BIOGRAPHICAL SKETCH

LYLE HICKMAN

From 1930 to 1936 Lyle Hickman was assistant dry kiln operator for the Big Lakes Box Company in Klamath Falls, Oregon. In 1936 he joined Crane Creek Lumber Company in Willow Ranch, California as Dry Kiln Superintendent until 1944 when he moved, in a similar capacity to Klamath Lakes Moulding Co. and Palmerton Lumber Company which later became Ellingson Lumber Company in Klamath Falls, Oregon. Since 1955 Mr. Hickman has worked with the Western Pine Association now called Western Wood Products Association in the capacity of Seasoning Technologist.

A DISCUSSION OF LUMBER SIZES RELATED TO MOISTURE CONTENT AND DRYING QUALITY CONTROL

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Wood is an extremely complex substance. Its versatility can not be matched by any other material. If one of our modern synthetic products exhibited even a few of the properties of wood, it would be considered a technological marvel. Yet, because of wood's abundance and general availability as well as the relative ease with which it can be worked, its exceptional characteristics are often taken for granted. Its faults are usually grossly exaggerated. Even at a meeting like this, sometimes it seems like more emphasis is placed on wood's defects and variability than on its positive characteristics.

In the past the use of wood required few special skills or technical grasp. If, for instance, there was any question of the ability of a wood structural member in a certain situation, the problem was usually solved by simply using a larger piece. This trial and error approach has had the effect of placing wood at a disadvantage in competition with the newer products of modern technology.

Since 1960, the lumber industry, its customers and users and regulatory agencies have attempted to establish new lumber sizes which will provide efficiency in lumber uses, structural adequacy and the ability for the lumber industry to compete with other construction material in the market place.

Most regulatory bodies, many producers, and others connected with lumber manufacture and use, desire that green and dry sizes be related to moisture content and that the use of green and dry sizes be technically equivalent. This equivalency has generally been defined as providing related widths and thicknesses based on actual shrinkage data. However, related volume of wood (net cross section) and related span capabilities are also important.

Other important factors for efficient lumber sizes are:

1. Lumber manufactured under these new sizes should be structurally equivalent to current sizes for common use such as joists and rafters.

2. A basic dry size for both thickness and width is desirable to both maintain present board widths and provide the most efficient use of dimension sizes for spans.

3. U. S. Forest Products Laboratory shrinkage factors should be used to equate green and dry sizes for spans.

4. Sizes should be of practical dimensions so as to avoid complex fractions that would be confusing to designers, specifiers and users of lumber.

5. Sizes should not give advantage to either green or dry products in terms of structural capabilities.

6. Where practical, sizes should be set to avoid manufacturing problems and to permit normal ripping or splitting of wide boards and dimension to smaller sizes.

With these criteria in mind, several dimensions have been proposed and studied. In virtually all size proposals, the basic dry sizes have been established at 1-1/2" thick by present widths. This size results in joist and rafter spans essentially equal to spans assigned to green sizes now being used. Some 800 million feet of dry lumber of 1-1/2 inch thickness by present widths will be marketed in the United States in 1966. This market place demand indicates there will be a continuing need for this size product in the future.

Exhibit A shows a comparison of three of the many green size proposals offered and their relation to the present dry 1-1/2" thickness and widths. To determine whether the sizes, cross sectional areas and spans are equivalent, the green sizes are reduced in width and thickness by U. S. Forest Product Laboratory shrinkage factors - 2.80% in width and 2.35% in thickness (excepting Redwood). This "shrunken" size is based on 19% maximum moisture content. The results are then comparable to the width, thickness, volume and spans of the dry sizes.

Table 1 shows width and thickness dimensions, volume, "strength" and "stiffness" values of the dry sizes tabulated as 100%. This is then used as a basis to compare relative green sizes. The actual green width and thickness dimensions in table 2-3-4 are reduced by their respective F.P.R.S. shrinkage factors and the resulting values are compared with the corresponding values in Table No. 1.

Exhibit B illustrates one example of many factors that must be considered when new lumber sizes are established--the ripping or splitting capabilities of the various widths. It is common practice to split some of the wider widths of finished dimension into narrower pieces. Therefore, both green and dry sizes need to be large enough to permit normal splitting into smaller dimension widths. This exhibit shows the splitting possibilities with the present sizes. In all cases the splitter knife width is 1/2 inch. When narrower widths which may be structurally equivalent to present green sizes are considered, splitting problems are encountered unless all sizes are adjusted accordingly. The narrowest practical splitter knife now available is 1/4 inch.

