

# CABLE YARDING SYSTEMS HANDBOOK



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## **ACKNOWLEDGMENTS**

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WorkSafeBC (the Workers' Compensation Board of B.C.) is grateful to John Wiley & Sons for permission to copy the tables on pages 140 to 143 from Soil Mechanics in Engineering Practice, (second edition, 1967) by Karl Terzaghi and Ralph B. Peck.

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Revised 2006



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Many publications are available on the WorkSafeBC web site. The Occupational Health and Safety Regulation and associated policies and guidelines, as well as excerpts and summaries of the *Workers Compensation Act*, are also available on the web site: <[www.WorkSafeBC.com](http://www.WorkSafeBC.com)>

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## 2006 Edition

### Library and Archives Canada Cataloguing in Publication Data

Main entry under title:

Cable yarding systems handbook. -- 1993--

Irregular

"WorkSafe."

ISSN 1712-5871 = Cable yarding systems handbook

1. Logging – British Columbia – Safety measures.
2. Logging, Skyline – British Columbia – Safety measures.
3. Logging – British Columbia – Machinery.
4. Forest machinery – British Columbia. I. Workers' Compensation Board of British Columbia.

SD387.S3C32

363.11'963498

C92-092323-2

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## ABOUT WORKSAFEBC

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WorkSafeBC (the Workers' Compensation Board) is an independent provincial statutory agency governed by a Board of Directors. It is funded by insurance premiums paid by registered employers and by investment returns. In administering the *Workers Compensation Act*, WorkSafeBC remains separate and distinct from government; however, it is accountable to the public through government in its role of protecting and maintaining the overall well-being of the workers' compensation system.

WorkSafeBC was born out of a compromise between B.C.'s workers and employers in 1917 where workers gave up the right to sue their employers or fellow workers for injuries on the job in return for a no-fault insurance program fully paid for by employers. WorkSafeBC is committed to a safe and healthy workplace, and to providing return-to-work rehabilitation and legislated compensation benefits to workers injured as a result of their employment.

### WORKSAFEBC PREVENTION INFORMATION LINE

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Phone 604 276-3100 in the Lower Mainland, or call 1 888 621-7233 (621-SAFE) toll-free in British Columbia.

To report after-hours and weekend accidents and emergencies, call 604 273-7711 in the Lower Mainland, or call 1 866 922-4357 (WCB-HELP) toll-free in British Columbia.



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# INTRODUCTION

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## PURPOSE OF THIS HANDBOOK

*Cable Yarding Systems Handbook* is a reference for cable log harvesting systems used in B.C.

WorkSafeBC produced this standard practice manual at the request of industry, labour, and other interested parties. WorkSafeBC designed it for use by employers and workers logging with cable yarding systems. Readers may use it on the sidehill, in the bunkhouse, or in the office.

WorkSafeBC also uses the *Cable Yarding Systems Handbook* in training its own occupational safety officers.

This handbook does not replace the *Workers Compensation Act* and Occupational Health and Safety Regulation; rather, it supplements it by providing examples of safe work procedures to follow when using cable log harvesting systems. Complying with the Regulation and applying these and other safe work practices will reduce injuries to forest workers.

There are differences between coastal and interior operations, such as terrain, log sizes, and weather conditions. Nevertheless, these basic safe work procedures apply to both.

WorkSafeBC has drawn on the experience of its occupational safety officers, as well as soliciting input from industry and labour. This material reflects the years of experience of many workers.

## HOW TO USE THIS HANDBOOK

Readers may use the *Cable Yarding Systems Handbook* as a self-paced course, reading it from cover to cover, or treat it as a reference work, consulting it as questions arise.

The contents are arranged in a strategic order. The first two chapters introduce readers to various types of cable yarding systems and equipment. The

remaining chapters examine specific aspects of safe work procedures in cable yarding.

Each chapter starts with simple yarding systems and moves on to more complicated systems.

This handbook contains references to several other publications that readers can order from WorkSafeBC:

- *Occupational Health and Safety Regulation*
- *Occupational First Aid Regulation*
- *A Manual on Splicing*

These and other publications are available from WorkSafeBC.com. A list of WorkSafeBC offices is included at the back of this handbook.

Throughout this handbook, illustrations that show hazardous work practices are marked with a .

## **RESPONSIBILITY FOR PLANNING AND SAFETY**

A well-planned workplace is a safer workplace. The cost in time and money for preplanning cannot be measured against the cost of disabling injuries and fatalities.

Historically, the serious injury rate for the forest industry is two times higher than the rate for all other high-risk industries combined. The forest industry fatality rate is about 10 times higher than the work-related fatality rate for all B.C. industries combined.

No one entity is solely responsible for ensuring a written logging plan is developed. Employers, owners, and leaseholders may all share in this responsibility. Ultimately, if a worker is injured, the primary responsibility falls on the employer of that injured worker. Depending on the circumstances surrounding ownership and work to be done, it is possible that licensees, contractors, and subcontractors will all have responsibility in developing the written logging plan and ensuring all hazards are identified and controlled.

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# TYPES OF CABLE YARDING SYSTEMS

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This chapter identifies the various types of cable yarding systems.

## SINGLE DRUM AND MAINLINE SYSTEM

This is the simplest cable yarding system. The mainline is manually pulled out to the logs. The log is hooked with the mainline, or the mainline is attached to one or more pre-set chokers. The operator then engages the mainline drum winch and yards the log to

the machine. Examples of this system are rubber-tired skidders, crawler tractors, and hand-logging operations.



*Single drum yarder with multiple chokers attached to the mainline.*

### **Advantages**

The single drum and mainline system:

- Is simple to use
- Is mobile
- Requires little rigging
- Is effective in high snowfall areas with favourable slopes
- Requires only one or two workers
- Is easy to lay out and plan

### **Disadvantages**

The single drum and mainline system:

- Is limited by mainline length
- Is inefficient for long skidding distances
- Requires that the mainline be pulled manually to the log or tree with the chokers
- Has limited application for downhill yarding
- Has a lack of control during downhill yarding
- Is limited by site degradation during spring breakup or wet weather
- Often makes unhooking the chokers take longer because the mainline may knot and hooks may foul
- Is not permitted on high-sensitivity slopes

## HIGH-LEAD SYSTEM

The high-lead cable yarding system is the simplest of the multi-drum cable yarding systems. The system consists of an inhaul drum and cable called the mainline and an outhaul drum and cable called the haulback. Most yarders have a small, third utility drum called the strawline.

### **Mainline functions and characteristics**

- Pulls logs to the landing
- Is the largest line
- Limits the yarding distance to the length of the mainline
- Usually has a lower-geared drum for greater pulling power

### **Haulback functions and characteristics**

- Pulls the mainline cable and butt rigging from the landing to the logs
- Provides lift to the mainline when the logs are being yarded
- Is smaller than the mainline

### **Strawline functions and characteristics**

- Is used to rig up and run in the yarding lines
- Is the smallest and longest line on the yarder
- Is usually divided into lengths of 76 m (250 ft.), but may be segmented in various lengths; each length is fitted at both ends with special connectors that can be undone and reconnected



*Small wood high-lead yarder.*

When the operator winds the mainline in, or goes ahead on the mainline, braking power is applied to the haulback to lift the butt rigging and provide lift to the front of the turn of logs. As the logs are yarded into the landing, haulback braking power is adjusted to clear obstructions on the yarding road and maintain the one-end log suspension.



*High-lead system on a skidder.*

To “skin” the rigging back, the operator engages the haulback drum and applies braking power to the mainline. The tension or braking power on the mainline lifts the butt rigging and chokers clear of the ground and obstructions on the yarding road.

The strawline is pulled by hand from the landing out to and through the tailhold blocks. The eye of the strawline is connected to the eye of the haulback. As the operator goes ahead on the strawline, it pulls the haulback through the back line block, across to the road line block, and back to the landing. The haulback is then connected to the butt rigging.

For road changes, the haulback is disconnected from the butt rigging. The strawline is then connected to the eye of the haulback. The operator applies braking power to the strawline as the haulback is “run around.” This ensures that the haulback spools properly on the drum. Once the haulback is spooled, the strawline is disconnected, repositioned to a new road line, and reconnected to the haulback. The haulback is then reconnected to the butt rigging.



