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LOADERS FOR GROUND-BASED LOGGING

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Figure 1 - Loading Trucks with a MS230 Knuckleboom Loader

ABSTRACT

A comparative study of a knuckleboom loader and rubber-tyred front-end loader (RTFEL) was undertaken in conjunction with a Caterpillar 528 skidder and a Komatsu D65 tractor. The objective of the study was to assess the minimum landing requirements and the loading times for each loader type in a high production, high log sort operation.

The loaders operated a hot deck system in which production averaged 400 tonnes per day with the number of log sorts produced ranging from 12 to 14. Both loader types were able to cope adequately with the number of log sorts, however the RTFEL required a 20% greater landing area to cope with the level of production. The loading times for the RTFEL were 22% faster than were recorded with the knuckleboom loader. While the level of value recovery was not affected by the loader type operating, the larger landing provided a superior work environment for the skid workers. Some cold deck load out was required to reduce landing stockpiles.

INTRODUCTION

High numbers of log sorts and a high degree of emphasis on value recovery now typify many second crop radiata clearfell operations.

As a result, and with hot deck loading operations in particular, the landing can become a major source of congestion in high production operations.

Associated with these developments comes pressure from the forest owner to restrict landing sizes. Their primary concern being the amount of land being taken out of production as a result of large landings and also to minimise construction and surfacing costs. Similarly, on steeper country and more sensitive soils, the resource management authorities also have interests in minimising the volume of soil disturbed during landing construction.

ACKNOWLEDGEMENTS

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WORK METHOD

Knuckleboom Loader

The loader studied during this trial was a 1980 model Mitsubishi MS230 hydraulic excavator-base machine with a standard length dipper stick. Modifications for log loading work included raising the cab 0.5m and the addition of a 2 tonne counterweight to yield a total weight of 25 tonnes.

To operate efficiently and to gain most advantage from its 8m reach, the knuckleboom must be centrally located to the processing area (Figure 2).

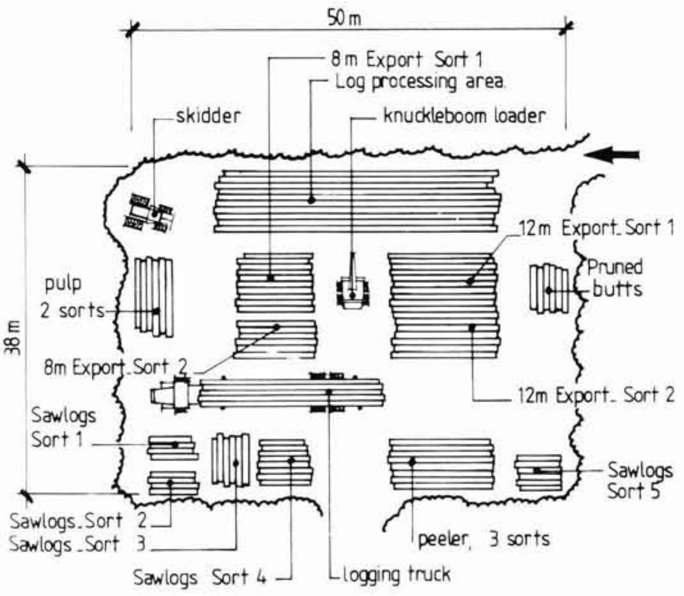

Figure 2 - Typical Knuckleboom landing layout

The log types representing the highest proportion of the volume are stacked immediately adjacent to the processing area and also immediately adjacent to the section of the whole tree from which they are cut. Consequently, it is preferable that all trees be extracted either as "head pulls" or "butt pulls" to minimise double handling. The less predominant log types are assembled into rough stacks for restacking when the opportunity arises.

In order to stack those log sorts out of reach from the loader, typically the pruned butts and the pulp from the head of tree, the loader must walk either around the stacks or across the processing area.

Rubber-Tyred Front-End Loader

The Volvo L90 rubber-tyred front-end loader (RTFEL) studied is a 104kW machine with an operating weight of 13.29 tonnes.

The RTFEL adopted the typical perimeter stack layout (Figure 3).

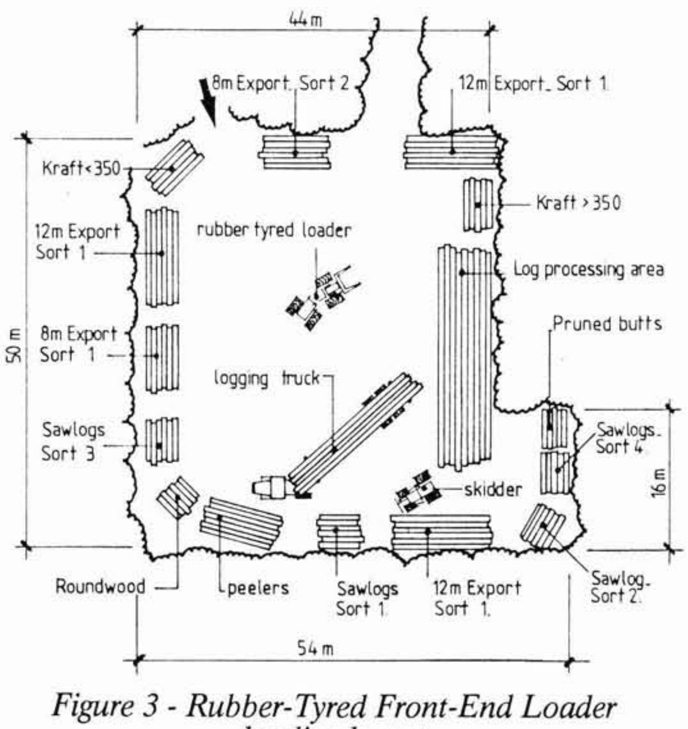

Figure 3 - Rubber-Tyred Front-End Loader landing layout

The preference for approaching the processing area from both sides was also evident when low stock levels allowed. When restricted to accessing the processing area from one side only, the RTFEL was able to move to either end of the processing area and continue fleeting.

