National Association of Forest Industries

Timber Manual
Datafile P5

Protecting Buildings from Subterranean Termites

Revised Edition
2004

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National Association of Forest Industries

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Introduction

Buildings are required to provide security, safety, protection and comfort for occupants and possessions. During their life, buildings, building materials and building contents are subjected to a number of hazards unless preventative action is taken. This can result in problems such as corrosion of metal, spalling of concrete, fire and water damage and termite attack.

In areas where a termite hazard exists, termites can be a threat to the safety of the structure and amenity of the building for occupants and their possessions.

For many years consumers have enjoyed property protection against infestation because building regulations have required protection of the whole building or home through the use of simple physical barriers or low cost chemical barrier systems, such as soil treatment with organochlorine insecticides.

Changes in building regulations and the banning of effective organochlorine insecticides for soil treatment has meant that new home owners, builders and designers will need to choose between:

- the traditional approach of providing whole building protection against termite infestation, or
- the partial solution of using termite resistant structural materials, which will avoid termite attack of timber building elements, although they do not provide any barrier to termite infestation.

Building owners, regulators, lending authorities and insurers recognise the benefits of providing effective termite protection to the building, including the structural framework, joinery, and furniture.

In all states and territories of Australia, the building legislation calls up the Building Code of Australia (BCA). This Code requires some form of protection if there is a threat of termite attack. Where no threat exists, no protection is needed. The section on Building Legislation in this timber manual provides more details about the BCA requirements.

For traditional Australian construction, ie: using timber floors off the ground, protection is afforded by incorporating physical barriers into the building, followed by the regular (at least annual) inspection of those barriers and the surrounding site. Australia's rich heritage of timber buildings is testimony to the effectiveness of this approach.

Construction methods utilising "slab on ground" or subfloor masonry walls and/or piers, leads to a different

Suspended timber floors – Protection is easily provided by ant caps and regular inspection.

level of risk of termite entry into the building. These construction methods will require the use of chemical soil barriers or special construction techniques utilising physical barriers in those areas where termites are a threat to buildings.

This Datafile has been prepared to provide building and home owners, designers and builders with information relating to their choice of termite protection systems and to provide descriptive detail about the options that are available. For further details reference should be made to Australian Standard AS3660 - 2000 Termite Management.

Readers can also consult the National Timber Development program's *Technical Report 3* (September 2003) *Termites and Timber: the good news,* available at www.timber.org.au in the technical reports section. That technical report includes a brief outline of the barriers, protective treatment products and suitable timber products that can be used to minimise the threat of termite attack.

Termites

Termites have existed for approximately 50 million years. Although they are commonly called "white ants" in many parts of the world, they have only a superficial resemblance to ants.

There are about 300-350 species of termites in Australia, occurring in all States and Territories, though it is generally accepted that termites are not regularly encountered in Tasmania.

The insects feed on a range of, mainly, cellulosic materials, including live and dead trees, plant debris, grass, roots and the humus matter in soil, stored grain, and timber. Although they derive no nutrient value from them, termites have also been known to attack buried telephone and electrical cables as well as plastic water pipes and the like.

The termites of economic importance to the Australian forest and timber industry can be divided into three groups: dampwood, drywood and subterranean termites.

Dampwood termites prefer wood that is decaying and, by definition, damp. They are usually associated with decaying timber in bathrooms, kitchens, laundries, etc. They are readily controlled by replacing the rotting timber and removing the source of moisture that gave rise to the problem in the first place.

Drywood termites can attack relatively dry and sound timber, from which they derive their moisture. There are a number of drywood termite species indigenous to Australia. However, the most destructive species known, *Cryptotermes brevis*, has been inadvertently imported with timber and can cause extensive damage where it occasionally occurs. It is a government-notifiable pest, found in small pockets in Queensland (and rarely as far south as Sydney). For more information on drywood termites contact Timber Queensland (contact details are provided at the back of this publication).

Subterranean termites may build above-ground nests or establish their colonies completely underground, based on the availability of water. The termite genera within this group include forest pests, which are able to attack living trees, as well as species that can attack building timbers, poles, posts, etc.

The subterranean termites are by far the biggest of the three groups of termites, constitute the main problem for the homeowner and are the subject of most control and eradication programmes. This publication deals only with subterranean termites.

The Termite Colony

A termite mound is the most familiar form of termite nest, however, not all species live in this sort of environment. Some prefer a completely underground existence, others build their nest within dead or living trees or construct no recognisable nest at all. Other species prefer to attach their nests to a tree but maintain connection with the soil via mud galleries running down the surface of the trunk. The photographs at the bottom of page 5 illustrate a number of these mound-building variations.

Cellulose is the basic food requirement of all termites, but any type of organic material may be attacked. While some species of timber are naturally resistant to termites, none are entirely "termite proof".

