A Guide to the Inspection of Existing Homes

for Wood-Inhabiting *Fungi* and. Insects

A Guide to the Inspection of Existing Homes for Wood-Inhabiting *Fungi* and Insects

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Contents

Tree species can be divided into hardwoods, which generally lose their leaves in the winter, and softwoods, which are usually evergreen. Oak, ash. hickory, and aspen are common hardwoods. Pine, hemlock, fir, and redwood are common softwoods. The terms hardwood and softwood do not refer to the hardness of the wood.

The wood of most trees consists of a light-colored outer band, the sapwood, and a darker-colored inner portion. the heartwood. The sapwood of all species is susceptible to attack by fungi and insects. The heartwood of some species is partially resistant. Examples of species with resistant heartwood are redwood, cedar, cypress, and black locust. These are becoming more difficult to obtain as we harvest younger trees, and are becoming more variable in their resistant quality. Consequently, the use of these woods is not recommended where there is a high risk of decay. Wood pressure-treated with preservative chemicals should be used in such situations.

At first sight. wood appears to be a very solid material. However, it is made up of many tiny tubes which make it very porous. If a piece of oven-dried wood is left in a room, it will pick up moisture from the air. The moisture is attracted to the walls of the tubes which make up the wood. As the walls absorb moisture, the wood swells. If the humidity is kept at 100 percent, the walls become saturated with water. The moisture content at which this occurs is the fiber saturation point: approximately 30 percent by weight for most species used in construction. Fungi will only decay wood with a moisture content above the fiber saturation point. To allow a safety margin, we say that wood with a moisture content above 20 percent is susceptible to decay. Wood in properly constructed houses seldom will have a moisture content above 16 to 18 percent. Thus, wood will only decay if it is in contact with the ground or wetted by an external source of moisture: for example. rain seepage. plumbing leaks, or condensation. Dry wood will never decay. Also, the drier the wood, the less likely it is to be attacked by most types of wood-inhabiting insects.

Wood-inhabiting fungi are small plants which lack chlorophyll and use wood as their food source. Some fungi use only starch and proteins in the wood and don't weaken it. Others use the structural components, and as they grow they weaken the.wood. which eventually becomes structurally useless. All fungi require moisture, oxygen. warmth, and food. The keys to preventing or controlling growth of fungi in wood in buildings are to either keep wood dry (below a moisture content of 20 percent) or to use preservative-treated or naturally-resistant heartwood. For detailed recommendations on selection of preservative-treated or naturally-resistant wood to prevent decay. see Appendix 1.

Wood-inhabiting insects can be divided into those which use wood as a food material — termites and wood-boring beetles, for example, and those which use it for shelter — carpenter ants and bees, for example. For termites, damage is caused by immature forms called nymphs and by mature forms called workers; for wood-boring beetles, by larvae or grubs; and for ants and bees, by adult insects. Pressure-treated wood is resistant to attack by all the insects. Other prevention and control techniques depend on the type of insect, and are described with the respective insect later in the guide.

Some wood-inhabiting organisms are found in all parts of the country. Others are highly localized. Some, although common. cause very little structural damage. The following section describes the major wood-inhabiting organisms, giving their geographic distribution and noting the parts of the house where they commonly occur. It must be stressed that these distribution data are approximate. Particular organisms will, on occasion, occur outside the marked geographic range. There may also be localized areas inside the marked ranges where they do not occur. The data on frequency of occurrence in different parts of the house indicate the part of the house where a particular organism is most commonly found. The data do not give the number of houses in an area where that type of organism occurs. Finally. typical damage caused by each organism is illustrated and described in the text. Use of this section of the guide will assist the inspector in knowing which organisms to expect in an area.

Surface Molds & Sapstain Fungi

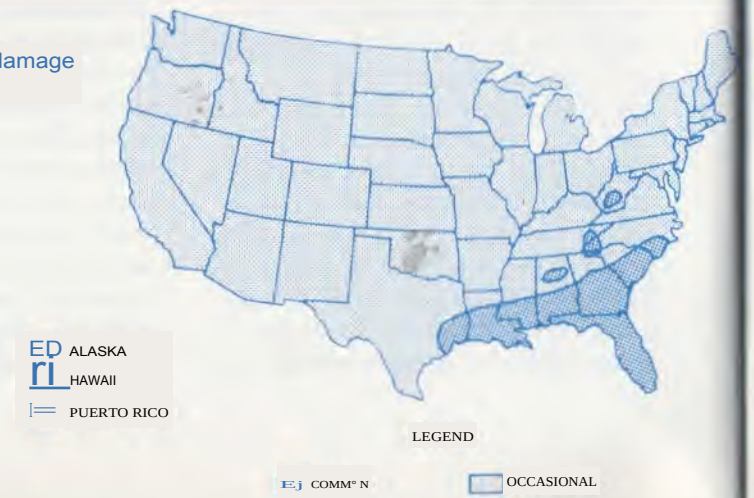
Figure 3. Sapstain fungi in pine sapwood

Surface molds or mildew fungi discolor the surface of wood, but do not weaken it. They are generally green, black, or orange, and powdery in appearance. The various building codes allow the use of framing lumber with surface molds or mildew, providing that the wood is dry and not decayed. Spores (or seeds) of surface molds or mildew fungi grow quickly on moist wood, or on wood in very humid conditions. They can grow on wood before it is seasoned, when it is in the supplier's yard or on the building site. or in a finished house. When the wood dries, the fungi die or become dormant, but they do not change their appearance. Thus, wherever surface molds or mildew fungi are observed on wood in a building it is a warning sign that *at some time* the wood was moist. or humidity was high. Surface molds and mildew fungi are controlled by eliminating the source of high humidity or excess moisture, for example by repairing leaks. improving ventilation in attics or crawl spaces, or installing soil covers. Before taking corrective action, the source of moisture which allowed fungus growth must be determined. **If the wood is dry and the sources of moisture are no longer present, no corrective action need be taken.**

Figure 4. Surface molds on plywood in attic

Sapstain or bluestain fungi are similar to surface molds, except that discoloration goes deep into the wood. They color the wood blue, black, or gray and do not weaken it. They grow quickly on moist wood and do not change their appearance when they die or become dormant. They usually occur in the living tree, or before the wood is seasoned, but sometimes in the supplier's yard, on the building site, or in a finished house. In the latter case they are normally associated with rain seepage or leaks. Stain fungi are a warning sign that at some time the wood was moist. Control is the same as for surface molds or mildew fungi.

Figure 1. Incidence of damage in the United States



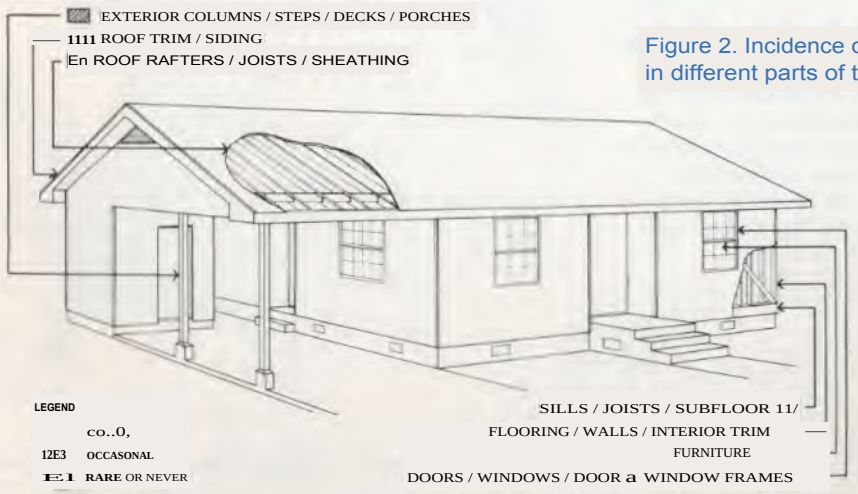


Figure 2. Incidence of damage in different parts of the house

Brown & White Rot

Figure 7. White rot, with black zone lines sometimes found in the early stages of decay

Brown and white rot are caused by fungi which decay wood and reduce its strength. The fungi often produce a whitish, cottony growth on the surface of wood. They grow only on moist wood. The fungi can be present in the wood when it is brought into the house, or can grow from spores which are always present in the air and soil. Wood attacked by these fungi should not be used in construction.

Wood decayed by brown-rot fungi is brittle and darkened in color. As decay proceeds. the wood shrinks, twists, and cracks perpendicular to the grain. Finally, it becomes dry and powdery. Brown rot is the commonest type of decay found in wood in houses.

Wood decayed by white-rot fungi is fibrous and spongy. and is bleached in color. Sometimes it has thin, dark lines around decayed areas. The wood does not shrink until decay is advanced.

Figure 8. Brown rot, with characteristic cracks across grain

The fungi can be controlled by eliminating the source of moisture which allows them to grow: for example, by improving drainage and ventilation under a house, repairing water leaks, or preventing water seepage. When the wood dries, the fungi die or become dormant. **Spraying wood with chemicals does not control decay.** If the moisture source cannot be eliminated, all the decayed wood should be replaced with pressure-treated wood.

Figure 5. Incidence of damage in the United States for untreated wood above ground. Untreated wood in contact with the ground, or wetted by condensation, plumbing leaks, rain seepage, irrigation water, etc., will decay in all parts of the country.

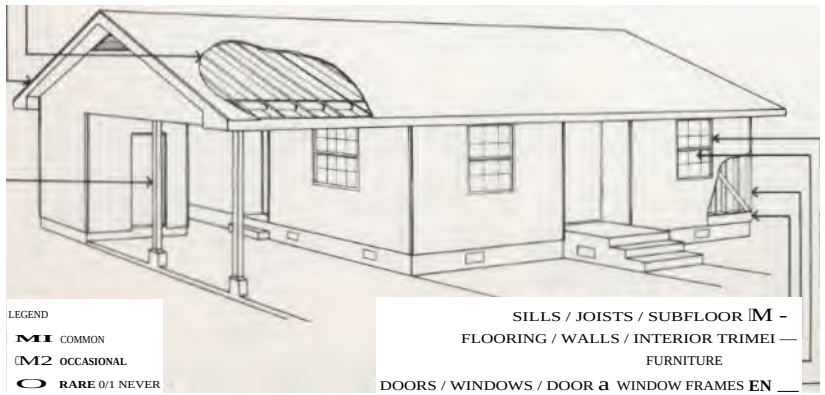
E..) ALASKA
EZ1 HAWAII
=1 PUERTO RICO

LEGEND

E:3 COMMON U OCCASIONAL RARE OR NEVER

IN EXTERIOR COLUMNS / STEPS / DECKS / PORCHES
Ma ROOF TRIM / SIDING
Ea ROOF RAFTERS / JOISTS / SHEATHING

Figure 6. Incidence of damage in different parts of the house



LEGEND
MI COMMON
M2 OCCASIONAL
O RARE 0/1 NEVER

SILLS / JOISTS / SUBFLOOR M –
FLOORING / WALLS / INTERIOR TRIMEI —
FURNITURE
DOORS / WINDOWS / DOOR a WINDOW FRAMES EN __

Water-conducting Fungi

Figure 11. Wood damaged by Poria, with apparently sound surface and severe rot below surface

Most decay fungi are able to grow only on moist wood and cannot attack adjacent dry wood. Two brown-rot fungi. ***Poria incrassata*** and ***Merulius iacrymans,*** **are** able to conduct water for several feet through root-like strands or rhizomorphs, moisten wood, and then decay it. These are sometimes called water-conducting or dry-rot fungi. They can decay wood in houses very rapidly, but fortunately they are quite **rare.** ***Poria incrassata*** is found most frequently in the Southeast and West. ***Merulius Iacrymans*** occurs in the Northeast. Both fungi can cause extensive damage in floors and walls away from obvious sources of moisture. Decayed wood has the characteristics of brown rotted wood except that the surface of the wood sometimes appears wavy but apparently sound, although the interior may be heavily decayed. The rhizomorphs which characterize these fungi can be up to an inch in diameter and white to black in color, depending on their

Figure 12. Rhizomorph of *Poria* growing from earth-filled porch

age. They can penetrate foundation walls, and often are hidden between wood members. The source of moisture supporting fungal growth must be found and eliminated to control decay. Common sources include water leaks and wood in contact with or close to the soil: for example, next to earth-filled porches or planters. Where the fungus grows from a porch. the soil should be removed from the porch next to the foundation wall to prevent continued growth of the fungus into the house. ***Poria incrassata*** normally occurs in new or remodeled houses and can cause extensive damage within 2 to 3 years.

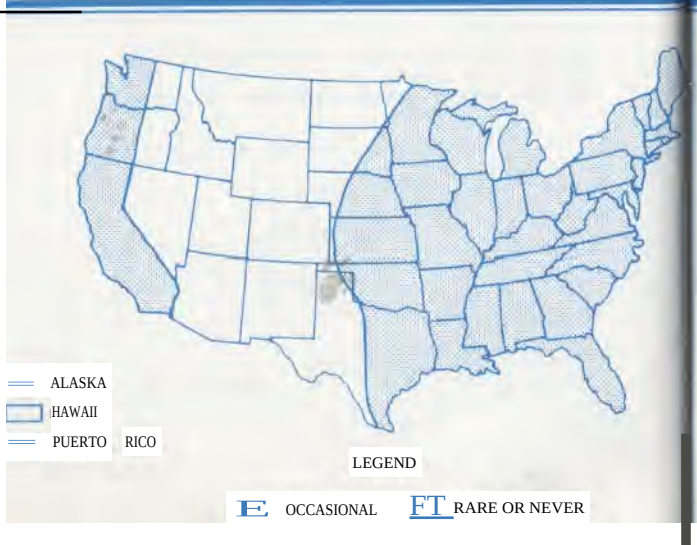


Figure 9. Incidence of damage in the United States

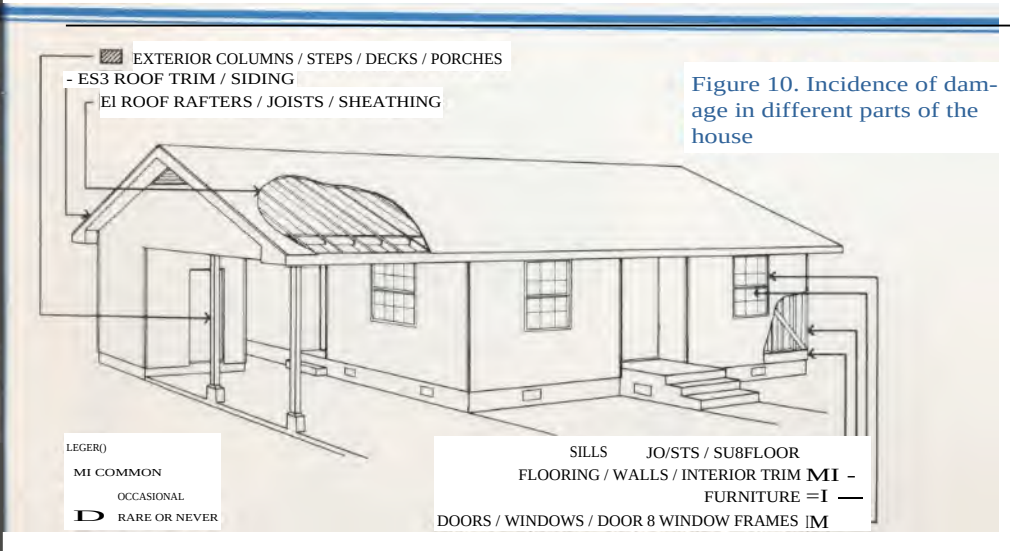


Figure 10. Incidence of damage in different parts of the house

White-pocket Rot

White-pocket rot is caused by a fungus which attacks the heartwood of living trees. Decayed wood contains numerous small, spindle-shaped white pockets filled with fungus. These pockets are generally 1/8 to 1/2 inch long. When wood from infected trees is seasoned, the fungus dies. Therefore, no control is necessary. White-pocket rot generally is found in softwood lumber from the West Coast.

