

HEADQUARTERS MECHANICAL DEVELOPMENT COMMITTEE

REPORT NO. 45.

on

THE SINGLE STRAND GRAVITY ROPEWAY

Origin

Experiments with ropeways in the predominantly thinning stage in British forests have shown that the time they require to erect and dismantle is a deciding factor in calculating whether or not they are an economic method of extraction.

A very light ropeway system developed by Mr. A. Koroleff, Director of the Pulp and Paper Research Institute of Canada was, therefore, of great interest and the design has been reproduced here for trial.

This report contains some general observations and the detailed results of an observed trial to determine operating costs.

Description

This single strand ropeway differs from other gravity ropeways mainly in the weight of the component parts and simplicity in operation.

The two main features are:-

- (a) The load carrying single strand wire which has a diameter of 0.160 inches and a breaking strength of 4,640 lbs. The weight is 69 lbs. per 1,000 feet.
- (b) Wooden blocks which act as runners on the wire to carry the load.

A complete ropeway equipment consists of:-

- 500 yards of 8 gauge wire.
- 2 wedge clamps to grip the wire.
- 1 Tirfor winch for tightening.
- 1 Dynamometer to measure tension.
- 200 Wooden blocks.

The cost of this equipment, excluding the wooden blocks which are locally made, is £72. An intermediate support for occasional use can be supplied for a further £6.10.0.

The operating team is 4 men. This number was found to give the best results in all phases of the operation.

Photographs of the equipment are attached to this report.

- Observations 1. No difficulty has been experienced in operating this ropeway on concave slopes where a single span could be used. In cases where it has been necessary to use intermediate supports some difficulty has arisen with the wooden blocks jumping off the wire and it is considered that convex slopes needing many supports could not be easily worked. It has been found possible in most cases to use a single span for runs up to 350 yards by siting the bottom anchor well away from the foot of the hill.
2. The minimum gradient on which the wooden blocks will run is 10° and although there is no limit to maximum gradient anything over 18° results in such high speed that it is difficult to stop the load at the bottom. On gradients of less than 12° it is necessary to lubricate the wire. This is quite easily done by filling a hole in the top of one of the wooden blocks with oil.
3. The maximum load that should be sent down the wire is 4 cubic feet.
- The method of usage is for two men at the top of the run to attach loads (using a wooden block at each end) to the wire. The load then slides down the wire and is removed and stacked at the bottom by a further two men. The wooden blocks were originally made of Hornbeam but it has been found that most species will do equally well and blocks have been made locally to very rough shapes with success. The life of a block is about 5 runs.
4. Tension in the wire measured on a number of occasions has shown that an initial tension of $\frac{1}{4}$ ton shows maximum tensions of $\frac{3}{4}$ ton during the descent of a 4 cu.ft. load. This initial tension of $\frac{1}{4}$ ton has frequently been exceeded and in no case has the wire broken when in use. In any

case it is necessary that all personnel stand clear of the wire when a load is in transit. $\frac{1}{4}$ Ton should be regarded as the maximum initial tension to be used.

5. An observed trial, primarily to establish operating costs, was carried out at Ennerdale in September - October 1955.

Eleven sites were used, nine of them to extract Japanese Larch from a narrow belt of forest across the river Liza. All were single span runs of 200 - 350 yards. The maximum drag by hand to the ropeway was $1\frac{1}{2}$ chains so each erection of the ropeway served only about 3 acres in this particular case. Labour was provided by ordinary forest workers paid on a time basis. There was no other method by which the timber could have been brought across the river except by fording with a tractor and trailer on days when the water was low.

Appendix A attached to this report gives details of the figures recorded on each of the 11 sites. The main points of interest revealed were:-

- (a) The small yields of timber from each site, in one case it was as little as 163 cu.ft. and 553 cu.ft. was the largest yield from any site during the trial. However, in the conditions where light ropeways of this kind are likely to be used volumes will frequently be small. The value of quick erection was made very clear.
- (b) The time taken to erect in no case exceeded 9 man hours i.e. 4 men working for $2\frac{1}{4}$ hours and on two occasions erection was completed in 5 man hours ($1\frac{1}{4}$ hours).
- (c) The gradients on the wire on this trial varied between 10° and 15° .
- (d) It is possible where a large stack of logs is available at a convenient loading point to send them down the wire at a rate of 50 cu.ft. per hour but

the average working rate throughout the trial (counting operating hours only) was only 24 cu.ft. per hour. This is explained by the time taken in changing from one loading point to another, altering the tension in the wire to suit different loading points, making good the stop butt at the bottom end and all the other incidental delays that occur. As the actual operating rate was only 50% of capacity it is in this direction that improvement could be expected.

6. Costs.

Examination of the detailed figures for each site given at Appendix A shows that the average cost of extraction on the 11 sites was 7.1d. per cu.ft. not counting avoidable lost time such as rain and also not counting the 40% labour on-cost. Erection and dismantling accounted for 1.2d per cu.ft. Charges for felling and dragging by hand to the ropeway line have not been taken into account. Both these operations had already been done at total piece work rates of 11d on the first site and 10d on the second.

