Session 6
Paper (b)

OPTIONS FOR SMALL LANDING CABLE HAULER OPERATIONS

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ABSTRACT

The arrival of new generation hauler equipment from the Pacific Northwest has brought about an increase in the productive potential of New Zealand mobile hauler operations. The application of these haulers has been mainly to small landings in the regional forests.

Landing organisation has been identified as an important component in maximising productivity of a hauler. The landing layout for case studies of two different cable hauler operations is described.

Time and productivity data were collected for each operation. Interference levels between work zones, production, and efficiency of each operation are discussed.

INTRODUCTION

Processing and loading at hauler landings have been identified as important components which influence hauler utilisation and productivity (Williams 1989). Ideally the productivity of the landing operations should exceed that of the hauler in order to ensure productivity is dictated by the prime mover (hauler). Research carried out during the 1980's has set the scene for the arrival of new equipment from the Pacific Northwest to log some of New Zealand's regional and environmentally sensitive forests.

Studies by LIRA found that hauler landings using hydraulic knuckleboom loaders, for fleeting and loading, were significantly smaller than those using rubber tyred front end loaders (Raymond, 1987). Hydraulic loaders were found to be superior at fleeting over the rubber tyred loaders however they were also found to be slower at loading (Duggan, 1989a). Processing trees in a separate area away from the chute was found to increase hauler utilisation and production through reduced interference to the hauler (Duggan, 1989b).

Hydraulic loaders were found to be capable of sorting, stacking and loading with minimal interferences to the hauler in a small landing situation. Truck scheduling was identified as an important factor to ensure a smooth woodflow (Kellogg, 1987). By 1989 it had been established that separating the chute, processing, and loading zones was the key to minimising landing delays to the hauler and improving landing efficiency.

In 1990, the first Madill 171 arrived in New Zealand, this hauler belongs to a genera of highly mobile haulers with faster linespeeds and larger linepulls than their earlier counterparts. Since then a number of similar machines have been imported, many of them destined for regional forests where environmental constraints limit landing sizes to, in general, a maximum of 0.2 ha. It was clear that a knuckleboom loader was to be the key machine for stacking and loading, however it was believed that a second machine may be required so that the landing could cope with the higher productivity levels expected expected of the new haulers.

Options for the second machine included either a Bell Ultralogger, a second knuckleboom loader, or a delimber/processor. This presentation aims at extending the results of LIRO research undertaken over the last year which has investigated landing layout, productivity and efficiency for the second loader or delimber/processor options.

MOBILE HAULER OPERATION

A Madill 171 operation was studied at Mohaka forest. The operation consisted of two knuckleboom loaders at the landing to clear the chute, sort, stack, and load trucks. The stand being logged was 29 year old radiata pine at a stocking of 269 stems/ha and average piece size of 2.25m^3.

The hauler used a Northbend system with two, eight metre strops attached to the rigging. One to two breaker-outs hooked up the trees which were then pulled across a gully to a landing sited on a small knoll. Upon arrival at the landing the trees were cleared from the chute by a CAT 225 loader to an adjacent processing area. Three to four skidworkers processed the trees into eleven log sorts and a CAT EL300 loader fleeted logs into mixed stacks. Logs which the EL300 could not reach were either stacked or presented to it by the 225 loader. Long lengths were stacked beside the loading zone furthest from the landing entrance and adjacent to where the longs unit of the truck would be placed. Similarly the short length logs were stacked within easy reach of the front of the truck. Peeler logs were stacked on the opposite side of the loading zone.

Trucks reversed onto the landing and were loaded from the side (Figure 1). The average time to prepare and load a truck was 19.5 minutes. Docket writing took a further 5 minutes.

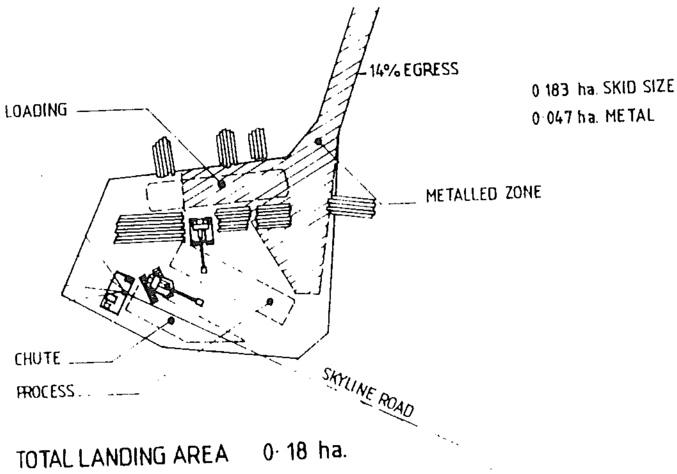

Figure 1 Landing layout; Madill 171 Operation.

