

# HOME BUILDERS & BUYERS

DESIGN

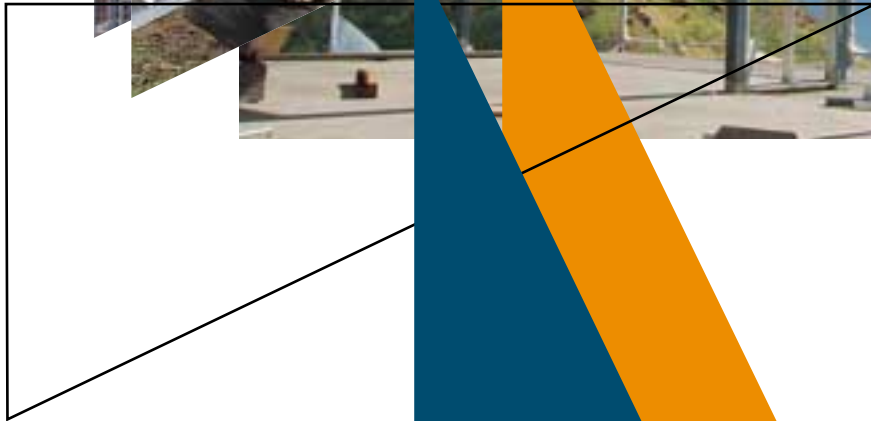
TERMITES

SAFETY

CONSTRUCTION

PERFORMANCE

## guide to steel framed construction



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## INTRODUCTION

Housing construction has undergone many variations over the years, evolving to meet economic, environmental and social considerations at different times. Floor plans and styles are developed to meet latest trends and fashions, while the choice of construction materials may be guided by reasons ranging from cost to conservation considerations.

Builders in the commercial and industrial sector have long recognised the many benefits of steel framing, such as consistent quality, precision measurements, light weight and infinitely variable lengths. As production techniques have been refined and new technologies have arisen, steel framing is securing increasing use in the domestic market.

Home builders and buyers need to make numerous decisions about the materials and fittings they will use and the designs they will choose when planning every aspect of a new home.

The planning stage is the ideal time to consider aspects such as health and safety as well as cost and appearance. The materials chosen for behind the walls, in the roof space and underfoot are once-only decisions.

To help you make informed decisions now that will reap rewards for years to come, this booklet is packed full of facts, figures and advice sourced and referenced from credible origins, including CSIRO, the Building Code of Australia, the SA Metropolitan Fire Service and published information from some of Australia's best known companies.

- High ceilings, large, open-plan areas, innovative features
- Two-storey homes
- Steel suits latest building materials
- Sloping sites



Steel-framing is becoming increasingly popular, with suggestions in the home building industry that these systems will secure a substantial share of the domestic market some time after the turn of the century.

As well as suiting traditional choices in layout and exterior finishes, steel framing can widen the options available.

The special qualities of steel, such as its strength and light weight, lend themselves to innovative design ideas.

### INTERIOR

Versatility is a key feature of many steel-framed homes, with design aspects including very high ceilings, large open-plan layouts that don't require loadbearing walls and columns, curved walls and circular and curved windows.

### EXTERIOR

Textured and rendered external walls are a stylish alternative to brick, and steel framing provides excellent results for anyone choosing these options. Many homes entered into prestigious building awards around the country have textured or rendered finishes. While this style of home was formerly considered only for the exclusive end of the home market, new cost-saving techniques and materials are putting this option within reach of the average household.

The strength and light weight of steel also make it ideal for two-storey homes, with some builders now promoting steel as the preferred option for multiple storeys.

### SLOPING SITES

Steel framing is ideal for homes designed for unusual blocks of land, including sloping sites.

### COSTS

As a rough guide, depending on the design you choose for your home, the cost difference between steel-framing and timber framing will vary from about \$500 less to about \$2000 more.

Due to innovative steel-framing technology, standard house designs can be manufactured and assembled for less than other framing systems.

On-going savings can include:

- lower insurance premiums;
- savings on termite spraying
- avoiding redecorating costs resulting from cornice cracking and nail popping
- less periodical structural maintenance costs to the building



**FIRE SAFETY**

- Building materials for a high fire-resistant home
- Steel frames top CSIRO recommended list
- Design and floor plan suggestions
- Tips to prevent accidents and limit damage

No home can be completely fire safe but there are a number of steps you can take to plan for a house which has a high resistance to fire.

Your choice of building materials is one way to improve your chances of establishing a fire-resistant home. This can influence how quickly and how seriously your house is affected by a fire, and whether your home could be repaired or would need to be completely rebuilt.

