MANAGING TERMITES

Understanding termites and reducing their risk to buildings

Termites can cause extensive damage to buildings if left undetected or not properly managed. This Building Technology Resource provides tips on how to reduce termite risk and to control termite infestations.

TERMITE BIOLOGY

Termites are small social insects that can feed on a range of cellulosic plant materials, including timber. Although sometimes called white ants due to their similar appearance and pale colour, they are more closely related to cockroaches (Figure 1). Like ants, termites have castes with well-defined roles, such as queen, king, soldier and worker. Workers leave the nest to forage, and feed the other castes with regurgitated or hind-gut food in a transfer process called trophallaxis. Soldiers protect workers and defend the galleries leading to the nest from predators such as ants. They use well-developed or modified mandibles for defense, the size and shape of which can be used to determine their species. The queen and king produce reproductive males and females, known as alates. During humid periods in the warmer months, often at dusk, swarms of alates may disperse from the nest to start their own colonies. These flying termites can be distinguished from flying ants by their straight rather than elbowed antennae and by their readiness to shed their wings upon landing or handling.

Termites have an important ecological role in recycling plant matter. There are more than 350 termite species in Australia, but only ~20 species cause any significant damage to human-made structures.

Depending on how they nest and feed, most termites may be categorised as either subterranean or drywood. Subterranean termites are the type most commonly found in Australia and are responsible for most structural damage.

SUBTERRANEAN TERMITES

Subterranean termites usually require a connection with soil, which provides the moisture they need to survive and allows them to search for food without the risk of desiccation. They may build nests underground; within trees, stumps, logs or roots; in damp locations inside buildings; or as large mounds on the ground or on trees (Figure 2).

FIGURE 2 Termite mound on young gum trees. (John Coppi/CSIRO)

To avoid sunlight – which can dry out their soft cuticle, or 'skin' – subterranean termites construct shelter tubes that extend from their nests and galleries over adjacent termite-resistant materials such as concrete, brickwork and durable timber. These tubes allow the termites to maintain their required humidity outside the nest, thus reinforcing successful explorations. The termites will usually forage within 30 m of the nest, although occasionally they may travel 100 m or more. Termites may also seal small gaps and crevices in timber with the same friable 'mud' used to construct shelter tubes.

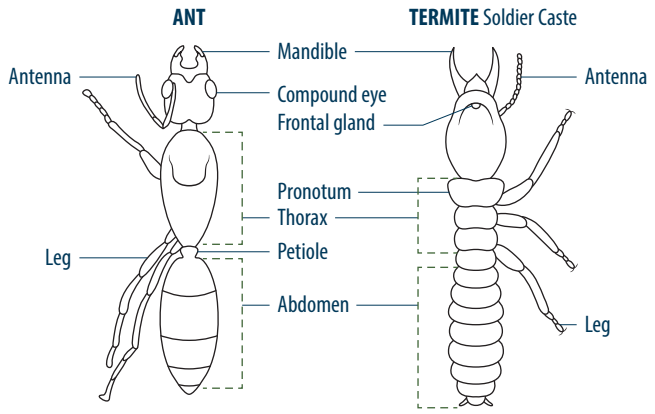

FIGURE 1 Termites can be distinguished from ants by their body shape and colour.

DRYWOOD TERMITES

Unlike subterranean termites, drywood termites do not require shelter tubes or a connection with soil to obtain moisture. Instead, they obtain sufficient moisture from the wood on which they feed. They make irregular cavities inside the wood and expel dry faecal pellets, called 'frass', through small holes and cracks.

Drywood termites are more common in humid areas, such as the tropical and subtropical regions of Queensland and New South Wales. The main species of concern in these areas is the introduced West Indian drywood termite (*Cryptotermes brevis*). Drywood termites can be difficult to control, and if found in Queensland, the Queensland Government should be notified so that it can organise eradication under the *Biosecurity Act 2014*.

REDUCING TERMITE RISK

Termites are found throughout Australia, but the presence of destructive species varies. The risk of termite attack on Australia's mainland generally increases in a northerly direction, with the highest risk in the subtropics and tropics (Figure 3). Above the Tropic of Capricorn, the giant northern termite (*Mastotermes darwiniensis*) is a particularly voracious species (Figure 4). Most states and territories have a moderate to very high risk of termite attack. In Victoria, some areas around Melbourne have low risk. Tasmania is the only state with negligible risk. However, environmental changes may cause variations in termite distribution in the future. For that reason, it is worth considering measures to reduce termite risk in buildings throughout Australia.