Our responsibility in this as dry kiln people will be to dry the lumber for one and one-half dimension to the required 19% M.C. or less. We will be expected to accomplish this and keep degrade to a minimum. With seasoning degrade almost directly proportional to moisture content, we must strive to keep the moisture content of the stock as uniformly high as possible within the allowable maximums.

These more exact requirements will mean more precise control of drying. It is apparent that equalizing periods near the end of the schedules, which require some extra time will be desirable in most cases.

Simple but complete records should be kept for each charge so when difficulties arise, such as excessive drying time, too high a moisture content or excessive degrade loss from overdrying, a file of data will be available to indicate what corrections should be made.

Besides charts from recording controllers and schedule information, some quality control sampling and recording method should be adopted.

One very good time when valuable moisture content and drying quality control records can be kept is when the lumber is checked at the end of the run before the charge is pulled. Many dry kiln operators shut the kiln off long enough to go in and use their moisture meters with 1-1/8" electrode pins in the edge of the outside boards. Proper correction factors can be applied to compensate for wood temperature, species, moisture loss or gain between dry kiln and shipping point etc. This practice gives the operator valuable information upon which to base his judgment as to what the final moisture content of the lumber will be. By observing the variation in moisture content readings he can get a fair indication of the quality of drying.

Many dry kiln operators who use this method of testing do not record the information but mentally scrutinize the information as they go. As a rule the results are amazingly accurate. However, when questions arise, a few records are worth a thousand words. Records are also most important when more than one person does the testing. Two people will not make the same decision after evaluating the same test information. When competent records are used, rules and methods may be established. If these are followed the results will be much more dependable.

Exhibit C is an example of one method of recording moisture content readings taken with a moisture meter with 1-1/8 inch electrode pins in the board edges of cribs. A specified number of randomly selected pieces are tested in each crib or location. The results are tallied on the form under the proper location heading. Two different evaluations may be made with this information.

First, a maximum moisture content exclusion line will have been previously established. Any of the test tallies that are below this line, in the higher M. C. ranges, will be out of range. If less samples are below the line than allowed by predetermined exceptance number, the charge may be considered dry and ready to condition and pull. If the number is more, the lumber would not be dry. The door would be closed and the lumber dried longer. An exceptance number must be established to suit the drying requirements of each drying sort. In the case of Exhibit C, if the exceptance number was 2 this lumber would be considered dry because there is only one tally below the line. If two tallies were below the line it would still be excepted. Three tallies below the line would mean rejection and further drying would be required.

Estimating the average moisture content of the lumber is the second evaluation that may be made with this form. Simply multiply the number of tallies in each M. C. range by the range M. C., add and average the results. In this case the result is 20.3. Assuming the temperature of the lumber required a 5% correction, the estimated M. C. of the charge is 15.3%.

Records kept of moisture content readings taken at the dry or planer chain can also be very valuable for control of drying quality. They are especially valuable if the information is recorded in such a way that it is easily analyzed. For instance, it is most necessary for adjusting the exceptance-rejection line on the chart just discussed. Simple M. C. tallies that are usually taken show a fair picture of the drying quality. The highest and lowest M. C. readings can be determined and the average may be calculated but with ordinary M. C. tallies, it is difficult to compare the drying pattern of similar charges.

Exhibit D shows a simple method of preparing and recording M. C. data for easy analysis. Enough M. C. readings are taken for each charge tested to reflect a reasonable cross-section of the drying quality, 75 to 150 samples should be sufficient. The number need not be the same for each charge as with most other M. C. comparison tests.

For this M. C. recording method, M C. readings are tallied in the usual way with each reading tallied in its proper M. C. percentage group. When the desired number of readings are taken the sum of the tallies in each M. C. percentage group is entered in its square on the chart. These sums are then added up to the sum total. The sums are then divided by the sum total and multiplied by 100. These percentages are accumulated from the top or 7 and below level down and entered in the proper "sample" line. If the calculations are correct, the last figure in the column will be 100.

This chart was designed for demonstration only and appears somewhat complicated. What it really amounts to is two charts in one for comparison. The second column from the left and the one for "load 1" show M. C. tallies grouped for each M. C.

percentage from 7 and less to 25 and over for most precise information. The first column and "load 2" column offer similar information but more generalized. Three M. C. percentage levels are combined in each group for less calculations.

