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DROPLINE CARRIAGE ON MADILL 071

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ABSTRACT

A dropline carriage was introduced to a Madill 071 operation in New Zealand. Results from a study showed that the carriage had considerable potential even though it was not being used in the best of situations.

Daily productivity of around 236m^3 was calculated from the cycle times and volumes recorded. Considerably higher production could be expected when the crew has gained more experience using this type of system and setting layout is better planned to suit dropline carriage operation.

It is recommended that Madill 071 owners should look seriously at the dropline carriage concept if they want to increase flexibility and improve efficiency.

INTRODUCTION

Hooking logs on to the rigging is usually the longest element in any cable logging cycle. The time taken to do this and the number of logs hooked on is often governed by the amount of slack available to the breaker-outs. Some systems such as highlead, slackline and basic shotgun have no slackpulling capacity and so the swath taken out with any one lineshift is limited to the length of strop available.

Figure 1 : A Dropline carriage can improve the efficiency of an Madill 071

Lateral hauling is possible with Northbend, Southbend and Block in the Bight systems but it is necessary to set an additional block in the tailrope to "bridle" the fall block away from the skyline. The degree of lateral hauling however is limited to a narrow path from the carriage to the last tailrope block, and "slack" is restricted to the length of the strop.

Special carriages like the Christy (Hemphill, 1985) and Koller (Duggan, 1989) facilitate manual slackpulling in shotgun systems by locking or clamping themselves to the skyline. With modification both carriage types can mechanically power slack out using the tailrope (Fry, 1983; Hemphill, 1985) although past experience with this concept has not been entirely successful.

There are two types of purpose built MSP (mechanical slackpulling) carriages, the double sheaved MSP carriage which feeds a pre-determined length of dropline through the carriage using the tagline, (e.g. Young YCC13, Danebo MSP) or the 3 drum, dropline carriage which spools a separate length of dropline from the centre drum of the carriage. MSP carriages can only be used on 5 drum skyline haulers or 4 drum running skyline machines.

Madill 071 haulers, are designed to operate MSP systems but in New Zealand they have been predominantly used with the Northbend system (Murphy, 1979). Improvements in performance had been recorded with MSP carriage operation (Mythen & McConchie, 1987) but little was known about dropline carriages.

One of the earlier "West Coast" three drum carriages was tried on a Madill 071 in Tairua Forest during the late 1970s. The heavy metal shield encasing the drums of this carriage made it difficult to rig and reduced the payload that could be carried. Long production delays, small drags and a lack of suitable planning resulted in poor performance and a reluctance to use it.

The design and construction of these 3 drum carriages has since been improved to make them easier to operate. Recently a 3 drum Interstate I-DLC 36S carriage was imported by Mitchell Bros. in Tapanui for use on their Madill 071. This report describes the operating procedures with the carriage and presents the results of a brief study of it.

ACKNOWLEDGEMENTS

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DESCRIPTION OF EQUIPMENT

The Madill 071 is a 5 drum skyline hauler mounted on a tracked undercarriage and incorporating a 15m integral tower (Donovan, 1978). The ropes used on Mitchell's machines were:

Skyline - 26mm
Mainrope - 22mm
Tagline - 10mm.

The Interstate I-DLC 36S is a 3 drum dropline carriage previously reported on in conjunction with a study of a Madill 171 (Prebble, 1989). Although Interstate no longer manufacture dropline carriages, the I-DLC 36S is available second-hand through the US market and Danebo make a S-35DL drumlock model. The new price for this carriage is $27,000 (N.Z. dollars).

Basic specifications of the Interstate carriage are shown in Table 1. All drum flanges are guarded with a continuous band and the dropline is guided into the carriage with a 23mm sheave and two side rollers.