*Rig-up and road change.*

### **Advantages**

The high-lead system:

- Can operate with a two-drum yarder
- Yards longer distances than a single-drum yarder (skidder)
- Makes it easy and quick to rig up and to make road changes
- Provides lift over stumps and other obstacles
- Can be used for both downhill and uphill yarding
- Can be used in more sensitive areas than ground skidding

### **Disadvantages**

The high-lead system:

- Requires special crew training
- Requires a larger crew to operate, depending on the size of the yarder
- Demands a more detailed logging plan
- Provides little flexibility to change the logging plan after the road systems are in
- Cannot be used for straight downhill yarding
- Requires substantial anchors for guylines and yarding lines
- Limits the width of the yarding road to the length of chokers

Common cable sizes and drum capacities for a small wood yarder and a large wood high-lead yarder are as follows:

<b>Small Wood</b>				
Type of Line	Line Size		Line Length	
	mm	in.	m	ft.
Mainline	14–16	$\frac{9}{16}$ – $\frac{5}{8}$	245–365	800–1200
Haulback	10–14	$\frac{3}{8}$ – $\frac{9}{16}$	730–915	2400–3000
Strawline	6–10	$\frac{1}{4}$ – $\frac{3}{8}$	915–1525	3000–5000
Guylines	14–16	$\frac{9}{16}$ – $\frac{5}{8}$	60–90	200–300

<b>Large Wood</b>				
Type of Line	Line Size		Line Length	
	mm	in.	m	ft.
Mainline	32–35	$1\frac{1}{4}$ – $1\frac{3}{8}$	365–425	1200–1400
Haulback	22–24	$\frac{7}{8}$ – $1\frac{5}{16}$	850–975	2800–3200
Strawline	10–11	$\frac{3}{8}$ – $\frac{7}{16}$	1525	5000
Guylines	32–35	$1\frac{1}{4}$ – $1\frac{3}{8}$	90–150	300–500

Each machine capable of cable yarding must have a specification plate, which must specify:

- The name of the manufacturer and date of manufacture
- The model and machine serial number
- The minimum size of the skyline mainline and haulback line to be used, if the yarder is designed for skyline slackline or modified slackline systems
- The maximum diameter of the mainline cable
- The minimum size, number, and placement of guylines, if required
- The permissible angles of yarding
- Any auxiliary that may be safely affixed to the mobile yarder
- The placement and number of outriggers, if required

All yarders must be operated within the limits of the specification plate.

## SKYLINE SYSTEMS

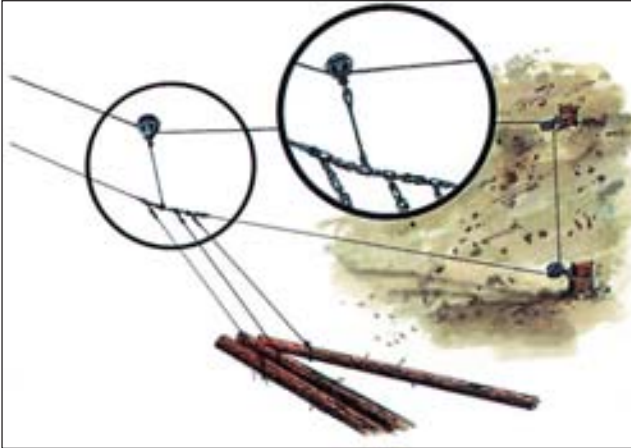
In a skyline yarding system, the skyline supplies lift for blocks, rigging, a carriage, and logs.

Types of skyline yarding systems include:

- Scab skyline (running skyline)
- Shotgun system on a live skyline
- Live skyline and carriage with haulback attached
- Standing skyline system

### Scab Skyline (Running Skyline)

The scab skyline is a variation of the high-lead system. Its purpose is to provide more lift to the butt rigging and choked logs. The scab skyline system has a rider or scab block on the bight of the haulback. The block is connected to the butt rigging with a short strap or chain. The scab skyline does not require another yarding drum and line.



*Scab skyline – the scab block holds up the butt rigging.*



## Shotgun System on a Live Skyline

The shotgun system is a simple, two-drum cable logging system for uphill yarding.

The mainline of the yarder is used as a slack skyline. The haulback is used as a mainline. The haulback is attached to a simple carriage that rides up and down on the skyline. Gravity pulls the carriage and mainline down the hill. The chokers are suspended from the bottom of the shotgun carriage. When the haulback is used as the mainline, it should be clear of the skyline at all times.



*The shotgun system uses the haulback as a mainline and the mainline as the skyline. A high-lead yarder must be designed for shotgun logging.*

A shotgun system does not require an outhaul system. The carriage and mainline are outhauled by gravity. After the turn is unhooked in the landing, the operator tightens up the skyline, ensuring it is held

securely by the brake. The operator then releases the mainline brake, and the carriage travels down the skyline. When the rigging crew signals “stop,” the operator applies the mainline brake and slacks the skyline until a “stop” signal is given.

When the turn reaches the landing, the operator disengages the skyline brake and slacks the skyline to land the turn. The cycle is then repeated.



*Shotgun system with mechanical lock.*

### **Advantages**

The shotgun system on a live skyline:

- Is fast on the outhaul portion of the yarding cycle
- Achieves significant fuel savings with the use of gravity for the outhaul portion of the yarding cycle
- Reduces product damage
- Reduces rig-up and road change time
- Creates no haulback bight
- Permits 100 percent suspension if deflection is adequate
- Allows for longer yarding distances with adequate deflection

### **Disadvantages**

The shotgun system on a live skyline:

- Can only be used for uphill yarding where adequate deflection and chord slope exists
- Limits the width of the yarding road to the length of the chokers
- Requires specialized skill for payload calculation on long yarding

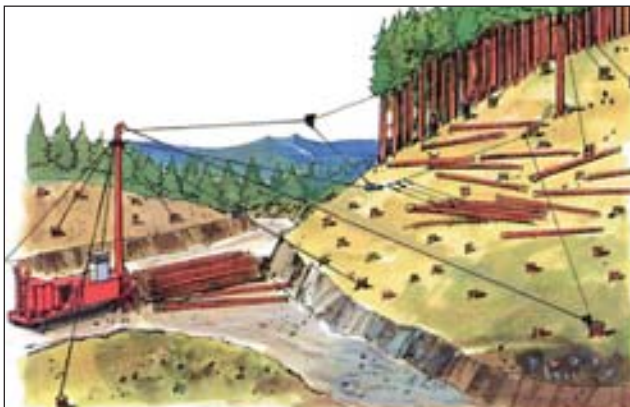
## Live Skyline and Carriage with Haulback Attached



*Slackline.*



*Dropline.*



*North bend.*

The live skyline and carriage with haulback attached is commonly known as a slackline yarding system. Slackline yarding machines have three yarding drums and cables:

- Skyline drum and cable
- Mainline drum and cable
- Haulback drum and cable

The fourth drum on the machine is a strawline drum, used for rig-up purposes.

### **Advantages**

The live skyline and carriage with haulback:

- Allows for a larger turn size
- Permits lateral yarding
- Permits increased yarding road width with the use of side blocking
- Permits increased control of turn when downhill yarding and landing the logs
- Reduces product damage with the one-end suspension of the logs
- Permits 100 percent suspension if deflection is adequate

### **Disadvantages**

The live skyline and carriage with haulback:

- Requires larger and more secure anchors for skyline and guyline tailholds than conventional high-lead
- Requires longer rig-up time
- Requires special crew training
- May require slacking down of skyline every turn to keep logs in landing during steep uphill yarding

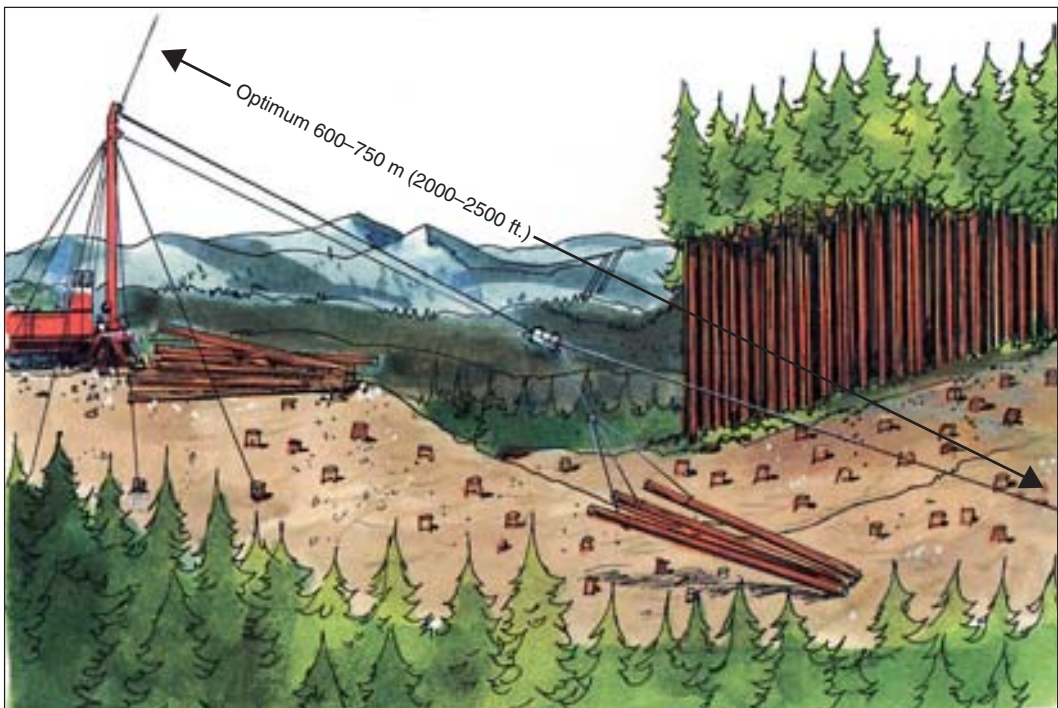
## Standing Skyline System

A standing skyline is used in conjunction with a carriage with slack-pulling or dropline capacity. A standing or fixed skyline is not easily slacked down, or at least not slacked every cycle.

