"Advanced Inspection of Crawlspaces" for home inspectors

The goal of this course is to teach students how to inspect crawlspaces of homes.

The student will obtain an advanced understanding of how to inspect a crawlspace, including:

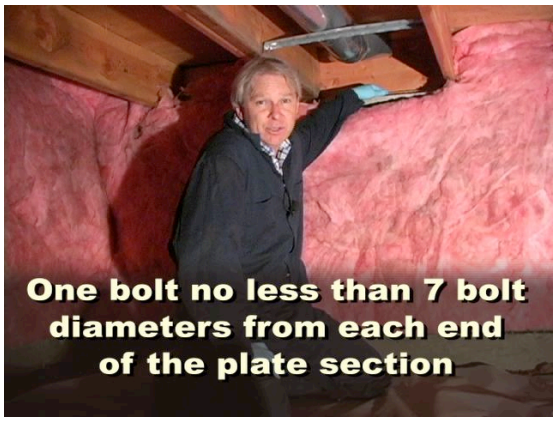
- using personal protection equipment;
- the InterNACHI Standards of Practice;
- an inspection checklist;
- suggested report narratives and language; and
- defect recognition.

The student will watch and learn how a Certified Master Inspector® performs two on-site inspections of actual crawlspaces, and how over 50 defects are discovered and reported. The course document includes suggested narratives and language that can be used in writing an inspection report.

Completing this course should enable an inspector to identify defects and safety hazards in relation to modern standards and requirements.

This is not a code compliance course. There are many codes, and they change regularly. Parts of this inspection are beyond what an inspector would do on a general home inspection and exceed InterNACHI's Standards of Practice.

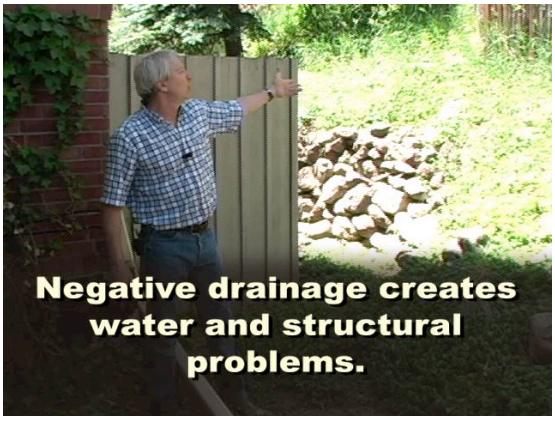
At the end of the course, we will go over some suggested narrative language that can be used in an inspection report. An inspection report should describe and identify in written format the inspected components of the dwelling and should identify defects that were observed on the day of the inspection.

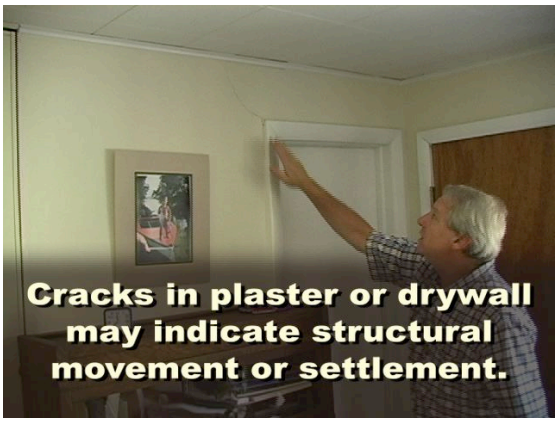


Section 1
Kenton Shepard
Personal Protection Equipment (PPE) and Inspection Tools
The student will learn about all the tools and equipment that can be utilized and worn for performing a crawlspace inspection, including GFCI-protection, infrared cameras, and moisture meters.
10 minutes

Section 2
Kenton Shepard
Inspecting the First Crawlspace
Kenton performs an inspection on a relatively clean and defect-free crawlspace. The InterNACHI Standards of Practice are taught. The student will learn about all of the components of the crawlspace to inspect, including going through an inspection checklist. Modern building standards will be reviewed with every component inspected.
20 minutes