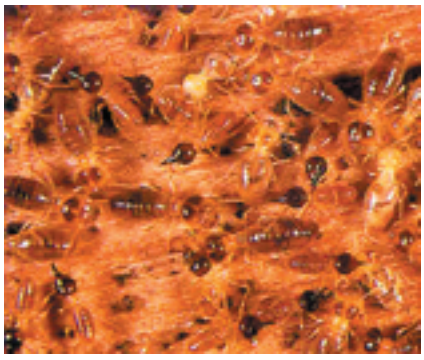
In the built environment, termites will often damage materials they cannot digest, e.g. plastic, rubber, metal or mortar. Primarily, this damage occurs when the indigestible items are encountered in the termites' foraging pathways, while they are searching for food.

Distribution

Figure 1 (the hazard map) provides a guide to the relative distribution of subterranean termites that are considered of economic importance, based on the potential damage to buildings.

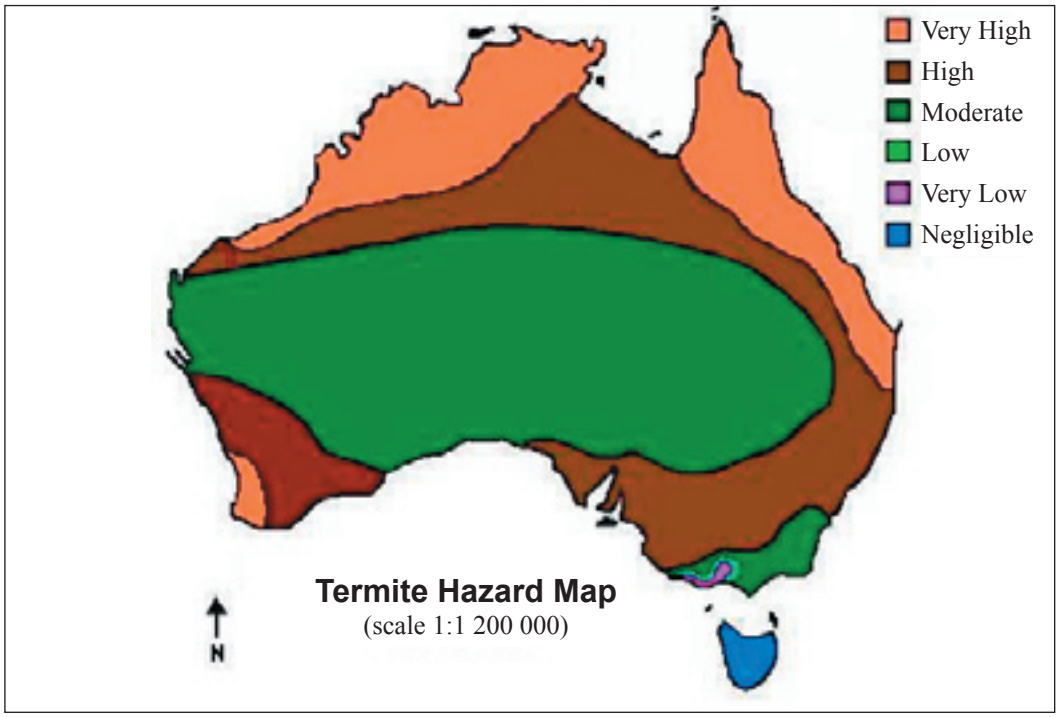
Termites are a major problem in the built environment in all States, with the exception of Tasmania where they are not considered a hazard for timber or other materials used in home construction. This is a function of the

Slab-on-ground construction – Requires more permanent protection methods due to inaccessible areas such as under the slab.



Termites, a natural part of the environment, can be managed to reduce infestation risks (Photo supplied by CSIRO Division of Entomology).

Figure 1: Termite Hazard Map



Map Note: The warmer tropical regions of Australia are more conducive to all-year-round feeding by termites. In the cooler regions of, say, Melbourne and Adelaide, termites are likely to be more influenced by seasonal variations. However, this is not to say that termites in the southern regions of Australia represent a lower risk or a lesser hazard than termites in the north. Local advice on termite protection is essential and should be available from local councils or the contacts listed at the back of this datafile.In areas of high and medium levels of termite risk, protective measures are recommended for all buildings. Where the termite hazard is "low or not present", again local advice should be sought regarding the need for termite protection.

cooler climate in that State, and it is believed that when moving from the south to further north into the tropics of Australia, the greater is the *risk* of termite attack, notwithstanding their relative distribution.

How Termite Infestation Occurs in Buildings

Attacks on buildings are usually initiated from a nest in the ground, from which the termites build galleries over piers or walls to reach the cellulose, including timber, in a building. Once inside a building, termites must maintain contact with the soil (for moisture) and with the central nest (the communications centre).

Usually, the nest is outside the building perimeter but occasionally a nest may be buried in the soil beneath the building. Brick and concrete construction by itself does not offer protection against termites that may gain access via wall cavities and fine cracks in mortar or slabs.

