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Timber frame construction in the United Kingdom

Holzrahmenbau im Vereinigten Königreich

Costruzione a telai in legno nel Regno Unito

Document in English

Timber frame construction in the United Kingdom

The timber frame market in the UK is vibrant and growing. With shares of 47% in parts of the UK, the timber industry plays a significant role in the new built sector and has become a strong competitor to the more traditional forms of construction, such as brick and block. In Scotland every second new built home is a timber frame construction. Similar trends are observed in Ireland.

The growth of timber frame has been supported by strategic research and development, enabling to extend the uses of timber to 6-storey construction. The information gathered in industry led initiatives has been vital to optimising and enabling timber design features, unlocking previously untapped potential. The drive to sustainable construction in the UK has also had a measurable impact on the use of timber frame. Independent environmental assessment methods, such as Ecohomes and BREEAM have enabled different forms of construction and techniques to be compared on a level base line. This has enabled larger developers to make strategic choices, which has often resulted in timber-based construction becoming the construction form of choice. Timber frame is enjoying an increased popularity because of the increased efficiency of off-site fabrication and the potential to reduce CO_2 impact with timber-based solutions. Even in traditional brick and block homes engineered wood products have replaced other forms of floor construction. These achievements have allowed timber-based solutions to strive in a very consolidated construction industry, as found in the UK. Large scale developments, which can provide up to 1000 dwelling units per development, have a clear impact on the overall usage figures and has allowed timber products to step grow.

There are very distinct differences between timber frame in the UK and the rest of Europe. The use of preservative treatment, timber sizes, the extent of use of staples and the standard board materials all differ from practices seen throughout the rest of Europe. The role of insurance requirements is also of wider impact and often influencing detailed design.

1 Introduction

The modern timber frame type of construction was introduced to the UK in the 1920s from Sweden. In the late 1930's the first trials of timber frame, as common today, were used in Scotland where the timber could be readily sourced and construction could be progressed quickly in potentially adverse weather conditions. It is believed that by 1940 over 3000 homes had been built in timber frame construction throughout the UK. World War II delayed further spread of timber frame. In 1963 the Canadian timber frame house practices were introduced to the UK and up to 1973 these were adapted and calibrated to UK practice and environment. Between 1973 and 1984 the timber frame industry experienced a steep increase but the demand for timber frame homes came to an abrupt halt, when the "World in Action" TV programme, at the time the most popular undercover investigative TV programme, disclosed bad practices in UK timber frame construction and associated producers and builders. The programme cast doubt on the ability of timber framed structures to withstand damp conditions and their durability over the lifetime of the structure. Confidence in timber systems had fallen. Throughout the 1990's organisations such as BRE were active in reviewing the claims, assessing the practices exposed and developed best practice guides to support the timber frame industry. This was further supported with the TF2000 project, which started in 1996, where timber frame type construction was to show its suitability for medium-rise construction and path the way for the industry to build on the achievements of the past decade and further expand into new areas, previously untapped markets.