TERMITE-RESISTANT MATERIALS

Using building materials such as preservative-treated timber, naturally resistant timber (Table 1), metals, masonry or concrete will ensure that termites' food source is limited. Products such as termite-resistant engineered wood (plywood, laminated veneer lumber and reconstituted woods) have insecticides added to their glue lines during manufacture. Australian Standard AS 1604.1-2012 specifies the requirements for preservative-treated timber, which depend on where the wood will be used and the conditions it will be exposed to. The minimum level of treatment required for house framing, for example, is H2 (inside, above ground; protected from wetting and leaching), or H2F for framing used south of the Tropic of Capricorn.

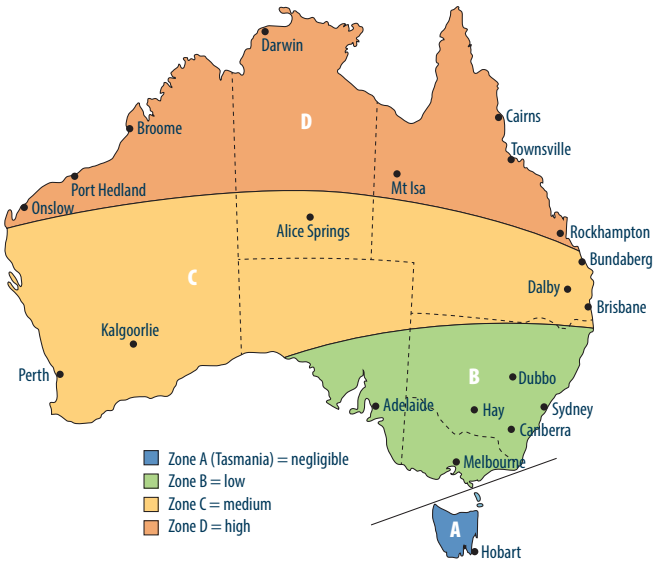

FIGURE 3 The risk of termite attack in Australia tends to decrease from north to south. (Leicester *et al*. (2003). A risk model for termite attack in Australia. Document No. IRG/WP/03-10468.)

FIGURE 4 Giant northern termite workers. (CSIRO Science Image)

TABLE 1. TIMBERS WITH TERMITE-RESISTANT HEARTWOOD.
SEE AS 5604 FOR FULL LIST.

Common name	Species name
Blackbutt	*Eucalyptus pilularis*
Black cypress pine	*Callitris endlicheri*
Brush box	*Lophostemon confertus*
Caribbean pine	*Pinus caribaea*
Coast grey box	*Eucalyptus bosistoana*
Cypress pine	*Callitris glaucophylla*
Grey box	*Eucalyptus moluccana*
Grey gum	*Eucalyptus propinqua*
Grey ironbark	*Eucalyptus paniculata*
Jarrah	*Eucalyptus marginata*
Maritime pine	*Pinus pinaster*
Merbau	*Intsia bijuga*
Red ironbark	*Eucalyptus sideroxylon*
Red mahogany	*Eucalyptus resinifera*
Red stringybark	*Eucalyptus macrorhyncha*
River red gum	*Eucalyptus camaldulensis*
Slash pine	*Pinus elliottii*
Spotted gum	*Corymbia maculata*
Sugar gum	*Eucalyptus cladocalyx*
Tallowwood	*Eucalyptus microcorys*
Turpentine	*Syncarpia glomulifera*
Western red cedar	*Thuja plicata*
White mahogany	*Eucalyptus acmenoides*
Yellow stringybark	*Eucalyptus muelleriana*

Spraying house framing in place using insecticides such as boron or pyrethroids is not ideal, as penetration is limited and not all surfaces can be accessed. For example, the face of the bottom plate fixed on the concrete slab – which is a prime access point for termites – will usually not be protected. Sprays applied to susceptible timber (which should not be confused with barrier sprays) do not guarantee the performance requirements set out in Australia's National Construction Code (NCC) for resistance to the actions of termites.

