

Termite Prevention and Control by Design in Florida

Presented by Faith Oi, Ph.D., University of Florida, Entomology and Nematology Dept., Gainesville, FL 32611. email: foi@ufl.edu



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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



Course Description

Building enclosures are responsible for controlling heat flow, air flow, vapor flow and a number of other elements. In Florida, a very significant additional design consideration for building enclosures and longevity is termites. This presentation will explore design considerations associated with wood-frame building enclosures and the role of control layers in addressing items such as durability, termite control and prevention and thermal continuity. Beginning with a review of building enclosure design fundamentals and considerations, it will then focus on best practices for a variety of wood-frame building enclosure assemblies and details with references from technical guidelines and case studies. Next, a brief overview of the termites encountered in Florida will be presented, with a focus on prevention and control strategies for multi-family and commercial wood buildings. A combination of initial design strategies to prevent termites from entering structures and proper maintenance programs for surveillance will be reviewed. Finally, the critical detail interfaces between different enclosure assemblies (i.e., walls, roofs, balconies, windows) will be reviewed with a focus on continuity of critical barriers.

Learning Objectives

1. Review building science fundamentals and building enclosure design considerations for light-framed wood buildings in hot and humid regions.
2. Explore the role of control layers in building enclosures for elements such as heat flow, bulk water intrusion and air flow.
3. Identify the types of termites that are found in the Florida and understand their paths of entry into building structures and the damage they may cause.
4. Understand and apply the Termite Protection requirements of the Florida Building Code to multi-family and commercial projects.

Florida has more termite species than any other state in the U.S.

- ~2,500 termite species
- ~45 in U.S.
- ~23 in Florida
- 7 are invasive
- Pest control companies are allowed to exclude *Coptotermes* species from contracts



USDA Termite Probability Map

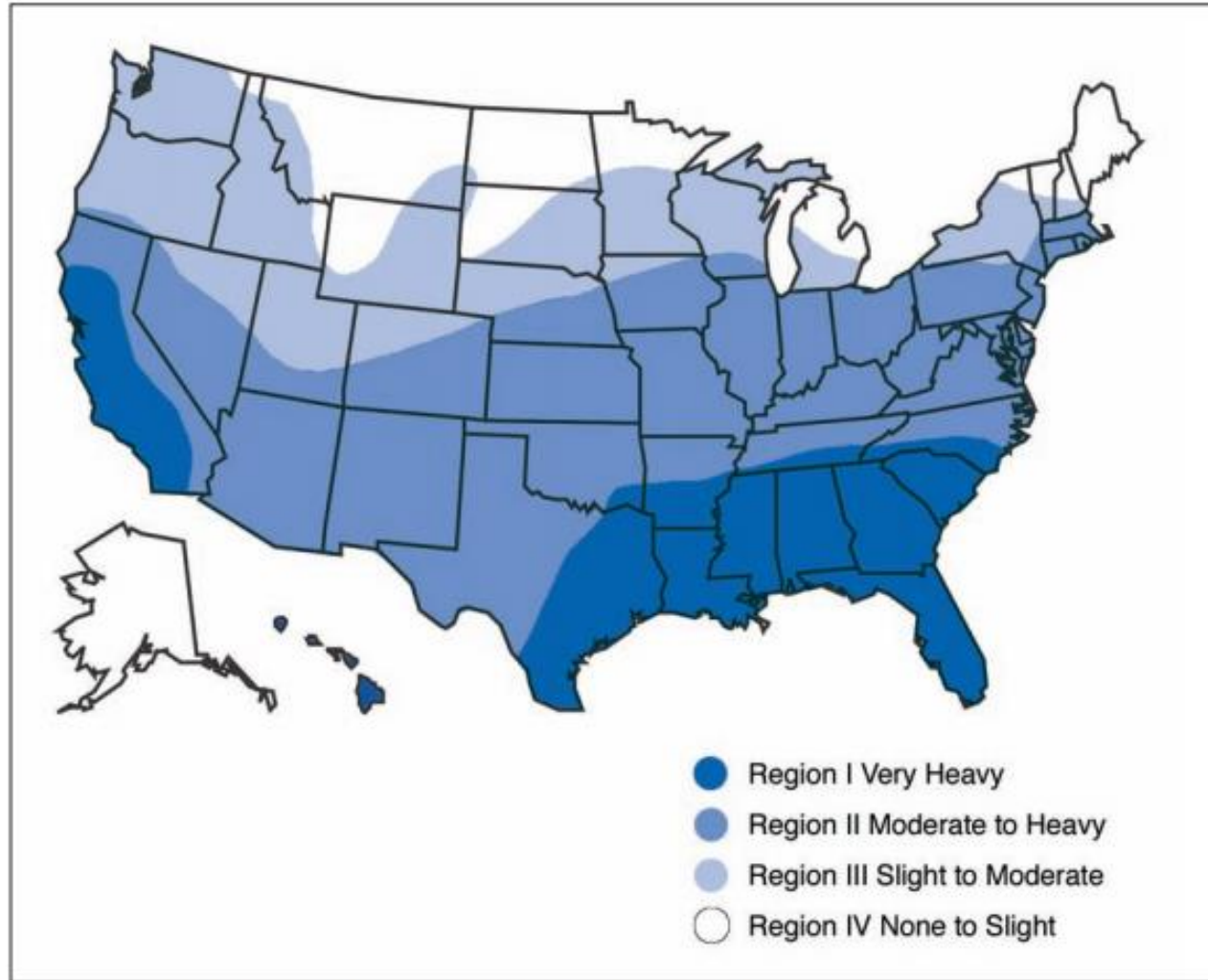


Figure 1. — Relative hazard of subterranean termite infestations in the United States.

What is a termite?

- Termites are blind, soft-bodied insects
- “Cryptobiotic”
- Exploit cellulose
- Thousands to millions in a colony
- Time is on their side
- Best control: PREVENTION with good building construction practices



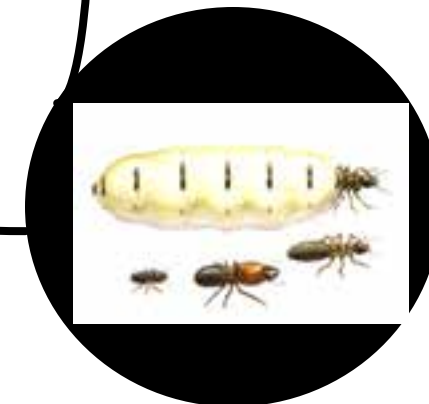
Where Termites are Found

- Drywood termites
- Attics, cabinets, trim, furniture
- Spot treatment; fumigation



- Dampwood termites
- Only where wood is constantly wet
- Dry out

- Subterranean termites; can build directly on a large colony
- Structural timbers
- Contents
- Soil termiticides, baits, borates, physical barriers (Termimesh, Basaltic Barrier)



General Information on DWs

- DW infestations generally localized
- Live in dry, sound wood
- No ground connection (so galleries do not contain mud)
- Galleries run across the grain of the wood



EVIDENCE AND DAMAGE



Often spot treatments are sufficient

Inspection—Attics

Use the Insulation to Help Find Frass



Fumigation is effective. And expensive. Based on volume.

- Several days to drop tarps
- Over 1 million cu. ft.
- Fume done over long weekend
- Challenges:
 - Finding and sealing areas to adjoining building
 - Wind tearing tarps



By far the most economically important termite is the subterranean termite. Damages structures and contents.



Global economic impact of termites is estimated at \$40B with 80% being due to subterranean termites

By far the most economically important termite is the subterranean termite. Damages structures and contents.



Box of pesticides



By far the most economically important termite is the subterranean termite. Damages structures and contents.



Global economic impact of termites is estimated at \$40B with 80% being due to subterranean termites

Paths of Entry into Structures

- Subterranean termites are blind, soft-bodied insects that follow guidelines and pheromones
- Examples of guidelines include the outside foundation wall, wall studs, coverings (e.g., EIFS, stucco), any pipes or conduits leading into a structure, landscaping