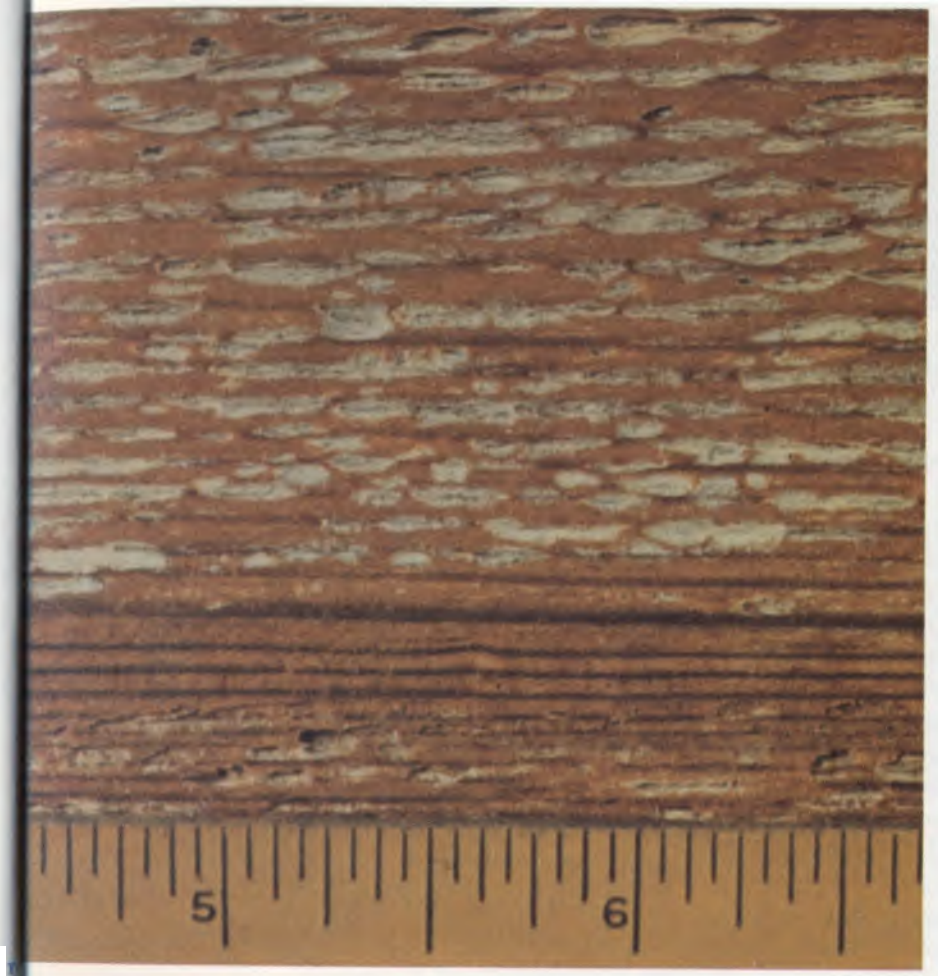
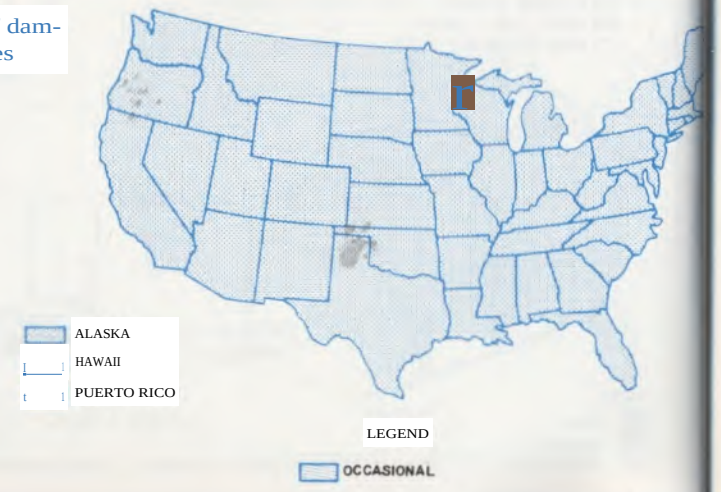


Figure 15. White-pocket

Figure 13. Incidence of damage in the United States



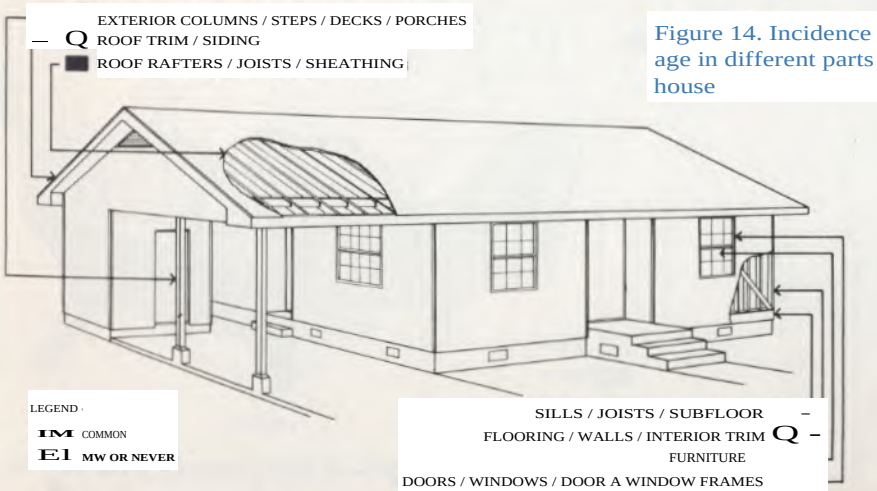


Figure 14. Incidence of damage in different parts of the house

Subterranean Termites

Subterranean termites normally damage the interior of wood structures. Shelter tubes are the commonest sign of their presence. Other signs include structural weakness of wood members, winged termites or swarmers, soil in cracks or crevices, and dark or blister-like areas on wood. The major characteristics of infested softwood when it is broken open are that damage is normally greatest in the softer springwood, and gallery walls and inner surfaces of shelter tubes have a pale, spotted appearance like dried oatmeal. The galleries often contain a mixture of soil and digested wood. Termites usually enter houses through wood in contact with the soil or by building shelter tubes on foundation walls, piers, chimneys, plumbing, weeds, etc.

Athough they normally maintain contact with the soil, subterranean termites can survive when they are isolated from the soil if they have a continuing source of moisture. Heavy damage by subterranean termites (except Formosans) does not normally occur within the first five to ten years of a house's life, although attack may start as soon as the house is built. Subterranean termites can be controlled most effectively by the use of chemicals in the soil and foundation area of the house. by breaking wood-soil contact, and by eliminating excess moisture in the house. For current information on control chemicals, the inspector should contact the extension entomologist at the local land-grant university, or a reputable pest control company.

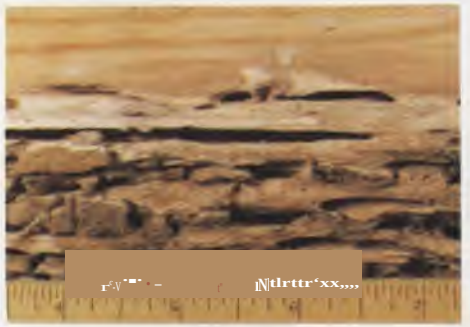


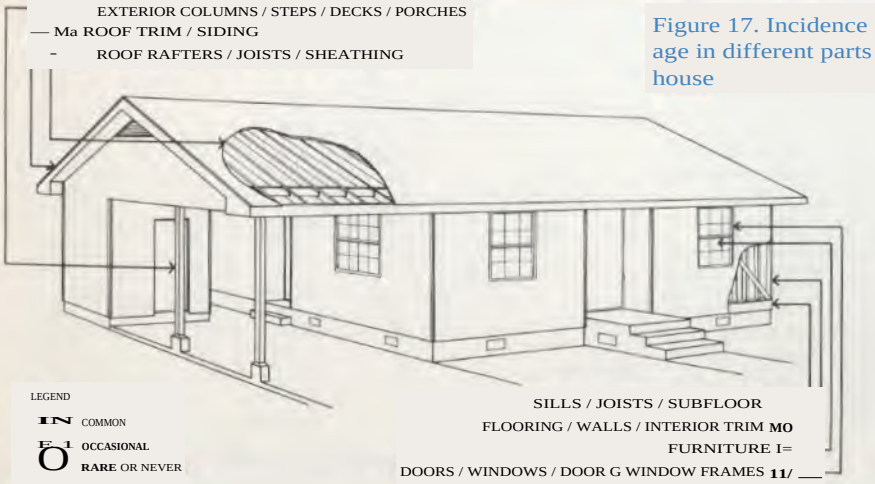
Figure 18A. Subterranean termite damage showing characteristic spotted appearance of the surface of the galleries, presence of soil in the damaged wood, and the preferential attack of the softer springwood

Figure 19. Subterranean termite shelter tubes on concrete block foundation wall

Figure 18B. Subterranean termite workers

Figure 16. Incidence of damage in the United States

Figure 17. Incidence of damage in different parts of the house



Formosan Subterranean Termites

Figure 22. Carton produced between studs by Formosan subterranean termites

Formosan subterranean termites are a particularly vigorous species of subterranean termite which has spread to this country from the Far East. They cause considerable damage in Hawaii and Guam and have been found in several locations on the United States mainland. It is anticipated that they could eventually become established along Southern Coasts, the lower East and West Coasts, in the lower Mississippi Valley, and in the Caribbean.

The most obvious characteristics which distinguish Formosan subterranean termite swarmers from those of native species are their larger size (up to 5/8 inch compared with 1/3 to 1/2 inch) and hairy wings (compared with smooth wings in other subterraneans). Soldiers have oval shaped heads, as opposed to the oblong and rectangular heads of native soldiers. Formosan termites also produce a hard material called carton which resembles sponge. This is sometimes found in cavities under fixtures, or in walls adjacent to attacked wood. Other characteristics — and control methods — are similar to those for native subterranean termites. However, Formosan subterranean termites are more vigorous, and can cause extensive damage more rapidly than do native species. For this reason Formosans should be controlled as soon as possible after discovery.

A

MM

B

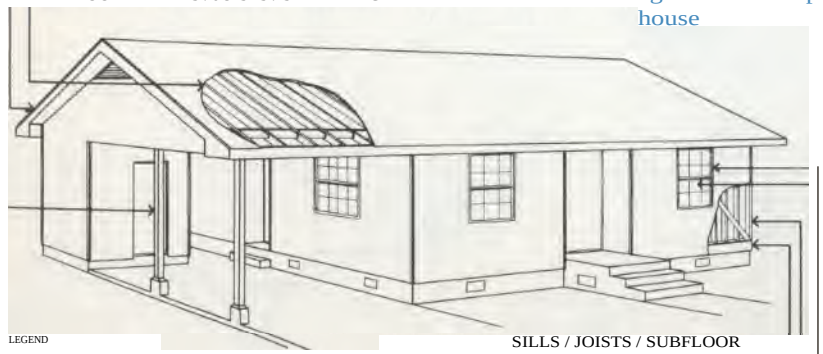
Figure 23. Head of native subterranean soldier (A) and a Formosan subterranean soldier (B)

Figure 20. Incidence of damage in the United States. The Formosan subterranean termite has spread to the United States from the Far East. It is common in Hawaii and the other Pacific Islands. It has been found in Texas, Louisiana, California, and South Carolina. It is thought that the insect may eventually become established along all Southern coasts, the lower East and West Coasts, in the lower Mississippi Valley, and in the Caribbean.

LEGEND

COMMON OCCASIONAL RARE OR NEVER

Figure 21. Incidence of damage in different parts of the house



Drywood Termites

Figure 26. Drywood termite damage showing pellets, large chambers of galleries in the interior of wood, and small "kick-holes" on the surface

It is quite common for houses to be infested by drywood termites within the first five years of their existence in southern California, southern Arizona, southern Florida, the Pacific area, and the Caribbean. Swarmers generally enter through attic vents or shingle roofs, but in hot, dry locations they can be found in crawl spaces. Window sills and frames are other common entry points.

Drywood termites live in wood that is dry. They require no contact with the soil or with any other source of moisture. The first sign of drywood termite infestation is usually piles of fecal pellets, which are hard, less than 1/25 inch in length, with rounded ends and six flattened or depressed sides. The pellets vary in color from light gray to very dark brown, depending on the wood being consumed. The pellets, eliminated from galleries in the wood through round "kick holes," accumulate on surfaces or in spider webs below the "kick holes." There is

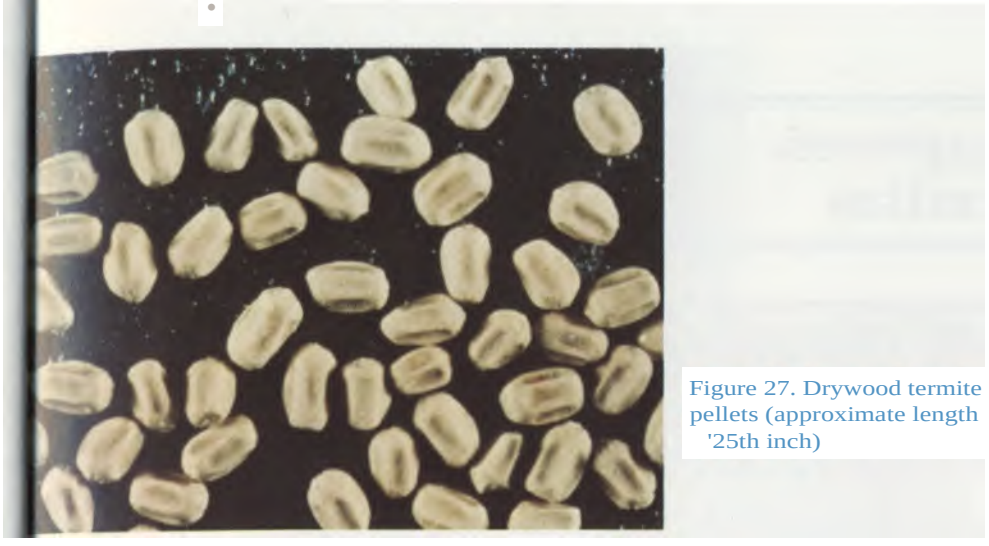


Figure 27. Drywood termite pellets (approximate length '25th inch)

very little external evidence of drywood termite attack in wood other than the pellets. The interior of damaged wood has broad pockets or chambers which are connected by tunnels that cut across the grain through spring- and summerwood. The galleries are perfectly smooth and have few if any surface deposits. There are usually some fecal pellets stored in unused portions of the galleries. Swarming is another sign of termite presence.

It normally takes a very long time for the termites to cause serious weakness in house framing. Damage to furniture, trim, and hardwood floors can occur in a few years. The choice of control method depends on the extent of damage. If the infestation is widespread or inaccessible, the entire house should be fumigated. If infestation is limited, spot treatment can be used, or the damaged wood can be removed.

Figure 24. Incidence of damage in the United States. Drywood termites can survive in furniture. Thus, they may be found occasionally in all regions of the country in furniture which has been imported from a region where the termites occur naturally

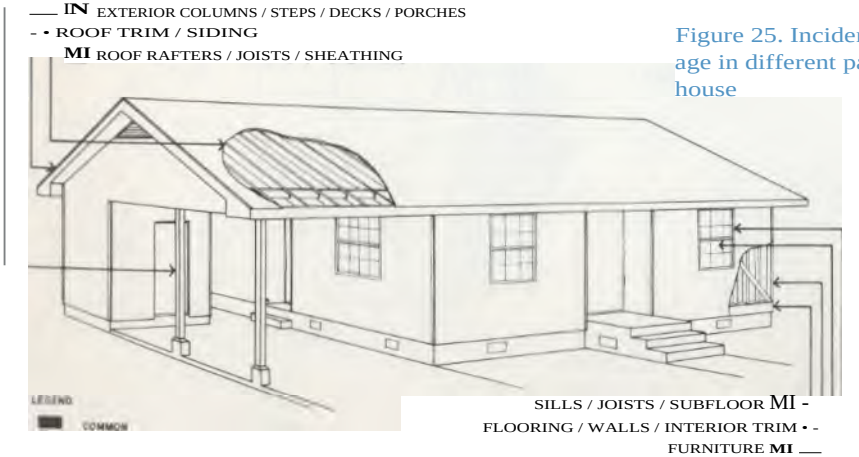


Figure 25. Incidence of damage in different parts of the house

Dampwood Termites

Figure 30A. Dampwood termite damage in one inch-thick board, showing some fecal pellets, the velvety appearance of the surface of the galleries, and the preferential attack of the softer springwood

Dampwood termites of the desert Southwest and southern Florida are rarely of economic importance in structures. Pacific Coast dampwood termites can cause damage greater than subterranean termites if environmental conditions are ideal.

Dampwood termites build their colonies in damp, sometimes decaying, wood. Once established. some species extend their activities to sound wood. They do not require contact with the ground, but do require wood with a high moisture content. There is little external evidence of the presence of dampwood termites other than swarmers or shed wings. They usually are associated with decayed wood. The appearance of wood damaged by dampwood termites depends on the amount of decay present. In comparatively sound wood, galleries follow the springwood. In decayed wood, galleries are larger and pass through both spring- and summerwood. Some are round in cross section, others oval. The surfaces of

Figure 30B. Dampwood termites

the galleries have a velvety appearance and are sometimes covered with dried fecal material. Fecal pellets are about 1/25 inch long and colored according to the kind of wood being eaten. Found throughout the workings. they are usually hard, and round at both ends. In very damp wood the pellets are often spherical or irregular, and may stick to the sides of the galleries.

