CROSS LAMINATED TIMBER
A DECADE IN DESIGN
LEADING DESIGNER OF CROSS LAMINATED TIMBER

Over the past decade we have pioneered the use of CLT. We have designed one of the tallest CLT structures as well as the biggest. We have also undertaken research studies with leading universities. We are the most experienced CLT engineers in the UK.
WHAT IS CROSS LAMINATED TIMBER?

Cross-laminated timber (CLT) is manufactured in panels with an odd number of softwood plank layers placed on top of each other at right angles and bonded together under pressure.

When obtained from a certified source and produced with non-toxic glue, CLT is a highly sustainable material. Fabricating timber building components uses half the energy needed to produce concrete, and just 1% of the energy required to manufacture steel.

CLT panel building systems also enable a fast construction programme as panels are prefabricated offsite and delivered to site.
SUSTAINABILITY

Trees absorb carbon dioxide while growing and store it until they decay or are burned. This makes timber a highly sustainable material. Furthermore, the panels can be re-used at the end of a building's life.

RESOURCE AND TIME EFFICIENCY

Walls, floors and roofs can be constructed from pre-fabricated panels. Off-site production means less on-site waste, a shorter build programme, and whole-life cost savings. A lighter frame and reduced weight ensures a lighter building and smaller foundations.
THERMAL AND AIRTIGHTNESS BENEFITS
Cross-laminated timber has good thermal properties, which contribute to minimising thermal bridges and act as thermally resistant layers. This makes it easier to achieve air-tight, thermal-bridge free construction.

AESTHETIC AND STRUCTURAL PROPERTIES
Cross-laminated timber can span great distances whilst retaining structural integrity. It also offers a beautiful finish without extra coating.

FIRE PERFORMANCE
Timber’s fire performance surpasses that of joists and studs as a result of the panels’ fire-retarding charring.
As trees grow they absorb and store CO$_2$ from the atmosphere. Building with CLT locks this away in the structural frame of our buildings, enabling low embodied carbon buildings.
WHY CHOOSE RAMBOLL?

We don't just look at steel and concrete solutions...

We use our 10 years of design and industry engagement to offer cost effective timber designs.
OUR PROJECTS
CHALLENGING PERCEPTIONS

Not all CLT buildings need to be rectilinear - the whole of this curved building was constructed using flat panels that were either facetted or curved to suit on site.

Construction techniques used in this three-storey school saved 2,900 tCO$_2$ compared with a steel or concrete frame.

Open Academy in Norwich was the country’s largest cross-laminated timber panel structure upon completion. Using over 3,600 cubic metres of timber, it provides 9,500 square metres of flexible school accommodation.

3D integrated structural modelling software was used to coordinate the structural design with the M&E design concept at an early stage, enabling an efficient and elegant solution.

Prefabrication of the Academy’s superstructure meant the site waste was cut down to just two skips.

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Our proposal to use CLT on this project shaved fourteen weeks from the construction programme of this project – at completion it was the largest solid timber panel school in the UK.

St John Fisher School saw us deliver a new sports hall and teaching facilities, in addition to refurbishing existing blocks in 2009. The architect originally proposed using loadbearing brick and precast concrete planks, but our analysis led us to suggest prefabricated timber panel structures as an alternative.

Using a flat-pack approach dramatically reduced labour and financial costs, which convinced the school to adopt the timber proposal. Timber’s natural strength meant it could be used for loadbearing walls, floors and roofs while eliminating the need for beams.
We produced a sustainable design for new this eight-storey residential building for the University of East Anglia - the UK’s joint tallest CLT structure.

Part of a £58 million redevelopment, this state-of-the-art CLT building’s sustainable design has a minimal carbon footprint. 69% of its energy comes from renewable sources. Other sustainable aspects include extra thermal insulation, triple glazing, photovoltaic panels and grey water recycling.

The superstructure has a concrete foundation resting on 150 piles, all of which were installed within five days. The entire building is made of European Spruce CLT with the exception of a concrete podium over part of the first floor level. It contains 1,520 cubic metres of timber in total.
CAVENDISH AVENUE, CAMBRIDGE

THE SMALLEST

A traditional residential street in the heart of Cambridge was given a contemporary facelift with the construction of an award-winning sustainable, three-storey timber frame house.

Using thick cross-laminated panels of sustainably and locally sourced fir, spruce and pine, we erected the watertight frame in six days. The most striking feature of this modernist, box-like building is a first floor wall panel designed to support floor and roof loads above.

As well as maximising natural light, a skylight which runs along the length of the house provides an eye-catching visual centrepiece. For airtightness and energy efficiency, the wall and floor joints are sealed and services are accommodated under-floor wherever possible.
THE BIGGEST

Containing 3,800 cubic metres of timber, this school is the largest CLT building in the UK.