Photo credit: Max

Mud tubes

Entry into buildings

Protection from

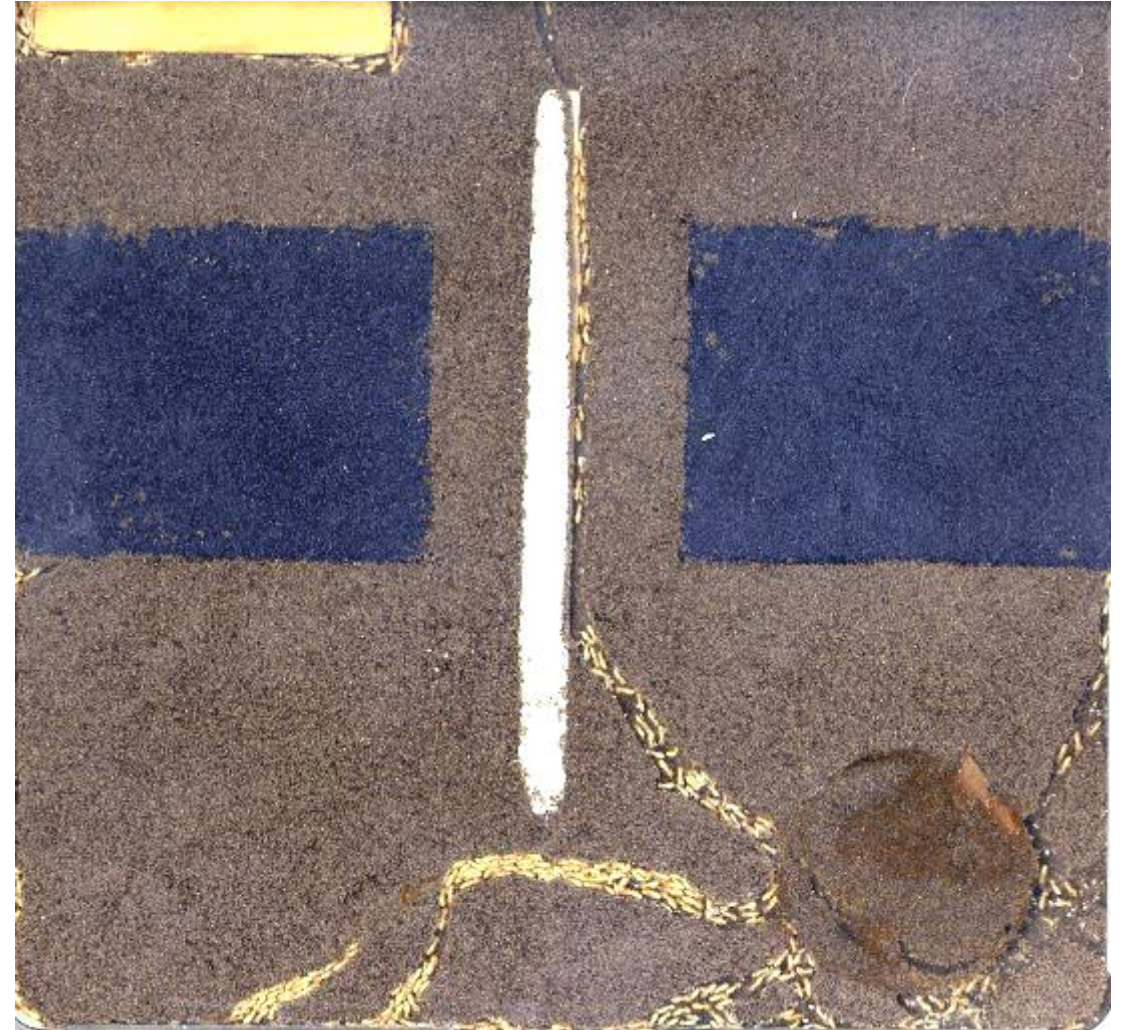
- desiccation
- predators



Termite Tunneling and Guidelines



Day 14



Day 14 (Found Gap 3d)

Paths of Entry into Structures

We have >60 building construction elements at PMU that termites can exploit to enter structures



Paths of Entry into Structures

We have >60 building construction elements at PMU that termites can exploit to enter structures



Termite prevention recommendations haven't really changed in ~85 years (and neither have the termites...or poor building construction)

BAD:

- Moisture
- No inspection space
- Guidelines, including plant roots leading to foundation; siding below grade, pipes and conduits
- Wood in contact with ground

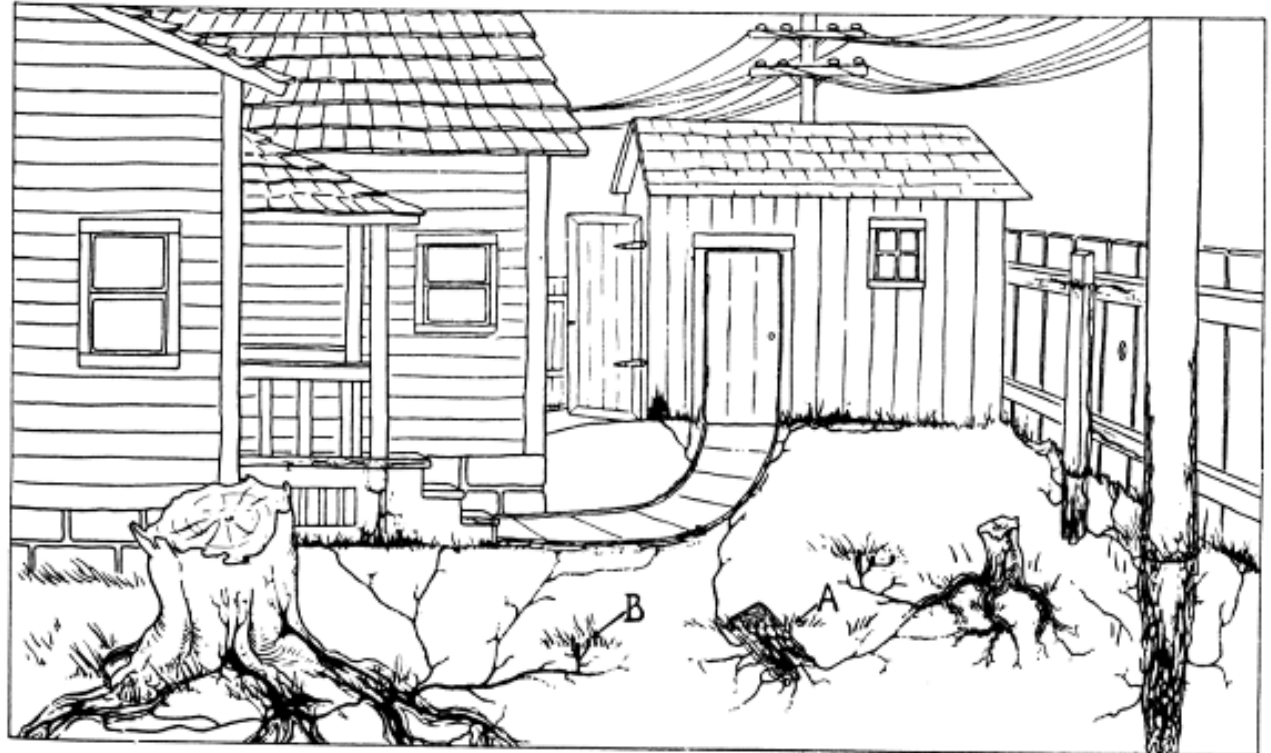


Fig. 50. This sketch combines the sorts of conditions found to prevail in many localities where wood has been improperly used. Unprotected wood in or on the ground makes possible both settlement and rapid increase of the subterranean termites. Workings in stumps, poles, posts, sidewalks, and wood of buildings are shown in black, as are the galleries within the earth. *A* marks the supposed original point of entry of one of the colonizing pairs, and *B* the points of emergence of swarming alates at the proper season.

From 1934 publication (Kofoid)

Soil termiticides are still the most commonly used method of control. Two times a structure can be protected: “New” construction and post-construction



Photo: B. Hamilton

1816 TERMITE PROTECTION

“Termite protection shall be provided by registered termiticides, including soil applied pesticides, baiting systems, and pesticides applied to wood, or other approved methods of termite protection labeled for use as a preventative treatment to new construction. See Section 202, “Registered termiticide.”

Google: “termiticides for new construction Florida”

TERMITICIDES REGISTERED IN FLORIDA FOR PREVENTIVE
TREATMENT OF NEW CONSTRUCTION

https://www.freshfromflorida.com/content/download/3134/19725/Termiticides_table_10-23-2018.pdf

1816 TERMITE PROTECTION

“... Upon completion of the application of the termite protective treatment, a **certificate of compliance** shall be issued to the building department by the licensed pest control company that contains the following statement: “The building has received a complete treatment for the prevention of subterranean termites. **Treatment is in accordance with rules and laws established by the Florida Department of Agriculture and Consumer Services.**”

Certificate of Compliance for Termite Protection
(as required by Florida Building Code (FBC) R318.11816.1.2)

• Company Name and Telephone Numbers

• Address of Treatment or Lot/Block of Treatment

• Method of Termite Prevention Treatment: soil barrier, wood treatment, bait system, other (describe)

The building has received a complete treatment for the prevention of subterranean termites. Treatment is in accordance with rules and laws established by the Florida Department of Agriculture and Consumer Services.

Authorized Signature



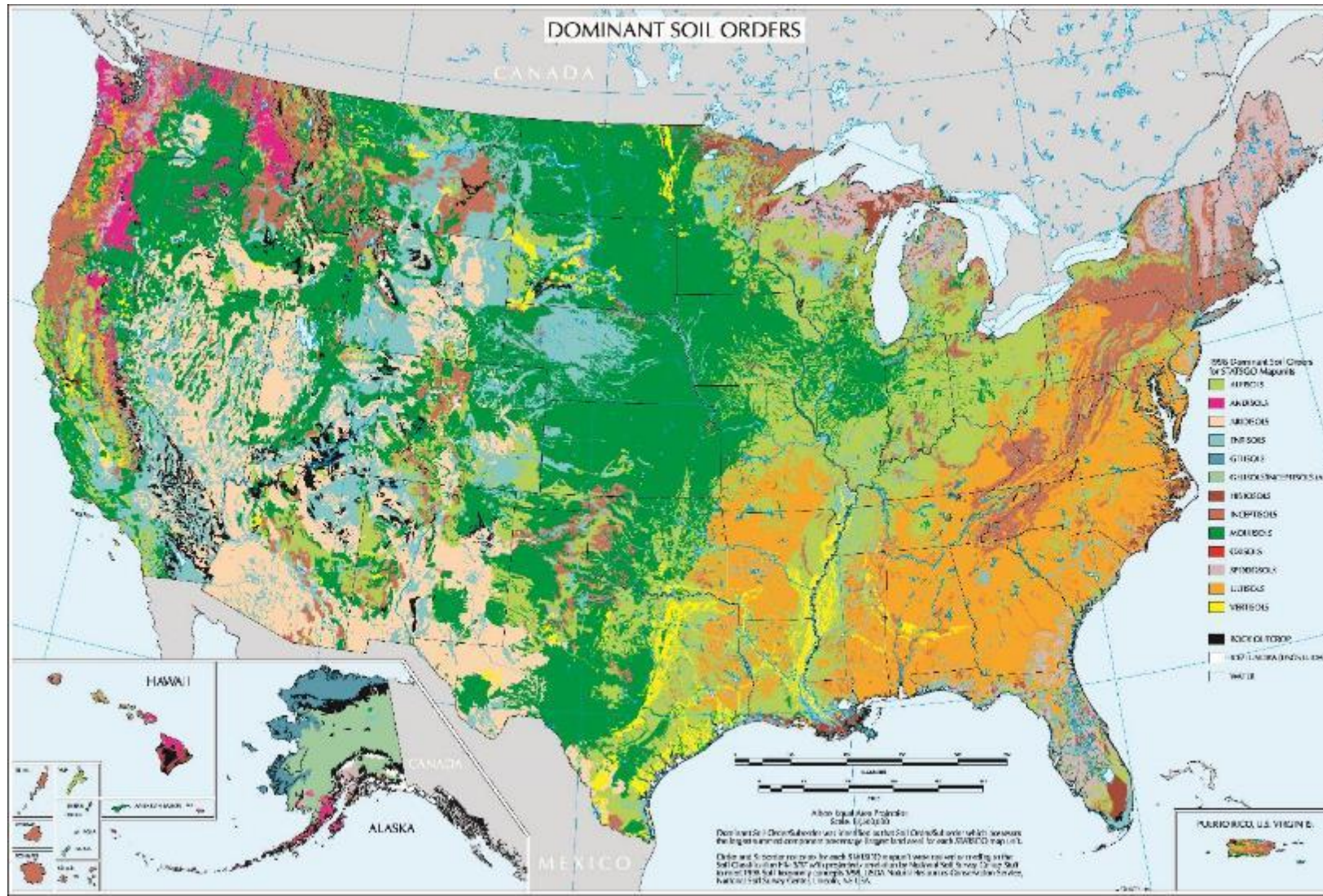
Termiticide label

1816.1.1 TERMITE PROTECTION

“If soil treatment is used for subterranean termite prevention, the initial chemical soil treatment inside the foundation perimeter shall be done after all excavation, backfilling and compaction is complete.”