Above-ground portion of a subterranean termite colony in native scrubland.

In rare cases, a nest may be established inside the building as an offshoot from an existing colony. This can occur where a source of permanent moisture is available to the termites within the building (e.g. leaking plumbing) and in this situation, there may be no contact between nest and soil.

In general, entry into a building by winged termites does not result in colony establishment, as it is mostly from the soil that major termite infestations occur.

Building Legislation

Following the requirements of the BCA, will provide protection for the structural elements of a building in those areas where a termite hazard is present. Under the BCA, all structural elements of a new building - the Primary Building Elements - must be protected in the areas at risk of termite attack, either by providing barriers to keep the termites out (or to force them into the open where they can be seen and eradicated) or by using termite resistant building materials such as naturally durable or preservative treated timber. In Queensland, the definition of the Primary Building Elements has been extended to include such items as door jambs, window frames and architraves.

The BCA calls up Australian Standard AS3660 *Termite Management* to define and detail appropriate systems of termite control, including suitable barriers and the

appropriate termite-resistant materials. This Standard, which is summarised below, sets out the design and termite management system performance requirements, guidelines for detecting and managing termite activity, and the criteria for assessing the effectiveness of termite management systems.

Australian Standard AS3660-2000 series

This Datafile deals primarily with new construction. Advice on the detection and treatment of termites in existing buildings can be found in AS3660 -2000.

AS3660 covers both new (Part 1) and existing (Part 2) buildings, with reference to just the subterranean termites. The three Parts of the Standard are closely inter-related.

The deemed-to-comply management systems are set down in Parts 1 and 2. After assessing the threat of termite attack by the methods in Part 3, the termite management approach is then approved by the various authorities that control building activity under the BCA.

The BCA is a performance-based document, meaning that any control system that can be shown to work, by documented evidence or by meeting the requirements of AS3660.3, will be deemed to comply with the Code. To comply with the current BCA, two approaches are regarded as acceptable, and will depend on the risk or threat of termite attack:

- Provision of barriers against termite infestation for the whole building (the traditional method) or
- Use of termite resistant materials for the structural frame.

The latter solution is generally regarded as only a partial solution that may result in an unacceptable incidence of termite infestation of buildings. Consumer expectations are likely to be met by combining physical barriers and termite-resistant timbers in a manner that relects the potential threat of termite attack.

(Note: It is important that if an active infestation is discovered, the termite workings are not further disturbed until the control approach has been determined by an experienced pest controller.)

Protection against Termite Infestation

In areas where termites are active, total building protection against termite infestation is the only way to minimise the risk to the structure, the non-structural building elements and its contents.
Protection against infestation can be achieved by appropriate design, care during site preparation, adoption of appropriate construction practices, and ongoing inspection and maintenance – all of which are detailed in the AS3660 series of standards.

Design - General

- In areas where subterranean termites are prevalent the level of risk of attack to buildings can be reduced by taking simple and inexpensive measures during construction to eliminate the presence and/or likely areas where moisture could be trapped and by providing adequate ventilation that allows timber to remain dry.
- Strip footings and slabs should be designed as integral components, minimising construction breaks or construction joints, as these provide potential avenues of termite entry.
- Services (pipes, plumbing, wiring etc.) should be designed and installed so that they do not penetrate through slabs or footings. Where this is not possible, a suitable protection system (physical or chemical barrier) should be installed.
- Cavity or hollow masonry should be avoided below ground level.
- Wherever possible, buildings should be designed with physical barriers which permit inspection for, and detection of, termites. Refer to Figures 3 and 4, and AS3660 for examples.
- Building debris should be removed from the site once the construction is completed, with a particular emphasis on the removal of such debris from the subfloor space.
- All materials in contact with the ground must be termite resistant.

Subterranean termite colonies established in quite different environments.

Suspended Timber Floors

The more traditional method of resisting termite infestation, is the use of suspended timber floors with ant caps or termite shields. It should be remembered, however, that such installations are not intended as primary barriers to termite entry. Rather, they are used to facilitate subsequent inspections (see below for more information about ant caps, etc.)

Chemical and physical barriers can also be used alone or in combination with ant caps or termite shields to provide protection to buildings with suspended timber floors. These options include chemical barriers around posts, stumps and strip footings as well as crushed granite or stainless steel mesh. Refer to "Slab on Ground Construction" for a description of these methods.

Houses with suspended timber floors should be designed to ensure a physical barrier is installed between the lowest timber floor and the ground. This also applies to stairs, pergolas and decks that attach to the building (Refer to Figure 2).

Support posts and stumps should be made of materials that discourage the entry of termites, by not providing them with a ready food source. These include termite resistant or treated timber, steel stumps and brackets, and continuous concrete stumps/footings (no cracks).