Dampwood termites must maintain contact with damp wood. Therefore, they can be controlled by eliminating damp wood. Treatment of the soil with chemicals can also be used to advantage in some areas.

Figure 28. Incidence of damage in the United States

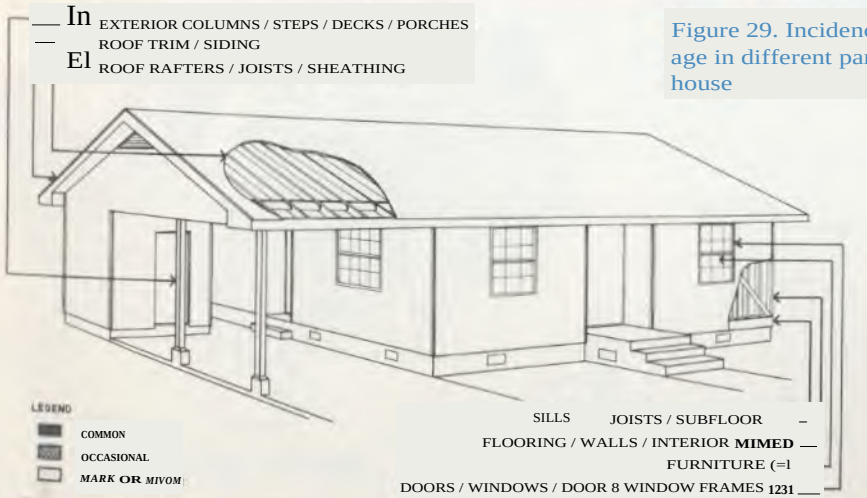


Figure 29. Incidence of damage in different parts of the house

Carpenter Ants

Figure 33A. Carpenter ant (approximate length 3/8 inch)

Larpenter ants burrow into wooa to make nests, and do not feed on the wood. They commonly nest in dead portions of standing trees, stumps, logs and sometimes wood in houses. Normally they do not cause extensive structural damage. Most species start their nests in moist wood that has begun to decay. They attack hardwoods and softwoods. The most obvious sign of infestation is the large reddish-brown to black ants, 1/4 to 1/2 inch long, inside the house. Damage occurs in the interior of the wood. There may be piles or scattered bits of wood powder (frass) which are very fibrous and sawdust-like. If the frass is from decayed wood, pieces tend to be darker and more square ended. The frass is expelled from cracks and crevices, or from slit-like openings made in the wood by the ants. It is often found in basements, dark closets, attics, under porches, and in crawl spaces. Galleries in the wood extend along the grain and around the annual rings. The softer springwood is removed first. The surfaces of the galleries are smooth, as if they had been sandpapered, and are clean. The most effective way to control carpenter ants is to locate the nest and kill the queen in colonies in and near the house with insecticides. It is sometimes also helpful to treat the voids in walls, etc. For current information on control, the inspector should contact the extension entomologist at his nearest land grant university, or a reputable pest control company.

Figure 33B. Carpenter ant damage showing clean galleries with a smooth surface, the preferential attack the softer springwood, and some brown rot on end grai

Figure 31. Incidence of damage in the United States

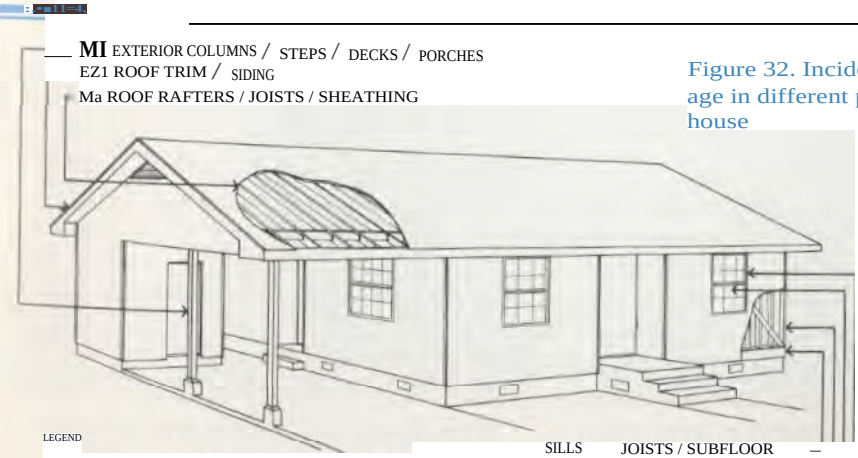


Figure 32. Incidence of damage in different parts of the house

Wood-boring Beetles, Bees, and Wasps

There are numerous species of wood-boring insects which occur in houses. Some of these cause considerable damage if not controlled quickly. Others are of minor importance and attack only unseasoned wood. Beetles, bees, and wasps all have larval, or grub, stages in their life cycles, and the mature flying insects produce entry or exit holes in the surface of the wood. These holes, and sawdust from tunnels behind the holes, are generally the first evidence of attack visible to the building inspector. Correct identification of the insect responsible for the damage is essential if the appropriate control method is to be selected. The characteristics of each of the more common groups of beetles, bees, and wasps are discussed following the table which summarizes the size and shape of entry or exit holes produced by wood-boring insects, the types of wood they attack, the appearance of frass or sawdust in insect tunnels, and the insect's ability to reinfest wood in a house.

To use the table, match the size and shape of the exit or entry holes in the wood to those shown in the table; note whether the damaged wood is a hardwood or softwood and whether damage is in a new or old wood product (evidence of inactive infestations of insects which attack only new wood will often be found in old wood: there is no need for control of these). Next, probe the -mine the appearance

Shape and size (inches) of exit/entry hole	Wood Type	Age of Wood Attacker	Appearance of *Frass in* Tunnels	Insect Type	Reinfesi
round 1/50-1/8	softwood & hard	new	none present	ambrosia beetles	no
round 1/32-1/16	hardwood	new & old	fine, flour-like. loosely packed	lyctid beetles	yes
round 1/16-3/32	bark/sapwood inte	new	fine to coarse. bark colored, tightly packed	bark beetles	no
round 1/16-1/8	softwood & hard	new & old	fine powder and pellets, loosely packed; pellets may be absent and frass tightly packed in some hardwoods	anobiid beetles	yes
round 3/32-9/32	softwood & hardy, o< (bamboo)		fine to coarse powder, tightly packed	bostrichid beetles	rarely
round 1/6-1/4	softwood	new	coarse, tightly packed	horntail or woodwasp	no
round 1/2	softwood	new & old	none present	carpenter bee	yes
round-oval 1/8-3/8	softwood & hard	new	coarse to fibrous, mostly absent	round-headed borer	no
oval 1/8-1/2	softwood & hard	new	sawdust-like, tightly packed	flat-headed borer	no
oval 1/4-3/8	softwood	new & old	very fine powder & tiny pellets, tightly packed	old house borer	yes
flat oval **1/2 or more or** irregular surface **groove 1/8-1/2 wide**	softwood & hardwo	new	absent or sawdust-like, coarse to fibrous; tightly packed	round or flat headed borer, wood machined after attack	no

of the frass. It should then be possible to identify the insect type. It is clear from the table that there is often considerable variation within particular insect groups. Where the

ins
pector is unsure of the identity of the insect causing damage, a qualified entomologist should be consulted.

New wood is defined as standing or freshly felled trees and unseasoned lumber.
Old wood is seasoned or dried lumber

Lyctid Powder-post Beetles

Lyctids attack only the sapwood of hardwoods with large pores: for example, oak, hickory, ash, walnut, pecan. and many tropical hardwoods. They reinfest seasoned wood until it disintegrates. Lyctids range from 1/8 to 1/4 inch in length and are reddish-brown to black. The presence of small piles of fine flour-like wood powder (frass) on or under the wood is the most obvious sign of infestation. Even a slight jarring of the wood makes the frass sift from the holes. There are no pellets. The exit holes are round and vary from 1/32 to 1/16 inch in diameter. Most of the tunnels are about 1/16 inch in diameter and loosely packed with fine frass. If damage is severe, the sapwood may be completely converted within a few years to frass held in by a very thin veneer of surface wood with beetle exit holes. The amount of damage depends on the level of starch in the wood. Infestations are normally limited to hardwood paneling, trim, furniture, and flooring. Replacement or removal and fumigation of infested materials are usually the most economical and effective control methods. For current information on the use of residual insecticides, the inspector should contact the extension entomologist at his nearest land grant university, or a reputable pest control company.

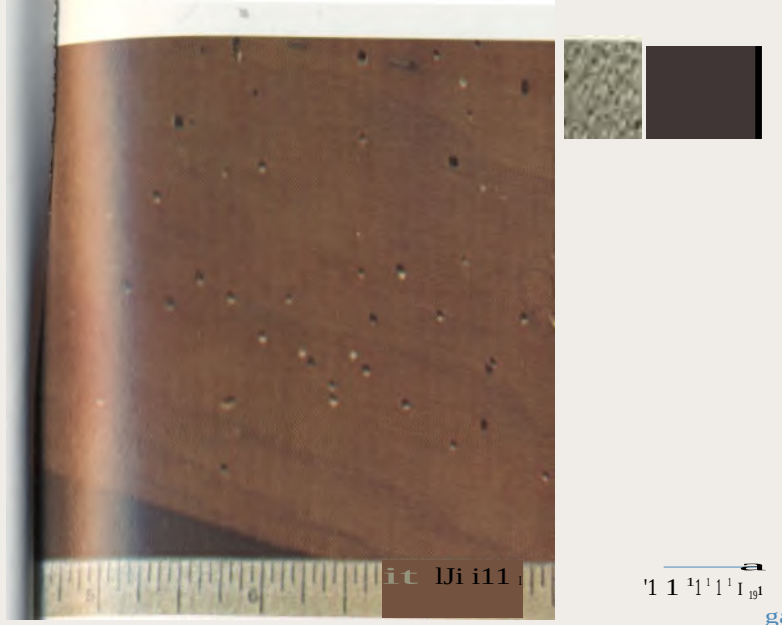


Figure 36. Lyctid powderposi beetle damage with exit hole on surface and powder-filled galleries in the interior

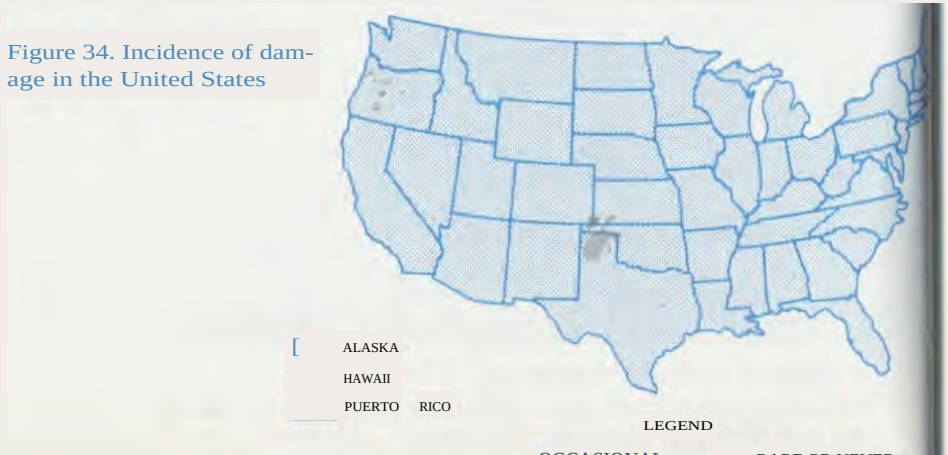


Figure 34. Incidence of damage in the United States

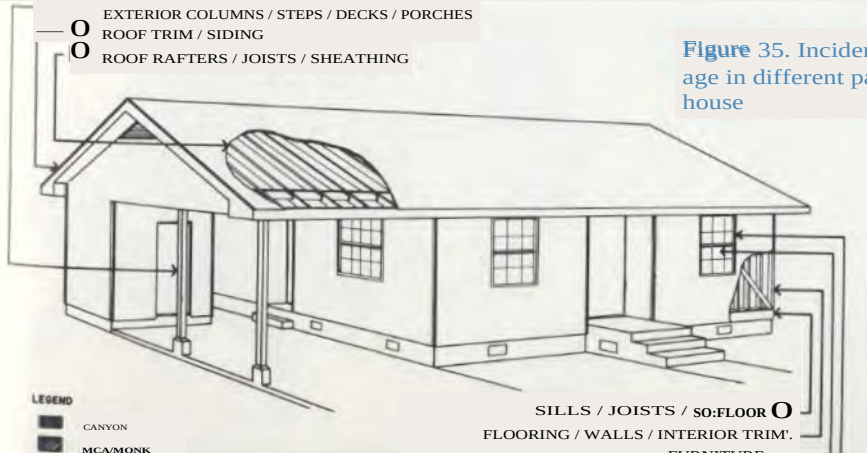


Figure 35. Incidence of damage in different parts of the house

Anobiid Beetles

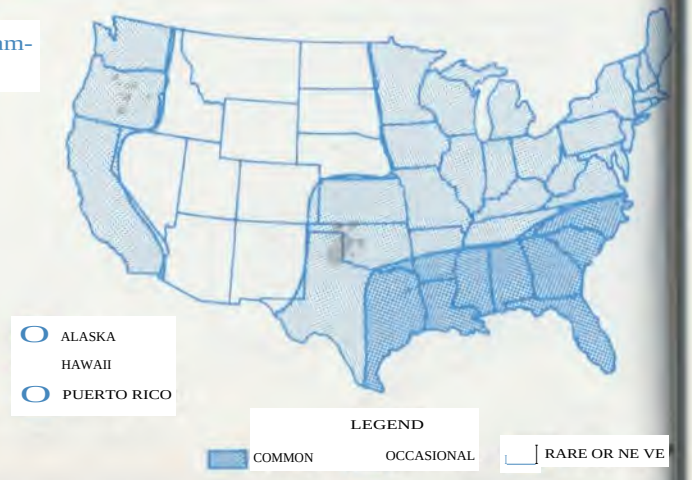
Figure 39. Anobiid damage with powder streaming from insect exit holes

The most common anobiids attack the sapwood of hardwoods and softwoods. They reinfest seasoned wood if environmental conditions are favorable. Attacks often start in poorly heated or ventilated crawl spaces and spread to other parts of the house. They rarely occur in houses on slab foundations. Anobiids range from 1/8 to 1/4 inch in length and are reddish-brown to nearly black. Adult insects are rarely seen. The most obvious sign of infestation is the accumulation of powdery frass and tiny pellets underneath infested wood or streaming from exit holes. The exit holes are round and vary from 1/16 to 1/8 inch in diameter. If there are large numbers of holes and the powder is bright and light-colored like freshly sawed wood, the infestation is both old and active. If all the frass is yellowed and partially caked on the surface where it lies, the infestation has been controlled or has died out naturally. Anobiid tunnels are normally loosely packed with frass and

Figure 40. Frass and pellet produced by Anobiid beetl((pellets approximately 1/2! inch long)

pellets. It is normally 10 or more years before the numbers of beetles infesting wood become large enough for their presence to be noted. Control can be achieved by both chemical and non-chemical methods. For current information on control of anobiids, the inspector should contact the extension entomologist at his nearest land grant university, or a reputable pest control company.

Figure 37. Incidence of damage in the United States



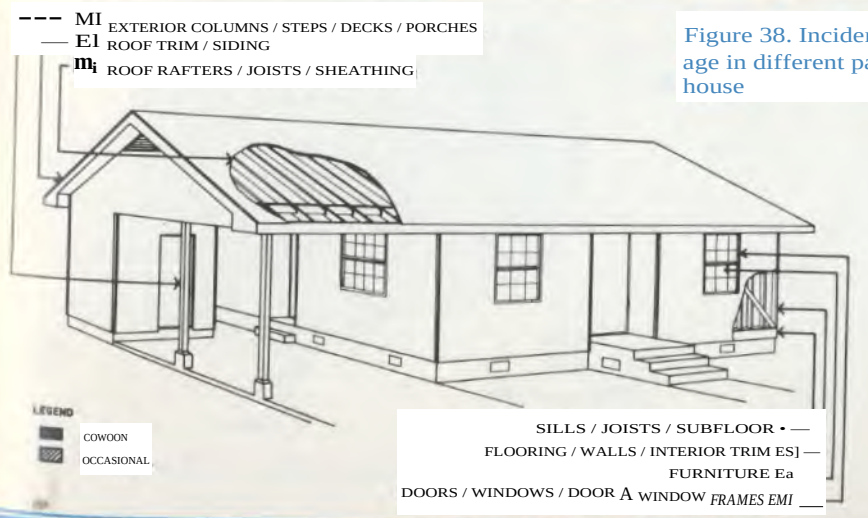


Figure 38. Incidence of damage in different parts of the house

Bostrichid Powderpost Beetles

Most bostrichids attack hardwoods, but a few species attack softwoods. They rarely attack and reinfest seasoned wood. Bostrichids range from 1/8 to 1/4 inch in length and from reddish-brown to black. The black polycaon is an atypical bostrichid and can be 1/2 to 1 inch in length. The first signs of infestation are circular entry holes for the egg tunnels made by the females. The exit holes made by adults are similar, but are usually filled with frass. The frass is meal-like and contains no pellets. It is tightly packed in the tunnels, and does not sift out of the wood easily. The exit holes are round and vary from 3/32 to 9/32 inch in diameter. Bostrichid tunnels are round and range from 1/16 to 3/8 inch in diameter. If damage is extreme, the sapwood may be completely consumed. Bostrichids rarely cause significant damage in framing lumber and primanly affect individual pieces of hardwood flooring or trim. Replacement of structurally weakened members is usually the most economical and effective control method.

