

Pros & Cons of Timber Frame Buildings

Anyone who considers using a structural timber frame will probably want to compare it to the alternatives, principally brick and block construction in Ireland. Generally speaking, no one system of construction is inherently better than another because it depends upon the requirements of a project and the preferences of the self builder, as well many other factors such as the location and constraints of the site.

To simplify the issues covered in this article, a typical brick-clad 'open panel' timber frame supplied and erected on site by a specialist company is compared with a typical 'brick and block' masonry house.



Speed

One thing that most construction professionals agree on is that if a prefabricated timber frame is used the time that it takes to construct a house on site can be quicker than a traditionally built house of standard brick and block construction. This is because the timber frame is usually erected on site by the supplier's own carpenters, in a matter of days rather than weeks. Seven to ten days is a typical time from the arrival of the specialist construction team on site to the frame being up.

Many of the trades involved in the construction of a house, such as electricians and plasterers cannot work in exposed weather conditions and therefore cannot start until the interior is protected from the weather. These trades can start much earlier in the build programme of a timber frame house, which means that the building can be finished earlier. If a brickwork outer skin is required, this is built up after the frame is watertight, at the same time as the internal areas are being fitted out. Houses with all-masonry walls require a longer period for mortar and plaster on the inside to dry out and this can extend the build time by several weeks.

Timber frame, by comparison, is a mainly dry construction process. The moisture content of the timber used for the structure has to stabilise after it is weathertight. Then the walls are usually clad in dry plasterboard.

Aside from the effect on drying out times, there are other limitations imposed by the weather on how quickly a standard blockwork wall can be built. If the temperature drops below 2 degrees centigrade work has to stop but timber frame can be erected in very low temperatures if necessary.

If an amateur self builder is doing the building work the process is usually a lot quicker and easier if a prefabricated timber frame is used because it is usually erected by the supplier. This means that the structure can very quickly protect the builder and materials from the weather.

Although the time spent constructing a prefabricated frame is short, time has to be allowed for it to be designed and made in the factory beforehand – 3 months is not unusual. This means that the design has to be finalised as early as possible and there is a longer wait before work starts on site than is necessary for an all-masonry house.

Quality and Ease of Construction

The easiest part on site is getting the frame up, but the quality that results from the protected and controlled conditions of a factory must be followed through. This is why virtually all suppliers of kits also erect the frame. Because the frame is constructed very accurately it will be erected quickly and easily, but a high level of site supervision is required to ensure that the exacting standard of construction necessary is achieved.

Thermal performance

A clear advantage for timber frame construction is that the insulation is contained within the depth of the structure, so a typical timber wall can be thinner than its masonry equivalent, for example, by 50mm.

Once a good level of insulation is achieved, the amount of heat lost as a result of air leaking out of the building then becomes more significant. Timber frame structures tend to perform well on this score, because they are sealed to prevent moist air reaching the inside of the construction.

A further difference between masonry and timber walls is how well they retain heat. Anyone who has lived in a masonry house will be aware that the central heating has to be set to come on well in advance of getting up on a winter's morning to ensure a warm start to the day. This is because the masonry inner leaf of the house must be heated first before the temperature of the air in the rooms can reach an acceptable level. Timber does not soak up heat in this way. Because of this a room enclosed by insulated timber frame walls will heat up and cool down more quickly. Whether this is a good thing or not may depend partly on the lifestyle of the inhabitants of the house and whether it has to be heated continuously or only in the evenings and weekends.

Noise and Sound Insulation

The easiest defence against loud noise is to put something solid and heavy between you and its source. Dense, heavy materials have an in-built ability to deaden all types of sound.

Because of its dead weight, masonry construction has an advantage over more lightweight timber. But a high level of sound reduction can be achieved with timber frame by building two

separate walls with a structural break between them. Part of the gap is filled with sound absorbent quilt, such as mineral wool. A similar blanket is placed in the floors, along with an absorbent layer laid immediately under the floorboards, over the floor joists. A simpler solution is to fill the wall voids around noise sources such as playrooms, bathrooms and WCs with sound absorbent quilt. In addition to this the plasterboard can be replaced with a heavier board, such as Fermacel or used in a double layer.