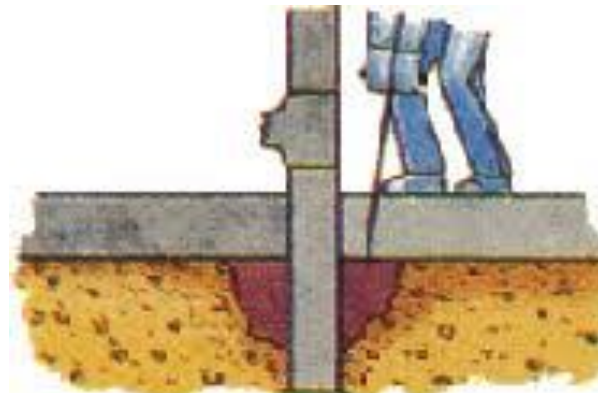
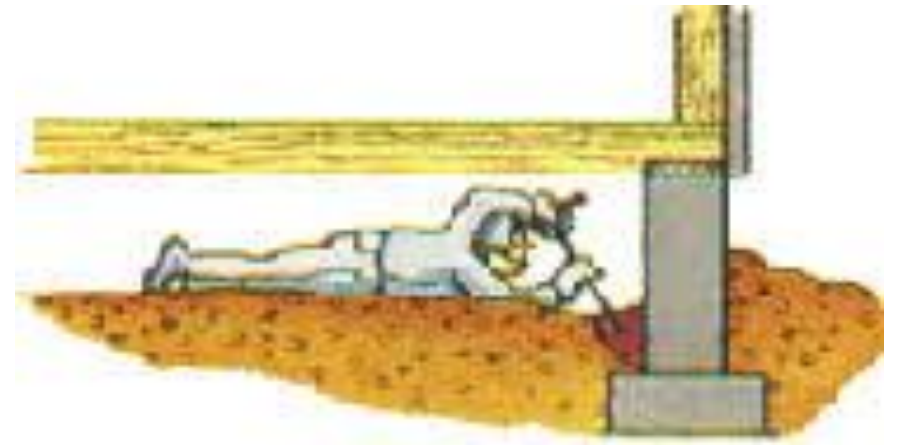
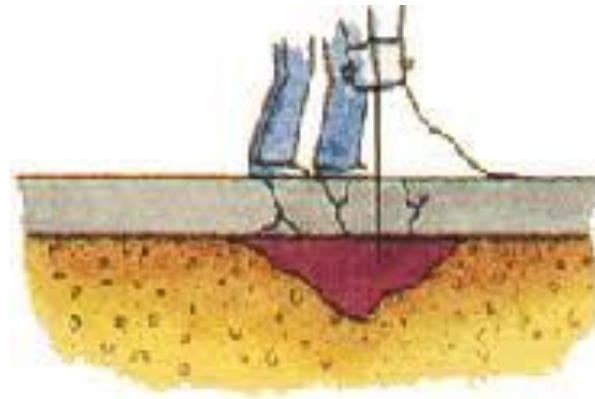
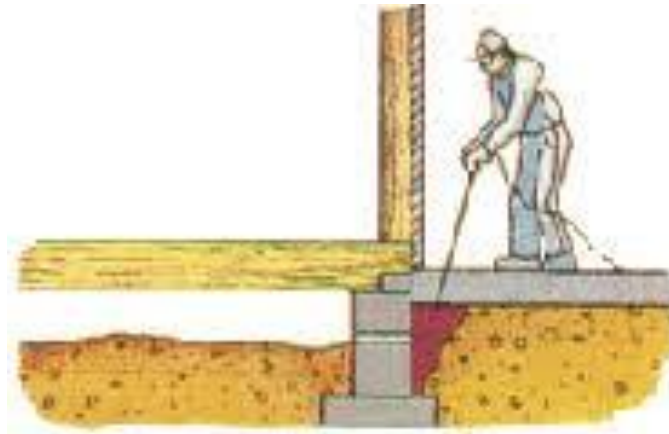


Efficacy of Soil Termiticides is Dependent on Many Factors, Including Soil Type



The goal of treatments is to create a treated zone or barrier

Images used in training of application methods



In reality, termiticide distribution in soil is analogous to the chocolate parts of a marble cake



From BTF, UGA

babeinthecitykl.blogspot.com (EX-Z.750)

