



TIMBER FRAME CONSTRUCTION

Building towards a more
sustainable future

THE UK TIMBER
FRAME ASSOCIATION



The building material developed over millions of years

The ultimate construction material isn't the product of a research lab. It's been designed by nature to adapt to almost every climate on Earth. Wood is always at home - whether it's hot or cold, humid or arid. It's little wonder that it's used in 70% of housing throughout the world today.

Modern timber frames are precision engineered to the highest level of accuracy and quality. Though it's relatively lightweight, it's remarkably strong and durable. And having been sourced from renewable forests, it's truly sustainable.

In fact, it's the only mainstream building material, during production i.e. whilst growing, that actually helps to store carbon and reduce greenhouse gases. When you choose a timber frame construction, you can be safe in the knowledge that it's a method that has stood the test of time like no other.



So what is timber frame construction?

Timber frame construction is the most popular method of building in the developed world. It's currently used in over 25% of all new houses in the UK and is becoming more widespread in the commercial sector too. It's versatility and flexibility is seeing timber frame increasing being used in educational facilities, retail units of all sizes, healthcare and office blocks - in fact, any project where speed, economy without compromise and a lower carbon footprint are desirable.

With typical timber frame construction, as the name suggests, the load-bearing structure of a building is made of engineered timber panels, instead of a steel frame or concrete block work. The panels comprise horizontal and vertical timber studs, together with a timber-based sheathing, to form a strong, rigid structural frame that transmits loads to the building's foundations.

Overall, it's a faster, more cost effective and considerably more sustainable building method. As the environmental challenges of 21st century building become apparent, more and more builders, architects and developers in all sectors are turning to the unique advantages of timber frame.



Timber frame brings plenty of practical advantages

- Quality assured off-site manufacture significantly simplifies construction, resulting in less on-site waste (as much as 20-40%, compared with other construction methods)
- Promotes greater efficiency and supply chain integration
- Brings predictability and greater control to the construction process
- Meets and often exceeds all current Building Regulations
- Improves on-site construction health and safety. Off-site manufacture with automated machinery reduces accidents, as a controlled factory environment is a safer work space
- Wet trades are all but eliminated, so there's no drying out time before work can continue on interior finishes
- Construction can continue through cold and inclement weather - meaning shorter and more predictable build programmes
- Design and manufacture takes place in a quality controlled factory environment, resulting in less on-site defects
- Provides excellent thermal efficiency, with lifetime savings in energy cost so an extremely environmentally friendly way to build
- Building in timber frame makes it easy to achieve a high performance building fabric by maximising thermal performance and minimising air leakage. This 'Fabric First' approach is a low risk, cost-effective way to achieve higher levels of the Code for Sustainable Homes.



Timeless timber

Timber frame construction is remarkable for its durability. There are many examples of timber frame buildings that are more than a thousand years old. It's also estimated that ninety percent of buildings that have survived since before 1600 were fashioned from timber.

Trends may come and go, but the appeal and advantages of timber frame construction have remained constant. It's a part of British history and culture - bringing with it associations of craftsmanship and enduring quality. When you choose a timber frame construction, you are continuing that history. In terms of performance and design, it also happens to be the material that's best able to meet the demands of the future too.

Timber frame has a growing appeal

As the construction industry strives to create environmentally-friendly buildings, with an increased use of sustainable materials, timber frame construction is an obvious choice. Timber - always sourced from renewable forests - is the ultimate sustainable material; both natural and renewable.

Precision-engineered timber frame systems result in reduced defects and improved quality both on-site and in the finished building. This means fewer callbacks for the builder and developer, reduced site time, fewer costs and a faster return on investment. The automated nature of the timber frame manufacture also reduces the likelihood of accidents, improving health and safety for the project.

With more efficient factory production, combined with new innovations in build technology, timber frame will continue to play a defining role for construction as this century progresses.

