LOGGING INDUSTRY RESEARCH ORGANISATION
NEW ZEALAND

ISSN 1171-6932

REPORT

Vol. 20 No. 25 1995

EAGLE II MOTORISED SLACKPULLING CARRIAGE

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Figure 1 - Eagle II MSP carriage in Tarawera Forest

INTRODUCTION

In today's economic climate, and with much of the cable harvested resource on difficult, broken terrain, it is important that cable loggers have at their disposal a range of tools to achieve and maintain high levels of production. One such tool is the motorised slackpulling (MSP) carriage.

While not an entirely new concept, carriages of this type were initially not considered suitable for use in New Zealand due to their cost, weight, and questionable reliability (Hemphill, 1985). Improvements to MSP carriages has prompted another look at them.

The two key advantages of the MSP carriage are its skyline clamping ability and its capability for lateral hauling. The skyline clamp means that drags can be broken out in any direction relative to the carriage, with minimal clamp slippage and therefore minimal skyline damage. Lateral hauling distance with an MSP carriage is limited only by the hauler's mainrope capacity, and how far the breakerouts want to pull the lead strop or chain. Obviously, there is a point where it is more economical to shift the skyline than to persevere with lateral hauling. However, this capability can mean greater productivity through larger drag sizes. Safety for the breakerouts can be improved too, with fewer moving ropes and shorter distances to walk to safe areas each drag.

MSP carriages weigh (and cost) more than other carriage types and consideration must be given to this during planning.

This report describes the carriage and reports a brief study of the carriage being used in conjunction with a Thunderbird TMY70 hauler.

ACKNOWLEDGEMENTS

LIRO acknowledges the co-operation of John Collins and his crew, and the assistance of Sam Baker (Eagle Truck & Machine Company) and Tasman Forestry Limited (Bay of Plenty) during this study.

THE CARRIAGE

The Eagle II motorised slackpulling carriage is manufactured by the Eagle Truck and Machine Company, La Grande, Oregon. The example studied here was the first standard Eagle II built to pass over intermediate supports. A removable adaptor kit is available to convert existing Eagle II carriages so they can pass over intermediate supports.

Eagle Truck and Machine Company manufactures a range of motorised slackpulling carriages, from the 'Eaglet' weighing 544kg with a load capacity of 5436kg, to the 'Eagle I' weighing 2174kg with a load capacity of 13590kg. It also manufactures the 'Golden Eagle' which has an internal dropline (127m of 16mm rope), weighs 3624kg and has a load capacity of 15855kg.

CARRIAGE SPECIFICATIONS

Carriage type:	Motorised Slackpulling Carriage
Make & Model:	Eagle II
N. Z. agents:	Brightwater Forest Equipment, Nelson
Price:	NZ$80,000 for the Intermediate support/shackle passing carriage.
Warranty:	1 year from purchase date, worldwide; includes radio system.
Weight:	1178kg (Standard shackle-passing carriage) 1268kg (Intermediate-support/shackle passing carriage)
Load capacity:	6795kg
Engine:	11kW air-cooled single-cylinder Lombardini diesel
Fuel capacity:	9.5 litres (gives about 10 hours' running)
Hydraulic oil:	11.4 litres
Gear ratio:	7.5:1
Load sheaves:	16" (407mm) Tommy Moore
Skyline:	7/8" (22mm) - 11/8" (28mm)
Mainrope:	5/8" (16mm) recommended will take 3/4" (19mm)
Slack puller line speed:	350'/min (1.8m/s) & 425'/min (2.2m/s)

PRODUCT SUPPORT

Brightwater Forest Equipment (BFE) in Nelson is the New Zealand agent and handles orders, warranties, parts and repair work. A comprehensive manual accompanies each carriage. It contains: detailed schematic diagrams on the hydraulic and electrical systems; an engine parts breakdown list with part numbers for genuine replacements and compatible alternative parts; simple user-manuals for the carriages' talkie-tooter system; 10 pages of problem/trouble-shooting (every problem, cause and solution since the first eagle carriage is listed). There is also an excerpt from the Oregon Forest code, on rigging intermediate supports and tail trees. A small spare parts kit is supplied and contains about 30 assorted items including relay switches, a fuel solenoid, all oil and fuel filters, warning lamp bulbs, and some electrical connectors. Any part(s) that have to come direct from the United States will take about four days to arrive in New Zealand. BFE stocks some parts that are common to other machines and as the number of Eagle carriages in New Zealand increases, BFE will stock more specific parts.

OPERATION

The carriage is designed for use in gravity and powered-return logging systems. With gravity return (shotgun) logging, the skyline clamp means the carriage can roll past the lowest point on the skyline and then be clamped so the drag can be hooked on.