A full list of termite resistant timbers that satisfy the requirements of AS5604-2003, can be found at the end of the National Timber Development Program's Technical Report 3, September 2003: *Termites and Timber: the good news (at www.timber.org.au)*.

Ant Caps (Termite Shields)

These man-made products afford physical barriers to termites that are inserted between the lower floor framing timber and the supporting stumps, piers or masonry bases etc. They are usually made from galvanised sheet metal and are designed to force the termite out into the open for detection during physical inspection, and responsive action. Any sign of future termite activity is evidenced by mud tunnels or galleries, by which the foraging termites bridge over the shields.

Termite shields may also be formed from stainless steel mesh.

Stumps, Posts and Poles in Ground Contact

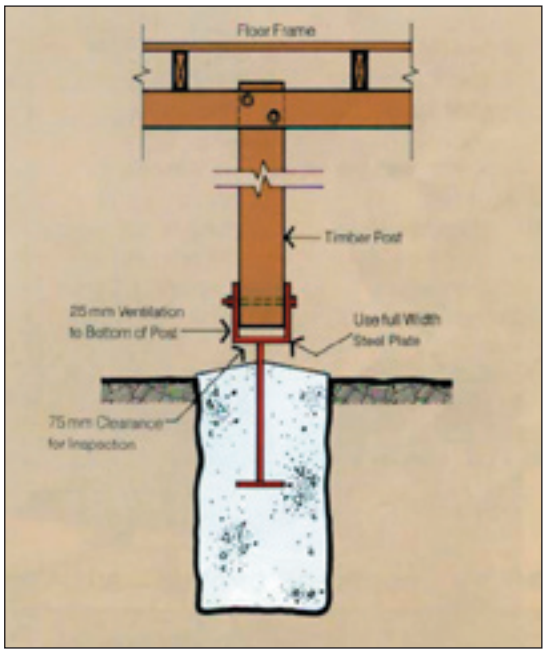
These members should either be naturally termite resistant timbers, preservative-treated timber to H5 Hazard Class, or other termite resistant materials.

A list of termite resistant timbers suitable for in-ground contact and for Hazard Class H2 inside above the ground, e.g. framing, is given in Table 1. See also AS5604 *Timber – Natural Durability Ratings*, AS3660 and AS1604.1- 2003 *Specification for Preservative Treatment* for the detailed requirements of Hazard Class H5 preservative treatment.

Strip Footings

Buildings with strip footings can be protected at ground level by the use of physical barriers such as crushed granite or stainless steel mesh, and chemical barriers, or by a combination of these products. For further details refer to "Slab on Ground Construction".

Figure 2: Good practice - Stumps or posts mounted on stirrups



Floor Clearance

Sufficient under-floor crawling space (400mm clearance on the underside of bearers) should be provided to

Table 1: Termite resistant timbers.

Highly Resistant	Resistant
swamp box	blackbutt
Carbeen	brush box
forest red gum	Caribbean pine
grey coast box	jarrah
grey box	kwila
Gympie messmate	red mahogany
sugar gum	river red gum
ironbark (all species)	forest red gum
red bloodwood	southern mahogany
tallowwood	spotted gum
turpentine	whote stringy bark
wandoo	yellow stringy bark
white mahogany	slash pine
	cypress
	Huon pine

Notes:

1. The natural durability and termite resistance applies to heartwood only.

2. Highly Resistant species are durability class 1 timbers, and are suitable for in-ground use.

3. Resistant species are regarded as suitable for Hazard Class H2 in accordance with AS1604 and are not suited for in-ground use without preservative treatment.

4. Further timber species resistant to termite attack are listed in AS3660 and AS5604.

allow easy access in the future and a regular (annual) inspection of the physical termite barriers.

Protection Options

Suspended Timber Floors

Table 2 provides a summary of the two main options available for protecting buildings with suspended timber floors. Note that all chemical treatments must be registered by the Australian Pesticides and Veterinary Medicines Authority (APVMA), and applied according to the chemical's approved label. Table 2 and Table 4 list those chemical actives approved by the APVMA at the time of reviewing this timber manual. Figures 2 and 3 provide examples of effective flooring design options.

Slab on Ground Construction

A range of chemical and physical barrier systems can be used to provide termite protection where slab-on-ground construction is selected. Most of these systems can also be employed to provide protection to stumps and strip footings for raised timber floors. Some options for providing protection against termites, are illustrated in Figure 4 and Tables 3, 4 and 5.

Ant caps and shields may be breached by foraging termites, but it is easy to see the termite's foraging galleries (arrow) bridging over them.

Physical Termite Barriers

Concrete Slab Barriers (Monolithic Slabs)

These barriers rely upon a good quality monolithic slab design (no cracks or construction joints). When constructed to the specifications/requirements of AS2870 *Residential Slabs and Footings* - Construction, they provide a substantial physical barrier for termites. Where construction or shrinkage joints and other service penetrations occur, additional forms of physical or

Table 2: Protection options - suspended timber floors.

