Building *with* steel

Part 1: Why choose steel?

In the first of a three part series, we discuss why steel can be a good choice for your build.

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Owner builders may be driven by many different things, but all have one thing in common – the time and motivation to select construction materials on the basis of their contribution to the finished project. This is particularly in evidence when it comes to the structure of the building, an area most homebuyers leave entirely to the builder. It's your money though, and what it gets spent on can have cost and benefit consequences throughout the life of the home.

When it comes to framed construction – the most common choice for Australian homes – the contribution of the frame to the durability and longevity of the home is immense. The frame bears or transfers almost all loads to which the home is subjected, and also supports all cladding and lining materials and most fixtures. Failure of the frame to fulfil these functions in any part of the home can have serious consequences. Steel framing means a long life, trouble free frame that will not warp, burn or rot.

The frame of the home should always be made from durable materials that will resist all forms of environmental attack. Any part of the structure made from anything else should be easy to inspect in order to assess and rectify any deterioration. The manner in which most homes are designed and constructed makes this inspection difficult and costly for many parts of the frame, including wall frames, intermediate floor framing and lined rafters in sloping ceiling structures.

The frame's contribution to the serviceability of the building is also significant. It provides the strength, stiffness and geometric stability of the building. Its ability to stay straight and square indefinitely, through varying seasons with temperature and humidity changes, is vital to just about everything which is attached to it – the exterior skin (brick or other cladding), roof tiles or sheeting, window units, door frames, plasterboard wall linings and so on. Superficial and so-called 'nuisance' defects, like sticking doors and windows, brickwork and cornice cracks, nail popping in wall linings and sagging roof lines, can often be traced to instability in the frame and contribute to the overall cost of ownership.

Advantages for homebuilding

When strength, durability and quality are the important selection factors, steel framing is the natural choice for brick-veneer and direct-clad home construction. Steel framing offers outstanding homebuilding advantages:

Durability: You need never be concerned that the structural frame you can't see is deteriorating due to environmental or biological attack by termites, borers or fungi.

Stability: Steel frames will not absorb moisture or dry out. Steel has outstanding dimensional stability to keep your home in shape indefinitely.

Structural efficiency: Engineered steel frames are extremely strong yet are light in weight.

Design flexibility: Create optimum architectural forms to suit your living needs and building conditions, including long clear spans for open plan living and even curved trusses.

Wide availability: The design you want can be built virtually anywhere in Australia.

Fire resistance: Does not burn nor contribute fuel to the spread of a fire.

Low maintenance: Low cost and effort to keep its design qualities intact.

Trade familiarity: Steel frames are easy to construct and finish, and you'll always have access to the skills to modify or extend your home.

Environmentally friendly: Steel is 100% recyclable, easily accommodates energy efficient design concepts, enables minimal site disturbance and produces little site waste.

Ed's note: Building Code of Australia 2008 Volume 2 Part 3.1.3 Termite Risk Management states that no termite barrier is required if a building has all of its primary building elements (designed specifically to take part of the building load) constructed of one, or a combination of, the following materials: steel, concrete, masonry, fibre-reinforced cement, naturally termite resistant timber, or preservative treated timber.

Advantages for owner builders

Whether you plan to do much of the work yourself or simply supervise your trade contractors, steel house framing is especially attractive to the owner builder. Nearly all frame suppliers produce installation manuals or sets of instructions, and some basic instructional videos. As steel framing is an engineered product, it is important to adhere strictly to the supplier's instructions on the number and positioning of fasteners, brackets, bracing etc. The owner builder will particularly benefit from the following steel framing advantages:

Steel framing is **light but strong**. There is less mass of material to be handled on site at frame stage, so it is safe and easy to handle and quick to erect.

Steel framing fabricators supply **prefabricated** frame sections in easily transportable and manageable panels and trusses.

Frame erection is **simple**. All components are identified to ensure the correct erection sequence.

Connections are quick and easy using screws, bolts and rivets applied with tools from any hardware store.

Verifiable **quality**. Steel is a consistent, engineered product free of natural imperfections.

Steel framing is **versatile and adaptable**. Depending on the home's architectural design, you can choose steel framing for part of it and combine it with other structural materials. At every stage and for every detail, it's your choice.

