

Estimated Footage Reduction in Kiln-Drying Air-Dried Hardwoods

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Air-dried boards shrink in width and thickness when they are kiln-dried to a lower moisture content. Although a change in thickness might be of concern particularly when the kiln-dried boards are thin, the reduction in footage associated with the shrinkage in width of the boards is usually of greater interest. The actual reduction in footage depends upon the species of wood, the moisture change that takes place in kiln-drying, whether the stock is plain or quarter sawed, and the distribution of widths and lengths of the boards in the particular shipment. Because of the variability of these factors in any single shipment of hardwoods it is difficult to estimate a probable value of the expected footage reduction for any given average moisture content change as based on available average shrinkage data. The principal difficulty in attempting to apply shrinkage data to a problem of this sort is associated with the adjustment of the shrinkage value for the influence of the method of footage measurement and the proportion of narrow, wide, and "line" boards in the shipment. If there is, however, a tendency for shipments to approach a "normal" in respect to the distribution of widths and lengths, estimated reductions in footage can be made from

available shrinkage data for any particular species of wood and for an average change in moisture content provided the "normal" distribution of widths and lengths of carload shipments is known. A recent study of the measurement tallies (on the 12-foot basis) of 87 carload shipments of various species of Appalachian hardwoods indicated that there was a tendency for shipments to be similar as to the distribution of board widths and lengths although certain species of wood and certain grades of stock sometimes ran to wide or narrow widths. From these tallies it was possible to calculate the estimated reduction in footage for car lots of plain-sawed stock assuming a change of 13 per cent moisture content in kiln-drying to an average moisture content of 5 per cent and using total tangential shrinkage data for the different species as given in table 1.

The calculated footage reduction data for the 87 different shipments were plotted against the total tangential shrinkage data and a straight line best fitting the points as shown in figure 1 was drawn to show the relation between basic tangential shrinkage data and the estimated footage reduction, the latter being expressed as a percentage of the air-dried tally. The 87 shipments studied included FAS, No. 1 Common and Better, and No. 1 Common grades of lumber of various thicknesses. Although the relationship of figure 1 applies only to the shipments studied, it seems general enough to be applied to shipment of most hardwoods.

In using the relationship shown in figure 1 for estimating the expected footage reduction of carload shipments of hardwoods kiln drying from an air-dried condition, it must be remembered that shipments which tend to run to narrow widths will have a lower estimated footage reduction and shipments having a high proportion of wide boards will have a greater footage reduction than that indicated by the figure. Yellow poplar, for example, with a total tangential shrinkage value of 7.1 per cent (Table 1) has an estimated footage reduction of about 1.1 per cent (Figure 1), whereas FAS shipments had an average calculated footage reduction of about 2.6 per cent because of the preponderance of wide boards, and the common grades had an average calculated footage reduction of about 0.6 per cent because of the increased number of narrow boards present in the shipments. Shipments of air-dried stock wetter than an average moisture content of 18 per cent will

Table 1.—Tangential shrinkage (per cent of dimension when green) values for 28 commercially important hardwoods grown in the United States. From green to oven-dried moisture content.

Species	Shrinkage Per Cent
Ash-Black	7.8
Commercial White	7.5
Aspen	6.7
Basswood	9.3
Beech	11.0
Birch, Sweet and Yellow	8.9
Cherry-Black	7.1
Chestnut	6.7
Cottonwood-Eastern	9.2
Northern Black	8.6
Elm-American	9.6
Rock	8.1
Slippery	8.9
Gum-Red	9.9
Black	7.7
Tupelo	7.6
Hackberry	8.9
Hickory-True	11.9
Pecan	9.3
Magnolia-Cucumber	8.8
Evergreen	6.6
Maple-Sugar	9.5
Red	8.2
Oak-Red	9.0
White	9.3
Poplar-Yellow	7.1
Sycamore	7.6
Walnut, Black	7.1

also have a greater footage reduction when kiln dried to a moisture content of 5 per cent than is shown in the figure. With these different factors in mind, however, the relationship of Figure 1, when used for making estimates of expected footage reduction for the different species of hardwoods, is of value.

A straightforward procedure to obtain footage reduction data in kiln-drying from an Air-dried condition would be to measure the same stock before and after kiln-drying. The study would have to be rather comprehensive in scope and the Forest Products Laboratory has not been justified in making such a study. A practical check on the calculated relationship of Figure 1, however, is found for basswood. A user of considerable quantities of air-dried basswood has found that over a period of the past few years the average reduction in footage was about 3.5 per cent of the air-dried tally when the stock was kiln-dried to a moisture content of about 5 per cent. The total tangential shrinkage of basswood is 9.3 per cent (Table 1) and from Figure 1 the estimated footage reduction is 3.8 per cent, which can be considered a reasonably good check on the calculated value.

It is interesting to note that Figure 1 indicates that species of hardwoods having a total tangential shrinkage of 6.2 per cent or less are not expected to result in a measurable footage reduction on kiln-drying from an air-dried condition. None of the commercial species of hardwoods listed in Table 1 have total tangential shrinkage values as low as 6.2 per cent, thus normal carload shipments of air-dried flat-sawed lumber of these species are expected to show some footage reduction on kiln-drying. On the other hand, the total radial shrinkage of most species of commercial hardwoods is less than 6.2 per cent and measurable reductions in footage are not to be expected when carload lots of quarter-sawed stock are kiln-dried.

Many buyers of air-dried lumber make a practice of checking the grade and tally of the shipments of hardwoods that they receive prior to and after kiln-drying. The Forest Products Laboratory will appreciate learning how the estimated footage reduction values as shown in Figure 1 compare with the actual values found in practice.

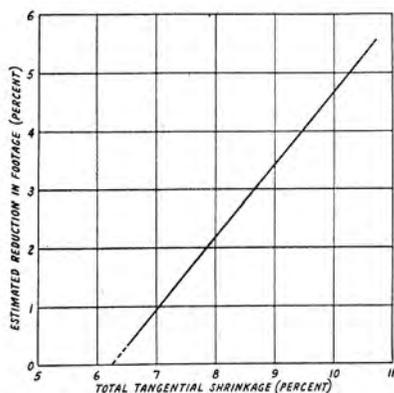


Figure 1.—Estimated reduction in footage (per cent of air-dried tally) vs. tangential shrinkage (per cent of dimension when green) for carload shipments of hardwoods when kiln-dried to a moisture content of 5 per cent from an air-dried condition of 18 per cent.

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