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PROCESSING OPTIONS FOR HAULER LANDINGS

Michael Duggan

ABSTRACT

A study of three loader types, operating in conjunction with a Madill 009 hauler, was undertaken. The objective of the study was to assess the level of interference to the haul cycle caused by the processing of logs in the chute area.

The trees were extracted tree length in a radiata pine clearfell operation, with a mean extracted piece size of 1.3m^3.

In conventional operations, the tree lengths were processed in the chute area and either a rope crane or a rubber-tyred loader sorted, stacked and loaded the logs. With the hydraulic heelboom loader, the tree lengths were shifted to an adjacent zone for processing.

At daily production of 250m^3, the reduction of landing interference achieved by processing the logs in a separate processing zone, increased hauler productivity by 10%.

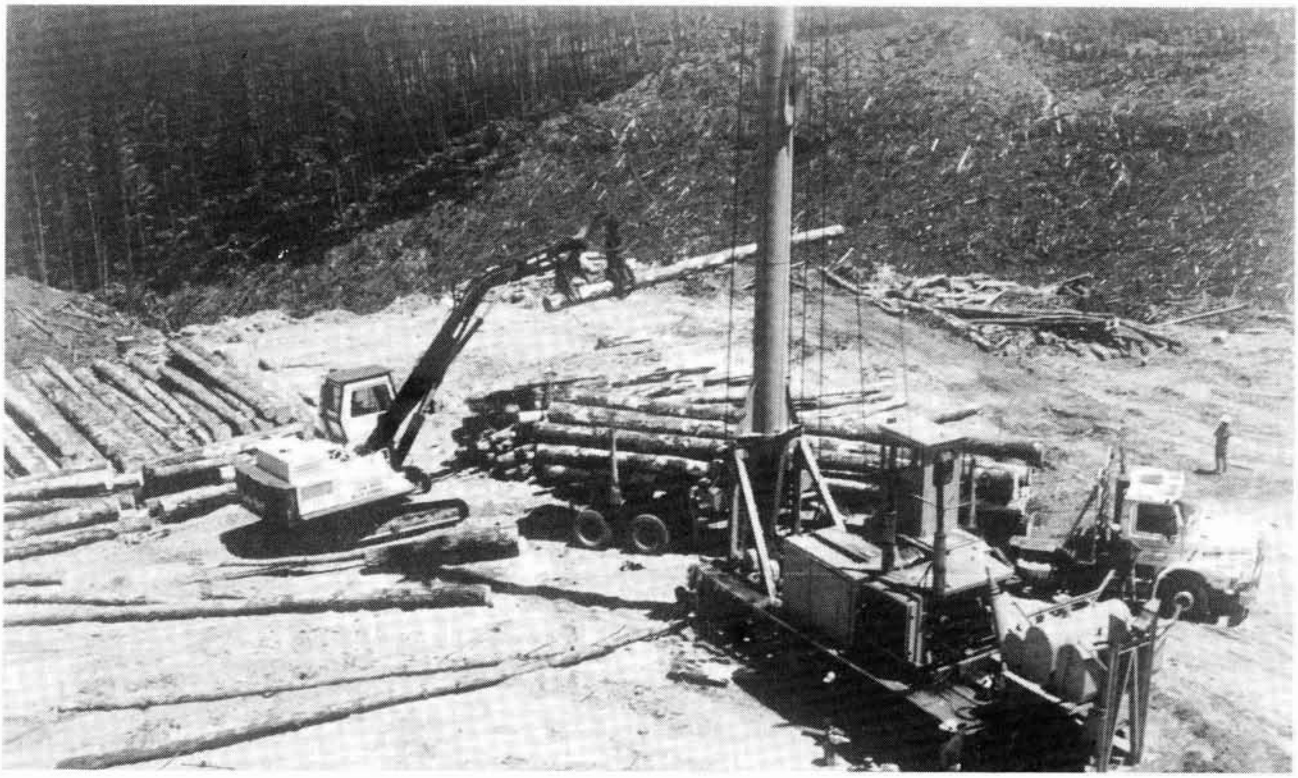

Figure 1 : A Heelboom loader clearing the tower and loading out.