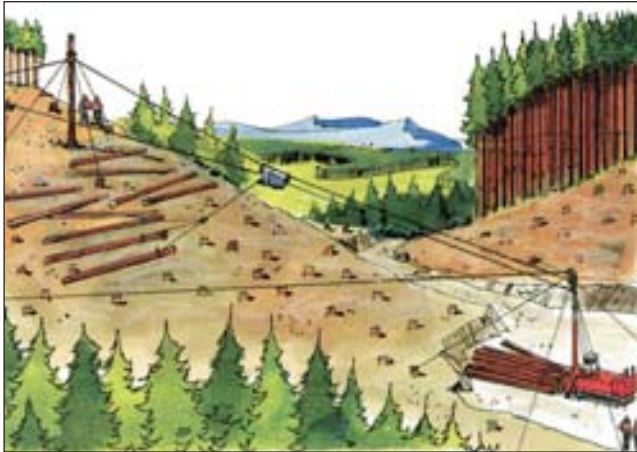
The standing skyline can be used in both uphill and downhill yarding and is often rigged with a backspar.

The three most commonly used skyline carriages on fixed skylines are:

- The gravity carriage with a skyline lock
- The mechanical slack-pulling carriage
- The radio-controlled motor-driven dropline carriage



*This illustration shows uphill yarding. A radio-controlled motor-driven carriage is used on the skyline. The carriage is pulled to the landing by the yarder mainline. No haulback is required, because gravity outhauls the carriage.*



*This standing skyline is rigged with a mechanical slack-pulling carriage, which is operated by the yarder operator upon signals from the rigging crew. The haulback is required for the outhaul portion of the cycle and for holding the carriage in place while setting and picking up the turn, unless the carriage is equipped with a skyline lock.*



*In this illustration, the carriage, used on a small wood yarder, has a radio-controlled skyline lock. The mainline is pulled by hand to the pre-set chokers. This is an effective means of corridor or selective cable logging.*

### **Advantages**

The standing skyline system:

- Is environmentally friendly; the one-end suspension of the logs causes less scouring of the duff and subsequent erosion
- Causes less damage to logs
- Limits the hazard of upending and swinging logs to the relatively short distance they are yarded to the skyline
- Permits positive operator control when yarding and landing the logs
- Works extremely well for selective logging of timber stands with the use of corridors

### **Disadvantages**

The standing skyline system:

- Makes finding suitable tailholds and guyline stump anchors difficult at times
- Requires specialized training to calculate the optimum payload and percentage deflection
- Requires increased cycle time for long-distance yarding



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# TYPES OF CABLE YARDING EQUIPMENT

---

This chapter identifies the various types of cable yarding equipment.

## SELF-PROPELLED STEEL SPARS

There are three types of carriers for self-propelled yarders: rubber-tired skidder-mounted units, truck-mounted units, and track-mounted units.

### Rubber-Tired Skidder-Mounted Unit



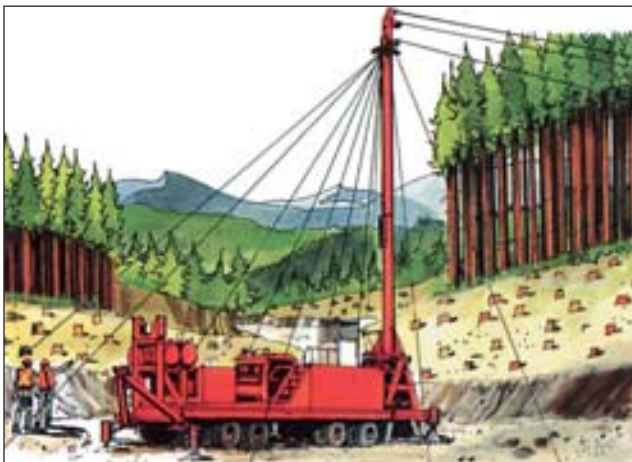
*Skidder-mounted unit.*

### **Features**

The rubber-tired skidder-mounted unit:

- Can negotiate rough grades
- Can negotiate mud or ice-covered grades, when chains are used
- Can be used off the haul roads on skid roads for cold decking and swinging log piles, which can reduce road-building costs

### Truck-Mounted Unit



*Truck-mounted unit.*

### **Features**

The truck-mounted unit:

- Travels faster than other units

## Track-Mounted Unit



*Track-mounted unit.*

## Features

The track-mounted unit:

- Can negotiate rough grades
- Can be used off the haul roads on skid roads for cold decking and swinging log piles, which can reduce road-building costs

## STEEL SLEIGH YARDER, OR LOG SKID-MOUNTED YARDER



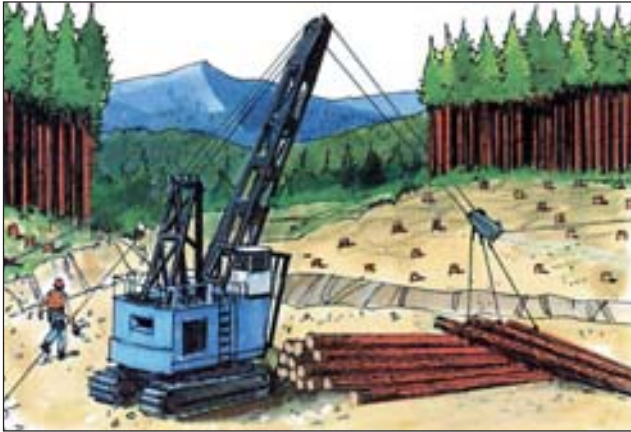
*Skid-mounted yarder with wooden spar.*

These yarders are used in conjunction with a wooden spar tree. These two- or three-drum winches work off a standing skyline.

These yarders are required to be tied down when yarding or rigging up. They require a trailer or lowbed for most moves. They require considerable rigging and labour for moving in the landing.



## SELF-PROPELLED SWING YARDER



*Swing yarder equipped with dropline carriage.*

The primary advantages of swing yarders are their quick rig-up and move cycle and their ability to swing sideways and use the road as a log landing area.

## TRAILER-MOUNTED STEEL SPAR YARDER



*A small trailer-mounted yarder ready for transport.*

A small trailer-mounted steel spar yarder can be towed by a pickup truck and moved long distances easily.



*A large trailer-mounted yarder ready for transport.*

A larger unit is usually a fifth-wheel design and requires a logging truck or similar tractor unit for the move.

## SELF-PROPELLED STEEL SPAR MOUNTED ON TRACKED CARRIER

The primary advantages of tracked carriers are stability and the ability to move on unfinished grades. The yarders can be used off the haul roads for cold decking logs and swinging the piles.

Tracked carriers may be powered by the yarder motor. These yarders require a lowbed for longer moves.



*Tracked carrier.*

# HIGH-LEAD BUTT RIGGING

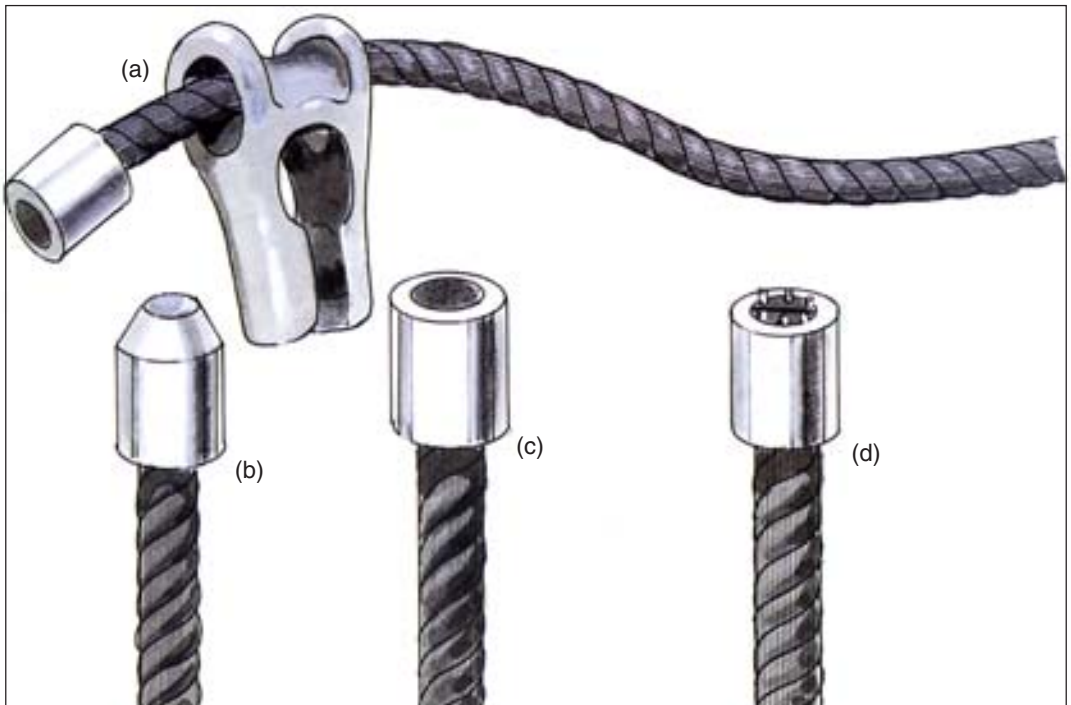
This chapter introduces the features of high-lead butt rigging.



Butt rigging can be used on two- or three-drum yarding machines. It can be used for uphill, downhill, or crosshill yarding.

