

AVERAGE MOISTURE CONTENTS REQUIRED TO CONFORM TO SOFTWOOD DRYING STANDARDS

George Bramhall
Western Forest Products Laboratory
Vancouver, British Columbia

The introduction of Voluntary Product Standard VPS-20-70 has provided kiln operators and quality control inspectors with new problems. The principal requirement of these standards is that at least 95 percent of the lumber be dried to a moisture content (m. c.) of 19.5 percent or less (the limit used by industry in view of the absence of tolerances in the standard). Where lumber fails to conform to this standard, decisions must be made as to (1) how much the average m. c. must be further reduced in order to conform, and (2) how the drying schedule must be modified to reduce the average m. c. by the required amount. The first question is answered in this article; the second will be discussed in a separate article.

As a kiln operator knows by experience, there is a fairly wide range of m. c. s in the lumber of any kiln charge, so that it is usually necessary to measure a large number of pieces to determine the proportion of lumber non-conforming. The m. c. in most charges approximates a "normal distribution". Such a distribution requires two features to describe it, the average m. c. and the standard deviation. The meaning of the average m. c. is generally understood. The standard deviation is a measure of the scatter or spread of m. c. This is illustrated in Figure 1 by three curves with different degrees of scatter. In all three cases, 5 percent of the pieces exceed 19.5 percent m. c. However, as the scatter becomes greater, a lower m. c. is required to limit the number of "overs" to 5 percent.

It is not customary for quality control inspectors to calculate standard deviations. However, it is both practical and desirable that they measure and tally the m. c. of 100 random pieces per charge of lumber passed along the dry chain. (Measuring pieces along the top or sides of kiln loads is not "random".) The m. c. of the 100 pieces should be averaged and the number of pieces over 19.5 percent tallied. These figures provide a good description of the m. c. distribution.

If there are more than the permitted 5 percent overs, Figure 2 can then be used to estimate the average final m. c. required to conform to standards. A point is found on the graph at the intersection of the observed "overs" and average m. c., and the curves are followed until the 5 percent "overs" line is crossed. This is the average m. c. required to pass standards.

An example is provided. Lumber is being dried to 15.2 percent average m. c., and inspection shows that 12 percent of pieces are over 19.5 percent m. c. To what final average m. c. should subsequent kiln loads be dried (assuming similar type of lumber and scatter of m. c.) to conform to standards?

The condition of the lumber is plotted on Figure 2 at point A (15.2 percent m. c., 12 percent overs). By following parallel to the curves, the 5 percent overs line is crossed at 13.4 percent m. c.

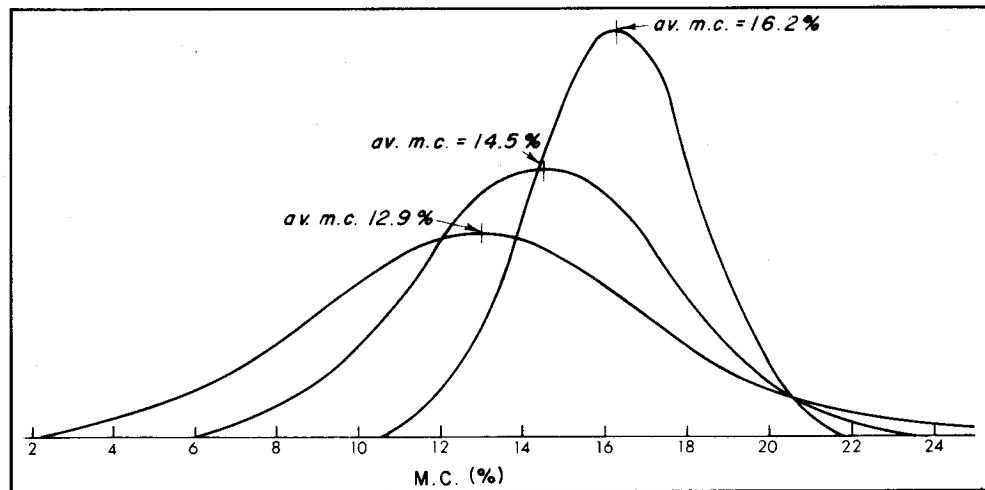


Figure 1. Normal moisture content distributions and average moisture contents for various degrees of scatter, all of which have 5% of samples exceeding 19.5% m.c. Area under a curve between two mc.s is proportional to the amount of lumber between those m.c.s. Area under each curve 19.5% m.c. is 5% of the total area under the curve.

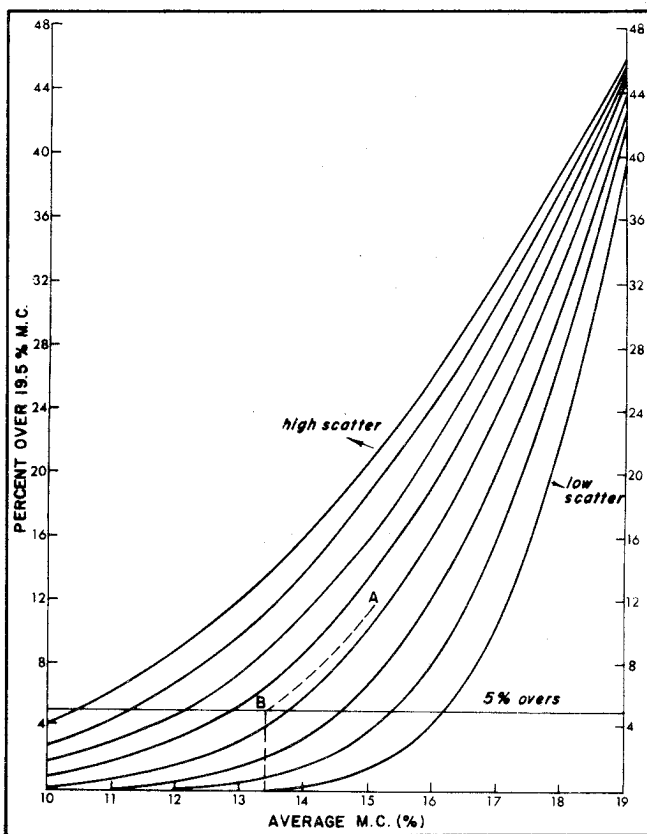


Figure 2. Relationship of "overs" to average moisture content for various degrees of scatter.

(point B). This is the required final m. c. Values given by this procedure will provide somewhat less than 5% overs with normal distributions, but will generally ensure passing standards with the other distributions which sometimes arise in practice.

As has already been indicated, a higher average m. c. is acceptable provided that the scatter is low. Low scatter can be obtained by limiting the charge to one species of uniform green m. c., by the use of slower schedules, by higher air velocities and thicker stickers, and by final equalization periods at relatively high humidities. These latter points are further discussed in various kiln manuals.