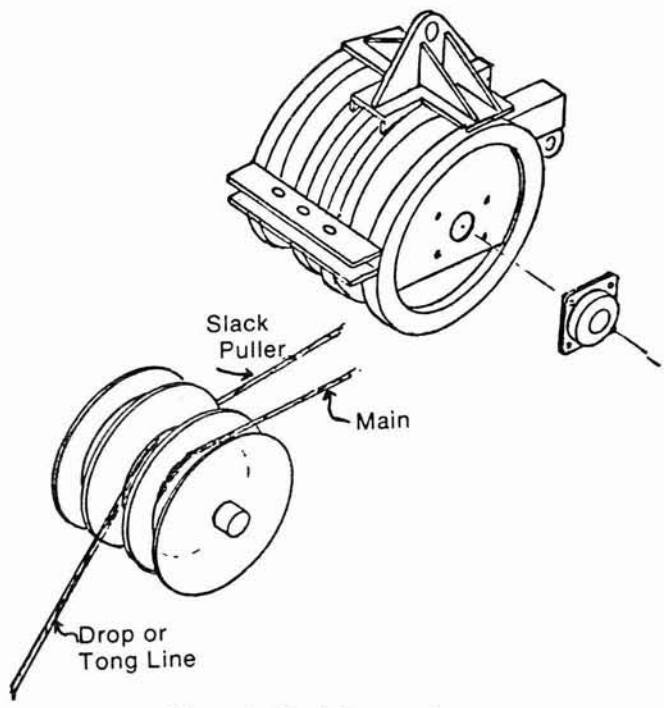

Figure 2 : Basic layout of Interstate I-DLC 36S carriage

Table 1 : Specifications

Weight (without ropes) - 726kg			
Drum Dimensions:			
Drum	*Mainrope*	*Dropline*	*Tagline*
Core diameter	*51cm*	*36cm*	*51cm*
Drum width	*13cm*	*13cm*	*13cm*
Flange size	*91cm*	*91cm*	*91cm*
Capacity (m)	*76-137*	*up to 76*	*76-150*
Rope size	*19mm*	*19mm*	*12mm*

These 3 drums are fixed to a common 62mm diameter high strength shaft so that when 1 turns all 3 turn.

To rig the carriage the mainrope is overwound on the left hand drum (assuming you are standing at the hauler facing the carriage). The dropline is overwound on the centre drum and the tagline is underwound on the right hand drum (see Figure 2). When first rigging the carriage a length of strawline (about 100-150m) has to be wound on to the mainrope drum by hand. The tagline is then connected to the right hand drum and by pulling in on the strawline, the tagline is reeved on to its drum.

The length of strawline is removed and replaced with the mainrope which is wound on to its drum by pulling in on the tagline. When there is enough mainrope on the drum and the tagline drum is nearly empty, the dropline is connected to its drum and by pulling in on the mainrope, both tagline and dropline are wound in to their respective drums. The dropline feeds in to the carriage through the fairlead at the bottom of the carriage. Strops are connected to the loose end of the dropline.

At the start of the logging cycle, the tag and dropline drums are full (strops are right up to the carriage) and the mainrope drum is virtually empty. In this state, the carriage is outhauled to the break-out site and held in position there by the tailrope. By pulling in on the tagline and releasing brake tension on the mainrope, the 3 drums in the carriage turn and the dropline is fed out to the breaker-outs. At the same time, the mainrope is wound on to its drum "loading" it ready for break-out. When the logs are hooked and the signal given, the mainrope clutch is engaged and tension released on the tagline brake. This winds both the dropline and the tagline into the carriage and simultaneously "primes" the tagline for the unhooking process at the landing. During inhaul, both the mainrope and tagline have to be pulled in at the same speed to keep the drag up to the carriage.

Table 1 shows that the mainrope and tagline have larger drum core diameters than the dropline. This gives the mainrope a 1:1.42 purchase on the dropline which increases the break-out force available through the carriage (big drum turning small drum). Applying the same principle, the larger tagline drum effectively gears down the dropline speed which gives better control of the slackpulling process.

The degree of break-out force can be increased or reduced by altering the amount of mainrope on the drum in the carriage, i.e. additional rope on the drum increases diameter which effectively increases power. This extra power also results in less tailrope brake pressure being required during inhaul because the ratio of the purchase is increased.

OPERATION DETAILS

The carriage was first set up in Compartment 210 in Timberlands Blue Mountain Forest, Tapanui. The stand was 63 year old P Nigra with an average piece size of approximately $1m^3$. Whole trees were being extracted to the landing where they were processed into five sorts and fleeted with a Michigan 55 rubber tyred loader. Three 7m long strops were used on the dropline. The crew consisted of:

- 2 machine operators
- 2 skiddies
- 2 breaking out
- 1 falling
- 1 utility person pre-rigging and assisting where required.

The setting was a narrow strip between a riparian belt along one side of a stream gully and the road. It was not really suited to dropline carriage operation because of the limited deflection available and the presence of two prominent intermediate ridges dissecting the profile (see Figure 3).

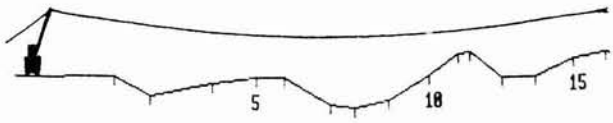

Figure 3 : Profile of dropline carriage setting (325m)

Extensive tailhold rigging was necessary to obtain sufficient deflection. After an introductory period of less than three days operation with the carriage, a brief production study was undertaken.