INTRODUCTION

Current practices in New Zealand tree length clearfell operations typically involve the processing of the stem on the landing.

A common feature of this type of operation, especially during periods of high production, is the interference caused to the haul cycle while either the loader, and/or the skidworkers complete their respective tasks. This problem has become increasingly evident with the move towards the production of a larger number of short logs to be manufactured and handled. This development has been paralleled with the greater emphasis placed on the safety of skidworkers in hauler operations.

Other potential sites for processing are available, including:

(a) in the bush, prior to extraction;

(b) two staging to a separate landing; or

(c) at a centralised processing yard.

However, each of these options are subject to limitations, and the future use of landings as the primary processing site is expected to continue.

The study was designed to quantify, and compare the level of interference to the haul cycle when processing logs either:

(a) in the chute area under the hauler ropes; or

(b) in a separate processing area.

ACKNOWLEDGEMENTS

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WORK METHOD AND MACHINES

(a) **<u>Processing in the Chute Area</u> - Wheel Loader and Rope Crane**

When processing in the chute area (or under the ropes) (Figures 2 and 3), skidworker activities are restricted essentially to part of the outhaul element and the hook on element. In this time the skidworkers must measure and mark the landed trees, cut off the sloven, crosscut the trees into log length, and retrim the remaining branches and branch stubs.

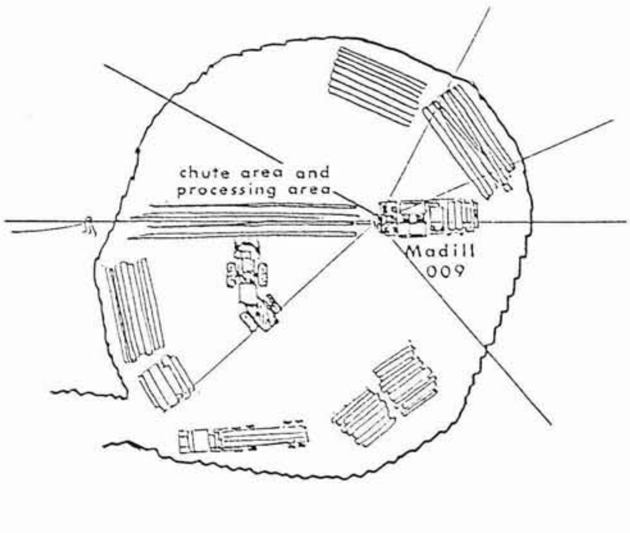

Figure 2 : Wheel Loader removing processed logs from the landing chute

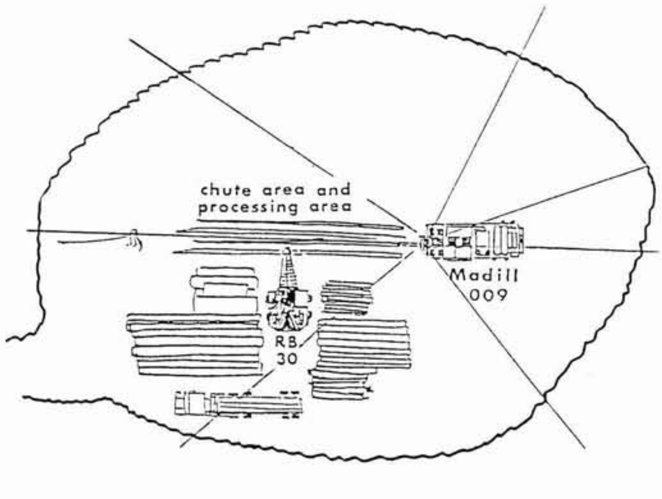

Figure 3 : Rope crane removing processed logs from the landing chute

(b) Processing in a separate area - Heelboom Loader

By moving the tree lengths to an adjacent area for processing (Figure 4), most of the haul cycle is available to undertake processing work. The only interference occurs while the loader is removing processed logs or restocking the processing area with tree lengths. The landing of "gut stropped" logs or logs with potential to swing, also requires the skidworker to retreat to a safety zone, until the drag is landed. Depending on the design of the landing, it is possible to work the processing zone on either side of the landing area.