CSIRO, Division of Building Research, Victoria, produced a paper<sup>1</sup> outlining the features of a high fire-resistant house. Major considerations include:

- steel wall frames, with gypsum board linings\* for further protection;
- concrete slab floor;
- the elimination of timber\*\* in the roof;
- brick veneer external cladding.

\*Although steel is not combustible, it will eventually lose strength at temperatures in the 400-500 degrees Celsius range. Gypsum linings with reliable resistance to fire will protect the steel frame.

\*\*The elimination of timber in the roof is a most important feature because, when a roof catches fire, the burning rafters fall down the space between the walls, which acts as a chimney, producing an intense local fire. (White pine ignites at 280°C)

Average stages of fire in the room of a house (Courtesy, SA Metropolitan Fire Service)

Stage of fire	Seconds	Temperature
Small flame	0	Room temperature +
Dense smoke	70	300°C (Ceiling)
Smoke + flame	90	100°C (Floor)
Flashover	150	600°C (Room)

Inferno throughout house, floor level or building in 3-5 minutes.

In the event of an external fire threatening the house, a bushfire for example, the main focus is to prevent sparks from gaining access to the building, principally through the space above the ceiling and from the space below the floor.

A steel roof simply cannot burn. In addition, the long lengths and tight overlaps prevent the entry of fire even when burning embers fall on the roof. Coverplates or closure strips seal off the small openings at the end of steel roofing profiles.

The space below the floor can be eliminated by building on a slab of concrete laid directly on the ground.



### FIRE SAFETY TIPS

(Courtesy SA Metropolitan Fire Service)

#### Smoke alarms:

Most States of Australia require smoke alarms to be installed in houses. When installing smoke alarms, get professional advice on the best model type for the home and the right locations to maximise their usefulness. The main aim of smoke alarms is to enable occupants to make an unimpeded escape from their house along a smoke free escape route.

#### Floor plan:

A good floor plan has the exit doors near the bedrooms, so everyone can quickly escape from the home. It is also a good idea to divide the house into sleeping, living, games and garage areas, separating each with a solid core door. Solid core doors have a high fire rating, which means a greater resistance to fire. Arches between areas allow a rapid path for smoke throughout the house.

#### Furnishings:

It is advisable to avoid excessive use of extremely combustible materials or items in the house, such as those made or constructed of petro-chemical products. Furnishings, fabrics, floor coverings, items and electrical appliances made from these combustible materials start to decompose at a temperature of approximately 220°C. If ignited, extremely toxic fumes and flammable vapours are emitted. A fire may only take seconds to unleash intense heat, smoke, toxic fumes and flammable gases.

#### Safety steps:

Common causes of fire in the home include: failure to maintain appliances and have them serviced to the manufacturer's specifications; using an appliance when there is a known mechanical or electrical fault; equipment being used for tasks they were not intended for; and unsafe cooking practices and appliance operation.

All family members need to be conversant and practice their home escape plan. Encourage family members to participate in hazard reduction programmes such as regularly disposing of old newspapers, magazines and garden refuse through the local government waste collection facility or local recycling centre. These practices reduce potential hazards that may cause loss, injury or trauma and risk of fire.

Have security devices that will not impede a rapid escape.

Before leaving the house unattended, switch off all non-essential electrical appliances at the power points and remove plugs from sockets; put out all fires and place fire screen guards in place, close all doors and windows to restrict the spread of fire and, if your fire alarm system is monitored, make sure it is switched through to the security monitoring service.

Similarly, go through the same procedures before going to bed, putting keys in door and window locks or placing them nearby, switching off non-essential electrical appliances, checking that each family member is not at risk, closing all bedrooms and remembering to turn off that electric blanket.

#### Outdoors:

Sprinkler systems, careful landscaping around the home and regularly removing leaves and other garden rubbish are steps towards protecting your home.

Further information on establishing or building a fire safe home is available from your State fire brigade.





- Termites cause millions of dollars worth of damage annually
- Termites are found all over Australia
- Timber framing needs on-going protection
- Steel is impervious to termites
- Regular inspections are recommended
- Termite chemical sprays linked to health problems
- Responsibility for on-going maintenance

Termites strike more individual homes and cause more damage than fires, storms, floods and earthquakes combined.

They attack timber or any material containing cellulose and a heavy infestation could mean up to 250,000 white ants travelling from a nest up to 40 metres away.