BUILDING CONSTRUCTION

Adhering to the following practices before, during and after construction will help to minimise the risk of termite attack:

- Remove tree stumps and large roots from the ground on which the house will be built. Do not allow timber off-cuts to be included with fill.
- Ensure that elevated floors have sufficient crawl space (400 mm minimum clearance to the underside of bearer, except in the last 2 m of a slope) and ventilation, to reduce humidity for termites and enable ease of visual inspection.
- Design strip footings and slabs as integral components, or protect construction joints using appropriate termite management systems.
- Avoid cavity brick or hollow masonry constructions below ground level. External siding and cement sheet should finish at least 100 mm above the soil, rather than extending towards the soil where they could provide concealed entry points for termites.
- Avoid placing gardens directly against the external walls of the house, as these can increase microclimate humidity and

conceal termite access. Keep soil and mulch levels below the concrete slab and away from weep holes in brick veneers. A concrete strip at least 50 mm lower than the house slab and 300 mm wide helps to separate the garden from the house and improves visibility during inspection.

- Ensure that renovations and extensions do not compromise existing termite barriers. For example, when a new concrete slab abuts an older slab, seal or protect the gap between them using an appropriate termite management system.
- Stop termites entering the house from outdoor timber posts, footsteps or pergolas by blocking their connection to the soil. For example, cut timber posts short of the soil and support the bottom ends on metal stirrups.
- Reduce moisture around the house. Grade the surrounding ground and paving so that rainwater flows away from the house. Check for water leaks from faulty plumbing or loose tiling. Avoid garden sprinkler systems that regularly water house walls and stumps. On timber decking, place pot plants between joists rather than over them, so that overflowing water quickly drains away. Direct the drainage water from air conditioners away from the building.
- Avoid stacking wood under or against the house. If placing shelving under the house, suspend it from the joists so that it has no connection to the soil.

WHOLE-OF-BUILDING PROTECTION

Even when the main structural elements of a building have been protected, termites can still enter buildings and damage cellulosic materials such as timber flooring and linings, architraves, books, furniture and even the paper backing on plasterboard. Whole-of-building protection uses physical or chemical barriers to deter the concealed access of termites. In modern buildings, the National Construction Code requires a notice advising the type of termite management system installed to be displayed in a prominent place (usually the meter box). As the integrity of barriers can be affected by renovations, garden alterations, concrete slab movement and insecticide depletion, termite inspections should be conducted regularly.

Chemical barriers

A common chemical barrier against termites is the use of insecticides to treat the soil before and after construction. The main chemicals used today include bifenthrin, imidacloprid, fipronil and chlorantraniliprole. Most insecticides will provide at least 3–5 years of protection. For slab-on-ground constructions, the pre-treatment of soil on its own (before the impermeable vapour membrane is laid and concrete slab poured) will not meet the NCC's requirements. Such treatment also requires the installation of a reticulation system under the slab, using perforated piping usually made from polyethylene or PVC. Insecticide can then be pumped into the reticulation system to replenish soil treatment.

More often, post-construction soil treatments are applied around the perimeter of concrete slabs, stumps and footings. A trench is normally dug around the slab or supporting structure and backfilled with treated soil. Under areas that will be paved, reticulation systems should be installed to enable insecticide replenishment; otherwise, problem areas will need to be drilled so that insecticide can be injected into the underlying soil, in a process called rodding. For perimeter treatment to be successful, any service holes or joins in the concrete slab must also be protected, such as with physical barriers and collars.

As part of the construction, flexible plastic sheets impregnated with a termite-specific insecticide (e.g. deltamethrin or bifenthrin) can be used as a barrier, and sealants and/or beads containing insecticide may be used to fill small gaps.

FIGURE 5 Termites reveal their presence by building a shelter tube to bypass an ant cap. (Forestry and Forest Products/CSIRO Science Image)

Physical barriers

Physical barriers prevent termite entry or force termites to build shelter tubes, which can reveal their presence. Examples include ant caps for stumps (Figure 5), metal strip sheeting for masonry walls, rigid collars of PVC or metal for sealing pipes that pass through slabs, and fine stainless steel mesh for slab penetrations, joins and perimeter details. Some termite management systems use graded crushed rock, which is impenetrable to termites, as a perimeter barrier around the slab, in external walls, around penetrations and along construction joints.

