



FOREST PRODUCTS RESEARCH BRANCH

# **A MILLING STUDY OF 150-YEAR OLD DOUGLAS FIR**

by

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## S U M M A R Y

The study was conducted at Haney, B.C. in the Vancouver Forest District. The woods sample consisted of 48 trees and their resulting 197 logs. One hundred and sixty-seven of these logs, including logs from 34 complete trees were processed through the mill. The average site index was between 160 and 170. The average top cut was 11.7 inches and the average length of stem utilized in the initial breakdown from trees to logs was 124 feet or 71 per cent of the average tree height. Twenty-six per cent of the total lumber recovered from the 34 complete trees was D Clear and Better and 45 per cent was Select Structural. Butt logs and second logs contained 68 per cent of the volume of lumber recovered, 94 per cent of D Clear and Better and 65 per cent of Select Structural lumber recovered. Forty per cent of the 167 logs milled were Grade 2. These contained 54 per cent of the volume recovered, 82 per cent of all D Clear and Better and 50 per cent of all Select Structural lumber. The average overrun for all logs was 19 per cent and the average lumber recovery factor was 7.4.

## S O M M A I R E

Cette étude, effectuée à Haney (C.-B.) dans le district forestier de Vancouver, portait sur 48 sujets et les 197 tronçons qu'on en a tirés. Cent soixante-sept de ces billes, y compris celles qui provenaient du tronc entier de 34 arbres, ont été usinées. L'indice moyen de fertilité du type forestier se situait entre 160 et 170. Le diamètre moyen au fin bout s'établissait à 11.7 pouces et la longueur moyenne de fût du premier tronçonnage était de 124 pieds, soit 71 p. 100 de la hauteur moyenne des arbres sur pied. Vingt-six pour cent de tout le bois d'oeuvre obtenu des 34 fûts entiers étaient de la catégorie D clair et meilleur et 45 p. 100 de ce bois d'oeuvre ont été classés comme bois de qualité structure choisie. Les billes de souche et les deuxièmes billes ont donné 68 p. 100 de tout le volume de bois d'oeuvre obtenu, 94 p. 100 du bois classé D clair et meilleur, et 65 p. 100 du bois de qualité structure choisie. Quarante pour cent des 167 billes usinées étaient de qualité n° 2. Ces dernières billes ont donné 54 p. 100 du volume de bois d'oeuvre obtenu, 82 p. 100 de tout le bois d'oeuvre classé D clair et meilleur, et 50 p. 100 de tout le bois de qualité structure choisie. La moyenne de surrendement pour toutes les billes s'établissait à 19 p. 100 et le coefficient moyen de rendement en bois d'oeuvre était de 7.4.

## A MILLING STUDY OF 150-YEAR OLD DOUGLAS FIR

### I. INTRODUCTION

Part of the continuing program of the Vancouver Laboratory of the Forest Products Research Branch is to assess the effect of tree and log size on lumber yield and quality. An opportunity to supplement available data on West Coast species was provided in the Spring of 1962 when a stand of 150-year old Douglas fir was logged at the University of British Columbia Research Forest at Haney, B.C.

The area in which the sampled stand was located is in the southwest corner of the Research Forest. Average elevation of the sample area is about 200 feet above sea level with broken topography and rock outcrops. The slope of the ground varies from 0 to 50 per cent and the overall aspect is southwesterly. The stand consisted almost entirely of Douglas fir except for a few western hemlock and western red cedar.

### II. STUDY PROCEDURES

The trees comprising the study sample were identified by number before logging commenced and data on the standing trees were obtained. Diameters at breast height ranged from 20 to 50 inches outside bark and the average height of dominant and co-dominant trees was 190 feet. The average stump-height age of the study trees was 141 years and the site index was between 160 and 170.

When the trees had been felled and bucked, the logs from each tree were identified by tree number and scaled by a licensed scaler using the B.C. Log Scale and the B.C. Cubic Scale and graded according to B.C. Log Grading Specifications. As various circumstances prevented the following of all 197 logs from the woods through the mill, the sawmill data recorded are based on 167 logs including logs from 34 complete trees.

The logs were transported by truck to a local sawmill which was equipped with a double circular headsaw, an edger and a circular resaw. The mill cut for maximum clear recovery and also cut heavily to timbers. Material other than timbers was directed through the edger to the green chain and whenever necessary through the resaw. All timbers and boards cut from the logs were identified by log numbers and graded rough green by a Pacific Lumber Inspection Bureau grader under B.C. Lumber Manufacturers Association Standard Grading and Dressing Rules No. 59. The grades and nominal dimensions of each piece were tallied by log number.