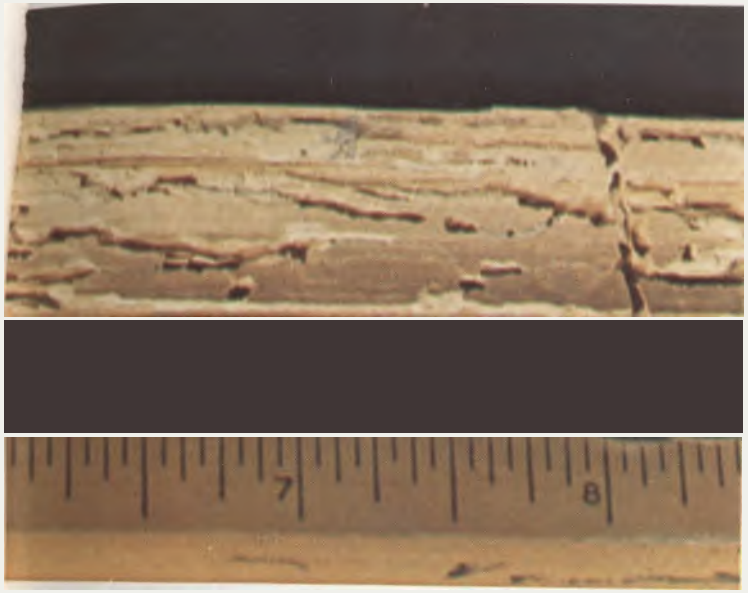
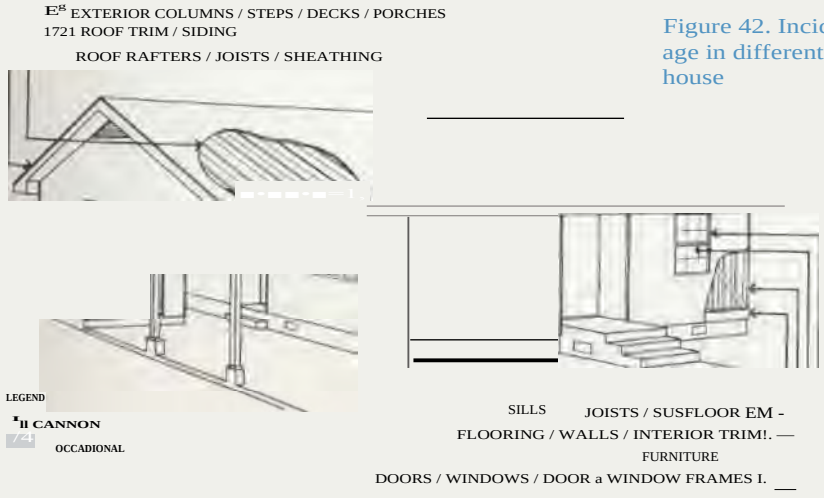


Figure 43. Bostrichid powderpost beetle damage in bamboo with exit holes on surface and some powderfilled galleries in the interior.

Figure 41. Incidence of damage in the United States

Figure 42. Incidence of damage in different parts of the house



Old House Borer

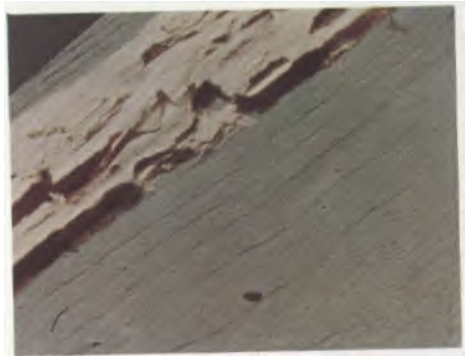


Figure 46. Old house borer damage with oval exit hole and powder-filled galleries in interior of wood

The old house borer attacks only the sapwood of softwoods, primarily pine. It reinfests seasoned wood, unless it is very dry. The old house borer probably ranks next to termites in the frequency with which it occurs in houses in the Middle Atlantic States. The beetle ranges from 5/8 to 1 inch in length. and is brownish-black in color. The first noticeable sign of infestation by the old house borer may be the sound of larvae boring in the wood. They make a rhythmic ticking or rasping sound, much like a mouse gnawing. In severe infestations the frass. which is packed loosely in tunnels, may cause the thin surface layer of the wood to bulge out. giving the wood a blistered look. When adults emerge (3 to 5 years in the South: 5 to 7 years in the North), small piles of frass may appear beneath or on top of infested wood. The exit holes are oval and 1/4 to 3/8 inch in diameter. They may be made through hardwood, plywood, wood siding, trim, sheetrock, paneling, or flooring.

Figure 47. Typical etching wall of old house borer gall

The frass is composed of very fine powder and tiny blunt-ended pellets. If damage is extreme, the sapwood may be completely reduced to powdery frass with a very thin layer of surface wood. The surfaces of the tunnels have a characteristic rippled pattern like sand over which water has washed. Control can be achieved by both chemical and non-chemical methods. For current information on control of the old house borer, the inspector should contact the extension entomologist at his nearest land grant university, or a reputable pest control company.

Figure 44. Incidence of damage in the United States

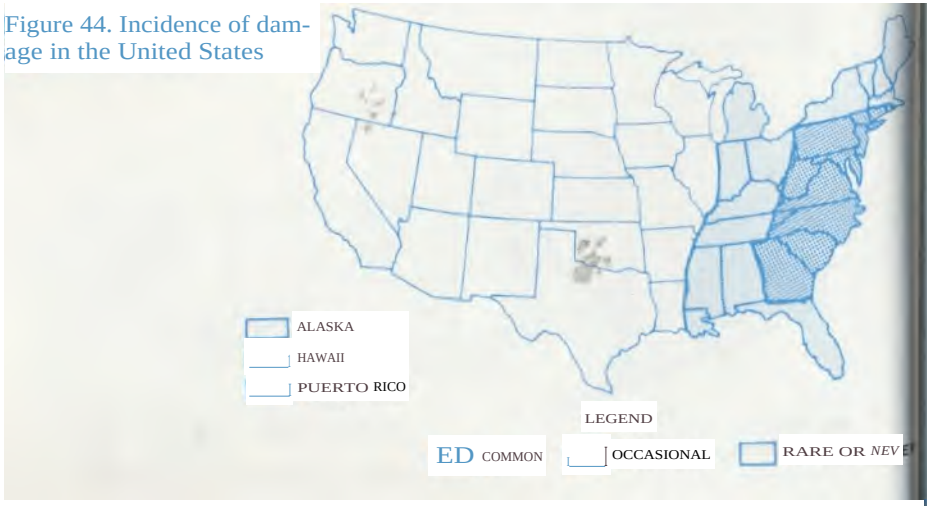
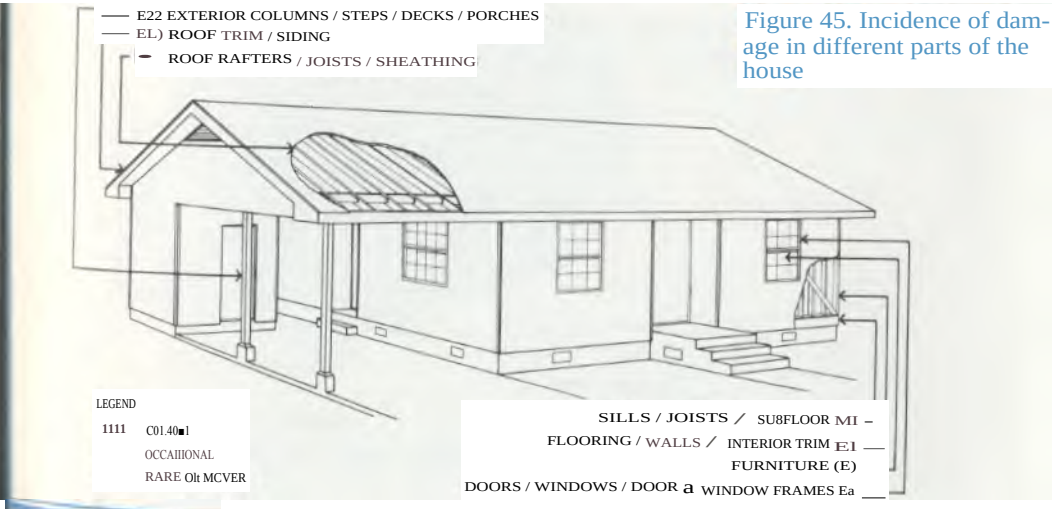


Figure 45. Incidence of damage in different parts of the house



Carpenter Bees

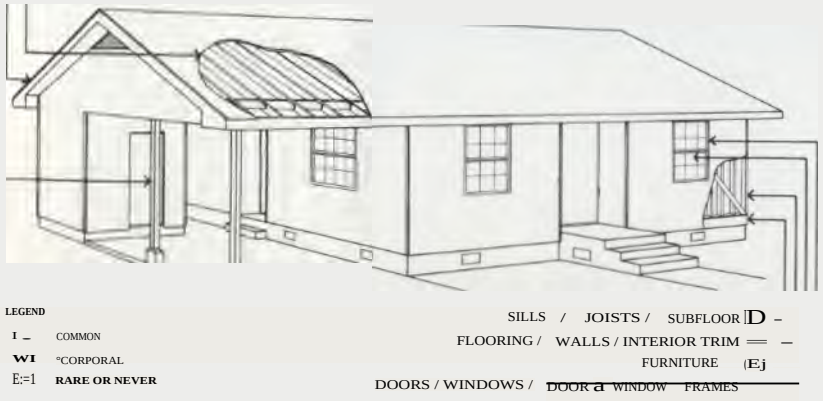
Carpenter bees usually attack soft and easy-to-work woods, such as California redwood. cypress. cedar, and Douglas fir. Bare wood. for example, unfinished siding or roof trim, is preferred. The only external evidence of attack is the entry holes made by the female. These are round and 1/2 inch in diameter. A rather coarse sawdust-like frass may accumulate on surfaces below the entry hole. The frass is usually the color of freshly sawed wood. The presence of carpenter bees in wood sometimes attracts woodpeckers, which increase the damage to the surface of the wood. The carpenter bee tunnels turn at a right angle after extending approximately an inch across the grain of the wood, except when entry is through the end of a board. They then follow

Figure 50. Carpenter bee entry hole (approximate diameter 1/2 inch) with streak of fecal matter below

the grain of the wood in a straight line, sometimes for several feet. The tunnels are smooth-walled. It takes several years of neglect for serious structural failure to occur. However, damaged wood is very unsightly, particularly if woodpeckers have followed the bees. The bees can be controlled by applying 5 to 10 percent carbaryl (Sevin) dust into the entry holes. Several days after treatment, the holes should be plugged with dowel or plastic wood. Prevention is best achieved by painting all exposed wood surfaces.

Figure 48. Incidence of damage in the United States

Figure 49. Incidence of damage in different parts of the house



Other Wood-inhabiting Insects

There are several other species of insects which infest dying or freshly felled trees or unseasoned wood, but which do not reinfest seasoned wood. They may emerge from wood in a finished house, or evidence of their presence may be observed. On rare occasions, control measures may be justified to prevent disfigurement of wood, but control is not **needed to** prevent structural weakening.

Ambrosia beetles

These insects attack unseasoned sapwood and heartwood of softwood and hardwood logs, producing circular bore holes 1/50 to 1/8 inch in diameter. Bore holes do not contain frass, but are frequently stained blue. black, or brown. These insects do not infest seasoned wood.

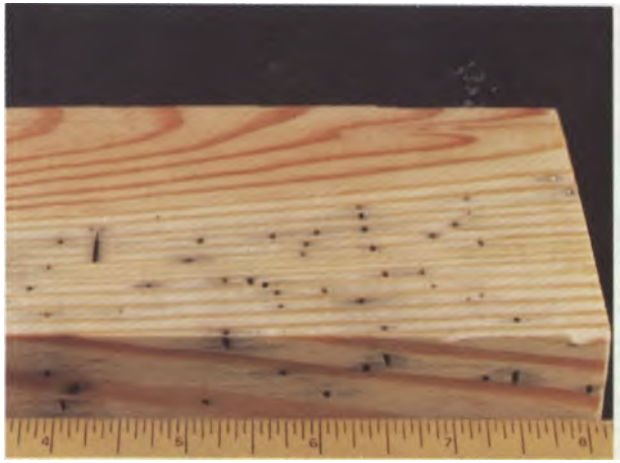


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Figure 51. Ambrosia beetle damage with characteristic empty pin holes surrounded by darkly **stained wood**

Bark beetles

These tunnel at the wood/bark interface and etch the surface of wood immediately below the bark. Beetles left under bark edges on lumber may survive for a year or more as the wood dries. Some brown, gritty frass may fall frorr circular bore holes in the bark. diameter 1/16 to 3/32 inch. These insects do not infest wood.

Figure 52. Bark beetle damage at bark/wood interface

Horntails (wood wasps)

Horntails generally attack unseasoned softwoods and do not reinfest seasoned wood. One species sometimes emerges in houses from hardwood firewood. Horntails occasionally emerge through paneling, siding, or sheetrock in new houses; it may take 4 to 5 years for them to emerge. They attack both sapwood and heartwood, producing a tunnel which is roughly C-shaped in the tree. Exit holes and tunnels are circular in cross section, with diameter 1/6 to 1/4 inch. Tunnels are tightly packed with coarse frass. Frequently. tunnels are exposed on the surface of lumber by milling after development of the insect.

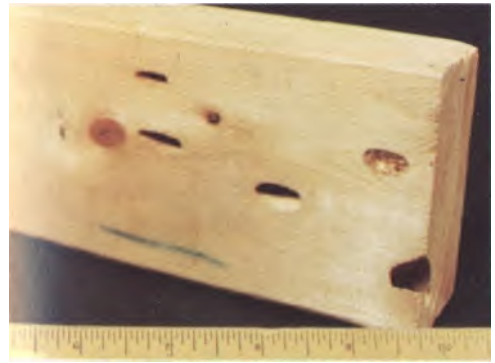


figure 54. **Round-headed borer damage**

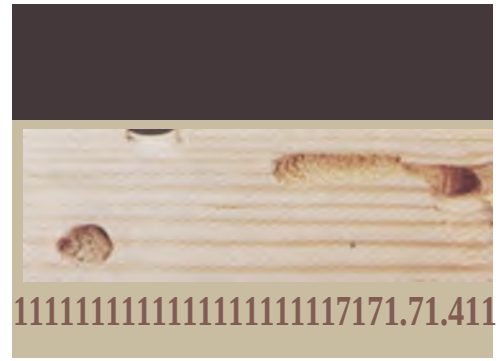


Figure 53. Horntail damage with characteristic circular galleries and tightly packed frass. Note slight stain around gallery in lower left corner.

Round-headed borers

Several species are included in this group. They attack sapwood of softwoods and hardwoods during storage, but rarely attack seasoned wood. The old house borer is the major round-headed borer which can reinfest seasoned wood. When round-headed borers emerge from wood. they make slightly oval to nearly round exit holes 1/8 to 3/8 inch in diameter. Frass varies from rather fine and meal-like in some species to very coarse fibers like pipe tobacco in others. Frass may be absent from tunnels, particularly where the wood was machined after emergence of the insects.

Flat-headed borers

They attack sapwood and heartwood of softwoods and hardwoods. Exit holes are oval, with the long diameter 1/8 to 1/2 inch. Wood damaged by flat-headed borers is generally sawed after damage has occurred, so tunnels are exposed on the surface of infested wood. Tunnels are packed with sawdust-like borings and pellets, and tunnel walls are covered with fine transverse lines somewhat similar to some round-headed borers. However, the tunnels are much more flattened. The golden buprestid is one species of flat-headed borer which occurs occasionally in the Rocky Mountain and Pacific Coast States. It produces an oval exit hole 3/16 to 1/4 inch across. and may not emerge from wood in houses for 10 or more years after infestation of the wood. It does not reinfest seasoned wood.