All the costs worked out in Appendix A refer to labour costs only. Although this very inexpensive equipment carries very small depreciation charges it is considered that $\frac{1}{2}$ d per cu.ft. would be a fair assessment. The average cost on the 11 sites with 40% on-cost charged on labour and $\frac{1}{2}$ d per cu.ft. added for plant depreciation is $9.9d + 0.5d = 10.4d$ not counting avoidable lost time; To reach the total extraction cost 10d* - 11d must be added for felling and dragging to the ropeway line so the overall cost of extraction (excluding avoidable lost time) was 20.4 - 21.4 pence per cu.ft.

Conclusions

This single strand ropeway has proved to be cheaper to operate than any other ropeway tested for the extraction of thinnings mainly because the first cost is low and the light equipment is easily erected.

Costs, are still high in comparison with tractor or horse drag but this ropeway does provide a means of extracting timber from those difficult sites where it is virtually impossible to use any other means.

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SINGLE STRAND ROPEWAY TRIAL AT EMMESDALE - SUMMARY OF DETAILS RECORDED

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11
Man hours on erecting	9	11	6	7	5	8	7	5	6	7	8
Man hours on operating	62	53	57	19	30	79	72	29	29	55	92
Man hours on dismantling	4	3	3	3	3	3	2	3	3	3	4
Man hour lost	9	11	2	1	18	19	19	3	36	9	27
Volume of timber extracted - cu.ft.	350	331	423	176	163	365	306	206	252	325	553
pence											
Cost of ropeway extraction per cu.ft. at 3/- per man hour	8.6	8.5	5.8	6.1	12.4	10.8	11.8	7.0	10.6	8.2	8.5
Cost at 3/- per man hour excluding lost hours	7.7	6.1	5.6	6.0	8.4	8.9	9.5	6.5	5.4	7.2	6.8
Cost excluding lost hours but adding 40% labour on-cost	10.8	8.5	7.8	8.4	11.8	12.4	13.3	9.1	7.6	10.1	9.5

The lost hours were normally due to rain, maintenance and tea breaks. On sites 9 and 11 the excessive number of lost hours was due to persistent rain (23 man hours on site 9)

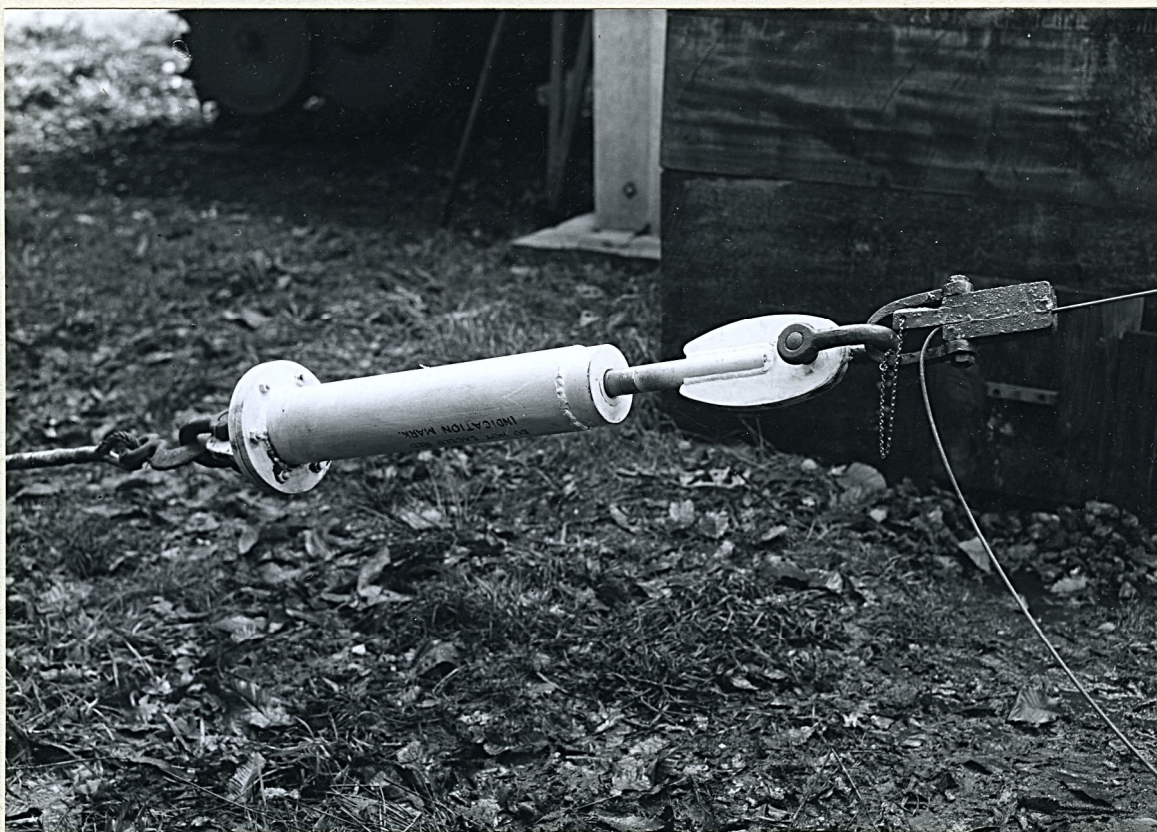
Costs exclude felling and dragging to ropeway line.



1. Showing a load running down the wire suspended at each end from the wooden blocks.



2. A close-up view of one of the wooden blocks carrying a load suspended from the wire.



3. The Dynamometer inserted in the line to record the tension in the wire.