

Frequently Asked Questions about Light Steel Framed Housing (LSF)

With review by Professor Charles Clifton

Q1. A colleague builder friend has just erected a steel framed house and said the weight of a steel frame is only one third that of timber. Is this true?

A. Yes. All New Zealand steel framing is made from thin gauge, high tensile steel, meaning that the frames are approx 1/3 of the weight of comparable timber framing.

Q2. What is the difference in cost between timber and steel framing?

A. This naturally varies with the volume that one buys and the design adopted but generally speaking steel is similar to timber. It is likely that the framing costs would be the same although framing costs would only be 10% of the total building cost, however there are other cost advantages when using steel where significant cost savings can be made. Steel is a lot faster to erect, and frames are much easier to handle. Money is saved because there are usually no callbacks or cracking to plaster linings. Therefore the final constructed cost will be the same or less for a house of comparable size and quality

Q3. Will the Building Consent cost more?

A. Most Building Consent Authorities have had Light Steel Frames (LSF) erected in their area and are now familiar with the procedure for consenting steel frames. Usually the fabricator will supply engineered detail drawings for your consent application.

The cost of the consent will be determined by the overall cost of the building not the material of the framing. Therefore there should be no difference between timber and steel framing consent costs. (NASH) National Association of Steel-Framed Housing also provides support and has an excellent relationship with DBH building officials.

Q4. Is steel framing a new New Zealand idea?

A. No. Steel framing has been around in New Zealand for over 50 years. In South Australia 30% of new homes are steel and all over Australia the percentage is 15%. In Hawaii it is 40% and Japan builds 150,000 steel homes every year.

Q5. How is it that we have built timber houses with timber weatherboards in New Zealand for a hundred years and now you are saying steel is better. I don't believe it. Isn't this just TV advertising hype?

- A. No. The timber houses of the past were built with heart timber, either native or pine, clad in building paper and with wall and roof cavities that could “breathe” and were relatively lightly insulated. This protected the timber from condensation and hence ensured its durability. Modern houses have claddings and building wraps that don’t protect from condensation to the same extent, the walls are highly insulated which restricts air flow and the timbers are “young crop” Pinus Radiata which is much less durable, sometime with surface only treatment against rot and borer. . Steel is an inorganic man- made engineered product which is much better suited to retaining durability in modern house construction and has a proven track record of this over 60 years in NZ. Furthermore it does not absorb water and change dimensionally meaning no cracking of gypsum board linings. Its rate of expansion with temperature is also comparable with that of typical cladding and lining materials. (See also the question below on thermal breaks).

Q6. Steel needs a thermal break to meet modern insulation requirements while timber does not. Why is that and does it mean timber is better?

- A. The reason steel needs a thermal break is because of its high heat conductivity relative to timber. Without the thermal break it means that when the inside of an external wall is warm compared with the outside, sufficient heat will flow through the steel stud to cool the inside surface of the wall and cause condensation as well as compromising the wall’s insulation rating.

This high thermal conductivity is often portrayed as being a weakness with steel but is in fact one of its greatest strengths. It means that when the thermal break is in place, all the steelwork on the inside of the thermal break remains above the temperature at which condensation from moisture in the wall cavity will occur. This ensures long term durability of the stud. In contrast with timber studs, the outside of the stud will attract condensation during winter, with resulting increase in moisture content, movement that damages linings and long term durability problems. This will occur irrespective of the weather tightness of the external cladding.

Q7. How do I hang a picture on the wall of a steel frame house?

- A. The answer is, carefully. The reason is it depends on the weight of the picture and the gib board. You can hang a picture up to 10 kg directly into gib board using proprietary fasteners such as a Wallmate or a toggle bolt. For heavier objects such as a mirror or a flat screen TV, they must be fixed through to the metal studs. These can easily be found with a magnet or by tapping and will normally be at 600mm centres. It is best to use a metal angle or bracket between two studs and do not pre-drill the hole but use a type 17 self drilling screw.

