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TRUCK LOGGING PROBLEMS
and
ANALYSIS OF TRUCKING COSTS

by
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PART I
LOGGING PROBLEMS

OLD-BELFRAIR ROAD
WILSON, N.C.

INTRODUCTION

The purpose of this study was to survey the truck logging problems of the Douglas Fir Region with particular reference to hauling costs. Truck logging is becoming more and more important each year and is a subject of natural interest to students in logging engineering. It is necessary that we know something of its history, the problems that it offers, and its probable future developments so that we can better prepare ourselves for future logging problems.

Probably the most complete survey of truck logging costs in the Douglas Fir Region was made by E. F. Rapraeger, in 1933. He compared similar logging "shows" and showed how various factors affect trucking costs. Due to the fact that many of the operators from which he obtained data had very poor cost accounting systems, his results would be of little use in computing trucking costs.

Truman Collins has written numerous articles for "The Timberman" and "The West Coast Lumberman". I am particularly indebted to him for the paper that he presented to the 1941 Pacific Coast Logging Congress. In this paper, he brought out questions that are frequently coming up on trucking operations.

HISTORY

The first attempt at truck logging was made in central Washington in 1914. J. T. McDonald, now of Lakeview, Oregon, undertook logging operations with Knox iron tired trucks. Later in 1914, L. A. Christensen, now of Seaside, Oregon, undertook truck logging in the Douglas Fir Region. The fact that both of these pioneer loggers are still engaged in the business of truck logging lends significance to the fact that logging trucks are going to play a more important part in future logging operations.

The chief advantages of the logging truck over the railroad are that they require a smaller capital investment, and they can be more satisfactorily used in rough topography. Road construction in the higher areas, where our major source of timber is now located, is much more difficult and costly than in the lower country. The alignment and curvature and grade requirements of successful railroad logging has made their costs of construction much greater than truck road construction costs. The equipment cost for railroad logging is also much higher than for truck logging. As our timber resource is gradually being broken up into smaller areas, operators are having difficulty in finding stands of a large enough volume to justify this heavy initial investment.

Trucks were first used as feeder units to bring the timber down to the heads of the railroads. The advent of

the caterpillar and the recent development of small portable mills has allowed the truck loggers to take over more and more of the major haul. Railroads, on the other hand, have continued to be used on the large operations and will likely be used for a long time in the future. Some of the changes in logging trucks that have led to their increasing importance are listed below.

1. Relatively large trucks with solid rubber tires and no trailer.
2. Large trucks with high pressure tires; some six wheel equipment.
3. Lighter trucks with single axel trailer.
4. Lighter trucks with low pressure tires.
5. Trucks of varying sizes with dual-axel trailers and auxillary transmissions.
6. Appearance of large custom-made trucks, diesel powered, and for use only on private roads.
7. Successful development of diesel power for trucks of conventional highway sizes.
8. At the present time log trucks are designed for special private hauls, for highway hauls, and for a combination of the two.

HIGHWAY HAULS

Highway hauls present a special problem. In Oregon the legal overall weight is 54,000 pounds and in Washington 68,000 pounds. Oregon also has a maximum length limit of 50 feet and Washington a length limit of 63 feet. Other highway regulations are listed below.

1. The bunks or bolsters of any truck hauling logs shall be straight or concave upward. Bunks which are convex upward will not be permitted.
2. The ends of the bunks will be provided with a chock-block that can be securely locked in position; and when the truck is loaded and the chock-block in position it shall have a height of not less than eight inches. No chock-block shall extend more than three inches beyond the limits of the bunk.
3. Loads shall be tied with not less than two ties. All ties shall entirely surround the load and the ends shall be securely fastened to the bunk of the trailer. In case any log is of insufficient length to rest securely upon both front and rear bunks it shall have an additional tie securely binding the unsupported end of such log to the remainder of the load. All ties shall be placed on the right hand side of the load and shall be drawn tight.
4. Any tie or fastening thereof shall have a maximum

breaking strength of not less than 15,000 pounds.

5. The method of loading shall be such that the outside logs in any upper tier or layer shall have their centers inside of the centers of the outer logs of the next lower tier or layer so that the load is stable without ties or bindings. The ties or bindings are to be regarded as a precautionary measure to insure stability while rounding curves or on super-elevated or sloping sections of highway.

