

Mechanized Up-Hill Transportation of Pulpwood

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Introduction

With the general rise in standard of living and increase in population, demand for paper and paper products is increasing day by day in the country. More pulp and paper mills are coming up and the existing ones are being expanded, even without considering the position of raw-material, disposal of effluent, water and electric power etc. to meet the growing demand of the developing nation. The country today (1976-77) is producing about one million tonnes of paper. It will need more than one and a half million tonnes of it in the year 1980-81.

To keep pace with the increasing demand, the pulp and paper industry has already started using all sorts of hardwoods, mixed grasses and even firewood from the open market, in addition to its conventional raw materials, with success. Lot of improvements and adjustments involving huge sums of money have been made at the existing mills to utilize the new types of raw material. The old machines are being replaced by more sophisticated and modern

To keep pace with the increasing demand for paper and paper products in the country more mills are coming up and the existing ones are being expanded. Improvements and adjustments, involving huge sums are being made to utilize unconventional raw materials. The old machines are being replaced by more sophisticated and modern equipments to increase production at decreased cost. No real steps however, seen to have been taken by the paper industry to improve the present conventional costly and wasteful harvesting methods. By introducing modern harvesting techniques and better transportation methods coupled with proper handling of the pulpwood in transit it is possible to deliver the wood at the mill yard at a cheaper price, thus lessening the manufacturing cost of paper.

More than 80% of the total cost involved in pulpwood harvesting pertains to its transportation. Off-road transportation is the most expensive items of work especially when the pulpwood is to be transported up-hill by engaging manual labour. For decreasing the off-road transportation cost when the material is to be transported up-hill, simple method of "Mechanised up-hill transportation of pulpwood" has been developed, which reduced the cost of off-road transportation to about 50% and labour to about 1/5th in a pine forests allotted to the Star Paper Mills Ltd., Saharanpur. Details of the equipment used and the studies conducted are in the paper.

equipment to increase the productivity and decrease the manufacturing cost of paper and paper products. But unfortunately no concrete steps have been taken up by this industry to improve the conventional wasteful pulpwood harvesting methods for reducing the cost of raw material. The conventional methods which are prevalent today are wasteful, slow, strenuous to the workers, uncertain and very expensive. There is much wider scope of decreasing the cost of the raw

material by introducing improved logging techniques for felling, conversion and transportation of pulpwood than to affect any economy within the four walls of the paper mills to decrease the cost of the end products.

Pulpwood Harvesting

The main items of work involved in pulpwood harvesting are :

1. Felling of trees.
2. Delimbing.
3. Conversion into billets.

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4. **Conversion into 'Hukari'**—Split wood—when the billets have more dia. than what is required by the chipper or beyond the capacity of manual handling.
5. **Debarking.**
6. **Transportation :**
 - (1) Off-Road Transportation
 - (2) Major Transportation
7. **Loading and unloading.**
8. **Handling of the pulpwood in transit and at the mill yard.**
9. **Stacking.**

These are the items of work on which millions of rupees are spent by the pulp and paper industry every year. But no scientific studies have been made to arrive at the reasonable logging costs, ofcourse, under different conditions, to get one tonne (air dry) of pulpwood delivered at the mill. These studies were not required when the mills were getting the raw material at a very nominal price and they could pay lavishly for its processing and delivery cost. But now the things have changed and the cost of raw material in the forest has gone up especially due to the internal competition within the industry coupled with the rising labour cost. To bring down the cost of the raw material when it is purchased from the Forest Department at a much higher rate than before, the industry has to focus its attention on the harvesting and transportation side of it in the interest of its future development.

Our experience has shown that

more than 80% of the total cost, involved in pulpwood harvesting, pertains to its transportation. In fact, off-road transportation is the most expensive and difficult item of work especially when the pulpwood is to be harvested from a hill forest. With a view to decreasing the off road transportation cost, when the material is to be transported up-hill, a simple method of up-hill transportation of pulpwood has been developed by using a small yarder which has been designed and fabricated under the guidance of the Logging Branch of F.R.I. at Dehradun a couple of years back.

Description of the Equipment

The equipment used for the Up-hill Transportation of Pulpwood consists of :

1. A Yarder
2. A Carriage
3. A Stop-device
4. A main cable
5. An operating cable
6. One or two pullies
7. A few cable clamps
8. One old Jeep tyre
9. About 1/2 dozen of choker ropes or ordinary slings.