The results of this study are presented in two parts in the following pages. In the first part, information obtained from the woods sample of 48 trees and their resulting 197 logs is given, and in the second part, results from the mill sample of 167 logs including 127 logs from 34 trees are presented.

### III. RESULTS

#### 1. WOODS SAMPLE

##### (a) Utilization Standards

Data obtained on the woods sample of 48 trees are presented in Table 1. The average top cut of utilized stem was 11.7 inches and the percentage of stem utilized increased from 59 per cent of total tree height in the 21-inch D.B.H. class to 83 per cent in the 48-inch D.B.H. class.

##### (b) Scaled Volume Contents

The average tree in the sample was in the 33-inch D.B.H. class and contained two 30-foot logs and two 32-foot logs. Table 2 shows the average tree volume contents by 3-inch D.B.H. classes. Gross and net cubic and board foot scales are shown as well as cubic volume deductions by type of deduction. The ratios of board feet log scale per cubic foot shown in Table 2 are based on net log scale and averaged 6.2 for the trees sampled. Total scaled volume for all 48 sample trees and their resulting 197 logs was 14,070 gross cubic feet or 87,563 gross board feet. Net scales amounted to 12,864 cubic feet or 80,178 board feet.

Table 1

WOODS SAMPLE - 48 TREES

BASIC TREE DATA

D.B.H. Class In.	No. of Trees	Average Age at Stump Height Years	Average Total Tree Height Feet	Average Stump Height Feet	Average Top Cut Inches	Average Length Utilized Stem	
						Feet	% of Total Tree Height
21	4	128	153	1.4	10.0	91	59
24	7	134	155	1.9	10.6	107	69
27	4	135	163	1.7	10.5	122	75
30	7	144	167	1.7	11.3	112	67
33	8	143	179	1.8	11.9	124	69
36	5	144	181	2.0	13.8	129	71
39	6	146	189	2.5	11.2	147	78
42	5	147	203	2.7	14.0	151	74
45	1	143	194	3.0	11.0	167	86
48	1	144	180	3.5	15.0	149	83
Total	48	-	-	-	-	-	-
Average	-	141	175	2.0	11.7	124	71

(c) Scaled Deductions

Twenty-three of the 197 logs in the study sample required scaled deductions for rot or shake. Twenty of these 23 were butt logs and the remaining 3 were second logs. The defective logs came from a total of 22 trees but only 11 of these trees were classified as having external indications of possible defect in the initial examination of the standing trees.

Table 2

WOODS SAMPLE - 48 TREES  
AVERAGE TREE VOLUMES AND SCALED DEDUCTIONS  
BY D.B.H. CLASSES

D.B.H. Class In.	No. of Trees	Av. Gross Cubic Scale	Av. Gross Bd.Ft. Scale	Average Volume Deductions Cubic Scale					Av. Net Cubic Scale	Net Cubic Scale as Per Cent of Gross Cubic Scale	Av. Net Bd.Ft. Scale	Bd.Ft. Log Scale per Cu.Ft.
				Rot Butt	Heart	Ring Shake	Crook & Sweep	Waste & Breakage				
21	4	99.0	518	1.6		4.3		3.1	90.0	90.9	461	5.1
24	7	143.1	820	3.1	3.6	0.5	0.6	3.5	131.8	92.1	752	5.7
27	4	202.8	1182	3.9		0.6	2.3	8.3	187.7	92.6	1098	5.8
30	7	206.1	1178	5.0		3.3	0.8	2.9	194.1	94.2	1112	5.7
33	8	271.5	1692	6.0	5.2	3.9		13.3	243.1	89.6	1518	6.2
36	5	333.6	2101	5.5				34.5	293.6	88.1	1860	6.3
39	6	424.3	2669	7.8				16.5	400.0	94.3	2522	6.3
42	5	553.2	3695	4.4		2.1		23.4	523.3	94.6	3497	6.7
45	1	651.5	4195					123.7	527.8	81.0	3492	6.6
48	1	615.8	4050			24.1		77.4	514.3	83.5	3347	6.5
Average		293.2	1824	4.1	1.4	2.9	0.4	16.4	268.0	91.4	1670	6.2



Defects such as rot, shake and sweep accounted for only 3 per cent of the gross volume. Broken logs, chunks, and logs left on the area accounted for 5.6 per cent of the gross scaled volume. After deductions the net cubic volume of all trees was 91.4 per cent of the gross cubic volume.