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FACTORS AFFECTING THE CHOICE OF A TRUCK

The two chief factors with which a truck operator is concerned are: first, the proper selection of a truck that will meet his particular requirements, and second, the efficient use of this truck on his operation so that it will render him the greatest return on his investment.

In selecting a truck an operator should first narrow his choice down by determining what weight capacity he requires. He must decide on the required horsepower and pick the wheelbase that fits his particular requirements.

Truck designers say that in public highway operations the tendency is to overemphasize the pay load. Although a lighter truck means a cheaper initial cost, too light a truck means low performance, inadequate brakes, and higher tire and repair costs. In general, operators have found that it pays to stay fairly close to the load capacity for which a truck was designed. Loss of production due to time spent making repairs is a factor that is hard to evaluate, as other trucks on the job are generally overloaded or speeded up to partly offset the loss of output.

The private road operator is limited by other considerations. Truck designers say that he generally has his truck overloaded and would obtain more satisfactory results by staying within limits of truck design. He is generally interested in a good, heavy truck that will carry a large load and negotiate adverse grades satisfactorily.

Other factors that effect the choice of a logging truck are listed below.

1. Type of Road

- a. Heavy adverse grades call for heavier trucks and steep favorable grades call for special breaking equipment.
- b. Tables are available giving the rolling resistance of various types of road surfaces. From these tables and a knowledge of the amount of adverse and favorable grades in the haul the amount of horsepower required and the approximate round trip time of the various types of trucks determined.

2. The financial condition of the organization influences the initial investment that the organization is willing to make on equipment.
3. The cost of fuel and labor are important items as heavy trucks operate on much lower fuel and labor costs than the light trucks.
4. Salvage or trade in values of the heavier trucks are lower due to the small re-sale market and to the larger obsolescence charges.

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LIGHT AND MEDIUM WEIGHT TRUCKS

The light and medium weight trucks have proved to be most satisfactory on public highway hauls. They have the advantage of greater speed, faster acceleration, and lighter construction which allows them to carry a larger pay load. Other factors favoring small trucks are listed below.

1. Lower capital investment for a given volume of output.
2. Higher comparative re-sale and trade in values due to the wide spread use of small trucks.
3. Lower obsolescence charge as light trucks can be traded in every two years. This makes it possible to keep the fleet up to date incorporating all of the latest improvements. Large trucks must be held longer and hence are subject to serious obsolescence charges.
4. Quantity production of light trucks yields greater intrinsic value per dollar of cost.
5. Servicing of light trucks is more satisfactory due to the accessibility and low cost of repairs.
6. Higher average speed than the conventional heavy trucks.

HEAVY TRUCKS

The heavy trucks are designed to handle loads ranging from eight to twelve thousand board feet. Their weight prohibits operators from using them on highway jobs. Many operators, working on private roads only, claim that the heavy trucks are cheaper and much more satisfactory. Factors favoring large trucks are listed below.

1. There is a very substantial saving in operating labor when large loads are carried.
2. They negotiate adverse grades more satisfactory. This makes possible a definite saving in road construction as well as in operating costs.
3. They are more adaptable to the use of diesel power. Diesel power is being used more and more in the logging industry. It allows a saving in fuel costs and may reasonably be expected to cut time lost due to breakage in the future.
4. The superior construction of heavy trucks allows a smoother production schedule to be followed as there is less loss of time for breakdowns and repairs.

EFFICIENT USE OF TRUCKS

The efficient use of a truck is largely a matter of getting low cost production. This is brought out in the cost analysis that follows. Proper lubrication and proper care of motor and brakes also play an important part in getting a low cost, but they are too large a subject to be included in this paper.

PART II
COST ANALYSIS

PROBLEMS AND DIFFICULTIES

It is extremely difficult to compare the cost figures of any two logging operations. The operating costs of each logging show present an individual problem in spite of the fact that many shows have factors in common or are similar in nature.