If signs of insect or fungus damage other than those already described are observed, the inspector should have the organism responsible identified before recommending corrective measures. Small samples of damaged wood, with any frass and insect specimens (larvae or grubs must be stored in vials filled with alcohol), should be sent for identification to the entomology or pathology department of the state land grant university.

Figure 55. Flat-headed borer damage

Inspection for Wood-inhabiting Organisms

The major purposes of inspecting houses for wood-inhabiting organisms are to discover the presence of wood-inhabiting organisms and the conditions which favor their presence. Ideally, a thorough inspection should be performed on a house during construction, and then at least once a year. When this is not done, a thorough inspection of existing houses is necessary to reduce the possibility of the future owner having to spend hundreds or thousands of dollars repairing damage. If an inspection is to meet this objective, it must involve more than a cursory glance in the attic and crawl space, and more than a quick walk around the exterior and interior of the house.

It is not feasible for a building inspector to examine every part of the house where wood-inhabiting organisms can occur. However, a careful inspection of all accessible areas will generally uncover serious damage or conditions which may lead to serious damage. Inaccessible areas which have not been inspected should always be listed on the report form to alert the future owner to potential danger areas.

When evidence of damage is found, the organism causing the damage must be identified so that the inspector can properly assess the potential for additional damage. This will sometimes require the assistance of a qualified entomologist or pathologist. Finally, the inspector must determine the need for repair, replacement, and treatment of the damaged areas, based upon the structural damage which has occurred and the potential for future damage.

Tools for Inspection

The following articles are needed if a professional inspection for wood-inhabiting fungi and insects is to be completed.

1. Coveralls
2. Bump helmet and gloves for crawl space and attic inspections
3. A good flashlight and spare batteries and bulbs
4. A screwdriver or similar instrument for probing wood
5. A hammer or similar instrument for sounding wood
6. A moisture meter with a range of at least 15 to 24 percent moisture
7. A pencil, clipboard, grid paper, and measuring tape
8. A ladder for inspecting roof trim kind other items above ground
9. A stepladder for gaining access to attics
10. Tools for opening accesses into crawl spaces
11. A hacksaw blade for checking earth-filled porches adjacent to crawl spaces

A moisture meter will enable the inspector to determine whether or not the moisture content of the wood is high enough to support growth of wood-inhabiting fungi. The moisture content of wood should be below 20 percent. The meter is used to check the moisture content of wood where moisture problems are suspected.

The electrical resistance of wood decreases as its moisture content increases. This is the basis for the operation of the small. commercially available moisture meters' They measure resistance between two needles inserted into the wood. and give a direct readout of the moisture content. The needles of the meter should be inserted along the grain of wood to give the most accurate results. Temperature corrections should be applied to the moisture content readings taken below 70°F and above 90°F (correction tables are supplied with meters). Finally, the meters should not be used in wood treated with water-borne wood preservatives or fire retardants.

Figure 56. Inspection equipment: stepladder, screwdriv, hacksaw blade, moisture meter, flashlight with spare batteries and bulb, clipboar- inspection form, pen, gloves bump helmet, and coveralls

Suppliers of suitable small meters include:

Delmhorst Instrument Company
51 Indian Lane East
Towaco, N.J. 07082
Tel. 1-800-222-0638

Moisture Register Products
2583 Pomona Blvd.
Pomona. CA 91768
Tel. 714-594-5545

Gann Sales and Service
12265 W. Bayaud Ave. Suite 105
Lakewood, CO 80228
Tel. 303-980-8484

Lignomat
P.O. Box 30145
Portland. OR 97230
Tel. 1-800-227-2105

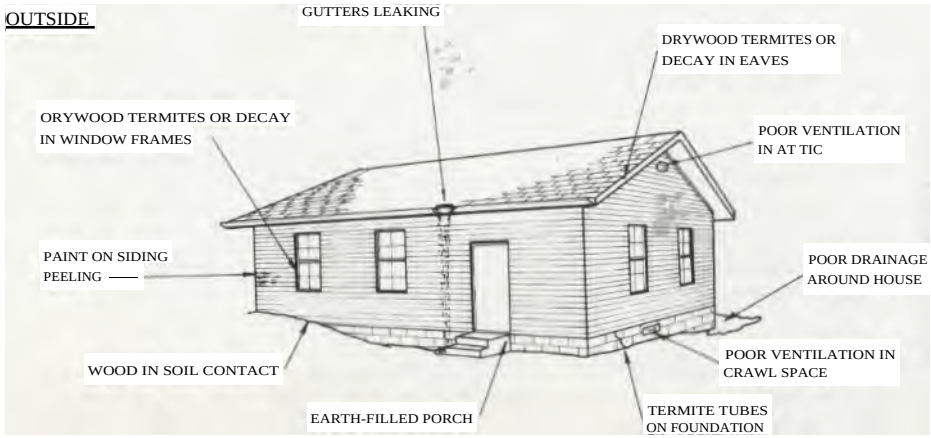
kocclusion from this list does not imply an inferior product. inclusion is not an endorsement.

Procedure for Inspection

Inspection should include examination of the exterior of the house, both at and above grade level; the interior living area; the attic; and the crawl space or basement where applicable. The inspector should, whenever possible, interview the occupant of the house before starting his inspection to gain useful information on previous or existing insect and fungus problems, water leaks, etc. However, it must be remembered that such information may be biased.

The first step of the inspection proper is to make a circuit of the exterior, recording on grid paper the dimensions of the house, including porches, patios. carports, etc. This will help you spot inaccessible areas that might be overlooked when making the inspection of the interior.

Look for signs of excessive moisture around the house. The lot should be graded so that water drains away frail the house, and downspouts should discharge water away from the house, not against it. In crawl space construction, check whether or not vents give satisfactory cross ventilation. To do this, they must be open in the summer. Wherever wood is in contact with or close to the soil. check it carefully for signs of insect attack and decay. This will require careful visual inspection, probing. and sounding with a hammer or similar instrument, and is particularly important for wood columns and steps, doors, door frames, and siding, and stuccoed walls, pilasters. and arches close to the soil. Note all areas where untreated wood is in contact with or too close to the soil. In regions where subterranean termites occur, look for termite shelter tubes on the foundation walls. in cracks in the walls and between the main foundation and attached slabs, behind shrubs or other vegetation, and in firewood, formboards, or



wood debris against the house. Also look carefully for evidence of termite activity in planters and in wooden structures such as fences, fence-posts. trellises, etc.. against the house. Plumbing inspection doors in slab-on-ground houses, meter boxes. and crawl space access doors should be examined carefully for evidence of insect attack and decay. Check for the presence of foundation waterproofing below grade on basement walls. Finally, determine if walkway, porch, and patio slabs slope away from the house. This can be done easily by pouring water on the slab and noting the direction of run-off.

Whenever insect attack, decay, excessive moisture, or untreated wood in contact with or too close to the soil is noted, it should be recorded on the inspection report. The type and extent of damage should also be recorded.

Continuing the inspection of the house exterior, examine wood siding, windows and window frames, roof trim including gables, eaves, soffits and fascia, and any other exposed wood items for signs of insect attack or decay. Insect exit holes, sawdust or pellets caught in cobwebs or on window ledges, cracked or blistered paint, and water stains are some of the most common signs of infestation. Window and door frames should be caulked and windows glazed. There should be flashing at doors, windows, at roof/wall and roof/chimney intersections, and around pipes and vents projecting through the roof. The shingles should form a continuous drip edge over the eave and rake. If gutters and downspouts are present, they should be free of leaks. and not be blocked by debris. There should be ventilation in all parts of the attic through the use of soffit and gable end of roof peak vents, depending on the roof type. Note on the inspection report evidence of decay and insect attack.

Turning now to the living area, every room of the house should be examined systematically for evidence of insect attack, decay, or moisture damage. This inspection should include not only a careful visual examination, but also probing and sounding of critical items. such as the baseboards and areas where damage is suspected. Inspection should start with the entrance door and its frame, include observation of the walls, ceiling, and floor, inspection of baseboards and wood trim, and a careful look in closets and around showers. tubs, sinks, washing machines, etc. These should be examined carefully for signs of leaks. For the shower, this is done by plugging the drain, running water

into the shower stall, and seeing if the water leaks out within 15 minutes. If subterranean termites occur in the area, the plumbing should be examined for termite tubes. The walls and ceilings should be examined for water stains; mud-like deposits which are sometimes built on exposed surfaces by Formosan subterranean termites working inside the walls; and slightly raised areas on paint or wallpaper, which may hide subterranean termites.

Cracks between baseboards and the floor and walls around the perimeter of the house should be inspected carefully for termite tubes in areas where subterranean termites occur. The baseboards should be tapped, and any hollow areas carefully probed. Examination of the baseboard area and of cracks around built-in cabinets and door and window frames is particularly critical in slab-on-grade construction, because termite entry points are often hidden by floor coverings, interior finish, and trim.

In trying to detect damage caused by insects inside the house, the observations of the homeowners can be very helpful, because they may have found and removed sawdust or pellets produced by insects. In areas where drywood termites occur, window sills, closet and cupboard floors, and around the baseboards should be examined for fecal pellets. The floors should be inspected not only for evidence of sagging. buckling, or settlement which would indicate extensive problems, but also for localized discoloration or depressions indicating limited insect or fungal attack. Oddly placed scatter rugs, tables. etc., may hide such damage.

Attic inspection is often complicated because some or all of the space is inaccessible or hidden by insulation. Such areas should always be noted on the inspection report. The attic should be inspected for signs of decay, insect damage, and water stains. Particular attention should be paid to the sheathing at the eaves, around chimneys, vent pipes, and TV antennas for signs of decay or water stains. In regions with severe winters, decay or water stains on the sheathing at the eaves may be due to the formation of ice dams. Elimination of this problem requires improvement of the ventilation and insulation in the attic. Roof rafters, the ridge pole, ceiling joists, wood attic vents, and the top plates of all partition walls should be examined for evidence of insect attack. such as piles or pellets or sawdust, and for insect exit holes. In regions where subterranean termites are a problem. chimneys and areas over earth-filled porches should be inspected carefully for termite tubes. As with other parts of the house, all damage should be noted on the inspection report as it is found.

The final major area of many houses which should be inspected is the crawl space or basement. Although attic inspection sometimes can be difficult or even impossible, the crawl space is normally the least pleasant area of the house to inspect. However, it is the area where fungi and insects often cause extensive damage without being noticed. Therefore, it must be examined carefully.

In crawl space inspection, the entire sub-floor area should be checked systematically for signs of decay.. insect attack, water stains, and mold or sapstain. Particular attention should be paid to wood next to earth-filled porches, planters, carports, patios, on the upslope side of houses on sloped lots, and other areas where soil is close to the wood, or where there is excessive moisture against the house. Also, wood under bathrooms. kitchens, and utility rooms should be examined carefully for signs of water leaks. If mold or sapstain fungi are present on the wood, corrective procedures should be recommended only if the moisture content of the wood is greater than 20 percent, or it is confirmed by some other method that the fungi are active. Earth-filled porches and planters should be checked to ensure that there is a barrier between the soil and the sills or headers. This can be done by inserting a thin blade at several points under the sills behind porches and planters. The blade should not penetrate beyond the sills or headers.

In areas where subterranean termites occur, all perimeter foundation walls, pillars, interior walls, chimney bases and hearths, and pipes making contact with the soil should be examined for the presence of termite tubes. Cracks between the foundations and sills, joists, and beams should also be inspected carefully for tubes.

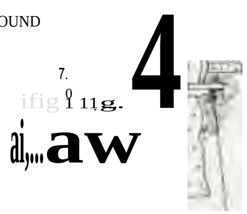
The presence in the crawl space of standing water, wet foundation walls, wood debris, formboards, tree stumps, and untreated wood in soil contact should be noted. The presence of polyethylene or a similar soil cover should also be noted. Clearance between the soil and untreated sills and joists should be at least 18 inches: for beams the clearance should be at least 12 inches. Vents from dryers and condensate lines from air conditioning units should discharge outside the house, not in the crawl space. Inaccessible areas should be noted.

In unfinished basements, the inspection procedure is similar to that for crawl spaces, except that it is usually much simpler. An additional step required is that all wood on the slab should be inspected carefully for signs of decay or insect attack. A note should be made of any untreated wood structures which penetrate or are in contact with the slab. Finished basements are inspected in the same way as living areas. However, if the basement has a suspended ceiling. panels should be removed to inspect sills, joists and beams resting on the perimeter walls for evidence of insect attack.

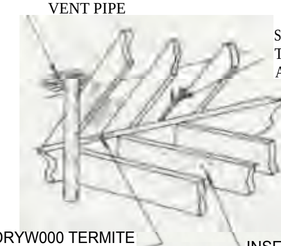
Attached and detached garages and storage sheds are the last items which should be checked by the inspector. This is particularly important for attached structures, because these can provide direct entry for fungi and insects into the house itself. The inspection procedure will normally be similar to that for unfinished basements. A thorough examination may be impossible because of the accumulation of stored materials. This should be noted on the inspection report.

When each part of the house has been inspected and the presence of decay and insect damage — or conditions which will allow such damage to occur — have been recorded, the inspector must decide what corrective action should be taken. This requires identification of the cause of damage: the type of insect, the type of decay, and the source of moisture which allows decay to occur. This may require the assistance of a qualified entomologist or pathologist. The recommended corrective procedures should take into account the amount of damage, the potential for spread of the damage, or the likelihood of new damage occurring because of poor construction procedures. The objective of corrective procedures should be to save money for the prospective purchaser of the house by preventing or controlling decay and insect damage. This can be gauged quite easily for correction of existing problems. However, the inspector should always use careful judgment before recommending corrective procedures designed to prevent future deterioration, particularly in existing homes which have stood for several years without decay or insect attack despite faults in construction.

IN CRAWL SPACE



IN ATTIC



Around the Foundations
Crawl Space Construction

(including crawl space areas in ranch, multi-story, half basement, and split level houses).

Checklist'

Outside	Yes	No	N/A
1. Surface water drains towards the house, not away from it	❑	❑	
2. Rain water from the roof drains under the house	❑	❑	
3. Walkway, patio, and porch slabs slope towards the house, not away from it			
4. **Form** boards, grade stakes, wood debris, and paper products have been left around the house	❑	❑	❑
5. Firewood and lumber piles are less than 6 inches away from the house	❑	❑	❑
6. Wood in contact with the soil is not pressure treated or not stamped with the appropriate quality mark			

Corrective Procedures

Alter surface drainage so that water runs away from the building by regrading the lot: by building a retaining wall or Swale: or by installing drain tile and/or gravel to intercept water before it reaches the house.

BEFORE AFTER

REGRADE SWALE RETAINING WALL DRAIN TILE/ GRAVEL

Drain rain water away from the house with gutters. downspouts and splashblocks; by regrading: or by attaching draintile to downspouts to deposit the water in a storm sewer, dry well, or other location where it will not run under a house.

Change the slope of the slab to direct water away from the house. If this is not practicable. caulk all cracks between the slab and the wall of the house to prevent water seepage under the house.

Remove untreated wood form boards and grade stakes, wood debris. and paper products. Otherwise, they may provide an entry point for fungi and insects.

Move firewood and lumber piles so that they are at least 6 inches away from the house.

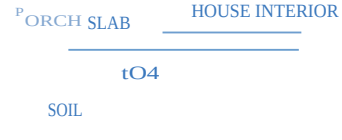
See Appendix 1 (p. 100) for examples of acceptable quality marks for pressure-treated lumber, and their applicability. Replace improperly treated or untreated wood in contact with the soil with pressure-treated wood or an alternative resistant material.

If the answer to any of these questions is yes, it should be recommended that the problem be corrected as described in the "Corrective Procedures" section, except that a corrective procedure designed to prevent future decay or insect attack should only be recommended in an existing house when there is good reason to believe that such problems will occur if corrective steps are not taken. For example. if framing in a 10-year. old house is oily 4 inches above outside grade, but free of fungus or insect attack, it is not necessary to recommend regrading.

