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VENEER RECOVERY from DOUGLAS-FIR LOGS

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PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
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INTRODUCTION

During 1956, the Pacific Northwest Forest and Range Experiment Station made a series of six veneer-recovery studies[1/] in the Douglas-fir region of Oregon and Washington. The net volume of logs involved totaled approximately 777 M board-feet. Purpose of these studies was to determine volume recovery, by grade of veneer, from the four principal grades of Douglas-fir logs processed at plywood plants.

In addition, supplementary veneer-recovery data were obtained from several studies similarly conducted by an independent consulting firm. Since the two sets of data were similarly collected and possessed considerable likeness, they were combined into one summary representing over 5.9 million board-feet (net log scale).

Use of this information should be helpful in predicting veneer-yield expectancy so that timber and logs can be more accurately appraised.

PROCEDURE

Experiment Station Studies

General

For the purpose of these studies, the Douglas-fir subregion was divided into three districts. This permitted testing the validity of the belief that quality of logs within a given grade varies with

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1/ Studies made at brookings Plywood Corporation, Brookings, Oreg.; Evans Products Company, Roseburg, Oreg.; Edward Hines Lumber Company, Westfir, Oreg.; U.S. Plywood Corporation, Eugene, Oreg.; Columbia Veneer Company, Kalama, Wash.; and Simpson Logging Company, Shelton, Wash.

Cooperators in these studies were Bureau of Land Management and Bureau of Indian Affairs, Department of the Interior; Douglas Fir Plywood Association; and the Northern California, Columbia River and Puget Sound log scaling and grading bureaus.

geographical distribution. District No. 1 comprised western Washington. Western Oregon was divided into two districts: northwestern Oregon (District No. 2) and southwestern Oregon (District No. 3). This division was made along a line approximating the southern boundary of Lane County.

Two plywood plants in each of three districts were selected for the studies. Criteria used in selecting the plants were: (1) a minimum average capacity of 3,000 M square feet per month, (2) representative equipment and practice, and (3) production of all commercial standard grades of plywood. Consideration was also given to the adequacy of certain physical facilities; namely, sufficient pond storage area and possession of a scraper-head type barker, a steam-heated drier, and a hot press.

Log Pond

All the study logs were scaled and graded in the water by a representative of the log scaling and grading bureau employed by the mill, with the regional Forest Service check scaler collaborating. Grading was done in accordance with the official log scaling and grading rules currently used by the Puget Sound, Grays Harbor, Southern Oregon, and Northern California log scaling and grading bureaus.

The length of each log selected was a multiple of the nominal 8 1/2-foot peeler block: 17, 26, 34, or 42 feet. This was done to avoid the development of mixed-length blocks in the test runs. Each log was identified as to log grade and the blocks cut from it maintained log identity. Blocks from logs of like grade were separated into units, each constituting a test run of approximately 4 hours' peeling time at the lathe (about 20 M board-feet).

At each plant, enough logs were selected to make seven test runs; two each of No. 1, No. 2, and No. 3 Peeler grades, and one of the Special Peeler grade[2/] (table 1). Two test runs were made in the No. 1, No. 2, and No. 3 Peeler grades to determine the effect of log diameter on volume and grade recovery. One run each was made for small No. 1 and small No. 2 Peeler logs--those with diameters of 30 through 36 inches; the test runs on large logs of the same grades were for those with diameters over 36 inches. The diameter range of the small No. 3 Peeler logs was 24 through 29 inches, and that of the large No. 3 Peelers was over 29 inches.

2/ No. 2 Sawmill logs (18 through 23 inches) meeting requirements of at least No. 3 Peelers, except for size.

Table 1.--Volume of Douglas-fir logs tested in six Forest Service studies, by grade and district, 1956

Log grade	District			Total
	Number 1 (Western Washington)	Number 2 (N. W. Oregon)	Number 3 (S. W. Oregon)	
	Board-feet			
No. 1 Peeler	91,850	66,250	57,240	215,340
No. 2 Peeler	84,700	64,460	61,890	211,050
No. 3 Peeler	77,780	87,670	82,220	247,670
Special Peeler 1/	28,150	35,040	39,880	103,070
Total	282,480	253,420	241,230	777,130

1/ No. 2 Sawmill logs (18 through 23 inches) meeting requirements of at least No. 3 Peelers, except for size.

