

a. Sub questions:

1. Can you build in traditional build cheaper
 - a. Answer: Yes
2. Can you build in traditional build in the same time window
 - a. Answer: No chance.

3. Will Traditional build (Block & Brick) be a better built structure?
 - a. Answer: No – for the very simple reason that there are many, many more components which are all hand applied by varying and different levels of skill set which leaves massive margin for error and shortcuts. It is impossible to do this with CLT.

SUMMARY COMMENT FROM THE AUTHOR

The author of this document has worked within the building industry for 35 Years and has specialised in advanced engineered timber construction. He has also worked with other build media with Tier 1 contractors and major UK housebuilders. He is a firm believer in applying the right build medium to the right type of project and that could be timber, concrete, brick and block or steel. All these products have their place and what we should try to do is to consider first and foremost the day to day user of the building, the impact of the building on the surrounding area during its build and the long term sustainable proposition that the building delivers. Cost is always an important factor but so often the hidden benefits of build speed, reduced waste, safety, long term energy efficiency are overlooked in favour of the bottom line material list cost alone, the softer benefits are often not quantified by the QS because very often there is not a chapter in their costing book for them – **Yet**. CLT is changing the way people view these peripheral benefits and beginning to realise that the cost savings and advantages are very apparent and realisable.