

Widespread Misapplication of the “BRITTLE TEST” for Asphalt Shingles

By Lyle D. Hogan, RRC, FRCI, PE

More than a few times, the issue of a “brittle test” has come across my desk. Misuse is becoming more prevalent for both the term and the test as the concept gains momentum among folks hoping to discount the reparability of a shingle roof. A casual web search will validate the gross confusion surrounding this matter. I even saw the brittleness aspect recently applied to a wood shake roof, generating consternation and prompting development of this treatise.

The procedure is a qualitative measure, presumably intended to characterize shingles with regard to carrying out localized repairs. The problem is that the procedure is touted as a bona fide determination by an installer who clearly has interest in the outcome. It is somewhat analogous to the equally useless “finger test” for evaluating the bond among sealing tab shingles. But that is another topic for another time.

Meanwhile, the bigger problem is: There

is no such thing as a “brittle test” for asphalt shingles (or asphalt pavement, BUR, modified bitumen, or anything else made from asphalt). That is because there is no singular identifiable temperature at which asphaltic materials become brittle. Some folks like to toss the term around, but the test simply does not exist in any recognized forum. Asphalt is neither a thermoplastic nor a thermoset; it is, instead, a viscoelastic material exhibiting rheological properties. That is, asphalt is a non-Newtonian fluid whereby every test conducted on

it is temperature-dependent—and highly so.

The behavior of bitumen (asphalt for our purposes here) merits further discussion. The freezing and boiling points of water are both well known, even to grade-school students. Asphalt, however, makes a transition from solid to semisolid and, eventually, to liquid over a wide range of temperatures. Such behavior can be plotted to express the glass transition, but there is no finite marker at which the material becomes liquid or solid.

Yet for grading and selecting the appro-

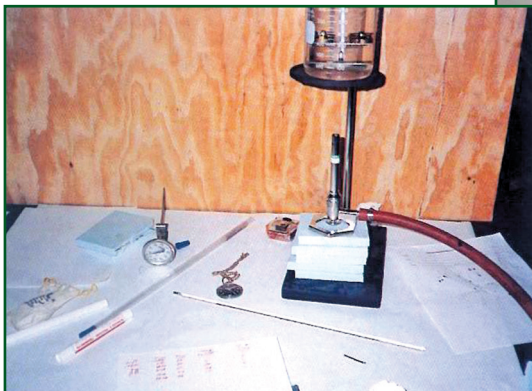


Figure 1 – Softening point testing underway by the author around 35 years ago.



Figure 2 – Wet soil is not a Newtonian fluid. Following inward wall collapse from hydrostatic pressure, all of the soil does not self-level; a portion of it remains in a somewhat undisturbed position.

appropriate material (such as for slope limitations), a uniform index was needed. Part of this characterization is seen in the softening point test (not the “melting point,” as it is sometimes erroneously called; the melting point applies only to crystalline homogeneous substances, and asphalt is neither of these). In the case of roofing, ASTM standard D36¹ is the uniform standard for such evaluation. *Figure 1* depicts such testing underway by the author around 35 years ago. Roofing asphalt specimens can be characterized and graded when evaluated by this method, uniformity being the entire purpose of the standards organization, ASTM International.

For those unfamiliar with Newtonian fluids, consider a tall basement wall, improperly constructed and backfilled with poorly draining soil. It may eventually collapse inward from hydrostatic pressure, but all of the wet soil does not self-level. A portion of it remains in a somewhat undisturbed position (*Figure 2*); therefore, wet soil is not a Newtonian fluid. Water in a swimming pool would be Newtonian, exerting pressure against the sides in a directly linear fashion proportional to the water depth. The behav-

ior of asphalt can be seen when the kettle man chops and opens containers in preparation for loading into the heating vessel. Some of the material may or may not deform and flow from the carton sides, depending on ambient temperature (*Figure 3*). The carton contents may indeed be brittle during the cold season, and semi-fluid at other times.

When practitioners of the brittle test are encountered, a few questions come to mind:

- Is the roof brittle in December or July?