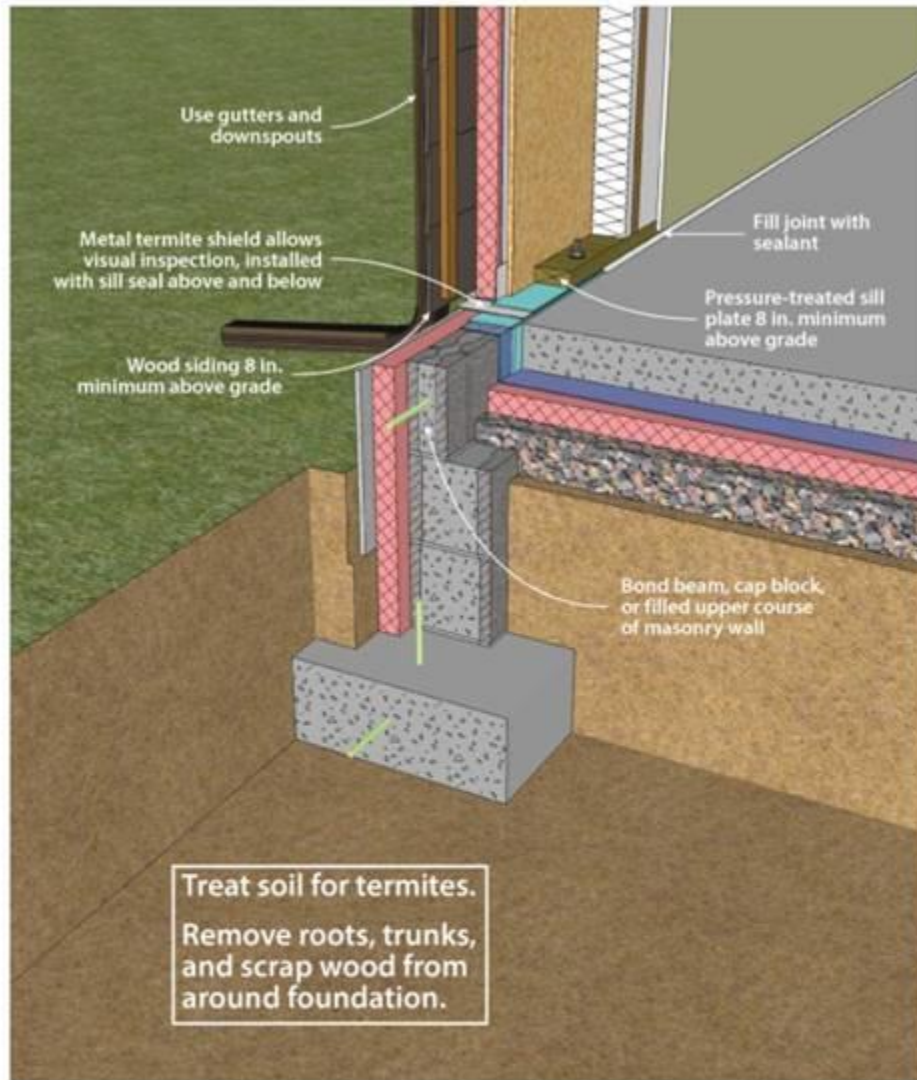


Figure 4-6. Slab-on-Grade Termite Control Techniques

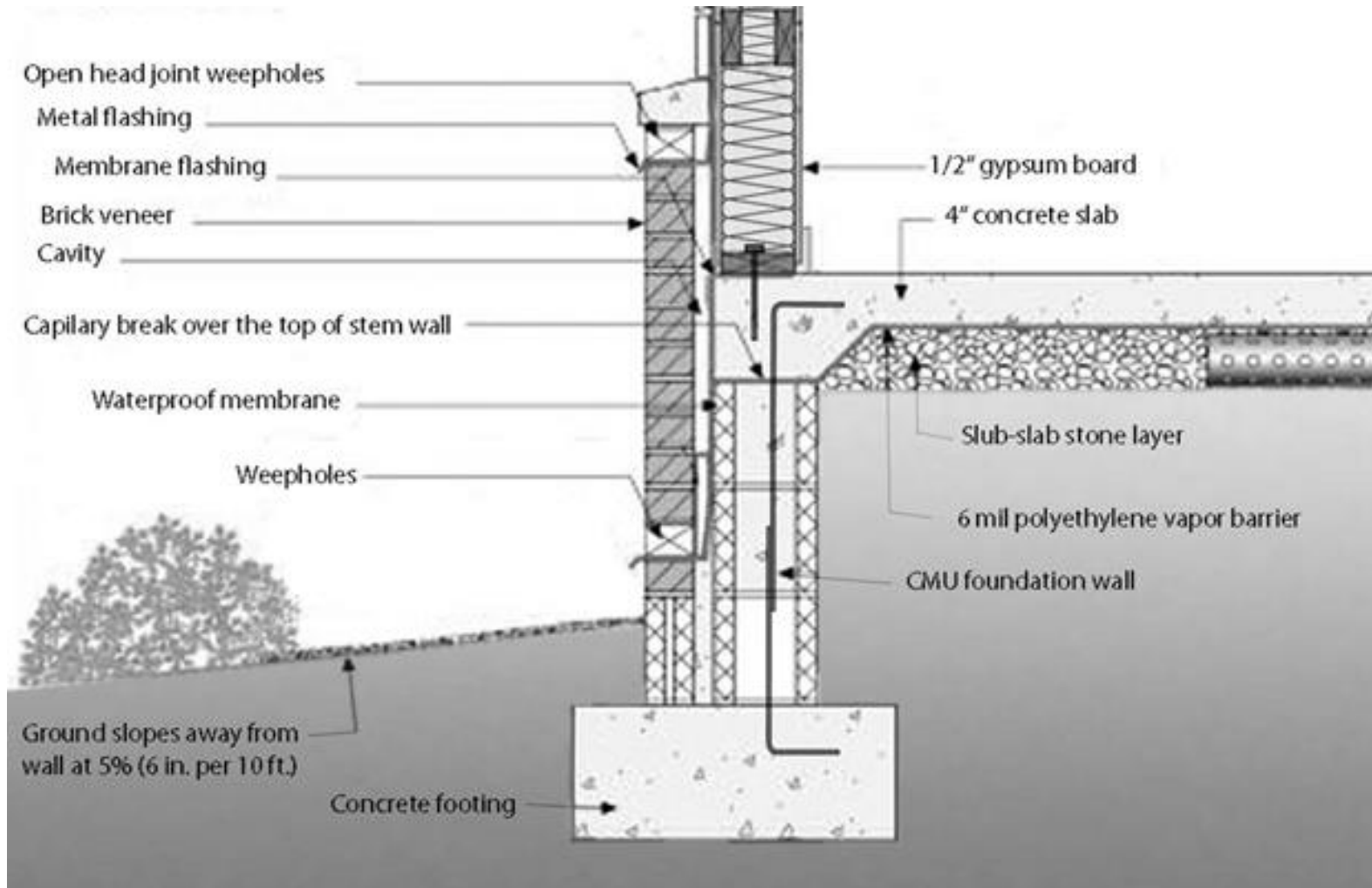
TERMITE AND WOOD DECAY CONTROL TECHNIQUES

Techniques for controlling the entry of termites through residential foundations are necessary in much of the United States (see Figure 4-6). Consult with local building officials and codes for further details.

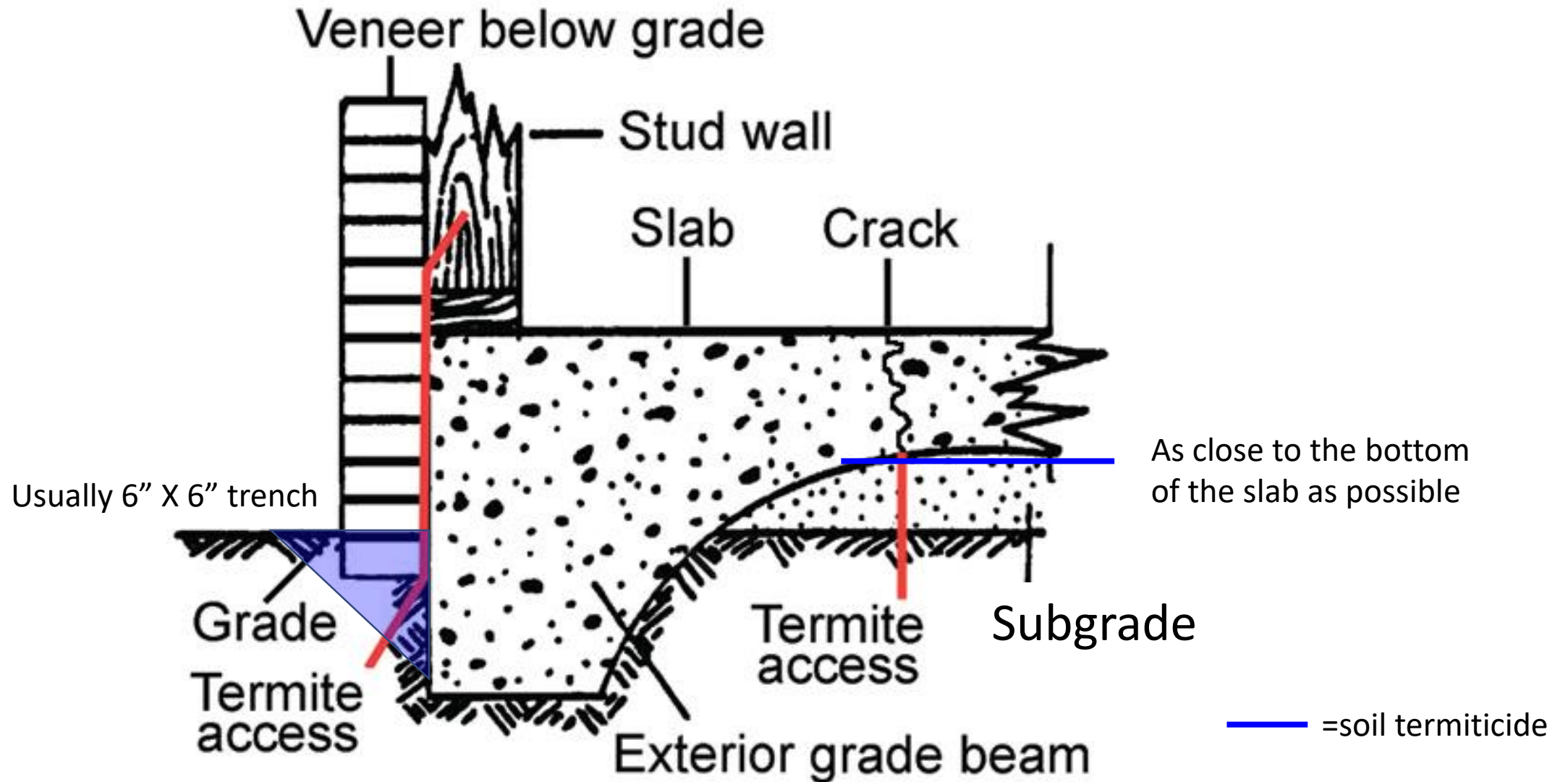
Termites can exploit every gap, including the I-bolt used to secure the sill plate to the masonry wall

In multi-family and commercial construction, when slabs contain “cold-joints” or with post-tension cable construction, it will be important to minimize “hidden access” and treat “critical areas”