To analyze the data offered on the chart we need only to look at the top figure in the column to find the lowest M. C. and at the last figure to find the highest. In column 1 we find 7% for low and 20% for high. The value nearest 50 represents the average M. C. In this case it is the 50 and is at the 15% M. C. level. In column 2 the average falls in the 14-16% range. The largest frequency for column 1, the level at which most readings occur, is at 19%., not at 15% as is the average. In column 2 both the average and the largest frequency fall within the 14-16 range. The "below" and "above" frequency figures are arbitrary. Here, we have set it at 19%. In column 1, 98% of the sample is below 20% and 2% above 19%. In column 2, 86% is below 20% and 14% above 19%.

One feature of this method of recording moisture content information is that the information is recorded in percentage figures. No definite number of readings need be taken and tallied, a difficult task when checking moisture content on a dry chain.

The big advantage is that the data is entered in one column. Several tests of lumber charges of the same drying sort can be listed on the same sheet. To analyze the quality of drying it is necessary only to compare the data for each factor across the sheet.

This discussion might imply that drying quality control and record keeping are important only for special drying such as for dimension with maximum moisture content requirements or finish grades, but this is not the case. It is just as important to know the moisture content pattern of dimension now being dried by present practices where 85% of the stock must have a M. C. of less than 19% with not over 15% of it over 19% M. C. For highest grade recovery, this lumber should not be overdried. It should be expected that some of the pieces have a M. C. higher than 19% but the amount should be kept under control and this can be done with good records.

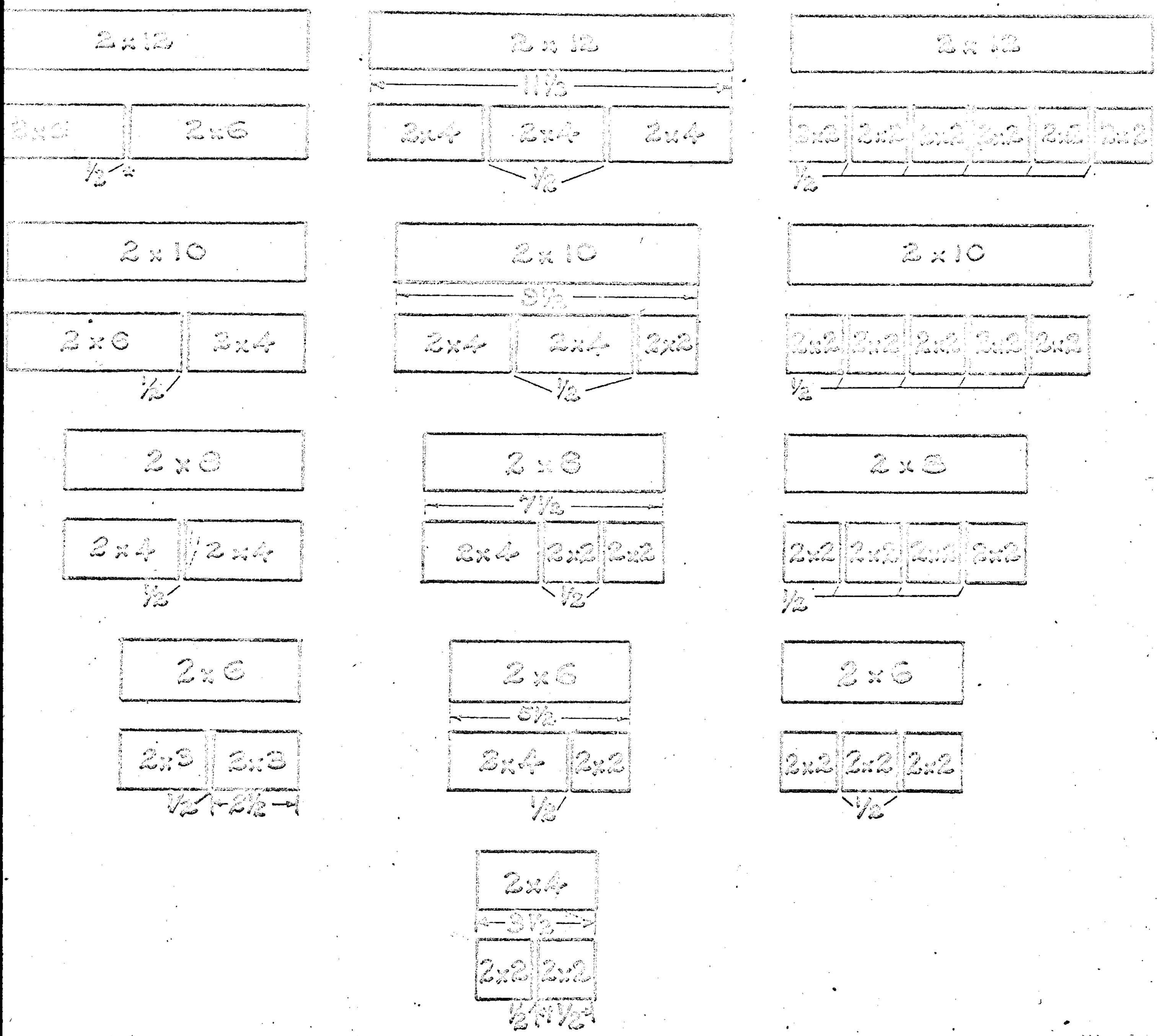
Drying quality control for seasoning needs not only saves drying time but also provides an excellent method of achieving better moisture content uniformity and better grade recovery as well. This is triple value, not to be overlooked for progressive seasoning.

