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LOG TRUCK UNLOADING

Steven Bates
Tim Robinson

Figure 1 - The Gantry Crane at Canterbury Timber Products, Rangiora

ABSTRACT

This report is based on the results of an investigation carried out during the summer of 1993-94, to determine log handling times for use in log truck scheduling.

Wheeled log stackers, a gantry crane and a rubber-tyred front-end loader (RTFEL) were studied unloading logs from log trucks. Truck unloading times (including unchaining) for short logs averaged 5.5 minutes for the stackers, 12.0 minutes for the gantry crane and 12.1 minutes for the RTFEL. For long logs, the stacker averaged 3.6 minutes per truck.

INTRODUCTION

The objective of this study was to determine accurate unloading time values for use in a log truck scheduling and despatching simulation. The results will also contribute to standing time estimates in truck costing and productivity calculations.

ACKNOWLEDGMENTS

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STUDY METHOD

A continuous time study technique was used to record truck unloading times. Each unloading operation was timed from the moment the truck and machine were both ready for unloading, to the moment the truck was empty. This includes the time taken to unchain the load, but not the time the truck spends waiting in a queue. Except for stackers working with long logs, the unloading machines were not able to lift the entire load from the truck in a single grab. The machines would grab part of the load, carry it to the stacking area and return to the truck for the next grab. For each truck, the number of grabs needed, the log size (long or short), and the net log weight were recorded. The unloading operation was broken down into a number of elements, which were timed separately.

The time elements were:

- preparation to unload (unchaining the logs and positioning the truck)
- unloading proper (lifting down the logs and stacking them)
- operational delays
- personal delays.

These elements provide sufficient detail to determine typical unloading times, which was the aim of the study. All machine operators observed in this study were experienced full-time operators.

Long logs (over 8m) and short logs (under 8m) require different truck and trailer configurations which, in turn, affects unloading. Short logs require a double unit so that packets of logs are carried on both the truck and trailer. Long logs are generally carried as a single packet supported at the front by the truck and at the back by the trailer. Other truck configurations are also used, but the general rule still applies: a load of long logs forms a single packet, while a load of shorts forms two packets. In either case, the payload is about the same - between 28 and 30 tonnes.

Stacker

Wagner stackers were studied at two sites: the CHH Forests Limited Kinleith logyard and the port at Mount Maunganui. Two different models of Wagner stackers were observed, a L90 and a L100, with maximum lift capacities of 40.8 and 45.3 tonnes respectively. The lifting power of an unloading machine needs to be greater than the weight of the log packet, as the logs settle in transit and extra breakout force is needed to overcome the friction between the bolsters. Even so, both these stackers have spare capacity and the difference between them was not expected to affect their performance in this instance.

Gantry Crane

The electric gantry crane studied at CTP in Rangiora is the only one of its kind in New Zealand. It is a 37m long crane with a fixed centre pivot and a maximum lifting capacity of 20 tonnes. It was built specifically for the CTP Mill in Rangiora to unload trucks and feed the debarking/chipping line. The crane is unusual in that has very low lifting power for

Table 1 - Summary of truck unloading times

ELEMENTS		STACKERS Longs	STACKERS Shorts	GANTRY CRANE Shorts	RTFEL Shorts
Unloading Proper (minutes)	Mean Range*	1.0 (0.4 - 3.8)	2.8 (1.7 - 4.8)	6.5 (4.0 - 10.1)	7.3 (3.1 - 10.3)
Other Activities (minutes)	Mean	2.6	2.7	5.5	4.8
Total Unloading Operation (minutes)	**Mean Range**	**3.6 (1.9 - 7.8)**	**5.5 (2.4 - 13.8)**	**12.0 (7.1 - 18.2)**	**12.1 (7.1 - 25.3)**
No. of Loads Studied		16	27	25	17
Load Size (tonnes)	Mean Range	28.6 (23.6 - 36.5)	28.1 (22.4 - 33.2)	27.7 (16.7 - 31.8)	29.3 (24.5 - 39.6)
Grabs per Load	Mean Range	1	2	4 (2 - 5)	8.5 (4 - 12)
Time per Grab (minutes)	Mean Range	1.0 (0.4 - 3.8)	1.4 (0.9 - 2.4)	1.6 (1.2 - 2.0)	0.9 (0.6 - 1.5)

* *Range: minimum - maximum. The times do not follow the normal distribution and confidence intervals would be misleading.*

a machine of this type, requiring four lifts to clear a truck load of shorts.

RTFEL

The RTFEL studied was a Kawasaki 80ZII, a medium-sized loader (118kW) with a 14.5 tonne operating weight. The study area was Tasman Forestry Limited's chipping yard in Taupo. The loader's main task was the unloading of trucks and the feeding of the chipper plant.

RESULTS AND DISCUSSION

The results for unloading are summarised in Table 1. The element "Unloading Proper" is the time required solely for lifting down the logs and stacking them, as described above. "Other Activities" is the sum of all the other elements.

It takes a stacker significantly ($p < 0.05$) less time to unload long logs (3.6 minutes) than it does to unload shorts (5.5 minutes), because it can pick up a load of longs in a single grab, but it takes two grabs to unload shorts.

The total unloading times for the gantry crane (12.0 minutes) and the RTFEL (12.1 minutes) are not significantly different ($p > 0.05$).

(*CTP have done their own time study on the gantry crane, and they achieved an average total unloading time of 9.0 minutes, from a sample of 53 loads.*)

Stackers and gantry cranes need a large area to operate and are used in places where a high influx of logs occurs. Gantry cranes are limited to unloading, stockpiling or feeding a plant directly, and they are operationally inflexible: it is difficult to change the layout of the log yard, increase productivity, or enlarge the yard to take more logs. If the crane breaks down, this can mean closing down the whole operation; hiring a replacement may not be an option.

Gantry cranes do have their advantages, however. They are safe, quiet, non-polluting, cheap to operate, and they do not damage the yard surface or create dust or mud. Most importantly, they can build very high log stacks, making maximum use of the available land.

It must be remembered that gantry cranes are generally custom-built for a particular job, and the example considered here is not necessarily typical of gantry cranes in general.

Stackers are more flexible than gantry cranes because they can cope with yards of any size and shape,, and can be used in pairs to increase productivity. Compared to RTFELs, they are more cost-effective to operate, provided there are enough loads per day to keep them busy. The main disadvantage of stackers is their high initial cost. The large axle weight (well over 30 tonnes) is not a problem for properly constructed log yards, but it can be too much for use in some applications, for example, on piled wharves.

RTFELs are more manoeuvrable and lighter, but they can not unload logs as quickly as stackers, nor as cheaply, in terms of dollars per tonne of logs unloaded. Nevertheless, they are adequate for the smaller mills, and of course they require a much lower capital investment.

CONCLUSION

The three unloading machines studied were used in different situations and for different purposes. The study was not intended as a machine comparison. However, it did achieve its objective, which was to obtain unloading times for use in transport simulation and truck costing calculations.

For further information, contact:

LOGGING INDUSTRY RESEARCH ORGANISATION
P.O. Box 147,
ROTORUA, NEW ZEALAND.

Fax: 0 7 346-2886 *Telephone: 0 7 348-7168*