Appendix D – Termites and ICF Construction

D1.0 – Termite Types

There are three main types of termites currently found in North America:

1. Dampwood termites
2. Drywood termites
3. Subterranean termites

Dampwood Termites

These are prevalent in the Pacific Northwest and coastal British Columbia and primarily attack decaying wood. Eliminating the moisture source leading to the decay will normally control their spread.

Drywood Termites

This type does not require a significant moisture source. They can fly directly into buildings and start colonies in dry wood. They are found in the southern part of North America such as Hawaii and Mexico. Use of treated wood is usually more effective against this type.

Subterranean Termites

Subterranean termites most commonly live in the soil to avoid temperature extremes as well as obtaining moisture essential to their existence. They can attack any dry wood or other source of cellulose within a foraging distance of their colony such as untreated fence posts, utility poles, cardboard, paper, fiberboard which are close to the ground.

Where a wood source is not in contact with the soil, workers will build earthen 'shelter tubes' over concrete foundation walls or in cracks in the concrete through which they can travel to and from the food source and soil moisture.

Besides gaining entry via wood touching or close to the ground, termites can enter through cracks in concrete foundations and slabs, and through spaces around utility pipes cutting through concrete foundations.

Subterranean termites are the most important type since they cause the most damage to building structures. Within this group the Formosan subterranean termite is the most aggressive and destructive in nature. Formosan termites are typically smaller in size than other species, but can consume more wood faster because of their sheer numbers.

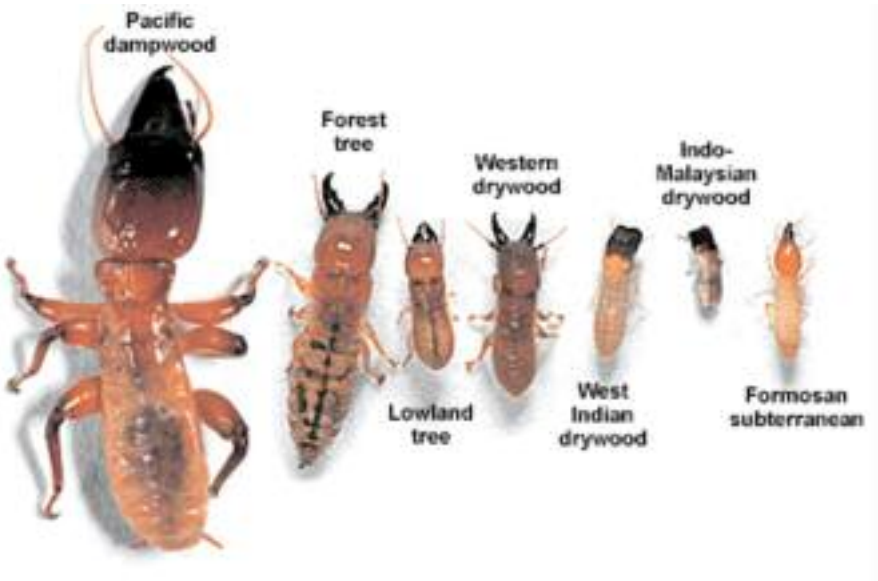


Figure D1.1 – Termites found in North America.
Copyright ©2000-2005, University of Hawaii Termite Project, www2.hawaii.edu/~entomol/index.htm

Figure D1.2 – Termite risk map of North America

D1.1 – Termites and ICF construction

The EPS foam and concrete which make up the Amvic ICF do not constitute a food source for any of the three types of termites found in North America. However subterranean termites can burrow through the EPS foam to reach areas of the building structure where there is a food source such as roof wood trusses, wood floor joists and hardwood flooring.

When ICF walls are used below grade in areas of very heavy termite infestations, it becomes more difficult to track their existence since termites can start burrowing through the EPS foam starting from below grade and upwards to the roof without being discovered.

D1.2 – Code Issues and EPS Foam Below Grade

The subterranean termites' ability to burrow through below grade EPS foam undiscovered led several national and local building codes in North America to ban the use of EPS foam below grade in areas considered to be very heavily infested. However the building codes have made exceptions and suggested measures which if used, will make the use of EPS foam acceptable.