The standard landing formation prescribed by the forest company was for a stumped area of 0.16ha (40m by 40m) in as round a shape as possible. Only the truck loading zone was metalled. The study landing had a metalled area of 0.05ha of a total landing

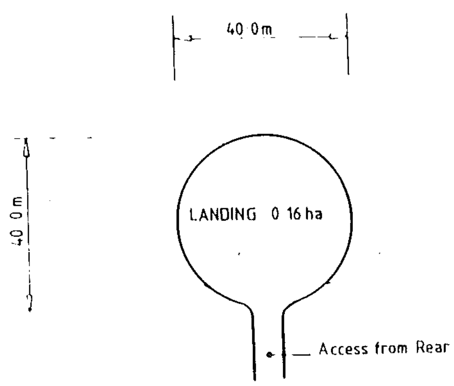

Figure 2 Preferred landing shape.

area of 0.18ha. For ease of truck access for loading and landing layout the contractor preferred the access to come onto the landing centrally and to the rear when facing the setting (Figure 2). The preferred hauler position was to one side of the landing in order to minimise interference from the guylines to the landing processes.

Three days of continuous time data were collected on the hauler, and all landing operations were measured using an activity sampling technique. Individual drag volumes were measured as they arrived at the landing.

	Day 1	Day 2	Day 3
Cycle time[1] (min)	4.18	4.36	4.33
Haul distance	113m	119m	114m
Drag volume (m^3)	3.5	3.5	3.3
Daily production	326m^3	265m^3	282m^3

[1] Time,distance and volume are mean values.

Table 1 Summary data from hauler extraction.

During the study the operation produced an average of 291m^3/day (Table 1). Daily production varied significantly from day to day, results are therefore presented as daily summaries.

Operation	Proportion of Day (%)		
	Day 1	Day 2	Day 3
Productive time	69.5	64.0	69.0
Mechanical delay	1.5	0.0	0.0
Personal delay	15.0	17.5	15.0
Landing interference	0.0	5.5	1.0
Rigging delay	10.5	10.0	10.0
Other delay	3.5	3.0	5.0
Production (m^3/day)	326	265	282

Table 2 Hauler time distribution.

Time data from the hauler showed that productive time was lowest during the second day of the study (Table 2). Tests showed that neither cycle time, haul distance or drag volume varied significantly from day to day (5% level). When utilisation and production were at their lowest, interference from the landing was at its highest. Interference to the hauler arose mainly from the CAT 225 loader having difficulty clearing trees from the chute. These delays amounted to a loss in productive time of 27 minutes which, given cycle time and drag volume, amounts to 22m^3 of production.

Time analysis for the CAT 225 loader show its primary job was to clear the chute (Table 3). Fleeting logs into stacks, or to the second loader was a secondary task for the machine. The 225 loader had low levels of interference from both the skidworkers and the hauler. The loader

Operation	Proportion of Day (%)		
	Day 1	Day 2	Day 3
Clear chute	33	30	45
Fleet	22	26	14
Clear landing	5	17	13
Assist skiddy	3	2	4
Assist hauler	4	0	5
Interference skiddy	1	1	1
Interference hauler	2	1	1
Operational delay	5	2	2
Mechanical delay	2	3	2
Idle/Wait	23	18	13
Production (m^3/day)	326	265	282

Table 3 Cat 225 time summary.

had significant levels of idle/wait time, it is interesting to note that the highest production day had the most idle/wait time. This time seemed to be mostly redistributed to clearing debris from the landing on the other two days.

Fleeting and loading were the primary tasks for the CAT EL300 loader (Table 4). This loader had virtually no interference to either the hauler or the chute clearing loader, however some interference delays were caused by the skidworkers working in close proximity. The EL300 loader had little time idle or waiting for work, however even when the operation was producing over 320m^3/day it was still able

Operation	Proportion of Day (%)		
	Day 1	Day 2	Day 3
Fleet	54	53	57
Load	25	30	22
Write docket	7	5	5
Clear chute	1	1	3
Clear landing	2	5	3
Assist skiddy	2	0	2
Assist hauler	2	0	0
Interference skiddy	2	1	3
Interference hauler	0	0	0
Operational delay	1	2	2
Mechanical delay	0	0	1
Idle/Wait	4	3	2
Production (m^3/day)	326	265	282

Table 4 Time summary for CAT EL300 loader

to keep up with production and load out 8 trucks during the shift.