2 N/A r4. not applicable

	Yes	No	N/A2	
7. Other wood exposed to a high risk of decay or insect attack is not preservative treated or naturally resistant, or not stamped with the appropriate quality or grade mark				See Appendix for wood items which should be pressure treated or naturally resistant. Replace untreated wood if practicable. Alternatively brush it with a wood preservative/ water repellent solution.
8. Wood siding is less than 6 inches above outside grade				Lower grade so that soil is 6 inches below wood siding, but prevent rain water from draining under the house.
9. Paint or stucco is blistered, peeling, or loose				Try to determine if problem is caused by excessive moisture, poor maintenance, or improper use of materials (for example, application of oil-based paints on latex, or latex paints on oil sometimes leads to blistering or peeling of the paint). If excessive moisture is the problem, locate the source of moisture and where possible eliminate it. For example, improve ventilation in crawl space, install vapor barriers in the walls, or vent moist air out of bathrooms, kitchens, and utility rooms. Loose stucco should be examined carefully for the presence of subterranean termites.
10. Untreated wood framing is less than 8 inches above outside grade				Lower grade so that soil is at least 8 inches below untreated wood framing. but prevent rain water from draining under the house.
11. Untreated wood framing is less than 8 inches above soil in earth-filled porches and planters (not critical when separated by flashing or poured concrete, or when porches or planters are separate structures)				Remove soil under the porch slab so that soil is at least 8 inches below untreated wood framing: or pour concrete to isolate soil from wood in the house. For planters, install continuous flashing or pour concrete to isolate from wood in the house.
12. Untreated wood framing is less than 8 inches above soil under carport and patio slabs				Install continuous flashing or pour concrete to separate wood framing from soil under the carport or patio slab if there is a possibility of moisture accumulation under the slab.

BEFORE



AFTER

SOIL EXCAVATED AT WOOD/SOIL CONTACT POINT

POURED CONCRETE AT WOOD/SOIL CONTACT PONT

	Yes	No	N/A?	
13. **Areas under suspended slab porches above grade are inaccessible for inspection**	❑	❑	❑	Provide inspection accesses from either the house side of the porch, or from the outside.
14. **There are termite tubes present on the foundation** walls **(these are particularly common where wood siding** is **close to outside grade, and there are shrubs or plants close to the wall, and** in **cracks in the foundation walls)**	❑	111	❑	Treat the house foundations with termite control chemicals.
15. **There is evidence** of **decay' close to the grade** in				Determine the source of moisture which allows decay to occur, and eliminate it if practicable. Replace structurally weakened wood° with sound untreated wood where the source of moisture can be eliminated. or with preservative-treated wood where it is in ground contact or where moisture cannot be eliminated (see Appendix for the appropriate treatment to use). Where slight decay has occurred in frames, doors, wooden steps, wood columns, access doors. etc. brush with a wood preservative/water repellent solution to reduce the rate of decay (do not apply to painted surfaces). Decay is commonly associated with rain splash against wood close to the ground due to an absence of gutters and downspouts, and lack of proper clearance between untreated wood and the ground.
a. wood siding	❑	❑	❑	
b. **doors, door frames and** sills	❑	❑	❑	
c. **wooden steps**	❑	❑	❑	
d. **wood columns**	❑	❑	❑	
e. **crawl space access doors**	❑	❑	❑	
f. **fence posts, arches, or other non-structural items attached to the house**	❑	❑	❑	
g. planters	❑	❑	❑	
h. other _____	❑	❑	❑	

[3] Evidence of decay is described on pages 8 thru 15.

Str ucturally weakened wood is defined as wood which, because of decay or insect attack, is no longer able to Perform the job for which it was designed. The definition can be applied to a single member or group of membaws.

	Yes	No	Nj.A.2	
16. There is evidence of insect attack' close to the grade in				
a. wood siding	❑	[11	❑	
b. doors, door **frames** and sills	❑	❑	❑	
c. wooden steps	❑	❑	❑	
d.. wood columns	❑	❑	❑	
e. crawl space **access** doors	❑	❑	❑	
f. fence posts, arches, or other non-structural items attached to the house	❑	❑	❑	
g. meter boxes			❑	
h. planters	❑	❑	❑	
bathroom inspection doors	❑	❑		
j. other ____	❑	❑	❑	
17. **There** is no access door to the crawl space	❑	❑		Provide an access door to the crawl space. Use preservative-treated wood for framing near grade. Note inaccessible areas under the house in any inspection report.
18. **There** is not adequate cross ventilation in the crawl space	❑	❑	❑	Install at least four ventilators in the crawl space to give cross ventilation with a net free area of at least 1/1500th the area of the crawl space. If no soil cover is present ventilation should be 1/150th the area of the crawl space. Place vents near corners to avoid dead air pockets in the crawl space.
19. Ventilators are closed in the summer	❑	❑	❑	Open ventilators which are closed in the summer.

Identify the type of insect from the type of damage present, for example termite tubes insect exit holes, sawdust, pellets, etc., and recommend the correct control procedure This may require the assistance of an extension entomologist at a land grant universih or a reputable pest control company. All structurally weakened wood' should be replaced as a part of the control procedures.

' Evidence of insect attack is described on pages 16 thru 40.

In the crawl space	Yes	No	NIA!	
20. Tree stumps, untreated wood form boards and grade stakes, wood debris, paper products, and plants have been left in the crawl space and under suspended slab porches	❑	❑		Remove tree stumps, untreated wood form boards and grade stakes, wood debris, paper products and plants, otherwise they may provide an entry point for fungi and insects. Treat stumps which are difficult to remove with termite control chemicals where subterranean termites are a hazard.
21. Untreated wood blocks support ducts or pipes on the ground				Replace untreated wood blocks with pressure-treated wood blocks or an alternative resistant material.
22. There is evidence of standing water in the crawl space, particularly where the grade inside the crawl space is below the outside grade	❑	❑		Determine the source of the moisture. If it is due to a plumbing leak, repair the leak. If it is condensate from an air conditioning condensate line, or clothes dryer vent, discharge the condensate outside the crawl space. If it is due to faulty drainage around the house, correct as described in 1 and 2; or by trenching around the inside of the foundation walls to run excess water into a storm sewer, street, or dry well by gravity drainage or sump pump; or by waterproofing the outside foundation walls below grade and installing drain tile and gravel around the footings.
23. There is no soil cover on the soil (not critical in arid regions)	O			Install a soil cover of 4-mil polyethylene or equivalent material over approximately 70 percent of the soil in the crawl space.
24. Clothes dryer vents and air conditioning condensate lines discharge moisture inside the crawl space	❑	❑		Extend vents and condensate lines to discharge moisture outside the house, not in the crawl space.
25. There is condensation on beams, joists, sills, and subfloor	❑	❑		Determine the source of moisture. If it is due to poor ventilation improve the ventilation as described in 18. If it is due to the absence of a soil cover, install a cover as described in 23. If it is due to standing water in the crawl space, correct as described in 22.

	Yes	No	11L.Az	
26. There **are** leaks under **the**				Repair leaks in plumbing and replace caulking and/or grout in showers and around sinks and tubs.
a. kitchen	❑	❑	❑	
b. bathrooms	❑	❑	❑	
c. utility rooms	❑	❑	❑	
d. **other** _____	❑	CI	❑	
27. **The** foundation walls are wet	❑	❑		Control excess moisture by improving drainage around the house as described in 1 and 2: or by trenching around the inside of the foundation walls to run excess water into a storm sewer, street, or dry well by gravity drainage or sump pump: or by water-proofing the foundation walls below grade and installing drain tile and gravel at the footings to discharge water into a storm sewer, street, dry well, or other area where it will not run under a house.
28. **Termite** tubes are present on				Treat the house foundations with termite control chemicals.
a. the foundation walls	☐	☐		
b. termite shields, poured concrete caps, or pressure-treated wood sills	☐	☐		
c. plumbing	☐	☐		
d. piers	☐	☐		
e. around fireplace foundations	☐	☐		
f. other	☐	☐		
29. Wood foundation walls and piers are not pressure-treated, or not stamped with a quality mark for foundation **use**	❑	❑		See Appendix 1 for examples of acceptable quality marks for foundation material and their applicability. Replace improperly treated or untreated wood with pressure-treated wood or an alternative resistant material.
30. **There** is evidence of decay3 in wood foundation walls and piers	❑	❑		Replace all decayed material with pressure-treated wood (see Appendix 1 for the appropriate treatment to use). or an alternative resistant material.
31. **There** is evidence of insect attack[s] in wood foundation walls and piers	❑	CI	❑	Control insect attack as described in 16.

	Yes	No	N/A
32. For wood beams			
a. untreated beams are less than 12 inches above inside grade	☐	☐	☐
b. there are mold or stain fungi on the wood *and/or* its moisture content is more than 20 percent	☐	☐	☐
c. there is evidence of decay[3] after visual inspection, probing, and sounding			
d.. there is evidence of insect attack[s] after visual inspection, probing, and sounding		E	
33. For sills, headers, joists, and subfloor (particularly in poorly ventilated areas, damp crawl spaces, and areas where the wood is adjacent to porches, patios, and carports)			
a. untreated sills and joists are less than 18 inches above inside grade	❑	❑	
b. there are mold and stain fungi on the wood *and/or* its moisture content is more than 20 percent			
c. there is evidence of decay[3] after visual inspection, probing, and sounding	CI	❑	
d. there is evidence of insect attack" after visual inspection, probing, and sounding	❑	❑	

a) Remove soil in the crawl space to provide a minimum clearance of 12 inches between beams and the soil. If this creates a water drainage problem, correct as described in 22.

b) Determine the source of moisture and eliminate it if practicable. If it is due to condensation, correct as described in 26. If it is due to a plumbing leak, repair the leak. If it is due to water seepage through the foundation, correct as described in 28. Replace structurally weakened wood" with sound untreated wood. If the source of moisture is not eliminated, then replace all wood with a moisture content greater than 20 percent with preservative-treated wood (see Appendix 1 for appropriate treatments to use).

c) Determine the source of moisture allowing decay to occur and eliminate as described in 32b. If there is extensive decay away from an obvious source of moisture, and no evidence of condensation having occurred on the beams. suspect the water conducting fungi *Poria incrassata* or *Merulius lacrymans.* If either of these is present, great care must be taken to find and eliminate the source of the fungus.

d) Control insect attack as described in 16.

a) Remove soil in the crawl space to provide a minimum clearance of 18 inches between the sills and joists and the soil. If this creates a water drainage problem. correct as described in 22.

b) Correct as described in 32b.

c) Determine the source of moisture allowing decay to occur and eliminate as described in 32b. If there is extensive decay away from an obvious source of moisture, and no evidence of condensation having occurred on the sills. joists, etc., suspect the waterconducting fungi *Poria incrassata* or *Merulius lacrymans.* If either of these is present, great care must be taken to find and eliminate the source of the fungus.

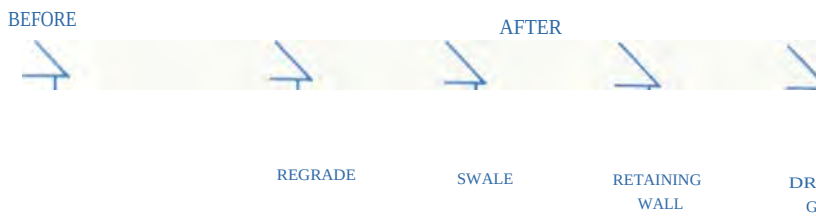
d) Control insect attack as described in 16.

Around the Foundations Basement Construction

(including basement areas in full basement, half basement, and split level and split foyer houses with rooms below grade).

Checklist'

Outside	Yes	No	N/A2.	Corrective Procedures
1. Surface water drains towards the house, not away from it	❑	❑		Alter surface drainage so that water runs away from the building by regrading the lot; by building a retaining wall or swale: or by installing drain tile and/or gravel to intercept water before it reaches the house.
2. Rain water from the roof drains under the house	❑	❑	❑	Drain rain water away from the house with gutters, downspouts and splashblocks: by regrading: or by attaching draintile to downspouts to deposit the water in a storm sewer, dry well, or other location where it will not run under a house.
3. Walkway, patio, and porch slabs slope towards the house, not away from it	❑	❑	❑	Change the slope of the slab to direct water away from the house. If this is not practicable, caulk all cracks between the slab and the wall of the house to prevent water seepage under the house.
4. Form boards, grade stakes, wood debris, and paper products have been left around the house	❑	❑	❑	Remove untreated wood form boards and grade stakes, wood debris, and paper products. Otherwise, they may provide an entry point for fungi and insects.
5. Firewood and lumber piles are less than 6 inches away from the house	❑	❑		Move firewood and lumber piles so that they are at least 6 inches away from the house.

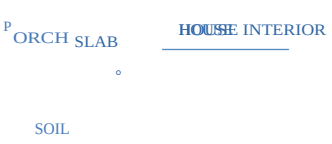


If the answer to any of these questions is yes. it should be recommended that the problem be corrected as described in the "Corrective Procedures" section, except that a corrective procedure designed to prevent future decay or insect attack should only be recommended in an existing house when there is good reason to believe that such problems will occur if corrective steps are not taken. For example, if framing in a 10-Year-old house is only 4 inches above outside grade, but free of fungus or insect attack, it is not necessary to recommend regrading.

[2] N/A knot applicable

	Yes	No	N/A.	
6. Wood in contact with the soil is not pressure **treated or not stamped** with the appropriate quality mark	❑	❑	❑	See Appendix for examples of acceptable quality marks for pressure-treated lumber, and their applicability. Replace improperly treated or untreated wood in contact with the soil with pressure-treated wood or an alternative resistant material.
7. **Other** wood exposed to a high risk of decay or insect attack is not preservative treated or naturally resistant, or not stamped with the appropriate quality or grade mark	❑	❑	❑	See Appendix for wood items which should be pressure treated or naturally resistant. Replace untreated wood if practicable. Alternatively brush it with a wood preservative/water repellent solution to reduce the risk of decay (do not apply to painted surfaces).
8. **Wood siding is less than 6** inches above outside grade	❑	❑		Lower grade so that soil is 6 inches below wood siding. but prevent rain water from draining under the house.
9. Paint or stucco is blistered, peeling, or loose	❑	Ell	❑	Try to determine if problem is caused by excessive moisture, poor maintenance, or improper use of materials (for example, application of oil-based paints on latex, or latex paints on oil sometimes leads to blistering or peeling of the paint). If excessive moisture is the problem, locate the source of moisture and where possible eliminate it. for example, install vapor barriers in the walls or on the floor, vent moist air out of bathrooms, kitchens, and utility rooms; or use a dehumidifier in the summer. Loose stucco should be examined carefully for the presence of subterranean termites.
10. Untreated wood framing is less than **8 inches above outside grade**		111	111	Lower grade so that soil is at least 8 inches below untreated wood framing, but prevent rain water from draining under the house.
11. Untreated wood framing is less than 8 inches above soil in earth-filled porches and planters (not critical when separated by flashing or poured concrete, or when porches or planters are separate structures)	111	❑	❑	Remove soil under the porch slab so that soil is at least 8 inches below untreated wood framing; or pour concrete to isolate soil from wood in the house. For planters, install continuous flashing or pour concrete to isolate soil from wood in the house.

BEFORE



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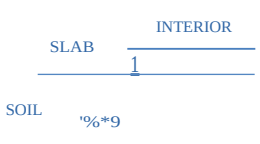
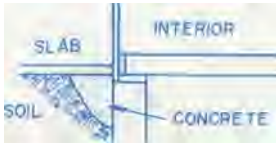


SOIL EXCAVATED AT WOOD/SOIL CONTACT POINT



POURED CONCRETE AT WOOD/SOIL CONTACT POINT

	Yes	No	NJA	
12. **Untreated** wood framing is **less** than 8 inches above soil under carport and patio slabs				Install continuous flashing or pour concrete to separate wood framing from soil under the carport or patio slab if there is a possibility of moisture accumulation under the slab.
13. **Untreated** wood framing in the basement is less than 8 inches above soil in crawl space areas adjacent to basement rooms				Remove soil in crawl space against basement wall so that the soil is at least 8 inches below untreated wood framing.
14. **Areas** under suspended slab porches above grade are in-accessible for inspection				Provide inspection accesses from either the house side of the porch, or from the outside.
15. There are termite tubes present on the foundation walls (these are particularly common where wood siding is close to outside grade, and there are shrubs or plants close to the wall, and in cracks in the foundation walls)				Treat the house foundations with termite control chemicals.
16. There is evidence of decay"; close to the grade in				Determine the source of moisture which allows decay to occur, and eliminate it if practicable. Replace structurally weakened wood' with sound untreated wood where the source of moisture can be eliminated. or with preservative-treated wood where it is in ground contact or where moisture cannot be eliminated (see Appendix for the appropriate treatment to use). Where slight decay has occurred in frames, doors. Wooden steps. wood columns, etc.. brush with a wood preservative/water repellent solution to reduce the rate of decay (do not apply to painted surfaces). Decay is commonly associated with rain splash against wood close to the ground due to an absence of gutters and downspouts, or lack of proper clearance between untreated wood and the ground.
a. wood siding				
b. doors, door frames and sills				
c. wooden steps				
d. wood columns				
e. fence posts, arches, or other non-structural items attached to the house				
f. planters				
g. other _____				

[3] Evidence of decay is described on pages 8 thru 15.