D1.2.1 – International Residential Code 2003, Termite Control and EPS Protection

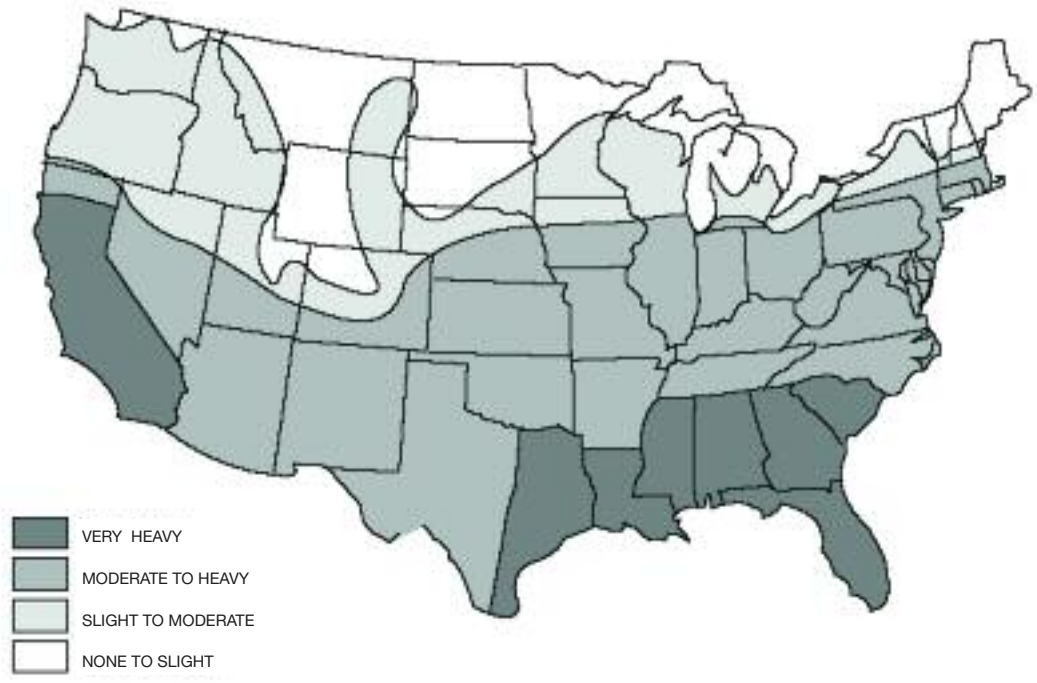
[R320.1] Subterranean termite control.

In areas favorable to termite damage as per table R301.2(1) methods of protection shall be any of the following:

1. Chemical soil treatment
2. Pressure preservatively treated wood in accordance with AWPA standards
3. Naturally termite resistant wood
4. Physical barriers such as metal or plastic termite shields
5. Any combination of above

[R320.4] Foam Plastic Protection.

In areas where the probability of termite infestation is 'very heavy' as per figure **R301.2(6)** [refer to figure D1.3 below], EPS foam shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. There should be a minimum clearance of at least 6 inches (152 mm) between foam plastics installed above grade and exposed earth.



Note: Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.

Figure D1.3 – Illustration R301.2(6) as per IRC 2003

Exceptions:

1. Building structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure preservatively treated wood.
2. In addition to requirements of R320.1 an approved method of protecting the foam plastic and structure from subterranean termite damage is provided.
3. On the interior side of basement walls.

D1.2.2 – National Building Code of Canada 2005, Termite Control and EPS Protection

[NBC 2005 – 9.12.1.1 (2)]

In localities where termite infestation is known to be a problem, all stumps, roots and other wood debris shall be removed from the soil to a depth of not less than 300 mm in unexcavated areas under a building.

[NBC 2005 – 9.3.2.9 (1)]

In localities where termites are known to occur,

a) clearance between structural wood elements and finished ground level directly below them shall be not less than 450 mm and, except as provided in sentence (2), all sides of the supporting elements shall be visible to permit inspection, or

b) structural wood elements, supported by elements in contact with the ground or exposed over bare soil, shall be pressure treated with a chemical that is toxic to termites.

[NBC 2005 – 9.3.2.9 (2)]

In localities where termites are known to occur and foundations are insulated or finished in a manner that could conceal termite infestation,

a) a metal or plastic barrier shall be installed through the insulation and any other separation of finish materials above finished ground level to control the passage of termites behind or through the insulation, separation or finish materials, and

b) all sides of the finished supporting assembly shall be visible to permit inspection.

D2.0 – Termite Protection and Control

There are several methods for protecting below grade and above grade structures including EPS foam from termites. The following are the most common methods currently being used in the market and are categorized according to their specific application techniques.