Q8. Is LSF a DIY product? Can I just buy just the components of a steel frame house and erect it myself.?

- A. There are some manufacturers that will supply the steel frame kit sets with coded parts and a CD to provide instructions as to how to put it all together. You will need a minimum of tools but you do need some experience in building. You will know that there are some restrictions under the new DIY Building Code so it would pay you to check it out with your local BCA. If you approach them first and

discuss what you intend to do you will find them helpful. Make them part of your building team and you will be surprised how smoothly things will go.

Q9. What type of barrier should be used in between the steel frame and treated timber?

- A. For H1 treated timber normal building paper will act as a separator and will suffice if the area is closed.

If however the situation is sheltered or exposed and H3 timber is used then a more substantial separator should be used such as window tape. This separation is more important if the site is severe or very severe marine and if the frame is not clad then an additional paint coat is necessary. NASH provides guidance on barriers to use in all applications of steel framing and there is a good New Zealand standard on which this information is based.

Q10. Does LSF conduct sound through inter-tenancy walls?

- A. Sound vibrations are conducted through any wall with solid material. LSF is very slightly better at acoustic insulation than timber framing, due to the flange flexibility, but the differences are only 1 or 2 dB and not usually noticeable. It means that a different design of wall is used between apartments or flats. This can be one wall with several layers of gypsum linings plus sound insulating fiberglass or consist of two separate walls each insulated and disconnected from one another. Care must be taken when cutting penetrations into in the inter-tenancy walls for power or TV outlets or air-conditioning units as these will provide a sound path. Good details are available from a number of sources including NASH and some linings suppliers.

Q11. Has LSF got a fire rating? What happens in a fire?

- A. Neither light steel framed construction nor light timber framed construction have a fire rating in themselves. Both require the application of fire resistant linings and when these are applied, both can deliver whatever magnitude of fire resistance is required.

With regard to performance of houses in fire, LSF has two very significant advantages over light timber framed construction. The first is that, being non combustible, when fire burns through the linings it will not spread within the framing cavity in steel framing, whereas this is a major cause of hidden fire spread in timber framing. The second big advantage is that it does not increase the fire load. Timber is combustible and there is at least 20 kg of timber per square metre of floor area in a timber framed house. This is 75% of the design fire load of a house contents, which means that a timber framed house is carrying at least 1.75 times the fire load of a steel framed house. The higher the fire load, the more severe the fire.

Given these two advantages, it is not surprising that fire case histories show steel houses perform very well in house fires, with little or no damage to the framing structure. Furthermore if steel framed members are not visibly distorted they can be left in place, cleaned and if necessary recoated. If they are distorted then they need to be replaced.

Electrical faults are the most common causes of fires in wall cavities but cannot ignite a steel frame.

Q12. Can I do an alteration that involves adding another storey with a steel framed house?

- A. If they were not initially designed for the extra storey then in the same way as required with a timber house, foundations and walls have to be checked and may need to be strengthened. If you want to move load bearing walls it is wise to use an engineer who has experience with steel framing. The big advantage of a steel wall is that it can be disassembled and reassembled in position with just a screw gun, however the amount of work required for this will be similar to that with a timber framed house.

Q13. Will vibration loosen the screws or rivets?

- A. No. All steel frames are designed and braced to resist wind and earthquake stresses and the number of fasteners is more than adequate to rigidly hold the house frame together. Furthermore because the steel is dimensionally stable including around screws and rivets they don't work loose over time as can happen with timber.

Q14. How do I attach lining to the frame?

- A. Gib-board linings are screwed either horizontally or vertically into the steel frame using self-drilling screws and a suitable wallboard adhesive. The correct board should be used where either a sound or fire rating is required.

Q15. Will I be able to renovate my steel frame home? And how do I fix the steel-frame to an existing timber frame when doing a renovation?

Yes. Since steel framing allows for larger spans, the house can be designed without interior load-bearing partitions, making it easier for homeowners to do alterations without affecting the rest of the structure.