Veneer Cutting

Blocks from the test logs were barked with a scraper-head barker and then rotary cut cold into veneer. The thickness of veneer, either 1/8 or 1/10 inch, was selected by plant management to maintain balance with orders. The peelable cores from the large lathe were cut into 3/16-inch veneer on a core lathe to approximately a 6-inch diameter. In studies at plants without a core lathe, the volume of veneer that could be obtained from the peelable cores--if rerun to a 6-inch diameter--was calculated and credited to D veneer.

The usual industry clipping practice was followed to recover all useful veneer.

Veneer Drying and Measurement

All the test veneer was dried in conventional steam-heated driers during the same working day it was peeled. The dry veneer was graded by company graders under the supervision of a Douglas Fir Plywood Association supervisor. The grading was done in accordance with Commercial Standard CS45-55 for Douglas-fir plywood, with the following modifications: (1) In 48 by 96-inch sheets, A-face admitted 8, and B-face admitted 12 Globe, Raimann, or Skoog patches or plugs acceptable in the grade; (2) sheets narrower than 48 inches admitted a proportional amount of patching; (3) the minimum-width strip considered for face veneer was approximately 12 inches.

After drying, the veneer was sorted into grades A, B, C, and D. Its volume was measured on the basis of equivalent 48 by 96-inch rough-trimmed panel (3/8-inch thick). For loads containing like-width material, the number of pieces was counted. For random-piled loads, the load dimensions were measured and the volume in terms of equivalent rough-trimmed panel was determined with the aid of conversion factors developed for each thickness of veneer at each study mill. Conversion factors were usually developed by piece-tallying several random loads to obtain the solid wood content. Reductions were then made for veneer jointing and breakage, and panel trimming. Conversions were sometimes developed by following random loads through the jointer and edge-gluer and recording the number of full-width sheets produced, or by following loads of crossband veneer through the glue spreader and recording the number of crossband plies produced. Thus, using these techniques, the volumes calculated include deductions for losses experienced in jointing the face-veneer strips for taping or edge-gluing and for trimming the panel to size.

Upon completion of the measurements necessary for volume computation, a large percentage of the potential A and B veneer was followed through the patchers and pluggers to determine fall-down from the grade assigned after drying. Additional grade fall-down information was obtained by following available random-width veneer through the edge-gluer. The veneer was then released to the production department.

Supplementary Recovery Data

Additional data on the recovery of veneer from peelable Douglas-fir logs were obtained from more extensive studies made by an

independent engineering consulting firm in Portland, Oreg. This information includes the results from peeling more than 5 million board-feet of test logs at 18 different plywood plants in Oregon and Washington from 1950 through 1955. Although the object of these independent tests was to improve operating procedures in mills, the results obtained also satisfy the Forest Service objective of predicting veneer-yield expectancy from various grades of peelable logs. These tests were not conducted in a manner to show the effect of log diameter on veneer recovery. However, the effect of log diameter determined in the Experiment Station studies was later applied to the supplementary data.

Care was used to select test-run data that represented conditions and techniques comparable to those in the Experiment Station studies. For example, the firm's data included information on the same four peelable grades of Douglas-fir logs, as designated by bureau grade, and reflected the veneer-grade recovery percentages for each log grade. Further, these data were based on tests made under practical operating conditions and were segregated according to the district boundaries established by the Forest Service.

The firm's tests were made during the period 1950-55. During that time, veneer grading rules in Commercial Standard CS45-48 were superseded by those in CS45-55. Therefore, data based on the earlier edition were adjusted to conform to CS45-55 requirements.

The allowable number of patches for each veneer grade was determined in accordance with the limits of patching established for the Experiment Station studies (see page 5) and was considerably below maximum allowable limits.

Logs included in the independent studies were graded in accordance with the same rules employed in the Experiment Station studies (Puget Sound Log Scaling and Grading Bureau) except in District No. 2, where they were graded according to the Columbia River Log Scaling and Grading rules. The chief difference between these two sets of rules occurs in the No. 3 Peeler log grade, where the Columbia River rules include a 50-percent surface-clear requirement.

