WOOD BITS

by
Cheryl A. Anderson, Dr. Joseph R. Loferski
and Dr. Frank E. Woeste, P.E.

Detecting Early Wood Decay

When asked to evaluate an existing wood structure, a structural inspector is concerned with two factors: building code conformance and structural integrity. Assuming all applicable codes are met, a close look at the connections and materials used is required to determine if they are capable of supporting the design loads.

Initial designs are based on the assumptions of the use of sound graded lumber and allowable stress values for the grades used. From a structural engineer's point of view, the design and construction can only be valid for future service if the material is in its original condition, free of degradation. Several factors can contribute to the degradation of lumber, including fungal decay. The purpose of this "Wood Bits" is to introduce and demonstrate the use of the "pick test" as a tool for evaluating the condition of lumber and timbers that may contain early stages of fungal decay.

Decay Facts

Detection of early fungal decay is an important part of the evaluation of existing wood construction. Once such decay has set in it continuously grows and expands, further degrading the wood and eventually compromising the strength of the element. Fungal decay is common in areas near fasteners, joints, checks, end grain, paint discoloration, and where lumber and timbers are in contact with or near soil.

The culprit is a form of primitive plant life. Requiring the presence of liquid water in the wood cells, decay fungi only attack wet wood. Protecting untreated wood from water is therefore critical to long-term durability. Decay fungi such as brown rot attack the cell wall material of wood, causing great losses in strength. For example, research indicates that with as little as a 3-percent weight loss due to decay fungi attack, there can be as much as a 70-percent loss of strength (Eslyn et al., 1979). Unfortunately, such small amounts of damage are difficult to detect visually without a microscope (Forest Products Laboratory, 1999).

The first strength property to be affected is toughness: the ability to withstand impact (Forest Products laboratory, 1999). With just a 1-percent weight loss wood loses 6 to 50 percent of its toughness, and with a 10-percent weight loss over 50 percent of toughness is lost. The "pick test" described below is based on toughness and has been proven to detect decay with as little as 5- to10-percent weight loss (Wilcox, 1983).

The Pick Test

The test involves using an ice pick to penetrate the wood surface in an area where fungal decay is likely or suspected. Similar tools such as an awl or even a small screwdriver can also be used. After penetrating the wood, the tool is rotated to pry a splinter, parallel to the grain, away from the surface. The appearance of the broken splinter is then used to determine if the piece is decayed.

Because different species have different densities and all lumber is affected to some

degree by its environment, applying the pick test in an area where the wood is known to be sound is a recommended means of establishing a “control” for the remainder of the inspection. The test should be conducted in a late-wood zone (the darker and more dense wood fiber that forms during the later, dry part of the yearly growth cycle), although the test may also work in early wood zones. Then begin testing areas that are conducive to fungal decay, noting how much pressure is required to penetrate the surface. The penetration depth should be about ¼ inch (6.4 mm). Pry out a small amount of the surface wood and compare the results to those of the non-decayed “control” sample.

Wilcox (1983) identifies three distinct modes of failure for decayed and non-decayed wood. Non-decayed wood will generally fail with either a fibrous failure or a splintering break, as shown in Figures 1a and 2. Decayed wood will have a brash, brittle failure with breaks directly over the tool. Very few splinters, if any, will appear and the break will occur across the grain, as shown in Figures 1b and 3. The samples pictured in Figures 1a and 1b were taken from a salvaged Douglas Fir log yard. Because the exterior of each is similarly weathered, they could be mistaken for being in comparable condition based solely on visual inspection.

Figure 1a. When subjected to the “pick test” this sample broke in a single, solid piece far from the tool. It was difficult to penetrate deeply, and the wood under the splinter is intact and looks new. The sample is not appreciably degraded by fungal decay and may be considered sound.

