EFFICIENCY AND COST OF TIMBER TRANSPORTATION BY GATTU

by

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Abstract

Results of a study on the travel speed and cost of timber transportation by gattu (small truck) in Siran Forest Division, N.W.F.P. show that the average travel speed of loaded and empty gattu on the forest roads is 5.6 and 7.9 km/hour, respectively. A gattu generally carries an average load of about 15 logs, with a volume of 6.75 m^3 (239.6 cft) under bark. The cost of timber transportation is calculated as Rs.19.91/m^3/km (Re. 0.56/cft/km). It was observed that road gradient has considerable effect on transportation cost, which is minimum as Rs. 5.88/m^3/km (Re.0.17/cft/km) for an average road gradient of 8%. It is concluded that standard forest roads are essential for speedy and economic transportation of timber in the mountainous forests of Pakistan.

INTRODUCTION

Gattus are small, open bodied, 4-wheel driven, old army trucks, which are used by forest contractors for minor transport of timber in the hilly regions of Pakistan. These have proved to be quite useful machines carrying heavy loads and negotiating steep gradients of more than 30% on narrow and winding roads of mountainous country. Under such terrain and road conditions, transportation cost of timber is evidently very high, because of low travel speed and high running and maintenance cost of the vehicle. A study was carried out during the months of March and April, 1988 in Compartment No. 1 and 2, Okharila Guzara, Siran Forest Division, Hazara Civil Division (NWFP) to determine the efficiency of timber transportation by gattu as far as its travel speed, volume of timber carried/trip and cost of transportation per m^3 of timber are concerned.

MATERIAL AND METHODS

Material

The working of two gattus belonging to a transportation contractor, was studied. The contractor had a contract to

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transport timber at the rate of Rs. 114.73/m^3 (Rs. 3.25/cft) for the forest contractor. The machine data on their running cost were collected from the contractor by personal interview. These are given below:

- Total investment cost in each machine = Rs. 400,000
- Diesel consumption = Rs. 50 lit./day
- Mobil oil consumption = Rs. 9 lit./month
- Repairs and spare parts = Rs.2,000/month
- Maintenance and lubricants = Rs. 1,500/month
- Tyres = Rs.60,000/year
- Tax = Rs. 6,000/year
- Pay of driver = Rs. 3,000/month
- Pay of helper = Rs. 1,200/month
- Wages of 7 workers at the rate of Rs.45/day/worker

The forest road length of 7.31 km between the loading point in the forest and unloading point at Khan Dheri Depot was divided into four sections on the basis of average gradient and road quality as detailed below in Table 1.

Table 1 Description of road sections

Section No.	From-To	Length (km)	No.of "U" turns	Average gradient (%)
I-Forest Contractor Road	A to B	1.26	6	+ 16
II- "	B to C	1.20	-	- 12
III- Improved Road	C to D	2.50	-	- 8
IV "	D to E	2.35	3	- 12

A is loading point in the forest
E is unloading point at Khan Dheri Depot
B, C and D are intermediate points

The transportation of load was against a positive gradient, on section-I, while on rest of 3 sections it was always on a negative gradient.

Methods

Time Studies:

To record the time of travel and other operations, a combination of multimoment with an observation interval of 1 minute

for recording the time of loading, unloading and delays and continuous timing method for noting down the time of loaded and empty travel of gattu over various road sections was used. In all, observations were recorded on 35 trips of gattu. The number of logs and their basal area volume carried/trip was recorded from the field book of forest munshi.

Cost Calculations:

For calculation of cost of transportation, the following costs were taken into consideration:

a. Capital cost

- Fixed cost
  - . interest on the investment in the machine
  - . Taxes on the machine
- Semi-variable cost
  - . depreciation of machine
  - . maintenance
- Variable cost
  - . fuel and lubricants
  - . repairs
  - . spare parts and tyres

b. personal cost

- . salary of driver
- . salary of helper
- . wages of 5 workers employed for rolling and loading and 2 workers for unloading at the rate of Rs.45/man-day.

Profit of contractor and overhead costs were not included in the cost analysis, which normally are taken as 25 and 10% of the total cost, respectively (Stoehr, 1989).

RESULTS AND DISCUSSIONS

The results of time studies on transportation of timber are given in Table 2.