Limitations

Steel is an extremely durable long life material. Nevertheless, there are certain environments and situations where it may be unwise to use standard steel framing products without expert advice. Fortunately these are very few, and will affect only a small number of intending homebuilders.

Generally speaking, where steel is unsuitable you will also find some limitations on the use of other homebuilding materials including aluminium, tiles and bricks. The main environments where precautions are advisable are marine and heavy industrial areas.

For marine environments, the Building Code of Australia Volume Two (Housing Provisions) specifies that metallic coated steel comprising 275 grams of zinc per square metre (Z275) or 150 grams of aluminium/zinc per square metre (AZ150) may be used for steel framing that is fully enclosed within the building envelope, beyond 300 metres from breaking surf conditions. Where the framing is outside the building envelope, such as sub-floor or exposed verandah framing, the same metallic coated steel may be used: beyond 1km from calm salt water, such as a lake or estuary; or beyond 10km from a coastal area with breaking surf.

Breaking surf normally occurs in areas exposed to the open sea, with regular breaking of waves about four days per week. It doesn't include choppy, white-capped water.

If you are proposing to build closer to an adverse environment than these distances, painting systems are available to increase the corrosion resistance of steel.

Living with steel

Apart from the frame, there is a wide variety of factory pre-painted architectural steel products available when you reach the finishing stages of your project. These products inherently have a very long low-maintenance life, which is particularly helpful on the higher parts of your home where maintenance access is difficult or hazardous.

Much of the environmental impact of buildings is determined at the design stage, through materials decisions, inbuilt efficiencies and performance criteria incorporated into the design. It is therefore important that environmental impacts be considered early in the design process, where the greatest potential is available for influencing outcomes.

Virtually all steel products used in residential construction are highly recyclable, contributing to steel's reputation as the most recycled metal on the planet. Steel generates a very low mass and volume of construction waste, and the small amount finding its way to landfill is basically inert and non-polluting.

Ed's note: Framing steel is fully recyclable and contains approximately 20% recycled materials. Methodologies and opinions vary on the assessment of the embodied energy of construction materials. The embodied energy due to the manufacturing process is still considered by some to be higher for steel than for timber framing. The longevity of steel framing along with the advantage of not having to use preservative-treated timber are two of many factors to be considered in the overall equation of lifecycle energy consumption.

Tools required

Steel framing requires a surprisingly small number of tools – many of which you may already own – for successful owner builder construction. You won't need anything that can't be bought at a good hardware store or that requires special training to use safely. Most tools and techniques are the same as for timber framing or masonry construction: string lines, T-square, levels, drills, hammers, screws, nails etc.

It's always advisable to invest in good quality tools, or to hire specific items for particular jobs. This will be discussed in more detail in part 2, but the following basic items will stand you in good stead throughout your project:

- A good quality battery screwdriver – 14.4 or 18 volt – with at least one spare battery
- An angle grinder of comfortable size and weight, typically 100mm disc diameter
- A pair of articulated snips
- Several toggle clamps

Getting started

To start the process, all that is necessary is for you to have a designer/architect prepare drawings of your house or extension, showing details such as floor layout, elevations and room dimensions. The frame supplier will be able to quote you a price for the structural frame, including floor, wall and roof framing, and this will usually include any required beams or columns. The scope of supply and the range of included materials will vary slightly from place to place, so be sure that you and your designer are quite specific as to what you require and verify what is included. The frame supplier will also be able to supply all the necessary components such as brackets, fasteners, and grommets from the same basic design information. ■

Part 2 of the series will cover the basic techniques for setting out and constructing a steel frame. **Part 3** will then concentrate on finishing: how to fit windows, doors, roofing and cladding materials.

Thanks to National Association of Steel-Framed Housing Inc (NASH) and Technosteel Australia for the information provided for this article.

- **NASH**

A good source of information on suppliers and technical information. Visit their website for up to date information on residential and low-rise steel framed construction.
Training is offered at some TAFEs for trades people wishing to gain expertise with steel framing. These courses may be suitable for owner builders with some experience in building.
1800 656 986, www.nash.asn.au

- **Technosteel Australia**

Manufacturer of steel house frames, roof trusses and floor systems, mainly for the owner builder.
1300 553 457, www.technosteelaustralia.com

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