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SELF-LOADING TRUCK STUDY

A self-loader truck and trailer unit with a 6 tonne/metre loader working at a thinning operation

INTRODUCTION

Truck mounted hydraulic knuckle-boom log loaders are firmly established only in some areas of New Zealand. In other areas, they are becoming increasingly important, particularly where production per day from individual gangs is low. As scattered woodlot logging increases, it is expected that they will assume a more important role.

This study examined how self-loaders are being applied in New Zealand forests today, and what factors affect the efficiency of their operation. The first objective was to determine the number of units in use. The effects of crane size, grapple size and crane position were also studied.

ACKNOWLEDGEMENT

This report is a summary of a study completed by Robert Van Rossen of Canterbury University in 1982. The full dissertation report, entitled "Self-Loading Trucks", is available on loan through LIRA's library.

INFORMATION AND DATA COLLECTION

A literature search revealed that the topic has been extensively studied in those countries where self-loading trucks have a major role. To obtain information on the New Zealand experience, a questionnaire was circulated seeking information on operator experience, servicing and parts availability, and views on the machine design and operating characteristics.

REGIONAL DIFFERENCES IN SELF-LOADER OPERATIONS

Trucks were studied in Tokoroa and Canterbury where self-loaders are most common. In the North Island, a typical unit consisted of a 350 hp truck fitted with a 6 tonne/metre capacity loader. In Canterbury, an average unit was a 220 hp truck fitted with the same capacity loader. Rigs in the North Island tended to be newer and the most powerful units were also found there (two trucks had loaders up to 13 tonne/metre capacity).

Of the eight trucks seen in the North Island, two were truck and trailer long log units with the loaders mounted behind the cab. Five were full trailer units with their loaders mounted in between the truck and trailer. The eighth truck was a shortpulp bin truck with the loader behind the cab. In Canterbury, eleven trucks had full trailer units with loaders mounted between the truck and trailer and seven had loaders behind the cab. Life expectancies of the loaders were considerably longer in Canterbury, but as a result they experienced more downtime due to maintenance problems. In the North Island, service from distributors was a major problem compared to that in Canterbury.

Cartage was mainly off-highway in the Tokoroa region. Haul distance averaged 19.5 km with the longest haul being 35 km. Payloads were very high due to the absence of road weight regulations. The average payload observed was 31 tonnes. Trucks here were hauling mostly from low production gangs in thinning operations or from steep areas where landings were small or non-existent. Large stackers were used for unloading. In Canterbury, the average haul distance was low but ranged to over 100 km. The average payload was 20 tonnes as on-highway hauling was common. Self-loaders were used here because of the high proportion of scattered woodlots and low production from small forests. Access to load-out sites in this area was generally good and occasionally the units could drive right into the stand. At mills, the loads were usually winched off or unloaded using the loader on the truck.

LOADER CHARACTERISTICS

In selecting a loader, operators considered parts and service availability, presumed reliability and lifting capacity. Most chose the grapple fitted as standard by the manufacturers. Several operators felt the loaders were under-powered for their purposes. Experience had shown that mounting a loader could prove hard on the truck chassis, which some operators had therefore strengthened.

Having the loader mounted behind the cab meant that it was possible to carry the trailer on the truck. A disadvantage of front-mounted loaders with full trailer units was that to load the trailer it had to be detached from the truck and positioned alongside.

The gross vehicle weight regulations applying to on-highway hauling meant that the addition of permanently mounted loaders effectively reduced the truck's payload. This payload loss (of up to 2.5 tonnes) resulted in increased haul costs.

The majority of loaders were operated from a seat mounted on top of the king post where the operator had good visibility over his work. Other loaders were operated from the ground. The best control layout was where control movements corresponded to loader movements in a logical fashion.

RATE OF LOADING

The loading rate is the product of two variables, the cycle time and the weight per grapple load. The factors which may have a significant influence on the rate of loading are :

(1) The lifting capacity and reach of the loader

(2) The piece size of the logs

(3) The presentation and accessibility of the wood

Operator skill is also important but this factor was not measured. All operators were considered experienced. The loading rates observed during the study ranged from 0.34 tonnes/minute (t/min) to 1.60 t/min with an average rate of .87 t/min. The mean rate for sawlogs was 0.92 t/min compared to the mean rate of 0.82 t/min for pulpwood/chipwood.

AVERAGE WEIGHT PER GRAB

Sixteen sample loads were taken from six loaders, each of 6 tonne/metre capacity. Although the maximum reach of this loader type was 7.3 metres, the average working reach was 5 metres. The calculated average weight per grab for each of the sixteen loads measured ranged from 0.49 tonnes to 0.86 tonnes, with an average of 0.72 tonnes.

The volume capacity was limited by the size of the grapple. The majority of the logs handled during the study were 5.8 metre lengths, although this length varied, especially with off-highway cartage. All of the six loaders were fitted with the same type of grapple. Given a constant log length, the relative uniformity of the weight per grab suggests that cross-sectional area of a grapple load did not vary greatly. The operators tended to fill their grapples to the same extent each time.

STACK PRESENTATION AND LAYOUT

Good stack presentation and accessibility are vital factors affecting the loading efficiency of an operation. In most cases, the load out sites were small. Where the turning space was restricted or ground conditions were damp, there was some difficulty manoeuvring a truck and trailer into position. In Canterbury, it was common practice to double handle wood in this situation.

The distance between the stack and the position in which the truck can align itself is very important. Self-loading trucks are limited by the maximum reach at which their loaders can operate.

Transferring a load of logs from the truck to the trailer (double handling situation)

A thesis* completed at Oregon State University concluded that the quality of stack presentation and the orientation of the stacks had a significant influence on loading rates. The results indicated that log stacks at angles between 20° and 45° were loaded faster than stacks parallel to the road, due to reduced slewing arcs. The quality of stack presentation affected the speed of loading in the study although with larger piece sizes, stack presentation became less important. Where one grab consisted of only one log, loading time was not affected by presentation at all. In a neatly aligned stack with little debris, picking up a dozen or so small diameter logs was achieved with little difficulty in one closing movement of the grapple jaws. Where the stacks were rough or there was a lot of debris, the operator had to spend time accumulating a grapple load.

SUMMARY

In future operations, more wood will be logged from steeper country, thinnings and farm woodlots. Daily production in many of these areas will be relatively low due to smaller piece sizes, small log sales and scattered sites. These factors combined with, in many cases, reduced landing areas will create a greater demand for self-loading trucks.

The study suggests that improvements in self-loader operations could result from the following:-

(a) Ensuring log stack presentation is organised for higher performance by assembling neat stacks free of debris.

(b) Forming stacks at an angle to the road to reduce slew time.

(c) Fitting larger grapples to units handling short length logs.

(d) Using detachable loaders, particularly where trucks are doing a number of trips to the same area. This enables payloads to be increased, especially on-highway.

(e) Introducing specialised training schemes to improve the productivity and operational safety of self-loading trucks.

*Ref. Clark, Cedric J. - "A Case Study of the Influence of Log Deck Configurations on Loading with the Self-Loading Truck". A paper submitted to Oregon State University in partial fulfillment of the requirements for the degree of Master of Forestry (1978).

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