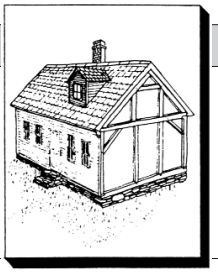
Tools of the Detective Trade



by John Leeke

If you've been working on old buildings any length of time you know how difficult it can be to determine the extent of damage until you open things up. In the past, when I worked full time as a tradesman, I know I found it difficult to anticipate hidden problems.

Now, I'm working as a preservation consultant, and my clients expect me to determine hidden conditions without damaging the building. I've found some neat tools that help me identify problems quickly and with a minimum of damage. These tools aren't found in the carpenter's toolbox. But some are inexpensive or useful enough that you might find them helpful on your projects.

The tools that make up my "house detective" kit are just extensions of my five senses: seeing, hearing, feeling, smelling, and tasting. They help detect subtle changes in the building's condition or help me analyze materials.

The Taste Test

I have a friend who has labored in the woodworking mills here in Maine all his life. More than once I've seen him put a freshly cut piece of wood to his mouth and taste it. The taste tells him what species of wood it is or if the wood is getting ready to decay. We'd get lead poisoning if we licked every old building we worked on, but modern chemistry can give us the same kinds of clues about a building's condition.

For instance, we can use a simple chemical test to show whether new plaster is sufficiently cured to hold paint. An alkaline surface, such as a new or imperfectly cured plaster, converts the oil or alkyd binders in paint to soap-like compounds that cause adhesion problems. The test goes like this:

- Use a 1% solution of phenolphthalein crystals in alcohol.
- Wet the plaster surface with water.
- Apply a tiny drop of the solution.
- If it turns purple, the surface may be too alkaline for ordinary alkyd or oil primer.

If the test shows the surface is too alkaline, you'll need to use a primer specially formulated for the alkaline surface of new plaster. Ask your paint dealer for a recommendation.

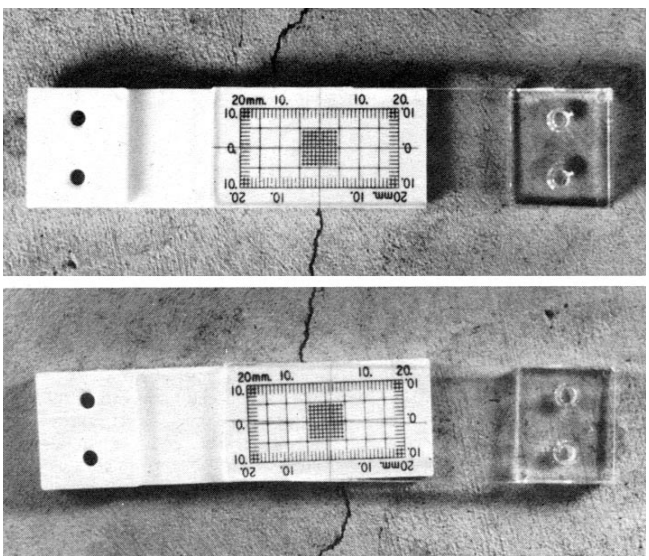


Figure 1. *Each half of the crack monitor is fastened securely to the wall (top). Over time, the cross hairs on the clear plastic have shifted off the grid lines beneath them (bottom) indicating movement and possibly serious structural problems.*

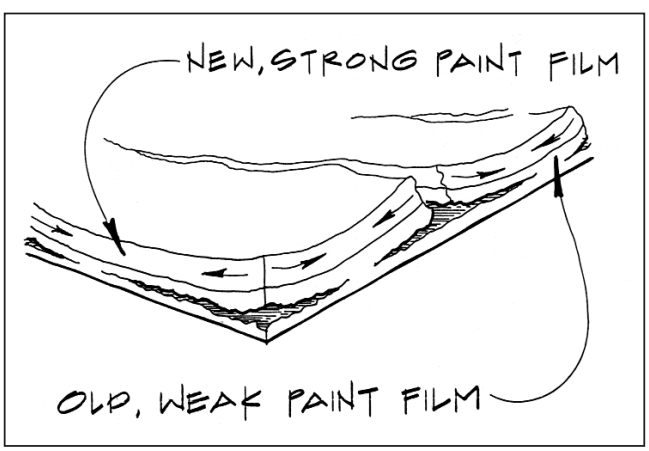


Figure 2. *Under a 30x pocket microscope, you could see the two-year-old paint already starting to peel. The loose, chalky surface of the original paint film was the weak link.*

Sensing Building Movement

You can't tell if a building is moving by touch or feel. Movement happens too slowly. But you can "sense" crack movement with a "crack monitor." Knowing whether a crack is moving is important because the crack could be an insignificant aesthetic defect or a serious structural problem. If the crack isn't moving, the building is probably fine. But if the foundation is shifting, crack movement may indicate soil or footing problems that need to be addressed before you continue.

A crack monitor is made of two plastic plates that overlap in the middle (see Figure 1). A measured grid on the bottom plate functions like a tape measure. The clear top plate has a cross hair marked on it. You position the monitor on the wall over the suspicious crack and fasten the ends of each plate to the wall on opposite sides of the crack. As the crack opens and closes, you'll see the cross hairs shift as the two plates slide over each other.