In 1933, E. F. Rapraeger made a survey of all the logging operations in Oregon and Washington that were transporting logs by truck. Due to differences in accounting methods and to numerous indirect cost factors that did not show on cost records, he found a great divergence in cost figures even though many of the operations seemed to be similar. It would require a survey similar to the one made by Rapraeger to bring out any sort of averages that could be used by operators in making their logging plan. Even then they would be of doubtful value due to the many indirect factors that could not be shown.

In a paper presented at the 1941 Pacific Logging Congress by Truman W. Collins, three pertinent questions and a means of obtaining their solution were brought out. The questions are listed below.

1. Other conditions being equal, what effect will a 10% increase in payload have upon the total trucking cost?

2. What would be the effect on operating cost of an improvement in the road that would cut the round trip

time by five or ten percent?

3. What would be the effect in final cost if trucks were operated overtime in order to increase the annual output per truck.

The first step in answering these questions offered was to arbitrarily classify operating costs. This was not done according to set rules, but each factor was assigned approximately its share of the total costs. The classification of operating costs was as outlined below.

A. Factors Varying with the Annual Input.

1. Obsolescence (Estimate 20% of Depreciation)
2. Interest
3. License
4. Insurance

B. Factors Varying with the Total Operating Time.

1. Labor
2. Compensation
3. Social Security
4. 40% of Depreciation (Estimate)

C. Factors varying with running hours.

1. Tires
2. Repairs and Maintenance
3. Fuel and Oil
4. 40% of Depreciation (Estimate)

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Truck Cost Data on Five, Gasoline Powered, Four Wheel, Medium Sized Trucks. For twelve month period from september 30, 1940 to Sept. 30, 1941.

Operating Labor	.92
Fuel and Oil	.79
Tires	.36
Repairs, labor	.27
Repairs, parts	.20
Depreciation	.43
Licenses and P.U.C.	.12
Supervision	.04
Compensation	.07
Social Security	.04
Insurance	<u>.05</u>
Total Cost Per M.	\$3.29

Statistical Data

Average Load	4,295 bd.ft.
Total Footage (Full Scale)	12,162,148 bd.ft.
Average one way mileage	31
Cost per truck, round trip mile	22.8¢
Average driver's wage for period	88¢ per hr.
River scale averaged 68% of full scale	
Average gross weight, Truck and Load	53,400 lbs.
Average Weight of Truck and Trailer	17,400 lbs.
Approximate average diameter (40 ft. long)	20"

EFFECT OF INCREASING LOAD

Detailed cost records of the operation showed the following increases in cost with increases in loading.

Item	% of Factors increasing directly as the load increases in dollars per round trip.
Tire Cost	15.0%
Repairs and Maintenance	7.0%
Fuel and Oil	5.0%
Depreciation	7.0%
Labor	15%
Compensation	15%
Social Security	15%
Licenses and Insurance	15%

By analyzing the costs a little farther I was able to express the value in dollars per round trip. The following table also gives the percent that each item is of the total.

Item	% of Total	Cost in Dollars per Round Trip
Operating Labor	28%	3.96
Fuel and Oil	24%	3.40
Tires	11%	1.56
Repairs, labor	8%	1.13
Repairs, parts	6%	.85
Depreciation	13%	1.84
License and P.U.C.	4%	.56
Supervision	1%	.14
Compensation	2%	.28
Social Security	1%	.14
Insurance	<u>2%</u>	<u>.28</u>
Total	100%	14.14

The figures above are in a form where they can be increased in proportion to an increase in load. The present average load is 4,295 bd. ft. If we increase this load by 10% and take out an average load of 4,725 bd. ft. the costs will increase as indicated in the following table.

Item	% increasing directly with the load.	Present amount	Increased amount
Operating Labor	15	\$3.96	\$4.02
Fuel and Oil	5.0	3.40	3.57
Tires	15.0	1.56	1.79
Repairs, Labor	7.0	1.13	1.21
Repairs, Parts	7.0	1.85	.91
Depreciation	7.0	1.84	1.97
Licenses and P.U.C.	15	.56	.57
Supervision	0	.14	.14
Compensation	15	.28	.28
Social Security	15	.14	.14
Insurance	15	.28	.28
		<u>\$14.14</u>	<u>\$14.88</u>

Cost per M. \$3.15

The figures indicate that the 10% increase in load would decrease the cost per M. by \$.14. This would decrease the cost per year by approximately \$1700. It would also increase the gross weight to an average of approximately 57,000 lbs. As a 10% margin is allowed in the state law making the absolute limit 59,400 lbs. it appears that it would be wise to increase the average load. A scale conveniently set up on the operation so that you could keep close to the limit might prove to be a good investment.

