LOGGING INDUSTRY RESEARCH ASSOCIATION NEW ZEALAND

REPORT

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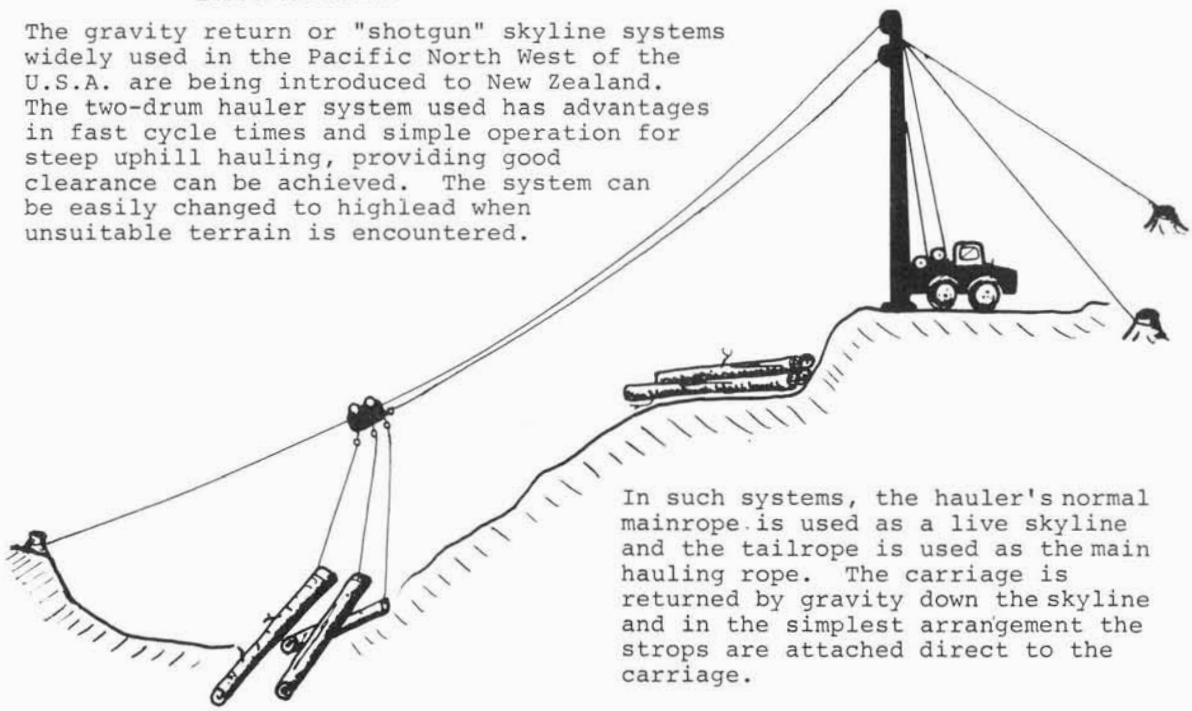
GRAVITY RETURN SKYLINES

This is the second in a series of descriptive reports on cable logging systems, aimed at encouraging the wider use of methods suitable for specific cable hauling situations in New Zealand.

The gravity return or "shotgun" skyline systems widely used in the Pacific North West of the U.S.A. are being introduced to New Zealand. The two-drum hauler system used has advantages in fast cycle times and simple operation for steep uphill hauling, providing good clearance can be achieved. The system can be easily changed to highlead when unsuitable terrain is encountered.



In such systems, the hauler's normal mainrope is used as a live skyline and the tailrope is used as the main hauling rope. The carriage is returned by gravity down the skyline and in the simplest arrangement the strops are attached direct to the carriage.

PLANNING CONSIDERATIONS:

The planning essentials for such a system are:-

1. A steep chord slope. More than 18° slope from spar lead block to back stump is required for effective operation over the whole span.
2. Adequate clearance for carriage and strops to return unimpeded to the furthest log on each haul line.
3. The edge of the landing must not interfere with carriage movement.
4. A free running carriage heavy enough to return at good speed.
5. Good guyline anchors, as heavy loads can be imposed on the system.

