TECHNICAL NOTE

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THE USE OF MOTORISED SLACKPULLING AND SKYCAR CARRIAGES IN CABLE OPERATIONS

Warwick Palmer and Peter Robinson
Forest Engineering Researchers

Introduction

Motorised carriages have been available in New Zealand for some time now. With clearfell cable operations looking to become more flexible and efficient, the introduction of such a carriage may be what is required to help improvements in these areas.

This Technical Note compares the two main types of motorised carriage that are being used in New Zealand; the motorised slackpulling carriage and the skycar. Notes are presented on the general differences of construction and operation.

General Specifications

Carriage Type	Rope size (mm)	Weight (kg)	Cost $(NZ)
Motorised slackpulling carriage	19 - 25	775 - 2180	$89,000 - $96,000
Skycar	14 - 16	1250 - 3630	$137,000 - $153,000

Hauler Suitability

Both the motorised slackpulling carriage and the skycar are suitable for 2-4 drum yarders. However, on a 2 drum yarder the systems are limited to shotgun.

Figure 1 - Motorised slackpulling carriage

Liro Forestry Solutions

Private Bag 3020, Rotorua, New Zealand
Telephone: +64 7 348 7168 Facsimile: +64 7 346 2886
Email: warwick.palmer@fri.cri.nz

General Comparisons

Rope Wear

The slackpulling sheaves on a motorised slackpulling carriage can, on some models, crush the end of the mainrope, reducing the rope life considerably. Also some damage may occur to the mainrope due to the sheaves skidding on the rope.

The skycar has its own skidding drum, so crushing from slackpulling sheaves does not occur. Rope life of up to two months can be expected with good operators on the controls. An added advantage is that the yarder mainrope life is extended due to its lower work rate (no bights induced by sheaves or blocks).

Rope Size

In New Zealand clearfell operations, mainrope on yarders generally range between 19 mm and 25 mm whereas the dropline on a skycar range between 14 mm and 16 mm.

The skycar's lighter winchrope means lighter strops can be used, which makes handling easier for the breakerouts. Pulling 16mm rope as opposed to 22mm rope makes life easier and so becomes a factor in reduced hook-on times, as well as enabling wider corridors to be pulled.

Carriage Positioning Control

Motorised slackpulling carriages have the ability to clamp to the skyline to enable the best breakout angle and control of drags during breakout and inhaul. This feature was instrumental in the success of harvesting radiata pine from a highly sensitive setting in Riwaka Forest (Liro Report Vol. 21 No.1, 1996).

It is possible to purchase a skycar with a skyline clamp. These are very rare and are normally fitted to skycars used in thinning applications where, if shotgunning the clamp is needed to hold the carriage in line with the extraction corridor. Under normal operation, the mainrope or tailrope is used to position the carriage.

Slackpulling Ability

Motorised slackpullers are limited only by the amount of yarder mainrope. However, more effort is required by the motor to power slack if excessive sag in the mainrope occurs, or if slack is required over a long distance.

The skycar does not pull mainrope slack from the yarder, but has its own skidding drum, so it is not affected by the length of span.

Dropline Flight and Inhaul

The skycar can raise and lower the dropline on the fly, whereas motorised slackpullers cannot; they have to be clamped to the skyline before slack can be pulled, regardless of whether the carriage is over the drag or at the landing.

As the distance between the skyline and the ground profile increase, the advantages of lowering the dropline on the fly become more apparent. This means there is less delay in getting the strops to the breakerouts.

Combining the inhaul from the yarder and skycar allow for quick drag speeds.

It is these features of the skycar that largely contribute to faster cycle times than the motorised slackpuller. Dropline flying patterns can be illustrated as squares versus arcs (Figure 2).

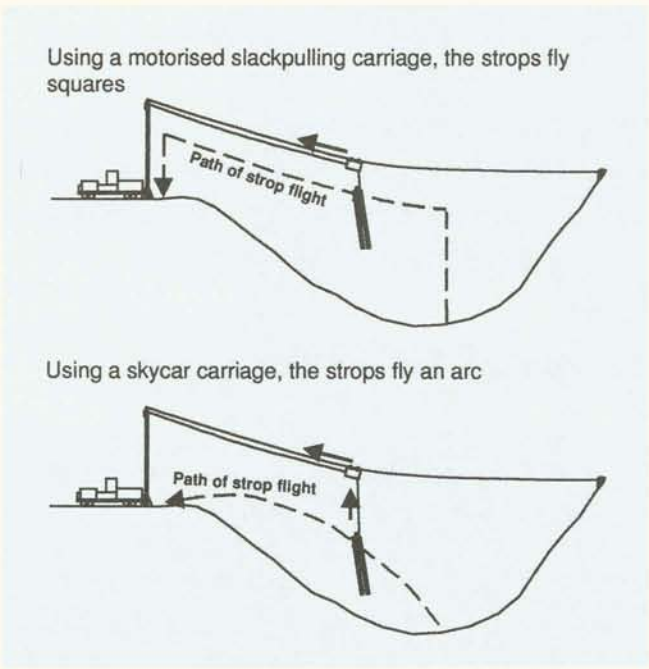

Figure 2 - Difference in strop flight

General Comments

- The ability for both carriages to provide slack to the breakerouts for the purpose of lateral pulling is a big plus. It means wider corridors can be made off one skyline road and therefore reduces the number of skyline shifts.