Table 2 Time spent on timber transportation operations

Work elements	Time (Min)	% of total trip time
1. Loading	71.5	28.6
2. Loaded travel	78.4	31.3
3. Unloading	20.4	8.1
4. Empty travel	55.5	22.2
5. Delay time/trip	24.6	9.8
6. Effective time/trip (sum of 1 to 4)	225.8	90.2
7. Total time/trip (sum of 1 to 5)	250.4	100

As shown in table 2, it took 250.4 minutes (4 hours and 10.4 minutes) for the gattu to make a two way trip over a distance of 14.62 km. In this way a gattu could hardly make two trips/day. Time of loaded and unloaded travel was 78.4 and 55.5 minutes respectively. Empty travel time was less than loaded travel time by 22.9 minutes or 29.2% Time spent on loading was 71.5 minutes against an unloading time of 20.4 minutes. Loading time was more than 3.5 time higher than unloading because of its being difficult in nature. Further,it also included the time of collecting and rolling the logs to the loading platform. Out of total time/trip, 225.8 minutes (90.2%) was effective time, while the share of delays took 24.6 minutes (9.8%). A gattu on an average transported about 15 logs with an underbark volume of 6.75m^3 (239.6 cft).

Travel speed

The data on the average loaded and empty (unloaded) travel speed of gattu over the entire road length as well as different road sections are given in table 3.

Table 3 Average loaded and empty travel speed of gattu

Road section No.	Average gradient (%)	Average Travel Speed km/hr	
		Loaded travel	Empty travel
I- Forest Contractor road	+ 16	2.6	4.1
II- "	- 2	5.8	7.2
III- Improved road	- 8	10.8	14.1
IV- "	-12	6.3	8.8
Average		5.6	7.9

Loaded Travel

Loaded travel of Gattu started from the loading point in the forest and ended at the unloading point at Khan Dheri Depot. As shown in table 3, the average travel speed of loaded gattu over the entire road length was 5.6 km/hour. However, loaded travel speed of gattu was different on different road sections, because of variation in gradient and road quality. Sections I and II were forest contractor roads built/improved for temporary use only for the extraction of timber, and were not properly designed and surfaced. Section-I had an average gradient of + 16% with maximum gradient of more than 30% as well as 6 narrow "U" turns. Therefore, the average travel speed of loaded gattu over this section was minimum as 2.6 km/hour. The speed was much better on section II, which had very low gradient (-2%) but poor road surface and narrow width. The average loaded travel speed of gattu over this section was 5.8 km/hour, which was more than double than that on section-I. Similarly, sections III AND IV consisted of improved forest road with a descending average gradient of 8 and 12%, respectively. Section IV also had 3 improved "U" turns. The average travel speed of loaded gattu on section-III and IV was 10.8 and 6.3 km/hour respectively. Except for section-II, the average travel speed of loaded gattu decreased with increasing gradient.

Empty Travel

Empty travel of gattu started from unloading point at Khan Dheri Depot and finished at the loading point in the forest. During this journey, the average speed of the empty gattu over the entire road length was 7.9 km/hour, about 2.3 km/hour faster than the speed when loaded. As in loaded travel, the average speed of gattu also remained different on different road sections and was 4.1, 7.2, 14.1 and 8.8 km/hour on section-I, II, III and IV, respectively. The average empty travel speed of gattu was higher than the average loaded travel by 58% in section-I, 81% in section-II, 73% in section-III and 72% in section-IV. However, both loaded and empty speed of gattu, was maximum on section-III with 8% average gradient.

Cost of Transportation

The analysis of cost/m^3 of timber transported is given as under:

- Investment in each machine	Rs. 400,000
- Useful life of machine	6 years
- Total utilization at the rate of 1200 hours per year	7,200 hours

- Capital cost

. Fixed cost	.. Interest at the rate of 10%/annum	=Rs.16.67/hour
	.. Tax at the rate of Rs.6,000/year	=Rs. 5.00/hour
. Semi-variable cost	.. Depreciation	=Rs.55.56/hour
	.. Maintenance	=Rs. 5.00/hour
. Variable cost	.. Fuel consumption	=Rs.24.69/hour
	.. Mobil oil consumption	=Rs. 1.80/hour
	.. Repair & spare parts	=Rs.20.00/hour
	.. Tyres	=Rs.50.00/hour
	Total	=Rs.178.72/hour-I

- Personal Cost

. Pay of driver	=Rs. 12.50/hour
. Pay of helper	=Rs. 5.00/hour
. Wages of workers (rolling, loading and unloading)	=Rs. 39.38/hour
Total	=Rs. 56.88/hour-II