Figure 3 – Asphalt is also non-Newtonian. Some of the material may deform and flow from the carton sides, depending on ambient temperature.

- Are molasses and honey brittle in the wintertime? How about in September?
- A motorcycle kickstand sometimes

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digs into hot asphalt pavement in July, but is otherwise fine in December. During which month did the pavement become brittle? If the coming warm season would make the pavement convert back to being resilient, wouldn't it do the same for an asphalt shingle roof?

In order to be valid, any test must be 1) random, 2) representative, and 3) repeatable. That applies for soil, concrete, steel, aggregates, wood, plastics, fasteners, asphalt pavement, and any kind of roofing material that can be named. The so-called brittle test for shingles—often administered by folks of dubious qualification—is in no way repeatable. Unless it's carried out on all the directional exposures, it is not representative. When individuals press the point, I simply ask for the ASTM test number; things suddenly go quiet. If the individual doesn't know what ASTM is, that just makes my point.

There can be low-temp flexibility testing, which can be very helpful in evaluating bituminous and pure thermoplastic membrane products (Figure 4). But, again, these results are highly influenced by temperature as well as by the mandrel size being used.² Without uniform constraints for the test procedure and environment (including conditioning of the specimen beforehand), these evaluations would mean nothing. And they mean nothing when carried out on a pitched roof during any season by all manner of talent. There is simply no meaningful basis for an outdoor brittle test of shingles.

Regarding the reparability of localized wind-damaged shingles, there is certainly a condition whereby old, weathered shingles are too deteriorated to be disturbed (Figures 5A, 5B, and 5C). That point is well taken, as many roofs are so badly

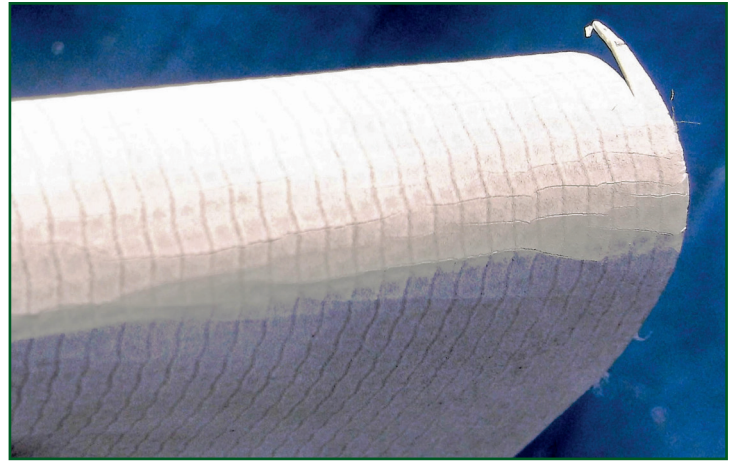


Figure 4 – Low-temp flexibility testing can be very helpful in evaluating bituminous and pure thermoplastic membrane products. But these results are highly influenced by temperature as well as by the mandrel size being used.

neglected and replacement has so long been postponed that shingles may tear or pulverize—even from light contact. That is all that needs to be said. On the other hand, if shingles are resilient enough (during whatever season) that tabs can be lifted for determination of the fastening pattern, they can certainly be lifted enough to facilitate repairs. This apparently runs counter to the brittle test, which is completely subjective and should be given a decent burial. [C]

REFERENCES

- 1) ASTM D36, *Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)*.
- 2) Lyle D. Hogan. "The Province of Testing." *Western Roofing*. September/October 1996. pp. 66-68.



Figures 5A, 5B, and 5C – Attempting to repair these shingles would be futile. Yet it would be inaccurate to characterize them as brittle. They are instead highly weathered, impractical to repair, and should be in a landfill.



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He has designed and administered roofing projects in half of the U.S. using a variety of systems. Hogan has received RCI's Lifetime Achievement Award, its Michael DeFrancesco Award, its William C. Correll Award, and its Richard M. Horowitz Award.