When attaching a steel frame to a timber one from the timber side, drill a clearance hole through the timber and screw a long self drilling screw into the steel. If you are fixing from the steel side, use a 12# x 40mm type 17 screw.

Q16. Does lightning affect a steel-framed home more than any other and is steel framing dangerous when lightning strikes?

- A. No. The steel frame offers better protection than other construction materials because it is a good conductor and provides many paths to earth directly to the ground. Steel creates a positive earth and the electrical energy of the lightning is conducted straight to the ground. All steel frames are required to be earthed so the lightning has less effect because it is not released destructively within the building as with other materials or framing.

Q17. Does the steel frame interfere with radio, mobile phone or TV signals?

- A. No. Electro magnetic waves pass through the spaces between studs which allow the use of radios, phones, and television sets in a steel frame home without interference. The steel framing will

provide marginally better protection from outside electromagnetic fields if you happen to live under a high voltage overhead power line.

Q18. Can a steel frame house still be energy efficient?

- A. Yes. Steel framing is required to meet NZBC energy standards and can easily meet higher standards. . Also because it is straight and true, the steel framing helps prevents cracks due to shrinking or warping thus preventing air leaks that result in loss of energy. A key component in this is the thermal break which has other significant advantages as mentioned earlier. This thermal break interrupts the thermal bridge between the metal and other materials.

Q19. Will my home maintain its resale value?

- A. Because your home does not look any different than your neighbours it will sell just as easily. However after living in your steel frame home you will want to tell the new owners about its advantages. Remember steel does not rot nor does it have to be chemically treated like timber so with these and steel's other advantages you will have additional selling features.

Q20. Will my home get a warranty?

- A. Yes, because most manufacturers belong to NASH, the National Association of Steel Housing and use AXXIS® steel for framing which is produced by New Zealand Steel. New Zealand Steel provides a 50 year durability statement to meet the requirements of the NZ BC B2 Durability. The components are precision manufactured using computer-aided design and computer-controlled roll formers and assembled to very tight tolerances.
Because of the high thermal conductivity of steel and the thermal breaks it stays dry under all but exceptional weather circumstances and if water gets into the wall cavity it is not absorbed by the framing and so can readily evaporate.

Q21. What about steel floors in a two-storey building.

- A. Because there are no issues with moisture, a steel joist floor system avoids, swelling or shrinking problems associated with timber framing and floors, A viable alternative is to use a metal deck concrete floor in conjunction with steel joists. The strength and dimensional stability of steel framing lends itself to suspended concrete floors typically cast onto profiled steel decking. These floors offer thermal mass, good airborne sound insulation and better impact sound insulation than most processed timber product floors.

Q22. Do copper pipes and lead flashings have to be isolated from the steel frame?

- A. Yes. These metals must be isolated because in the presence of moisture they will develop bi-metallic corrosion that could damage the protective zinc coating of the steel frames. The recommended method is isolation by underlay or plastic membrane or the use of grommets or clips.

Q23. Are the frames protected against rust at cut edges and drill holes?

- A. Yes. Steel frames are zinc coated or galvanised which protects steel from cut-edge corrosion by cathodic or galvanic action. Where the underlying steel base becomes exposed at cut edges holes or mechanically damaged areas, the zinc coating will corrode in preference to the steel. The ability of a hot-dipped zinc coating on steel to protect it against corrosion is known as sacrificial, or cathodic protection because the cathode metal, which is the cathode, is the one protected. In this way the zinc coating adjacent to the edge or hole protects the cut area. Furthermore because corrosion is a surface phenomenon the cut surface protects the steel inside from corrosion. Rust cannot spread through steel from a point on the surface or cut edge, unlike rot in surface treated timber in which all cut ends need application of a rot preventing chemical to preserve the durability of the stud.

Q24. How can architraves and skirtings be fixed to steel frames?

- A. The use of light gauge metal in steel frames allows the use of needle point self-drilling screws which unlike nails will never spring out. A combination of screws and adhesive can be used for timber while plastic skirtings can be secret fixed with clips.