(d) Taper

Table 3 shows the taper in scaled logs by log position. Second logs had the least taper followed by butt logs and then mid and top logs. The average taper for all logs was one inch in 8.1 lineal feet.

2. MILL SAMPLE

(a) Lumber Recovery from Complete Trees

One hundred and twenty-seven of the 167 logs processed through the mill were logs from 34 complete trees and Table 4 shows the average percentage lumber grade recovery by tree D.B.H. classes for these 34 trees. Clear grades of lumber recovered increased from 12.6 per cent in the 21-inch D.B.H. class to 29.5 per cent in the 33-inch D.B.H. class and from there did not vary appreciably with further increases in tree diameter. Percentage Select Structural grades recovered decreased as D.B.H. increased but there was a fairly consistent total of around 70 per cent Select Structural and Clear grades recovered from each tree D.B.H. class.

Data on lumber recovery by log position are presented in Table 5. Sixty-eight per cent of the total lumber recovered was in the butt and second logs and of this 36 per cent was D Clear and Better lumber and 43 per cent was Select Structural lumber. Of the total lumber recovered from mid and top logs only 5 per cent was Clear lumber but 49 per cent was Select Structural.

Table 3

WOODS SAMPLE - 197 LOGS

TAPER IN LOGS BY TOP DIAMETER CLASSES  
LINEAL FEET PER INCH

Top Diameter Class	Butt Logs		2nd Logs		Mid & Top Logs		All Logs	
	No. of Logs	Taper	No. of Logs	Taper	No. of Logs	Taper	No.	Taper
6	-	-	-	-	4	5.4	4	5.4
9	-	-	-	-	12	6.8	12	6.8
12	1	8.2	4	13.9	31	6.4	36	6.9
15	5	8.4	8	11.6	20	8.3	33	9.1
18	12	12.0	11	12.5	21	6.3	44	8.6
21	7	7.8	7	9.6	8	8.1	22	8.4
24	10	8.0	9	12.8	5	9.1	24	9.6
27	5	6.9	3	10.9	2	5.4	10	7.5
30	4	6.9	3	9.0	-	-	7	7.7
33	4	7.6	1	16.5	-	-	5	8.6
Total	48		46		103		197	
Average		8.5		11.6		6.8		8.1

Note: Two 2nd logs from 2 log trees were designated as top logs.

Table 4

MILL SAMPLE - 34 TREES  
AVERAGE PERCENTAGE LUMBER GRADE RECOVERY BY TREE D.B.H.  
CLASSES FOR COMPLETE TREES

D.B.H. Class In.	No. of Trees	D Clear and Btr.	Select Structural	Con- struction	Standard	Utility Economy	Total	Lumber Recovery Factor
21	4	12.6	56.4	13.4	6.7	10.9	100.0	5.9
24	6	14.6	62.5	10.7	2.5	9.7	100.0	6.7
27	3	25.7	48.8	14.5	2.7	8.3	100.0	6.6
30	6	19.0	42.6	16.2	3.9	18.3	100.0	6.9
33	6	29.5	46.4	13.0	5.6	5.5	100.0	7.7
36	3	28.8	50.3	11.6	2.0	7.3	100.0	7.8
39	2	25.3	42.7	26.8	3.1	2.1	100.0	8.0
42	3	30.3	34.9	21.9	4.1	8.8	100.0	7.9
45	*	30.0	38.0	21.0	5.0	6.0	100.0	-
48	1	29.3	42.1	20.1	6.0	2.5	100.0	7.6
Total	34	-	-	-	-	-	-	-
Average	-	25.8	45.1	16.9	4.0	8.2	100.0	7.4

\* Values given for the 45" D.B.H. class are graphical estimates.  
No complete data available for the diameter class.

(b) Lumber Recovery by Log Grades

One hundred and sixty-seven study logs were converted into lumber at the mill. Table 6 shows the B.C. Forest Service grade classification by log position and by top diameter. A private scaler graded 13 of the logs as No. 3 peelers and another 18 as No. 4 peelers. All of the logs graded as peelers were butt logs. Eleven No. 3 peelers and fifteen No. 4 peelers were graded from the No. 2 sawlogs. Two No. 3 and three No. 4 peelers were graded from the No. 3 sawlogs.

