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MILL RUN STUDY FOR THE ECONOMIC LOG

by

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OBJECT AND INTRODUCTION

The object of this thesis is to find the economic log, or the relation of the size of the log to the size of the mill. To make this study on a scale which would be possible for a student, costs of manufacture were not taken into consideration, and the economic log for the mill studied, is assumed to be that size from which it takes the least time to manufacture one-thousand board feet of lumber.

THE MILL STUDIED

The study was performed by Herbert Dennis and myself, and several Saturdays were spent in looking for a mill of the size wanted. We finally chose the Winney Brothers Lumber Company mill, located about one mile west of Corvallis.

The daily cut of the mill is from twenty to thirty thousand board feet per day, and it seemed to be about the right size for a student to make a mill study, taking into consideration the fact that a mill cutting over that amount would require more than two men to accomplish.

This mill hauls all of the logs about twelve miles by truck. The sizes ranging from eight to thirty-one inches in diameter, with a log length from fourteen to twenty-four feet, the average length of log is about twenty feet.

The trucks unload the logs on a log role leading to the carriage. The carriage is about twenty feet long equiped with a hand ratchet. The logs are all turned by hand. The fact that the logs are turned by hand is a large factor in determining the economic log, because it is almost impossible for the men at the carriage to turn logs over twenty-six inches in diameter. Logs over that diameter require help from the other men in the mill to turn them.

The head-rig is equipped with a fifty-six inch lower, and a fourty-eight inch upper circular saw, both having inserted teeth. The mill also has a three saw edger of the table type. The edger is capable of handling lumber three inches thick with two saws cutting, but the best it can do with more than two saws cutting is to handle two inch material. This is due to the fact that the head rig and edger are run by the same steam engine, coupled with belts. A more efficient way of

supplying the power to the edger would no doubt increase the output, and give a better grade of lumber.

m The larger timbers are cut and edged on the head rig. This increases the time of cutting because of the extra time taken in cutting the cants into timbers and planks on the head rig.

From the head rig and edger the lumber is moved by hand pushing over dead rolls to the cut-off saw. The cut-off saw being a single circular saw run by an individual engine.

In the actual manufacture, the length of logs brought from the woods were held to the length of lumber called for by the orders on hand. The logging equipment is a high lead system which required that the logs be cut in advance so as to have them on hand while running, which was a handicap as they could not always know size of log to cut sufficiently far in advance to have them in the woods as the orders required. Often due to the orders they were cutting two to eight feet off the length of timbers of ten by ten and twelve sizes, and using the waste for firewood. A more mobile type of logging equipment would have remedied this by greater selectivity of logging thus supplying the mill with more overrun instead of an underrun due to the large amount of waste.

METHOD

In making this study, my colleague and I looked up various articles on the performance of these studies, as conducted by the United States Forest Service. The following quotation gives what a mill production study is, and what is required to make one.

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"Lumbermen are realizing more and more the influence exerted by log size and quality on logging and sawmill costs and profits. This is evident in the growing practice of selecting logs in the woods, the establishing of mills specially equipped to handle small logs economically, and the greater tendency to sort and hold logs for the items and grades they will yield to best advantage. The necessity for more 'cutting to order' and the need for keeping inventories of slow-moving items at a minimum has brought home forcibly the need for better knowledge of the possibilities in each log. Such knowledge is obtained through carefully planned and conducted mill-scale studies or, as they are more appropiately called, mill-production studies."

"A mill-production study determines the milling time for logs of different species, sizes, and qualities, and the lumber recovery therefrom by grades and by sizes, under current conditions in the mill where the study is made. Sawmill costs, and selling prices of the product perunit of volume are matters of record. The manufacturing cost for a given log at a given date can be computed from the sawing time and the sawmill costs of that date. Similarly, a log's recovery value, the value of the products recovered from it, can be computed from the lumber-recovery data and the current selling prices. The difference between the recovery value and the manufacturing cost is the log's conversion value. If the value of the products from a given log is less than their manufacturing cost, the log's conversion value is negative. If the value of the product is greater than the manufacturing cost the conversion value of the log is positive. In the latter case, if the margin over and abover the cost of manufacture is greater than the cost of the log delivered at the pond, a yield is obtained on capital invested."

"The United States Forest Service has been conducting mill-production studies since early in its existence. These studies have been of unquestioned value to the Forest Service, partly through providing scalers with first-hand information as to lumber-grade recovery,

* From THE TIMBERMAN, Feb. 1935
"A Mill-Production Study...What It Is"
by J. Elton Lodewick

manufacturing costs, and returns from logs of different qualities and sizes is indispensable in timber appraisal. To date, however, loggers and sawmill operators have made little use of the information thus accumulated. Is this because the purpose of mill-production studies have not been understood? Or is it because presentation of the results of such studies has placed too much emphasis on conversion values and too little on the data from which these values were computed and through which they can be adjusted to fit different operating conditions?"