Q25. Are more trade skills required to work with steel framing?

- A. No. Building and finishing with steel frames and most trade skills are the same as they are with timber. Some trades may require specific information which is provided by NASH or the steel frame manufacturers. Builders that have worked with timber all their lives and changed to steel framing have been surprised how easy it is to work with steel. Furthermore steel framing is now an integral part of apprentice carpenter training so the next generation of carpenters will be trained from the start of their careers in both materials.

Q26. How does steel framing perform as a support for wall lining materials and plaster cornices?

- A. Because steel screws and adhesives are used to fix linings and also because there is no frame shrinkage to cause cracking and nail popping, steel framing is the preferred option. Lining materials in steel framed houses can be expected to perform better and look better than in houses built from timber.

Q27. Can I alter a steel-framed home at a later date?

- A. Yes. Additions are made in the same way as any other building system but the original steel structure will be straight and true regardless of its age, making the job of matching up the addition much easier.

Q28. Will a steel home look different than the rest in a housing development?

- A. No. Only if it is meant to. Because of steel's properties the architect or designer can design a home with larger open spaces. With steel framing cladding finishes can be the same as adjacent homes also there is no restriction on the type of wall cladding as bricks, weatherboard and E I F S (External insulation finishing system – polystyrene) can all be used.

Roof pitches can be low or high and roof claddings can be concrete or metal tiles or profiled metal cladding. Whatever the choice, the finished home can be different as you like or match the current architectural style of the subdivision where it is built.

Q29. What about the environmental impact of steel framing construction?

- A. The overall recycling rate of the steel industry is 66%, the highest in the country, offering an environmentally sound home framing alternative. Steel is 100% recyclable and can be used time again and again without losing its properties. Because it weighs less transport costs are lower and it doesn't end up as waste. So its environmental credentials are as good as timber framing

Q30. What about mold?

- A. Mold requires an organic nutrient source and moisture to grow. Kiln dried Pinus timber has between 10-18% residual water content and without chemical treatment it will rot and promote mold. Steel cannot promote the growth of mold because it is not absorbent. Mold will grow on paper backed lining where there is inadequate ventilation and it is kept moist by wet timber framing.

Q31. How well does steel framing stand up to earthquakes or hurricanes?

- A. LSF can be engineered to meet the highest seismic and wind loads prescribed by the NZ Building Code. Steel has the highest strength to weight ratio of any framing materials and a lighter structure with stronger connections results in lower damage from earthquakes. Steel framed houses in Christchurch suffered only superficial but no structural damage. Stronger connections (screws vs. nails) can withstand greater winds including cyclones.

Q32. Can I use brick veneer with steel framing?

- A. Yes. Most steel framing in New Zealand uses brick veneer as a cladding because like the steel frame behind it will last a very long time. New Zealand LSF has been seismically tested at Swinburne University in Melbourne to many more times the seismic forces than we ever have had in New Zealand. There was no damage to the structural frames and only minor dislodgement of bricks. This was due to the great flexibility and strength of LSF. These tests were witnessed by experts in their field as well as BRANZ.

Q33. Are there any environmental benefits when using steel framing?

- A. Yes. Steel offers owners and builders an environmentally friendly alternative to timber. There is little waste when using steel framing materials because all metal is engineered and cut to length in the factory.

Any small amount of steel scrap has value and can be recycled. If for any reason your steel framed house has to be demolished then it can be reused, relocated or recycled. Even steel framing scrap is a valuable commodity so it will not end up as landfill.

Q34. How is electric cabling and telephone and computer wiring run?

- A. The studs have pre-punched holes to facilitate easy cable installation, and grommets are fitted to protect the cable insulation when pulling them through the hole. Additional holes can be drilled or punched as required.

Q35. Will a steel frame rust?

- A. No, not in normal use. Steel frames used in New Zealand are all galvanised and as framing is used in what is termed a closed environment it is not normally subject to severe corrosion from marine salts or industrial pollution.