Timber frame is solid, yet highly flexible

Whatever the nature of your project, timber frame offers unrivalled versatility and design flexibility. Throughout the world, it's the preferred choice for medium and low-rise residential buildings, commercial projects, leisure facilities, schools, hotels, etc. And when used in conjunction with other build methods and materials such as glass and steel, timber frame construction is making a significant contribution to our modern architectural landscape.

Timber frame is easy to customise, alter and extend. Unique designs can be readily translated to factory production - so even prefabricated buildings needn't be uniform in appearance. Panels can be manufactured off-site and quickly constructed to keep disruption to a minimum.

Timber frame offers limitless design options, as well as a huge range of external finishes and claddings. And since external cladding is not loadbearing, materials can be selected on the basis of aesthetics and performance in the local environment. Timber frame also allows for the easy installation of services - saving time and money for your project.







Types of timber frame

Open panel systems

The traditional timber frame system uses an open panel system of structural panels for the internal loadbearing leaf of the cavity wall. The panels are typically made from a softwood timber frame and sheathed with structural sheet material, such as plywood or oriented strand board (OSB). They have a water-tight, yet breathable, membrane on the outside and are left open on the inside (hence the name). The insulation which is fitted within the panels can either be factory fitted or installed on-site once the panels have been erected. The detailing, quality controlled manufacture and site install all contribute to Timber Frame meeting the increasingly demanding thermal and air-tightness requirements of the UK.

Closed panels

Many UKTFA manufacturing members are evolving fully insulated closed panel systems. The sides of the walls are closed and a vapour barrier is fixed during manufacture to ensure air-tightness. Plasterboard can be factory-fitted, or attached to the panel's battens on-site. Many manufacturers also offer the option for doors and windows to be included within the panel. The off-site manufacture of the panels in a controlled environment can further reduce on-site defects and improve health and safety through automated processes.

Crossed laminated timber panels

These solid panels, made entirely of timber, are the latest addition to the diverse timber frame market. They use finger jointed timbers that are cross laminated to produce wall, floor and roof elements that are used to create incredibly air-tight structures - that also have excellent thermal mass properties. Commonly found in the construction of educational facilities and care homes, demonstrating the versatility of timber in the wider construction market. In many cases these complement traditional timber frame panel systems.

High performance post and beam

Engineered wood products offer huge potential to deliver large and often complex structures. Using GluLam and Kerto™ LVL as the principal structural elements in the construction, they are often used in conjunction with timber framed wall, roof and floor elements. There are many examples of these types of structures in the UK from across the spectrum - from Supermarkets to Museums.



The ultimate green building material

Whether for use in commercial, public or residential buildings, timber frame is widely accepted as one of the most sustainable construction methods available.

The timber used is naturally renewable and responsibly sourced from managed forests. Even taking into account transportation, it's carbon neutral. It also reduces the embodied carbon dioxide of a building when used instead of more energy intensive materials. In fact, this can be up to six times lower than masonry. For every cubic metre of wood used instead of other building materials, 0.8 of a tonne of CO₂ is saved from the atmosphere - with the average timber frame home saving around 4 tonnes.

The use of timber frame construction components can potentially reduce the amount of waste generated on-site by 20-40% and can also have a positive effect on the whole life cycle costs of the building. Put quite simply, if you're serious about sustainable construction, you should make timber frame your first choice.



Building towards greater energy conservation

All new buildings must now reach increasingly higher standards of energy conservation. The **Code for Sustainable Homes, Approved Documents Part L of the Building Regulations** and the **Scottish Building Standards** are all driving the reduction of carbon emissions in new buildings. Building in timber frame makes it easy to achieve a high performance building fabric that maximises thermal performance and minimises unwanted air leakage.

Code for Sustainable Homes

The UK government has set the building industry a series of progressively more demanding targets that aim to substantially reduce CO₂ emissions from all new build homes, with the ultimate goal of a zero net carbon standard by 2016. Achieving the necessary compliance credits for The Code for Sustainable Homes (CSH) requires a greater emphasis not only on energy-saving technology, but also on using building materials with less embodied carbon.