Options	Protection of Stumps		Protection of Perimeter Foundings		Refer Figure
	Termite Shields/Ant caps	Chemical treatment*	Termite Shields/Ant caps	Chemical treatment*	
1	✓	-	✓	✓	3
2	-	✓	✓	✓	3

** APVMA approved chemicals include: bifenthrin, imidacloprid, chlorpyrifos and fipronil.*

Table 3 Protection options – slab on ground: non chemical.

Options	Protection at stumps			Protection at Perimeter Footings (Only one perimeter protection system is required)			Refer Figure
	Monolithic Slab to AS2870*	Crushed Granite	Stainless Steel Mesh	Exposed Slab Edge	Crushed Granite	Stainless Steel Mesh	
1	✓	-	-	✓	✓	✓	4
2	-	✓	-	✓	✓	✓	4
3	-	-	✓	✓	✓	✓	4

**Service penetrations through the slab must be protected by other physical methods.*

Table 4 Protection options – slab on ground: chemical or combined chemical/physical.

Options	Protection at stumps			Protection at Perimeter Footings (Only one perimeter protection system is required)			Refer Figure
	Monolithic Slab to AS2870*	Chemical treatment*	Chemical treatment*	Exposed Slab Edge	Crushed Granite	Stainless Steel Mesh	
1	✓	-	✓	-	-	-	4
2	-	✓	✓	✓	✓	✓	4

**Service penetrations through the slab must be protected by other physical or chemical methods.*

Figure 3: Protection system for suspended timber floor.