DETECTING TERMITES

When buying a home, it is advisable to have a termite inspection conducted before purchase. Some of the methods used to find termites include:

- Search for shelter tubes, which may appear over impenetrable structures such as stumps, ant caps and the edges of concrete slabs. Most termite attacks originate from the soil.
- Examine joints and crevices in timber to see if they have been packed and sealed by termites with friable 'mud'.
- Look for evidence of expelled frass underneath any small holes in wood (which may be only 1 mm wide), indicating the presence of drywood termites. The frass will feel gritty, like sand or ground pepper.
- Search for damaged wood, including skirting boards, door and window frames, posts embedded directly into soil, wardrobes and materials in storerooms (Figure 6).
- Tap timber with a hard-tipped tool (e.g. small hammer or handle of a screwdriver) and listen for a dull hollow sound, suggestive of cavities.
- Probe timber with a knife or screwdriver to detect hidden galleries. The 'skin' of timber concealing termite activities may

FIGURE 6 Termite damage in wood. (iStock.com/Pixygirlly)

be wafer-thin, as the termites retain the shell of wood to avoid desiccation.

- Look for areas of dampness, which may appear discoloured or stained. Bathrooms, laundries and areas of poor drainage (such as where paving directs water towards the house) are particularly vulnerable.
- Observe alate flights, especially if coming from inside the house, to find their launch sites. The termite nest may be outside, many metres away.
- Probe and inspect garden timbers. However, the presence of termites in the garden does not necessarily mean that they will enter the house, and not all termite species are structural pests.

Professionals may use other detection methods, including lures and bait stations, sound or movement detectors, thermal cameras and sniffer dogs. If termites are discovered, care should be taken to avoid disturbing them further. Several options for controlling termite colonies rely on finding active termites.

CONTROLLING TERMITE COLONIES

Successful deterrence or eradication of a termite colony usually requires the services of a licensed pest manager and involves the use of insecticides. Although home owners can buy termite control products, care must be taken in their application to avoid disturbing termites and driving them away temporarily.

Common methods for applying insecticide include:

- Spraying: The treatment involves trenching and spraying the soil around concrete slabs and around the stumps and footings of suspended floors. In the absence of a reticulation system, it may also involve rodding through paving and surrounding concrete slabs.
- Baiting: Bait stations or lures containing non-durable wood (such as ash eucalypt) are placed against infested wood or active shelter tubes or partially buried in soil around the building. Small quantities of slow-acting, non-repellent insecticides – such as chlorfluazuron, hexaflumuron and triflumuron – are incorporated into baits when first installed or added after termites have been attracted. After feeding, termites will distribute the insecticide to the nest and queen by trophallaxis. The baits should be checked every few weeks for termite activity.
- Dusting: Insecticidal dust – incorporating toxicants such as arsenic trioxide or fipronil – is applied directly to the termites or puffed inside their galleries so that they pick it up on their moist bodies. Termites ingest the insecticidal dust while grooming and then spread it throughout the colony.
- Fumigating: Extensive infestations of drywood termites that cannot be eradicated by the local application of insecticide foam or dust may require the building to be tented and fumigated.

As most of these methods provide no lasting protection against reinfestation by other termite colonies, regular inspections (at least annually) are required.

MORE INFORMATION

Additional information can be found in the following resources. Please check your local authorities for specific legislation, codes and guidelines, as they can vary between states and territories.

Australian Building Codes Board (2016) National construction code. Canberra: Australian Building Codes Board

Australian Environmental Pest Managers' Association (2014) A code of practice for prior to purchase specialist timber pest inspections. 2nd ed. Hendra: Australian Environmental Pest Managers' Association

Australian Standard AS 1604.1-2012 Specification for preservative treatment. Part 1: Sawn and round timber

Australian Standard AS 3660.1-2014 Termite management. Part 1: New building work

Australian Standard AS 3660.2-2017 Termite management in and around existing buildings and structures

Australian Standard AS 5604-2005 Timber – Natural durability ratings

Ewart D, Cookson LJ (2014) Termites and timber. In Schulz TP, Goodell B, Nicholas DD (eds) Deterioration and protection of sustainable biomaterials. Washington, DC: American Chemical Society, pp. 159–181

Hadlington P, Staunton I (2006) Termites and borers. Sydney: University of NSW Press