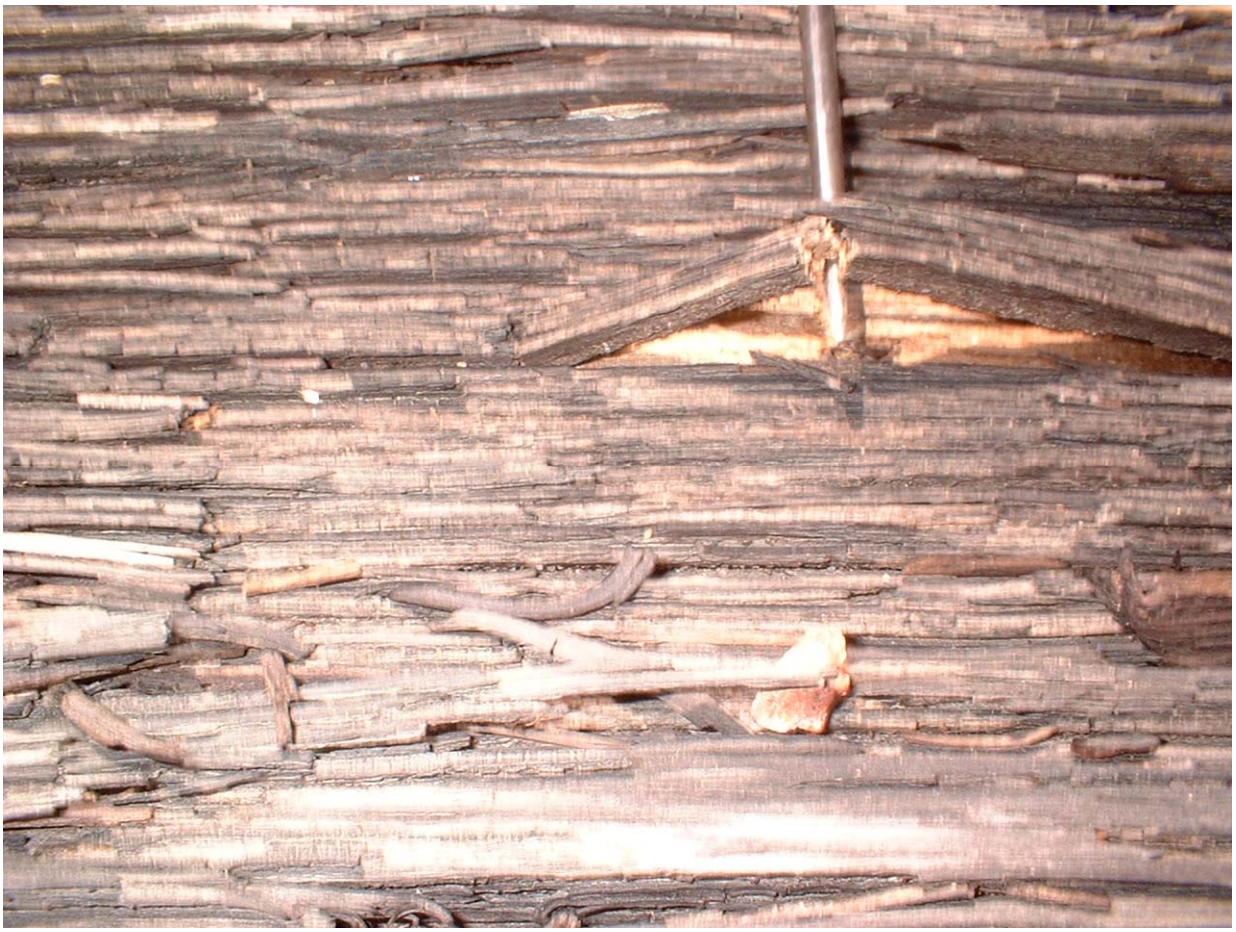

Figure 1b. This decayed wood broke easily. The break occurs across the grain without splintering.

In a fibrous failure, the splinters are long and separate from the surface far from the tool, as shown in Figure 2 (virgin Douglas Fir), whereas a splintering break typically occurs directly over the tool with numerous splinters. Sound wood is very dense and in such good condition that penetration is difficult. The sound caused by the break can also be an indication of the quality of the wood. With non-decayed wood, the sound will be what one expects to hear when wood breaks. In contrast, when decayed wood breaks the sound will not be as loud—sometimes barely audible.