Ramboll provided modelling expertise and structural engineering services for this four-storey school in West London. Initially planned to be a concrete frame building, Kier Construction changed it to a timber superstructure to improve cost-efficiency and reduce the construction programme.

The building is founded on piles and reinforced concrete ground beams, with precast concrete panel floors at ground level. Key structural elements of the building’s frame are of steel or glulam though the majority of the structure is cross-laminated timber. The building was assembled in just nineteen weeks.
The University of East Anglia’s sustainable low-carbon ethos combined with innovative construction techniques gives Building 57 a very small carbon footprint.

We established that CLT and precast concrete plank hybrid produced the fewest emissions through modelling. However, this combination of diverse materials in a single structure had yet to be attempted, creating exciting design challenges.

The structure has arguably the smallest carbon footprint of any office type building in the United Kingdom. Building 57 has a deep reinforced concrete basement and is founded on continuous flight auger piles. Throughout the construction of the basement we monitored the effects of vibration to minimise impacts on an adjacent datacentre.
COLLABORATION

After working together to build the Open Academy in 2010 we re-joined forces with Sheppard Robson, Kier Eastern and KLH for the City Academy project in Norwich.

Like Open Academy, this school is located in Norwich and replaced the existing Earlham High School. In addition to the structural integrity and aesthetic appeal of exposed timber, the speed of erection led to a build period of just sixteen weeks. Sustainability of the materials chosen helped the building to achieve a BREEAM ‘Excellent’ rating.
Housing an interactive theatre space, an activity studio, a main hall and central atrium, this three-storey building is a hybrid of CLT and a structural steel.

The academy has a single-storey entrance wing backed by a three-storey curved building. The hybrid construction provides the client with a flexible floor plate, adaptable for future uses by changing the partitions.

The roof, floor and walls are of loadbearing CLT with a central steelwork spine to support the structure internally. Using 500mm deep CLT cassettes allowed us to increase the floor spans to 10m.

An estimated 3,000 tonnes of CO$_2$ saved versus traditional construction is a tribute to Ramboll’s sustainable credentials.
CLT & CONCRETE HYBRID

Research put into practice for this new school’s dance studios.

We worked with Make and Kier to redevelop Thomas Clarkson Community College Cambridgeshire. While most of the school’s buildings were relatively straightforward, demanding vibration criteria and a slim floor construction for a dance floor at the school posed significant engineering challenges.

To overcome these, we implemented research that we worked on with the University of Cambridge and developed TimCrete®, a cross-laminated timber concrete composite method of floor construction.
RESEARCH AND EDUCATING THE COMMUNITY
SHAKING UP DANCEFLOOR DESIGN

We constantly strive to improve our knowledge of timber. We achieved significant increases in stiffness with our timber-concrete composites research.

This photograph shows the physical testing of a timber concrete composite panel with timber notches for the shear connection. This process is advancing the techniques applied for the design of the lightweight, long-span dance floor at Thomas Clarkson Community College capable of withstanding the vibrations generated by a school dance class. Working with the University of Bath to develop the composite, our research continues to take timber concrete composite to the next level.
Making Unusable Timber Usable

Identifying limits of current design prompted us to investigate polymerisation of timber to allow us to build taller.

Timber is the only renewable material used for architecture and engineering. However, vast quantities of sustainably managed plantation timber are pulped as they are of insufficient quality to be used for structural purposes.

To counter this, research conducted by the University of Cambridge and Ramboll has explored how chemistry can improve the performance of natural timber enabling low grade timber to be modified so it can be used for high grade applications in buildings.

This electron microscopy image of polymerised timber shows the tracheids and resin ducts filled with a polymer which improves its compressive strength.
We created the Carbon Cube installation to highlight the issues of climate change.

Ramboll created this interactive artwork which invited passers-by to consider sustainable living and promoted dialogue about the use of renewable materials in construction. The 2.4 metre cube represented the volume of timber needed to sequester the annual carbon output of the average UK citizen.

We then invited visitors to make a pledge to reduce their carbon footprint by decorating a smaller ‘pledge cube’ which formed part of a mosaic in timber.
ABOUT RAMBOLL

Ramboll is a leading engineering and design consultancy company at the forefront of innovation.

Our team of 10,000 dedicated specialists share knowledge globally, applying their expertise and enthusiasm on projects at a local level that benefit both people now and future communities.

Ramboll is long established, financially strong and structured for longevity through the Ramboll Foundation ownership.

We provide consultancy in the areas of Buildings, Transport, Environment, Energy and Management Consultancy.

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