The choice of building fabric has a major effect on a home's overall energy consumption, as well as its environmental rating. In both of these considerations, timber frame scores highly and is fast being regarded as the natural solution for Code compliance. The cost of meeting minimum heat loss parameters is lower, compared with other build methods. Timber frame also helps to deliver the air-tightness and acoustic performance required to meet the demands of their respective Code categories.

Additional technical information can be found in the UKTFA's 'Comfort and Cost' report and a the CSH Technical Guide can be downloaded for free from www.communities.gov.uk



Zero Carbon homes

As the industry starts to address the reality of 2016, most have come to the same conclusion: energy efficiency, ideally through the fabric of the home, is the first priority.

The industry also recognises the cost implications of meeting the higher Code levels. A Fabric First approach provides the basis of a cost-effective, zero maintenance building envelope.

Timber frame falls into the A rated categories in the CSH Material Credits section - scoring the highest credit rating for responsible sourcing - and CO₂ emissions for timber frame are up to six times lower than equivalent masonry building methods.

Part L

In short, Part L of the Building Regulations requires that throughout the building process, greater attention be paid to every factor that contributes to the energy consumption or heat loss of a building.

As this Regulation now requires a 'whole house' approach to demonstrating compliance, developers are required to meet an overall energy performance target. There is also a greater emphasis on ensuring that the building construction meets the standards assumed at the design stage and that the heating and hot water systems are correctly commissioned.

As the energy efficiency standards in Approved Document Part L are further strengthened in the 2010 amendments, requiring a 25% decrease in target CO₂ emissions and lower levels of unwanted air-leakage, the high performance building fabric of timber frame makes the new targets easily achievable.



SAP

SAP (Standard Assessment Procedure) is a government-defined process that calculates the energy performance of new dwellings. The SAP rating examines the built structure of domestic buildings, along with the heating, lighting and hot water system, plus any renewable technologies used. It then assigns a score from 1 to 100+ to indicate the dwelling's annual energy costs.

The higher the number, the lower the fuel running costs - with 100 representing zero energy cost. Homes with a rating in excess of 100 create more energy than they use. More information can be found at www.communities.gov.uk/planningandbuilding

Building with timber frame makes it simple and easy to achieve a high performance building fabric, thus meeting SAP targets with ease.

Scottish Building Regulations

For nearly fifty years, Scotland has had its own set of Building Regulations. For many years the energy standards in the regulations were set at a modest level, broadly following those that existed in the remainder of the UK. As we moved into the 21st century and the climate change agenda gathered momentum, the energy standards incorporated the best levels of thermal insulation in the UK, reflecting Scotland's colder climate.

The standards introduced at the start of October 2010 reduce the CO₂ emissions from new buildings by a further 30% from the 2007 Regulations. These standards are comparable with the best in Europe. All things being equal, the new Scottish Building Regulations will reduce CO₂ emissions from new buildings by around 70% when compared to the 1990 standards.

For full details on The Building (Scotland) Amendment Regulations 2010 visit the Built Environment section at www.scotland.gov.uk





How to cut costs without cutting corners

Complying with new codes and regulations can take a hefty chunk from the project budget - which in the current economic climate is a key consideration when selecting the most appropriate build method to use. If additional energy saving technologies still required to meet standards, the cost of these can be considerable.

However, by specifying timber frame construction, you can make significant savings when compared to the cost of a brick and bloc alternative. Because you're starting with a naturally energy efficient building fabric, it is much easier to build airtight and highly insulated constructions.

Timber frame typically requires around 30% fewer on-site labour days and therefore a significantly faster construction period. This means a faster return on investment, reduced disruption to local communities and safer sites to work on. There's also no longer any significant difference in cost compared with brick and block - plus you'll find timber frame manufacturers are much more responsive to your needs.