Risk of Condensation

Condensation is caused by warm moist air produced by space heating and activities such as washing and cooking cools. Moist air has a tendency to move to where the air is drier, usually from the inside to the outside. As moisture passes through the walls the temperature of the air drops, its capacity to hold vapour reduces and eventually water begins to condense. In winter this point may occur either on the surface of the walls, windows or other internal surfaces, or inside the construction, in which case there can be a risk of long-term damage.

A masonry construction, such as a cavity wall, can suffer from condensation at the point where the warm, inside air has passed through most of the insulation. It can do limited harm here, because modern insulation cannot rot. The outer brickwork leaf allows moisture to gradually pass through it and the inner face of the outer leaf is designed to allow water to run down it and drain away. However, condensation within a timber frame-wall cannot be treated so casually, and preventing it is a major concern for designers and builders.

The most effective method is to position a vapour check such as polythene sheet between the lining of the inside wall and the insulation, which will not allow any vapour to pass through it. Foil-backed plasterboard is often used for this role.

Rot and Beetles

It is very rare for a modern timber frame to suffer from rot. External timber elements, such as cladding and fascia boards are prone to rot if not well maintained, but the actual frame itself is well-protected. In Ireland, because of the climate the main threat to timber buildings comes from fungal decay. Wet rot is the commonest form of fungal attack although the other form, dry rot, is the one that provokes the most fear and excitement. In order for either of these to survive there must be a very high moisture content to the timber, usually at least 20%. In a modern heated house the moisture content will usually settle down at about 12%. Denied its principle requirements of warmth and dampness, rot will never be able to establish itself.

Infestation of the frame by insects is similarly unlikely. Many of the potentially damaging species only affect hardwood, or newly-felled timber. Provided the moisture content of the timber is below 20%, a timber frame will not be attacked. The ubiquitous woodworm or furniture beetle can infest drier timber, but is deterred by the well-ventilated, warm dry timber found in modern timber construction. A well-built and maintained timber frame will never produce conditions that are suitable for fungi or beetles.

Fire

Quite obviously, timber can burn, whilst some of the alternative materials such as masonry and steel do not, although they will eventually crumble and disintegrate if subjected to sustained high temperatures. This may lead to the hasty conclusion that timber buildings are not as safe in the event of a fire as a brick and block built house, but the real picture is not so simple. The progress and level of destruction of most house fires and the likelihood of death or injury are mainly determined by factors such as whether there are smoke alarms fitted, the habits and behaviour

of the occupants (for example whether they smoke), and the flammability of the contents of the house. However, there is some evidence to suggest that if the frame is not built correctly, it is more difficult to extinguish the fire and more damage to the structure can occur. Also it seems that timber frame houses are more vulnerable to fire damage during construction, before all the fire protection has been built over the frame. As far as the risks to people are concerned the crucial factor in survival is how quickly people can escape. If anyone is trapped, how long the construction of the house will protect them from flames and smoke until they can be rescued becomes important.

If asked whether a steel beam or a timber beam is most vulnerable when exposed to flames most people will say timber. This is a natural response, because steel doesn't burn. In fact the answer is again not so straightforward. When steel reaches a critical temperature, it will fail, suddenly and catastrophically, because in great heat it softens and eventually melts. When a timber beam is placed in a fire, the outside starts to burn immediately, as you would expect. But after the outer parts of the beam have been burnt, they turn into charcoal, which does not burn and actually insulates against heat. Because of this charring effect, the centre of the beam is protected from damage for a long time before the beam actually fails and collapses.

The studs that make up the structural walls in a typical timber frame are not oversized in this way, due to cost and practicality. However the frame is clad in material that resists heat and flames, usually plasterboard or sheets of similar material and also there are barriers built into cavities in the building to block flames from spreading.

Provided that it has been designed and built by people who understand the technology, the risks from fire in a typical timber frame house do not seem to be any different from those that are faced by the occupants of a brick and block equivalent.

Structure And Robustness

Timber has proved to be a strong and durable material. If built well timber frames buildings will last for hundreds of years.