*Butt rigging.*

Butt rigging is a system of swivels, chain-like links, shackles, and bull hooks. It is connected between the mainline and haulback. Chokers are attached to the butt rigging with choker hooks. Three chokers are commonly attached.



*(a) Choker.*

*(b) Pressed ferrule.*

*(c) Babbitt.*

*(d) Wedge and socket.*



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# TYPES OF SKYLINE LOGGING CARRIAGES

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This chapter identifies the various types of skyline logging carriages.

## SHOTGUN CARRIAGE



*Shotgun carriages with multiple chokers attached.*

### Features

- The shotgun carriage is the simplest of the skyline carriages.
- It is used in uphill yarding on a slack skyline.
- Chokers are attached to the bottom of the carriage.
- Its reach is limited by the length of the chokers.
- Gravity pulls the carriage and mainline down the hill.

## SHOTGUN CARRIAGE WITH A SKYLINE LOCK



*Shotgun system with skyline lock.*

### Features

- Gravity pulls the carriage and mainline down the hill.
  - The operator radio-controls or mechanically cycles the skyline lock when the carriage is in the landing, and the carriage operator/rigging slinger controls it when the chokers are being set.
  - The carriage is also equipped with a mainline lock that locks the mainline once the hook hits the carriage.
- The hook on the end of the mainline is pulled by hand to the pre-set chokers.
  - An accumulator powers the skyline lock or clamp; the accumulator is charged by gears that are turned by the carriage sheaves on the inhaul and outhaul.
  - This carriage can be moved up or down the skyline once the turn is set to attain better lead when skidding the turn to the skyline corridor.

## SHOTGUN CARRIAGE WITH A MECHANICAL STOP

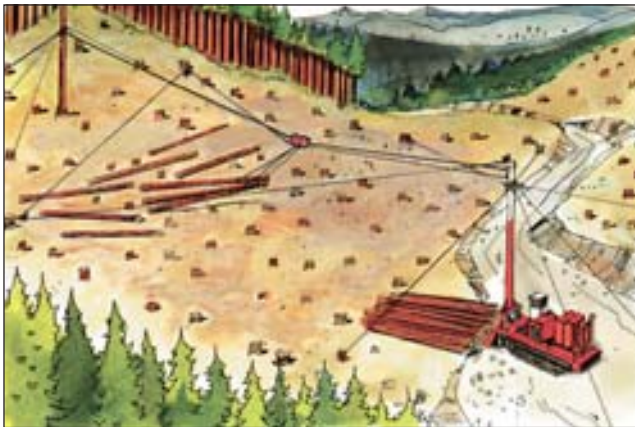
### Features

- Gravity pulls the carriage and mainline down the hill.
- The mechanical stop holds the carriage from running down the skyline.
  - The mechanical stop is positioned on the skyline by hand, using wrenches and bolts; it can therefore only be used effectively on slack skylines.
  - The carriage has a mechanical cam lock system on the mainline to prevent the chokers and logs from jamming in the carriage.
  - The skyline and carriage are slacked to land the logs.



*Mechanical stop holding a shotgun carriage.*

## SLACK SKYLINE CARRIAGE



*Slack skyline carriage.*

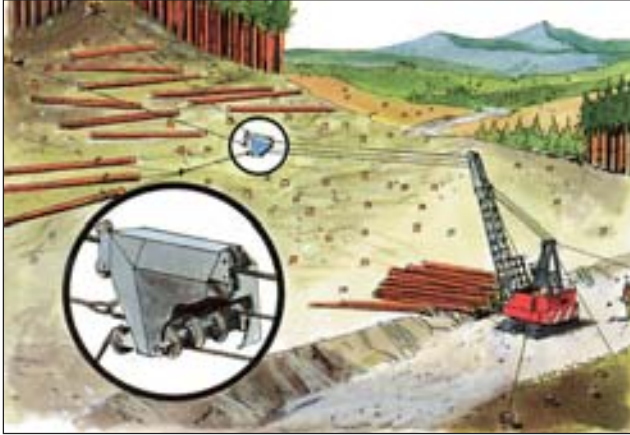
### Features

- The haulback controls the slackline carriage on the outhaul.
- The chokers are attached to the butt rigging, which is hooked to the bottom of the carriage.
- The slackline carriage can be used for uphill, downhill, or crosshill yarding; it may require the use of a backspar with four guylines to provide the required lift.
- The skyline and carriage are lowered to land the logs.
- The carriage provides positive operator control for downhill yarding and landing of the logs.
- The carriage takes away some operator control in downhill yarding when rigged with a north bend system to increase road width.

## MECHANICAL SLACK-PULLING CARRIAGE ON A RUNNING SKYLINE

### Features

- The haulback controls the carriage on the outhaul and holds it in place when lifting the turn.
- This carriage can be used on a running, fixed, or slack skyline.



*Mechanical slack-pulling carriage.*

- This carriage may require the use of a backspar with four guylines to provide the required lift.
- The yarder operator controls all line and carriage movement.
- Mechanical slack-pulling carriages can be used for uphill, downhill, and crosshill yarding.
- This carriage provides positive operator control for landing the logs.

## RADIO-CONTROLLED MOTOR-DRIVEN SLACK-PULLING CARRIAGE EQUIPPED WITH A SKYLINE LOCK



*Radio-controlled carriage – no haulback.*

### Features

- The motorized slack-pulling carriage is best suited for uphill yarding.
  - Gravity takes the carriage and mainline down the skyline.
  - The landing worker normally controls the carriage motor and skyline lock in the landing, and the carriage operator/rigging slinger controls them when the chokers are being set. The yarding operator has backup controls for safety.
- The logs are yarded to the carriage, using the power of the yarder mainline winch; the carriage motor is used for pulling slack when setting chokers.
  - For crosshill or downhill yarding, the haulback is attached for controlling the carriage on the inhaul and pulling the carriage out on the outhaul phase of the cycle.
  - An accumulator system charges the skyline lock on the outhaul; the lock is radio-controlled.

## RADIO-CONTROLLED MOTOR-DRIVEN SELF-CONTAINED YARDING CARRIAGE

### Features

- The motor and winch in the carriage yards the logs to the carriage.
- Some of these carriages can carry 230 m (750 ft.) of dropline.
- The carriage operator/rigging slinger controls the carriage winch by radio when the chokers are being set and the logs are being yarded to the carriage.



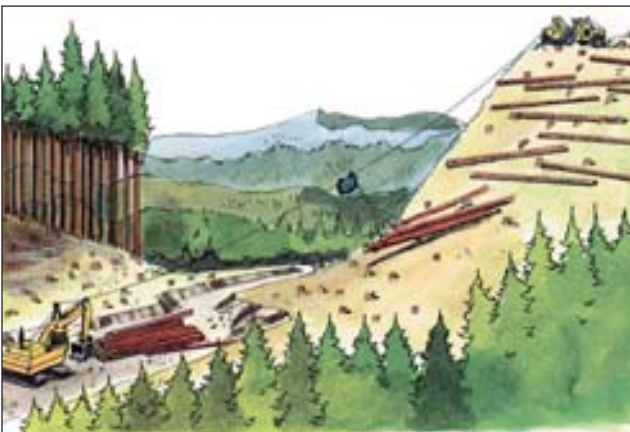
*Radio-controlled carriage with haulback attached.*

- This carriage can be used for uphill, downhill, and crosshill yarding; the haulback is used to control the carriage during downhill or crosshill yarding.
- Gravity pulls the mainline and carriage downhill during uphill yarding.
- These carriages do not require a skyline lock.

## RADIO-CONTROLLED SELF-PROPELLED CARRIAGE

### Features

- Radio-controlled self-propelled carriage can be used in uphill, downhill, and crosshill yarding.



*Radio-controlled self-propelled carriage – no haulback.*

- The carriage contains its own winch and dropline cable.
- The carriage propels itself along the skyline using the winch motor; no mainline or haulback is required.
- The skyline may be rigged so that it may be slacked down under full load in the event of motor problems on the carriage.
- The unit is radio-controlled and works best with full log suspension.



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# GENERAL PLANNING CONSIDERATIONS

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Several basic elements must be considered in a logging plan:

- Safety of the workers
- Type of terrain
- Size and volume of the timber
- Yarding distances and available deflection
- Potential landing and haul road locations
- Type of machine and cable yarding system
- Environmental considerations

## TYPE OF TERRAIN

Topographic features will affect the planner's choices. Proper planning can minimize the impact on worker safety and productivity.

## SIZE AND VOLUME OF TIMBER

Each forest region in the province has its own unique tree species, with a common or average tree size and volume per hectare. Planners should ensure that the logging plan includes correctly sized equipment and appropriate log-handling requirements. Failure to do so could result in safety hazards from anchor or rigging failures.

## YARDING DISTANCES AND AVAILABLE DEFLECTION

Yarding distance is determined by deflection, the line capacity of the equipment, and the type of cable logging system. At less than the required minimum deflection, the cable system may fail. Logging firms can develop a logging plan using topographic maps, aerial photographs, and field data. They may run deflection lines along the proposed yarding slopes to ensure that proper deflection can be maintained. If required, intermediate support trees/backspars should be identified at this time to prevent them from being felled.