Timber is the ultimate, proven sustainable building material and easily the most cost effective, flexible solution.



A naturally strong performer

As a building material able to take on the challenges of the 21st century, timber frame more than measures up.

Thermal performance

Timber frame has advantages over masonry construction because it allows a greater thickness of insulation to be used easily in the external walls. To achieve equivalent U-values in masonry may require an increase in cavity size or the fitting specialist insulation, both of which can be costly. Timber frame allows lower U-values (the lower the U-value the higher the standard of performance) to be achieved within standard constructions.

Fire safety

A well-built timber frame building is as safe from fire risk as any well-built with masonry. The fire safety of a building is far more complicated than whether the materials are combustible or not - the characteristics of the entire system must be taken into account. A completed project, built using tried and tested materials, in accordance with relevant Building Regulations, presents no more significant risk than any other.

To promote fire awareness during construction, the UKTFA is promoting an initiative called **SiteSafe**. The aim is for the entire construction industry supply chain to give more consideration to fire safety - especially on sites where timber frame structures are exposed.

SiteSafe ensures all UKTFA member manufacturers give clear concise information and assistance to the principal contractor regarding fire safety on construction-sites. With timber frame, it starts from pre-construction planning through to erection of the timber frame on-site and then finally the hand-over of the structure.

SiteSafe ensures all contractors are fully briefed on identifying fire risks during the construction phase. It also requires that the local fire authorities be briefed, so that a response and action plan can be developed. While the responsibility for addressing the fire risk lies with the principal contractor, SiteSafe provides a framework through which any risk can be consistently communicated so that appropriate action can be taken.



Minimising unwanted air leakage

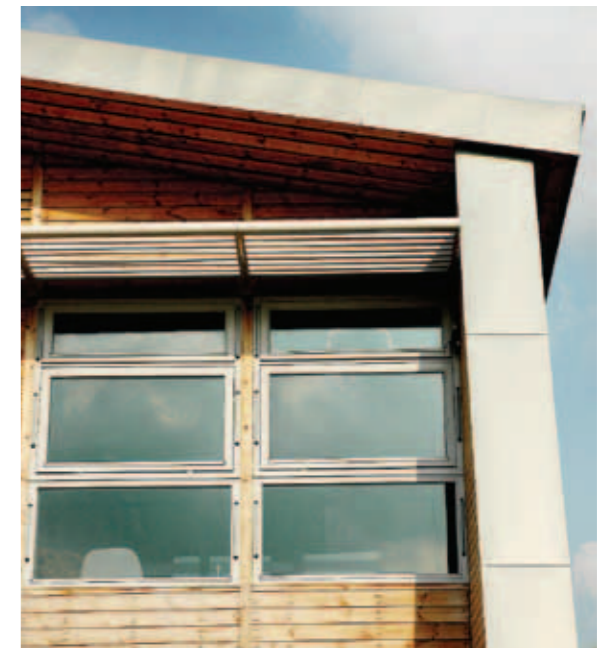
Air tightness testing came into force on the 6th April 2006 and is a requirement of part L1a of the Building Regulations in England and Wales. Air leakage is the uncontrolled flow of air through the gaps and cracks in the fabric of a building. Too much air leakage leads to heat loss, resulting in higher CO₂ emissions.

Good detailing, along with benefits of pre-fabricated off-site manufacture, are key factors in the delivery of airtight structures. Timber frame, unlike masonry, is not subject to the air leakage that occurs, mainly through the perpendicular mortar joints in the block work, that impact the air-tightness of structures. Research by Malcolm Bell (Making Sustainability Work, 2004) concluded that masonry buildings can be treated with an internal sealing coat to reduce air leakage. The application of a sealing coat, at additional cost, effort and time, reduces air leakage to levels commonly achieved by timber frame.

Acoustic performance

Don't assume that only a solid stone wall will bring peace and quiet. Timber frame structures can exceed all current Building Regulations and standards on sound insulation and acoustic performance.