RESULTS AND DISCUSSION

The results of these studies are considered to represent the practical grade-yield expectancy from peelable Douglas-fir logs under average conditions of effective plant operation.

Recovery--by District

Results from the six Experiment Station studies, covering 777 M board-feet of Douglas-fir logs, were combined with those from the supplementary engineering studies, which covered 5,137 M board-feet of similar logs (table 2). Since, in the studies from which the data in this report were obtained, the test veneer was not followed through the entire production operation (no data obtained beyond glue spreader), the average recovery ratios shown may be slightly higher than the industry average.

The combined results in table 2 are derived from 24 different studies in which there was some difference between the results of individual studies. For example, the Experiment Station studies showed a range of 29 to 58 percent for the combined A and B recoveries from No. 1 Peelers; of 25 to 48 percent for No. 2 Peelers; and of 11 to 37 percent for No. 3 Peelers. The other studies showed similar variations.

The percentages shown in table 2 must not be interpreted as reflecting the yield required by the log-grading rules. These rules require that No. 1 Peelers must yield 50 percent and No. 2 Peelers 35 percent or more of their net scaled contents as clear, uniform-colored veneer. The rules do not define clear veneer nor indicate where the yield should be measured. Since sawmills determine lumber recovery on a green-volume basis, there is a precedent for plywood plants, when determining compliance with log-grade rules, to measure veneer recovery on a green-volume basis. Veneer-yield values in this study were obtained from measurements taken after spurring at the lathe, shrinking in the driers, and trimming to finished plywood width and length.

By comparing results for any of the log grades (table 2), it is noted that there were no great differences between districts in average volume yield of veneer. It is also shown that there were no great differences between districts in the amounts of A and B veneer produced from any of the peeler log grades. Total amount of veneer recovered and percentages of A and B veneer recovered may have differed appreciably between individual timber stands and plywood plants, but the average recovery from any grade of log was quite consistent between the three districts covered. No doubt it is true that the assortment of log grades available from a timber stand varies geographically. The average results shown in table 2 include logs from many logging operations.

Table 2.--Recovery of dry Douglas-fir veneer, by district[1/]

District and log grade	Net log scale	Veneer recovered (Percentage of net log scale)				Recovery ratio[2/]
		A	B	C	D	
	Bd.-ft.	------Percent------				
No. 1 (Western Washington)						
No. 1 Peeler	365,780	36	9	25	22	2.47
No. 2 Peeler	364,530	26	9	29	27	2.44
No. 3 Peeler	293,450	14	10	29	36	2.38
Special Peeler	112,150	7	9	38	33	2.31
Total	1,135,910	-	-	-	-	-
No. 2 (Northwestern Oregon)						
No. 1 Peeler	1,377,900	33	9	20	28	2.40
No. 2 Peeler	1,313,820	23	8	22	38	2.43
No. 3 Peeler	1,061,170	14	7	23	43	2.31
Special Peeler	297,140	7	6	27	44	2.23
Total	4,050,030	-	-	-	-	-
No. 3 (Southwestern Oregon)						
No. 1 Peeler	223,990	33	10	29	18	2.39
No. 2 Peeler	209,390	26	8	30	27	2.42
No. 3 Peeler	219,800	15	7	31	37	2.41
Special Peeler	75,520	7	6	40	37	2.41
Total	728,700	-	-	-	-	-
Total	5,914,640	-	-	-	-	-

1/ Based on 24 mill studies in western Washington and western Oregon, 1950-56.

2/ Volume of dry veneer recovered (3/8-inch rough-trimmed panel basis) divided by net log scale.

Recovery--All Districts Combined

Due to the similarity of average veneer recoveries obtained in the three districts, all data were combined (table 3). The combined data represents the recoveries obtained from approximately 6 million board-feet of Douglas-fir logs from over the entire Douglas-fir region. For the upper three grades of logs, the percentage yields of B veneer and C veneer were approximately constant. Together, these two grades of veneer constituted slightly over one-third of the net log scale. Therefore, as the yield of A veneer increased or decreased, the yield of D veneer inversely decreased or increased, since B and C were constant.