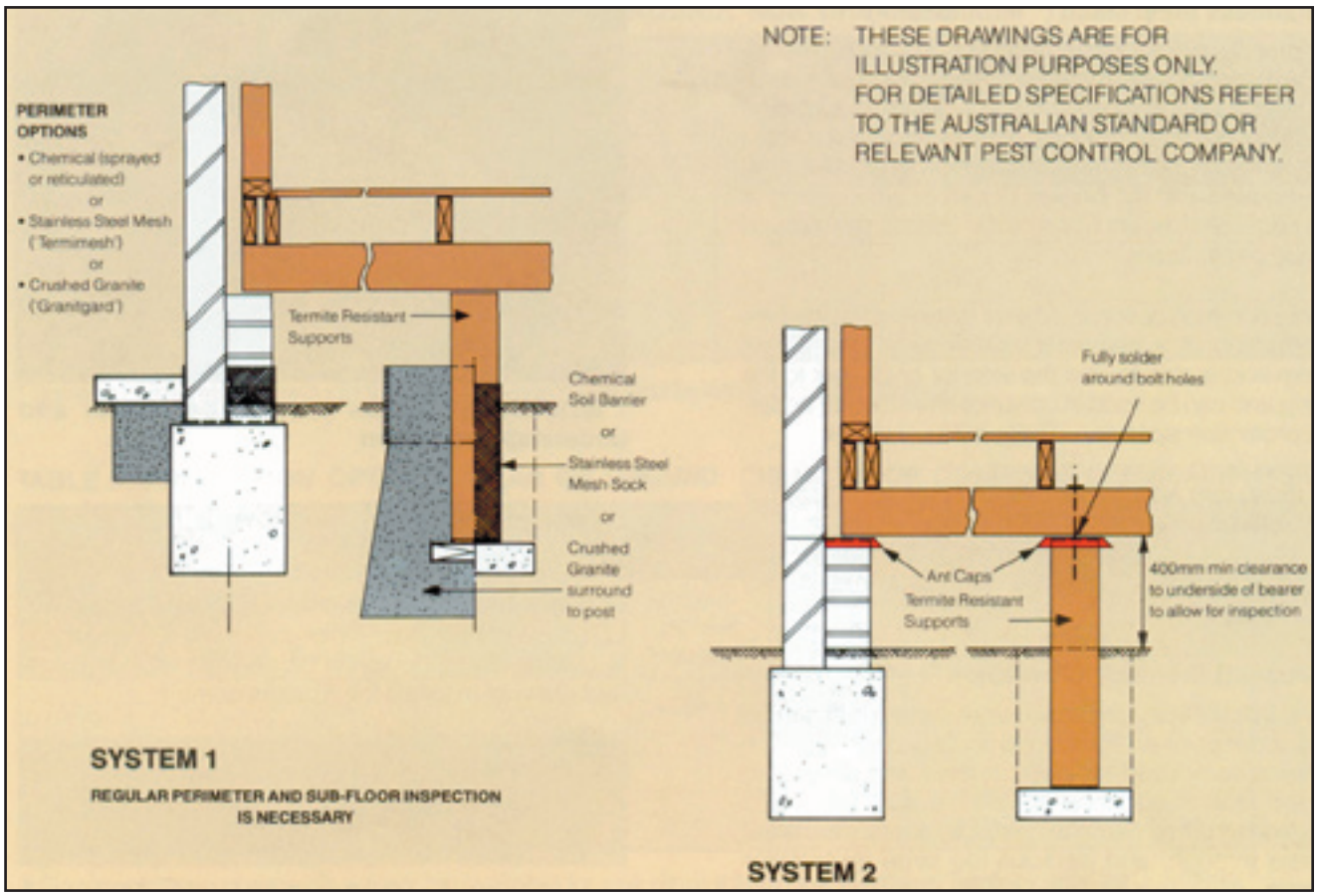
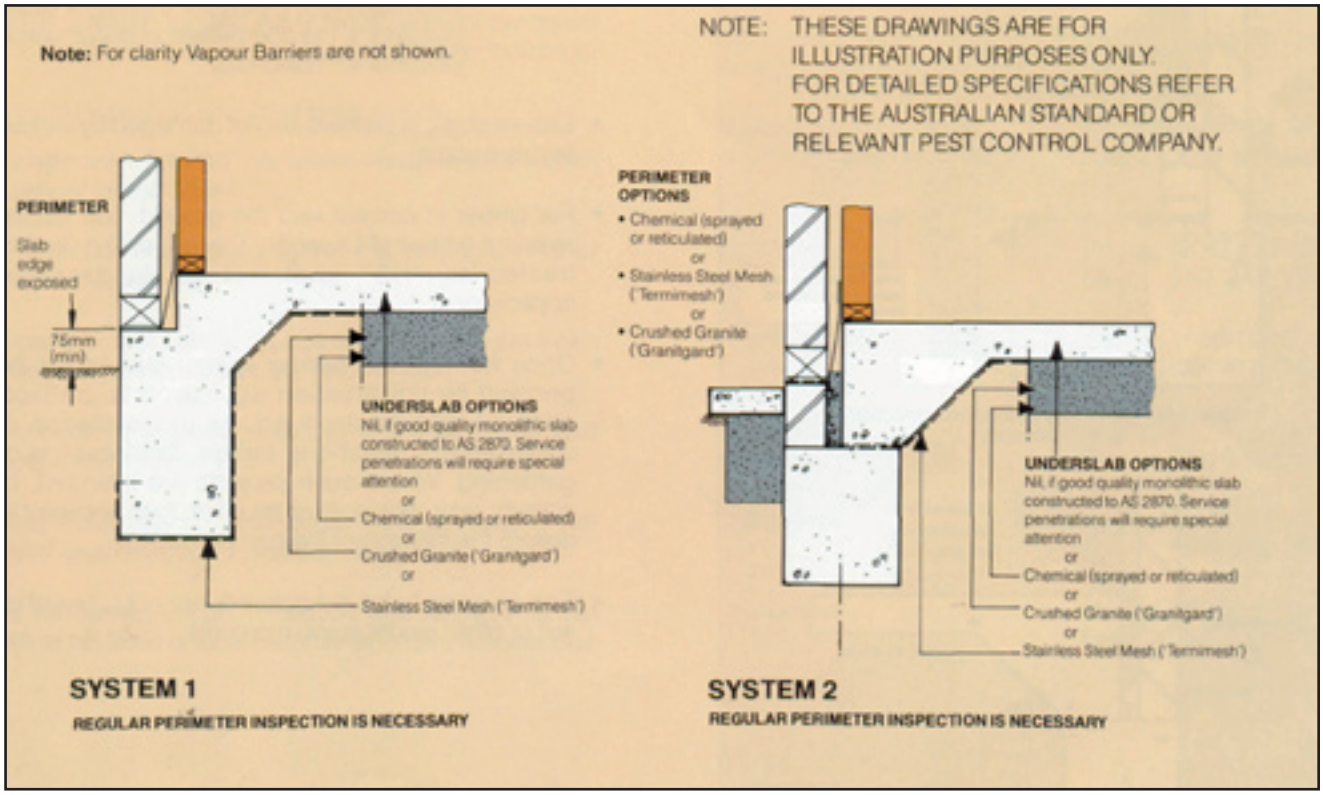


Figure 4: Protection systems for slab on ground.



chemical barriers must be provided in areas of risk of termite attack. The physical inspection and detection of termites is easier where the edges of the slabs are permanently exposed.

Tables 3 and 4 provide a summary of the protection options available for slab on ground buildings.

Stainless Steel Mesh ("TermiMesh")

This proprietary product consists of a fine woven marine grade stainless steel mesh which acts as a physical barrier for termites. The mesh is too small for termites to pass through and too tough for them to chew through. The full system involves mesh being laid underneath a concrete slab and incorporated with the brick work skin or ant capping at slab edges. Sleaves and clamps are used to seal around the service penetrations.

A more common option is a partial system which involves the construction of a perimeter barrier only. This partial system is intended to seal the exterior brickwork to the footing and can be used in conjunction with other under-slab protection systems. (Refer to Tables 3 and 4 for an outline of the protection options associated with concrete slabs.).