Table 5

MILL SAMPLE - 34 TREES

PERCENTAGE LUMBER BY LOG POSITION BY TREE  
D.B.H. CLASSES FOR COMPLETE TREES

D.B.H. Class In.	No. of Trees	Butt Logs		2nd Logs		Mids & Tops		All Logs	
		% Lbr.	Av. Length Ft.	% Lbr.	Av. Length Ft.	% Lbr.	Av. Length Ft.	% Lbr.	Av. Length Ft.
21	4	47.0	31.0	32.2	34.7	20.8	30.0	100.0	31.6
24	6	45.0	30.7	28.5	31.2	26.5	29.5	100.0	30.0
27	3	43.9	30.0	33.1	34.7	23.0	20.7	100.0	26.5
30	6	37.2	30.0	34.9	32.0	27.9	32.2	100.0	31.5
33	6	37.2	30.7	30.9	32.0	31.9	24.0	100.0	27.1
36	3	36.7	32.0	29.8	32.0	33.5	24.0	100.0	27.4
39	2	36.8	32.0	30.4	32.0	32.8	28.3	100.0	29.8
42	3	30.3	30.0	29.1	32.0	40.6	26.2	100.0	28.1
48	1	38.2	32.0	34.3	32.0	27.5	22.0	100.0	26.0
Total	34	-	-	-	-	-	-	-	-
Average	-	37.1	30.7	31.0	32.4	31.9	26.4	100.0	28.9

Table 6

MILL SAMPLE - 167 LOGS

NUMBER OF LOGS BY LOG GRADE, LOG POSITION  
AND BY TOP DIAMETER CLASSES

Top Diameter Class	Butt Logs		2nd Logs		Mids & Tops			All Logs			Total
	Grade		Grade		Grade		L.R.*	Grade		L.R.*	
	2	3	2	3	2	3		2	3		
6	-	-	-	-	-	2		-	2		2
9	-	-	-	-	-	6		-	6		6
12	1	-	3	1	-	24		4	25		29
15	3	2	3	5	-	13	1	6	20	1	27
18	8	4	8	3	-	17	1	16	24	1	41
21	6	-	4	2	-	7		10	9		19
24	10	-	6	3	-	3		16	6		22
27	5	-	2	1	-	2		7	3		10
30	2	1	1	2	-	-		3	3		6
33	3	1	1	-	-	-		4	1		5
Sub- total	38	8	28	17	-	74	2	66	99	2	167
Total	46		45		76		167				

\* L.R. - Lumber Reject - Contains sound wood but not suitable for lumber.



A total of 90,000 board feet of lumber was obtained from the 167 logs studied. The following tabulation shows how this lumber was distributed by grade in each log classification:

Percentage Distribution of the Total Lumber  
Recovered in Each Lumber Grade by Sawlog Grades

Mill Sample - 167 Logs

<u>Log Grades</u>	<u>D Clear &amp; Btr.</u>	<u>Select Structural</u>	<u>Con- struction</u>	<u>Standard</u>	<u>Utility Economy</u>	<u>Per cent of Total</u>
No. 2	81.9	50.1	23.1	36.2	54.5	54.0
No. 3	18.1	49.8	76.8	61.1	45.0	45.9
Lumber Rejects	-	0.1	0.1	2.7	0.5	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

Almost 82 per cent of all Clear lumber recovered and 50 per cent of all Select Structural lumber recovered was from Grade 2 logs. Grade 3 logs yielded 50 per cent of all Select Structural and 76.8 per cent of all Construction lumber recovered.

Table 7 shows percentage lumber grade recovery by log grades and by top diameter classes for each log classification and for all logs. In both Grade 2 and 3 logs the percentage of D Clear and Better increased with log top diameter and the percentage of Select Structural decreased as top diameter increased. Figure 1 illustrates percentage recovery by lumber grades for Grade 2 and 3 logs.