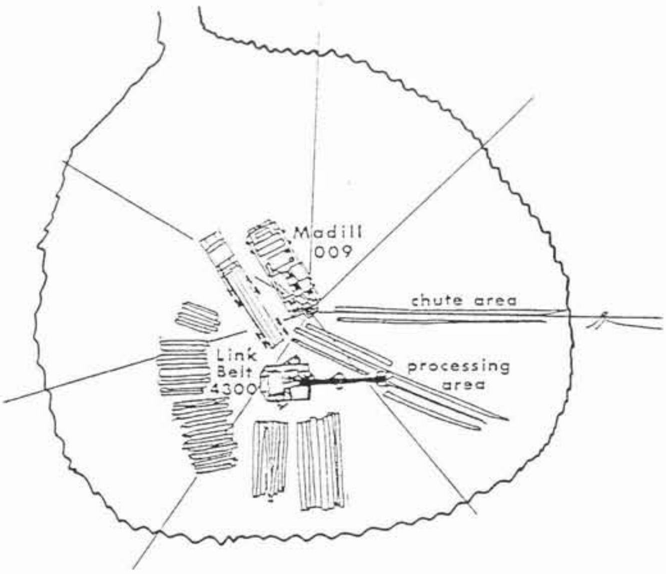

Figure 4 : Heelboom loader moving logs to a separate area for processing

A rubber-tyred loader can be used to move tree lengths to a separate processing area.

However, as well as requiring a significantly larger formed landing on which to operate, the wheel loader frequently needs access to both sides of the landing chute when moving tree lengths into the processing area. Furthermore, unless the tree lengths can be landed without overhanging the edge of the landing, they can become entangled in the ropes during removal, creating a hazard for the breakerout(s).

A crane loader, particularly heel boom type, doesn't have these limitations.

LOADERS USED

The Ruston Bucyrus 30 runs a rope operated grapple off a 10m boom. The RB 30 is track mounted and has been used in the Bay of Plenty since the mid 1960s. It has an operating weight of 30 tonnes.

The Cat 966 is a rubber-tyred front end loader with standard log forks. It weighs 20 tonnes and has a maximum lift of 5 tonnes.

The Sumitomo LS 4300 is a 30 tonne, track mounted hydraulic loader with a purpose-built Prentice logging boom and live heel grapple.

STUDY AREA AND METHOD

A production study of the hauler, loader and landing activities was undertaken, in which a total of 325 haul cycles were recorded.

The study area was a 55 year old radiata pine stand on moderate to steep terrain and typical of the steep country currently being logged in the Bay of Plenty. While the mean tree size is larger than the anticipated second crop piece size (2 to 3 m^3), the number of log sorts to be manufactured, the level of clean-up trimming, and the mean extracted piece size are representative of a second crop stand. Details of the stand data were obtained from pre-harvest inventory by NZFP Forests Limited staff.