## POTENTIAL LANDING AND HAUL ROAD LOCATIONS

Haul road systems and log landing areas should be located to ensure:

- Safe yarding and landing of the logs
- Optimum yarding distances and deflection
- The use of correct types of yarding and loading equipment
- The use of a correct landing size for the equipment and functions
- That logging trucks have the ability to travel the grades both empty and loaded



*Jump-up landing for a small wood yarder.*



*Small wood yarder with intermediate support tree.*

## **TYPE OF MACHINE AND CABLE YARDING SYSTEM**

Safe, productive logging plans should be laid out for a specific size and type of yarder using one or more types of yarding systems. Effective yarders are capable of:

- High-lead yarding uphill and downhill
- Shotgun yarding with a slack skyline
- Gravity yarding and slack pulling
- Grapple yarding
- Being rigged with mechanical and motorized dropline carriages

Planners should not overlook the option of cold decking logs and swinging the pile with either a skidder or a second rig-up of the yarder. This is often effective in rocky areas with high road-building costs.

Some considerations in machine selection are the:

- Size of the wood to be yarded
- Length of yarding road
- Volume of wood on each yarding road
- Cost per cubic metre for operating and covering fixed cost
- Production per day per worker
- Number of days per year the yarder can work

These figures are available from various research organizations, logging associations, and equipment manufacturers.

## COMMON PLANNING MISTAKES

Some common planning mistakes include:

- Inadequate guyline anchoring methods
- Deflection lines not run
- Too small or too large a yarder for the size of wood
- Small, poorly located landings that quickly become congested and are extremely hazardous for the workers; in these landings, there are no safe work areas for the landing workers, nor is there sufficient room to land, deck, buck, and load logs
- Safety hazards such as runaway logs and rolling debris
- Falling timber within two tree lengths of the active yarding lines
- Timber being dumped rather than laid out for yarding direction
- Trees and logs not felled and bucked in an effective pattern for selective corridor logging
- Danger trees left standing within reach of the yarding crews' work areas
- Too small a falling crew to keep ahead of the yarding crew; this is common in deep-snow areas
- Insufficient timber felled prior to yarding
- Failure of various phase personnel to consult with one another

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# WORKER SAFETY AND ENVIRONMENTAL CONSIDERATIONS

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With the implementation of the Forest Practices Code and *Forest and Range Practices Act* there is an increased requirement for standing trees to be left in areas that previously would have been clear-cut. These partial cuts range from selection cuts to clear-cuts with retained patches.

The primary drivers for these non-clearcut harvesting prescriptions are biodiversity, water quality for fish, forest structure, soil disturbance/site degradation, and visual impact.

These harvesting prescriptions present significant but manageable safety challenges for cable loggers. The established standard industry safe work practices and procedures, and the requirements of the Act and the Occupational Health and Safety Regulation, can be accommodated by effective planning, supervision, and training of *both* the forestry engineers and harvesting crews. Forestry engineers must know about task-specific harvesting work procedures. Harvesting crews must know about the specific goals and objectives of the harvesting prescription and logging plan. Employers must ensure communication and sharing of knowledge in the development of the silviculture plan, logging plan, and the harvesting of the block.

There are common safety considerations that planners and cable loggers must address. The management of these concerns must be recognizable in the plan and on the ground. Failure to address these concerns may result in worker injury and closure by WorkSafeBC officers.

## FALLING NON-CLEARCUT PRESCRIPTIONS

The silviculture plan and logging plan must allow for:

- Trees to be felled without the unnecessary brushing of standing timber
- Removal of over-the-line danger trees and trees that present a hazard to workers; the specific areas to be monitored are Riparian Management and Reserve Zones, Gully Management Zones, Wildlife Tree Patches, and areas adjacent to side and back lines
- Faller substitution of one leave tree for another
- Limitation of upslope falling of trees to within acceptable industry standards
- Removal of trees that interfere with the rig-up or that could be pushed or pulled into the work area

Fallers should have plasticized maps that clearly indicate the boundaries of all residual areas, corridors, landing locations, and backspars.

By knowing the specific type of equipment and rigging, fallers can establish a falling plan that will minimize residual tree damage and site disturbances.

An informed falling crew will eliminate controllable hazards for rigging crews and landing workers. Hazards controlled by fallers also reduce the number of additional hazards that rigging crews face.

## LOG LANDING AREAS

Increased pressure to minimize site degradation is being reflected in the reduction in size of log landing areas. Landings must be constructed to safely accommodate all the required equipment and functions, as well as to provide safe work areas for ground workers. Landings must be large enough to land two-thirds of the length of the average log being yarded.

Landings can be classified as temporary structures and rebuilt once harvesting is finished. Guylines must be secured to suitable anchors. This will require that guyline corridors be felled in some areas.

Yarding corridors should be flared at the landing to prevent trees being yarded onto the equipment and workers. Trees that will interfere with the rig-up, landing of the logs, or the loading process must be removed.

## CORRIDORS

Corridors must be wide enough to facilitate safe yarding of logs. This will be a function of deflection, equipment size, timber size and height, and log length.

Corridors should be clearcut and flared at the landing. Where possible, corridors should be angled slightly cross-slope for uphill yarding.

## CROSS-SLOPE MOVEMENT OF THE SKYLINE

Planners and logging crews must minimize hazards created by the skyline striking standing trees on the edges of corridors. Under no circumstances should the skyline create widow makers in the crowns of trees. This can be controlled by use of a lead block for directional control of the skyline and/or by lowering the skyline. The use of designated “rub trees” is acceptable provided the trees’ stability is assured. If a rub tree becomes unstable, it must be removed immediately.

## RUNAWAY LOG HAZARD

**Straight downhill yarding on steep slopes is prohibited.**

Straight uphill yarding should be limited to slopes upon which there is no significant hazard to the rigging crews. On blocks where it is feasible, given the prescription, angle the corridors cross-slope so that the rigging crew is up-slope of the turn. Where no practical alternative exists to straight uphill yarding corridors on steep ground, the crew must walk a sufficient distance, cross-slope, to be clear of the runaway log hazard. Activities in the landing that may dislodge materials must be stopped when the down-slope crew is in the hazard area.

## OVERHEAD HAZARDS

There can be a significant increase in overhead hazards in partial cuts or intermediate cuts. Brushing of trees increases with the density of the residual stems. It is desirable to have the block felled well ahead of yarding activity. This increases the likelihood that residual trees will have the small broken limbs blown out of them by the wind. If the residual density is high and freshly felled, work should stop if the wind comes up past 15–20 km/h (10–15 mph).

Rigging crews must be aware of any forest health issues such as root rot. This will alert them to potential unstable trees missed by the fallers.

There is a significant hazard of trees being yarded over or snapped off by the tong line if the positioning of the carriage and placing of chokers is poor. Logs that are being laterally yarded to the carriage should be bucked to facilitate clear yarding. Logs should not be “powered” out of the hang-up position.

Rub trees that have been overused by the yarding crew or poorly selected by the planners or fallers may become hazardous very quickly. Hazardous rub trees must be removed immediately.

## WIND THROW

There is a significant increase in wind throw hazards in the following areas:

- Partial cuts in which a sufficient number of stems per hectare have been removed, reducing intercrown damping
- Riparian and Gully Management areas in which the edges have not been feathered or the crowns reduced
- Side and back lines laid out without sufficient consideration of predominant wind in relation to elevation and topographic features

Cable yarding crews must have a written wind speed shutdown criteria in order to ensure control of the wind throw hazard. The operation should also have administrative procedures to control post-wind throw hazards, such as leaning trees or unbuffered danger trees in Riparian Zones.



## **WIND THROW AMENDMENTS**

In many of the wind-thrown edges, retaining standing trees to function as a wind break may be desirable to prevent further blowdown. The logging plan for the wind throw amendment must reflect:

- The location of the yarding corridors
- The lay of the wind-thrown trees in relation to the direction of yarding
- The specific type of yarding equipment to be used (for example, skyline with dropline carriage); this is important because a grapple yarder system cannot fulfil the performance requirements of a dropline system
- Faller substitution of residual trees to allow for hazardous tree removal and establishment of corridors
- Widening of the corridor at the roadside
- Availability of backspars and/or tailhold stumps
- Appropriate deflection for the yarding system

## **RIPARIAN MANAGEMENT AND RESERVE ZONES**

The logging plan must include notations to allow for tailholds in reserve areas and skyline corridors through the reserve areas of the block where safe deflection is necessary.

It may be necessary to map and field mark backspars or tailhold trees and provide a written description of how tree damage will be controlled.

Danger trees within reach of a skyline that passes through the Riparian Reserve Zone must be removed. It is important that planners include appropriate comments on the silviculture and logging plans.

## FEATHERED EDGES

Many prescriptions require that the edges of Riparian Zones be selectively cut to reduce wind throw potential. The larger “trigger trees” and other merchantable timber are removed. To minimize hazards to the rigging crew from residual saplings and trees being yarded over, it is advisable to yard these trees in tree lengths. If the trees are bucked to log length, residual trees made hazardous by yarding activities must be removed before workers set chokers in the hazardous areas.

## TRESPASS

It is important that each logging plan provide for the removal of over-the-line danger trees within reach of the work areas. Each operation must have a formal internal reporting system between the fallers, supervisors, and forestry engineers. Forest engineering staff must in turn establish formal approval procedures for removal of over-the-line danger trees not covered in the original logging plan.