"Information as to conversion values permits the operator to determine which sizes and grades of logs are being manufactured at a loss or at such a low positive return that they are reducing the unit return on the output. A logger-manufacturer may carry log selection still further by requiring that only those logs be removed from the woods which will show a conversion value sufficient to defray the cost of delivery to the mill. Of course, there may be instances in which a log of low positive or even of negative conversion value will yield material of a quality needed to round out the mill's production. In such cases the value of filling orders may offset losses occasioned by manufacturing this log. Whether marginal or submarginal logs shall be retained must be decided by the operator on the basis of his needs and of the character of the recoveries possible from such logs."

"The outstanding limitation on the use of conversion values is that they are indicative only under the specific manufacturing conditions, costs, and selling prices in effect at the time of the analysis. By the time the results of mill-production analyses become available, conditions usually have changed to such a degree as to render the conclusions potentially misleading. Another limitation is that the results of studies made in one mill are not directly applicable to another."

"Use of the data recorded during a mill-production study, however, permits adjusting conversion values to fit changed conditions. It also permits adjusting such values to apply rather closely to the product of another mill, if this second mill is using approximately the same type and quality of logs as the original mill and is similar in layout. It would be foolish to attempt, for example, to compare a mill sawing logs with deep clears with one sawing logs with shallow clears, or a mill sawing all large logs with one sawing a mixture of diameters. Similarly it would be misleading to compare a mill equipped to produce 50,000 feet per day with one producing 250,000 feet.

> "To determine conversion values and to adjust them if necessary to different manufacturing conditions and to different mills, data are needed on (1) type, quality, and size of logs sawed; (2) capacity and equipment of mill; (3) sawing time perthousand feet lumber tally for logs of dfferent sizes; and (4) lumber recovery, by sizes and grades, for average logs of each size. The first and second kinds of data listed permit comparisons between different mills; the third and fourth kinds give the basis for allotting manufacturing costs and recovery values among the various log sizes and for adjusting them in conformity with changed costs and selling prices."

The study made by my colleague and I is not as elaborate as those performed by the Forest Service. In making our study, we worked for the sawing time only of the various sized logs. Disregarding the length, and averaging the times, scales, and tallys of the samples of each diameter size.

The collecting of data was comparatively simple. One man stood at the log deck, scaling the logs, and timing them through the mill. The other man tallied the lumber for each individual log as it came through the mill. The time being taken from the moment the log was first sawed on until the last board went through the cut-off saw. Working that way we acquired the scale, time of manufacture, and tally of each log.

The grade of logs and lumber was disregarded. In second groath Douglas Fir, there has been no set metheod of grade classification for logs. As for lumber grades, the small mills of the Douglas Fir Region cut largly to order, and for the most part do not require or try to get lumber over number one common. The orders are usually for construction types of lumber, and therefore based on strength of material rather than grade.

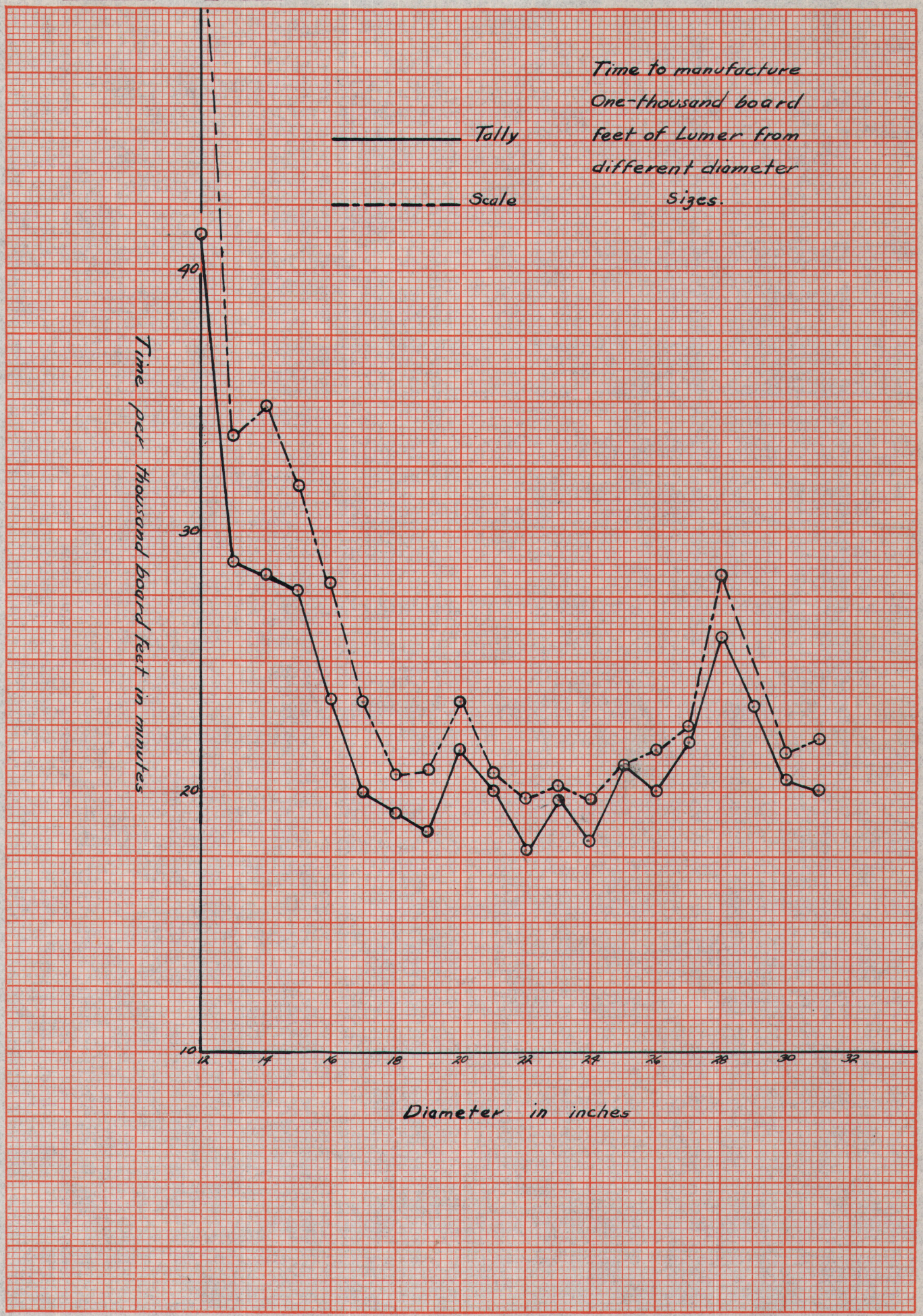
In the office the tally was rung up for each sample. For each diameter size, the scales were averaged to give