Table 1

Stand age	*55 years*
Total stocking	*300 sph*
Mean DBH	*60 cm*
Mean Tree Volume	*3.8m^3*
Mean extracted piece size	*1.3m^3*

Table 2 : Hauler cycle times and interference incurred by loader type

Processing Site	Processing in the Landing Chute		Processing in a separate area
Loader Type	Rope Crane	Wheel Loader	Heelboom Loader
No. of Observations (cycles)	85	48	192
Hauler Cycle time (min)[1,2]	8.27	8.27	8.27
Landing interference (min)	0.96	0.87	0.09
Total Hauler cycle time (min)	9.23	9.14	8.36
Daily Productivity (tonnes)[3]	224	224	247

1 Includes operational delays
2 Average haul distance 200 m
3 Based on 8 available machine hours and an average drag volume of $4.3m^3$

RESULTS AND DISCUSSION

A summary of results is provided in Table 2. Analysis of the data for the rope crane and heelboom (landing interference excluded) revealed no significant difference (at 95% confidence limits) between cycle times. No standardisation of the data was therefore necessary. Because of the shorter average haul distance recorded for the wheel loader study, the cycle times for the hauler in the wheel loader study were adjusted to a 200m average haul distance.

As would be expected, the clearing of the landing chute and processing in a separate area, resulted in less interference to the haul cycle. Both loaders which handled wood processed in the landing chute, recorded similar levels of interference. A 10% increase in productivity was achieved by processing logs away from the landing chute.

A further analysis of the data (for the rope crane and heelboom only) was undertaken to determine how the level of interference varied with daily production (Figure 3).

The advantages of processing away from the chute area were greater as daily production increased. Gains of 17% in hauler utilisation were recorded when production was $300m^3$/day compared to 5% when production dropped to $200m^3$/day.

