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**HOUSE FRAMING LUMBER
SHOULD BE KILN DRIED**

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In the average six room house, a twenty dollar bill should be enough to cover the difference between the use of kiln dried framing lumber or the use of partially seasoned framing. This increased initial cost has recently been estimated as the result of experiments conducted by the Forest Products Laboratory on a moderate priced house to be much less than the cost of correcting the effects of shrinkage where partly seasoned joists and other structural members are used.

It has been general practice to consider that air seasoned material was satisfactory for structural purposes. Also that where thoroughly air seasoned material was not available, partially seasoned material could be used inasmuch as considerable seasoning would take place during the building operation. In the dwelling studied by the Forest Products Laboratory, the joist were Douglas fir and, though they had been in the local lumber yard at Madison, Wis., during the previous winter, they were only partially seasoned, the average moisture content being in excess of 25 percent when delivered. During the building operation an appreciable amount of drying took place; however, only that drying which occurred before the plastering operation proved to be beneficial in minimizing plaster cracks.

The studs and plates in the house were kiln dried ponderosa pine and had an average moisture content of about 10 percent when delivered. The subflooring was air dried eastern hemlock averaging about 18 percent moisture content when delivered. When all studs and rough floors were in and walls ready for lathing three 1/4-inch steel pipes were placed vertically in the bearing wall, one pipe starting on top of the girder in the basement and extending to a point approximately 6 inches above the attic floor, the others starting on the partition caps of the first and second floors, respectively, and also extending above the attic floor. The pipes were capped top and bottom and so arranged that very accurate measurements could be made between the cap of the pipe and a special washer on the floor. Any increase developing after installation in the distance between the floor washer and cap would indicate the amount of shrinkage in the wooden members between the bottom of the pipe and the attic floor. To obtain a record of moisture content of the frame and other concealed parts, metal contact points were driven into the various members and wires carried to the basement where readings may be made at any time with an electrical moisture meter.

The bearing partition was supported on a steel girder which in turn was supported by steel columns. The studs in both first and second floor start on top of a 2 by 4 inch partition plate. With this system of construction all joist, plates, caps, and rough floor act as supports in the vertical height of the wall. It is the shrinkage of these members that constitutes practically all of that found when the pipes were measured from time to time. The total change in dimension as determined from each pipe has been plotted on Figure 1. The curve AA on both Figures 1 and 2 represents the average moisture content of the joist, plate, subfloor, and cap in the first floor unit, the curve BB the similar members in the second floor unit, and CC the joist and rough floor of the attic unit. The net change of each floor unit as determined from the difference in dimensional change between the various pipes is plotted on Figure 2. For example, A represents the shrinkage developing in the first floor joist, rough floor, partition plate, and cap as plotted on Figure 2. B represents the same members on the second floor, and C the attic joist and floor. The curve C on Figure 2 was obtained by determining the actual shrinkage as shown on Figure 1 and calculating the proportionate shrinkage based on the same amount of wood used across the grain as is used in A and B. With the various curves comparable in terms of amount of wood, the difference in moisture content is sufficient to account for practically all of the difference in shrinkage.

Plaster cracks in the house appeared first in cross walls on the second floor and later some minor cracks developed in the bearing wall and around the fireplace on the first floor. A fair proportion of the shrinkage had taken place before cracks developed as may be noted on Figures 1 and 2. This may be explained by the fact that under ordinary use conditions some shrinkage in the structural frame can take place without producing plaster cracks, or in other words there is a certain amount of "take up" or slack between the frame and the plaster. Tests have shown that the grounds, studs, door and window jams pick up moisture from fresh plaster, and expand slightly. Subsequently after redrying they shrink away from the plaster and leave a space even though very small that will permit some movement of the plaster sheet before contact is reestablished. After the take up or slack was absorbed in the house under consideration further shrinkage caused the cracks to extend in proportion to the shrinkage. In spite of the amount of shrinkage found in this house the effect of shrinkage in terms of plaster cracks and other defects has not been important on the first floor. On the second floor some unsightly cracks have developed and, because of distortion in the frames of two doors in cross walls, adjustment of the hardware has been necessary so that the doors would latch.

The plaster cracks did not appear in the first floor until about 7 percent change in moisture content had taken place in the wooden members. On this basis these cracks might not have appeared at all if the original moisture content of the members composing the first floor unit had been somewhat less than 13 percent. The figure of 13

percent is obtained by adding the 7 percent to 6 percent, which is the lowest moisture content found in this unit. Cracks in the second floor appeared after about $5\frac{1}{2}$ percent moisture change had occurred in the first floor units and $4\frac{1}{2}$ percent in the second floor units. On this basis the first floor joist units should contain less than $11\frac{1}{2}$ percent moisture and the second floor less than 12 percent ($4\frac{1}{2} + 7\frac{1}{2}$) to prevent plaster cracks on the second floor. In other words, if plaster cracks and other shrinkage effects are to be avoided kiln dried lumber having a moisture content of approximately 12 percent or less at the time of installation should be used in house framing.

With joist of low moisture content the method of construction is relatively unimportant with the advantage somewhat in favor of the platform type for interior partitions. For bungalows or one-story structures the advantage lies wholly with the platform type regardless of original moisture content.