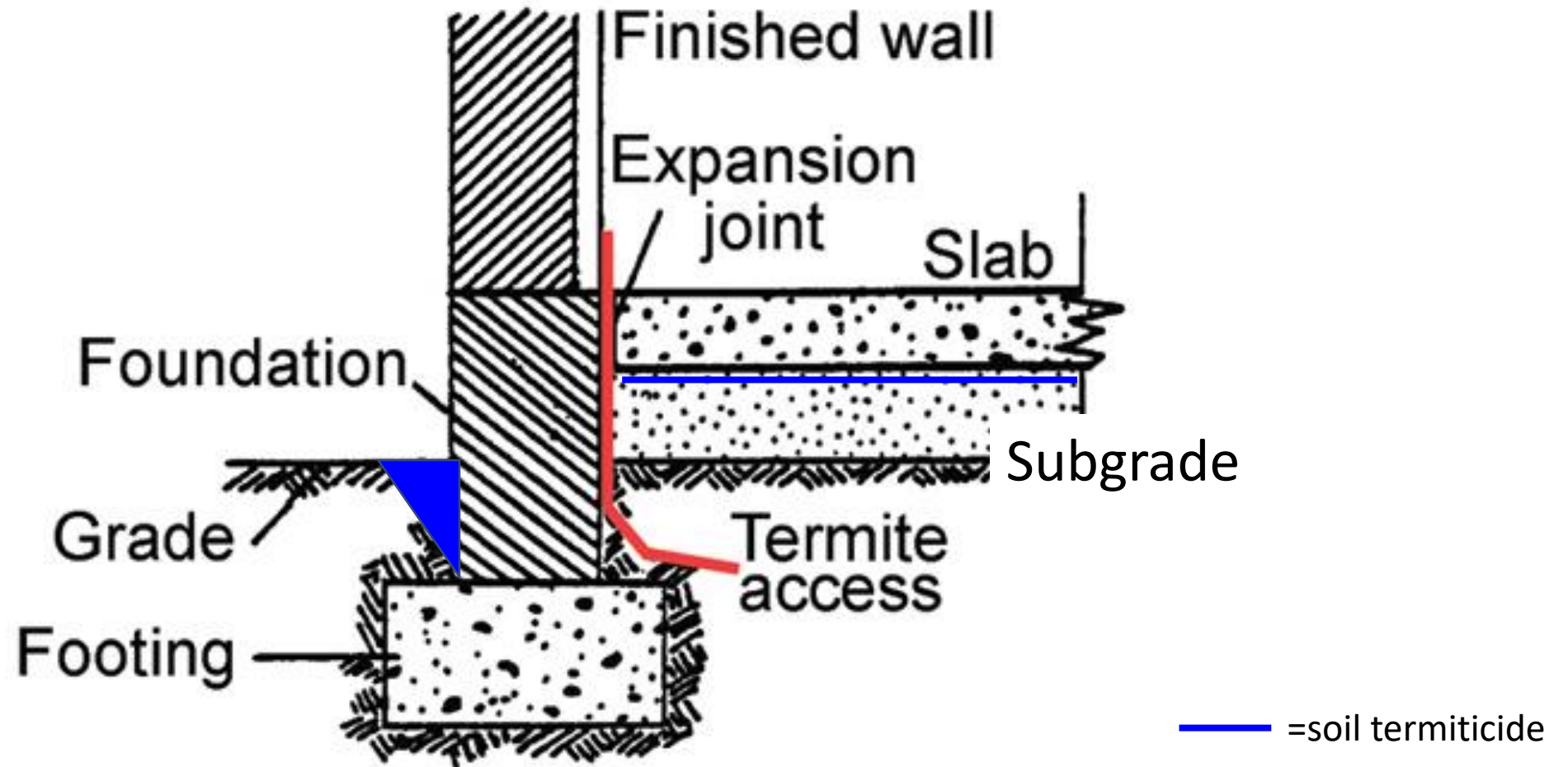
How termites enter structures



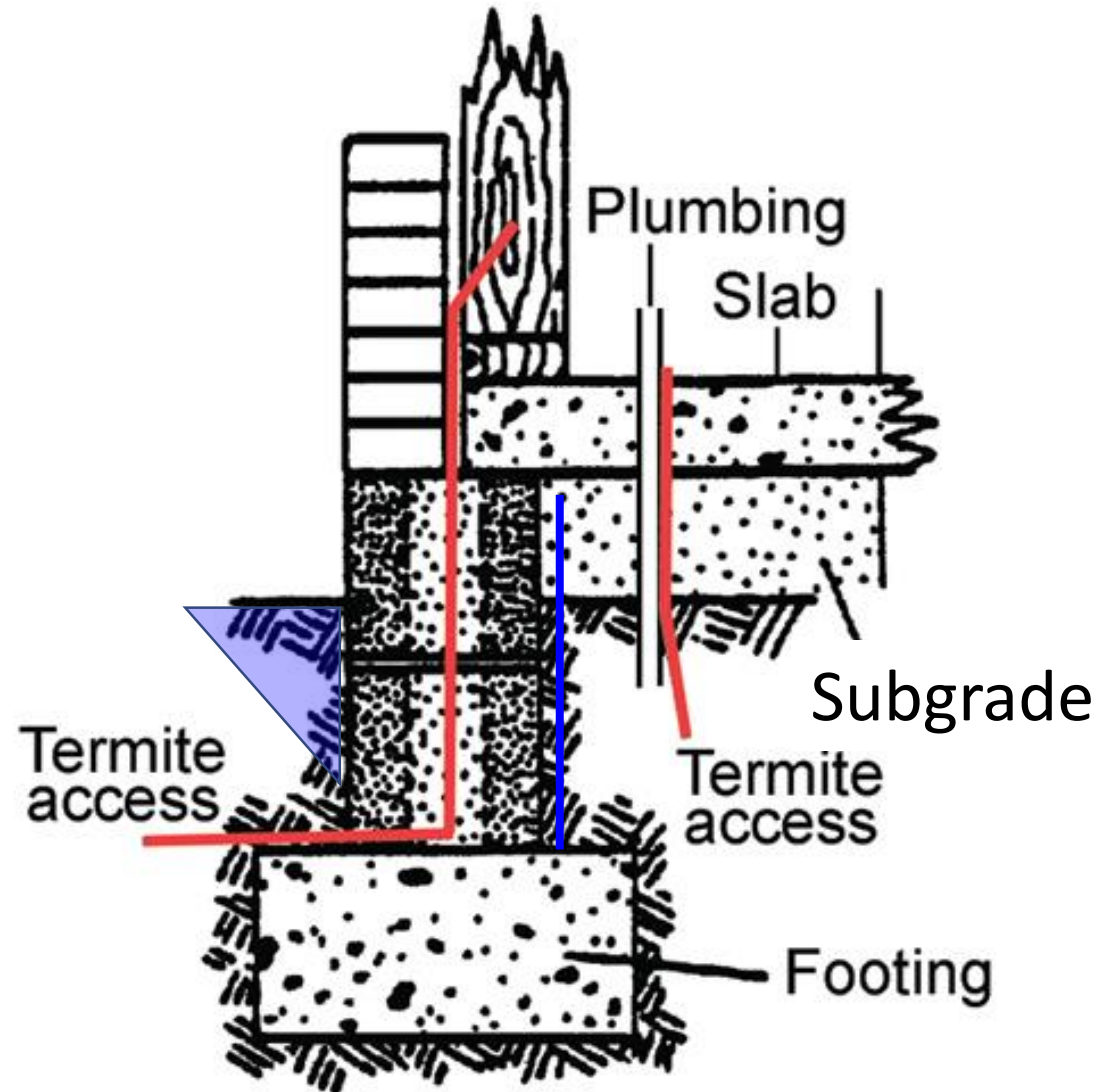
How Termites Enter: Monolithic (more single family)



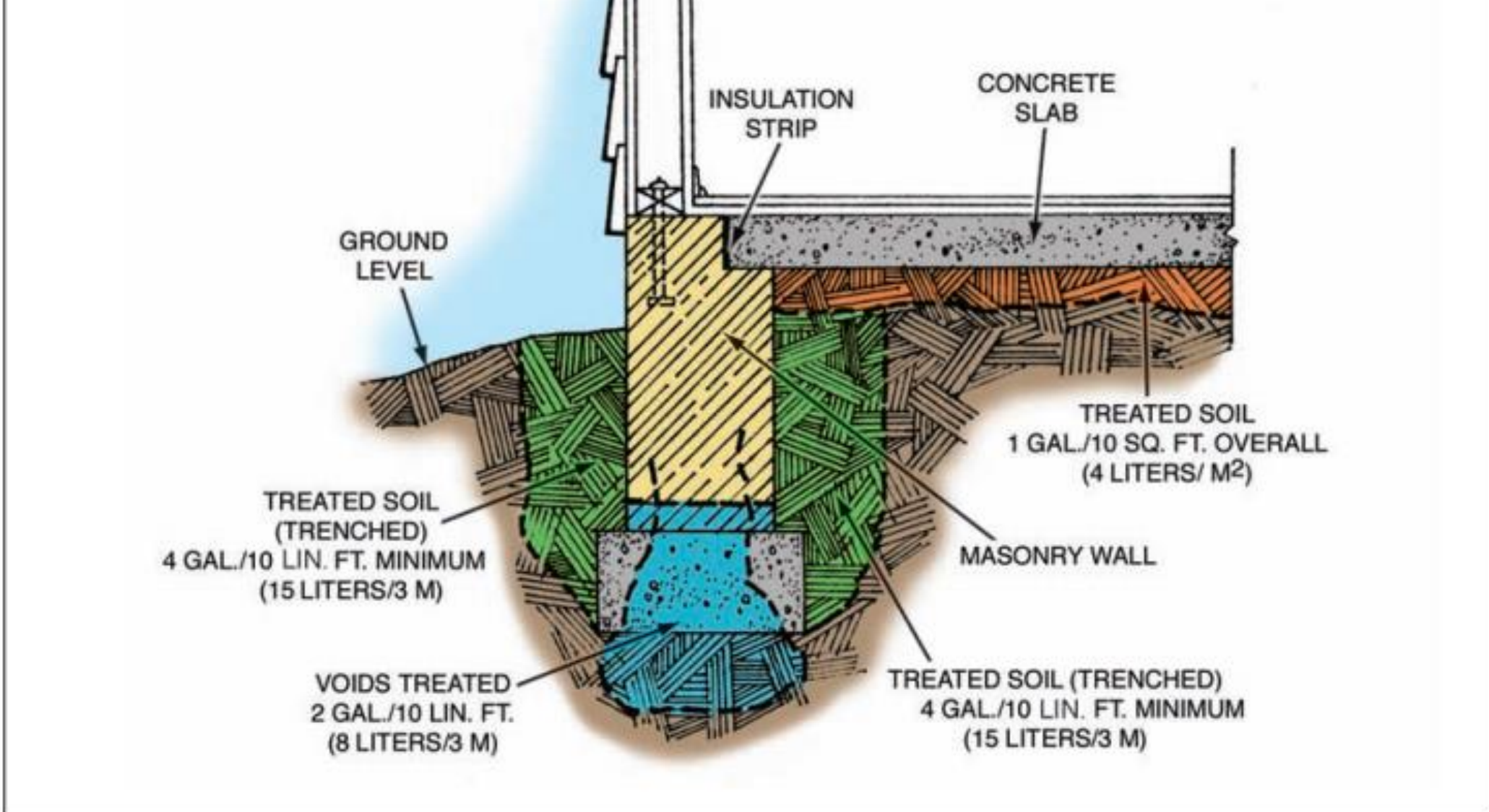
How Termites Enter: Floating Slab



How Termites Enter: Supported Slab



Soil Termiticide Treatment Areas



Soil Termiticide Treatment

Usually Several Hundreds of Gallons

Monolithic slabs

- 1 gallon per 10 ft²
 - + 4 gallons per 10 linear feet per foot of depth around perimeter

Supported or floating slabs

- 1 gallon per 10 ft²
 - + 4 gallons per 10 linear feet per foot of depth inside perimeter of stem wall (concrete block walls)
 - + 2 gallons per 10 linear feet for block voids
 - + 4 gallons per 10 linear feet per foot of depth around outside perimeter



1816.1.2 TERMITE PROTECTION

“If soil treatment is used for subterranean termite prevention, soil area disturbed after initial chemical soil treatment shall be retreated with a chemical soil treatment, including spaces boxed or formed.”

Moving plumbing and adding bay windows, etc.



Soil Termiticide Treatment



Any disturbance to the treated soil can displace the termiticide. Even the simple act of laying out and moving the hose for treatment has to be thought out.

1816.1.3 TERMITE PROTECTION

“If soil treatment is used for subterranean termite prevention, space in concrete floors boxed out or formed for the subsequent installation of plumbing traps, drains or any other purpose shall be created by using plastic or metal permanently placed forms of sufficient depth to eliminate any planned soil disturbance after initial chemical soil treatment.”

=DO NOT DISTURB SOIL AFTER TREATMENT

1816.1.4 TERMITE PROTECTION

Use a vapor barrier after treatment

“If soil treatment is used for subterranean termite prevention, chemically treated soil shall be protected with a minimum 6 millimeter **vapor retarder** to protect against rainfall dilution. If rainfall occurs before vapor retarder placement, retreatment is required. Any work, including placement of reinforcing steel, done after chemical treatment until the concrete floor is poured, shall be done in such manner as to avoid penetrating or disturbing treated soil.”