Section 3
Kenton Shepard
Inspecting the Second Crawlspace
Kenton performs an inspection on a crawlspace that is filled with safety hazards, water damage, and major structural defects. The student will learn how to recognize the major defects that are discovered, including the affect grading has on a crawlspace, recognizing signs of water penetration and moisture damage, and major structural defects that require further evaluation by a structural engineer.
25 minutes





Section 4
Kenton Shepard
Inspecting the Areas Affected by the Crawlspace Defects
The student will discover signs of structural defects in the crawlspace that have manifested at the interior rooms above the crawlspace and at the exterior, including plaster cracks, out-of-square door frames, and openings in the exterior components.
4 minutes

Section 5
Kenton Shepard
Course Ending
1 minute

Online Video Course Time: 1 hour
Study Time of Downloaded Printed Material: 1 hour
Exam Time Allotted: 60 questions: 1 hour

TOTAL TIME: 3 hours

Section 1
Personal Protection Equipment and Inspection Tools

All crawlspaces are required to have access.

Measure the crawlspace access. The minimum access dimension is 16" x 24" when the access hole is through perimeter wall of the crawlspace. The minimum access dimension is 18" x 24" when the access is through the floor above the crawlspace. If the access is greater than 4 feet in any dimension, the header and trimmer joists should be doubled.

Orientation: Be sure to orient yourself in the crawlspace correctly. Crawl the perimeter of the crawlspace, looking for additional spaces. Pay attention to the relationship between the structure footprint as seen from the exterior and the exposed foundation and accessible areas as seen from the interior.

Document inspection restrictions to any inaccessible spaces.

Crawlspaces can be dangerous places. There can be electrical hazards, disease exposure, viruses, spider and insect bites, mold spores, construction debris, and animals.

Personal Protection Equipment (PPE)

The reasons for using tools and personal protection equipment are (1) to be safe, (2) to be fully equipped, and (3) to perform a thorough inspection. PPE allows to you concentrate on what you are doing.

Crawlspace Inspection Tools and Equipment:

- Personal Protection Equipment (PPE)
- Suit, full-body, canvas, long sleeves (protection from hazards including simple abrasion).
- Pockets (to carry inspection tools, leaving your hands free)
- Knee pads (protection from rocks, water, debris, nails, concrete)
- Protective gloves, cloth or latex. Not too loose that your finger can't be used to take a picture with your camera.
- Digital picture camera. With fresh batteries, and carry extra batteries. Used for documenting inspection restrictions and conditions observable on the day of the inspection.
- Protective cloth cap or hardhat
- Shoes just for the crawlspace
- Probe or poker
- Screwdriver or hand tools. Hand tools could be used for probing or knocking. Decayed or damaged wooden components sound different than those that are sound and solid.
- Flashlight with fresh batteries. Use rechargeable batteries. Carry extra batteries into the crawlspace.
- Laser pointer
- Headlight or headlamp. Can be used as a backup to a flashlight. Can be used as the primary light source. Headlamps keep your hands free.
- Extra batteries

- Non-contact voltage detector beeper instrument. To check electrical wires and their condition. Oftentimes, an inspector will discover loose, disconnected, live wires hanging from the crawlspace ceiling.
- Work light. Work lights have the advantage over flashlights by flooding the space with light. And a work light does not require the use of hands.
- GFCI-protection. Use GFCI-protection especially if you are using a work light with an extension cord. Many extension cords have integrated GFCI-protection devices.
- Extension cord. Make it a heavy-gauge cable. At least 14-guage should be used; 12-guage wire is better. Make sure the cord is plugged into a properly wired and grounded receptacle.
- Carpet for cleanliness. Use the carpeting to stand upon after exiting the crawlspace, particularly if the access is an interior opening and the crawlspace is muddy.
- A note and a business card. If you are inspecting a crawlspace in a vacant house, leave a note and a business card somewhere in the living space - to alert people entering the house of your location and the reason for your presence.
- GFCI tester. Bring one inside the space, just in case there is a receptacle discovered in the space.
- Measuring tape
- Moisture meter. A moisture meter should be used to confirm what is visually observed.
- Moisture gauge
- Infrared thermography camera. There are various ways to use this technology. It needs a good holster or carrying bag to offer padded protection.
- Jar for collecting insects. A captured termite inside a glass jar is a fantastic way of demonstrating and confirming the presence of active infestation in a crawlspace to your client.
- Mold test kit to confirm visual evidence. Do not report the presence of mold without performing a mold test.
- Mask/respirator, lower face or full face. Used to protect your lungs and your eyes. Do not use a dust mask.

