

PRODUCTIVITY AND COSTS OF GRAPPLE YARDING IN BRITISH COLUMBIA

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INTRODUCTION

In 1778 the English explorer Captain James Cook entered Nootka Sound to cut trees to replace spars and masts, which had been broken during the rough voyage from New Zealand. He is credited with being the first white man to log timber on the coast of British Columbia. In the 1890's, steam powered winches were introduced for yarding logs. In the 1900's, this cable logging system has steadily been improved and is presently known as the highlead system. In 1966 the grapple yarding crane was introduced. Grapple yarding is a form of highlead logging that utilises the haulback as a running skyline. This provides the additional lift required to place the grapple on the log. Grapple yarding has become a popular alternative as a yarding system in coastal British Columbia.

It is my opinion that using the grapple yarding system is an effective way of reducing logging costs. In this paper I will discuss:

- Systems Concept in Timber Harvesting
- Operating Aspects of Grapple Yarding
- Advantages of the Grapple Yarding System
- Productivity and Cost Improvements in the Yarding Phase
- Improvements and Future

Developments

- Problems and Solutions

SYSTEMS CONCEPT IN TIMBER HARVESTING

Systems concept involves the completion of activities to achieve a common objective. In timber harvesting this objective is to make a profit by producing quality, marketable wood products. As all phases of the operation are interdependent, it is imperative that these complement each other.

To illustrate this concept; At MacMillan Bloedel's Port McNeill Woodlands, there was an increase from 1985 to 1988 of 16% in lower cost windrowed wood available at roadside. This contributed to a productivity, per shift, increase in the loading phase, of 30%.

Many alternatives are available when selecting yarding systems. The choice is dependent on the flexibility of the equipment available and the variability of the timber and terrain. In larger operations a variety of yarding equipment and methods are used:

- supersnorkel loaders yard to roadside all areas up to 45 meters.
- grapple yarding cranes yard to roadside in settings with good lift, and yarding distances up to 275 meters.
- highlead spars yard to landings in settings with fair lift, and yarding distances up

to 350 meters.

In smaller operations it is important that the equipment selected has the flexibility to operate effectively in a variety of timber and terrain conditions. The Madill 123 interlock swing yarder is suitable for this size of operation as it is capable of highlead, grapple, and drop-line carriage yarding.

In the yarding phase it is essential that the systems selected are cost effective and meet the needs of the whole timber harvesting operation.

### OPERATING ASPECTS

The grapple yarding crane, with interlocking haulback and mainline drums, is well suited for grapple yarding. The interlock sustains tension to create lift on the running skyline. A third line, the slackpulling line, is used to open and close the grapples. Where yarding distance and conditions are such that grapple yarding is less efficient, the interlock allows the possibility of choker yarding using the dropline carriage. As the running skyline is rigged with no bight in the haulback, presetting of chokers on both sides of the yarding road is possible. We have recently used electronically released chokers, which allows choker yarding without a landingman. This is an advantage as the three man crew can effectively change back and forth from grapples to chokers without a change in manpower requirements.

The walking guyline sheaves, mounted on the gantry, allow the grapple crane to swing and to move up and down the road up to ten metres without changing roads. This mobility and swing capability allow the operator to take advantage of the best yarding conditions and to direct the turn past potential hang ups. When it is time to change roads, it is relatively easy as only two guylines are required.

The grapple yarding crane windrows wood at the roadside, eliminating the need for landing construction. This inventory of windrowed wood increases the efficiency of the loading phase as the loader is not dependent on the yarder's production.

When ground conditions permit, mobile backspars can be used to provide additional lift and reduce delays when changing roads. This often allows the crew size to be reduced to two people. Grapple yarding cranes and mobile backspars are moved to the yarding road, which provides the operator with a good line of sight on the turn. This advantage reduces the yarding cycle time.

In sensitive ground conditions, road building excavators are adapted with a fairlead mast mounted on the boom. On less sensitive ground conditions, logging tractors are used with a fairlead mast usually mounted on the C frame. These mobile backspars usually have about five meters of lift capability.

Like other yarding systems, grapple yarding performs to its optimum capability only under certain conditions. This system is most effective when:

- Roadside wood is loaded previous to grapple yarding. This provides space to windrow wood at roadside.
- The timber is fallen directionally to allow the butt ends of trees to be grappled. This increases visibility, reduces breakage during yarding, and provides for easier roadside sorting.
- Smaller timber, 30 cm to 60 cm, is mechanically fallen into bunches of optimised turn size.
- Used in conjunction with other yarding systems to generate the lowest cost per meter.

The most significant cost in any

timber harvesting operation is labour. As harvesting systems become more mechanised, the selection and training of the crew becomes increasingly important. It is up to management to ensure the employees understand the value of their contribution, and to promote their involvement in the planning and execution of the harvesting operation.

Grapple yarding is more productive when the crew:

- Is involved in preplanning the next setting before yarding commences. This includes such things as prerigging of lines and notching of guyline stumps, which reduces moving time, and can often be done while the operator is still yarding in the present setting.
- Switches jobs periodically during the day. This reduces operator fatigue and enhances training of the crew.
- Is trained to service and repair their equipment.
- Is involved in the selection of yarding equipment and systems.
- Is on a production bonus or profit sharing plan.