D2.1 – Physical Barriers

D2.1.1 – Waterproofing and Termite Barrier System.

Polyguard 650 XT membrane is specifically designed for ICF foundation walls and can be used for foundation waterproofing as well as termite protection.

Compliance of Polyguard 650 XT membranes with building codes issues pertaining to waterproofing and termite protection is covered under the International Code Council *ICC-ES Legacy Report #2136 (Formerly SBCCI Evaluation Report #2136* which can be downloaded from the following website:

www.polyguardproducts.com/products/architectural/datasheets/ICC-ESreport2136.pdf

For more information on Polyguard 650 XT refer to the following website:

www.polyguardproducts.com/products/architectural/icf.htm

D2.1.2 – Chemical Treatment of Soil

Adding chemicals (termiticide) to the soil surrounding the building structure has been a traditional and primary method of termite control. Subsequent follow up treatment at regular periodic intervals is required to continuously keep any termite population near the structure in check.

Certain city by-laws have been known to ban this method in areas where the water-table level is very high and there is an environmental danger of the chemical agents seeping through.

D2.1.3 – Metal Termite Shield

Metal termite shields are physical barriers to termites which prevent them from building invisible tunnels. When installed properly, the metal termite shields will force subterranean termites to build tunnels on the outside of the shields which are easily detected.

Metal shields are installed on top of concrete walls, and are fabricated of sheet metal which is unrolled and attached over the foundation walls. The edges are then bent at a 45 degree angle. Metal shields must be very tightly constructed, and all joints must be completely sealed. Joints may be sealed by soldering, or with a tar-like bituminous compound.

Figure D1.4 – Metal termite shield using copper metal on top of foundation wall.
Copyright ©1998-2005, Urban Entomology Program, University of Toronto
www.utoronto.ca/forest/termite/termite.htm

Figure D1.5 – Detail of metal shield at corner.
Copyright ©1998-2005, Urban Entomology Program, University of Toronto
www.utoronto.ca/forest/termite/termite.htm

D2.1.4 – Particle Sized Barrier

A physical barrier consisting of particle-sized rocks, such as crushed basalt, silica sand, natural sand, granite, glass shards, limestone, quartz and coral sand, can be used to prevent termite entry. There are three basic requirements that must exist for a particle sized barrier to be effective:

1. Granules size must be small enough so that when compacted together, the space between them is too small for the termites to squeeze through.
2. Granules must be big and heavy enough so that the termites can't pick them up and move them using their mandibles.
3. Granules must be too hard for the termites to chew.

The current studies conducted by entomologists reveal that particle sizes between 1.4 - 2.8 mm are impenetrable to subterranean termites.

Particle-sized barriers are used under slabs, around foundations, and around plumbing to create a physical barrier against termites.

An example of a successful particle sized barrier is the Basaltic Termite Barrier (BTB) made of crushed and/or sieved basalt. BTB was invented in Hawaii and is currently being used extensively throughout the state for new commercial and residential construction. BTB is made commercially available by Ameron and under license from the University of Hawaii. For more information on the availability of BTB please refer to the following website:

Ameron, Basaltic Termite Barrier (BTB) – www.ameronhawaii.com/plagg.html

D2.1.5 – Termimesh

Termimesh is a marine grade 316 stainless steel wire mesh which protects the foundation walls and slab on grade of a structure from termite penetration. The aperture grille of the mesh is too small for the termites to penetrate and too hard for them to chew. Termimesh will not kill or eliminate termites. It will physically prevent termites from penetrating a building structure.

Termimesh can be installed during construction on the exterior of foundation walls, under the slab on grade, and around service pipes penetrating the structure. For the system to be effective, proper installation is critical. Termimesh can only be installed by licensed professionals who have been trained by the company to specifically install Termimesh.

Compliance of Termimesh with building code requirements for termite protection is covered by the ***Southern Building Code legacy report No. 9713B*** which can be downloaded from the following website:

www.icc-es.org/reports/pdf_files/SBCCI-ES/9713B.pdf

For more information on this product and its availability please refer to following website:

www.termi-mesh.com

D2.2 – Suppression

D2.2.1 – Termite Baits

Termite bait systems were developed based on the social behavior of insects to groom and feed each other thereby transferring chemical toxicants to a termite colony and eventually eliminating it.