The mesh can also be formed into "socks" for stump/post applications, but each installation must comply with the manufacturers specification.

Crushed Granite ("GranitGard")

This is a proprietary physical barrier system that can be used under slabs and/or around posts and footings. The barrier is comprised of finely crushed and accurately graded (screened) rock of size that is designed to prevent termite movements ie: voids between the crushed rock are too small to pass through and particles are too large for termites to shift.

The installation must comply with the manufacturer's specification.

Chemical Barriers

General

Chemical barrier systems provide a zone of treated soil, poisonous to termites, either under or around footings and slabs.

A number of chemical systems are now approved by the APVMA for use as soil treatments. Each of these chemicals may need replenishing every 5 – 10 years, depending upon their exposure to weather, soil conditions etc. These chemicals may require a reticulation system to assist treatment in inaccessible areas ie: under slabs.

Concrete slab - special attention is required around the service penetrations and joints.

Reticulated Chemicals (" Slabset", "Termguard", "Altis" etc.)

These proprietary systems use a grid of pre-installed piping and distributors that enable chemicals to be applied to the underside of concrete slabs and around perimeters of buildings. The chemicals are applied under pressure at the completion of construction by licensed post controllers and on a scheduled basis thereafter.

Protection against Termite Damage to Structural Elements

Protection against termite damage to the structure of buildings and against termite infestation can be achieved as described above and/or by the use of termite resistant structural materials.

Options for using termite-resistant structural material which minimise the threat of termite attack, are illustrated in Figure 5.

Construction Considerations

It is important to note that effective termite management strategies begin prior to site disturbance and include the overall or total construction practices. The following matters in particular, should be considered.

Figure 5 Termite resistant structural materials.

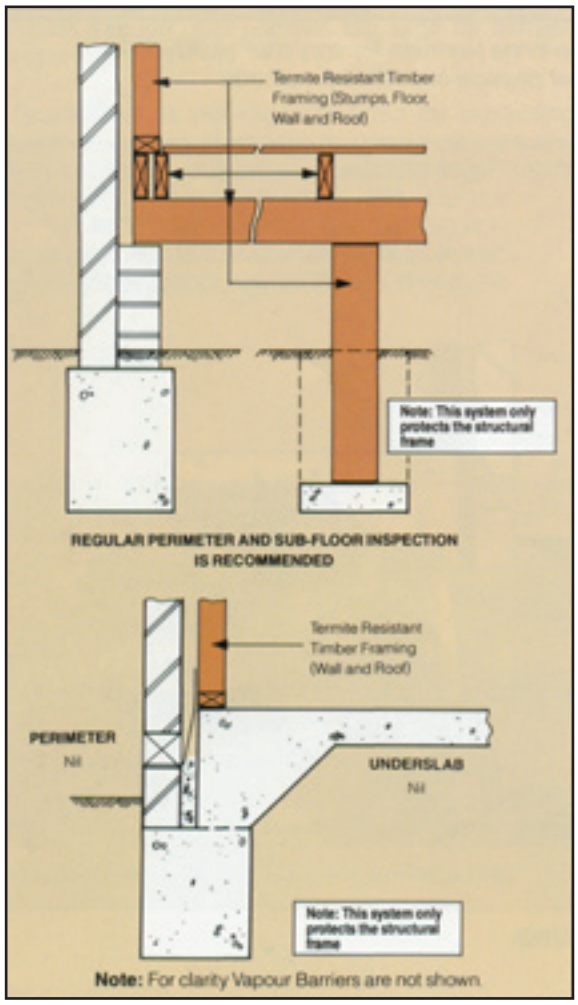


Table 5: Summary of options for managing termite risk.

Physical barriers	Timber products	Surveillance
Ant caps/termite shields (e.g. Termicide sealants, Termicide)	(see AS5604 & AS 3660)	Site preparation prior to construction
GranitGard	Up to H5 graded timber for use in contact with the ground	Post-construction annual surveillance
TermiMesh	Up to H2 graded timber for internal framing (e.g. Hyne T2, Framesure LOSP H2 and Blue, Hybeam I-joists)	Termicide monitoring stations
Concrete slabs	Naturally resistant timbers	
Chemical applications for timber products and on the ground (in tables 2, 3, and 4)	Timbers listed in Table 1	

Site Preparation

- Prior to site disturbance, survey the site and determine whether there are any signs of termite activity, or if colonies are present. If economically damaging termite species are located, do not disturb them. Instead, engage a licensed pest controller to take remedial action and treat the nest or colony in accordance with AS3660.
- Clear the immediate building site of all logs, tree stumps, tree roots, and other vegetation prior to construction.

