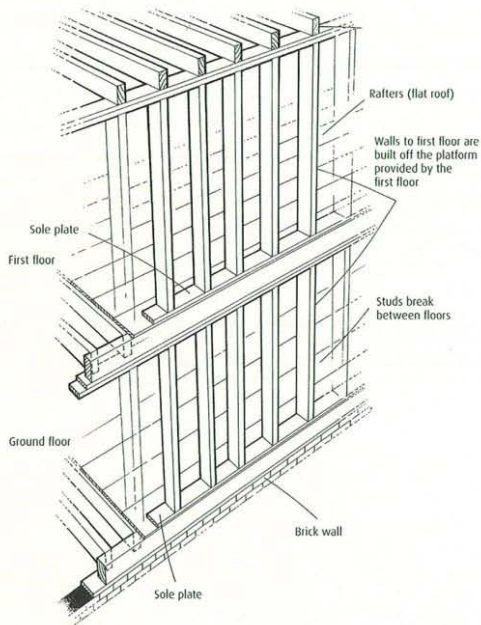
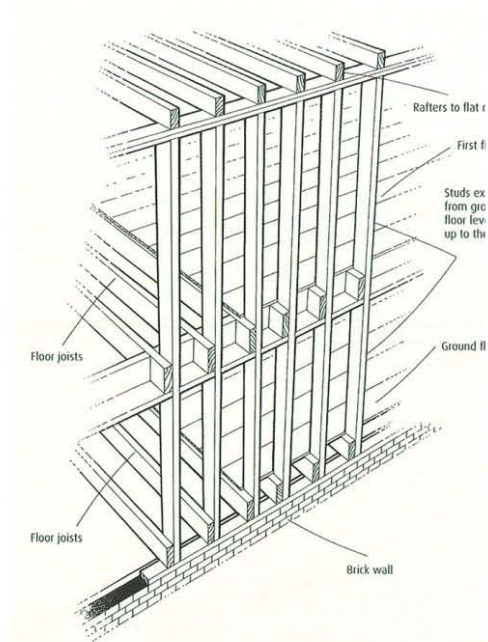


TYPES OF Modern Timber Frame Construction





Platform frame construction



Balloon frame construction

Kit and Modern Timber Frame

Timber has been used as a building material for thousands of years but also plays a key role in many modern, high-tech methods of construction which are helping to make new houses easier to build. If you are thinking of building a home using timber, what are the options and how do you choose which of them is best for your project?

Timber is so commonly available that we all tend to take it for granted as a part of our everyday lives. But this truly remarkable and versatile material is playing a key role in the construction of twenty first century houses. There have been recent innovations that use it to increase the speed of construction and make our buildings more eco-friendly. Many experts believe that the only way to reduce carbon emissions significantly in the building process is to use timber as the main building material. The term 'timber frame' is used rather loosely in the construction industry, and in fact some systems don't actually feature a frame at all but use timber in the form of sheets or panels. There are many ways of forming a frame with timber, although the type that is constructed entirely on site is rare. Most of the modern systems depend on factory pre-fabrication for their advantages in use and to keep costs down to a realistic level. This article picks out the main types of

kit homes. There are two principle approaches to the structure a timber frame building, and most systems that use studs, joists + rafters are a variation of one of these.

Balloon and Platform Frames

Platform Frame With this method, the ground floor walls and first floor structure is erected and the resulting platform is used as a base upon which to construct the next floor. This means that the whole frame can be built on site from relatively short timber lengths.

Balloon Frame The balloon frame method is similar in principle to the platform, but the walls are built as a continuous structure from ground floor level up to the eaves. A benefit is that once the frame can be erected to a watertight stage faster. The balloon frame cannot usually go higher than two storeys because there is no timber sufficiently long enough to reach further in one go.