Use care not to create any holes in the material

1816.1.5 TERMITE PROTECTION

Remove overpour

“If soil treatment is used for subterranean termite prevention, concrete overpour or mortar accumulated along the exterior foundation perimeter shall be removed prior to exterior chemical soil treatment, to enhance vertical penetration of the chemicals.”



Concerns with Liquid Termiticides

Use of many gallons of chemicals to treat a structure

Longevity questions

- Soil type, climate, etc

Can't be used in certain situations

- Wells
- Low lying areas
- Areas subject to high moisture



1816.1.7 TERMITE PROTECTION

“If a registered termiticide formulated and registered as a bait system is used for subterranean termite prevention, Sections 1816.1.1 through 1816.1.6 do not apply; however, a signed contract assuring the installation, maintenance and monitoring of the [baiting system](#) that is in compliance with the requirements of Chapter 482, *Florida Statutes* shall be provided to the building official prior to the pouring of the slab, and the [system must be installed prior to final building approval](#). If the baiting system directions for use require a monitoring phase prior to installation of the pesticide active ingredient, the installation of the monitoring phase components shall be deemed to constitute installation of the system.”



Situations Where Baiting Systems May Be Preferred

Close proximity to wells

High water tables

Concerns about chemicals

Situations:

- Where termiticides may wash away
- Resulting from poor construction practices
- Where pets and vertebrate pests may dig
- Where soil will be disturbed by landscape or irrigation system installation and maintenance

Subterranean Termite Baits

- Low impact approach
- Highly selective
- Requires no drilling in concrete
- Control can often be achieved without entering the structure
- Uncertain of efficacy in multi-story buildings
- Possible to use “above ground” bait
- Not effective against *Nasutitermes* or drywood termites

Why Bait? Challenging Building Construction

Rigid foam board below grade

Foam insulation to the third floor with FST infestation

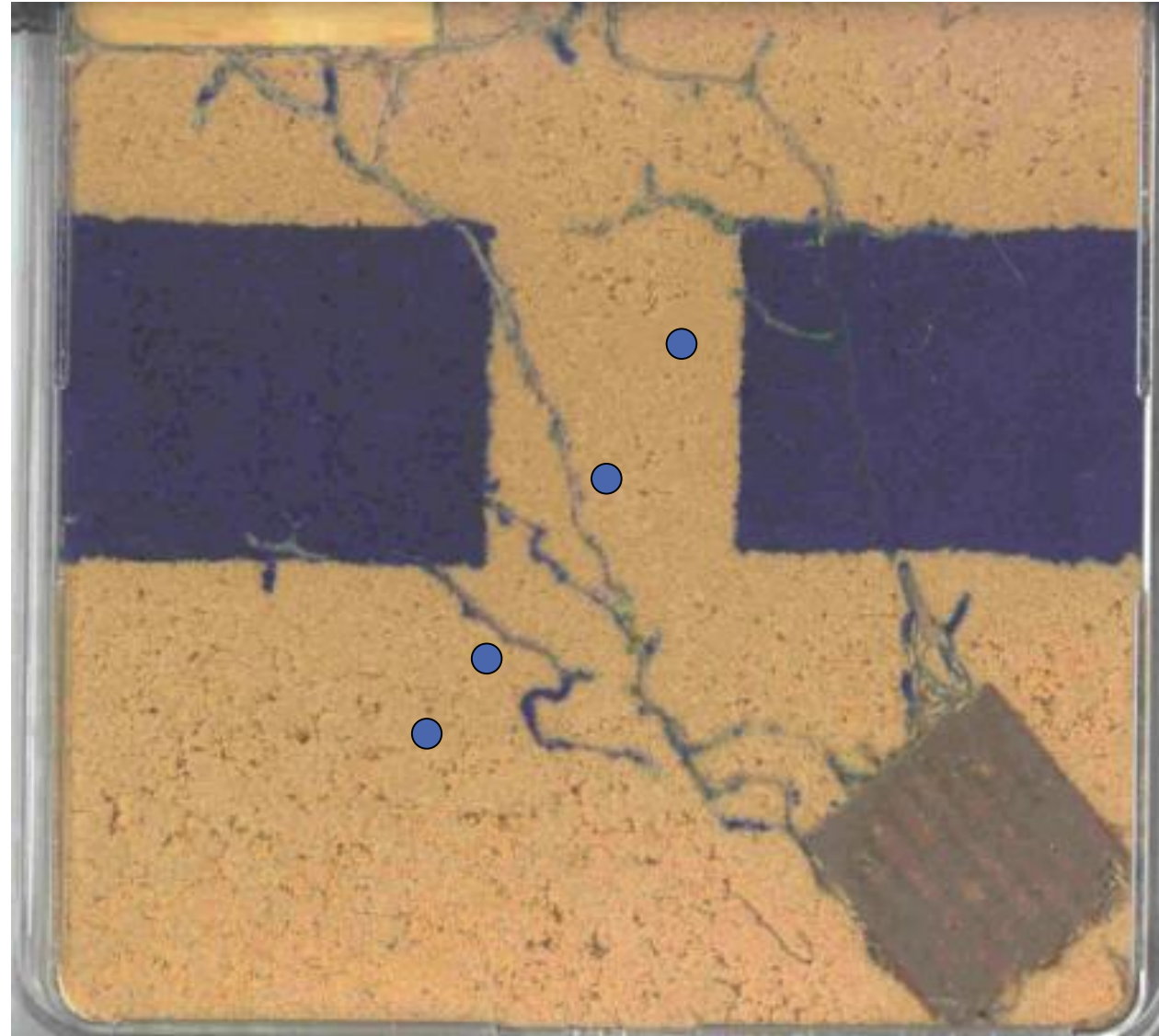
Rationale: If termites are not in an area, structures are not as risk



Disadvantages of Baits

Success also depends on skills and dedication of the technician for installing, monitoring, baiting, and maintaining the bait station

On-going cost of maintaining the system



If bait stations are placed in areas of “conductive condition,” more stations are “hit” and faster.

1816.1.8 TERMITE PROTECTION

“If a registered termiticide formulated and registered as a wood treatment is used for subterranean termite prevention, Sections 1816.1.1 through 1816.1.6 do not apply. Application of a **wood treatment** termiticide shall be as required by label directions for use, and must be completed prior to final building approval. **Changes in framing or additions to framing in areas of the structure requiring treatment that occur after the initial wood treatment must be treated prior to final building approval.**”



Borate-Containing Compounds

Disodium octaborate tetrahydrate (DOT)

- Similar to boric acid
- Acts as a stomach poison
- Termites will generally avoid wood that has been treated with borate compounds
- Treatment methods include penetrating (sometimes referred to as borate pressure treated or industrial) and topical
- Includes borate-containing compounds like Bora-Care
 - Bora-care is the only borate approved for new construction in Florida

Challenges with borates



The “newest” termite species in Florida that does not respond to baits and borates



Nasutitermes corniger

Habitat and tunneling behavior



Physical Barriers

Barrier prevents termite penetration

Termi-mesh

- corrosion-resistant stainless steel

Must be installed at time of construction



1816.2 Penetration

“Protective sleeves around piping penetrating concrete slab-on-grade floors shall not be of cellulose-containing materials. If soil treatment is used for subterranean termite protection, the sleeve shall have a maximum wall thickness of 0.010 inch, and be sealed within the slab using a noncorrosive clamping device to eliminate the annular space between the pipe and the sleeve. **No termiticides shall be applied inside the sleeve.**”



Table of Possible Control Methods for Wood Frame Construction

Method	Subterranean	Drywood	Decay Fungi	Longevity	Comments
Soil termiticide	Yes	No	No	2 to 15+ years	Math
Baits	Yes	No	No	4 to 7+ years to indefinitely as long as system is maintained	Relying on termite foraging
Wood treatment	Treated areas only	Treated areas only	Treated areas only	10+ years; inorganic salt	Can be used to meet 2304.12 on wood-decay
Physical barriers	Yes	No	No	10+ years	QA? Could be excellent option for larger structures; \$\$

Best practices: Use more than one method in conjunction with good building practices. Eliminate debris, no wood-to-ground contact, hidden access, moisture

1403.8 PERFORMANCE REQUIREMENTS

“In order to provide for inspection for termite infestation, clearance between exterior wall coverings and final earth grade on the exterior of a building shall not be less than 6 inches (152 mm)...”



1403.8 PERFORMANCE REQUIREMENTS

Despite exceptions, it is better to keep an inspection space

- **Exceptions:**
- Paint or decorative cementitious finish less than $\frac{5}{8}$ inch (17.1 mm) thick adhered directly to the masonry foundation sidewall.
- Access or vehicle ramps which rise to the interior finish floor elevation for the width of such ramps only.



1403.8 PERFORMANCE REQUIREMENTS

Despite exceptions, it is better to keep an inspection space

- **Exceptions:**
- A 4-inch (102 mm) inspection space above patio and garage slabs and entry areas.
- If the patio has been soil treated for termites, the finish elevation may match the building interior finish floor elevations on masonry construction only.



1503.7 Protection against decay and termites

“Condensate lines and roof downspouts shall discharge at least 1 foot (305 mm) away from the structure sidewall, whether by underground piping, tail extensions, or splash blocks...”



1503.7 Protection against decay and termites

“...Gutters with downspouts are required on all buildings with eaves of less than 6 inches (152 mm) horizontal projection except for gable end rakes or on a roof above another roof.”