The blend of materials used - and their considered detailing - together with the separation and air cavity that helps to prevent the airborne transmission of sound, provides an excellent level of sound insulation in modern public and private buildings.



Durability

It's a misconception that an organic material can't be long lasting - after all, the oldest building in the UK is a timber-beamed church in Essex dating back to the 11th century. And that's not just a one-off. Modern timber frame buildings age well compared to their masonry-built equivalents. All of the softwood used in the production of structural elements is treated during manufacture to provide additional protection against damp and pests. There's no reason why a properly built and maintained timber frame structure can't last several lifetimes.

Thermal Mass

One way to passively improve the thermal comfort of a building is to increase its thermal mass (the capacity of materials to store heat), thus reducing the energy used to regulate temperatures and helping buildings to stay comfortable. There is no significant difference in thermal mass between masonry and a lightweight timber frame construction. However, timber frame can be adapted to increase specific areas of thermal mass in a building.

Flood resistance

Flooding is fast becoming a major problem in some areas of the UK and may get worse with the impact of climate change. Timber frame is manufactured to meet all new standards aimed at ensuring durability in flood conditions. Ultimately, it is the duty of planners to avoid locations that are particularly vulnerable, but where building does go ahead the most cost effective approach is to raise the building or the lowest floor level above the known flood levels. Timber frame is particularly adaptable for this because it is a lightweight form of construction.



UKTFA - building awareness

The UK Timber Frame Association is dedicated to providing a definitive voice for the timber frame industry. We're committed to the ongoing promotion of timber as the ultimate sustainable building material, as well as to raising awareness of the proven advantages of timber frame across all sectors of the construction industry.

With 300+ member companies, the UKTFA provides help and support for anybody involved in construction and looking for a more robust and cost effective way of achieving the highest standards in energy and carbon efficient building design.

Expertise and literature

The UKTFA is recognised as the authoritative voice of the timber frame industry, providing definitive technical information, plus news and views from across the sector. We provide literature to meet the specific needs of members and the wider building industry - from architects and designers, builders, housing associations and local authorities.

The UKTFA website carries a whole host of useful technical guidance documentation to download. Visit www.uktfa.com for further information.

Technical support

UKTFA provides a professional support network to its members. Initiatives such as the Quality Assurance standard and SiteSafe ensure that the highest service standards are represented throughout the entire UK timber frame industry. We're also committed to providing robust and reliable technical guidance for our members.



Quality Assurance Scheme

The UKTFA has redesigned the quality requirements for membership of the Association, giving members the best possible credentials as the industry moves forward. It is a requirement of membership that members comply with one of the following routes:

Designers

UKAS accredited ISO9001:2008 or BM Trada design protocol and have 50% of the design staff accredited at UKTFA Gold level.

Manufacturers

UKAS Accredited ISO9001:2008 or BM Trada product certification. Members can choose to increase certification of their products by requesting specific testing of their products in line with BM Trada standards (such as Acoustic or Thermal performance).

Suppliers

There are two levels for supplier members :

Minimum Standard - UKAS accredited ISO 9001:2008 (minimum standard)

Accredited membership - UKAS accredited ISO 9001:2008 and an environmental certificate such as ISO 14001, other environmental certificates may be acceptable. CE marking of fasteners etc. also required.

Erectors

The Timber Frame Erector quality scheme is now competence based and requires member companies to fall into one of the following categories:

Member

Accredited Member

Minimum competence levels have been set for Apprentice, Improver, Team Leader and Management Level.

Education and training

The UKTFA has, in partnership with Construction Skills, developed the National Occupational Standards (NOS) for Timber Frame Erectors.

The UKTFA still offers Manufacturing and Design open learning qualifications accredited by City & Guilds. These awards are available at 3 levels - Bronze, Silver and Gold.

Working with Wood for Good and Cortexa, the UKTFA is assisting in the development of an online learning module for Architects. It is envisaged that this work will be completed by January 2011.





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