STUDY AREA AND METHOD

A production study of the two loaders and skidder cycles were undertaken over a ten day period.

The study area was a tended 28 year old radiata pine stand on easy to moderate terrain. A limited amount of delimbing was undertaken in the bush, however the bulk of delimbing and all log making was carried out by the log maker and two skiddies.

The mean extracted piece was $2.75m^3$. Details of the stand data were obtained from preharvesting inventory by Tasman Forestry Limited.

RESULTS AND DISCUSSION

The loader production study is summarised in Tables 1 and 2.

Both loaders performed well during the trial and proved capable of handling the high level of production and the high number of log sorts. The knuckleboom loader did however demonstrate its ability to fleet processed logs more quickly and on a smaller area than the rubber-tyred loader. The rubber-tyred loader required 20% more time to fleet the processed logs and also required 20% more landing area on which to operate. Because a relatively smooth landing is necessary for the rubber-tyred machine to operate efficiently, 9% of the machine time was involved in the maintenance of the landing. In contrast, the knuckleboom loader left the skid clearing duties for the occasional blading off by the extraction machines. The overall effect on the two landings was that the rubber-tyred loader provided a better environment for log making and generally looked more organised while the knuckleboom loader was quicker at fleeting processed logs. The comparatively untidy skid gave the impression of not being able to keep up with production. Another feature of the two

Table 1 : Load Times by Loader Type

	Volvo L90	Mitsubishi MS230	% difference
	(mins/tonnes)	(mins/tonnes)	
Longs 82.5% of volume	.32	.41	25
Shorts 17.5% of volume	.47	.62	17
Total	.35	.45	22

Table 2 - Loader Activity by Loader Type

Activity	Volvo L90 %	Mitsubishi MS230 %
Fleet	54	45
Load trucks (incl.prep + dispatch)	30	37
Clean skid	9	-
Wait	1	5
Idle	-	2
Delay	6	11
	100	100

loading systems was the extra time the knuckleboom loader must wait for the skiddies to process logs. The more manoeuvrable rubber-tyred loader was able to quickly move to where the skiddies were not working and continue fleeting.

What gains the knuckleboom loader achieved with its fleeting were offset by slower loading times when compared to the rubber-tyred machine (Table 2). Overall the load time (mins/tonnes) was 22% down on the wheeled machine. This effect was most evident when loading long logs (82% of the production) where the difference increased to 25%.

An attempt was made to study the impact of the truck dispatch system (centralised versus loader controlled) on extraction machine productivity. The difficulties encountered in manipulating the existing system however, precluded this. Previous work with knuckleboom loaders (Williams, 1989) demonstrated the benefits of regularly spaced loader controlled truck dispatch on wood flow through the landing. As a general observation, the knuckleboom loader was able to load two trucks consecutively and the RTFEL three trucks consecutively before the productivity of the extraction machines became impeded.

Although this study concentrated on the loader's ability to fleet and load a high number of log sorts and the skid area required, the mobility of each loader type must be taken into account during the loader selection process.

The ability of the rubber-tyred loader to travel quickly between skids to load out or to push trucks is superior to track mounted equipment. The operation of track-mounted equipment therefore requires more precise operational planning, and all logs should be loaded out before the loader leaves the landing.

However, what is lost in travel speed of tracked equipment is regained in its ability to operate both in wet conditions and to act as a prime mover either during periods of extraction machine downtime or when the extraction machine is on long hauls. The knuckleboom loader is particularly efficient for logging out to 100m from the roadside or skid (Moore, 1990).

CONCLUSIONS

Both the rubber-tyred front-end loader and the knuckleboom loader were found to be efficient at fleeting and loading 400 tonnes per day with up to 14 log sorts. The knuckleboom loader was capable of working on 20% smaller skid area than was required by the rubber-tyred loader.

While the rubber-tyred loader was 22% faster during loading activities, this was offset by the knuckleboom's superior fleeting ability. The work environment for the skiddies was found to be superior on the larger skid area on which the rubber-tyred loader was operated. The value recovery achieved by the skiddies however was not influenced by the type of loader being operated.

Where possible trucks should be dispatched at regular intervals throughout the day. To avoid reducing the productive potential of the extraction machines no more than two trucks should be loaded consecutively with the knuckleboom loader and no more than three trucks loaded consecutively with the RTFEL.

A further study to evaluate a knuckleboom loader working a continuous roadside landing systems, in which no skid construction carried out will also be undertaken.

REFERENCES

Moore, T. (1990) : "Pilot Trials with Loader Logging in New Zealand", LIRA Report, Vol. 15 No. 2.

Williams, M. (1989) : "An Evaluation of a Hydraulic Knuckleboom Loader in a Production/Multiple Log Sort Operation", LIRA Project Report No. 47.

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