Wood or some other type of cellulose is used in termite baits, to attract foraging termite workers. The cellulose is impregnated with a slow-acting toxicant that cannot be detected by the termites. The toxicant must be slow acting because termites tend to avoid sites where sick and dead termites accumulate. Termite workers feed on the treated material and carry it back to other colony members, where it slowly poisons the termites and eventually reduces or eliminates the entire colony.

Typically, in-ground stations are inserted in the soil next to the structure and in the vicinity of known or suspected sites of termite activity. Initially the stations contain untreated wood to serve as a monitoring device. Once termites locate and start feeding on it, the wood is replaced with the slow acting chemical toxicant. In addition, aboveground stations may be installed inside or on the structure in the vicinity of damaged wood and shelter tubes.

Figure D1.6 – Inserting a termite trap containing wood as bait

Termite baits are used for controlling termite infestations rather than being a barrier to prevent termites from penetrating a structure.

There are several commercial termite bait systems available on the market including:

1. Dow AgroSciences LLC - **Sentricon® Colony Elimination System**
   www.sentricon.com
2. FMC Corporation - **FirstLine® Termite Defense System**
   www.fmc-apgspec.com
3. BASF Corporation - **Subterfuge® Termite Bait**
   www.spd.basf-corp.com/default.asp?page=pestpro/products/subterfuge
4. Ensystex Inc. - **EXTERRA™ Termite Interception and Baiting System**
   www.ensystex.com

D2.2.2 – Trap Treat Release (TTR)

TTR is similar to termite baits in that it uses their social behavior to spread slow acting chemical toxicants into a termite colony.

With TTR, termite traps are placed in suitable locations near the structure. The traps are checked regularly for termite presence. Once termites hit a trap, it is removed and the termites are extracted for treatment. A slow acting chemical toxicant is applied externally to termite bodies as a groomable coating. After treatment the termites are released back to their colonies. Coated termites carry effectively larger loads of toxicant than do bait-fed termites.

These topically treated termites act as a delivery system, spreading the toxicant throughout the colony. Cleaning and grooming by other members of the colony, result in the ingestion of the pesticide by the grooming individuals. After ingestion, the pesticide is further distributed by mutual feeding behaviors. Because of its more efficient delivery system, TTR has better results in the laboratory and field conditions than bait systems.

TTR was developed by Dr. T. G. Myles at the University of Toronto, and was licensed by the University of Toronto Innovations Foundation to FMC Corporation.

D2.3 – Site Management

The following are measures to be taken during construction to reduce the probability of termite infestation in a building structure. These measures are meant to be used **IN ADDITION** to the other termite prevention and control methods discussed above and should not be used nor considered as standalone solutions.

1. Building sites should be cleared of stumps, roots or other woody material that remains beneath or adjacent to the building.
2. All stakes, forms and building debris should be removed from beneath and adjacent to buildings. Do not backfill over such debris.
3. The site should be well drained so that moisture is not retained under, or adjacent to, a building. Downspouts should carry water away from the building.
4. No wood (stair supports, posts or other wood) should project through concrete floors or foundations.
5. Foundations should be of concrete or masonry, and soil debris should be kept clear of wood resting on them. Make sure foundation wall is high

enough to allow sufficient top soil placement and still leave at least 6-8 inches (15-20 cm) of clearance between the bottom of siding or stucco and the ground.

6. Slabs, concrete floors and foundation joints should be sealed against moisture, and regularly inspected for cracks which should be immediately sealed.
7. In areas determined to be very heavily infested with termites, it is recommended to remove an 8 inch (20 cm) strip of EPS above the grade line to expose the concrete. Any termite shelter tubes will be clearly visible and the required treatment measures can be adopted.

D2.4 – Recommendations for Termite Prevention and Control

1. Wood or cellulose is the main food source for termites. Reducing or eliminating wood structural elements in a building structure, greatly enhances its durability against termite infestation. If wood cannot be eliminated, use treated wood or naturally resistant wood to termites.
2. Consider using more than one line of defense from the three different categories of termite control and prevention methods discussed above (Physical Barriers, Suppression and Site Management).
3. Always retain the services of licensed/professional Pest Control Operators (PCOs) to implement commercial termite control and prevention methods especially chemical treatment of soils, metal termite shields, termite baits and TTR.
4. Monitor the structure on a regular basis and inspect for any signs of termite infestation or damage. This should be performed by professional PCOs. Take remediation action when termites are discovered.