	Proportion of Day (%)		
	Day 1 (4 men)	Day 2 (3 men)	Day 3 (3 men)
Productive time	47.5	46.0	53.0
Saw maintenance	17.5	20.0	20.0
Assist hauler	1.5	13.5	7.5
Interference loader	3.5	7.0	10.5
Interference hauler	0.0	0.5	0.0
Personal delay	2.0	2.0	2.0
Idle/wait wood	20.0	11.0	7.5
Other	8.0	-	-
Production m^3/day	326	265	282

Table 5 Skidworker time summary.

The number of men working at the landing changed from four men on day one to three men for the following two days. Time analysis shows interference from the loaders was lowest on the most productive day. This may have been due to the presence of the extra man helping to minimise the time the men spent working in the path of the loaders. The extra man on day one may also have influenced the increased idle/wait time as trees were processed faster by the larger team.

SWING YARDER OPERATION

A swing yarder operation was studied working in clearfell radiata pine at Lismore forest. The operation typically worked small landings and used a stroke delimber for the majority of processing.

The machinery used at the landing included a Thunderbird TSY 255 swing yarder for hauling, a Denis DM3000 stroke delimber mounted on a Thunderbird 736 excavator base for processing, and a Thunderbird 838 (40 tonne) heelboom loader for fleeting and loading.

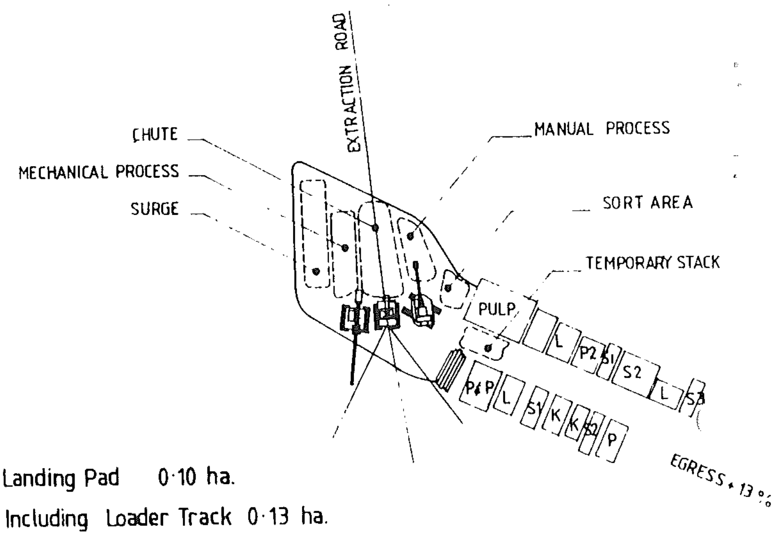

Figure 3 Landing layout, swing yarder operation.

The hauler used a running skyline system with a Danebo mechanical slack pulling carriage and three, eight metre strops to extract material uphill to the landing. Three breaker-outs were used to hook up tree lengths and butt logs which had been cut to length on the flatter ground. The drags were landed into the chute where the yarder slewed around to present the wood to the delimber. The larger trees were cleared away to a separate zone where they were processed manually by two skidworkers (Figure 3).

The delimber processed trees into logs turning them end for end to complete the processing. A separate surge area was used for storing tree lengths when the chute became full. Processed logs were then placed in front of the hauler to present them to the loader.

The loader sorted both the mechanically and manually processed logs to either the sort area or the temporary stockpile. Logs were then cleared to their individual stacks. Trucks reversed down the loader track where they were loaded from the rear. Three shorts units were timed for loading. The average loading time/truck was 9 minutes, including truck preparation, for an average of 38 pieces/load.

The terrain at Lismore forest is characterised by sharp spurs 300m to 400m apart. Hauler pads are placed on these spurs and are typically very small. At the landing under study the pad was only 0.1 ha in size. Placement of machinery on the landing is dictated by the position of the yarder (Figure 3). If there is not enough room for a machine either side of the yarder then the delimber sits closest to the yarder and the loader is sited on the other side of the delimber.