an average log. The times and tallies were also averaged for each diameter size. From this averaged data the times per thousand board feet were found by the following process. One thousand divided by the average tally times the average time equals the time to manufacture one thousand board feet. This was also done for the average scales. The results were then plotted on the graph (fig.1) . The tally and the scale plotted show how overrun affects the time for cutting one thousand board feet.

RESULTS

Log diam.	No. of samples	Ave. time "	Ave. scale	Ave. tally	Ave. overrun %	time/M scale "	time/M tally "
8.	1	4.00	46	50	5.7		
9.	0	- -	-	-	-		
10.	1	4.00	63	73	15.8		
11.	2	5.00	78	80	2.5		
12.	4	4.00	75	98	30.1	53	41
13.	3	4.83	144	169	17.3	33.5	28.7
14.	10	4.65	136	164	20.6	34.2	28.4
15.	14	5.10	162	183	13.0	31.4	27.7
16.	12	4.87	178	205	15.1	27.4	23.7
17.	17	4.82	209	244	16.8	23.0	19.8
18.	18	5.41	261	285	13.3	20.5	19.0
19.	23	6.20	302	336	15.1	20.5	18.4
20.	13	6.79	291	317	8.9	23.2	21.4
21.	13	7.30	355	371	4.5	20.5	19.6
22.	7	7.30	375	412	9.9	19.4	17.7
23.	14	8.68	440	442	.5	19.7	19.6
24.	8	9.20	475	517	8.8	19.4	17.8
25.	5	10.1	492	492	0	20.7	20.7
26.	5	11.5	548	582	6.2	21.0	19.8
27.	1	11.0	528	508	-3.8	20.8	21.6
28.	1	16.0	569	625	9.9	28.0	25.5
29.	1	14.0	612	612	0	23.0	23.0
30.	1	14.0	656	701	6.8	21.0	20.0
31.	1	14.0	701	729	9.7	21.4	19.8

175 samples



CONCLUSIONS

From the graph of results, one concludes that a twenty-two inch log would be the economic log for the mill studied, but that any log within the range of sixteen to twenty-six inches in diameter are close enough in time per thousand to be good log sizes for a mill cutting twenty to thirty thousand board feet per day with similar equipment. Although not sufficient samples were gathered for logs over twenty-six inches in diameter to give any sound basis for a conclusion that they are uneconomical for this size of mill, one would gather from watching the operation that too much time was being taken to turn the logs due to the necessity of having men working in other parts of the mill run back and help. The fact that twenty-four inch diameter logs take about the same time as the twenty-two inch, can be explained because the mill was using that size log to make two eight by sixteen timbers, thus cutting doun the sawing time a great deal. The secular trend of the graph is doun to the twenty-two inch log, from there the trend starts up. Although as I said before due to lack of samples obove twenty-six inches in diameter no definite conclusions can be reached that logs above that size are uneconomic. If power turning equipment were used in the mill logs over twenty-two inches in diameter would all take about the same time per thousand board feet to manufacture.

Since the Columbia River log rule was used, the overrun is less on the large logs than on the smaller ones. Those logs showing an underrun are caused by the great amo-

unt of waste in trimming the timbers to the length specified in the order.

The fact that some logs of larger diameter have a smaller scale than the previous diameter size is due to the discrepancy in lenth and having to few samples for a complete and comprehensive study.