Table 7

MILL SAMPLE - 167 LOGS

## PERCENTAGE DISTRIBUTION OF LUMBER GRADES BY LOG GRADE AND TOP DIAMETER CLASSES

LUMBER GRADES	Top Diameter Classes (inches)										Total
	6	9	12	15	18	21	24	27	30	33	
GRADE 2 LOGS											
D Clear & Btr.	-	-	8.0	14.7	23.7	33.3	43.2	48.7	52.3	58.4	41.2
Select Structural	-	-	67.4	60.2	56.3	39.8	44.0	35.6	21.2	26.5	40.4
Construction	-	-	19.7	10.0	6.3	10.8	3.8	9.3	14.2	3.7	7.5
Standard	-	-	-	6.4	1.4	2.5	3.7	1.3	6.0	1.1	2.7
Utility, Economy	-	-	4.9	8.7	12.3	13.6	5.3	5.1	6.3	10.3	8.2
Total	-	-	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
GRADE 3 LOGS											
D Clear & Btr.	-	3.8	3.0	6.4	8.4	6.4	10.5	16.1	22.2	63.1	10.7
Select Structural	55.6	65.5	64.6	54.1	41.8	43.4	49.3	41.7	41.7	27.2	47.2
Construction	40.6	13.3	19.5	23.8	37.1	40.4	25.3	37.4	16.3	1.1	29.3
Standard	2.3	5.6	5.0	4.1	4.1	6.7	6.7	2.3	6.5	2.2	5.0
Utility, Economy	1.5	11.8	7.9	11.6	8.6	3.1	8.2	2.5	13.3	6.4	7.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
LUMBER REJECTS											
D Clear & Btr.	-	-	-	6.1	-	-	-	-	-	-	3.2
Select Structural	-	-	-	15.0	-	-	-	-	-	-	7.8
Construction	-	-	-	5.8	16.4	-	-	-	-	-	10.9
Standard	-	-	-	73.1	38.2	-	-	-	-	-	56.4
Utility, Economy	-	-	-	-	45.4	-	-	-	-	-	21.7
Total	-	-	-	100.0	100.0	-	-	-	-	-	100.0
ALL LOGS											
D Clear & Btr.	-	3.8	3.8	8.3	14.1	19.7	33.9	40.6	42.1	59.3	27.1
Select Structural	55.6	65.5	64.9	55.1	47.0	41.5	45.6	37.1	28.1	26.6	43.5
Construction	40.6	13.3	19.5	20.3	25.5	25.8	9.9	16.3	14.8	3.2	17.5
Standard	2.3	5.6	4.3	5.5	3.3	4.7	4.5	1.5	6.3	1.3	3.9
Utility, Economy	1.5	11.8	7.5	10.8	10.1	8.3	6.1	4.5	8.7	9.6	8.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

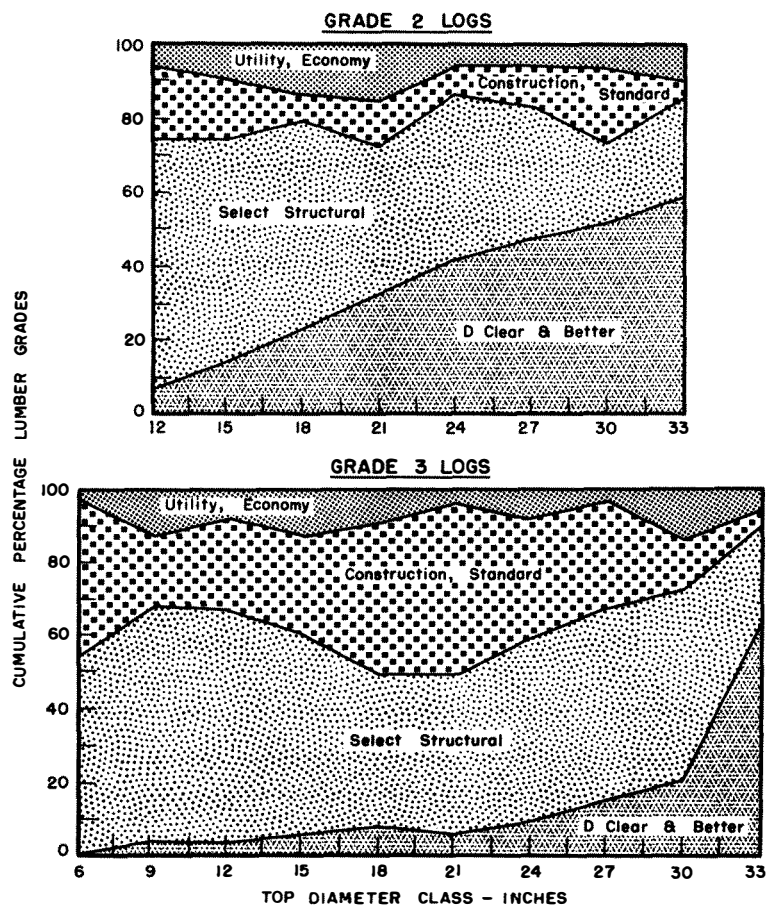


FIGURE 1 - Cumulative Lumber Grade Percentages by Top Diameter Classes for Grades 2 and 3 Logs.