This notification process is extremely important in controlling hazards in areas such as Riparian Zones or Biodiversity Patches. Wind throw creates these hazard areas during the harvesting phase. The logging plan must also note trees felled for guyline stumps and guyline corridors.

Remember:

**“PLAN THE WORK AND WORK THE PLAN.”**

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# LANDING LAYOUT AND GUYLINE PLACEMENT

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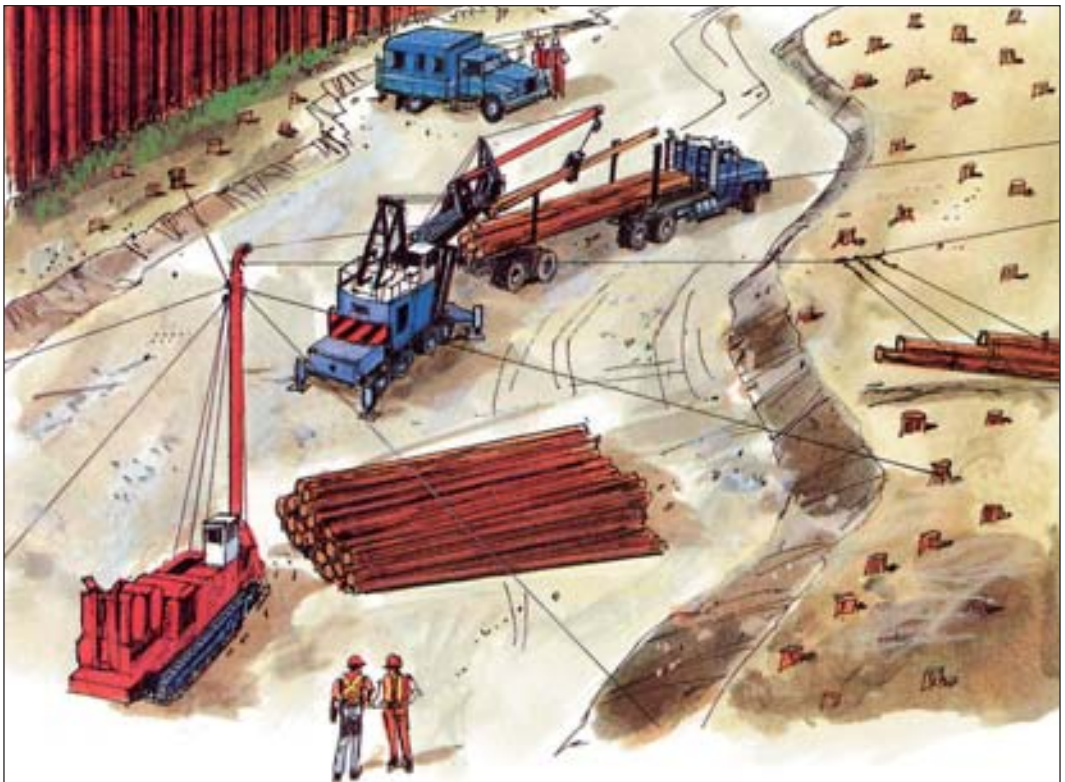
This chapter describes selection and design of landings and placement of guylines.

## LANDINGS

### Typical Landing Layout

Log landing areas should provide:

- Sufficient room for two-thirds of the length of the log to be landed
- A flat surface that ensures the logs will not slide back down the hill; workers must be able to unhook the chokers without the aid of a loader or skidder
- Enough room for swing yarder and loader operators to maintain 60 cm (2 ft.) of counterweight clearance
- Room for through traffic or other mobile equipment, if it is being used in the area



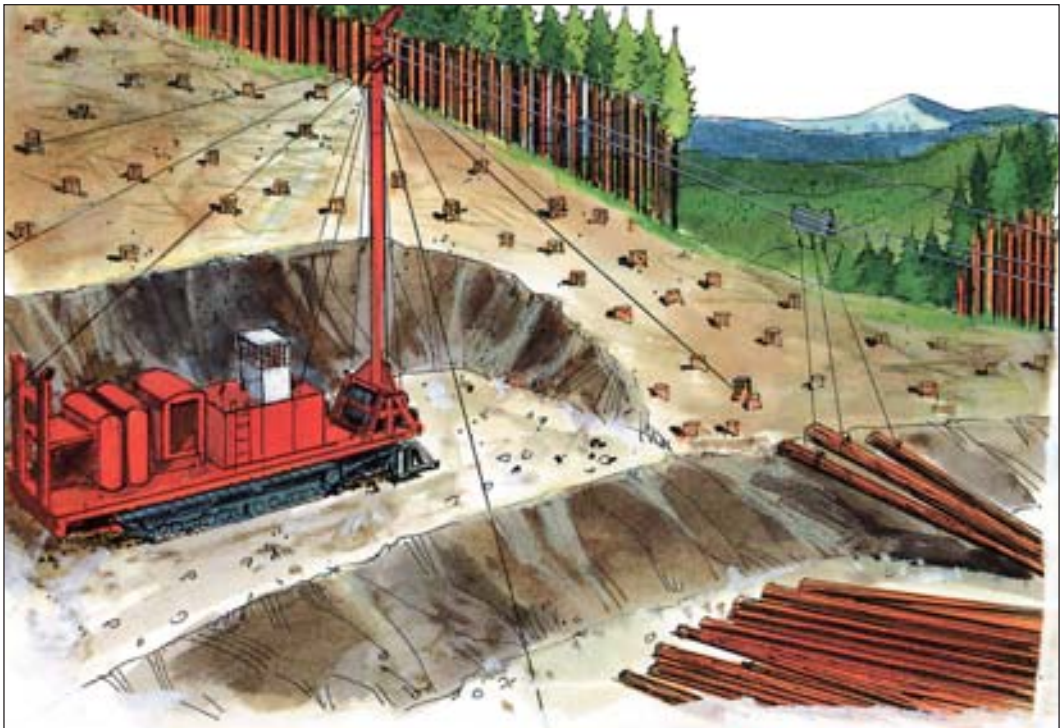
*Good landing layout.*

## Guyline Clearance

Planners must consider the requirements for guyline clearances on landings. Guylines must be secured to stumps. If necessary, guyline corridors must be felled through the timber and all danger trees removed. Operations must cease if wind creates a wind throw hazard.

## Jump-up Landings

On steep ground, jump-up landings may be the best solution for creating a safe log landing area. In creating a jump-up landing, a short spur is built above the haul road. The yarder is placed on the level at the top of the spur, and logs are landed on the haul road below.



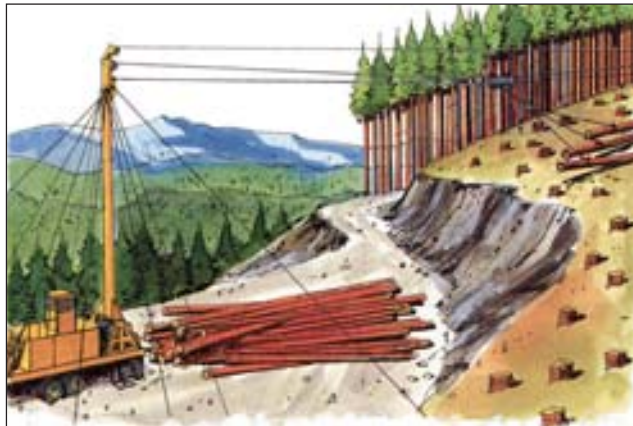
*Jump-up landing.*

## Downhill Yarding Landings

Log landing areas for downhill yarding should provide sufficient room for the log to clear the cut bank and be landed in a controlled manner. The machine should be far enough back that the logs will not roll or swing into the machine.



*Inadequate landing.*



*Adequate landing space.*

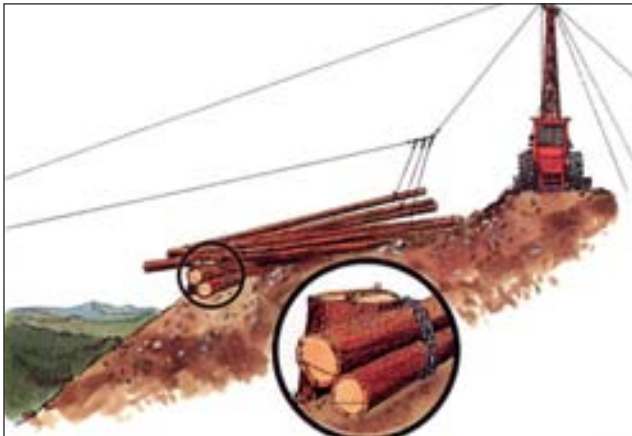
## Small Wood Log Landing Areas in Steep Ground

The three common log landing arrangements for steep ground small wood logging are:

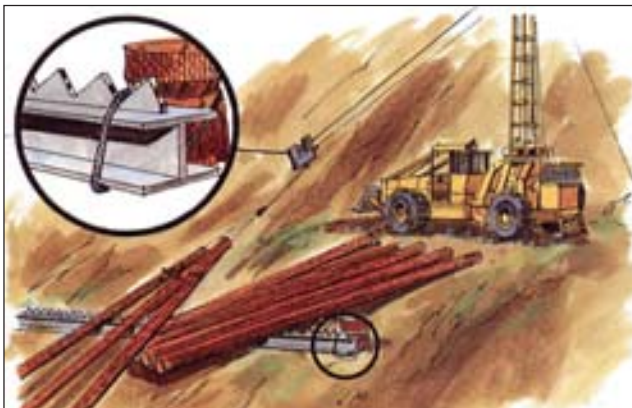
- Chutes (natural draws)
- Brow logs
- Log brakes



*Chute.*



*Brow log.*



*Log brake.*

### **Chutes**

Chutes are natural, V-shaped draws that allow the operator to land logs on steep slopes. The unchoked ends of the logs are held by the side slope of the draws. The choked ends of the logs are laid on the fill from the road cut. Usually, no more than one or two turns can be piled before the logs have to be skidded clear. Proper planning takes advantage of these natural chutes and locates the corridor within them.

