

Letter to the Editor

I am submitting this letter to encourage some additional research on load duration and damage modeling. Considerable work has been done in these areas over the last decade in the United States, Canada and Europe, some in controlled environments, others in environments without humidity control. Several different damage accumulation models have been applied to the research results that appear to be different between laboratories, perhaps as a result of different species or environments. Some of the models include a stress-related threshold below which no damage is assumed to accumulate, although I have not seen any supportive data for a threshold.

A recent study reported by Kenneth Fridley et al. (Effect of cyclic RH on the load duration behavior of structural lumber. *In Proceedings, International Engineering Conference, Tokyo, Japan, 1990*) showed that varying humidity can have a pronounced effect on load duration of structural lumber, echoing the effect established in past research on clear wood. While large swings in humidity were used, results suggest that some subtle differences in load duration might be expected between controlled-room and uncontrolled-room environments at lower stress ratios of loading. Another possible but related cause of differences in load duration results might occur when constant load specimens are tested at moisture contents different from those of the control specimens tested for static strength. In the absence of much change in environmental humidity, specimens loaded at high stress ratios would have longer durations when at lower moisture contents than at higher moisture contents.

Fridley's research left some unanswered questions. His most profound results were

based on cycling humidity after wood specimens were loaded when at equilibrium moisture content. Thus, large changes in moisture content observed early on decreased to smaller "stabilized" cyclic changes as time progressed. A necessary followup study should be conducted to address the question of how much load duration is affected by a cyclic environment when the constant load is applied only after the specimen has been "stabilized" in that cyclic environment. I would expect a much smaller effect than was found by Fridley. The scope of such a study should include at least two different levels of humidity swings (a high and a low) around a given humidity, e.g., 50% RH. Results of such a study would have practical engineering significance in that expected changes in the environment could be properly accounted for in reliability analyses of wood structures.

A second study should evaluate the significance of damage model parameters. There is a question in my mind that some damage models contain more parameters than can be estimated in an unbiased statistical sense with existing load duration data. Such a study should be done by a professional statistician or one who thoroughly understands joint probability theory. Without such an evaluation, reliability studies using models with biased parameters just don't make sense, particularly where comparisons are made between models.

CHARLES C. GERHARDS, Retired
*Formerly Research General Engineer
U.S. Forest Products Laboratory
One Gifford Pinchot Drive
Madison, Wisconsin 53705-2398*