SEASONING AND MACHINING DEGRADE IN YOUNG-GROWTH DOUGLAS-FIR DIMENSION LUMBER

by B. G. Anderson & A. C. Knauss

SUMMARY [1]

The increasing volume of young-growth Douglas-fir timber cut in the Pacific Northwest emphasizes the need for more knowledge on the characteristics of lumber sawed from these trees.

The study described here was initiated to learn the extent and causes of degrade resulting from kiln-drying young-growth Douglas-fir dimension lumber. At the same time it was possible to determine the degree of shrinkage during and after kiln-drying, and to check the final shipping weights of the lumber after drying.

Degrade was measured in ten kiln charges of approximately 6500 fbm (feet board measure) each, of 2- by 8-inch by 16-foot young-growth Douglas-fir dimension lumber which were kiln-dried and surfaced to 1-5/8 by 7-1/2 inches. An additional charge was surfaced green to determine the change in grade caused by machining alone.

Neither the average final moisture contents to which the charges were dried (approximate range 12-18 percent) nor the temperatures used in drying the charges seemed to have an appreciable effect on the amount of degrade. The amount of degrade was greater, however, when a low EMC [2] level was maintained during the schedule, as shown by the following table:

EMC of low humidity step (range)		Average total degrade (fbm basis) [3]	
		No. 1 Common	No. 2 Common
Per cent		Per cent	Per cent
3.3 - 4.4	Shake & grain separation	0.7	0.6
	Loose knots & edge knots	1.9	0.4
	Planer split and warp	5.7	3.8
	Season checks	1.4	0.2
	Knotholes	3.2	1.0
	Total	12.9	6.0
7.7 - 11.0	Shake & grain separation	0.7	0.8
	Loose knots & edge knots	1.9	0.7
	Planer split and warp	1.2	1.1
	Season checks	0.0	0.1
	Knotholes	2.1	0.5
	Total	5.9	3.2

1. The complete text of this report may be had on request from the Oregon Forest Products Laboratory, Corvallis, Oregon.
2. Equilibrium moisture content; the moisture content which wood will attain after long exposure to given atmospheric conditions.
3. Degrade from shrinkage (skips in dressing)is not included.

Total degrade in the Select Structural grade was consistently higher than degrade in No. 1 C (Number 1 Common). The amount of lumber in the select structural grade, however, was too small for full analysis.

Although young-growth Douglas-fir lumber is relatively free from the black knots found characteristically in old-growth, an average of 18 per cent of the green pieces in both No. 1C and No 2C contained black knots over 3/4 inches in diameter. Despite this fact, the average degrade from knot damage including knotholes was only about 4-1/2 per cent in No. 1C and about 1-1/3 per cent in No. 2C. Some of the knotholes that developed during seasoning or machining were too small to lower the original grade. The pieces containing these small knotholes averaged 2.9 per cent in No. 1C and 5.5 per cent in No. 2C.

Degrade from planer split and warp in lumber dried using a high minimum EMC step in the kiln schedule averaged 1.2 per cent in No. 1C and 1.1 per cent in No. 2C. Using a low minimum EMC step in the schedule led to an average degrade from planer split and warp of 5.7 per cent in No. 1C and 3.8 per cent in No. 2C.

Prices received at the mill are usually higher for kiln-dried than for green dimension lumber. Not all of this premium is gained by the mill, however, because of the drop in grade of some pieces during drying and machining. A summary of these factors is shown below.

	Mill prices[1]		Recovery value of kiln-dried lumber		Loss from degrade	
Grade	Green	Kiln-dried	Low EMC	High EMC	Low EMC	High EMC
Sel Str	$78.50	$92.00	$88.24	$89.81	$3.76	$2.19
No. 1C	68.50	82.00	79.66	81.30	2.34	0.70
No. 2C	65.25	76.00	74.19	75.13	1.81	0.87

1. Prices per M fbm based on Crow's Price Reporter, 20 August 1953. Average of "Most Sales". A price differential of $10.00 is assumed between Select Structural and No. 1C.

Average shrinkage in thickness and width during kiln-drying to 12 per cent average moisture content was 3.5 per cent, with 80 per cent of the pieces shrinking 4.1 per cent or less.

When lumber which had been kiln-dried to 18 per cent average moisture content and surfaced was allowed to dry further to about 12 per cent moisture content, the average additional shrinkage was found to be about 0.9 per cent, with 90 per cent of the pieces shrinking 1.5 per cent or less. The average residual shrinkage when dried from 18 to 5 per cent moisture content was 2.5 per cent.

The shipping weight of S4S green dimension ranged from 2500 to 2800 pounds per thousand board feet. When kiln-dried to 18 per cent average moisture content, the surfaced lumber averaged 2170 pounds per thousand, and when dried to 12 per cent moisture content averaged 2080 pounds per thousand board feet.

Time required for drying to a final average moisture content of 18 per cent ranged from 48 to 90 hours. The shorter interval was needed for kiln schedules with a constant dry-bulb temperature of 200 deg.F. and 7.7 per cent EMC level.

Drying time to 12 per cent average moisture content was 110 - 120 hours.

A general picture of drying times may be gained by comparing charges 2 and 5A with charges 6 and 7:

Charge	Dry-bulb Temperature Initial	Dry-bulb Temperature Final	EMC Initial	EMC Final	Drying time	Avg. final MC
					Hours	%
2	135	175	16	4	75	18
5A					110	12
6	180	180	12	9	72	18
7					120	12

FACTORS WHICH MAY BE CONSIDERED IN DRYING LODGEPOLE PINE

An outline of points to be covered by a panel representing the Eastern-Oregon & Southern Idaho Dry Kiln Club.

Kiln Drying

1. Schedule as compared with Ponderosa.
2. Amount of variation in final moisture.
3. Condition of knots at end of run.
4. Conditioning periods used and results
5. Amount of degrade in top course.
6. Number of stickers used.
7. Amount of noticeable crook, warp or cup.
8. Amount of kink.

Air Drying

1. Drying rate
2. Number of stickers used.
3. Tendency toward stain.
4. Degree of warp, twist and cup found.
5. Spacing of loads.