The planning for the system must ensure that all sectors of the setting can be hauled to the landing with good clearance on not less than 18° slope. In cross gully applications, if the tailhold location results in less than 18° chord slope, it might be desirable to work the setting from both sides of the gully as the carriage would not move back past the lowest point in the skyline span. To allow for skyline clearance at the edge of the landing, stepped landings are advantageous.

Loading can be done from the stepped landing or alternatively logs may be cleared to a processing landing by another machine. (Currently safety rules in some organisations do not allow men to work under ropes on the landing and thus logs are pulled clear in any event.)

SUITABLE CARRIAGES:

With the simplest gravity return carriages reach to the side is limited by the length of chokers. Although choker length can be varied, much more lateral reach is possible with locking carriages. These carriages can be be locked to the skyline and the main hauling rope pulled some distance to the side from it. The first of these in N.Z. (the Christy carriage) is currently being used by contractor Malcolm Whale at Waiotapu.

The Christy carriage locks on the skyline after hitting a stop previously positioned by the breaker-out. The mainrope is then released from the carriage and this rope and chokers can be pulled easily to the side. Little problem is thus encountered with the longer side hauls necessary at the far end of a typical hauling line.

CHRISTY CARRIAGE. Locked to stop during break-out. →

ADVANTAGES OF THE SYSTEM:

The gravity return method with a locking carriage has the following advantages:

1. Lateral hauling to the skyline is possible.
2. A pull to a fixed point on the skyline is advantageous for thinning or partial logging.
3. Less rope shifts are required when the lateral hauling potential is exploited.
4. It is possible to pre-set chokers in a well-planned operation, particularly when hauling at right angles to the contour of the land, as men do not have to work in the bight of a rope.
5. There is a fast hook-on time as the carriage is kept in the air. This means chokers do not tangle and are easily pulled out to logs.
6. Returning the carriage and strops in the air does not foul slash or throw chunks of wood.
7. The direct lift to the skyline during breaking-out means fewer hang-ups occur.

8. The butts of logs can be held clear of the ground during the in-haul thus shock loading is reduced.
9. Faster in-haul and out-haul speeds are possible.
10. Increased haul distances over highlead are possible if topography is favourable.

HAULERS FOR THE SYSTEM:

A suitable machine to operate a gravity return system needs two operating drums. It must be able to operate the skyline from the back drum position or have some other provision to prevent the ropes crossing. One option is to run the mainrope through a block attached to a guy; this also allows logs to be landed alongside the machine. The skyline drum should be able to be set to slip on overload as it is possible to set up very high tensions on this rope, the spar, and back-stumps. The mainrope drum must run freely out of gear to allow the carriage to return at speed by gravity.

PERFORMANCE POTENTIAL:

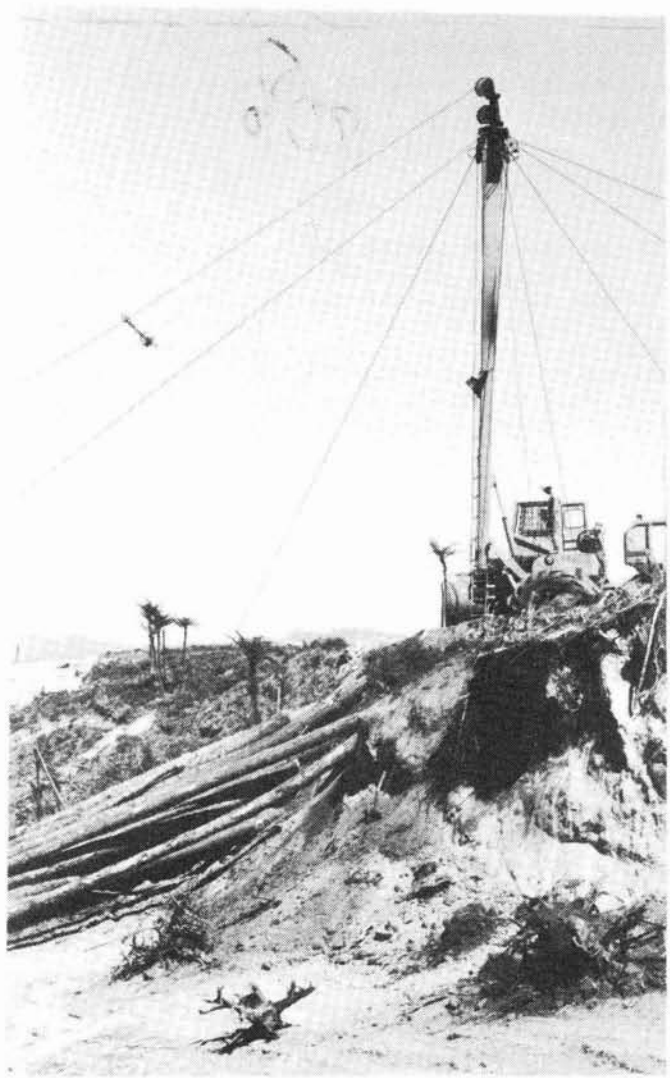
To date gravity return systems have not been operated long enough in New Zealand to get reliable production estimates, but it is already evident on Malcolm Whale's operation that fast cycle speeds and good production are possible. The following figures provided by the N.Z.Forest Service's Work Study Group at Kaingaroa indicate the average cycle times for a study over two days of operation of the Ecologger with a 12.8 m spar.

Average haul distance:	127 metres (Max. 280 m, Min. 40 m)
Average haul volume:	1.99 cu.metres (2.01 pieces of Larch logs)
Average cycle time:	4.83 minutes (including carriage-stop shifts)

An overseas comparative study between highlead and gravity return systems, where operating conditions were virtually identical, is that recently completed on a Madill spar operation in British Columbia.* The figures indicated that gravity system out-produced the highlead even though it operated over a greater hauling distance as the following figures show:-

	Gravity Return System	Highlead
Maximum haul distance	300 m	275 m
Number of pieces per turn	2.19	1.9
Out-haul	.52 mins	.60 mins
Break-out	3.90 "	4.24 "
Haul	.76 "	.90 "
Unhook (includes landing)	.99 "	.82 "
Haul line changes (pro-rated)	.91 "	.65 "
Total cycle time	7.08 mins	7.21 mins
Production per shift	216 m^3	199 m^3

* "Comparison of Shotgun with Highlead Yarding" by Brent J.Sander. Forest Engineering Research Institute of Canada, Technical Note TN-18, 1978.



† *Ecologger positioned above stepped landing where skidder can pull logs clear.*

CAUTIONS IN USING THE SYSTEM:

Precise operational planning is required to ensure that skyline slope is sufficient and clearance adequate.

It is important to position the hauler to get clearance at the edge of the landing. The large landing normal to N.Z. cable logging will not allow this, therefore a stepped landing, shorter logs, or the ability to land logs and have them remain close to the hauler, is necessary.

The ability to tension the skyline, then hold it and transfer all power to the mainrope gives great potential to overload the system, particularly where there is little deflection in the skyline. A skyline brake set to slip if overloaded is the best insurance, but good back anchors are essential - at least two back guys well anchored are required. A working rule should be to ensure deflection is not less than that adequate to give good clearance. A minimun of 8% is required. If this cannot be achieved load size should be reduced.

Skyline wear may be uneven as it is concentrated round the spar lead block on each haul line. It is most important that the rope is correctly spooled on the skyline drum otherwise the high operating tension can cause excessive rope damage on the drum.

SUMMARY:

Gravity return skyline systems have potential for high production in steep uphill hauler settings where topography is suitable. The planner needs to ensure sufficient slope and clearance are available by modifying landing layout and size to suit the system. The ability to interchange quickly between highlead and gravity return to suit the topography gives this combination great flexibility with relatively simple haulers.

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