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RUBBER-TYRED FRONT-END LOADER APPLICATION

(A PILOT STUDY BY A. TWADDLE - FOREST RESEARCH INSTITUTE)

INTRODUCTION:

In early 1978 the FRI Harvesting Research group carried out a pilot study of two loading operations in "old crop" radiata pine clear-fellings. Both used rubber-tyred front-end loaders of similar power ratings and carrying capacities, operated by skilled drivers. One loader was part of a highlead-cable extraction system, and the other was a part of a tractor extraction system.

	OPERATION 1	OPERATION 2
Extraction system	Highlead hauler	Tractor and arch
Extraction unit	Madill 009	Komatsu D80
Loader unit	Fiat-Allis 645 B	Hough 65C
Crop extracted	"Old crop" radiata pine (1934)	"Old crop" radiata pine (1934)

Table 1 - General Background

The pilot study aimed at identifying the work elements, the work cycles, and the factors influencing productivity of the loaders, for the guidance of future research work. It was incomplete in that the loaders were observed only for that period of the day when the whole extraction crew were on-site. For 2½ to 3 hours before the rest of the crew arrived, both loader operators were on-site loading "export" trucks with logs for the port at Mt. Maunganui.

LOADER ACTIVITIES:

The basic work patterns of the two loaders were similar. Incoming stems were dropped in a processing area where they were cut into logs of different lengths and qualities by the skidworkers. The loaders then collected the logs in the processing area, sorted them into groups of uniform length and

Hough 65C - Loader unit for tractor operation. ←

FRI photo

type, and heaped them about the skidsite. Trucks arrived at varying intervals during the day and were loaded either from the accumulated heaps or directly from the processing area.

The loader units therefore had two main functions. The first was to remove wood from the processing area where it would otherwise interfere with the extraction phase, and stack the prepared logs into heaps of various log types (i.e., sorting and stacking). The second function was to load the trucks (i.e., loading.) *Table 2* details the time spent by the two loaders in various activities over the days they were observed. All times were measured by stopwatch.

	Hauler Loader		Tractor Loader	
Activity	Daily Ave. (min)	%	Daily Ave. (min)	%
Sorting and stacking (and associated activities)	224.4	42.0	188.8	38.5
Loading (and associated activities)	180.1	33.7	84.9	17.3
Idle (waiting for work)	94.3	17.7	122.5	25.0
Repairs, maintenance,and refuelling	4.3	0.8	1.6	0.3
Operator rest	31.1	5.8	93.0	18.9
TOTAL	534.2 (8.9 hrs)	100	490.8 (8.2 hrs)	100

Table 2 - Distribution of the Loaders' Time

In the two operations studied, sorting and stacking activities occupied comparable amounts of the recorded time. However, the time spent in loading trucks (and associated activities) occupied a greater proportion of the hauler loader's time as more trucks were loaded over the observed period in that operation (average 6.8 trucks per day in the hauler operation compared to an average 4.7 trucks per day in the tractor operation).

Idle or'waiting for work' time was also similar in both operations; however it was accumulated differently. In the hauler operation, idle time occurredat irregular intervals, usually when problems arose during extraction. In the tractor operation, idle time occurred at regular intervals. The loader was able to sort and stack each haul and accrue idle time before the next haul arrived on the skidsite because the average cycle time of the tractor unit was longer than that of the hauler.

SORTING AND STACKING:

The loader services the extraction unit and its performance is affected by several variables which alter according to the type of system utilised. These variables are:

1. The cycle time of the extraction unit. This sets the limit for the period of unrestricted access the loader has to the haul deposited in the processing area.
2. The volume of wood arriving at the landing with each haul. This determines the amount of wood the loader must move within the period limited by the cycle time of the extraction.
3. The number of different log types into which the haul is cut and the number of pieces in each (this factor is important if one or two particular sorts dominate the cutting pattern).

FRI photo *Fiat-Allis 645B - Loader unit for cable operation* ↑

These three factors interact to determine the amount of time available for the loader to sort and stack each haul arriving on the landing and, to some extent, the pattern of cycles which must be undertaken to achieve this objective. A comparison of the variables observed in the two operations is outlined in *Table 3* below.

	Hauler Operation	Tractor Operation
Average extraction-cycle time (min)*	8	17
Average haul-volume (m^3)*	5	13
No. different log types cut	10	5
Percentage of pieces cut in the predominating log type	27	53

Table 3 - Extraction unit variables which affect the loader

* *estimated*

The sorting and stacking phases of the two operations are therefore quite different. The loader in the hauler operation had a smaller average haul-volume to handle but less time to remove the logs from the processing area, a larger number of types to handle , and a greater spread of pieces within the different log types. This resulted in a different pattern of work for the operator who had to carry out a greater variety of cycles to complete his sorting and stacking.

Ten different cycle types were identified in the sorting and stacking phase for the two front-end loaders observed. The proportions of the various cycles utilised by both loaders differed markedly as the sorting and stacking pattern of the hauler loader was more complex.

The number of log types cut by a gang is possibly the most easily altered variable which can have a marked affect on the ability of a loader within a given system to carry out its allocated functions efficiently. With 10 log types the hauler loader operator was required to maintain a constant high pace of work, whereas the tractor loader with five types could handle its work load comfortably. This factor should therefore be taken into account by those considering changes in the cutting pattern of a logging operation.

LOADING:

Just as the sorting and stacking phase is affected by the extraction unit, so too is the loading phase. When loading a truck the loader can collect its logs from two main sources - either the heaps piled about the landing or the cut logs in the processing area but not yet moved.

The long cycle-times and large haul-volumes of the tractor and arch unit meant that the loader in that system often had time to transfer logs directly from the processing area to the truck deck, thus reducing the amount of double handling. This occurred in 55% of all of its observed loading cycles. In the hauler operation the shorter cycle time and lower haul volumes, and the added necessity to keep the processing area clear of logs, allowed only 18% of the loading cycles to be carried out from the processing area. Double-handling was therefore increased.

Added pressure is placed on the loader in the hauler system because the hauler cannot land the extracted logs in any position other than directly under its ropes. The loader therefore has to remove the logs from the processing area frequently or interference can occur to the extraction unit. More importantly, the skidworkers could be placed in danger. When the loader is loading trucks it often has to return to the processing area to clear wood away. This therefore increases loading time. Because the tractor unit can place its haul in any position on the skidsite, its loader can defer sorting while it is loading trucks without endangering the skidworkers or interfering with the extraction phase.

CONCLUSIONS:

The loader unit within an extraction system is affected by several external factors which influence its work pattern. These must be understood if it is to work efficiently and not create dangerous working conditions for the skidworkers nor interfere with extraction. In the two operations studied where the loader units were of similar capacities, the hauler loader had a higher work content and a more complicated work pattern than the tractor loader because of (1) requirements imposed by the main extraction unit, and (2) management decisions regarding log assortments.

The extent to which loader units affect logging production should be more thoroughly researched. Further work by FRI will examine the important features which influence the ability of a loader to cope with its sorting, stacking, and loading functions within a given extraction system.

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For effective log loader selection and application, an understanding of the factors influencing operational performance is desirable. This pilot study by A. Twaddle of FRI outlines relevant information on rubber-tyred front-end loader application, and LIRA acknowledges the priviledge of being able to publish the report to fit in with the current LIRA log loader project.

For Further Information Contact: N.Z. LOGGING INDUSTRY RESEARCH ASSOC. INC.
P.O.Box 147,
ROTORUA, NEW ZEALAND. Phone 82-620.