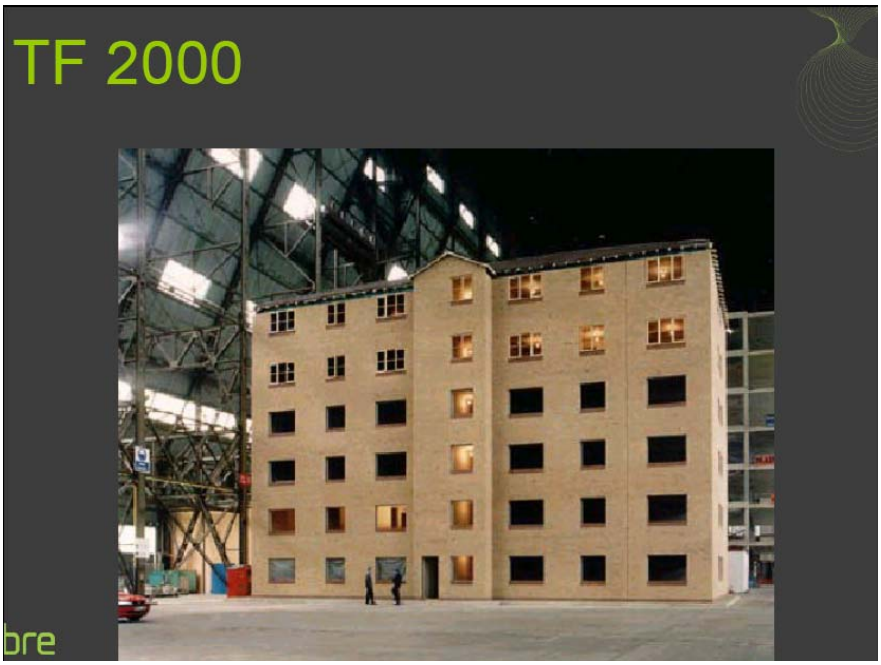


Image 1: The six-storey TF200 building, the first of its kind in the world

- Value engineering and process benchmarking
- Differential movement.
- Structural performance: whole building stability (racking stiffness).
- Fire: stairs and compartmentation performance.
- Acoustics: walls and floors [6][7].
- Disproportionate collapse.
- Guidance documents.

Image 2: The performance and economic factors studied and the outputs produced

Since 1998 timber frame market share in 1 to 6 storey construction has steadily increased as the following figures can illustrate.

Percentage of timber frame starts by region

Region	2005 Q1	2005 Q2	2005 Q3	2005 Q4	2005 Year	2006 Q1	2006 Q2	2006 Q3	2006 Q4	2006 Year
North East	10%	8%	4%	11%	8%	13%	7%	4%	6%	8%
North West	22%	17%	9%	14%	16%	18%	19%	7%	9%	15%
Merseyside	27%	17%	11%	12%	16%	6%	10%	0%	10%	7%
Yorkshire & the Humber	3%	4%	6%	3%	4%	4%	3%	5%	2%	4%
West Midlands	9%	9%	7%	9%	9%	8%	5%	8%	8%	7%
East Midlands	3%	5%	3%	8%	5%	9%	7%	7%	4%	7%
Eastern	11%	16%	12%	12%	13%	12%	9%	8%	11%	10%
South West	20%	7%	16%	15%	15%	13%	14%	7%	12%	12%
Greater London	6%	19%	12%	12%	12%	8%	6%	5%	6%	6%
South East	13%	12%	14%	10%	12%	14%	13%	11%	10%	12%
England	11%	12%	10%	10%	11%	11%	10%	7%	8%	9%
Wales	9%	16%	9%	7%	11%	15%	9%	10%	11%	11%
Scotland	65%	62%	65%	60%	63%	61%	57%	62%	48%	57%
Northern Ireland	7%	6%	5%	6%	6%	7%	12%	12%	18%	12%