Throughout the greater part of the United States the minimum moisture content range of thoroughly air seasoned material is 12 to 15 percent, but the average for stock as it comes from the lumber yard is generally higher. Stock may be considered well air seasoned and still contain 15 to 17 percent of moisture. Such material will lose very little moisture during the building operation as it is already nearly in equilibrium with the atmospheric condition. Best results will be obtained by having structural material kiln dried to a moisture content averaging say 8 to 10 percent. During the building operation such stock will absorb some moisture from the atmosphere but the average moisture content will remain appreciably lower than air dried stock under like conditions of exposure. The surface may become wet from rain but such moisture will dry off rapidly during subsequent dry weather. Kiln dried joist may not always be available in the local lumber yard, in which event owners and builders should place orders for kiln dried material with their dealer.

Figure 1.--Curves showing shrinkage (a) between basement girders and attic floor; (b) between first floor partition cap and attic floor; (c) between second floor partition cap and attic floor. The average moisture content of the wood represented in the first floor, second floor and attic units is also shown.

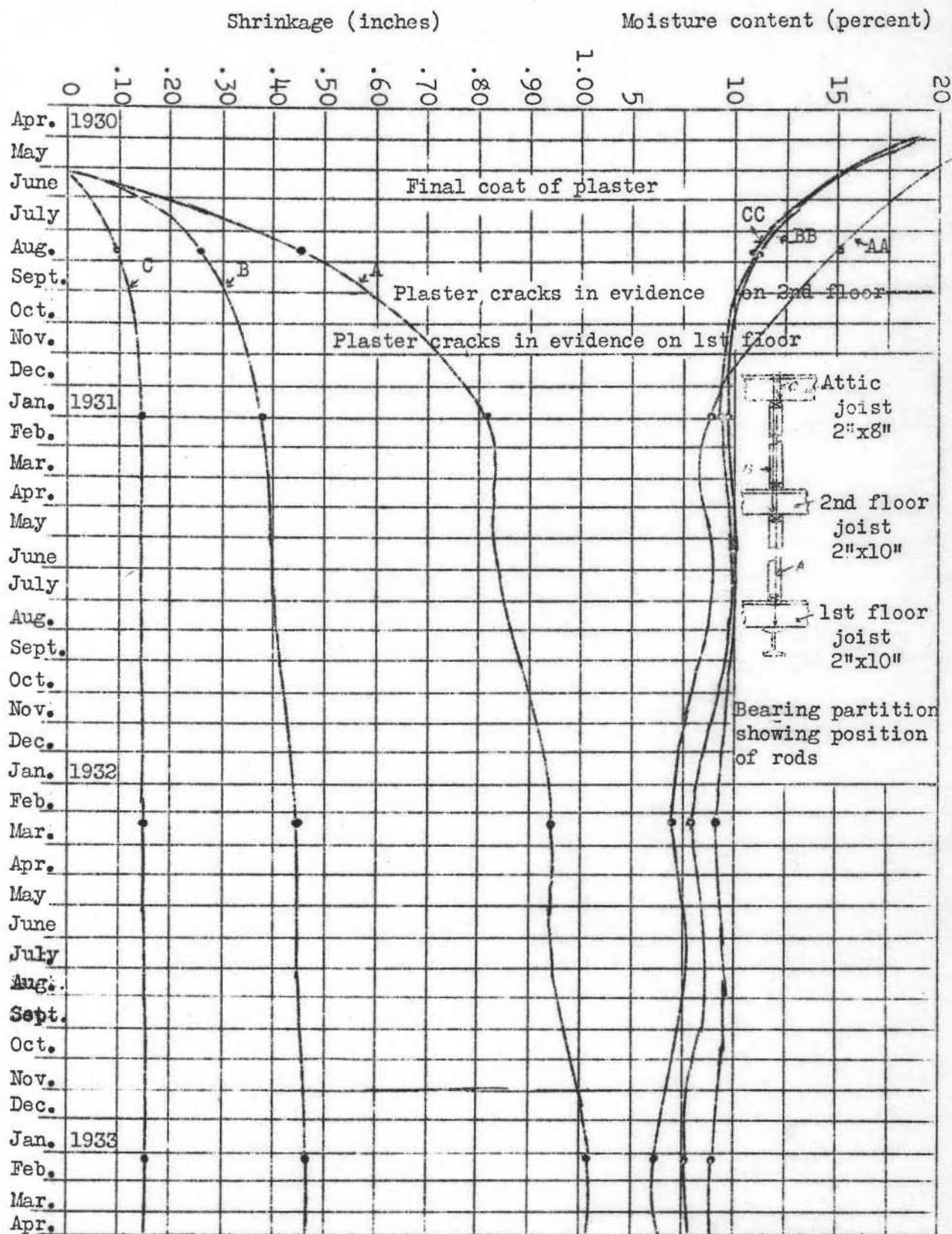


Figure 2.--Curves showing shrinkage (a) between top of basement girder and top of first floor partition cap; (b) between top of first floor partition cap and top of second floor partition cap; (c) between top of second floor partition cap and attic floor. The average moisture content of each unit is also shown.