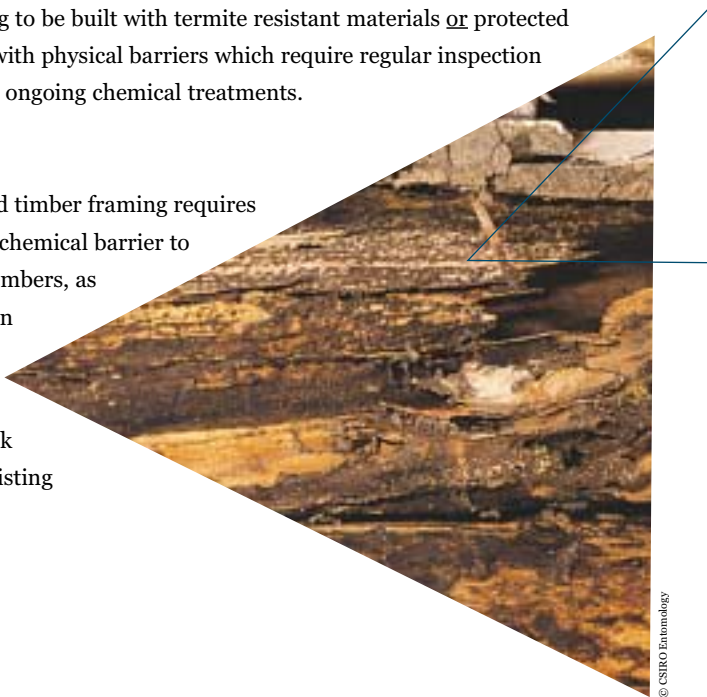
The threat of a termite attack can be reduced to a minimum with the sensible use of materials, building methods and protective measures.

All new buildings and extensions in Australia must be built in accordance with the Building Code of Australia. The Building Code requires all structural members, including wall, floor and roof framing of a building to be built with termite resistant materials or protected from attack by termites with physical barriers which require regular inspection and maintenance and/or ongoing chemical treatments.

**TIMBER**

The most commonly used timber framing requires some type of physical or chemical barrier to protect the structural members, as specified in the Australian Standard AS 3660.1 -

- Termite management –
- Part 1: New building work
- Part 2: In and around existing buildings



There are a number of ways you can discourage termites getting into your home and attacking timber framing. The Standards outline the various methods available, the amount of protection provided, the warranties available and most, importantly, the ongoing obligations for you, as the home owner. You may choose one or a combination of methods with your builder.

The Standards do point out, however, that:

“It is important to realise that there is no system that provides total protection against termite ingress. This Standard is therefore concerned with minimising, not totally eliminating, the risk of subterranean termite attack.”

### STEEL

Steel is impervious to termite attack and qualifies as a termite resistant material under the Building Code of Australia (BCA). The BCA states that if you build with a steel frame, you do not have to install physical or chemical barriers. The reality is that steel framing provides in-built structural protection for home owners and builders. (Termites cannot eat steel).

Interest in steel framing to avoid the danger of termites attacking the structure of a home has escalated since the ban on organochlorine soil treatments from July 1995.

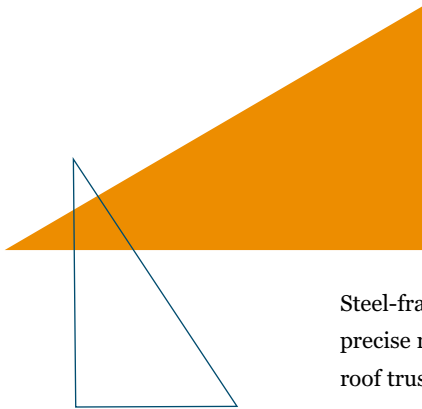
### MAINTENANCE

On-going regular inspections and vigilance by the home owner are necessary elements of any strategy to beat termites.

Most termite attacks originate from the perimeter of the home. While it is relatively simple to inspect for signs of termite activity on skirting boards etc inside the home, or around piers or a well-maintained slab outside, it is generally impossible to inspect a wall frame.

No matter what termite protection system you choose, the Australian Environmental Pest Managers Association (AEPMA) recommends that houses are thoroughly inspected on a regular basis, including architraves, skirting boards and furniture. It is important that inspections are carried out by professional pest managers who have experience in finding out where termite barriers may have been bridged or breached.





- Saving time and labour
- Weather and ease of access
- Last minute changes
- Future additions
- Different steel-framing methods
- Home “kits”

Steel-framed homes can be built quickly and economically, with the light weight of the material and the precise measurements of each component saving construction time and labour, because wall panels and roof trusses are delivered to the site pre-manufactured.

Because steel has consistent material strength and complies with strict quality controls and tolerances, no time is lost sorting through the materials to select suitable pieces and there is minimal wastage, because steel is not prone to warping or twisting.

Most connection systems allow builders to quickly and easily disassemble sections for on-site alterations during construction.

Future additions are also relatively simple, particularly as the original steel structure will be straight and true regardless of age, making the job of matching up the addition easy.