The amount of A veneer obtained by industry may be somewhat higher at some mills than that shown in these studies. They may use more than 8 patches for a 48 x 96-inch sheet of A veneer since the commercial standard admits 18 patches. More extensive patching would raise some B, C, and D veneer reported in this study to A and B grades. The cost of patching and the reluctance of the customer to buy plywood containing extensive face patching restrain the industry generally from patching face veneer to admissible limits. The limits for patching set up in this study (maximum of 8 for A and 12 for B) were considered to represent fairly conservative patching practice.

Effect of Log Diameter

As explained earlier, the Experiment Station studies were made in such a way as to show the effect of log diameter on recovery ratio. Figure 1 shows this relation. In all instances, the smaller logs yielded higher recoveries than larger logs of the same grade. The difference between the small and the large logs was about 5 percent for No. 3 Peelers, about 9 percent for No. 2 Peelers, and about 7 percent for No. 1 Peelers. It is suspected that these differences may be due, in part, to an oddity of the Scribner Decimal C log rule. In comparison with the actual calculated volume of logs, this rule underscales logs 32 through 36 inches in diameter considerably more than logs immediately above and below that range (over 36 inches and 25-31 inches). The greatest underscale is for logs 34 inches in diameter.

For evaluation purposes, the differences shown in figure 1 should be recognized by adjusting the recovery ratios of table 3 so as to distinguish between small and large logs within a grade. This

Table 3.--Recovery of dry Douglas-fir veneer;

Districts 1, 2, and 3 combined[1/]

Log grade	Net log scale	Veneer recovered (Percentage of net log scale)				Recovery ratio[2/]
		A	B	C	D	
	Board-feet	Percent				
No. 1 Peeler	1,967,670	34	9	25	23	2.42
No. 2 Peeler	1,887,740	25	9	27	30	2.43
No. 3 Peeler	1,574,420	14	8	28	38	2.36
Special Peeler	484,810	7	7	35	38	2.31
Total	5,914,640	-	-	-	-	-

1/ Based on 24 mill studies in western Washington and western Oregon, 1950-56.

2/ Volume of dry veneer recovered (3/8-inch rough-trimmed panel basis) divided by net log scale.

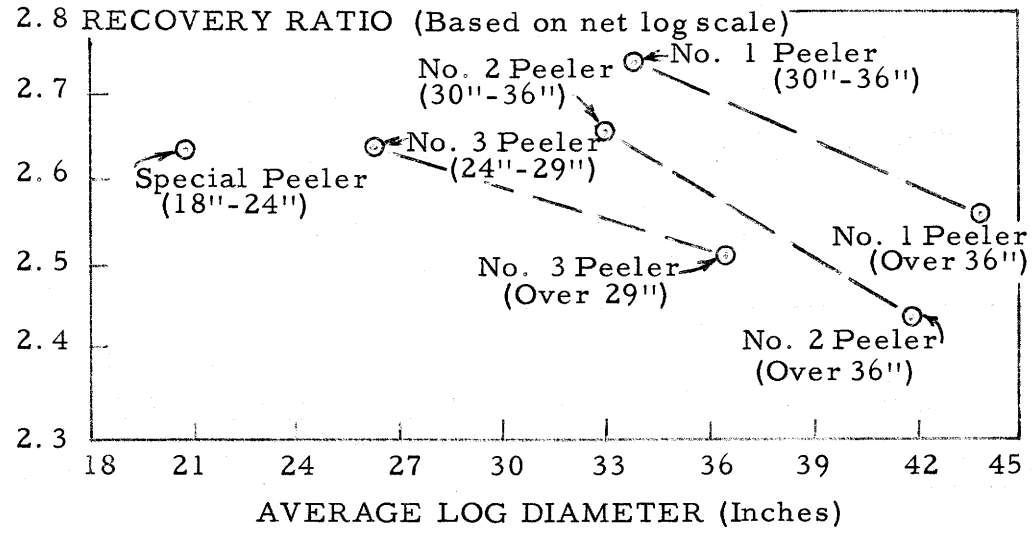

Figure 1.--Effect of log diameter on recovery ratio from Douglas-fir peeler logs. (Based on sample of 777 M board-feet net log scale.)

adjustment was calculated by increasing the recovery ratio for the small logs and decreasing the recovery ratio for the large logs. This increase and decrease was made by an amount equal to one-half the total difference between the small and large logs of a grade, as shown in figure 1. This technique requires also that the percentages of veneer grade recovery be adjusted upward or downward proportionately to fit the increased or decreased recovery ratios (table 4).