- Both carriages are ideal for pre-stropping, if the conditions allow it. One breakerout can run the toggle or hook through the rings while the other breakerouts take the strops and plan their next drag.

- Both carriages offer good control of the drag from the breakout phase to inhaul. At inhaul the motorised slack pulling carriage can be clamped or released at any time to the skyline, which allows the breakerout to "steer" the drag, (the carriage must first be stopped before clamping). This operational procedure may be necessary in steep broken country to avoid stem breakage. The skycar can either use the winch on the carriage, or mainrope on the hauler, or combine the two to provide the best control over the drag.

- One advantage the motorised slackpulling carriage has is the ability to bridle long distances. This can be done by attaching butt-rigging to the end of the mainrope, and pulling the mainrope laterally with the tailrope. The carriage is clamped to the skyline while pulling slack which makes it easier for the breakerouts to "spot the rigging".

- On some makes, care must be taken to ensure the tailrope pulls mainrope slack no faster than the speed the slackpulling sheaves are driving, or damage to the engine may occur.

- Although it's technically possible to bridle with the skycar, it's not readily practiced, for these reasons;
  1. The hydraulic system has a valve fitted to prevent the winch from lowering a drag in high range. This is because there is a danger of the winch motor over-speeding and becoming a pump which in turn could over-speed the engine.
  2. The butt-rigging and tailrope would provide enough load to engage low range, making bridling a slow process.
  3. Damage would occur if the dropline was pulled to its limit placing a sudden load on the mainrope and winch.

- Some motorised carriages can be used on intermediate supports.

- The winch on the skycar may have difficulty with heavier payloads (over 4 tonnes) leading to slower cycle times and excessive strain on the engine and winch. For this reason, it is more suited to settings of smaller average piece sizes. High stocking stands will also allow for optimisation of drags (the optimum drag is 3-3.5 tonnes).

- Piece size does not really influence the motorised slack pulling carriage from achieving an optimum drag. The winching of a drag is governed by the yarder (more horsepower) and not the carriage. So, in settings with larger piece size, a motorised slack pulling carriage is more suited than the skycar.

- One of the advantages of the skycar over the slackpullers is the simplicity of operation (less moving parts). The motorised slackpuller has a skyline clamp, mainrope brake and slackpuller, which makes the operation of the carriage more complicated.

- Most motorised carriages today give very little trouble and comments received about the mechanical and radio reliability of both types of carriage are positive.

Appendix

Makes and models of various motorised slackpulling carriages and skycars

Make	Model	Description	Engine (HP)	Weight (kg)	Skyline size (mm)	Drum capacity	Load capacity full drum	System	Dropline speed	Intermediate supports
Danebo	SC-40	Skycar	160	3180	35>	116m of 19mm 153m of 16mm		Hydraulic	128m/minute	No
Danebo	SC-20	Skycar	106	2040	29-32	122mm of 16mm		Hydraulic	150m/minute	No
Danebo	Heavy Duty	Motorised SP	30	1410	29-38			Hydraulic		No
Danebo	Mini dart	Motorised SP	24	1000	22-29			Hydraulic		No
Boman	Mark III - H	Skycar	106	1975		122mm of 16mm		Hydraulic		No
Boman	Mark III - A	Skycar	170	2630	32-38	122mm of 16mm		Twin disc torque conv Friction clutches		No
Boman	Mark IV	Skycar	106	1680	29-32	92m of 16mm		Hydraulic		No
Boman	Mark V	Skycar	78	1250	22-29	92m of 16mm or 107m of 14mm		Hydraulic	132m/minute	No
Boman	Mark VI	Skycar	78	1340		92m of 16mm		Hydraulic		No
Howeline	HLSPC 1	Motorised SP	7	450	12-16	NA	6000	Hydrostatic		Yes
Howeline	HLSPC 2	Motorised SP	14	700	22-30	NA	10000	Hydrostatic		Yes
Howeline	HLSPC 3	Motorised SP	28	1070	22-36	NA	16000	Hydrostatic		Yes
Eagle	Eagle II	Motorised SP	14.5	1180	22-29	NA	6810	Hydraulic	107/130m per minute	No
Eagle	Eagle III	Motorised SP	28.5	1630	29-32	NA	9080		107/130m per minute	No
Eagle	Eagle I	Motorised SP	28.5	2180	32-38	NA	13620		107/130m per minute	No
Eagle	GoldenEagle	Motorised SP	106	3630	35-38	152 of 16mm	15890		123m/minute	No
Eagle	Eaglet	Motorised SP	12	545	16-29	NA	5450		92/107m per minute	Yes
Maki	Maki II	Motorised SP	14	650	19-26	NA	8000	Hydraulic	76/148m per minute	Yes
Maki	Maki IIS	Motorised SP	22	1100	22-36	NA	10000	Hydraulic		Yes
Maki	Mini-mak I	Motorised SP		320	14-25	NA	6810	Hydraulic		Yes
Maki	Mini-mak II	Motorised SP	14	650	19-25	NA	6800	Hydraulic	100m/min	Yes
Maki	Mini-mak III	Motorised SP	20	1360	25-35	NA	13600	Hydraulic	107m/min	Yes