The exercise of building in timber requires more precision and planning than a brick and block property. For economy, the elements of a timber frame are carefully designed and calculated to use as little material as possible for the strength required. As a result, it is not straightforward to alter or extend the frame of an existing house and demolition of walls should not be undertaken without seeking structural advice.

If anything substantial is to be fixed to a timber stud wall, such as a heavy bookshelf, the fixings must be made into the frame, not the plasterboard wall covering alone which will not be able to support the load.

Green Construction

Timber has many environmental benefits not found in other building materials. The level of carbon dioxide (CO²) in the air is increasing significantly as a direct result of our lifestyle and mankind's industrial activities and is a major cause of the greenhouse effect which in turn leads directly to global warming. Trees will lock away CO² in their wood, which is retained throughout the existence of the timber. The use of timber as a building material encourages the growth and expansion of the forests that provide the supply, which absorb CO² and therefore help to reduce the level of global warming.

Timber is said to be 'renewable' because, in order to replace it, another tree is planted. Provided that a similar tree is planted for every one that is felled, the supply is infinite. This is in stark contrast to bricks, blocks and concrete, all of which rely on the extraction of raw materials from the earth, which ultimately will run out.

Apart from the ability of trees to absorb and store CO² itself, they also need less CO²-producing activities, such as industrial processes, to be created. To make steel for example, raw materials have to be mined, transported and then combined together in factories also producing waste. By contrast, there is almost no waste in timber production – even sawdust is used for chipboard or paper production.

Cost

Cost comparisons are difficult to make between timber frame and other construction materials. Actual construction costs are probably a few percentage points higher for a typical timber frame over brick and block. Architects and builders less experienced in timber frame construction tend to increase their prices to compensate for the extra time needed to ensure that the design is correct.

However there are other factors that can affect the cost of a timber frame that have more to do with the way that the suppliers are chosen than the actual construction costs. Many timber frames are sold as pre-designed kits, a relatively expensive way of building whatever the material used, causing timber frame prices appear high.

Another factor that confuses the true cost of a timber frame is the way that prices are quoted. Quite often the initial price provided will be an approximate cost/square meter. Some companies will calculate this on the gross area, which includes the thickness of the walls as well as the rooms inside the house on each floor. Other companies will use the net area which is the area measured along the inside of the outside wall – that is, not including the external wall thickness. The price quoted for the gross area could appear 10 to 15 % cheaper. Similarly, some companies include the frame and other sundries, such as the skirting boards and always include the erection costs but others will add some of these on as 'extras' at a later stage in the negotiations.

Whilst the costs of a timber kit house may be higher, there is more price certainty. Factory costs are far more predictable than building costs on site and tend to fluctuate less. Finance costs may be increased slightly, because unlike a typical builder, who is always paid after work has been completed, kit suppliers ask for money in advance to cover the off-site investment that is required. Having to pay earlier means that interest charges are spread over a longer time period and are therefore higher. Whether this is offset by the faster build time on site is down to the circumstances and organisation of an individual project.

How to Lower the Cost of a Timber Frame without Reducing the Quality

1. If you want a bespoke design, use an independent architect.
2. Get fixed prices for your own design from several kit suppliers in competition.
3. Ensure that budget prices quotes early are all on the same basis and can be easily compared.
4. If possible, build in an area where there are carpenters skilled in timber frame, e.g. Scotland.

5. Keep the shape simple and avoid designing in spans that exceed the normal limits of timber.
6. Build it yourself, if you have or can acquire the skills.
7. Pay as little as possible as a deposit before delivery.
8. Ensure that it is assembled by skilled carpenters, thus reducing snagging and repair work.

Seriously consider timber frame construction if:

1. You need the structural shell up quickly e.g. if building in winter
2. The ground on which you are building is particularly poor.
3. You expect the heating to be frequently turned on and off daily during a typical week in winter.
4. You wish to promote the use of environment-friendly materials.
5. There is no major source of noise, such as a main road, nearby.
6. You do not expect to have to make major alterations to the property once built.
7. The design of the plan does not include very large structural spans.
8. The site is very constricted, with limited access and/or space to store materials.
9. You intend to do a lot of the construction work yourself.
10. The site is a timber-friendly area, such as Scotland.
11. You like the timber frame aesthetic, which is genuine in feel and appearance