Image 3: NHBC statistics, 2006

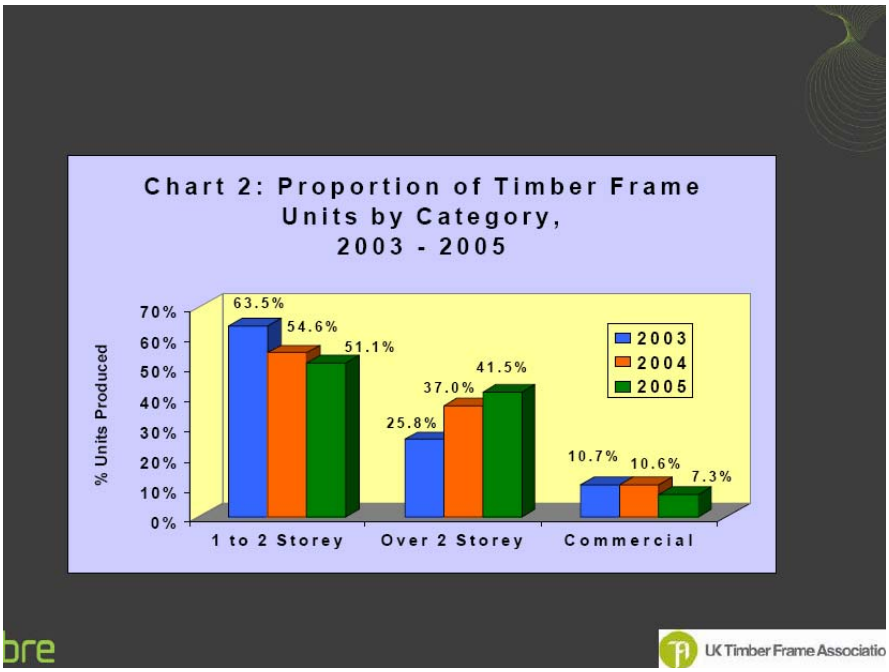


Image 4: Timber frame units produced in different applications

2 Drivers for timber frame in the UK construction industry

The UK construction environment, especially the residential new built sector is healthy. Government figures estimate that about 200 000 new homes will be required in the next four years. It is estimated that abou1.5 million households require an affordable home now, and that overall 85 000 affordable homes will be required every year into the near future. With traditional construction techniques, which have comparatively long turn around times from concept to final build, a shortfall of production capacity is lying in the region of 70 000 units per year. These challenges demand for new solution, which can deliver high quality buildings, quick erection times and controlled erection processes. Especially the labour intensity and skill requirements of traditional building techniques slow down the build process and offsite manufactured solutions, including timber frame offer “packages” where the planning, design and erection process are handled and supervised by a specialist provider.

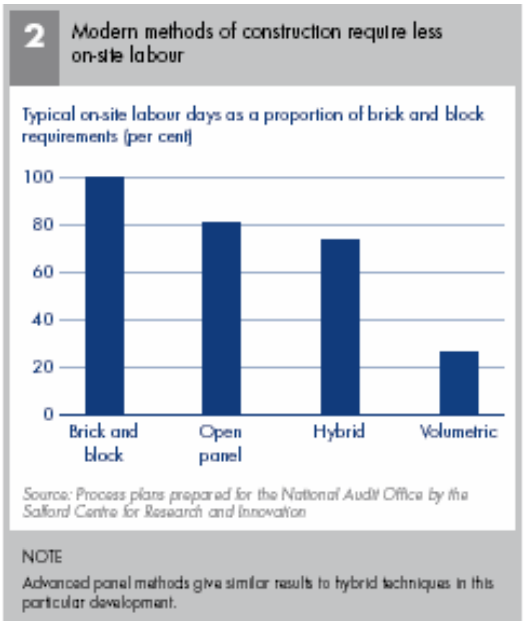


Image 5: Modern methods of construction require less on-site labour

Off-site Construction Market Statistics

Forecast market size for Off-site Construction Technology in the UK (£million)

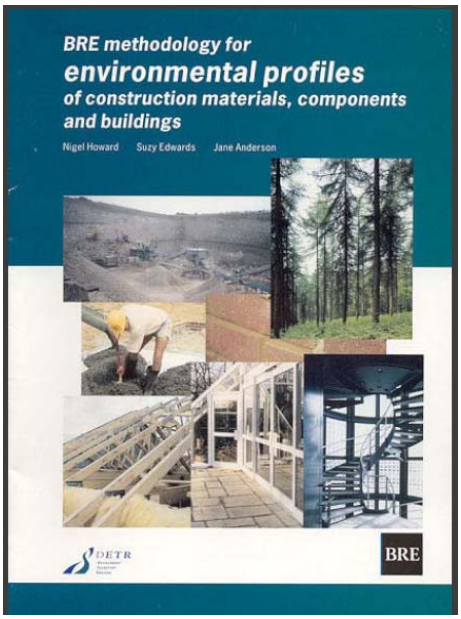
Sector	2003	2004	2005	2006	2007
Health	247.00	266.00	291.00	325.00	370.00
Education	255.00	274.00	300.00	336.00	384.00
MOD	63.60	81.50	102.60	127.70	157.70
Industrial	102.00	104.00	106.00	109.00	113.00
Hotel	178.00	186.00	198.00	211.00	227.00
Housing	27.80	37.70	52.90	77.40	119.00
Custodial	91.00	109.00	130.00	154.00	180.00
Total	964.40	1058.50	1180.50	1340.10	1550.70