Termite Problem Areas

Roofs and Gutters

Complex roofs and improper flashing

- Trap water
- Contribute to leaks

Downspouts directed close to building

- Rainwater erodes treated soil
- Moisture degrades termiticides



Termite protection language in

Chapter 23 Wood—Use naturally durable or *preservative-treated wood*

2304.12 Protection against decay and termites.

2304.12.1.1 Joists, girders and subfloor.

2304.12.1.2 Wood supported by exterior foundation walls.

2304.12.1.3 Exterior walls below grade.

2304.12.1.4 Sleepers and sills.

2304.12.1.5 Wood siding

2304.12.2 Other locations.

2304.12.2.1 Girder ends.

2304.12.2.2 Posts or columns.

2304.12.2.3 Supporting member for permanent appurtenances.

2304.12.2.4 Laminated timbers....

2304.12.8.1 Foam-plastic insulation

“...In order to reduce chances of termite infestation, no wood, vegetation, stumps, dead roots, cardboard, trash, or other cellulose-containing material shall be buried on the building lot within 15 feet (4.6 m) of any building or the position of any building proposed to be built.” (Similar language in 2304.12.9 Preparation of building site and removal of debris)



Termite protection language in

Chapter 26 Plastic—Use an approved method of protecting foam plastic

2603.8 Protection against termites.

2612.4 Termite and decay resistance.

2603.8 Protection against termites

“In Florida, extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be not less than 6 inches (152 mm)...”



2612.4 Termite and decay resistance

Build with termite resistant materials

“Plastic composites containing wood, cellulosic or any other biodegradable materials shall be termite and decay resistant as determined in accordance with ASTM D7032.”

SECTION 2114 TERMITE INSPECTION

2114.1 Cleaning

“Cells and cavities in masonry units and air gaps between brick, stone or masonry veneers and the structure shall be cleaned of all nonpreservative treated or nonnaturally durable wood, or other cellulose-containing material prior to concrete placement.”

Soil Termiticides are Applied in an Imperfect World so
We Need to be as Thorough as Possible



2114.2 Concrete bearing ledge

“Brick, stone or other veneer shall be supported by a concrete bearing ledge at least equal to the total thickness of the brick, stone or other veneer, which is poured integrally with the concrete foundation.

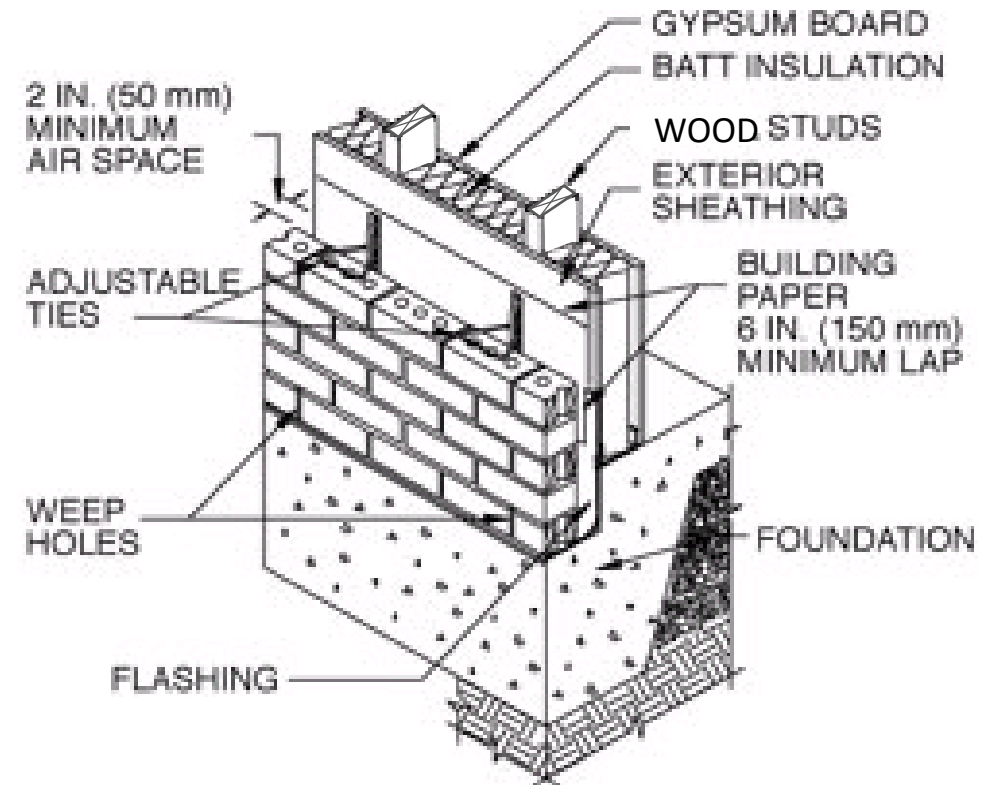
No supplemental concrete foundation pours which will create a **hidden** cold joint shall be used without supplemental treatment in the foundation unless there is an approved physical barrier...



2114.2 Concrete bearing ledge

“...An approved physical barrier shall also be installed from below the wall sill plate or first block course horizontally to embed in a mortar joint.

If masonry veneer extends below grade, a termite protective treatment must be applied to the cavity created between the veneer and the foundation, in lieu of a physical barrier.”



Lessons from the Field:

I asked for feedback from PMPs

Summary of comments: “Moisture drainage wall cladding systems on wood sheathing, either stucco or fiber cement board. spray foam insulation on roof decks, walls or floors. crawlspace encapsulation with plastic or foam. poor drainage on most new construction lots (in my area). 4-inch slabs (we're barely out of the dirt) and at grade once we sod/mulch. stem wall construction using BoraCare as the primary pre-construction treatment. Ventilated soffits (vinyl or metal). Louvered gable end vents. 5-inch gutters attached directly to the fascia. landscaping codes requiring trees/shrubs against the structure. HERS ratings which promote everything but ventilation (we have no way to dry our homes when they get wet from our sealants and AC systems). I'll work on Chapter 2 tomorrow – lol.”

The Hot Topic: Spray Foam and Termites



Photo: B.L. Thorne

Borates are “not a viable treatment option” for *Nasutitermes* spp. (Peters and Fitzgerald 2006)

2/19/2019

Spray Foam Makes Wood Construction More Attractive in Florida | SBC Magazine

Spray Foam Makes Wood Construction More Attractive in Florida

stronger in hurricanes and more resistant to termites. Homeowners are finding out that hurricanes don't discriminate — they destroy and damage block homes, too. Plus, termites will still burrow through the crack of concrete and destroy your home. Given that wood frame construction is the predominant method of residential construction throughout the country, old paradigms for concrete are fading.



The switch from masonry construction to wood frame construction has little to do with the debate on which method is stronger or more termite resistant. With **borate lumber, the termite issue is resolved**, and new highly-engineered wood connectors make most wood structures amazingly strong. In fact, wood construction is preferred by many in earthquake zones. Plus, with spray foam insulation and opportunities to increase traditional insulation, wood framing has been found to be more energy efficient and environmentally friendly. **The switch is precipitated by saving time and money.**

The same reasons that made termite control a challenge are true today

- Florida is a “visual and accessible” state
- Spray foam obscures evidence of termites





Conducive Conditions

Moisture...is the root of all evil (infestations)



Conducive Conditions

Then Lack of Access (Obscuring Inspection Space)