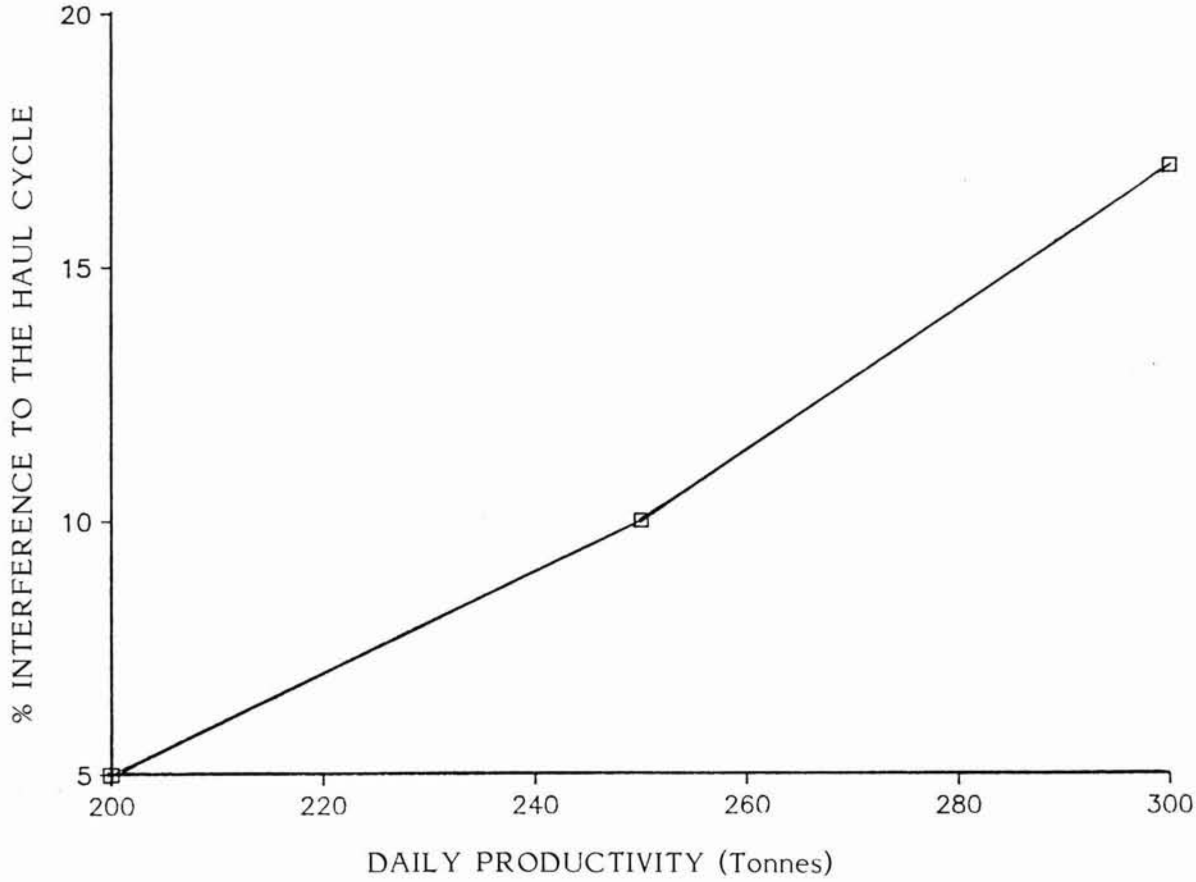

Figure 3 : Effect of Daily Productivity on the Level of Interference to the Haul Cycle

Table 3 : Unit Cost by Loader Type

	CREW CONFIGURATION		
	Rope Crane (Secondhand)	Wheel Loader (New)	Heelboom Loader (New)
<u>Daily Costs:</u>			
Loader	$ 300	$ 550	$ 550
Total[1]	$2950	$3200	$3200
Production (tonnes)	224	224	247
Unit Cost $/tonne	$13.20	$14.30	$13.00

[1]Daily Cost based on Hauler, Tractor, 8 men and 10% profit

Figure 4 : Rope Crane loading and removing processed logs from the landing chute

Cost/Benefit of Processing Alternatives

Using the LIRA costing format (Wells, 1981), the hauler's production was considered in terms of the overall cost using a secondhand rope crane, a new hydraulic heelboom and a new rubber tyred loader (Table 3).

While the secondhand rope crane yielded the lowest daily cost, the unit cost of wood was found to be only marginally less (3%) than the heelboom loader.

Other Considerations in Loader Selection

Although this study concentrated on the interference to the haul cycle, in terms of where processing was undertaken, other factors must be taken into account, during the loader selection process.

These factors include:

(i) Loader Mobility

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 to be loaded out before the loader leaves the landing.

However what is lost in travel speed of tracked equipment is made up for in the ability to operate both in wet conditions and to act as a prime mover during periods of hauler downtime or line shifts.

(ii) Landing Size

The processing of a large number of log sorts on confined landings will become increasingly prevalent as steep country harvesting operations intensify outside the Bay of Plenty and Nelson areas. Given this requirement, the ability of the heelboom type loader to stack logs radially with no or minimal movement around the landing, is a major advantage.

The costs stated in this Report have been derived using the procedure shown in the LIRA Costing Handbook for Logging Contractors. They are only an estimate and do not necessarily represent the actual costs for this operation.

CONCLUSION

The evaluation of the two alternative sites for processing the landed tree lengths indicates benefits from processing away from the landing chute.

By reducing interference to the haul cycle, through processing away from the landing chute, an additional 10% of the work day was available for production. On high production settings with a potential production of 300m^3 per day, up to 17% of the total work time was lost through interference caused by processing in the landing chute. This reduced to 5% when production averaged 200m^3 per day.

While the mean tree size in this study was larger than the anticipated second crop piece size (2 to 3m^3), the number of log sorts to be manufactured, the level of clean-up trimming, and the mean extracted piece size are representative of a second crop stand.

The heelboom loader offers the additional benefits of being able to handle a large number of log sorts in a confined area and has the ability to extract logs itself during periods of hauler downtime. Adverse ground conditions do not restrict loader mobility. However, the tracked undercarriage limits travel speeds between skids.

REFERENCE

WELLS, G.C.(1981) : "Costing Handbook for Logging Contractors", LIRA.

For further information, contact:

N.Z. LOGGING INDUSTRY RESEARCH ASSOC. INC.
P.O. Box 147,
ROTORUA, NEW ZEALAND.

Fax: (073) 462-886   Telephone (073) 487-168