Section 2

The First Crawlspace

InterNACHI Standards of Practice:

2.3. Basement, Foundation & Crawlspace

I. The inspector shall inspect:

A. The basement.
B. The foundation
C. The crawlspace.
D. The visible structural components.
E. And report on the location of under-floor access openings.
F. And report any present conditions or clear indications of active water penetration observed by the inspector.
G. For wood in contact or near soil.
H. And report any general indications of foundation movement that are observed by the inspector, such as but not limited to sheetrock cracks, brick cracks, out-of-square door frames or floor slopes.
I. And report on any cutting, notching and boring of framing members that may present a structural or safety concern.

II. The inspector is not required to:

A. Enter any crawlspaces that are not readily accessible or where entry could cause damage or pose a hazard to the inspector.
B. Move stored items or debris.
C. Operate sump pumps with inaccessible floats.
D. Identify size, spacing, span, location or determine adequacy of foundation bolting, bracing, joists, joist spans or support systems.
E. Provide any engineering or architectural service.
F. Report on the adequacy of any structural system or component.

Utilize an inspection checklist for the crawlspace inspection.

Check the following components and conditions:

Document any restrictions to the inspection of the crawlspace. Document inaccessible areas.

In the video, the foundation walls are covered with insulation.

A crawlspace can be filled with debris or stored items. An access can be too small. Opening a crawlspace access should not require special tools or knowledge. Crawlspaces with excessive moisture can be an inspection restriction. Crawlspaces that have animals or vermin can be an inspection restriction.

Check for water or moisture penetration. In the video, there is active water penetration visible at the exterior foundation wall and footing. Efflorescence is discovered.

Efflorescence occurs in masonry, brick and concrete, when water moving through a wall structure brings salts to the surface that are not commonly bound as part of the cement stone. As the water evaporates, it leaves the salt behind, which forms a white, fluffy deposit that can usually be brushed off. The resulting white deposits are referred to as "efflorescence" in this instance. In this context efflorescence is sometimes referred to as "salt petering." Since primary efflorescence brings out salts that are not ordinarily part of the cement stone, it is not a structural, but, rather, an aesthetic concern.

Check for visual signs of mold. If you suspect mold being present, the recommend having the structure tested for mold by a qualified inspector. To find a qualified mold inspector, go to www.iac2.org. For certified mold training, go to www.reliablelab.com.

Check the sump pump or drainage system. Determine if the sump pump or drainage system is original to the house or not. If it has been installed after the house was built, the property owner may have disclosed information about a history of water problems. Ask the property owner about the performance of the sump pump or drainage system.

Sump pumps that are installed in a hand-dug dirt hole are prone to premature failure and erosion of the soil. The sump pump installed in a dirt hole is not reliable. Recommend that a professional install the sump.

Pay attention to odors in the crawlspace. An odor associated with moisture may not necessarily be related to a mold problem.

The recommendations for a vapor barrier installation include: 6-mil minimum polyethylene plastic sheet, sealed well around all penetrations, six inches of overlap with the overlaps sealed, and six inches of the barrier carried up the foundation wall and sealed.

Check for nonconditioned spaces with insulation installed on the under-side of the floor system above the crawlspace. Check your local codes about the proper integration of insulation, ventilation, and vapor barriers in relation to crawlspaces in your geographical area.

Check for moisture or humidity problems.

Check for condensation developing on the vapor barrier that is installed on the floor system above the crawlspace.

Check and document the insulation type and quality or condition of the installation.

In the video there is a poorly installed vapor barrier over the exposed dirt floor of the crawlspace.

Check the ventilation of the crawlspace. Modern standard suggests at least 1 square foot for each 150 square feet of under-floor crawlspace area. 1:150 ratio. One vent should be installed within 3 feet of each corner of the structure. There is an exception to venting a crawlspace. Ventilation is not required where exposed earth is covered with a 6-mil vapor barrier (sealed and overlapped) AND (a) continuous exhaust fan is installed and insulation installed on perimeter wall OR (b) conditioned air is supplied and air is returned from the crawlspace and insulation is installed on perimeter wall.