During Construction

- Remove all formwork, form board profiles, pegs, etc. near or under the foundations or slabs.
- Install physical or chemical soil barriers in accordance with AS3660 or the manufacturers approved recommendations. Refer Figures 3 and 4.
- Ensure physical barriers are not damaged by various trades-people.
- For timber in contact with the ground, use termite resistant timber of Durability Class 1 or 2 or timber treated to Hazard Class 5 level (H4 for landscaping applications) – see AS 1604 for further details on the uses for the various durability classes of each timber .
- Once formed, the barrier system should not be bridged by construction elements e.g. carports, trellises, annexes, or breached e.g. as in installation of underground telephone cables, landscaping or gardening. Where such building projects are intended, or already exist, action must be taken to maintain or to restore the integrity of the termite barrier system.
- Ensure weep holes in brickwork are not covered by soil or other landscaping materials.
- Termite resistant timbers are listed in Table 1. The list includes timber species that may be used in contact with the ground, those that are considered to be highly resistant to termites, and those timber species or products that can only be considered as resistant to termites if used above ground in dry, well ventilated conditions, such as wall framing.
- Note that only the heartwood of the timber may be deemed to be resistant to termites. The sapwood of all timbers should be preservative treated to confer resistance. See AS1604 for further details.
- Chemical soil barriers must be installed by licensed pest control operators where required by state legislation.
- As well as underslab treatment, AS3660 requires a perimeter treatment of buildings at the completion of construction and just prior to “hand-over” in areas where houses are at risk of termite attack.

Options for managing termite risk

In those areas where houses are at risk of termite attack, it is possible to incorporate a number of features into the house design and construction to minimise the threat of termite damage.

The mix of physical barriers and timber products will be determined by both the termite hazard posed at each building site and the physical nature of the building elements.

Table 5 contains a summary of the options for addressing the hazards posed by termites and the importance of an on-going surveillance program for keeping houses free of termites.

“GranitGard” - being installed under a slab.

“TermiMesh” - can provide perimeter and underslab protection.

Inspection and Maintenance

Landscaping

Where landscaping or disturbing the site by other means (new telephone cables, slabs, etc.) affects the perimeter chemical soil barrier, engage a licensed pest control operator to re-treat around the building perimeter in accordance with AS3660.

To minimise the risk of termite attack:

- Do not store wood or other organic material against buildings.
- Keep gardens and landscaping clear of weep holes, physical barriers (ant caps), and damp proof courses.
- Maintain regular inspections to ensure the perimeter of the house is kept clear of organic material.

Annual Inspection

Have annual inspections carried out (preferably by a licensed pest controller) to detect termite activity in the building and immediate surrounds in accordance with AS3660.

Annual inspection should at least include:

- Inspection around perimeter weepholes in brick veneer constructions.
- Inspection of landscaping timbers, fencing and other timber structures.
- Inspection of termite shields, ensuring they are intact and not breached by galleries.
- Underfloor inspection of stumps, floor frame and perimeter masonry.
- Particular attention should be paid to areas under kitchens, bathrooms and laundries.

For further advice on inspection and remedial action refer to AS3660 or local management associations.

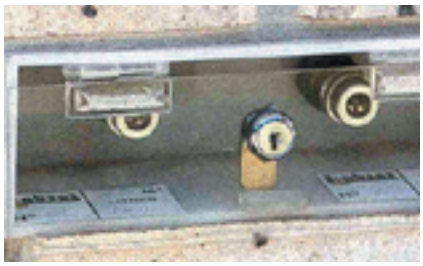
Search for and eliminate sources of persistent moisture or dampness within or near buildings.

NOTES: Perimeter treatments are usually not necessary for elevated timber construction supported on stumps or posts where physical barriers, such as "ant caps" are provided in accordance with AS3660.

Termite-resistance proprietary product suppliers

For further information on proprietary systems and licensed pest controllers contact:

Australian Environmental Pest Management	Phone (03) 9597 0664 Fax (03) 9597 0669 www.aepma.com.au
Australian Futurebuild	Phone 1800 284 792 Fax 08 8739 7313 www.chhfuturebuild.com
TermiMesh	Phone (1800) 632 111 Fax:(09) 249 1021 www.termimesh.com
Hyne Timber	Phone 07 4121 1211 Fax 07 4122 4607 www.hyne.com.au
GranitGard Pty Ltd	Phone (1800) 032 549 Fax:(03) 417 6008 www.granitguard.com.au
Termicide	Phone 07 5563 3006 Fax 07 5563 3004
Altis Pty Ltd	Phone (08) 9377 2753
Slabset	Phone (07) 5496 8918
Termguard	Phone (02) 9956 8805 Fax (02) 9956 6494
Woodlogic (Framesure)	Phone 1800 335 293 Fax 1800 624 362



"Slab-Set" - reticulation valves are easily accessible for post-construction treatment to underslab area.

Ant caps provide ground separation for stairs, but regular inspection is required.

Traditional construction: For over 200 years ground separation has provided effective termite protection.

Other References

1. AS3660- 2000 Termite Management. Standards Australia
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