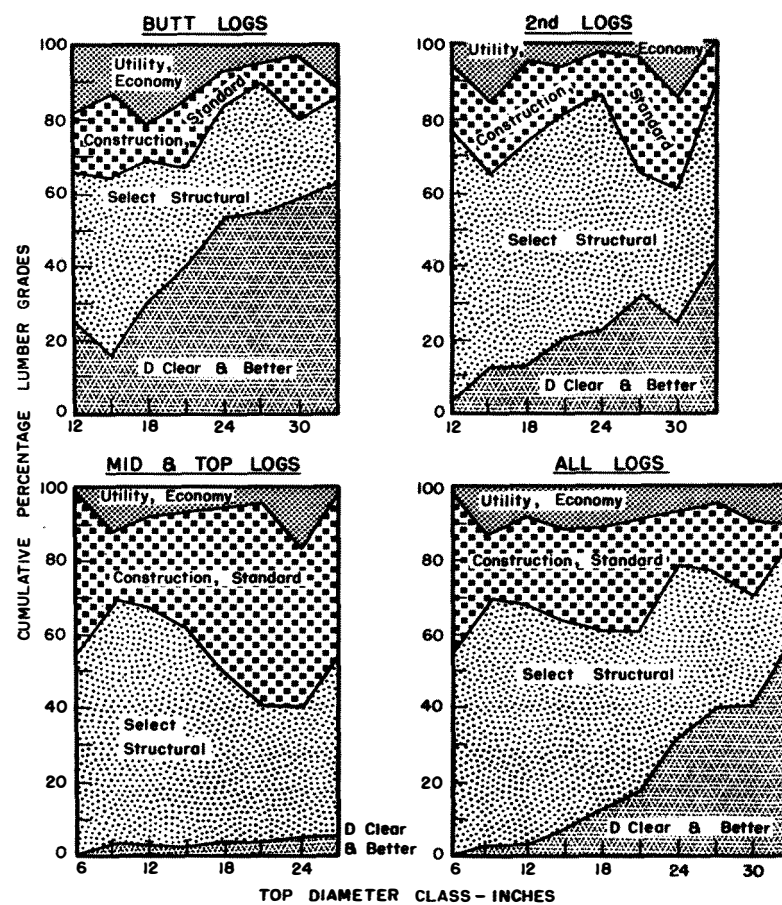


FIGURE 2 - Cumulative Lumber Grade Percentages by Top Diameter Classes for Butt Logs, 2nd Logs, Mid and Top Logs and All Logs.

(c) Lumber Recovery by Log Position

Forty-six of the 167 logs studied in the mill were butt logs, 45 were second logs and the remainder were mid and top logs. Table 8 shows the percentage lumber recovered by grade for each log position. In butt and second logs the amount of Clear grades recovered increased with log top diameter. However, the average butt log yielded almost 50 per cent Clear lumber compared to almost 22 per cent from the average second log and only 4 per cent from the average of the mid and top logs. Almost 80 per cent of the lumber obtained from butt logs and 76.8 per cent of the lumber obtained from second logs was Select Structural and better. Figure 2 illustrates percentage lumber grade recovery by log top diameter classes for butt, second, mid and top, and all logs.

(d) Lumber Recovery by Thicknesses for all Logs

Lumber recovered from all logs was tallied by grade and thickness on the green chain. Of the total lumber recovered 27.1 per cent was graded D Clear and Better of which 48 per cent was in thicknesses of from 3 to 5 inches. Select Structural grade recovery amounted to 43.5 per cent of total lumber recovery and 56 per cent of the Select Structural grade was in timbers 6-inches thick and over. Sixty-eight per cent of the total lumber recovered was 3 inches and over in thickness, 23 per cent was 2-inches thick and 9 per cent was 1-inch material.

(e) Summary of Total Lumber Recovery by Log Top Diameter Classes

Table 9 shows the number of logs, the lumber recovery factors, percentage overrun and percentage distribution by lumber grades for each diameter class of sound, defective, and all logs.

In sound logs the lumber recovery factor (L.R.F.), which is the ratio of lumber recovered from the log to the cubic scale of the log, increased up to the 21-inch diameter class and then started to drop. Overrun which is the lumber recovery expressed as a percentage of the board-foot scale of the log, decreased as diameter increased in sound logs. No well defined trends were apparent in L.R.F. and overrun for defective logs.