Yarder

It is small winch which is operated by a 5 H.P. air cooled diesel engine mounted on a skid. It is provided with three forward and one reverse gears to wind and unwind the operating cable on the drum of the winch. The drum is designed to accommodate about 800 m of 6 mm dia. operating cable.

Carriage

It consist of two fixed pullies which are mounted on a frame and one moving pully which slides down to reach the load.

Stop-device

It is a simple device to hold the carriage on the main cable when it reaches the top station with a load for unloading.

Sometimes a stop device is also required to stop the carriage at a particular point at the down station for loading. A small wooden block with a hole in its centre or an old tyre can be used to act as a stop device in that case.

Main cable

It is an ungalvanised steel wire rope with hemp core having the following specifications.

1. Dia. 13-16 mm.
2. Right hand regular lay
3. Construction 6 x 7
4. Breaking strength 8 tonnes
5. Length about 600 m.

It is manufactured in the country and is available without any difficulty.

Operating cable

It is also an ungalvanized steel wire rope with hemp core having the following specifications.

1. Dia. 5-6 mm.
2. Right hand regular lay
3. Construction 6 x 19.
- 4 Breaking strength 2 tonnes
5. Length required about 800 metres.

Pullies

One or two pulley-blocks should be there with the equipment. These are used to lift the main

cable at the top station to gain more height specially when the load would touch the ground.

Cable clamps

These clamps are used for holding the main cable after taking it round a tree at the lower and the upper stations of the cable way. These are also required when tension is given to the main cable.

Old Tyre

It is kept in position at the down station near the loading point to stop the carriage.

Choker ropes-Slings

These are required for making bundles of pulpwood billets and then loading the same on the carriage. A dozen of choker ropes or good slings should be available when the work of transportation is in progress.

Installation of the cable ways

The following steps are taken to install the cable way for up-hill transportation of pulpwood :

1. The area is surveyed to fix the loading and the unloading stations.
2. The yarder is brought to the unloading (i.e. top station) and anchored there.
3. The main cable which is usually wound on a reel is pulled out and carried down from the top station along the line, which has already been marked on the ground, with the help of manual labour. To start with only one person is sufficient to take the main cable along the slope up to

about 150 metres or so. After that 2 or 3 persons are required to carry the main cable up to the loading point.

4. The free end of the main cable is taken round one or two living trees and clamped at the down station for its anchorage.

5. The main cable is passed through a pulley block fixed at about half the height of a living tree available along the line at the top station to provide sufficient clearance between the main cable and the ground level to facilitate unloading of pulpwood at the top station. It is then anchored with the living trees and clamped.

6. A suitable tension is provided to the main cable with the help of the operating cable which is pulled by the winch. Some times a cable puller is also used for this purpose.

7. The stop device for holding the carriage at the top station is clamped on the main cable. It is provided with a string which is pulled to release the carriage when the load is removed.

8. The carriage is placed on the main cable after fixing the operating cable with it, at the top station.

9. It is then allowed to slide down along with a few choker ropes, under its own weight, to reach loading point making the installation complete for the uphill transportation of pulpwood.

Working Technique

The choker ropes carried by the

carriage are removed at the loading station. Pulpwood is tied in shape of a bundle with the help of the choker rope and loaded on the carriage. Only one person is sufficient to make the bundles and load them on the carriage at the down station. The average weight of the load which would be carried should be about one quintal. This weight could be increased by increasing the H.P. of the engine. The operator at the top station is informed, by blowing a whistle or waving a white flag, when the loading is finished. On receiving the signal the operator starts the engine to pull the load up to the top station.

On reaching the top station the carriage is held by the stop device and the load is lowered to the ground where two persons are waiting for its unloading. The load is removed, the choker rope is loaded back on the carriage and the carriage is released to slide down again for the second trip. In the mean time the man at the loading station has made another load ready for transportation. When the carriage is away from the top station the labour there is engaged in removing and stacking of the pulpwood. Thus it provides a continuous work for one person at the loading station and three or four persons in addition to one operator, at the top station.

The working technique for up-hill transportation of pulpwood as described above has already been tried, under the guidance of the

author of the paper, for the Star Paper Mills Ltd. in one of their "Twisted Chir" Pine forests at Jorasi, West Almora Forest Division (U.P.). A rough sketch of the forests where this method has been used is given in appendix I. In this case the pulpwood billets were available at the loading station. This device can also be used for side-dragging of pulpwood at the loading station within a radius of about 10 metres.