EXHIBIT "A"

Nominal Size	Green Size	Dry Size	Thick-ness	Width	Volume	"F" Span	"E" Span	Relative Efficiency
TABLE 1--"DRY" Sizes. 1-1/2" X ALS Widths								
Approved at WWPA Annual Meeting, 1966. Also adopted by ALS Committee in 1963								
2 x 4		1-1/2 x 3-5/8	100	100	100	100	100	100
2 x 6		" 5-1/2	"	"	"	"	"	"
2 x 8		" 7-1/2	"	"	"	"	"	"
2 x 10		" 9-1/2	"	"	"	"	"	"
2 x 12		" 11-1/2	"	"	"	"	"	"
TABLE 2--Green Sizes. Equivalent to Table 1.								
Note: (Thickness rounded to a 16th and widths rounded to 1/8ths except 4 inch.)								
Percentages Related to Table 1								
2 x 4	1-9/16 x 3-11/16		101.7	98.9	100.6	99.8	99.5	98.9
2 x 6	" 5-5/8		"	99.4	101.1	100.3	100.0	98.9
2 x 8	" 7-5/8		"	98.8	100.5	99.7	99.4	98.9
2 x 10	" 9-3/4		"	99.8	101.5	100.6	100.3	98.8
2 x 12	" 11-3/4		"	99.3	101.0	100.2	99.9	98.9
TABLE 3--Green Sizes. Equivalent to Table 1.								
Note: (Widths rounded to 1/16ths.)								
Percentages Related to Table 1.								
Also adopted by ALS in 1963								
2 x 4	1-35/64 x 3-11/16		100.7	98.9	99.6	99.3	99.1	99.5
2 x 6	" 5-5/8		"	99.4	100.1	99.9	99.7	99.6
2 x 8	" 7-11/16		"	99.6	100.4	100.0	99.9	99.5
2 x 10	" 9-3/4		"	99.8	100.5	100.0	100.0	99.5
2 x 12	" 11-13/16		"	99.8	100.6	100.1	100.0	99.4
TABLE 4--Green Sizes. Approved at WWPA Annual Meeting, 1966								
Percentages Related to Table 1.								
2 x 4	1-9/16 x 3-5/8		101.7	97.2	98.9	98.0	97.8	98.9
2 x 6	" 5-1/2		"	"	"	"	"	"
2 x 8	" 7-1/2		"	"	"	"	"	"
2 x 10	" 9-1/2		"	"	"	"	"	"
2 x 12	" 11-1/2		"	"	"	"	"	"

Exhibit 'B'