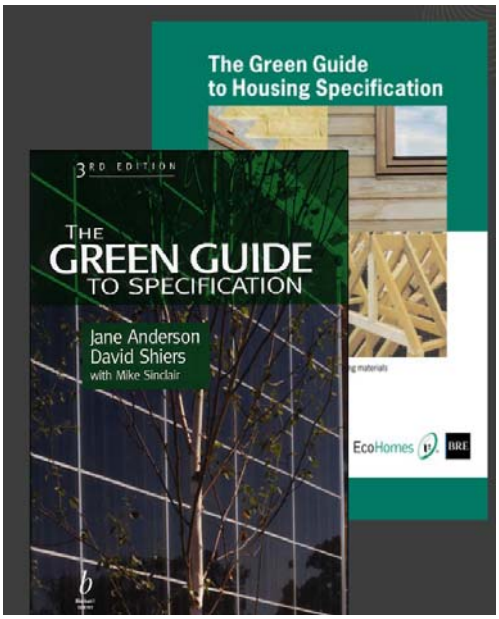
10–15% of new homes in 2004 were built using timber frame, 5% using other MMC, equate to 25,000+ MMC homes per year.

bre

Image 6: Off-site Construction Market Statistics

Another driver in the UK construction is the increased strive for sustainable forms of construction. The UK Government wishes to see a 60% reduction in CO_2 emissions by 2050. Constructions, more specifically buildings, are seen as one of the key areas, not only contributing to considerable extent to CO_2 emission levels but also affecting citizens' general quality of life. There has been a better awareness of the issues related to the sustainable design and construction of buildings and a suite of tools and assessment methods, such as construction products environmental profiling, BREEAM, EcoHomes and green guides to specification (shown below) have enabled practical improvements and implementation. This has lead to an increased interest in the use of timber as a key element in construction and the applications now range from the main structural frame to the external façade finishes, in the more traditional two storey domestic market but also more widely in applications such as refurbishment, for both domestic and non-domestic applications. On certain sites all new built construction has to meet a certain BREEAM or Ecohomes rating (see categories assessed below) to be eligible for use.





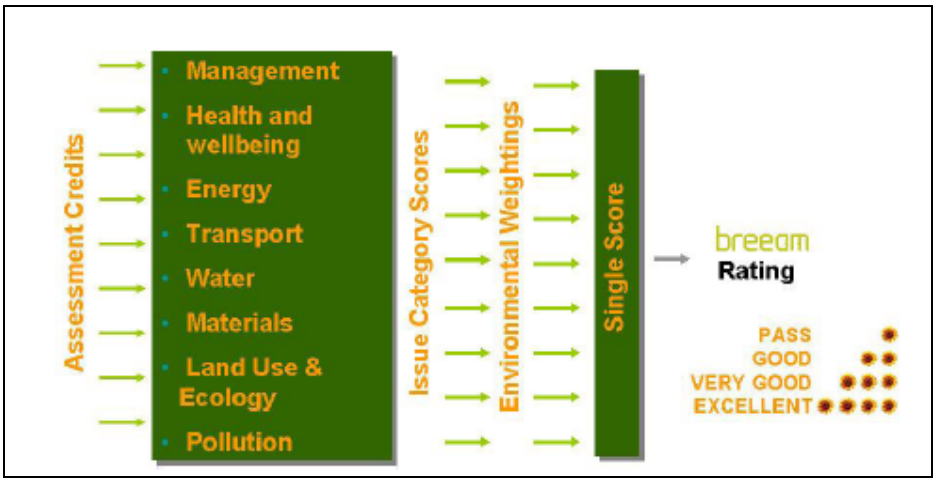


Image 7: The suite of environmental guidance available to all sectors of the construction industry