Technical data

1. Length of the Span	395 m
2. Slope about	50%
3. Labour engaged	5 persons
4. Wage rate/day	Rs. 4.5
5. Staff engaged for this work	Two persons: an operator and a helper.
6. Rent of one room hired for the Staff at Jorasi.	Rs. 25/- per day.
7. Requirement of diesel/day normal	4.7 litre
8. Cost of fuel and lubricants delivered on spot.	Rs. 6/- per day.
9. Mechanized Equipment	
(a) Cost of Yarder + Carriage	Rs. 12,000.00
(b) Cost of ropes etc.	Rs. 3,000
(c) Transportation cost	Rs. 150.00
(d) Cost of installation including cost of the shed etc.	Rs. 165.00
(e) Life of the equipment	4 Years.
(f) Scrap value at the end of 4 years.	Rs. 3,000.00
10. Rate of interest on the capital	At 10%
11. Number of installation/year	one
12. Working days/year	200 days.

Work Study

With a view to finding out the economics of mechanised up hill transportation of pulpwood 'Time and cost study' was conducted under normal conditions for a

period of 30 working days. Average time taken by different elements for one complete trip is given as under :

	Min.	Sec.
1. Time taken for the empty carriage to travel from the top station to the down station.	1	22
2. Time taken for loading of the pulpwood at the loading point.	1	17

3. Time taken for the loaded carriage to travel from the down station to the top station.	2	33
4. Time taken for		

unloading at the top station.	0	30
5. Unproductive time/ trip including minor break down etc.	1	06

Average time per trip = 6 - 48

Number of trips/day (8 hours) 70.59 trips.

Total number of trips involved in this study to see the performance of the equipment were 2118 trips. The study was conducted in a Twisted Chir Pine forest at Jorasi, West Almora Forest Division (U.P.), which was allotted to Star Paper Mills Ltd., Saharanpur, for pulpwood extraction.

Cost Calculations

I. Fixed cost

1. Cost of the Yarder & the carriage	12,000.00
2. Cost of the ropes etc.	3,000.00
3. Cost of transportation of equipment & installation including cost of the shed (taken one installation/year)	800.00

II. Variable cost/day

1. Labour	22.50
2. Staff	15.00
3. Rent	1.50
4. Fuel and lubricants	6.00
5. Repair etc.	2.00
6. Miscellaneous cost @ 10%	4.70

Total 51.70

Annual costs

Depreciation and Average Annual cost have been worked out by

using the following formula :

$$\text{Dep.} = \frac{(I-R)}{N} = \frac{(15000-3000)}{4} = 3000.00$$

$$\text{AAC} = (I-R)(N+1) \div 2N + R$$

I stands for Investment, R for Scrap value, N for life of equipment as number of years, AAC for Av. Annual Cost.

$$= (15000-3000)(4+1) \div 2 \times 4 + R = 10,500$$

$$\text{Interest on AAC @ 10\%} = 1050.00$$

Total Transportation cost per day/ per quintal

1. Installation including carriage of the machinery/day = 4 00
2. Operating+ Miscellaneous cost/day = 51.70
3. Depreciation cost/day = 15.00
4. Interest on AAC/day = 5.25

$$\text{Total cost/day} = 75.95$$

Average quantity of pulpwood transported in one day is 70.02 quintals. For calculations we

have taken 70 quintals only per day.

Cost of uphill transportation for one quintal of pulpwood comes to :

$$\frac{75.95}{70} = \text{Rs. 1.08 per quintal} +$$

15 NP up the Road side

$$= \text{Rs. 1.23}$$

Transportation cost/quintal which was being paid by the Star Paper Mills for conventional methods

Cost of transportation of pulpwood from the down station upto the road side, by using conventional method of head-portage by manual labour for which arrangements were already made by the mill, was Rs. 2.35 quintal. In this case the labour had to traverse about 2 Km distance between the down station and the roadside from where the pulpwood would be lifted for major transportation by trucks. This method was not only expensive and slow but also very strenuous to the poor workers.

Conclusion

By introducing mechanization the uphill transportation cost could be reduced to about 1/2 (Rs. 1.23 against Rs. 2.35). 15 paisa per quintal which were spent for further handling of pulpwood at the top station could also be saved by proper alignment of the main cable.

In addition to the reduction of transportation cost there was an appreciable reduction in the requirement of manual labour. A team of 7 persons (5 labourers + one operator + one helper) could bring at an average about 70 quintals of pulpwood from the down station to the top station for its further major transportation, while this quantity (i.e. 70 quintals of pulpwood) could be transported/per day by a gang of 35 persons. The labour requirements could therefore be reduced to about 1/5th.