If the recovery information is wanted on the basis of percentage of total veneer produced, rather than percentage of net log scale, the conversion is readily obtainable from table 4 as follows: (1) Multiply the percentage of veneer recovered by 2.67 (recovery ratio based on 100% of net log scale); (2) divide this product by the appropriate recovery ratio. Thus, for No. 1 Peeler logs, 34 percent A-veneer times 2.67 divided by 2.42 = 37.5 percent of the total veneer produced. Similarly, for the No. 2 Peeler logs, 27 percent C-veneer times 2.67 divided by 2.43 = 29.7 percent of the total veneer produced.

Table 4.--Recovery[1] of dry Douglas-fir veneer; Districts 1, 2, and 3 combined: Modified to show effect of log diameter

Log grade	Net log scale	Log diameter class	Veneer recovered (Percentage of net log scale)				Recovery ratio[2]
			A	B	C	D	
	Board-feet	Inches	-----Percent-----				
No. 1 Peeler	1,967,670	3/	34	9	25	23	2.42
		30-36	35	9	26	24	2.50
		over 36	33	9	24	22	2.34
No. 2 Peeler	1,887,740	3/	25	9	27	30	2.43
		30-36	26	10	28	31	2.54
		over 36	24	8	26	29	2.32
No. 3 Peeler	1,574,420	3/	14	8	28	38	2.36
		24-29	14	8	29	39	2.42
		over 29	14	8	27	37	2.30
Special Peeler	484,810	18-23	7	7	35	38	2.31
Total	5,914,640	-	-	-	-	-	-

1/ Based on 24 mill studies in western Washington and western Oregon, 1950-56.

2/ Volume of dry veneer recovered (3/8-inch rough-trimmed panel basis) divided by net log scale.

3/ All diameters in grade, i.e., 30 inches and over for No. 1 and No. 2 Peelers, and 24 inches and over for No. 3 Peelers.

Comparison With Industry-Average Recovery Ratio

For comparison with industry production reports, some readers may be interested to have the results of these studies expressed in terms of the reported industry-average recovery ratio of approximately 2.3. Since recovery ratios by individual log grades are not available from industry, and since table 3 indicates that differences in volume recovery between log grades is slight, it is not believed unfair to reduce all the percentage values and recovery ratios to the common base of 2.3. Such a technique was followed to construct table 5. A 2.3 recovery ratio reflects an 86 percent utilization of the net log scale (2.3 divided by 2.67 is .8614).

Table 5.--Adjusted recovery of dry Douglas-fir veneer; Districts 1, 2, and 3 combined[1/]

Log grade	Net log scale	Veneer recovered (Percentage of net log scale)				Total
		A	B	C	D	
	Board-feet	Percent				
No. 1 Peeler	1,967,670	32	8	24	22	86
No. 2 Peeler	1,887,740	24	8	26	28	86
No. 3 Peeler	1,574,420	14	8	27	37	86
Special Peeler	484,810	7	7	35	37	86
Total	5,914,640	-	-	-	-	-

1/ Veneer recovery percentages in table 3 adjusted to the industry-average recovery ratio of 2.3.

Comparison with the industry-average recovery ratio may not be too meaningful, however, because the industry ratio includes factors that were eliminated in the design of this study. These factors are:

1. The industry-average recovery ratio--which is based on reports from a high percentage of the plants producing softwood plywood--includes plants of high efficiency and those of low efficiency, whereas none of the mills cooperating in the study would be rated as low in efficiency.

2. Study logs were all water scaled, whereas the industry ratio includes both water and truck scale. Truck scale, giving slightly higher log volumes than water scale, tends to lower recovery ratio.

3. The industry ratio includes certain low-grade types of logs not included in the study.

4. The industry ratio reflects the volume loss resulting from bucking odd-length logs, whereas the test logs were selected in multiple lengths of the 8 1/2-foot peeler block (17, 26, 34, or 42 feet).

Another reason for the industry ratio not being altogether comparable with the study ratios is that the volume of logs studied in each log grade was not selected in proportion to industry usage.