Exposed dirt floor in the crawlspace introduces high humidity levels. Vapor barrier should be installed.

A concrete floor of the crawlspace should be 3 1/2" thick, with four (4) inches of stone beneath the concrete.

There should not be any non-treated wood in contact with the soil.

Check for floor system defects. Check for improper cutting, notching, or bored holes in the floor joist system. For advanced educational/training video for inspectors titled "Cuts, Notches, and Bored Holes," go to www.nachi.tv.

Check for damaged or cracked joists. Some joists dry out and crack at natural knots in the wood.

The determination of allowable spans of floor joists is beyond the scope of a home inspection. Many inspectors use an "add 2" method. You assume the lumber is grade #3. Then add 2 to dimensional height. That gives you the span. It is essentially a way to guess spans. For example, assume grade #3 for a 2x10 joist, add 2 to 10, you get 12. Then the allowable span for that 2x10 is about 12 feet when joists are installed 16 inches on center.

In the video, Kenton has a concern about 2x8 floor joists, 24 inches on center, spanning about 16 feet. Without a set of design plans, Kenton does not want to report the floor system as a structural defect.

Check load-bearing support posts and columns. Wood columns should be a minimum dimension of 4x4 inches.

Check adequate fastening and connections of load-bearing structural wooden components. In the video, the wooden column is not properly secured in Kenton's opinion. Several framing defects discovered during an inspection may indicate the overall quality of the framing in the rest of the property.

Follow the ends of every girder and beam, and inspect the load-bearing point.

Modern building standards recommend that wooden floor joists have a minimum of 1½ inches of bearing where they rest upon supporting structures.

Modern building standards recommend that wooden floor joists or wooden girders have a minimum of 3 inches of bearing where they rest upon supporting structures unless additional adequate support is provided.

Check for a 1/2-inch clearance around the end of a wooden girder or beam.

Check the shims at the load-bearing point under and supporting the girder or beam.

Check the top plate that may be installed on top of the wooden girder or beam. Check for fasteners. Check for toe nailing. Inspecting the nailing schedule in the framing is beyond the scope of a home inspection.

Check areas where the floor joists change direction. In the video, Kenton provides a general "rule of thumb" to measure the cantilever. It is 2/3rds of a floor joist should be visible inside the crawlspace with no more than 1/3rd of the joist cantilevered out of the crawlspace. 2/3 : 1/3 ratio.

Be careful with insects. In the video, Kenton finds spider webs, spider eggs (white pods), and wasp nest.

Steel beams should be coated with a rust-inhibitive paint or coating. Steel beams in a crawlspace that are not coated should be written the report.

Wood sill plate in contact with masonry should be treated.

Inspect the sill plate and check for anchor bolts and straps. Be sure to know what is required in your local area in relation to seismic strapping and fasteners.

Wood sill plate should be anchored to the foundation with anchor bolts. The anchor bolts should be spaced a maximum of 6 feet on center, and should have a minimum of two bolts per plate section. One bolt should be located no more than 12 inches and no less than 7 bolt diameters from each end of the plate section. The anchor bolts should be at least 1/2-inches in diameter. The anchor bolts should extend at least 7 (seven) inches into the masonry.
Check for evidence of wood destroying insects by probing and knocking. Be sure to document inspection restrictions including insulation covering structural components.

Check for water marks or damage that are particularly located under the exterior doors, especially old slider doors.

Before entering a crawlspace check for animals, nests, snakes, wildlife, insects, and signs of animal activity. Look for chewing on electrical cables, droppings, urine stains, disturbed soil, mouse holes in fiberglass insulation, and scratches on wooden components.

Check the ductwork. Ducts that pass through nonconditioned space should be insulated to prevent excessive heat loss or heat gain in cooling installations. Insulation also prevents cool surfaces of air-conditioning ducts from condensing moisture. Vapor retarders should be installed over insulation on cooling supply ducts that pass through nonconditioned air.

Ducts should be sealed, not with duct tape, but with mastic. Mastic is a thick liquid that can be applied by hand (using gloves) or with a brush. Duct tape lasts only about 3 years. Unsealed ducts can lose up to 40% of the energy that is being distributed. Duct leakage could reach 350 cubic feet per minute while the blower fan is in operation.

