

PLANNING REQUIREMENTS FOR GRAPPLE YARDING OPERATIONS

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INTRODUCTION

The success of a forest harvesting operation is dependent on good planning. As with other yarding systems, planning is essential with grapple yarding as this system works well in some conditions and not so well in others. In this paper I will discuss the main factors to be considered in planning for grapple yarding. These are:

- Road layout
- Logging chance
- Deflection
- Setting layout
- Environmental impact

Road Layout

For road layout topographic maps, aerial and timber cruise maps are used. Ground reconnaissance is required to confirm the appropriate yarding system and road locations. Road layout includes the design, location, and construction of the roads required for timber harvesting.

The road design, including gradient, surface, alignment, width, and number of turnouts has direct impact on the efficiency of the hauling phase. The main roads, with high traffic density, are usually built to the highest standard and maintained for many years. The spurs and branch roads are built to a lower standard and are abandoned after logging is complete. Where wood is to be grapple yarded and windrowed at roadside, gradients of less than 15% are preferred in order to maintain the stability of the

grapple crane while yarding.

The location of the spur and branch roads will take advantage of the natural benches and breaks in the topography, to enhance the layout for the grapple yarding system. On steep and broken terrain a combination of highlead and grapple systems will complement each other. In areas where there are few landings, the grapple crane is often more effective due to its capability of swinging the logs onto the road. Due to its mobility the grapple crane generally yards perpendicular to the road, therefore, the yarding distance is decreased. If there is a lift problem often a backspar tree or a mobile backspar will improve the grapple yarding. Where there are good landings, the highlead spars can yard the timber. Since a log loader is usually required to stay with the highlead spar, the loader production ought to increase as it can also load the roadside windrow, which was yarded by the grapple crane.

The road construction cost per kilometer is reduced with grapple yarding. This is due to the reduced cost of landings since grapple yarded wood is windrowed at roadside. This reduced cost is equalised however, due to the grapple yarding distances being slightly less. The extra spurs required for grapple yarding can be minimised through good setting layout. The logging engineer must be thoroughly familiar with any natural breaks in the topography, and utilise these to enhance the lift capabilities of the grapple yarder.

Logging Chance

Planning will enhance the logging chance through choosing the road layouts and harvesting methods best suited to the timber and ground conditions.

The piece size and volume per hectare have a direct effect on cable yarding productivity. In grapple yarding when the piece size falls below 1 m³, the following options are available:

- mechanical falling will increase turn size by bunching several trees together
- directional falling and tree length yarding will minimise breakage and increase turn size
- the interlocking grapple crane, when choker yarding with drop line carriage, can increase turn size.

In areas of less than 500m³ per hectare, grapple yarding is often more successful than other cable systems, as its mobility allows for less delay time due to road changes. Roadside processing is possible as the logs are windrowed at roadside. Processing and sorting at roadside is especially effective in smaller timber, such as second growth. This allows for these logs to be limbed and sorted for quality and destination. I have seen pulp logs which normally sell for \$35.00 per metre, upgraded through roadside processing to export logs, selling for \$75.00 per cubic metre.

The ground conditions including steepness and roughness of terrain have a direct impact on the choice of yarding systems. On flat, wet ground or areas with slopes over 40%, rubber tired skidders and tractors have limited use. With good quality road and setting layout these areas can often be logged successfully with cable systems such as grapple yarding. The grapple yarder can operate successfully on relatively steep and broken terrain by moving

frequently to take advantage of lift opportunities. Often grapple yarding is the most effective cable system in broken terrain since it is more productive in these short yarding situations than skyline or highlead systems. This is due to its short cycle time, and ability to windrow wood at roadside. Where there are long steep slopes on even terrain the distance on the slopes between potential road locations will limit the use of grapple yarding, and the grapple crane can be used for choker yarding with the dropline carriage.

Deflection

Deflection is the one condition that is an absolute necessity in the grapple yarding system. Deflection is the vertical distance between the chord or tight line and the sag in the running skyline. The minimum deflection required for effective grapple yarding is usually 6%, with 8% to 10% being more acceptable.

When planning the setting layout, the logging engineer estimates the capability of the yarding lines to lift the grapple onto the turn of logs. Deflection lines are surveyed perpendicular to the contours to simulate the actual lift requirements of a yarding road line. When the lift capability is marginal these deflection lines are run at intervals of approximately every 200 metres along the road. This ground profile is plotted and the sag in the line is calculated. A concave slope profile generally allows for plenty of deflection. If sufficient deflection is not available, which happens more often with a constant slope profile, then the yarding distance must be reduced, a backspar can be used to gain the required lift, or an alternative yarding system can be considered.

The capacity of a running skyline to support a load increases with an increase in deflection. An advantage of the interlocking grapple crane is its ability to limit the tension on the suspended

lines and adjust the deflection to the weight of the load. This is an important factor for extending equipment and cable life.

In terrain which is extremely concave it is often difficult to place the grapple onto the turn of logs as the running skyline provides too much lift. The alternatives are to release the grapple carriage from the running skyline thus reducing the lift, or choker yard with the dropline carriage.

Setting Layout

A setting is the area of timber selected to be harvested. The size and sequence of settings to be cut will vary depending on environmental impacts, fuel management concerns and silvicultural requirements. Usually the setting is between 40 and 100 hectares, and the sequential clearcuts allow for two to five years between logging of adjacent settings.

In setting layout an initial reconnaissance is required to determine the best way to log the setting. The variables to consider are the terrain, timber size and volumes, drainage and potential road locations. It is important that the roads are designed to complement the yarding systems to be used.

In planning for grapple yarding it is important to locate all yarding split lines and mobile backspar trails. This will identify questionable deflection areas and additional spur road requirements.

Once the layout is complete a setting plan is produced. This indicates to the logging crew which areas are potential grapple yarding areas. This will help them to plan the falling, yarding and loading activities. The grapple yarding windrowing is completed previous to the arrival of the highlead spars. This improves the cost of both yarding and loading phases as it reduces congestion and increases the amount of wood available to the log loaders.

Environmental Impacts

When planning for forest harvesting protecting the environment is an important consideration. The two main concerns are soil damage and water quality.

Soil damage through compaction is often created through the use of rubber tired skidders. On wet ground or steep terrain this problem can be reduced by using cable systems such as grapple yarding. Where backspar trails are required these can be punched using unmerchantable wood and crossditching can be completed once logging is completed.

Water quality is a concern, especially if yarding adjacent to streams. The grapple cranes are very effective at yarding timber away from water courses, due to their mobility. Any debris that enters the streams can often be removed by the grapple. When a creek classification system is used, the streams that require special consideration can be identified and treated accordingly.