Structurally weakened wood is defined as wood which, because of decay or insect attack, is no longer able to Perform the job for which it was designed. The definition can be applied to a single member or group of Inernters.

	Yes	No	N/A[2]	
17. **There** is evidence of insect attack' close to the grade in				Identify the type of insect from the type of damage present, for example termite tubes, insect exit holes, sawdust, pellets, etc., and recommend the correct control procedure. This may require the assistance of an extension entomologist at a land grant university or a reputable pest control company. All structurally weakened wood' should be replaced as a part of the control procedures.
a. wood siding	O	❑	❑	
b. doors, door frames and sills		❑	❑	
c. wooden steps	❑	❑	❑	
d. wood columns	❑			
e. fence posts, arches, or other non-structural items attached to the house	❑	❑	❑	
f. meter boxes	❑	❑	❑	
g. planters	❑	❑	❑	
h. bathroom inspection doors	❑	❑	❑	
i. other	❑	❑	❑	
18. **Outside surfaces** of foundation walls below grade are not waterproofed (not necessary in **arid regions)**	❑	❑	❑	Waterproof the outside of the foundation walls below grade level if there is any evidence of moisture problems in the basement.
19. **There is no drain tile connected to a positive outflow installed around the footings (not necessary in arid regions)**		❑		Install drain tile and gravel at the footings to discharge water into a storm sewer, street, dry well, or other area where it will not run under a house, if there is any evidence of moisture problems in the basement.

[5] Evidence of insect attack is described on pages 16 thru 40.

In the basement

Checklist'

Inside	Yes	No	NL.A.2	Corrective Procedures
20. Form boards and grade stakes have not been removed from the basement and under suspended slab porches	❑	❑		Remove untreated wood from boards and grade stakes. otherwise they may provide an entry point for fungi and insects.
21. Untreated wood columns are in direct contact with **or** penetrate the floor slab	❑	❑		Replace improperly treated or untreated wood in contact with the slab with pressure-treated wood or an alternative resistant material. See Appendix for examples of acceptable quality marks for pressure-treated lumber, and their applicability.
22. Wood in contact with the slab is not pressure treated **or** not stamped with the appropriate quality mark	0	0		See Appendix for examples of acceptable quality marks for pressure-treated lumber and their applicability. Replace untreated wood in contact with foundation slabs with pressure-treated wood if practicable. Alternatively brush with a wood preservative/water repellent solution to reduce the risk of decay.
23. Wood foundation walls **are** not **pressure treated** or not stamped with a quality mark for foundation use	❑	❑		See Appendix for examples of acceptable quality marks for foundation material, and their applicability. Replace improperly treated or untreated wood with pressure-treated wood or an alternative resistant material.
24. There is evidence of water leaks or excessive condensation on the basement walls and floor	o	❑	0	If these are caused by plumbing leaks. repair the leaks. If excessive amounts of water are passing through the foundation walls, waterproof the outside of the foundation walls below grade and install drain tile and gravel at the footings to discharge water into a storm sewer, street, dry well or other area where it will not run under a house: or improve drainage around the house as described in 1 and 2. If there is excessive condensation, determine and eliminate the source of moisture by, for example, installing a vapor barrier on top of the slab if there is not one below the slab: venting moisture from bathrooms, kitchens, and utility rooms to the outside; or using dehumidifiers in the summer.

If the answer to any of these questions is yes, it should be recommended that the problem be corrected as described in the "Corrective Procedures" section, except that a corrective procedure designed to prevent future decay or insect attack should only be recommended in an existing house when there is good reason to believe that such problems will occur if corrective steps are not taken. For example. if framing in a 10-year-old house is only 4 inches above outside grade. but free of fungus or insect attack. it is not necessary

onr-Idino

=N/A not applicable

3 Evidence of decay is described on pages 8 thru 15.

Structurally weakened wood is defined as wood which, because of decay or insect attack, is no longer able to Perform the job for which it was designed. The definition can be applied to a single member or group of mei/lbws.

25. There is evidence of leaks on **the** ceiling under

a. kitchen ❑ El ❑

b. bathrooms ❑ ❑ ❑

c. utility rooms ❑ ❑ ❑

d. **other** ❑ ❑ ❑

Repair leaks in plumbing, replace caulking and/or grout in showers and around sinks and tubs.

26. There is evidence of **leaks** in the basement in

a. kitchen ❑ ❑

b. bathrooms El ❑

c. utility room ❑ ❑ CI

d. **other** ❑ ❑

Repair leaks in plumbing, replace caulking and/or grout in showers and around sinks and tubs.

27. Termite tubes are present on

a. the foundation walls ☐ ☐

b. **termite** shields, poured concrete caps, or pressure-treated wood sills ☐ ☐

c. plumbing ☐ ☐

d. columns ☐ ☐ El

e. other _____ ☐ ☐

Treat the house foundation with termite control chemicals.

28. In unfinished basements and accessible areas of finished basements

a. there are mold or stain fungi on framing lumber *and/or* its moisture content is more than 20 percent ❑ ❑ ❑

b. there is evidence of decay[3] in framing lumber after visual inspection. probing. and sounding ❑ ❑

c. there is evidence of insect attack[s] after visual inspection, probing, and sounding ❑ ❑ Cl

a) Determine the source of moisture and eliminate it if practicable. If it is due to water leaks through the foundation wall, or condensation, correct as described in 24. If it is due to a plumbing leak. repair the leak. Replace structurally weakened wood with sound untreated wood where the source of moisture is eliminated. If the source of moisture is not eliminated, then replace all wood with a moisture content greater than 20 percent with preservative-treated or naturally resistant wood (see Appendix 1 for appropriate treatments).

b) Determine the source of moisture allowing decay to occur, and correct as described in 28a. If there is extensive decay away from an obvious source of moisture, suspect the water-conducting fungi *Poria incrassata* or *Merulius lacrymans.* If either of these are present great care must be taken to find and eliminate the source of the fungus.

c) Correct as described in 17.

29. In finished basements there is evidence of decay[3] in			
a. window and window frames	☐	☐	☐
b. doors, door frames and sills	☐	☐	☐
c. wood baseboards	☐	☐	☐
d. walls	☐	☐	☐
e. other _____	☐	☐	☐

30. In finished basements there is evidence of insect attack' in			
a. windows and window frames	❑	❑	❑
b. doors, door frames and sills	❑	❑	❑
c. wood baseboards	❑	❑	❑
d. walls	❑	❑	❑
e. other	❑	❑	❑

Determine the source of moisture allowing decay to occur, and correct as described in 28a. Where decay is in window and door frames check, and repair if necessary. out side caulking or glazing.

Con ect as described in 17.

[2] N/A = not applicable

[3] Evidence of decay is described on pages 8 thru 15.

'Evi dence of insect attack is described on pages 16 thru 40.

Around the Foundations — Slab-on-grade Construction

Checklist'

Outside

	Yes	No	NLA.[1]	Corrective Procedures
1. Surface water drains towards the house, not away from it			D	Alter surface drainage so that water runs away from the building by regrading the lot: by building a retaining wall or swale; or by installing drain tile and/or gravel to intercept water before it reaches the house.
2. Rain water from the roof drains under the house	❑	❑		Drain rain water away from the house with gutters, downspouts and splashblocks: by regrading; or by attaching draintile to downspouts to deposit the water in a storm sewer, dry well, or other location where it will not run under a house.
3. Walkway, patio, and porch slabs slope towards the house, not away from it	❑	❑		Change the slope of the slab to direct water away from the house. If this is not practicable, caulk all cracks between the slab and the wall of the house to prevent water seepage under the house.
4. Form boards, grade stakes, wood debris, and paper products have been left around the house	El	❑	[1]	Remove untreated wood form boards and grade stakes, wood debris, and paper products. Otherwise, they may provide an entry point for fungi and insects.
5. Firewood and lumber piles are less than 6 inches away from the house	❑	❑		Move firewood and lumber piles so that they are at least 6 inches away from the house.
6. Wood in contact with the soil is not **pressure treated** or not stamped with the appropriate quality mark	❑	❑		See Appendix (p. 100) for examples of acceptable quality marks for pressure-treated lumber, and their applicability. Replace improperly treated or untreated wood in contact with the soil with pressure-treated wood or an alternative resistant material.

BEFORE

REGRADE

AFTER

SWAL E | RETAINING WALL | DRAIN TILE/ GRAVEL

[1] If the answer to any of these questions is yes. it should be recommended that the problem be corrected as described in the "Corrective Procedures'' section, except that a corrective procedure designed to prevent future decay or insect attack should only be recommended in an existing house when there is good reason to believe that such problems will occur if corrective steps are not taken. For example, if framing in a 10-Y.ear-old house is only 4 inches above outside grade. but free of fungus or insect attack, it is not necessary to recommend regrading.

[1] N/A °not applicable

	Yes	No	N'/Lkz	
7. Other wood exposed to a high risk of decay or insect attack is not preservative treated or naturally resistant, or not stamped with the appropriate quality or grade mark	❑	❑	❑	See Appendix for wood items which should be pressure treated or naturally resistant. Replace untreated wood if practicable. Alternatively brush it with a wood preservative/water repellent solution to reduce to risk of decay (do not apply to painted surfaces).
8. Wood siding is less than **6** inches above outside grade	❑	❑	☐	Lower grade so that soil is 6 inches below wood siding. but prevent rain water from draining under the house.
9. Paint or stucco is blistered, peeling, or loose	☐	☐	☐	Try to determine if problem is caused by excessive moisture, poor maintenance, or improper use of materials (for example, application of oil-based paints on latex, or latex paints on oil sometimes leads to blistering or peeling of the paint). If excessive moisture is the problem, locate the source of moisture and where possible eliminate it. For example, install vapor barriers in the walls or on the floor: vent moist air out of bathrooms. kitchens, and utility rooms: or use a dehumidifier in the summer. Loose stucco should be examined carefully for the presence of subterranean termites.
10. Untreated wood framing is less than **8** inches above **outside grade**	❑	❑	☐	Lower grade so that soil is at least 8 inches below untreated wood framing, but prevent rain water from draining under the house.
11. Untreated wood framing is **less than 8 inches above soil in planters (not critical when separated** by flashing or poured concrete, or when planters are separate structures)	❑	❑	❑	Install continuous flashing or pour concrete to isolate from wood in the house.
12. There are termite tubes present on the foundation slab or walls **(these are particularly common where wood siding is close to outside grade, and there are shrubs or plants close to the wall, and in cracks in the foundation slab)**	⬭	❑	❑	Treat the house foundations with termite control chemicals.

13. There is evidence of decay[3] close to the grade in

a. wood siding	0	❑	❑
b. doors, door frames and sills	❑	❑	❑
c. wooden steps	❑	❑	❑
d. wood columns	❑	❑	❑
e. fence posts, arches, or other non-structural items attached to the house	❑	❑	❑
f. planters	❑	❑	❑
g. other _____	❑	❑	❑

Determine the source of moisture which allows decay to occur, and eliminate it if practicable. Replace structurally weakened wood[4] with sound untreated wood where the source of moisture can be eliminated, or with preservative-treated wood where it is in ground contact or where moisture cannot be eliminated (see Appendix for the appropriate treatment to use). Where slight decay has occurred in siding. frames, doors, wooden steps. wood columns, etc.. brush with a wood preservative/water repellent solution to reduce the rate of decay (do not apply to painted surfaces). Decay is commonly associated with rain splash against wood close to the ground due to an absence of gutters and downspouts. or lack of proper clearance between untreated wood and the ground.

14. **There is** evidence of insect attack' close to the grade in

a. wood siding	❑	❑	❑
b. doors, door frames and sills	❑	❑	❑
c. wooden steps	❑	❑	El
d. wood columns	❑	❑	❑
e. fence posts, arches, or other non-structural items attached to the house	❑	❑	
f. meter boxes	❑	❑	
g. planters	El		
h. bathroom inspection doors	❑	❑	El
other	❑	❑	❑

Iye

Identify the types of insect from the type of damage present, for example termite tubes, insect exit holes, sawdust pellets, etc.. and recommend the correct control procedure. This may require the assistance of an extension entomologist at a land grant university or a reputable pest control company. All structurally weakened wood' should be replaced as a part of the control procedures.

In the living area

See "Inside the living area and attic," page 90. In regions where subterranean termites occur, a particularly careful inspection must be made for their presence in the living area of slab-on-grade houses.

[3] Evidence of decay is described on pages 8 thru 15.

Structurally weakened wood is defined as wood which, because of decay or insect attack, is no longer able to perform the job for which it was designed. The definition can be applied to a single member or group of

5Evi dence of insect attack is described on pages 16 thru 40.

Outside House
Above Ground Level

Checklist,

	Yes	No	NA
1. Windows are not properly glazed	❑	❑	❑
2. Window and door frames are not properly caulked	❑	❑	❑
3. Flashing is absent a. around doors and windows	❑	❑	❑
b. at intersections of different materials on the walls when exterior finish does not provide a self-flashing joint	❑		
c. at roof/wall intersections	❑	❑	❑
d. at roof/chimney intersections	❑	❑	❑
e. at pipes and vents projecting through the roof	❑	❑	❑
4. Shingles do not extend 3/4 inch beyond, and form a continuous drip edge at the eave and rake	❑	❑	❑

It the answer to any of these questions is yes. it should be recommended that the problem be corrected as described in the "Corrective Procedures" section. except that a corrective procedure designed to prevent future decay or insect attack should only be recommended in an existing house when there is good reason to believe that such problems will occur if corrective steps are not taken. For example, if framing in a 10-

Corrective Procedures

Glaze all areas around windows where glaze is absent.

Caulk all areas around window and door frames where caulk is absent.

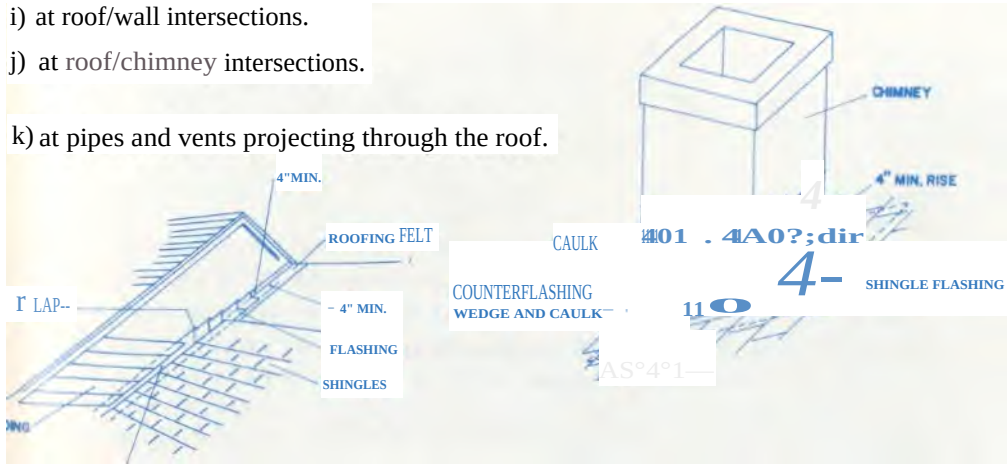
Install flashing
a) around doors and windows.

b) at intersections of different materials on the walls when exterior finish does not provide a self-flashing joint.

i) at roof/wall intersections.

j) at roof/chimney intersections.

k) at pipes and vents projecting through the roof.

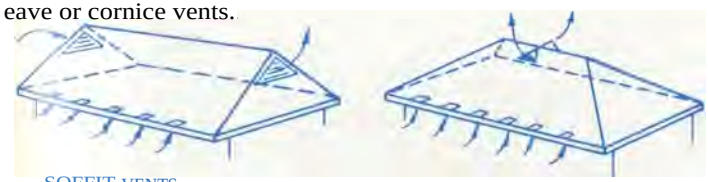


Install shingles to extend 3/4 inch beyond. and give a continuous drip edge at, the eave and rake, or install flashing.

cooldmhmoeundis grnaldyi4 inc es above outside grade. but free of fungus or insect attack. it is not necessary to recommend

N/A '-irinot applicable

5. Gutters are not provided where the roof overhang is less than 12 inches in width for one story houses, or 24 inches in width for two story houses		❑		Install gutters and downspouts where the roof overhang is less than 12 inches in width for one story houses, or 24 inches in width for two story houses.
6. Gutters leak or are blocked by leaves or other trash	❑	❑	❑	Repair leaks in gutter. and remove leaves and other trash.
7. Downspouts leak				Repair leaks in downspouts.
8. There is not adequate ventilation in the attic	O	❑	❑	Install gable end, roof peak, or soffit vents as appropriate, to give a free ventilating area of 1 sq. ft. per 150 sq. ft. of horizontal floor area in the attic. This can be reduced to 1 sq. ft. per 300 sq. ft. if a vapor barrier is installed on the warm side of the ceiling, or at least 50 percent of the ventilating area is provided with fixed ventilators in the upper portion of the space to be ventilated, with the remainder provided by eave or cornice vents.
9. There is evidence of decay[3] in				
a. wood siding	❑	❑		
b. windows and window frames	❑	❑		
c. doors, door frames, and sills	❑	❑		
d. wooden steps	❑	❑		
e. roof trim — gables, eaves, soffits, fascia	❑	❑		
f. other _____	❑	❑		



SOFFIT VENTS OPTIONAL

SOFFIT VENTS NECESSARY

SOFFIT VENTS NECESSARY

51I_____

Determine the source of moisture which allows decay to occur, and eliminate it if practicable. Replace structurally weakened wood' with sound untreated wood where the source of moisture can be eliminated. or with preservative-treated wood where it cannot be eliminated (see Appendix for the appropriate treatment to use). Where slight decay has occurred at window and door frame joints, in wooden steps, in window joints and cross cut surfaces of siding and roof trim, brush with a wood preservative/water repellent solution to reduce the rate of decay (do not apply to painted surfaces). Decay is commonly associated with the absence of caulking or glaze around Window and door frames and windows, no flashing at roof/wall intersections, eaves and rake, or around doors and windows, and shingles not extending beyond the eave and rake to form a continuous drip edge.