Check the vents. Bathroom exhaust fans should not vent into crawlspaces. Dryer vents should not exhaust into crawlspaces. Dryer vents should be smooth-wall metal.

Check for insulated hot water pipes. That's a green energy feature.

Check the supports for pipes. Water and fuel gas pipes should be adequately supported.

Check the sewer drainage pipe for adequate support, leakage, proper slope, and damage. Check for water leaks and damage located under each bathroom and laundry room.

Check for water shut-off valves.

Check for electrical installation problems. Check for loosely hanging wires. Using a non-contact voltage detector, check any disconnected wires that may be hanging out. All junction boxes should have cover plates installed.

Section 3
Inspecting the Second Crawlspace with Major Defects

Evidence of major moisture damage is found. A moisture meter is used to confirm the visual evidence of moisture.

Measurements are taken in several areas using the moisture meter.

Extensive moisture damage and apparent microbial growth is found.

A bucket is found located underneath a bathroom. The bucket is an indication of an active (or at least recent) plumbing leak. There is a sewer odor.

Kenton discovers and describes major structural defects at a load-bearing support wall. The ledger board is water damage, inadequately supported, and is sagging at the far end. The finished floor of the room above is affected. Major structural defects in the crawlspace have telegraphed upwards to the living rooms above.

Water penetration is causing structural decay. The negative grading is directing water towards the crawlspace. There is undermining and soil erosion discovered in two areas at the footing.

Where there is moisture, check for wood decay.

The crawlspace interior has been affected by the structure's exterior grading. They are related.

There is rust on fuel gas pipes.

There is major water damage and structural integrity compromises discovered at the rear corner of the crawlspace. The particleboard is completely rotten and a few inches of the board edge are actually missing.

In this crawlspace, the vapor barrier is not properly installed. The ductwork is not insulated or sealed. The piles of construction debris (some with rusty nails) should be removed.

There are signs of water forming puddles or pools. There are signs of standing water. There are signs of water flowing through the crawlspace from one corner to the other.

The foundation footings were not poured level. Excessive, improper shimming was used to compensate. The poor quality in the footing and framing is noticeable at the finished living rooms above.

A structural engineer is recommended where there are floor joists with cantilevered and lapped sections.

Since the foundation wall is exposed, Kenton inspects for cracks, settlement, or movement. A crack in the footing is discovered.

No anchor bolts are installed at the sill plate on top of the foundation wall.

An infrared camera and moisture meter are used in an attempt to pinpoint a major plumbing leak coming from an area around a bathroom toilet wax seal. Moisture was detected.

Rust and corrosion was discovered on the ductwork. The ductwork was located below a hot water tank utility room. There was no water leak catch pan installed.

A temperature-pressure-relief valve is improperly installed. It is discharging into the crawlspace.

Cracks in the plaster and drywall can indicate structural movement or settlement, or may indicate structural defects. Door frames that are out-of-square are good indicators of settlement or structural movement. All interior doors should be operated with this possible condition in mind.

A close inspection of the exterior can offer indications or evidence of structural movement or settlement of the foundation system. Again, the exterior is directly related to the interior. Cracked, pulled, or separated caulking may indicate structural movement.

Suggested Narratives and Language for Report Writing:

CRAWLSPACE
Crawlspace is inaccessible

Crawlspace conditions that, in the Inspector's opinion, posed a personal safety hazard limited examination of the crawlspace to only those home systems and their components visible from the access hatch. Some areas of the crawlspace were not visible from the access hatch. The Inspector specifically disclaims defective conditions in all areas not visible in the crawlspace from the access hatch at the time of the inspection and which are not listed in the area of this report pertaining to crawlspace conditions.

The inspector recommends that inspection of the entire crawlspace by a qualified inspector be performed after conditions that provide reasonable, safe access to the entire crawlspace exist.

Conditions, which may limit access, include but are not limited to any of the following:

- Less than 18 inches of headroom.
- Excessive moisture in soil or on the floor.
- Unsafe structural conditions.
- Suspected biological contamination of the crawlspace.
- Suspected chemical contamination of the crawlspace.
- Presence of pests (insects, reptiles, mammals)
- Hazardous electrical conditions

The point at which conditions represent a safety hazard is decided upon solely by the Inspector, entry or refusal of entry being completely at the Inspector's discretion.