- Total Cost/hour = I+II =Rs. 235.60
- Total Cost/trip = 4.17x235.60 = Rs. 982.45
  Timber transported/trip = 6.75m^3
- Cost/m^3 = Rs.145.55
  or = Rs. 4.12/cft
- Cost/m^3/km = Rs. 19.91
  or = Re. 0.56/cft/km

The cost of transportation/m^3 of timber is computed as Rs.145.55 (Rs. 4.12/cft) and per m^3/km as Rs. 19.91 (Re. 0.56/cft/km) on one way distance of 7.31 km. This cost also includes the cost of rolling, loading and unloading of logs and the delays.

Ayaz and Stoehr, (1988) have reported the cost of transportation by gattu in Dewli Guzara as Rs. 5.88/m^3/km. This figure was based on contracted rate and is less than one third of

the transportation cost calculated in this case. On the basis of experiences of N.W.F.P. Forest Development Corporation in Kaghan Valley (Stoehr et al., 1988) the cost of transportation by gattu was found out to be Rs. 15.21/m^3/km, which is again lower than the cost calculated in this study. This indicates that the contractors bid without the knowledge of some hidden costs involved in the operation. The contractor may intentionally bid low to recover his losses in transport cost through other operations or from the sale of timber.

High cost of mechanized transportation in developing countries including Pakistan is due to high capital costs of machines which in this case is about 75.6% of the total cost. In a similar study cost of transportation of timber with skidder and trolley, which are more expensive machines, was found to be Rs. 83.20/m^3/km in the same area and was more than four times higher than with gattu (Anonymous, 1987). High capital costs are due to high purchase price of machines, fuel and lubricants as well as high degree of repair and maintenance due to wear and tear of the machines on poor forest roads.

Transportation Cost and Road Gradient

The cost of transportation in relation to average gradient was computed on the basis of total hourly cost and total travel time (loaded + empty) in minute/km, over various road sections representing different gradients. The data are given in table 4.

Table 4 Cost of timber transportation and road gradients

Road section	Average gradient (%)	Travel Time (loaded + empty travel)	Transportation cost	
			Rs./km	Rs./m^3/km
II	2	18.6	73.04	10.82
III	8	10.1	39.66	5.88
IV	12	16.3	64.00	9.48
I	16	37.7	148.04	21.93

As shown in table 4, the transportation cost of timber varied with the gradient. The cost of transportation was minimum at Rs. 39.66/km (Rs. 5.88/m^3/km) for an average gradient of 8% (section-III). It increased with increasing gradient and was Rs. 64.00/km (Rs. 9.48/m^3/km) for gradient of 12% (section-IV) and was maximum of Rs. 148.04/km (Rs. 21.93/m^3/km) for gradient of 16% (section-I). However, the transportation cost also increased when the average gradient fell below 8% and it was Rs. 73.04/km (Rs. 10.82/m^3/km) for an average gradient of 2% (section-II). It is made clear here that in this case it was not only the gradient, but

also the other road features which controlled the cost of timber transportation by gattu.

CONCLUSIONS AND RECOMMENDATIONS

The actual cost of transportation as Rs. 145.55/m^3 (Rs. 4.12/cft) and Rs. 19.91/m^3/km (Rs. 0.56/cft/km) is very high and the gattu owner suffered a loss of Rs. 30.82/m^3 (Rs. 0.87/cft), even though his margin of profit and overhead costs were not included in the cost analysis. As a result, at the end of operation the transport contractor had to sell one of his gattus to settle the accounts with his workers. The high transportation cost was mainly due to low travel speed and high capital costs (75.8% of the total cost/hour) as a result of accessive wear and tear of the machine, high fuel consumption on steep gradients and rough and winding road sections. On the improved road (section-III) with an average gradient of 8% and no u-turns the actual transportation cost was Rs. 5.88/m^3/km against the contracted rate of Rs. 15.69/m^3/km, leaving a high profit margin of Rs. 9.81 /m^3/km for the contractor. More gentle gradient of even 2% (section-II) did not help in reducing the transportation cost due to poor surface and narrow curves. It is, therefore, recommended that the forest roads under Himalayan conditions should be built with a ruling gradient of 8%, with minimum U-turns, and proper road surfacing to reduce the timber transportation cost as well as to avoid timber losses due to its degradation in the forest and to ensure the economic viability of private enterprise

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