Sawing SHOLO LOGS: Three Methods

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ABSTRACT

Three different methods of sawing the SHOLO log were compared on a board-foot yield basis. Using sawmill simulation, all three methods of sawing were performed on the same sample of logs, eliminating differences due to sampling. A statistical test was made to determine whether or not there were any real differences between the board-foot yields. Two of the sawing methods provided about the same board-foot yields; one provided about 40 percent less.

IN THE APPALACHIAN AREA, there are large quantities of low-grade hardwood logs that cannot be profitably converted to products by conventional sawing methods. To solve this problem for factory-grade 3 and local-use class logs, the SHOLO (from SHOrt LOg) concept was developed *(Reynolds and Gatchell 1970)*. The SHOLO concept means that each processing step after the tree is felled is aimed at producing specific products or product parts. Long, low-grade logs are bucked into SHOLO logs, which contain the desired end product and an allowance for end trim. Conventional lumber is not produced. If the SHOLO procedure is used, gross defects are eliminated at the bucking station; and the effect of allowable defects can be minimized by proper positioning of the SHOLO log relative to the saw.

It is easy to buck the SHOLO log from long logs. But once a SHOLO log is bucked, there is a question as to the best way to saw it into boards. We used computer simulation *(Reynolds and Gatchell 1969)* to compare three different methods for converting SHOLO logs into acceptable parts *(Reynolds and Gatchell 1970)* for the standard 48- by 40-inch warehouse pallet. Other products, such as furniture or flooring cuttings, could have been made. We found that the best way was to live-saw SHOLO logs into boards and then selectively rip these boards into pallet parts. We based our conclusion on yield of acceptable pallet parts.

Comparing Sawing Methods by Computer Simulation

Computer simulation provides a precise way of comparing sawing methods. All methods are compared on the same sample of logs, thus eliminating any sampling error. We chose a representative sample *(Goho and Wysor 1970)* of 150 factory-grade 3 red oak logs having a diameter range of 8 to 18 inches. These logs were bucked into SHOLO logs for pallet parts, and 150 of the SHOLO logs were randomly selected for study. All 150 qualified for the length class (44 inches) of deckboards and 100 of the selected SHOLO logs qualified for the length class (52 inches) of stringers.

Each of the 150 SHOLO logs was actually live-sawed into 1-inch thick boards. The location and size of all defects in each board were determined, and the SHOLO logs were then reconstructed within the computer. Then, by computer simulation, the SHOLO logs were sawed into boards, using three preselected sawing methods. The boards were then converted into pallet parts. Comparisons of sawing methods were based on yield of acceptable pallet parts.

The standard warehouse pallet (48 by 40 inches) contains deckboards that are 1 inch thick and either 4 or 6 inches wide and 40 inches long and stringers that are 2 inches thick, 4 inches wide, and 48 inches long. For computer simulation, the minimum face width in live-sawing for the first cut was 4 inches. The thickness of boards was either 1 or 2 inches plus $\frac{1}{8}$-inch saw kerf. Where the sawing method called for production of cants, one face of the cant was either 4 or 6 inches wide, and the adjacent face width was in multiples of product thickness (1 or 2 inches) plus resaw kerf. Cant dimensions and locations were adjusted to optimize part production.

Sawing Methods

Three sawing methods were combined with the SHOLO concept for the study: (1) selective, (2) gang, and (3) combination. The selective method (fig. 1) is based on live-sawing SHOLO logs into boards and selectively ripping and end-trimming these boards into parts. The SHOLO log is placed on the carriage of a circular saw or band saw with the poorest face of the log facing the saw blade to minimize the effects of allowable defects. The boards are positioned manually on the ripsaw to obtain the desired quality of parts of prespecified widths. The final step is to end-trim the parts to specific product

Figure 1.—Selective-method flow chart.