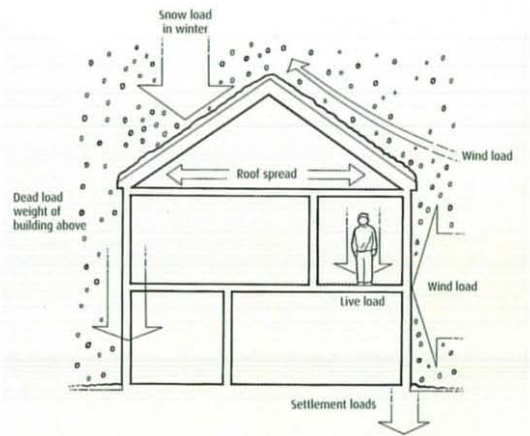
Open Panel Timber Frames

This is the most widely available. It is popular because it is easy to put together both when the pre-fabricated parts are made in a factory and when it is assembled on site. In the factory, softwood studs form the main structure, and a rigid board such as plywood provides bracing. These are simply nailed together to form a strong, rigid panel, designed for easy delivery and assembly. The studs and panels fixed to them are both crucial elements of the structure.

and if either is damaged or missing, the strength of the panel is reduced. The name 'open panel' derives from the fact that when the panels arrive on the site one side is open and un-boarded. It is usually left open until the building is weathertight at which point services and insulation are put into position. It is closed over with a sheet of plasterboard or a gypsum-fibre board along with a vapour control layer to prevent condensation within the panel.

The platform frame method of assembly is generally used for the open panel system, because the short sections of timber needed lend themselves to prefabrication and transport to site – longer timber would require a special lorry. Internal walls that are not carrying any load are usually supplied along with the rest of the frame, but can be improvised on site if necessary. If the internal wall is part of the structural design of the frame, it must be manufactured as part of the kit.

- Features of an Open Panel Timber Frame**
- Fast construction on site
 - Can be clad in any material
 - Easy to transport – robust and damage easily repaired
 - Cost effective use of the materials
 - Suitable for self-builders
 - High level of insulation possible
 - Limited alterations on site are possible



Some of the loads that affect a house Kit and Modern Timber Frame Homes

The panels support the roof and are in an identical location within the structure to that of the block work inner leaf of a masonry cavity-wall construction. The voids between the studs are filled with insulation. Because warm air from the house carries moisture, the internal lining of an outside wall usually has a vapour control layer, such as a foil backing to the plasterboard, ▶



Front of timber frame, house

Andrew Bradley



Rear of the same timber frame, house (on previous page)

Andrew E

to stop air leaking into the inside of the panel. To disperse any vapour that does find its way in, the outer sheathing of an external wall is covered with a breather membrane, that keeps out water (such as rain) but allows vapour-laden air to pass through to the outside of the frame.

The timber structure of an open frame is never exposed and would not look very attractive even if this were possible. The outside cladding can be almost any building material, including bricks, softwood boarding, tiles and render. When brick cladding is used, only an expert eye will be able to spot that there is a timber frame concealed behind it.

Closed Panel Timber Frames

If the framework of studs is enclosed on both sides it is called a closed panel system. The panels are factory-made in their entirety, including the insulation, electrical wiring and window and door linings. The main job required on site is to assemble them, after which the inside is ready for fitting out and decoration. The idea is that once it is in place, the wall will not have to be

drilled or cut. If this happens, the panel is damaged and careful repair is needed. As a result a very high degree of pre-planning is necessary. The position of anything that is to be fixed onto the walls, or supported by them in any way has to be built in while the panel is made. Assembly once the panels have been delivered to site is quick, although relatively large lorries will be needed for transportation with cranes to lift the panels. Apart from the speed of erection and higher quality control, another benefit is that building is easy to make air tight. Once in position, the frame is then clad in whatever material is required, in a similar way to open panel frame.

Features of a Closed Panel Timber Frame

- Very high quality of construction
- Most of building assembled in the factory
- Very quick erection on site
- Careful handling during transport is necessary
- Very little work needed on site after groundworks and floor slab
- Low level of labour required on site
- Little room for improvisation on site

Green Oak Frame

There is a very strong element of nostalgia that attaches to traditional timber buildings and those genuine examples that have survived are greatly prized. However, there are many companies that have studied traditional methods of construction and do their best to replicate them. One advantage the new buildings have over the real thing is that they comply with modern standards. A much higher level of insulation is possible and they also allow modern layouts and room sizes.