RESULTS

The results of the study are shown in Table 2.

Table 2 : Average Cycle Time for Madill 071 with Dropline Carriage

Element	*Time, mins*
No of cycles	*85*
Raise rigging	*.23*
Outhaul	*.67 (200m)*
*Position**	*.42*
Lateral out	*.22 (11m)*
Hook on	*1.73 (3.7pcs)*
Break-out	*.29*
Inhaul	*1.23 (200m)*
Lower rigging	*.14*
Unhook	*.51*
Delay free total	*5.44(SD=1.08)*
Operational delays	*.46*
Landing delays	*.03*
*Rigging***	*.64*
Other (smokos, etc)	*.86*
Total cycle times	*7.43*
No of pieces	*3.7*
Average drag volume	*3.87m^3*
Productivity per hour	*31m^3 (30pcs)*

Note:
* *Position included untangling strops.*
** *Rigging time does not include the time taken to set up the tailhold.*

Outhaul and inhaul times have been standardised to 200m using the regression equations:

$$out = .081 + .003\,(Dis), \quad r^2 = .82$$
$$Inh = .547 + .003\,(Dis), \quad r^2 = .35$$

The poor reliability of the inhaul equation reflects the difficulty of the profile being logged. Frequent stoppages were necessary to raise the skyline during inhaul (59% of the cycles had delays attributable to inhauling). An overheating problem with the tagline clutch caused slack in the tagline which also slowed inhaul speeds over the longer haul distances.

The rigging delays occurred as follows:

- 26 min lost when the tag line broke (the tower had to be lowered)
- 17 min lost to a lineshift (including moving the hauler)
- 3 min for changing strops on the dropline
- 6 min taken to move the tailrope block.

DISCUSSION

Based on the study data, productivity per 8 hour shift would be 236m^3 assuming machine availability of 95% (i.e. 31m^3 x 8 x .95). This is high compared to an earlier study on a Madill 071 using a Danebo MSP carriage where a daily production of 174m^3 per day was predicted (Mythen & McConchie, 1987). The operation was in log length Douglas fir with a similar average extracted piece size. Machine utilisation in the dropline carriage study was 73%.

From a practical viewpoint, the crew found the carriage easy to operate and were impressed with the advantages that mechanically powering slack offered when breaking out. The average distance of lateral pull was 11m and the maximum distance 42m.

The operator adapted quickly to the use of the fourth drum on the hauler and apart from the occasional snagging of the tagline managed to keep the two ropes inhauling

at the same speed. A 200m section of 12mm rope has since been added to the tagline to reduce the frequency of breakages.

There were no bird's nesting problems recorded with the dropline in the carriage although subsequent to the study, Mitchell Bros. have indicated that the dropline only lasts about 130 hours.

The daily cost structure of owning and operating a Madill 071 is shown in Figure 4 (excluding operator). It can be seen that the $20,000 dropline carriage constitutes a very small proportion of the overall costs.

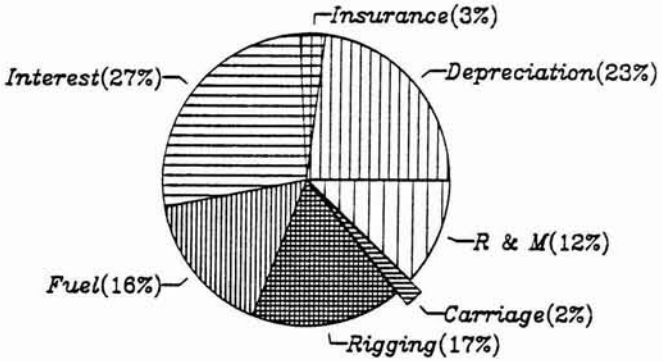

Figure 4 : Daily Cost Structure of Owning and Operating a Madill 071

CONCLUSION

Productivity of the Interstate I-DLC 36S on the Madill 071 was high even though the setting was not suited to dropline carriage operation. Future planning should avoid using the carriage in areas with such limited deflection.

The crew quickly learnt how to take advantage of the features of the dropline and very little carriage related downtime was recorded. Productivity could increase even further as the crew gains experience with the carriage. Slackpulling distances and the possibility of pre stropping are subjects for further investigation.

The disadvantages of higher tare weight and longer set up times with the dropline carriage appear to be offset by easier breaking out, increased lateral pulling capacity and faster cycle times. The daily productivity recorded in this study would make the Madill 071, dropline carriage combination cost competitive with other logging systems.

Madill 071 owners should be looking closely at the dropline carriage concept if they want to increase the flexibility and efficiency of their haulers.

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