You can mark the location of the cross hairs on a record sheet at regular weekly or monthly intervals. In a relatively short time you see a pattern of movement. The crack may be getting wider and wider, or expanding and shrinking with seasonal changes.

This information can help you identify the root cause of the crack and develop an effective treatment. If the crack is stable you could leave it alone or fill it with grout or mortar.

If the crack always expands in late fall or early winter, you might surmise that the problem is water build-up in the soil or frost heave in the ground outside the foundation. A more flexible acrylic or epoxy filler would be in order. And, you can take care of the exterior water problem with gutters and a drainage system.

Seeing is Believing

On a project in Tennessee, I had to decide how the exterior woodwork should be maintained. One building had been painted 25 years ago (when it was built) and again 15 years ago. I recommended completely removing the paint before recoating. Even though there was not a heavy buildup, I knew the loose chalky surface would not hold paint well.

My recommendation started a controversy. The maintenance manager, the lead painter, and even the paint dealer thought taking the paint off was unnecessary. During the animated discussion, I moved the group around to the front of the building which had been recoated just two years ago.

I took out my pocket microscope just to check my initial judgment of the surface conditions. The plastic microscope, about 6 inches long, has high quality optics and a color-corrected battery-powered light source. It makes the surface 30 times larger than normal.

As we talked about what materials would be best for recoating over the existing paint, I handed the microscope to the manager and then the others. As they looked at a close-up view of what was happening to the recent recoating, they shifted sides in the controversy, supporting complete removal (see Figure 2).

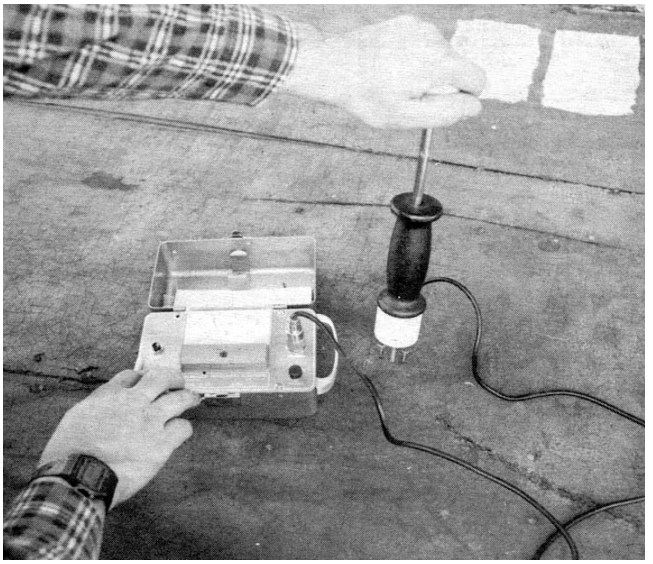


Figure 3. *A moisture meter reads moisture levels at the depth the pins are driven. Here it indicates trapped moisture in this wood deck covered with built-up roofing.*

You don't need a microscope when the paint is peeling down to bare wood—just in cases where you suspect an adhesion problem. However, severe paint peeling sometimes means you have a serious moisture problem. Just how do you tell if the wood is really wet?

Damp or Dry?

An extension of your sense of touch, a moisture meter detects subtle variations in the moisture content of wood. The moisture meter I use measures the electrical resistance of the wood between two metal contacts.

The meter has a probe with a sliding hammer. The hammer drives slender pins into the wood. The pins are insulated except for the pointed ends, which are the contacts. As you drive the pins into the wood, the meter shows the moisture content at the depth of the contacts. More moisture in the wood means less resistance, and the meter's scale displays a higher number (see Figure 3).

On one project I had to find leaks in the roof of a cupola. Water stains on the framing indicated leaks everywhere, but they weren't all actively leaking. It hadn't rained for weeks, and heat in the attic had dried the surfaces of all the timber.

I used my trusty moisture meter with 3-inch-long pins to probe deep within the wood. Variations in the moisture content lead me quickly to the location of five active leaks. The sensor even showed me which leaks were the worst—the moisture content was highest in these.

Testing techniques like these allow you to come up with answers to building problems. Like a doctor making a diagnosis of a hidden illness, your ability to sense, see, and touch the "patient" can be the most important tool in planning the treatment. ■

John Leeke, of Sanford, Maine, restores and maintains historic buildings. He also consults with contractors, architects, and owners working on older buildings. If you have questions on restoration topics, write to John Leeke, c/o JLC, *1233 Shelburne Road, Suite C1, South Burlington, VT 05403.*

For More Information

For further information about diagnostic equipment mentioned in this article, contact the following companies:

Calibrated Crack Monitor
Avongard
2836 Osage
Waukegan, IL 60087
708/244-4179

Moisture Meter
Delmhorst Instrument Co.
P.O. Box 68
Towaco, NJ 07082
800/222-0638
201/334-2557 (in N.J.)

P.R.G.
5619 Southampton Dr.
Springfield, VA 22151
703/323-1407

Phenolphthalein
Fisher Scientific
50 Valley Stream Parkway
Malverne, PA 19355
215/640-7940

Pocket Microscope
Edmund Scientific Co.
101 E. Gloucester Pike
Barrington, NJ 08007-1380
609/547-8880