Features of an Oak Frame Construction

- Authentic traditional appearance
- High quality construction
- Structure is expressed as part of the design
- Weathers naturally – no need for finishes
- Very durable – no preservative needed in most cases
- Suited to 'open plan' design

These buildings are not the cheapest in comparison to the other types of frame and require a relatively generous budget. The modern oak framed house takes the practices and principles of carpenters from the middle ages and re-interprets them using twenty first century factory prefabrication methods. Chunky beams, columns and rafters are assembled with slotted and dowelled joints just like the traditional frames. The building is clad either by filling the gaps between the posts with insulated panels, or covering the whole structure with a cladding such as tiles, timber boards, render or brick.



A section of a closed panel house being erected

Dan Wood

Often referred to as 'green' oak, this is because when relatively freshly cut it is fairly easy to saw and shape. Once felled, the timber gradually begins to harden and become impervious to water. After about 18 months to two years, it has become so hard it is resistant to insects and difficult to cut or sink a nail into. As the green oak matures, it dries out and begins to shrink, twist slightly and even develops small splits. In an ordinary building this may be considered a disadvantage and no one should choose a green oak house unless they accept that this is part of the character of the material and key to its charm. ▶



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Jointing detail Green Oak Framing from Green Mountain Post and Beam

Structural Insulated Panels (SIPs)

This method of construction, which is timber panel rather than timber frame, has long been used in North America, but it is a comparatively recent innovation in Europe. Instead of using timber to form a frame, SIPs consist of timber-based boarding, sandwiching sheets of rigid foam insulation such as expanded polystyrene. The two materials are firmly bonded together so that they effectively act as a single structural component. The resulting panels are said to be five to ten times stronger than conventional timber frame. In Europe, they are used mainly for internal and external walls, although they are increasingly replacing rafters because they provide a clear roof space that can be used for bedrooms. The first SIP houses in Europe were built from panels shipped from America, but there are now factories in the UK, Ireland and the rest of Europe. ▶



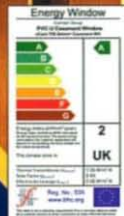
A SIP being fixed in place

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Features of a Structural Insulated Panel (SIP) House

- No frame – a 'flat pack' house
- Very high levels of insulation possible with thin walls
- Clear roof space for use as accommodation
- Low leakage of air to the outside
- Wide range of cladding choices
- Cost advantage if standard designs used
- Little wastage of materials on site

The insulation is more effective in comparison with other systems and masonry construction. In addition to this, the walls to SIP houses are relatively thin, freeing up more space for use in the rooms of the house – a factor that could be important on a cramped site. The relatively airtight construction is a major contribution to energy efficiency by reducing the amount of warm air escaping in winter.

On site a crane is needed to manoeuvre the panels into place and assembly a job that is best left to specialists, who slot them together and seal the joints. The structure of an average sized house (e.g.150 sqM) can be assembled in two or three days.

Modernist Style Timber Frame

Most of the countries in continental Europe are ahead of Ireland in terms of the use and diversity of timber frame houses and in general terms are also more adventurous with design and technology. Many would agree that Germany was the birthplace of modernist design, which places a high priority on expressing the construction of a house in the design and making it an integral feature of the appearance. Modernist principles work well with German post and beam construction which allows large, simple internal spaces well-lit by large areas of glazing.

Features of a Continental Style Post & Beam House

- Prefabricated and exported to UK
- Very high standard of design and construction
- Relatively expensive
- Structure of the frame is a key part of the appearance
- Large open plan spaces
- Large areas of glazing
- Usually very high levels of insulation
- More likely to be a complete construction service rather than frame only

North American Post and Beam

In the USA and Canada, there is a long tradition of building in timber frame from abundant locally available raw material. This together with a heritage based on self-sufficiency and the pioneering spirit have led to the development of a style that is particular to North America.