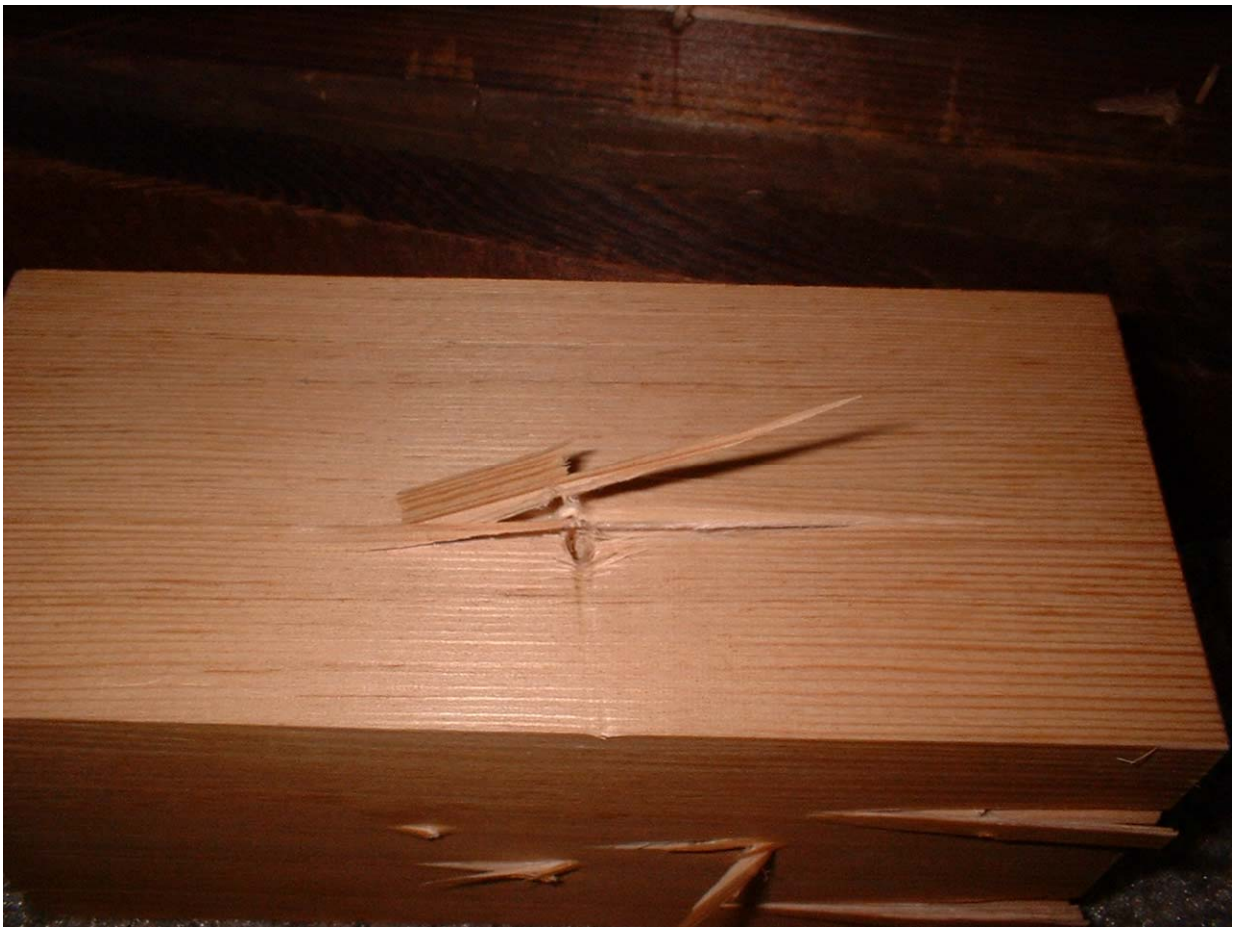

Figure 2. This sample is a block of virgin Douglas Fir with no decay. It shows a splintered break that begins far from the penetration.

Figure 3. On its surface, this 50-year-old Douglas Fir purlin looked sound. When subjected to the pick test, however, decay is indicated by a brittle cross-grain break directly over the tool. The entire break is less than 1-inch (25 mm) long.

Conclusions

The pick test is a simple, subjective test that is useful in detecting decay near the surface of wood members. With experience, the user will be able to identify fungal decay more readily and detect the subtle differences between decayed and non-decayed areas. The test is especially useful for inspections in which only knowledge of the presence of decay is needed. For example, we recommend that wooden members be replaced if any decay is detected in a residential deck or balcony.

Due consideration should always be given to whether or not the lumber is pressure preservative treated when requiring the replacement of elements. In determining the presence or extent of decay in large structures or where members are very costly or difficult to replace, other tests such as coring, stress-wave mapping or even X-rays analysis should be considered. ☙

Questions and comments are welcome and may be sent to Dr. Woeste via e-mail at fwoeste@vt.edu.

References

Forest Products Laboratory. 1999. *Wood Handbook: Wood as an Engineering Material*. General Technical Report FPL-GTR-113. Forest Products Laboratory. U.S. Department of Agriculture Forest Service. Washington, D.C. (Text online at *www.fpl.fs.fed.us/documnts/FPLGTR/fplgtr113/fplgtr113.htm*.)

Eslyn, Wallace E. and Joe W. Clark. 1979. *Wood Bridges—Decay Inspection and Control*. Agricultural Handbook No. 557. Forest Products Laboratory. U.S. Department of Agriculture Forest Service. Washington, D.C.

Wilcox, W. W. 1983. "Sensitivity of the 'Pick Test' for Field Detection of Early Wood Decay." *Forest Products Journal* 33(2):29–30. Forest Products Society. Madison, WI.

Cheryl Anderson *and* ***Dr. Frank E. Woeste, P.E.****, are Graduate Research Assistant and Professor, respectively, at the Virginia Tech University, Blacksburg, Biological Systems Engineering Department.*

Dr. Joseph R. Loferski *is a Professor at Virginia Tech's Wood Science and Forest Products Department.*