EFFLORESCENCE
Efflorescence visible

Efflorescence (white powdery deposits) visible on the inside surfaces of the foundation walls in the crawlspace is an indication of moisture intrusion. Moisture intrusion can affect the ability of the soil beneath the foundation to carry the weight of the structure above and may cause structural damage from soil movement.

Moisture intrusion can also damage home materials and encourage the growth of microbes such as mold.

Efforts should be made to identify the source of the moisture and correct this condition to help avoid future damage from moisture intrusion.

Efflorescence visible (negative grade)

The Inspector recommends correction of any neutral or negative grade around the home. Grade should slope away from the structure 4 inches per linear foot for a minimum distance of 6 feet from the foundation.

VISIBLE MOISTURE

Wet soil visible

Soil in the crawlspace was damp or wet. This condition may be the result of rising ground water or may result from surface runoff seeping under and/or through the foundation walls. You should ask the seller for any information they can provide about this condition.

Moisture intrusion can affect the ability of the soil beneath the foundation to carry the weight of the structure above and may cause structural damage from soil movement. Moisture intrusion can also damage home materials and encourage the growth of microbes such as mold.

The Inspector recommends taking action to identify the source of the moisture intrusion and correct the condition.

ODOR

Odor (unable to locate source)

The crawlspace had an odor typically associated with elevated moisture levels. The Inspector was unable to locate any source of leakage or other source of excessive moisture. Mold fungi or soil-borne bacteria can cause odors similar to those noticeable in the crawlspace at the time of the inspection.

If the odor persists, consider consulting with a qualified industrial hygienist to determine the source of the odor and gain an idea of options and costs for correction.

FLOOR FRAMING GENERAL CONDITION

Uneven floor framing (historic home) -qualified contractor

The home, built in approximately ___ had uneven floor framing not unusual in a home of this age, of this quality, located in this area.

Some unevenness may have been created at the time of original construction by the use of poor construction methods. Some may have been the result of failure of building materials due to the quality of the materials available, the ways in which they were used in building construction or conditions to which they were exposed over time.

At the time of the inspection, determining the actual condition of the floor framing would have required examination of the floor structure to an extent easily exceeding the scope of the General Home Inspection.

Although efforts to support sagging joists were visible in the crawlspace area of the home, efforts were not uniform throughout the floor structure and some work was not performed to a high level of quality.

The floor structure appeared to be basically stabile, with some areas more stabile than others.

The inspector recommends additional inspection of the floor framing be performed by a qualified contractor to more closely determine the actual condition of the floor structure and to provide an idea of options and costs for any needed work.

MICROBIAL GROWTH

Microbial growth (elevated moisture)

Floor joists in the crawlspace had areas covered with a substance resembling mold. Qualified personnel can only positively identify mold through sampling and analysis.

Mold decay fungi can compromise the structural integrity of wood framing members such as joists. Joists appeared to retain adequate residual strength at the time of the inspection.

The moisture meter showed elevated levels of moisture present in floor joists at the time of the inspection. This condition often indicates moisture intrusion or a significant plumbing leak.

The Inspector recommends that you employ a qualified contractor to locate and correct the source of moisture intrusion.

You should also consider having mold sampling performed to determine whether mold spores are present in unacceptably high (unhealthy) concentrations in indoor air.

DUCTS IN CRAWLSPACE

Ducts in unheated space

Air supply ducts installed in the unheated crawlspace were not insulated at the time of the inspection. Ducts that are not insulated passing through nonconditioned space can lose 25% to $40% of their energy. This means 25 cents to 40 cents of every dollar spent on heating may be wasted.
The Inspector recommends insulating supply ducts to save on heating costs.

Ducts not sealed

Air supply ducts are installed in the crawlspace and are not sealed at the time of the inspection. The Inspector recommends sealing all accessible ducts with mastic to improve heating system efficiency.

INSULATION

No insulation

No insulation was installed in the crawlspace.

The best approach to insulating crawlspaces has recently been the subject of controversy. It is generally agreed that an insulation design that works well in one climate may perform poorly in another. The Inspector recommends that the crawlspace be insulated according to recommendations for the climate zone in which the home is located.