3 Typical UK timber frame construction

UK timber frame is typically constructed as shown below. Timber or timber based products, such as I-joists or metal-web girders, are used. Solid timber is common in loadbearing wall, solid joists are increasingly replaced by I-joists in floors. Common stud and floor joist sizes are shown in the table below. The roofs are generally trussed rafter girders, although there is an increasing trend to habitable roof space. The timber industry has competitive products for all main construction elements, and timber is also increasingly used as external cladding material. The majority of UK timber frame construction uses a drained and ventilated cavity.

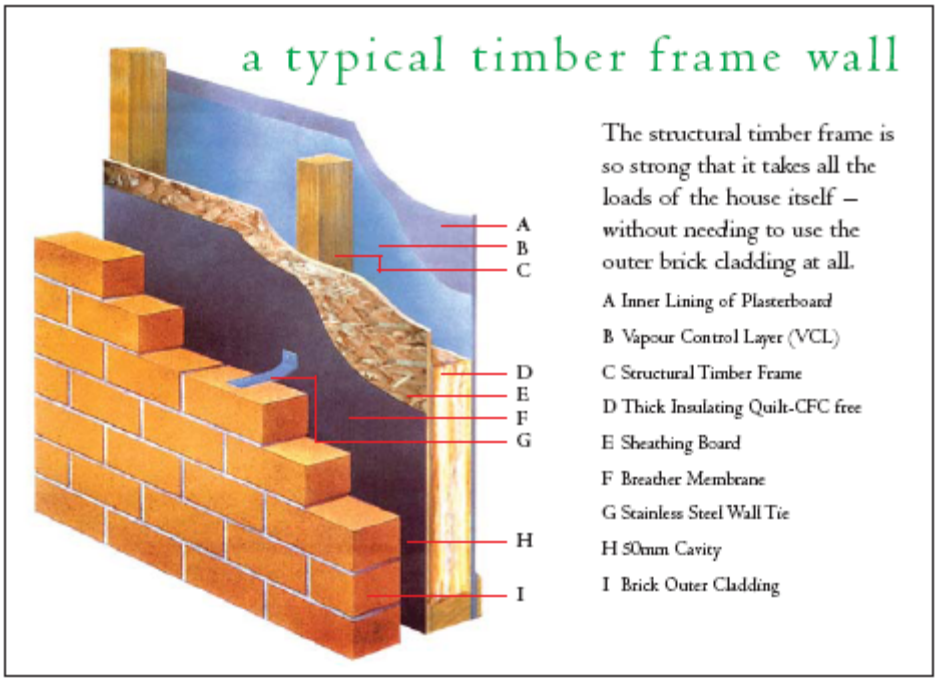


Image 8: Typical timber frame wall (Source: Timber frame fact sheet, wood for good)

Application	Width (mm)	Depth (mm)
Studs	38	63
		89
		140
	45	95
Joists	38	184
		235
	45	145
		200
	75	200

They are a couple of signification differences to continental timber frame as summarised in the following:

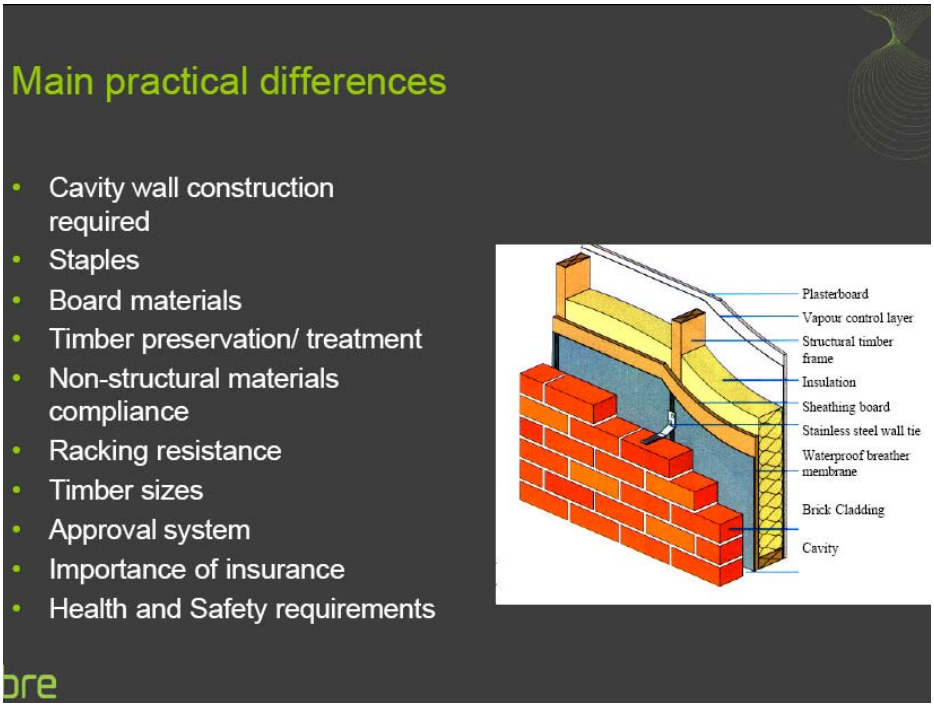


Image 9: Summary of main differences in UK timber frame construction

Image 10: The TF 2000 building, typical floor and wall construction and building processes

Image 11: Timber frame structures in the UK: 1 to 2 family dwellings and small public buildings (top 4) to 6 storey commercial structure (bottom right) and multi-occupancy terraced timber frame student accommodation with traditional façade (bottom left)

4 Regulatory background

The UK has three sets of building regulations, for England/ Wales “Approved Documents”, Scotland “Technical Handbooks” and Northern Ireland “Technical guidance documents”. All building regulations are performance-based, so that, in principle, every form of construction and all materials can be used as long as support information and evidence can be provided to show that the suggested solution is meeting the safety, durability and usability goals laid out in the regulations. The building regulations for England and Wales, comprises, in total 14 Approved Documents – parts-, A to P, are to inform building design about the minimum performance levels required and address all topics from structural design to fire performance, acoustic and thermal performance and others as shown below.

A	Structure
B	Fire safety
C	Site preparation and resistance to contaminants and moisture
D	Toxic substances
E	Resistance to the passage of sound
F	Ventilation
G	Hygiene
H	Drainage and waste disposal
J	Combustion appliances and fuel storage systems
K	Protection from falling, collision and impact
L	Conservation of fuel and power
M	Access to and use of buildings
N	Glazing – safety in relation to impact, opening and cleaning
P	Electrical safety

Image 12: The Building Regulations for England and Wales

However, the use of construction systems in the UK construction industry is also to considerable extent influenced by third party insurance companies, such as the NHBC and Zurich. Achieving insurance cover is a pre-requisite to enabling the homebuyer/ owner of a building to get mortgage/ financial cover and the related insurance. Insurance requirements are allowed to divert from accepted codes and standards and can in cases be more onerous than accepted best practice. The insurance requirements can be quite comprehensive, setting minimum requirements in the following key areas (taken from NHBC standards):

- Materials
- Foundations
- Substructure and groundfloors
- Superstructure
- Roofs
- Services and internal finishes
- External works
- Conversions, alterations.

5 Summary

Timber frame construction in the UK has experienced a major step growth in the past 20 years. It has become a well established form of construction with a competitive edge and viable, innovative concepts. The drive to sustainable construction has had a measurable impact on the use of timber frame in the UK and independent environmental assessment methods, such as Ecohomes and BREEAM have enabled all forms of construction be compared and strategic choices have become available to larger developers. This is of special importance in the very consolidated construction industry as found in the UK. There are some distinct differences in UK timber frame construction, not only in the regulatory environment but also in the accepted method of use, compared to other European countries.