#### ADVANTAGES OF THE GRAPPLE YARDING SYSTEM

Grapple yarding has several advantages over the conventional high-lead systems. Some of these are:

- Manpower requirements are less. When using a mobile backspar two men are usually used. These are; a grapple yarder operator and a hooktender who spots the grapple (when required) and moves the mobile backspar. When stump rigging, three men are usually used. These are; a grapple yarder operator, a hooktender who rigs stumps

and a third man who helps the hooktender and spots the grapple when required.

- Cycle time is reduced. When the operator has good visibility, time is reduced to the in-haul and out-haul time.
- Delays in road changes are reduced. Mobile backspars and the use of only two guylines reduce rig up time. When the operator can spot the grapple, this allows the hooktender and a third man to notch stumps and pre-rig lines for the next yarding road.
- Safer yarding conditions as the running skyline is rigged with no bight in the haulback.
- Grapple yarding can be done at night. This allows for greater production per day. This is often done to balance inventories so the loaders operating on day shift can optimise their loading potential.

These advantages make grapple yarding a productive and cost efficient system when used in settings with good lift and moderate yarding distances.

#### PRODUCTIVITY AND COST IMPROVEMENT IN THE YARDING PHASE

For costs to be reduced in the yarding phase a higher percentage of wood must be yarded by the lower cost yarding systems. At MacMillan Bloedel Port McNeill Woodlands there was an increase of 16% in windrow wood available at roadside. This contributed to a yarding phase productivity increase of 30%. The corresponding cost saving was 24%, or \$1.15 a cubic meter. This inventory of windrowed wood at roadside contributed to similar productivity improvements in the loading phase.

The cost saving in the yarding phase was caused by the following equipment changes:

TABLE 1 : 1985 PRODUCTION AND COSTS

	YARDER TYPE			AVERAGE TOTAL	LOADED TOTAL	STUMP TO DUMP TOTAL
	H/L	S/S	G/Y			
% of YARDED	43%		57%			
m <sup>3</sup> /MACHINE	267m <sup>3</sup>		367m <sup>3</sup>	315m <sup>3</sup>	360m <sup>3</sup>	
Cost per m <sup>3</sup>	\$7.13		\$4.50	\$6.00	\$2.60	\$22.76

H/L = Highlead      S/S = Super Snorkel      G/Y = Grapple Yarding

TABLE 2 : 1988 PRODUCTION AND COSTS

	YARDER TYPE			AVERAGE TOTAL	LOADED TOTAL	STUMP TO DUMP TOTAL
	H/L	S/S	G/Y			
% of YARDED	27%	27%	46%			
m <sup>3</sup> /MACHINE	283m <sup>3</sup>	589m <sup>3</sup>	389m <sup>3</sup>	410m <sup>3</sup>	470m <sup>3</sup>	
Cost per m <sup>3</sup>	\$7.25	\$1.95	\$4.85	\$4.85	\$2.14	\$20.89

H/L = Highlead      S/S = Super Snorkel      G/Y = Grapple Yarding

1987  
1988  
YARDER

A Madill highlead spar was replaced with a Cypress 7280B. The increase in productivity per shift was approximately 31%.

- One Madill 044/075 super snorkel.

- An American 7220 short distance grapple yarder was replaced by a Madill 044/075 supersnorkel. The increase in productivity per shift was approximately 60%.

IMPROVEMENTS AND FUTURE DEVELOPMENTS

One of the greatest improvements in grapple yarding cranes is the versatility provided by yarders such as the Madill 122 interlock swing yarder. This yarder can effectively use several different yarding systems. The electronically released chokers, presently sold by Johnson Grapples in Vancouver, are a definite asset when choker yarding with the swing yarder. The high speed yarding drums allow this yarder to operate effectively at longer yarding distances.

The 1988 production and costs, as indicated in Table 2, are based on the following equipment complement:

- Two Madill highlead spars
- One cypress 7280B interlock swing yarder
- One Madill 044 double main-line grapple yarder

Hoe chucking is a relatively new addition to methods being used to

enhance grapple yarding. Within a setting there are often areas with no lift, which are difficult to log with any cable system. Hydraulic loaders, such as the Chapman 1825C, will walk out into these areas and swing these logs into deflection for grapple yarding.

program to ensure that the on shift breakdowns are minimised.

Grapple yarding productivity decreases when the operator can no longer spot the grapple onto the log. Portable video cameras are being experimented with so the operator can maintain his view of the grapple. The television screen is mounted in the cab of the yarder, giving the operator a full field of vision. Often the hooktender is able to spot the grapple onto the log better than the operator. Joysticks are being experimented with, which would allow the spotter in the woods to operate the grapple yarder and guide the grapple onto the log.

Mechanical sorting and processing of logs at roadside is becoming increasingly popular. Fitted on the boom of a Cypress 1825C, the Steyr processing head can pull logs from windrowed wood at roadside and cut them into appropriate lengths. The cutoff saw handles up to 60 cm in diameter. Another method of processing at roadside is to use a loader to swing wood to the Hahn processing deck. The operator will grade and delimb the log, measure the length with an electronic eye, then cut it off with a saw. A processor can produce up to 600 cubic meters per shift of sorted wood.

### PROBLEMS AND SOLUTIONS

Grapple yarding cranes are a high cost item. In order to make it a worthwhile purchase the areas to be harvested must suit the machine and there must be enough wood to be harvested per year to warrant this investment.

*100,000 m<sup>3</sup>/yr.*

As with any mobile equipment grapple cranes are a high maintenance item. It is important to have a preventive maintenance