With powered-return systems, the tailrope is generally attached to the rear of the carriage, as in standard dropline configuration. In some cases, it may be necessary to leave the skyline anchored in one position and pull the powered slack laterally uphill quite some distance. In this case, a butt rigging can be attached to the mainrope and the tailrope attached to that. By altering the position of the tail and corner blocks, the hauler can pull the required slack out through the carriage.

The carriage engine drives the slackpuller and provides oil pressure for the slackpuller clutch and skyline clamp. The slackpuller mechanism consists of two sheaves stacked vertically, with the mainrope fed round them in an 'S' pattern. The sheave diameter means the preferred mainrope size for use with this carriage is 16mm (5/8"), although the slackpuller will take 19mm (3/4") rope (Baker, pers comm). Where the mainrope diameter is larger, either a length of 16 or 19mm rope can be added to the mainrope, or the tailrope can be used as the mainrope, depending on the desired rigging configuration and haul distances.

The skyline must be lowered to start the carriage each morning, then it can be started and stopped with remote control signals during the day, before being lowered to switch off the electrics at night. The carriage remote control unit is similar to the standard 'talkie-tooter', having a mercury switch and a 'talk' transmitter. There are two buttons, arranged vertically, and carriage functions are controlled with a combination of signals on one or both buttons. There are two remote controls - one for the breakerout(s) and the other for the hauler operator. The carriage has a built-in loudspeaker so the hauler operator can speak to the breakerout(s) through the carriage control.

CARRIAGE TRIAL AND CREW IMPRESSIONS

The Eagle II MSP was observed with the tailrope attached to the carriage in a radiata pine clearfell operation on a Thunderbird TMY70 hauler. The five drum hauler was rigged with a 28mm (11/8") skyline and 22mm (7/8") mainrope. The TMY70 tailrope was the required 19mm (3/4") but it was decided to add on a 150m length of 19mm rope to the mainrope for the short trial.

The setting was steep (up to 40°), and broken with one prominent intermediate ridge dissecting the profile (Figure 2).

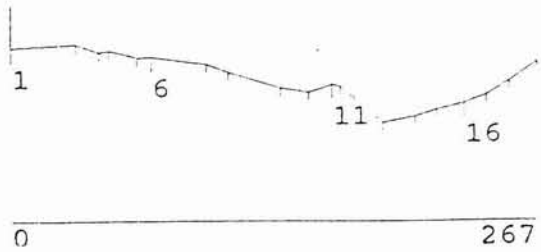

Figure 2 - Profile of the Eagle II trial setting (267m)

The skyline was tied off on stumps along a spur that dropped sharply away into the 'toe' of the gully being logged. The gully was from 190 to 250 metres from the hauler and as lateral pulling (up to 75m below the carriage and 65m to the side) was needed to log it, the breakerouts concentrated on this area for the duration of the trial. Poor deflection limited payload, consequently drag size was low at 1.4m³. LoggerPC analysis of the profile and equipment showed that payloads of 3m³ could be carried without exceeding the safe working load of the skyline (static load analysis) However, remote tension monitor data from the skyline and load-bearing guylines showed skyline tensions of up to 110% of safe working load were generated at breakout. It must be noted that LoggerPC cannot model breakout forces, and that dynamic tensions differ markedly from static loads.

A mechanical delay highlighted carriage operation for the crew. It is important to leave a good metre to spare between the end of the logs, and the bottom of the carriage on inhaul. This was not done and on one occasion, when the head of a long-hooked tree struck the ground during inhaul, the butt broke a hose fitting on the hydraulic lines to the skyline clamp.

The demonstration was compromised by the short duration of the trial and the difficult nature of the setting. The crew found the carriage easy to operate, but a period longer than the 3½ days available would be necessary to get the most out of it. The contractor was impressed with the carriage's features and capabilities, saying that it exceeded what he would expect from his 3-drum dropline carriage in this setting.

CONCLUSIONS

Mechanical slackpulling carriages of this type are quite versatile, with unlimited slackpulling capability, the ability to pass over intermediate supports and breakout wood in any direction relative to the carriage. They can also be used with gravity or powered haulback and with a butt rigging and tailrope, for 'easier' lateral slackpulling.

The main application for the Eagle II MSP carriage is with medium-large haulers running compatible diameter ropes in clearfell situations. The optional multispan capability is also seen as having potential on long span cable systems, logging unstable or inaccessible forests. To make full use of MSP carriage features, harvest planning needs to be based around them.

REFERENCE

Hemphill, D. (1985) : "Skyline Carriage Survey". NZ Logging Industry Research Association.

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