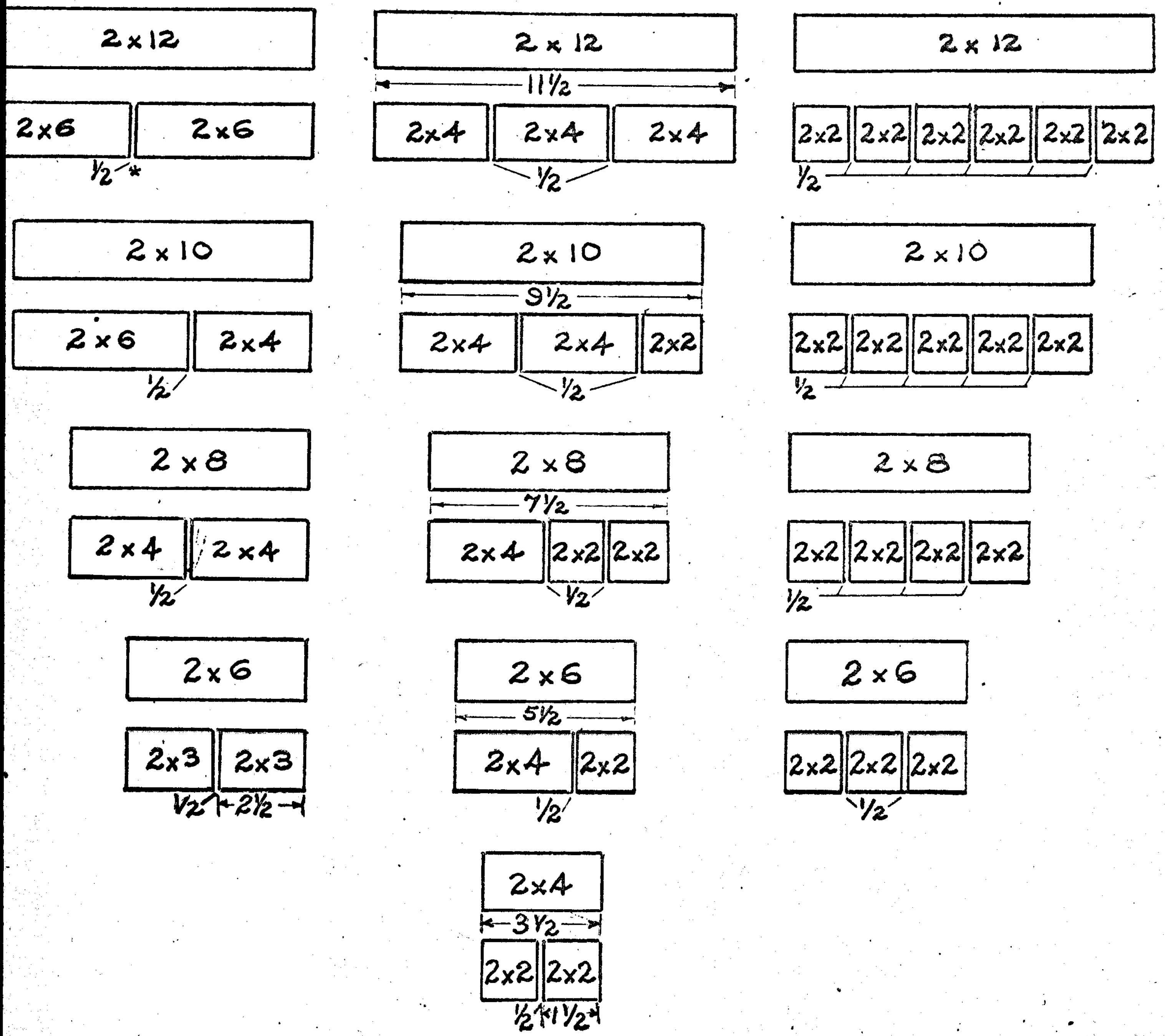
"DRY" Sizes



* Minimum thickness of splitter knife

EXHIBIT 'B'

"DRY" Sizes



* Minimum thickness of splitter knife

Exhibit C

Meter Reading	1	2	3	4	5	6	Number of Samples	M.C./No. of Samples
7 or less								
8								
9								
10								
11								
12								
13								
14								
15					I		1	15
16								
17		I	II				3	51
18					II	I	3	54
19	I	II		I		II	5	95
20			I			II	3	60
21	I	I	I	I	I		5	105
22			I	I			2	44
23	II	I			I		4	92
24				I		I	2	48
25				I			1	25
26								
27								
28	I						1	
29								
30 & over								

Samples in Range	29	Total 589
Samples out of Range	1	
Moisture Content Average		20.3
Temperature Correction Factor	5	
Estimated Moisture Content		15.3

Grade ______________

Exhibit D   Kiln No. __________   Species__________________   Size________   Sort ______________

Cumulative Frequency Percent

Moisture Content Percent	Moisture Content Percent	Load 1	Load 2	Load 3	Load 4	Load 5	Load 6	Load 7	Load 8	Load 9	Load 10
7 and Below	Below 6										
	6		1								
	7	2									
8 - 10	8	8									
	9	13	13								
	10	16									
11 - 13	11	21									
	12	29	21								
	13	34									
14 - 16	14	43									
	15	50	62								
	16	61									
17 - 19	17	74									
	18	82	86								
	19	98									
20 - 22	20	100									
	21										
	22										
23 - 25	23										
	24										
	25										
Over 25	Over 25										
Moisture Content	Low	7	7-								
	High	20	25+								
	Average	15	14-16								
	Largest Frequency	19	14-16								
Frequency	Below 20	98	86								
	Above	2	14								