EFFECT OF ROAD IMPROVEMENT

The second question of an improvement in the road that would cut the round trip time by 10% would effect a 10% saving in cost of the items listed under "C". Using the same set of cost figures we would obtain the following result.

Tires	\$.30
Repairs & Maint.	.47
Fuel and Oil	.79
Depreciation	<u>.18</u>
	\$1.80

$$(\$1.80) (10\%) = \$.18 = \text{Saving Per M.}$$

An 18¢ saving per thousand would give a yearly saving of \$2,190. This means that it would be profitable to spend an additional amount up to approximately \$2,000 a year on road improvements if by so doing you can cut hauling time by 10%.

EFFECT OF REDUCING LOST TIME

If lost time could be reduced by 10% you would be justified in expecting a saving of approximately 10% of the costs listed under "A", and if this time could be used to get additional trips the saving would be approximately 10% of the costs listed under B.

Assuming that this is the case and again using the same set of cost figures the saving would be as shown below.

Obsolescence	.09
License	.12
Insurance	.05
Labor	.92
Compensation	.07
Social Security	.04
Depreciation	.17
	<u>\$1.46</u>

Saving Per M. \$.15

Saving Per Year \$1,824

The above figures show the value of making time studies. By doing this and attempting to eliminate unnecessary loss of time, operating efficiency can be greatly increased and substantial savings obtained.

EFFECT OF OPERATING OVERTIME

The effect in final cost of operating trucks overtime in order to increase the annual output per truck would effect a saving of the costs listed under "A". Other factors except labor would remain approximately constant. Labor would be increased by 150% as overtime pay would be necessary. Again using the same cost figures the cost would vary approximately as follows if you operated 10% longer per day.

Item	Saving
Obsolescence	.09
License	.12
Insurance	.05
	<u>\$.26</u>

Saving on factors varying with the annual input \$.03/M

Additional labor cost.

$$\begin{array}{r}
 .92 \text{ / } (9.2 \times 1.5) = 1.06 \\
 \text{less } .92 \text{ / } 9.20 \quad \underline{1.01}
 \end{array}$$

Extra Cost .05/M

The figures show that there would be a loss of approximately .02/M. If double shifting in the summer with an extra crew were possible the saving would be in a direct relationship with the factors varying with the annual input. For example, if annual production could be increased by 20% the saving would be .20 times .26 or 5.4¢ per thousand.

RESULTS AND CONCLUSIONS

The rapid development of the logging truck to its present state has been due largely to its low initial cost and flexibility of use. Railroads, on the other hand, require large investments and cannot be used satisfactorily in the higher choppy country where the major portion of our standing timber is located. For these reasons increased use of trucks can well be expected in the future.

Truck loggers have a large variety of factors to consider in the selection and use of trucking equipment. For this reason accurate accounting and sound cost analysis is essential if the best use is to be obtained from trucks.

For the cost figures used the following results were obtained.

1. Other things being equal, an increase in the payload of 10% can be expected to net a saving of approximately 14¢ per M. Scales are recommended as a means of staying as near as possible to the allowable limit.
2. An improvement in the road that will cut operating time by 10% can be expected to net a saving of approximately 18¢ per M. It would be good economics to invest up to \$2,000 per year in road improvements to effect such a saving.

3. If the lost time could be reduced by 10% through time studies it would effect a saving of approximately 15¢ per M.
4. The effect on final cost of operating the trucks 10% overtime would be to increase the cost of production by approximately 2¢ per M.
5. A saving of 5¢ per M. could be made by double shifting in the summer if by so doing the annual output could be increased by 20%.
6. While the results obtained from this study apply only to the figures used, a similar method of analyzing costs using cost variation percentages to fit the particular show in mind should be of value in obtaining minimum hauling costs.

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