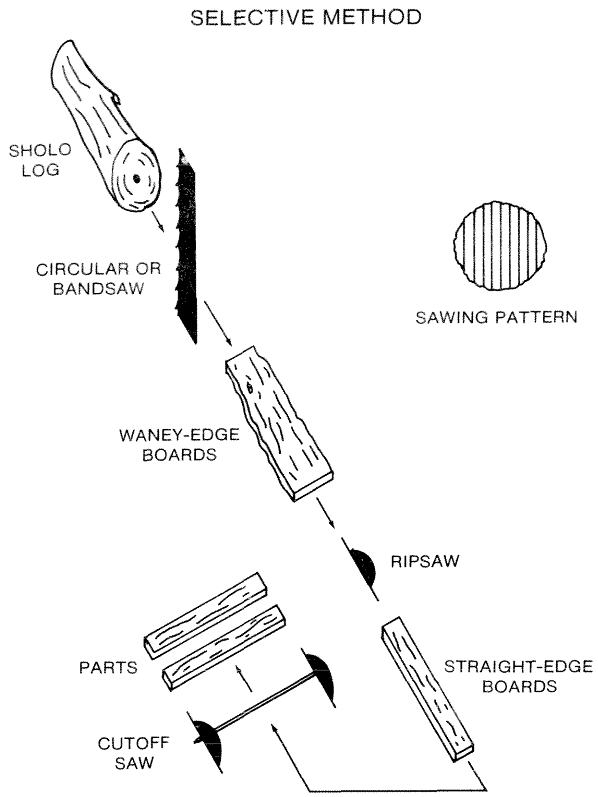
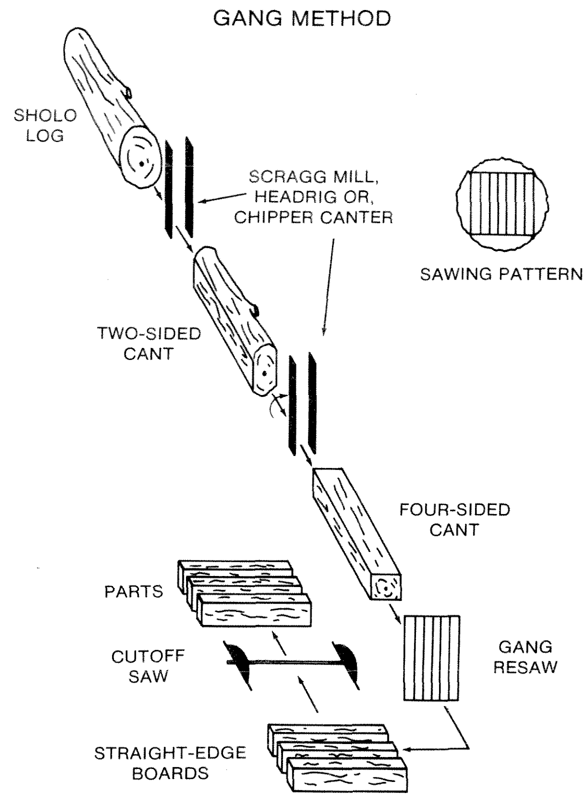


Figure 2.—Gang-method flow chart.



lengths. The quality of the part can sometimes be increased at the end-trim station by maneuvering the board to eliminate end defects.

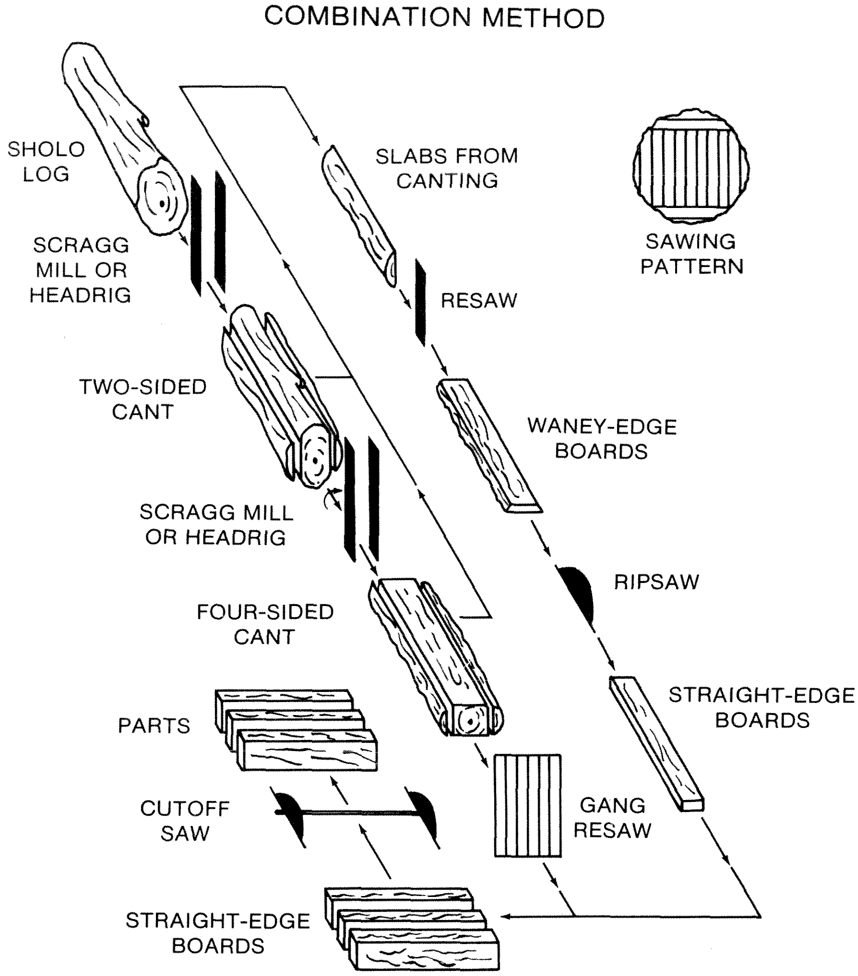
The gang method (fig. 2) produces a cant (or cants if the log is large enough) of specific dimensions that is resawed into boards. When end-trimmed, these boards match the preselected product dimensions. The gang method gives a high production rate, but about 30 percent of the volume of the SHOLO log is lost because the slabs are not used for parts production.