If steel framing is to be used outside and unclad then it should be protected by painting which will need to be maintained.

This is not necessary if it is completely enclosed and protected from the weather except in some very severe marine environments. Details are given in the durability statements from New Zealand Steel that support the AXXIS framing

Q36. Can I have my home designed by a steel frame supplier?

- A. Yes. Not all steel frame suppliers provide this service, but there are many who do. If you explain to your supplier what you would like, he will give you the most economic options which you could take to a designer or simply to design yourself. If you need help contact NASH.

Q37. Aren't steel frames noisier than timber?

- A. No. Steel homes are quiet inside. The exterior walls and ceiling are filled with thick insulation, restricting outside noise. Wood contracts as it dries and at ambient temperatures it expands whereas a steel framed home doesn't creak at all due to humidity variations and temperature changes have less effect.

A steel frame is mechanically jointed and in a well constructed and insulated home thermally induced movement is not an issue. Steel framing expands and contracts at rates very similar to the other materials used in building, which means it is unlikely that there will be noise or cornice cracking problems. If a dark colour profiled metal roof cladding is chosen, it is good practice to use an insulating separator between the metal cladding and the purlin and to tell the roofer to use oversized holes.

Q38. Is a steel frame safe when exposed to a live electric wire?

- A. Yes. Steel frames are safe because they are earthed and it is a requirement that all new housing be fitted with one or more RCD (Residual Current Device) circuit breaking safety devices. If the frame is exposed to a live-wire the earthing creates a short and trips the residual current safety switch and prevents the chance of electrocution so there is little chance of you touching anything live. A broken or pierced wire in a conventional building can remain live and leaking current can cause troublesome faults and create a fire risk.

Q39. How many storeys can a LSF building go up to?

- A. There is a difference between steel framing types; those that are load-bearing and those that are non-load-bearing. For many years non-load-bearing metal studs have been used for internal partitioning in commercial high-rise buildings. From an engineering point of view steel framing with current technology and detailing can go up to three or four storeys although most residential buildings are limited to two storeys.

Q40. What is the maximum span for a steel truss?

- A. Normal LSF sections can be made to suit most residential spans. However because high strength steel is used, and also because of its high strength to weight ratio, trusses can span larger distances.

Q41. Do steel framed homes have to be built on piles or concrete slabs?

- A. Either. Steel frames can be fixed to a concrete slab or fixed to a lightweight steel floor system on concrete or steel piles. Lightweight steel flooring systems are ideal for elevated or sloping sites as they can minimise foundation requirements.

Q42. I want to design a penthouse on top of an existing six-storey office block in the CBD but there are weight and fire requirements for the site. Is steel suitable?

- A. Steel is definitely your best choice for framing for many reasons not the least of which is the ease with which frames can be hoisted up without the use of cranes. If the site is severely restricted frames can be assembled on the roof. Working with steel is also not so weather dependent as it is with other materials. LSF also means lighter foundations. There are some excellent examples of this in the Auckland Central Business District, for example one very picturesque apartment building next to the Auckland Art Gallery which had two LSF floors added to the existing building in the 1990's.

Q43. How are different external claddings fixed?

- A. This depends on the cladding as there are many different types of screws that are suitable for all claddings. Brick and stone veneers are very popular and use standard brick ties screwed to the metal framing, and EIFS plaster systems can also be used as well as weatherboard and fibre cement. Thermal breaks are fixed to the exterior face of all steel frames before the building underlay or wrap is applied and the cladding fixed.

Q44. My architect has designed our new home in timber. Can I convert my plan from wood to steel?

- A. Yes. Most steel frames are made to the same dimensions as standard timber dimensions and therefore there is no problem in converting your plans to steel. Sometimes the biggest problem is the architect who has perhaps never worked with steel. BUT once converted they usually become a fan.

Tell your Architect/Designer about steels many advantages or better still download this document and send it to them.

General note: Please also see our other NASH publications on the website – they will help you.