	Mean Values (2.5 days)
Delay free cycle time (min)	6.34
Haul distance (m)	233
Drag volume (m^3)	4.15
Daily production (m^3/day)	270

Table 6 Summary data from yarder extraction.

Two and a half days continuous time data were collected on the yarder, and an activity sample was carried out on the delimber, loader, and the two skidworkers. Drag volumes were estimated from the average extracted piece size determined from 100 pieces scaled within the setting. During the study the operation produced 270m^3/day over an average haul distance of 233m (Table 6).

Time data from the hauler showed rigging delays to be the largest delay (24%). The majority of this delay was due to splicing ropes, and this was a reflection of the difficulty of the setting being logged where a new eye was put on the tong line each day and one long splice was required when one of the main ropes failed. Interferences from the landing were low (2%) and arose mainly from the skidworkers (Table 7). Both the loader and the delimber caused very little interference to the hauler.

Operation	Proportion of day (%)
Productive time	67.0
Mechanical delay	0.0
Personal delay	6.5
Landing delay	2.0
Rigging delay	24.0
Other delay	0.5
Production (m^3/day)	270

Table 7 Yarder time distribution.

Activity sample data from the landing was collected at half minute intervals over a period of 8.25 hours. Time data from the delimber and loader showed levels of utilisation were 68% for the delimber and 73% for the loader (Table 8). The highest levels of interference came from the skidworkers (8.3% and 13.1% respectively). This was normally due to the machines waiting for the men to move clear before they were able to continue work. The large percentage of idle/no work for the delimber was due to the delimber not being able to process all of the wood being extracted. This difficulty was alleviated to some extent by the removal of some of the butt logs during the felling of the stand.

	Proportion of Day (%)	
	Delimber	Loader
Productive time	68.3	73.2
Idle/ no work	14.5	8.7
Interference skiddy	8.3	13.2
Interference loader	0.5	-
Interference delimber	-	0.5
Interference hauler	0.3	1.1
Mechanical delay	6.7	3.0
Personal delay	1.4	0.3

Table 8 Time Distribution, loader and delimber.

During the course of the study up to four skidworkers worked the landing. This was due to assistance from the contract faller and one of the breaker-outs. Data collected was restricted to only the times when two skidworkers were present, this was done to capture the normal working environment at the landing.

Time data for the two skidworkers was combined to obtain an average time distribution per skidworker (Table 8). The proportion of the day spent in productive work by the skidworkers was 39.5%. Interference from machinery did not appear to pose much of a problem to the skidworkers. Time spent idle/waiting for work (45%) suggests that at this level of production only one skidworker would be necessary at the landing.

SUMMARY

Both landings studied produced in excess of 260m^3/day. Daily production rates over 300m^3/day occur and it is apparent that the fleeting and processing machinery had the capacity to handle extra production.

	Proportion of Day (%)
	Skid-worker
Productive time	39.5
Saw maintenance	8.5
Assist hauler	3.5
Interference loader	1.5
Interference hauler	2.0
Idle/wait wood	45.0

Table 9 Skid-worker time summary.

Results from the two case studies indicated low levels of interference between the heavy machinery working on small cable hauler landings. This may be attributed to a combination of separating the work zones for each machine, and the relatively static position of excavator based fleeting and processing machinery.

Interference to machinery from the skidworkers appeared higher on the smaller landing. It was noticed that when skidworkers retired to a safe point behind the hauler they crossed the loaders workspace. This highlights the importance of organising safe workspaces for men working amongst heavy machinery. Many hauler crews have a working procedure to operating the landing where issues such as right of way, priority and safety are understood by all men working at the skid.

The amount of time skidworkers spent idle or waiting for wood ranged from 7.5% to 45%. When an operation is producing below its normal rate, the flexibility of the manpower needs to be used and this could be seen at the Madill 171 operation where the fourth skidworker spent the extra available time learning to operate the hauler. In some situations however it may be worthwhile keeping an extra man working at the skid even on the slower days. This may be necessary in order to keep interference to the machines at a minimum by getting the job done quicker with more men.

The Madill 171 operation showed how small interference levels could be attained through separation of work spaces. The combination of excavator loaders and loading zone placement minimised the surfacing requirement at the landing. Variation in day to day production showed the flexibility of the landing operations to cope with the capacity of the hauler

The swing yarder operation showed itself capable of working a very small space with both mechanical and manual processing. The success of this operation on such a small landing was attributable to not only to the presence of the delimber but also to the method of placing the stacks off the landing along the roadside, and use of a live heel to load trucks over the rear from the loader track.

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