The combination method (fig. 3) combines the operations of the selective and gang methods. A cant is produced by slabbing the SHOLO log to the dimensions required by the gang method. Subsequent processing of the cant is the same as that for the gang method. If each slab is large enough to produce a board with a minimum 4-inch face, it is resawed into pallet cuttings, which are then selectively ripped and end-trimmed.

The Study

Two computer simulation programs were used to determine the yield of acceptable product parts. Program DEFECT, which contained the SHOLO log-defect data library, was used to simulate sawing the SHOLO logs into boards according to the sawing pattern of the particular sawing method. When cants were produced, a different sawing pattern was used for each 1-inch increment of log diameter to take maximum advantage of larger log size. The output of program DEFECT was boards with all defects portrayed. This output was used as input to program YIELD,

Figure 3.—Combination-method flow chart.



which simulates the ripping and end-trimming operations.

Program YIELD searched each board for the widest cutting first. Because all deck-boards were either 4 or 6 inches wide, program YIELD would always seek out a 6-inch wide cutting from all boards greater than 6 inches in width. If no cutting of sufficient quality could be found, the program searched for satisfactory 4-inch wide cuttings. This operation was not necessary in the production of stringers because they were all 4 inches wide.

The output data from program YIELD were converted to board-foot measure, and a yield comparison was made among the sawing methods.

Comparing Yields

In the production of 1-inch (table 1) and 2-inch thick parts (table 2), the selective method produced a slightly greater board-foot yield than the combination method. The selective method also produced the highest percentage of wide parts (table 3). Of all three methods, the gang method produced the least yield.

Tests were made by means of covariance analysis (data available upon request) to determine whether or not there was a real difference of board-foot yields among the sawing methods. The results of these tests showed that there was no real difference between the board-foot yields of the combination and the

Table 1.—*Board-foot yields of 1-inch thick parts (by computer simulation)*

Number of SHOLO logs	Diameter (inches)	Board-foot yields		
		Gang	Combination	Selective
7	8	15.68	29.67	26.85
18	9	58.24	93.33	94.04
12	10	40.71	63.67	65.88
13	11	46.47	91.23	83.61
16	12	83.63	124.18	125.38
16	13	74.45	162.09	192.02
17	14	157.54	237.68	256.50
19	15	179.94	280.42	309.55
6	16	75.45	130.11	162.80
13	17	211.76	327.23	360.08
13	18	249.37	369.85	401.30
150	—	1,193.24	1,909.46	2,078.01

Table 2.—*Board-foot yields of 2-inch thick parts (by computer simulation)*

Number of SHOLO logs	Diameter (inches)	Board-foot yields		
		Gang	Combination	Selective
5	8	10.68	10.68	13.35
11	9	32.04	66.75	64.08
9	10	48.06	58.74	66.75
9	11	37.38	74.76	61.41
9	12	37.38	69.42	72.09
13	13	64.08	120.13	114.81
10	14	109.47	165.54	197.58
13	15	98.79	200.25	213.60
4	16	53.40	90.78	109.47
8	17	138.84	226.95	229.62
9	18	216.27	315.06	331.08
100	—	846.39	1,399.06	1,473.84

Table 3.—*Parts yields of 1-inch thick parts (by computer simulation)*

Number of SHOLO logs	Diameter (inches)	Number of parts					
		Gang		Combination		Selective	
		1x4	1x6	1x4	1x6	1x4	1x6
7	8	14	0	25	1	13	7
18	9	52	0	55	19	35	33
12	10	11	17	25	21	29	20
13	11	40	1	74	5	40	24
16	12	73	0	90	14	60	33
16	13	62	4	92	35	79	62
17	14	84	38	98	74	65	110
19	15	108	35	149	66	90	125
6	16	45	15	61	37	38	72
13	17	34	104	79	143	71	168
13	18	81	95	117	143	75	190
150	—	604	309	865	558	595	844

selective methods. However, there was a difference between the board-foot yields of the gang method and the other two methods. Comparison of regression lines showed that the board-foot yield of parts obtained from the gang method would be about 60 percent of the board-foot yield from the selective or combination method.

Conclusions

To obtain the greatest board-foot volume, a SHOLO log should be sawed by either the selective or combination method. If, however, a greater ratio of wide to narrow cuttings is desired, the SHOLO log should be sawed by the selective method because more selection is available at the ripping station. The combination method eliminates any selectivity within the cant it produces. Although the degree of quality of the cuttings is beyond the scope of this paper, we believe that the selective method will produce the highest quality cuttings.

The gang method gives a high production rate, but the yield will be about 40 percent less than from the selective or combination methods. This large loss is due primarily to utilizing the slabs for a secondary product rather than parts. The use of the gang method is not advised unless a very high price is available for a chipped or pulverized secondary product. In most areas, the value per pound of parts is many times the value per pound of chips or other secondary products.

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