[3] Evidence of decay is described on pages 8 thru 15.

Stru
cturally weakened wood is defined as wood which, because of decay or insect attack, is no longer able to Perform the job for which it was designed. The definition can be applied to a single member or group of members.

O,

10. There is evidence of insect attack' in

a. wood siding ❑ ❑

b. windows and window frames ❑ ❑

c. doors, door frames, and sills ❑

d. wooden steps ❑

e. roof trim — gables, eaves, soffits, fascia ❑

f. other _____ ❑

identify the type of insect from the type of damage present, for example, termite tubes, insect exit holes, sawdust. pellets, etc.. and recommend the correct control procedure. This may require the assistance of an extension entomologist from a land grant university or a reputable pest control company. All structurally weakened wood' should be replaced as a part of the control procedures.

[5] Evidence of insect attack is described on pages 16 thin 40.

Inside the Living Area & Attic

Checklist'	Yes	No	N/A'	Corrective Procedures
1. There is evidence of water leaks in				
a. kitchen	❑	❑	❑	Repair leaks in plumbing. replace caulking and/or grout in showers and around sinks and tubs.
b. bathrooms	❑	❑	❑	
c. utility room	❑	❑	❑	
d. other _____	❑	❑	❑	
2. There is evidence of water stains, mildew, or mold growth on				
a. walls	❑	❑		Determine the source of moisture. If this is a plumbing or roof leak, repair the plumbing or roof. If this is excess moisture in the building eliminate it by, for example, venting moisture in bathrooms, kitchens, and utility rooms to the outside: improving ventilation, drainage, or installing moisture barriers in the crawl space; or using dehumidifiers in the summer. If vapor barriers on insulation in the walls and ceiling are absent, or placed towards the outside of the house, reverse the position of the vapor barrier where practicable, or apply an aluminum paint on the living area side of walls. In areas of the country with severe winters water leakage into walls and interiors of houses is sometimes caused by ice dams. If this is the source of moisture, improve ventilation and insulation in the attic.
b. ceilings	❑	❑	0	
3. The floor sags or is buckled	❑	❑	❑	Determine the cause of the problem. In crawl space houses if there are insufficient supports under the floor, install more supports. If there is decay or insect attack in the subfloor, correct as described in 16 and 32b in "Inspection of existing homes: around the foundations — crawl space construction," page 50 through 57. If buckling is due to water leaks, eliminate the leaks. Replace all structurally weakened wood' and delaminated plywood.
4. There are gaps between the floor and baseboards	❑	❑		If gaps are due to drying of wood. caulk gaps if desired. If they are due to settlement of the floor in crawl space houses, correct as described in 3.

If the answer to any of these questions is yes. it should be recommended that the problem be corrected as described in the "Corrective Procedures" section. except that a corrective procedure designed to prevent future decay or insect attack should only be recommended in an existing house when there is good reason to believe that such problems will occur if corrective steps are not taken. For example, if framing in a 10.

&'ear•old house is only it inches above outside grade, but tree of fungus or insect attack, it is not necessary to recommend regrading.

[2] Apt applicable

	Yes	No	Na.2	
5. There is evidence of decay[3] in				
a. windows and window frames		❑	❑	
b. doors, door frames, and sills	o	ID	❑	1
c. wood baseboards	❑			
d. wood flooring				
e. walls	a			
f. other _____				
6. **There is** evidence of insect attack[s] in				
a. windows and window frames	❑	❑	0	
b. doors, door frames, and sills	❑	❑	0	
c. wood baseboards	o			
d. wood flooring				
e. walls				
f. other	o	❑		
7. **There** is no access door to attic	❑	❑	❑	

Determine and eliminate the source of moisture which allows decay to occur. Replace structurally weakened wood" with sound untreated wood. Decay is commonly associated with the absence of caulking or glaze around window and door frames and windows, or plumbing leaks. If there is extensive decay away from an obvious source of moisture, suspect the water-conducting fungi *Poria incrassata* or *Merulius lacrymans.* If either of these are present, great care must be taken to find and eliminate the source of the fungus.

Idei ' tify the type of insect from the type of damage present, for example, termite tubes. insect exit holes, sawdust. pellets. etc., and recommend the correct control procedure. This may require the assistance of an extension entomologist from a land grant university or a reputable pest control company. All structurally weakened wood[y] should be replaced as a part of the control procedure.

Provide an access door to the attic. Note inaccessible areas in the attic in the inspection eport.

[3] Evidence of decay is described on pages 8 thru 15.

[4] Structurally weakened wood is defined as wood which, because of decay or insect attack, is no longer able to perform the job for which it was designed. The definition can be applied to a single member or group of lli members.

Ev idence of insect attack is described on pages 16 thru 40.

	Yes	No	NA	
8. There is evidence of rain seepage or decay' in the attic				Determine and eliminate the source of moisture. Replace structurally weakened wood4 with sound untreated wood. Rain seepage or decay is commonly associated with leaks around vent pipes and TV antennas or through broken shingles. Decay may be due to excessive moisture in the building. This can be eliminated as described in 2. In areas of the country with severe winters, water leakage is sometimes caused by ice dams. If this is the source of moisture, improve ventilation and insulation in the attic.
a. sheathing (particularly around vent pipes and TV antennas)	❑	❑	❑	
b. rafters	❑	❑	❑	
c. joists	❑	❑	❑	
d. wall top plates	❑	❑	❑	
e. other	❑			
9. **There** is evidence of insect attack[s] in the attic				Correct as described in 6.
a. sheathing (particularly around vent pipes and TV antennas)	❑	❑		
b. rafters	❑	❑		
c. joists	❑	❑		
d. wall top plates	❑	❑		
e. other	ill	❑		
10. The vapor barrier on insulation is on the side of the insulation towards the outside of the house, not the living **area**	❑	❑		Reverse the vapor barrier if it is placed towards the outside of the house, not the living area. If this is not practicable apply an aluminum paint on the living area side of walls where the vapor barrier is incorrectly applied (in the Gulf Coast area it is advisable to omit all vapor barriers in the walls and ceiling).

Inspection Report for Wood-inhabiting Fungi and Insects

An essential part of the inspection procedure is accurate reporting of the results of the examination, and development of recommendations for prevention or control of fungus and of insect problems. Inspection reports should be simple to complete, but at the same time must present to the homeowner and buyer an accurate picture of existing and potential problems. The report should include a diagram of the structure, showing damaged areas, inaccessible and uninspected areas, and areas where damage is likely to occur if no corrective measures are taken.

The report for existing houses is based on the "Standard Structural Pest Control Inspection Report (Wood-Destroying Pests or Organisms)" developed by the California Structural Pest Control Board, FHA Form No. 2053, and a "Wood-Destroying Organism Report" under consideration by the Oregon Department of Veterans' Affairs.

In addition to containing the results of inspection, the report should list recommended corrective procedures which will either control or prevent decay and insect attack. However, in recommending corrective procedures it must be stressed again that the objective of any recommendation should be to save the homeowner money by controlling or preventing decay and insect attack. In existing houses, corrective procedures designed to prevent future problems should be recommended only when there is good reason to believe that such problems will occur if corrective steps are not taken. For example, if a 10-year-old house has only a 6-inch roof overhang, but there is no evidence of decay or insect attack in wood siding, window frames, roof trim, etc.. it is not necessary to recommend installation of gutters. although they should be present in good construction. When corrective procedures are recommended, care should be taken to ensure that the least expensive procedures are given. For example, if a door is heavily infested with lyctid powderpost beetles, replacement of the door, rather than fumigation of the house, should be recommended.

Wood-inhabiting Organisms Report–Existing Homes

Property Address

Inspection requested by _____

Inspector Date of Inspection _____

Inspector's Address _____

Case Number _____ Age of House

Inspection Findings (explain in detail below)

A. Wood-inhabiting organisms

	Yes		No
	Active	Inactive	
1. Mold and stain fungi	❑	❑	❑
2. Decay fungi (brown and white rot)	❑	❑	❑
3. Water-conducting fungi	❑	❑	❑
4. Subterranean termites	❑	❑	❑
5. Formosan subterranean termites	❑	❑	❑
6. Drywood termites	❑	❑	❑
7. Dampwood termites	❑	❑	❑
8. Old house borers	❑	❑	❑
9. Anobiid beetles	❑	❑	❑
10. Lyctid powderpost beetles	❑	❑	❑
11. Bostrichid powderpost beetles	❑	❑	❑
12. Carpenter ants	❑	❑	❑
13. Other	❑	❑	❑

Protective treatments for low decay hazard zone

Item	Foundation treatment	Ground contact treatment	Above ground treatment	Water repellent treatment	Decay resistant species[1]
Foundation and substructure items, subject mainly to ground moisture					
· Foundation: permanent pole, lumber, or plywood components in ground contact or separated from ground by only a water-resistant membrane.	X	–	–	–	–
· Furring strips in basement below grade.	–	–	X	–	X
· Joists, girders, or beams embedded in concrete or masonry wall foundation, & ends are not ventilated. Sills, plates or other wood components below minimum clearance, but above exterior grade.	–	X	–	–	–
· Piers in crawl space (on concrete or solid masonry footing at least 6 inches above grade).	–	–	X	–	X
· Sills, plates, or sleepers on concrete slab (wood to earth separation at least 8 inches).	–	–	X	–	X
· Sills or plates on concrete or masonry wall foundation (wood to earth separation at least 8 inches to exterior grade and 18 inches to interior).	–	–	X	–	X
· Sills or plates embedded in concrete slab.	–	–	X	–	–
· Posts set in ground (fence and others not a part of the dwelling).	–	X	–	–	X
Outside items subject to rain wetting					
· Access panels, doors, and frames to basementless spaces.	–	–	X	–	X
· Arches or other major loadbearing items which are integral parts of the structure and are exposed to the weather.	–	X	–	–	–
· Frames, sash, and trim (windows, screens, doors).	–	–	–	X	–
· Porch, patio, deck and balcony framing.	–	–	X	–	X
· Porch, patio, deck and balcony decking.	–	–	X	–	X

[1] Redwood, cypress, and cedar heartwood.

Protective treatments for moderate decay hazard zone

Item	Foundation treatment	Ground contact treatment	Above ground treatment	Water repellent treatment	Decay resistant species[1]
Foundation and substructure items, subject mainly to ground moisture					
· Foundation: permanent pole, lumber, or plywood components in ground contact or separated from ground by only a water-resistant membrane.	X	–	–	–	–
· Furring strips in basement below grade.	–	–	X	–	X
· Joists, girders, or beams embedded in concrete or masonry wall foundation. & ends are not ventilated. Sills, plates or other wood components below minimum clearance, but above exterior grade.	–	X	–	–	–
· Piers in crawl space (on concrete or solid masonry footing at least 6 inches above grade).	–	X	–	–	–
· Sills, plates, or sleepers on concrete slab (wood to earth separation at least 8 inches).	–	–	X	–	X
· Sills or plates on concrete or masonry wall foundation (wood to earth separation at least 8 inches to exterior grade and 18 inches to interior).	–	–	X	–	X
· Sills or plates embedded in concrete slab.	–	X	–	–	–
· Posts set in ground (fence and others not a part of the dwelling).	–	X	–	–	–
Outside items subject to rain wetting					
· Access panels, doors, and frames to basementless spaces.	–	–	X	–	X
· Arches or other major loadbearing items which are integral parts of the structure and are exposed to the weather.	–	X	–	–	–
· Exterior columns (porch, carport) resting on concrete slab.	–	–	X	X	X
· Fence framing and panels	–	–	X	–	X
· Frames, sash, and trim (windows, screens, doors).	–	–	–	X	–
· Porch, patio, deck and balcony framing.	–	–	X	–	X
· Porch, patio, deck and balcony decking.	–	–	X	–	X
· Shutters.	–	–	–	X	–
· Treads and stringers (carriages) resting on elevated concrete base.	–	–	X	–	X

[1] Redwood, cypress, and cedar heartwood.

Protective treatments for high decay hazard zone

Item	Foundation treatment	Ground contact treatment	Above ground treatment	Water repellent treatment	Decay resistant species[1]
Foundation and substructure items, subject mainly to ground moisture					
· Foundation: permanent pole, lumber, or plywood components in ground contact or separated from ground by only a water-resistant membrane.	X	–	–	–	–
· Furring strips in basement below grade.	–	–	X	–	–
· Joists, girders, or beams embedded in concrete or masonry wall foundation, & ends are not ventilated. Sills, plates or other wood components below minimum clearance, but above exterior grade.	–	X	–	–	–
· Piers in crawl space (on concrete or solid masonry footing at least 6 inches above grade).	–	X	–	–	–
· Sills, plates, or sleepers on concrete slab (wood to earth separation at least 8 inches).	–	–	X	–	X
· Sills or plates on concrete or masonry wall foundation (wood to earth separation at least 8 inches to exterior grade and 18 inches to interior).	–	–	X	–	X
· Sills or plates embedded in concrete slab.	–	X	–	–	–
· Poles set in ground (fence and others not a part of the dwelling).	–	X	–	–	–
Outside items subject to rain wetting					
· Access panels, doors, and frames to basementless spaces.	–	–	X	–	–
· Arches or other major loadbearing items which are integral parts of the structure and are exposed to the weather.	–	X	–	–	–
· Exterior columns (porch, carport) resting on concrete slab.	–	–	X	X	X
· Fence framing and panels.	–	–	X	–	X
· Frames, sash, and trim (windows, screens, doors).	–	–	–	X	–
· Exterior wood doors subject to rain splash.	–	–	–	X	–
· Porch, patio, deck and balcony framing.	–	–	X	–	–
· Porch, patio, deck and balcony decking.	–	–	X	–	–
· Roof edges: fascia and rake boards.	–	–	X	–	X
· Shutters.	–	–	–	X	–
· Siding and trim.	–	–	–	X	X
· Treads and stringers (carriages) resting on elevated concrete base.	–	–	X	–	–

[1] Redwood, cypress, and cedar heartwood.

B. Conditions favoring wood-inhabiting organisms

	Yes	No	NA[1]
1. Faulty grade			☐
2. Untreated wood-earth contact			☐
3. Improperly sealed earth-filled porch or planter			☐
4. Wood debris—form boards, grade stakes, stumps, etc. around foundation			☐
5. Water leaks (plumbing, shower, etc.)			☐
6. Excessive moisture conditions	☐		☐
7. In crawl space construction			
a. no soil cover			☐
b. insufficient ventilation			☐
8. Insufficient attic ventilation			☐
9. Blocked or leaking gutters and downspouts			☐
10. Inaccessible or uninspected areas[2]		☐	☐
11. Other _____			☐

[1] NA = not applicable.
[2] Explain in comments and recommendations section.

Comments and recommendations

House Diagram

Explanation of symbols

A - Anobiid beetles
B = Bostrichid powderpost beetles
C = Carpenter ants
D — Decay fungi
F = Formosan subterranean termites
H = Old house borer
K = Drywood termites
L = Lyctid powderpost beetles
M Mold and stain
0 = Other (specify)
- Subterranean termites
W Water-conducting fungi
Z Dampwood termites

BLG = Blocked or leaking gutter, downspo
EC = Untreated wood/earth contact
EM Excessive moisture
EP = Improperly sealed earth-filled porci or planter
EV = Existing vents
FG = Faulty grade
IA Inaccessible or uninspected area
OT Other (specify)
PV - Proposed vents
WD Wood debris, form boards, etc.
WL Water leaks

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