Conducive Conditions Poor Design





Inspection space preferred

Conducive conditions

And the termite company knew it



Termite Problem Areas

Windows

Windows with inadequate or no flashing

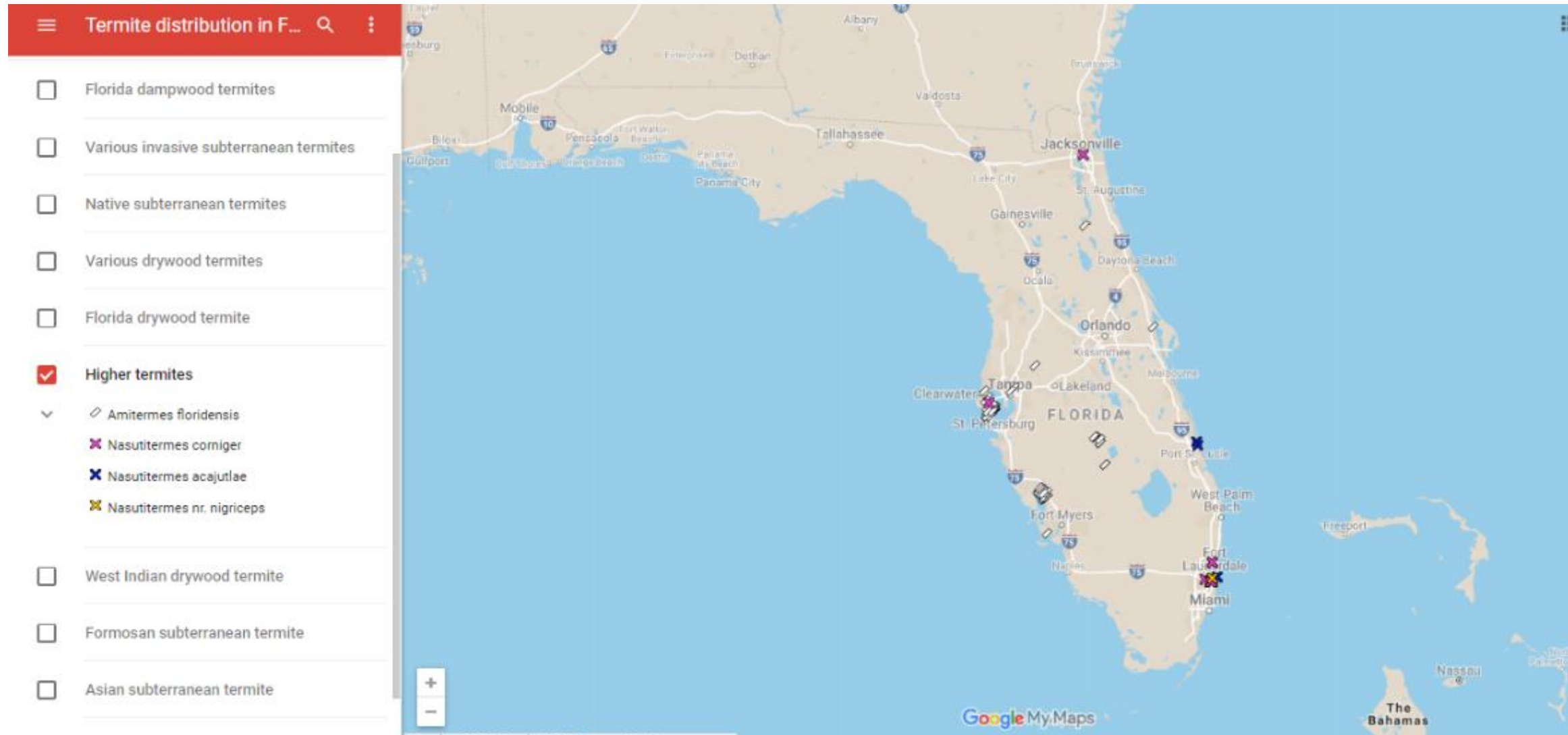
- Allows moisture to seep in

Windows with top moldings

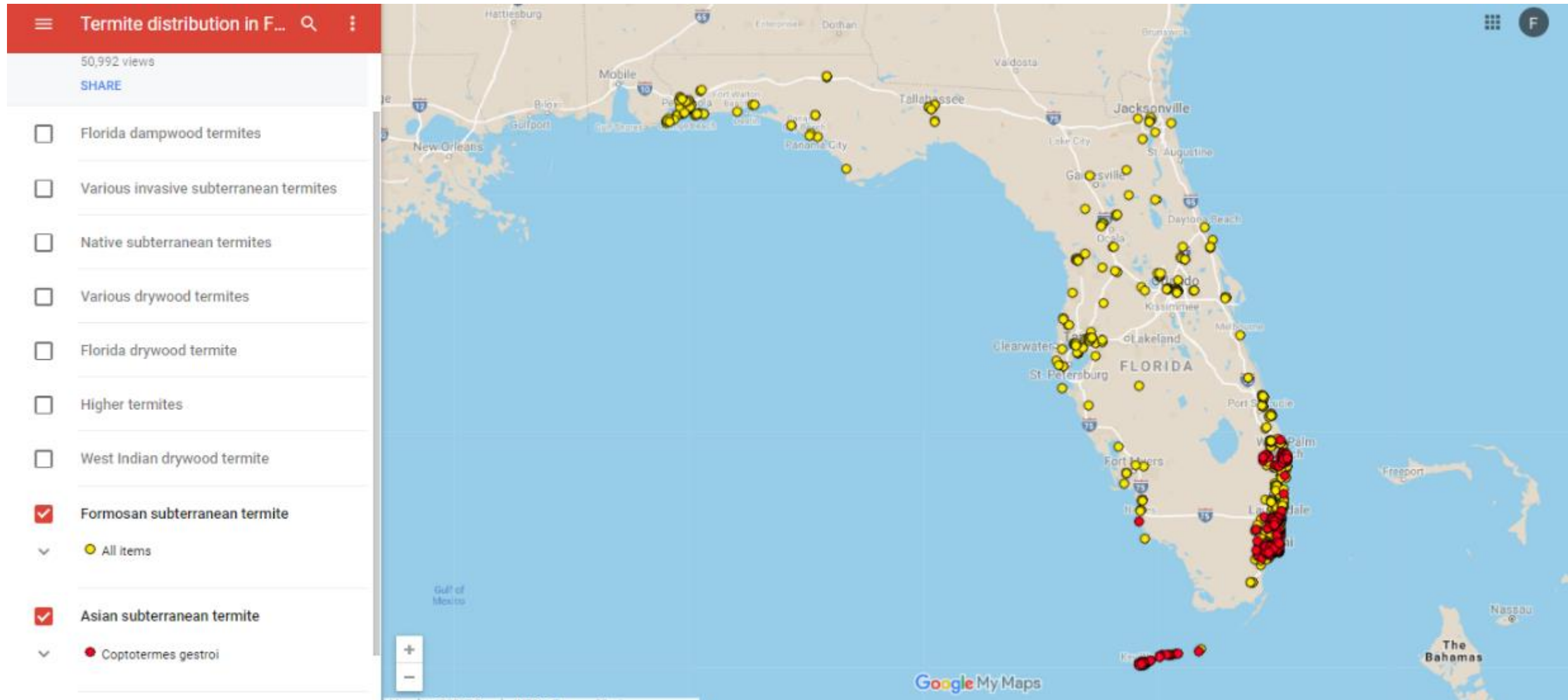
- Act as ledges to catch water



Distribution of *Nasutitermes corniger*



Distribution of *Coptotermes* spp.



Borates—can be a helpful “add-on”



Florida allows borates as a stand-alone, new construction treatment. Most states do not allow borates as a stand-alone. Be aware!

Spray Foam Insulation & Pest Management

The Georgia Structural Pest Control Commission (SPCC) serves the public by adopting regulations and policy to protect the health, safety and welfare of the citizens of Georgia. As part of their mission, the SPCC works with GDA to educate the public about structural pest management. This document was created to provide a background on spray foam insulation and issues related to pest management.

Reference – Polyurethane Spray Foam Insulation (PSFI)

The following is important information for Georgia consumers related to *Polyurethane Spray Foam Insulation*.

The Georgia Department of Agriculture **does not** regulate Polyurethane Spray Foam Applicators, but is responsible for regulating the Pest Management Industry in Georgia. The **Pest Management Industry has noticed an increase in PSFI installations** in the State of Georgia during routine inspections for wood destroying organisms and have brought this to the attention of the SPCC. **This publication is an effort to inform consumers how PSFI products may adversely impact the ability to inspect for and control termites, carpenter ants, wood boring beetles, and other pests including rats and mice.**

If you are considering the installation of PSFI or have already installed this product, we urge you to read the following information to understand the potential impact on your home's structural integrity.



Georgia Dept. of Agriculture Consumer Notice

- The Georgia SPCC does not regulate PSFI, but it is “responsible for regulating the Pest Management industry in Georgia.”
- To inform consumers “how PSFI may adversely impact the acility to inspect for and control termites, carpenter ants, wood boring beetles, and other pests including rats and mice.”

Rodent rub marks
Photo: B. Williams





Challenges
for
termite/WDO
control and
building
construction
will continue

Solutions will
evolve...**So**
what to do?

Termite prevention recommendations haven't really changed in ~85 years (and neither have the termites...but can we...)

Do:

- Decrease moisture
- Keep an ample inspection space
- Decrease guidelines, including plant roots leading to foundation; siding below grade, pipes and conduits
- Eliminate wood in contact with ground

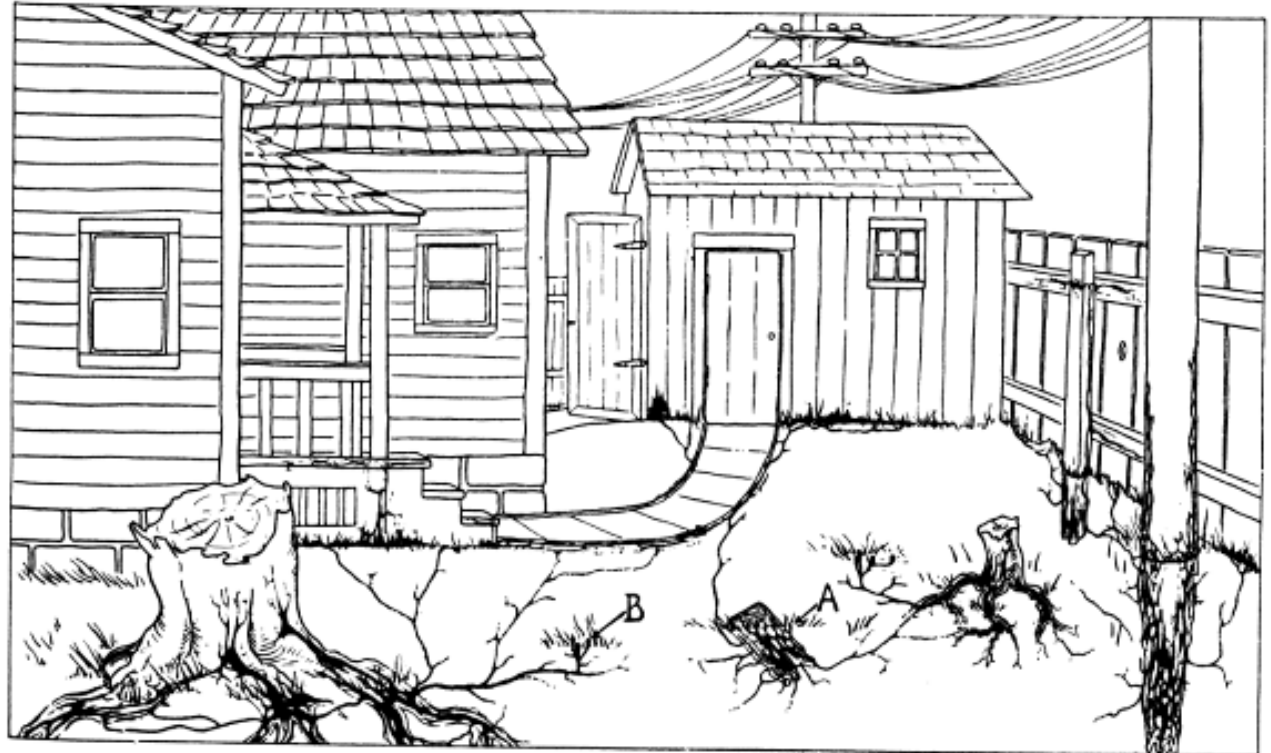


Fig. 50. This sketch combines the sorts of conditions found to prevail in many localities where wood has been improperly used. Unprotected wood in or on the ground makes possible both settlement and rapid increase of the subterranean termites. Workings in stumps, poles, posts, sidewalks, and wood of buildings are shown in black, as are the galleries within the earth. *A* marks the supposed original point of entry of one of the colonizing pairs, and *B* the points of emergence of swarming alates at the proper season.

From 1934 publication (Kofoid)

> QUESTIONS?

This concludes The American Institute
of Architects Continuing Education
Systems Course

Faith Oi

University of Florida, Entomology and
Nematology Dept

foi@ufl.edu