**Table 8**  
**MILL SAMPLE - 167 LOGS**  
**PERCENTAGE LUMBER GRADE RECOVERY BY LOG POSITION AND TOP DIAMETER CLASSES**

LUMBER GRADES	Top Diameter (inches)										Av. Log
	6	9	12	15	18	21	24	27	30	33	
(a) BUTT LOGS											
D Clear & Btr.	-	-	25.8	16.5	31.2	40.6	54.8	55.2	59.0	63.6	49.8
Select Structural	-	-	38.3	49.4	38.4	26.6	28.8	34.8	20.0	21.5	29.8
Construction	-	-	17.7	14.3	6.7	12.9	2.3	3.0	13.3	1.8	5.9
Standard	-	-	-	7.5	1.8	3.3	5.9	0.1	4.0	1.3	3.0
Utility, Economy	-	-	18.2	12.3	21.9	16.6	8.2	6.9	3.7	11.8	11.5
Total	-	-	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(b) 2nd LOGS											
D Clear & Btr.	-	-	4.0	12.3	12.8	20.5	22.9	32.3	25.8	42.0	21.8
Select Structural	-	-	74.2	53.6	61.7	61.0	64.5	34.4	36.0	47.5	55.0
Construction	-	-	16.6	14.9	18.6	10.6	10.0	28.2	16.4	8.7	14.8
Standard	-	-	-	2.6	1.3	1.0	1.9	3.3	8.4	1.3	2.8
Utility, Economy	-	-	5.2	16.6	5.6	6.9	0.7	1.8	13.4	0.5	5.6
Total	-	-	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) MID & TOP LOGS											
D Clear & Btr.	-	3.8	2.9	1.8	4.4	4.3	6.0	6.0	-	-	4.0
Select Structural	55.6	65.5	64.2	58.7	44.3	36.2	34.6	50.4	-	-	48.1
Construction	40.6	13.3	20.1	27.0	40.8	47.4	33.2	39.8	-	-	35.2
Standard	2.3	5.6	5.3	6.0	5.2	8.1	9.2	2.6	-	-	6.1
Utility, Economy	1.5	11.8	7.5	6.5	5.3	4.0	17.0	1.2	-	-	6.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-	-	100.0



The average L.R.F. and overrun for sound logs were 7.5 and 20 per cent respectively. For defective logs these values were 6.9 and 11 per cent. The influence of the large number of sound logs was felt in the summary for all logs and the L.R.F. and overrun trends here were similar to those of the sound logs.

In this study, the trend for percentage yield of clear lumber to increase with diameter and percentage yield of select lumber to decrease with increase in diameter is illustrated for all logs in Figure 2.

#### IV. SUMMARY

##### 1. WOODS SAMPLE

The net scaled volume of all sample logs was 91 per cent of the gross scaled volume. Volume of breakage and waste amounted to almost 6 per cent of the gross volume. This figure is not excessive and was due mainly to heavy stocking and subsequent number of stumps, broken topography with rock outcrops, and a felling area which was rather restricted for the height of the trees. Average stump heights and average top cuts fell somewhere between the intermediate and rough utilization standards of the B.C. Forest Service interim standard cubic-foot volume tables of 1955.

Deductions for defect were made in 22 of the 48 trees studied. Butt rot, heart rot and shake individually and collectively occurred to some extent in all 22 defective trees, but deductions for these defects amounted to only 2.9 per cent of the gross volume of all trees. Deductions for crook and sweep were a negligible amount of total gross volume.

Butt logs had an average taper of one inch per 8.5 lineal feet, second logs averaged one inch per 11.6 lineal feet and mid and top logs one inch per 6.8 lineal feet. The average taper for all logs was one inch per 8.1 lineal feet.

Table 9

MILL SAMPLE - 167 LOGS

SUMMARY OF LOGS BY 3" TOP DIAMETER CLASSES  
(LUMBER RECOVERY FACTORS, OVERRUN, AND PERCENTAGE LUMBER BY GRADE)