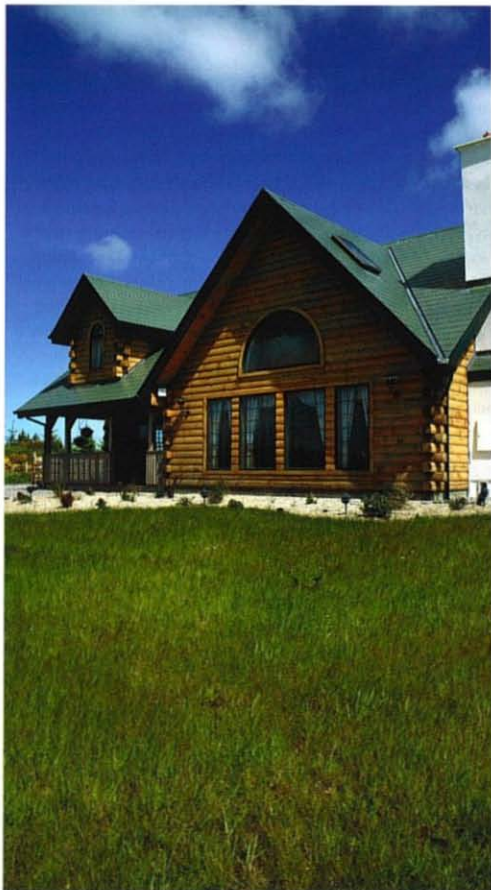
There are a number of North American manufacturers who fabricate timber frames including windows, doors and cladding and export them as a kit for assembly in Europe as a watertight shell. Cedar cladding is often used, as well as structural softwood such as spruce or fir. These houses have a distinctive style that shows off the high quality native timber to good effect.

Features of North American Style Timber Frame Houses

- Post and beam construction, often using long lengths of timber
- Extensive use of timber cladding internally as well as externally, sometimes painted
- Prefabricated in North America
- Large areas of glazing often up to ridge height
- Roof spaces open to the rooms
- Large floor areas

Log Construction

Colloquially known as 'log cabins' this system has its origins in what was probably the earliest form of timber construction. The kits originate mainly from Scandinavia, particularly Norway and occasionally North America. The basic concept of logs piled on top of each other to form walls with dovetailed joints chiseled out at the corners to interlock has been developed into a more sophisticated version. Chunky sections of timber are shaped by machine so that tongue and groove joints along their length



A modern log home

Kuhns Bros Log Homes, Christopher Hill Photography



Detail showing thickness of exterior timbers

Kuhns Bros Log Homes, Christopher Hill Photographic

interlock as they are stacked up to form the inner leaf of the wall. The logs can be flat, oval or round to imitate true logs. Timber alone is usually not a good enough insulator to satisfy current regulations, so there is then a layer of insulation, usually faced with timber boards on the outside. Alternatively, the structural wall can be insulated internally and dry lined. Either way, log construction is more energy efficient than ▶



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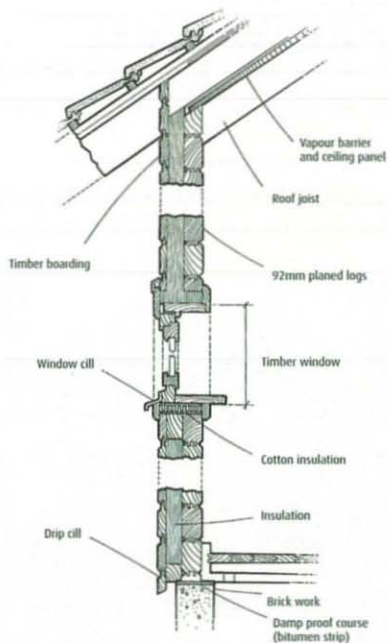
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A typical log construction house
(After Erland Haus)

Kit and Modern Timber Frame Homes

ordinary timber frame, because the bulky timbers absorb and store more heat than the relatively lightweight timber studs and posts.

Features of a Log Construction

- Originated in Scandinavia and North America
- Logs are actually made from several sections of timber bonded together
- Inner structural wall of logs is usually concealed behind insulation and timber boarding
- High level of insulation possible
- Usually have timber internal walls

Self-Built Timber Frames

Some of the timber building systems mentioned above can be constructed from scratch, on site, using wood from a builder merchant. Timber frames can be cut and erected, rather than using a manufacturer to prefabricate and prepare the frame in a factory. This is often done in the USA. However, a mixture of bureaucracy, the current lack of sufficiently well-trained carpenters and unfamiliarity with the techniques involved amongst other building trades make this more difficult in Ireland.



Julian Owen RIBA is a founder member of ASBA (Associated Self-Build Architects) and the author of *Kit and Modern Timber Frame Homes*, ISBN 9781 86126 9508
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