### METHODS

There are a number of construction methods used for steel frames, each suited to different requirements. They vary from on-site methods similar to those for timber frames to various types of pre-fabricated kits which are manufactured and partially assembled in high-tech factories and delivered on-site for final erection.

Steel frames constructed off-site are generally clinched, riveted or screwed together, while latest on-site systems allow the steel to be nailed.



Pre-fabrication is ideal in areas where the weather is unpredictable or where access to sites is difficult, and is particularly popular in the project home market. On-site construction further increases the flexibility offered by steel-framing, enabling last minute changes and adjustments to the design. This method is particularly suitable for homes with unusual dimensions and design features.

### KITS

Steel framing has given new meaning to the term ‘kit homes’. Because of precision manufacturing techniques and consistent quality of materials, building companies can confidently package together all the components for a new home and deliver them on site, ready for assembly.

Steel-frame kit homes also provide rural communities with homes at city prices. Package systems can take ordering, stocking, working drawings and inventory hassles out of the equation for rural builders, plus the dangers of inaccurate costings.

As well as making life much easier for building firms, package home kits including comprehensive guides, instruction manuals and working drawings are ideal for the home builder using sub contractors.



- Steel frames avoid common settling problems
- On-going maintenance
- All weather conditions
- Assurances



Steel-framed homes are gaining an increasingly enviable reputation for customer satisfaction.

Because steel does not shrink, steel-framed homes avoid settling problems often found in new homes using other framing systems, such as warped walls, nail pops and squeaky floors. Buyers choosing steel framing also identify low on-going maintenance costs.

The enforcement of strict manufacturing standards and the advantages of computerisation and other high-technology advances in recent years guarantee consistently high performance from steel-framed homes.

Steel performs well in any climate and, not surprisingly, it is the preferred material in areas where temperatures vary enormously and also in cyclone-prone areas.

It is significant that in Darwin, where there is high humidity, extreme temperatures and high incidence of termites, steel wall framing constitutes more than 50% of the home building market.

Similarly, steel is a popular choice for people building on difficult blocks, such as unusual sloping or steep sites.

Doors, windows and Cornices:

Steel does not shrink and therefore avoids problems of sticking doors and window jambs. It also moves at the same rate as other building materials when temperatures change, so noise and cornice cracking are unlikely.

Stable roof structures:

Roofs of steel framed homes do not sag over time, even with concrete tiles, so the finished structure keeps looking good.

Smooth walls:

Steel frames are straight and true, which means walls, ceilings and roofs do not have ripples or bumps.



#### Noise:

In a properly constructed, insulated home, thermally induced movement and noise is no more likely with steel framing than with timber framing.

#### Corrosion prevention:

All homes, whether timber frame or steel frame, use fasteners and galvanised connector plates to hold together wall frames and trusses. Zinc and zinc/aluminium alloy coatings serve to protect cut edges and holes in steel from rusting.

#### Safety switches:

All new homes are now required to be fitted with safety switches, also known as an RCD (Residual Current Device) or ELCN (Earth Leakage Circuit Breaker). The switch is designed to prevent death by accidental electrocution in the majority of cases.

#### Automatic light switches:

External automatic systems provide efficient safety and security lighting, revealing steps, tree branches and other objects hidden by the night, while internal systems can save you stumbling around in the dark looking for a switch.

#### ASSURANCES



BHP Coated Steel-Australia has issued a Steel Building Frame Warranty - Zinalume<sup>®</sup> Steel 50 years. This states in part that the frame manufactured from Zinalume<sup>®</sup> Steel ("Framing Componentry") "shall be warranted from structural failure solely caused by corrosion for 50 years from the date of installation."

The alternative steel house-framing material, zinc-coated (galvanized) steel with a Z275 (275 g/m<sup>2</sup>) coating conforms to the applicable Australian Standard (AS 1397) and is also suitable.

#### Insurance companies

Some businesses offer discounts on their premiums for homes with a steel roof structure.

#### NASH

The National Association of Steel-framed Housing is an organisation formed by companies which supply, manufacture and erect steel-framed housing. These companies share the goal of providing quality housing and are bound, as members of the Association, to have sound business and ethical practices.



### Acknowledgments

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### Information sources

<sup>1</sup> Proposals for a frame house with high resistance to fire, from CSIRO's Building Materials and Equipment, Vol 16. No 6. pp 35 -37

SA Metropolitan Fire Services; CSIRO Division of Building Research; Standards Association of Australia

Delaney Kelly Golding Pty Ltd

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Building Code of Australia (BCA); Australian Environmental Pest Managers Association (AEPMA) South Australian Housing Code

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