Top Diameter Class (inches)	No. of Logs	Lumber Recovery Factor	Over- run %	Percentage Lumber by Grade						
				D Clear & Btr.	Select Struct.	Con- struction	Std.	Util.	Econ.	Total
(a) SOUND LOGS										
6	2	5.2	109	-	55.6	40.6	2.3	-	1.5	100.0
9	6	5.1	45	3.8	65.5	13.3	5.6	9.2	2.6	100.0
12	28	6.3	28	3.6	64.7	20.2	4.5	5.8	1.2	100.0
15	24	7.1	22	7.8	57.9	20.4	5.4	7.3	1.2	100.0
18	37	7.2	20	12.6	48.9	27.7	3.5	4.3	3.0	100.0
21	14	8.3	30	15.5	44.0	30.0	5.1	3.1	2.3	100.0
24	16	8.0	19	27.4	51.8	11.6	4.8	2.9	1.5	100.0
27	9	8.0	21	39.9	38.1	18.1	1.8	1.4	0.7	100.0
30	4	7.7	12	31.7	34.4	17.3	6.1	4.1	6.4	100.0
33	4	7.8	9	58.6	26.5	3.7	1.1	5.8	4.3	100.0
Total	144									
Wtd. Av.		7.5	20	23.2	46.7	19.6	3.9	4.1	2.5	100.0
(b) DEFECTIVE LOGS										
6	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-
12	1	6.9	33	5.5	72.5	5.9	-	14.3	1.8	100.0
15	3	5.4	4	12.9	29.7	20.7	5.8	22.5	8.4	100.0
18	4	7.4	29	29.0	28.0	4.3	0.9	24.2	13.6	100.0
21	5	6.3	2	36.6	32.7	8.5	2.2	9.8	10.2	100.0
24	6	6.8	6	57.5	23.5	3.7	3.5	7.8	4.0	100.0
27	1	7.8	20	46.7	29.7	0.5	-	15.7	7.4	100.0
30	2	7.3	11	65.6	14.4	9.4	6.3	3.1	1.2	100.0
33	1	7.6	13	63.1	27.1	1.1	2.2	4.3	2.2	100.0
Total	23									
Wtd. Av.		6.9	11	48.2	26.2	6.0	3.1	10.5	6.0	100.0
(c) COMBINED SOUND & DEFECTIVE										
6	2	5.2	109	-	55.6	40.6	2.3	-	1.5	100.0
9	6	5.1	45	3.8	65.5	13.3	5.6	9.2	2.6	100.0
12	29	6.3	28	3.8	64.9	19.5	4.3	6.2	1.3	100.0
15	27	6.9	20	8.3	55.1	20.3	5.5	8.8	2.0	100.0
18	41	7.2	21	14.1	47.0	25.5	3.3	6.1	4.0	100.0
21	19	7.8	23	19.7	41.5	25.8	4.7	4.5	3.8	100.0
24	22	7.7	16	33.9	45.6	9.9	4.5	4.0	2.1	100.0
27	10	8.0	21	40.6	37.1	16.3	1.5	3.0	1.5	100.0
30	6	7.6	11	42.1	28.1	14.8	6.3	3.8	4.9	100.0
33	5	7.8	10	59.3	26.6	3.2	1.3	5.6	4.0	100.0
Total	167									
Wtd. Av.		7.4	19	27.1	43.5	17.5	3.9	5.0	3.0	100.0

## 2. MILL SAMPLE

### (a) Complete Trees

Thirty-seven per cent of the total lumber recovered from the 34 complete trees sawn in the mill was in butt logs, 31 per cent in second logs and 32 per cent in mid and top logs. A total of 25.8 per cent D Clear and Better grades of lumber was obtained from all of the 34 trees and of this 70.3 per cent was in butt logs, and 23.6 per cent in second logs and 6.1 per cent in mid top logs. Select Structural lumber obtained amounted to 45.1 per cent of total lumber recovered from the complete trees and 23.6 per cent of this was in butt logs, 41.0 per cent in second logs and 35.4 per cent in mid and top logs.

Percentage D Clear and Better and Construction lumber increased as tree diameter at breast height increased. Percentage Select Structural lumber and combined Utility and Economy lumber recovered decreased as tree D.B.H. increased.

### (b) Total Logs

A total of 167 logs was put through the mill. Of these 66 were Grade 2, 99 were Grade 3 and 2 were lumber rejects. Grade 2 logs contained 82 per cent of all the D Clear and Better lumber recovered and 50 per cent of all Select Structural lumber recovered. Seventy-seven per cent of the Construction lumber and 61 per cent of Standard lumber recovered was from Grade 3 logs.

The average butt log contained 50 per cent Clear lumber and 30 per cent Select Structural lumber. The average second log contained 22 per cent Clear lumber and 55 per cent Select Structural lumber and the average of the mid and top logs yielded only 4 per cent Clear lumber but almost 50 per cent Select Structural.

Sixty-eight per cent of all the lumber cut was 3 inches and thicker, 23 per cent was 2-inches thick and 9 per cent was 1-inch thick.

Lumber recovery factors increased with log top diameters for sound logs and percentage overrun decreased as log top diameters increased. The average L.R.F. was 7.5 for sound logs, 6.9 for defective logs and 7.4 for all logs. The average overrun was 20 per cent for sound logs, 11 per cent for defective logs and 19 per cent for all logs.

Twenty-seven per cent of the total lumber recovered in this study was D Clear and Better, 44 per cent was Select Structural, 17 per cent was Construction, 4 per cent was Standard and the remaining 8 per cent was Utility and Economy lumber.