### **Brow Logs**

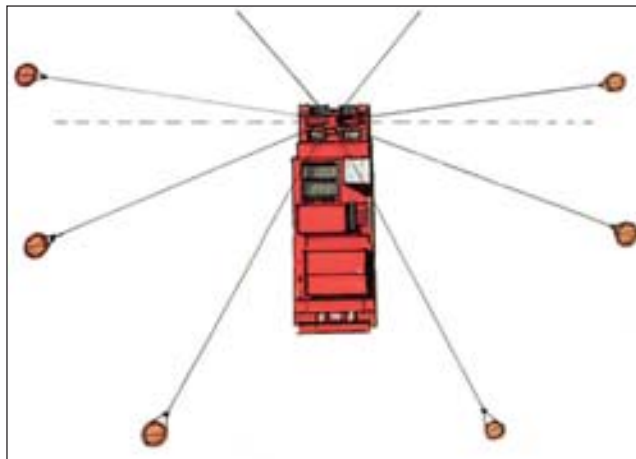
Brow logs may be used where no natural chute exists to prevent logs from sliding back down the hill. Brow logs are one or more logs chained to high stumps located just below the roadway. The turn of logs is yarded past the brow log(s). When the lines are slacked, the unchoked ends of the logs rest against the brow log(s), preventing them from sliding back down the hill.

As with the natural chute, the wood should be progressively skidded away or swung by a loader.

### **Log Brakes**

A log brake is a mechanical device of steel spikes, upon which the turn is landed. The steel spikes hold the logs while the turn is unhooked.

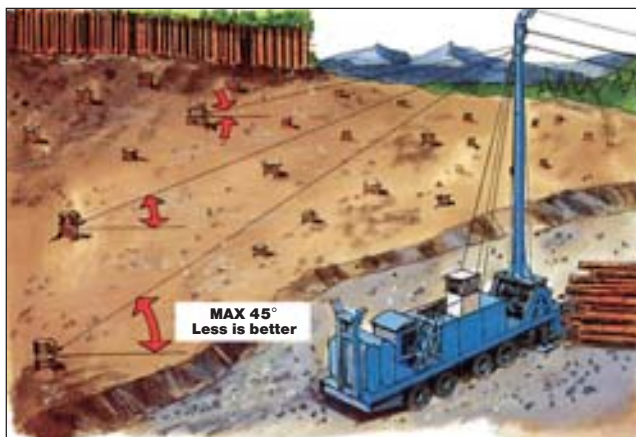
## YARDER GUYLINES



Correct guyline placement – eight guylines.



Small wood yarder – three guylines.



Maximum guyline angles.

Today's yarders are fitted with two to eight guylines.

Guylines and guyline stubs are critical components for yarder stability. Guylines are commonly used until external wear or corrosion indicates they should be replaced. When damage to a line occurs, such as severe abrasion, corrosion, or kinking, the line must be removed from service.

Guylines must be periodically inspected. One method is to open the line to the core. If the core is dry or lacking lubrication, the worker inspecting the line should check for other deficiencies, such as broken wires, excessive wear, or line deformation. If any of these are found, the line must be removed from service.

See "Wire Rope Rejection Criteria," page 61, or the Occupational Health and Safety Regulation, Section 15.25.

The following practices will damage wire rope and should be avoided:

- Pulling guyline stubs behind a vehicle from one setting to another severely abrades the exterior of the line, creates heat, and forces dirt into the line, which then acts as an abrasive in the core and between strands.
- Running over guylines with tracked and rubber-tired mobile equipment, (loaders, crawler tractors, and log trucks) during a rig-up or move may cut or severely kink the line.

If the line is coated with dirt or mud, damage is not always apparent. Damage can be eliminated by spooling guylines and stubs properly onto a "line horse," or placing them in storage where they cannot be damaged by mobile equipment.

Once guyline stumps are selected and notched, guylines are then pulled out to the anchors. On large yarders, this is done with the aid of the yarder strawline. On small yarders, the guylines are normally pulled out by hand.



*Stringing a guyline with strawline.*



*Pass chain wrapped against the pull.*

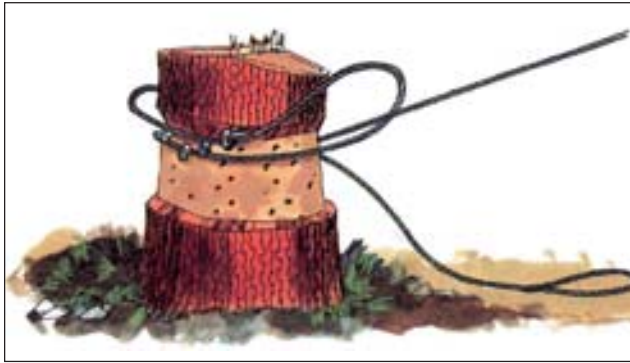
Remember the following points when pulling out guylines with the strawline:

- Hang a light strap and Tommy Moore block on the guyline stump or just behind it and string the strawline.
- Connect the strawline to the guyline end with a pass chain far enough up the guyline to provide enough slack for the guyline end to go around the stump.
- When wrapping the guyline with the chain, ensure the chain is wrapped opposite the direction of pull.
- Place the guyline around the stump with the lead to the spar on the high side. This will make disconnecting the guyline easier.
- Use a proper guyline shackle to connect guylines to the anchors.
- Insert the guyline shackle pin from the bottom for easier removal.
- Place the pin in the eye of the guyline and secure it.



## Safety Wrap for Additional Spiked Guylines

When additional yarder guyline support is required, guylines may be spiked to the anchor with railway spikes.



*Safety wrap.*

The release of a guyline spiked to a guyline anchor stump will create a hazard if a safety wrap is not used. The following safe work procedure can reduce this hazard (additional, site-specific work procedures may be required):

1. Check the spikes in the guyline wraps to ensure they are solidly in the stump. There must be three wraps on the stump.
2. If the guyline is tightly tensioned, it may be necessary to drive additional spikes in the last wrap to stop it from slipping when the first and second wraps are released.
3. The guyline slack and loose guyline end must be out in front of the guyline anchor stump.
4. Use a spike bar and hammer to pull the track spikes from the first wrap. Remove the wrap from around the stump.
5. Pull the spikes from the second wrap.
6. Take the second wrap around the back of the stump and form a loop. Hold the loop in place by hooking the bight under a spike positioned just above the last wrap. This will hold the line down and stop it from flipping over the stump when the last wrap is released.
7. The guyline slack and loose guyline end must be pulled out in front of the guyline stump on the lead side.
8. With the bight of the guyline held down by the single spike, remove the spikes carefully from the top side of the last wrap inside the looped bight.
9. Remove these spikes one at a time.
10. The worker using the spike bar must stand on the loop side of the guyline, away from the hazardous area, which will be swept by the released guyline.
11. The worker using the sledge hammer to drive the spike bar must also stand on the loop side of the guyline.

## SUITABLE ANCHORS

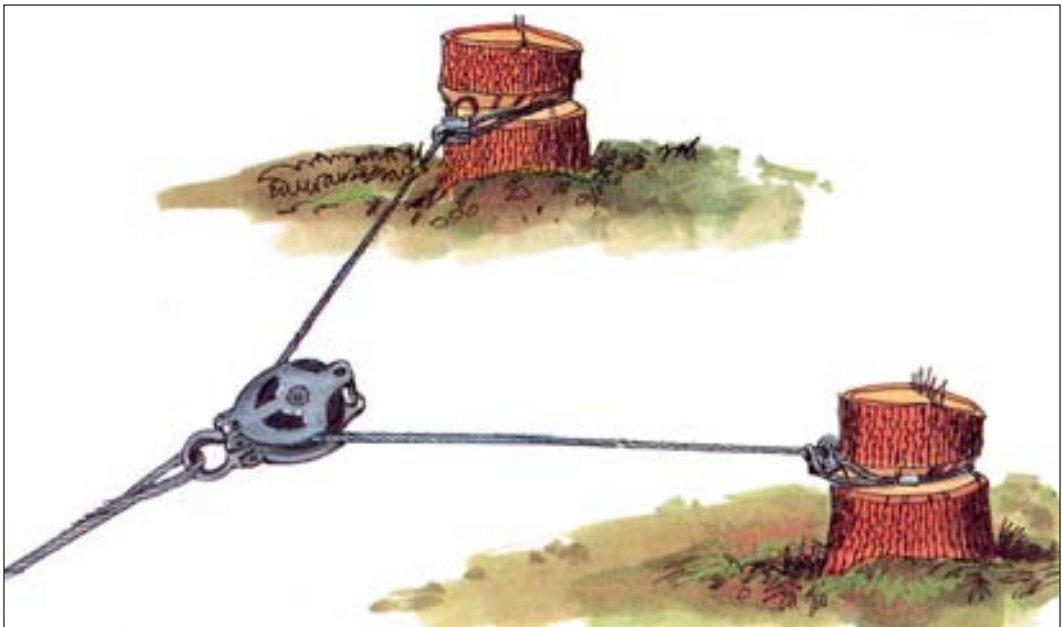
Many factors affect the suitability of a stump to withstand the stresses placed on it during yarding. Each species of tree has a different root system. Factors that affect the root system are:

- Soil type
- Moisture
- Density
- Slope change

Predicting the holding power of a stump is difficult. Therefore, all stumps used as anchors must be inspected daily. A rule of thumb is to make a stump's holding power proportional to the square of the diameter; for example, an 80 cm (32 in.) stump is four times stronger than a 40 cm (16 in.) stump. The holding power of a stump:

- Increases with soil depth
- Increases with soil density
- Is greater on an uphill pull
- Decreases as soil moisture increases

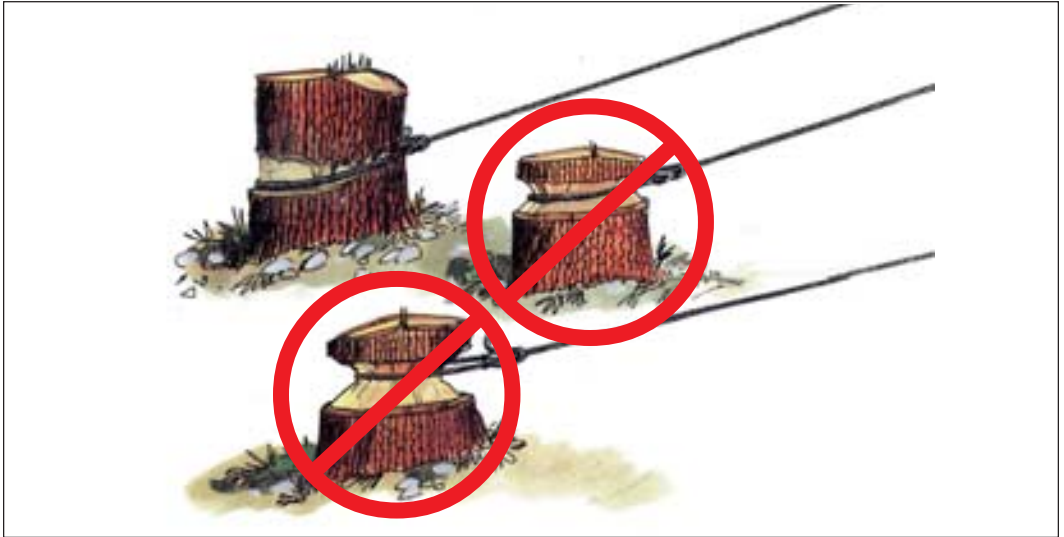
In the event that a single stump is not adequate, multiple stumps must be tied together and used. This could be a two-stump configuration where a bridle block is used, or it could be several stumps tied together (see page 43).



*Bridle block.*

## NOTCHING OF STUMPS

Stumps must be notched to hold the guyline. To prevent slabbing, the notch should be placed as close to the bottom of the stump as possible without cutting off the roots, and in lead with the guyline.



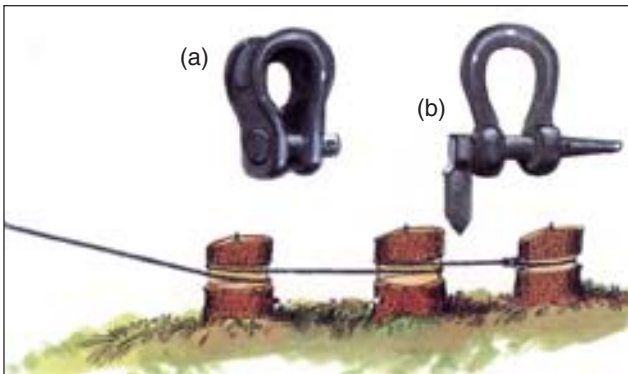
The top stump is properly notched. The notch in the middle stump is placed too high. The notch in the bottom stump is too deep.

## SECURING OF STUMPS

When there is doubt about a stump's dependability, use one or more of the following methods to increase stability and holding power:

- Multiple stump anchors
- Twisters
- Jill-poke supports
- Deadweight anchors

### Multiple Stump Anchors



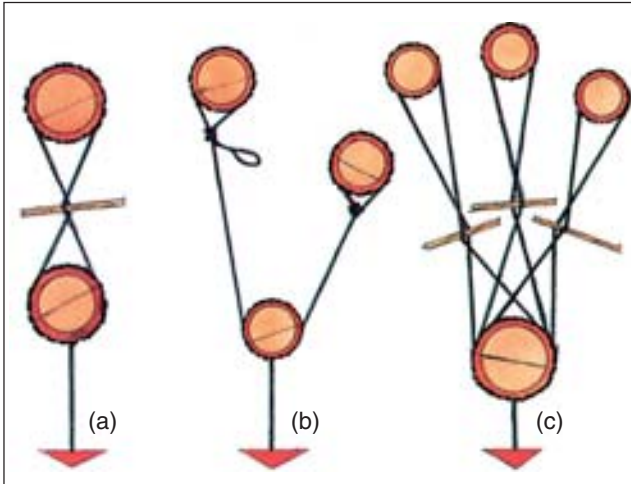
Acceptable multiple stump anchors:  
(a) flat shackle, (b) bell shackle.

When a single stump is not available or is inadequate, it is acceptable to use multiple stump anchors such as a "wrap and choke." Guylines or skylines must be anchored to stumps with acceptable devices such as flat or bell shackles. Pins must be secured with Molly Hogans or other effective devices.

## Twisters

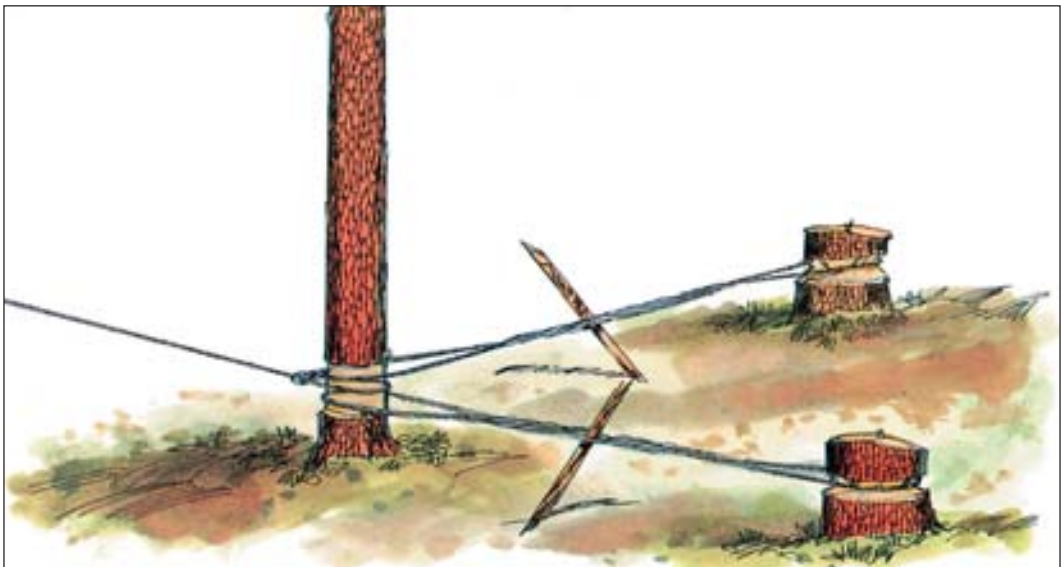
Remember the following points when securing stumps with twisters:

- Select suitable anchors in lead with the pull.
- Select suitable line for the twisters.
- Notch secondary anchors to prevent line slippage.
- Select a good, sturdy, green limb or sapling of sufficient length for the twister stick.
- Install the twister with a minimum of two wraps (four-part line).



(a) Single twister. (b) Two legs with cable clip.  
(c) Multi-legged twister.

- Secure with a timber hitch.
- Use two poles if a long span requires more than one.
- Tension lines so they will almost touch.
- Place the twister pole between the lines.
- Rotate the twister pole uphill until tight.
- Secure the pole 90 degrees to the twister lines.
- Ensure that a worker check system is used when only one worker is available to install twisters.
- Unwrap a twister when removing it. Do not cut the pole to reduce tension.

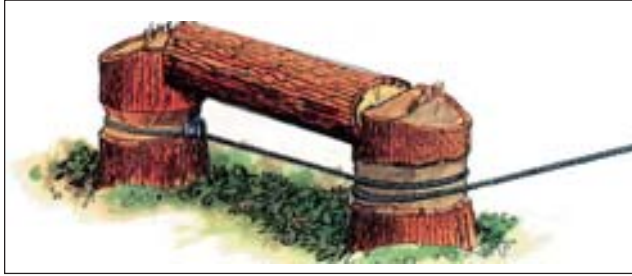


*Twisters on a standing tailhold.*

## Jill-Poke Supports

Follow these four steps when using jill-poke supports to secure stumps:

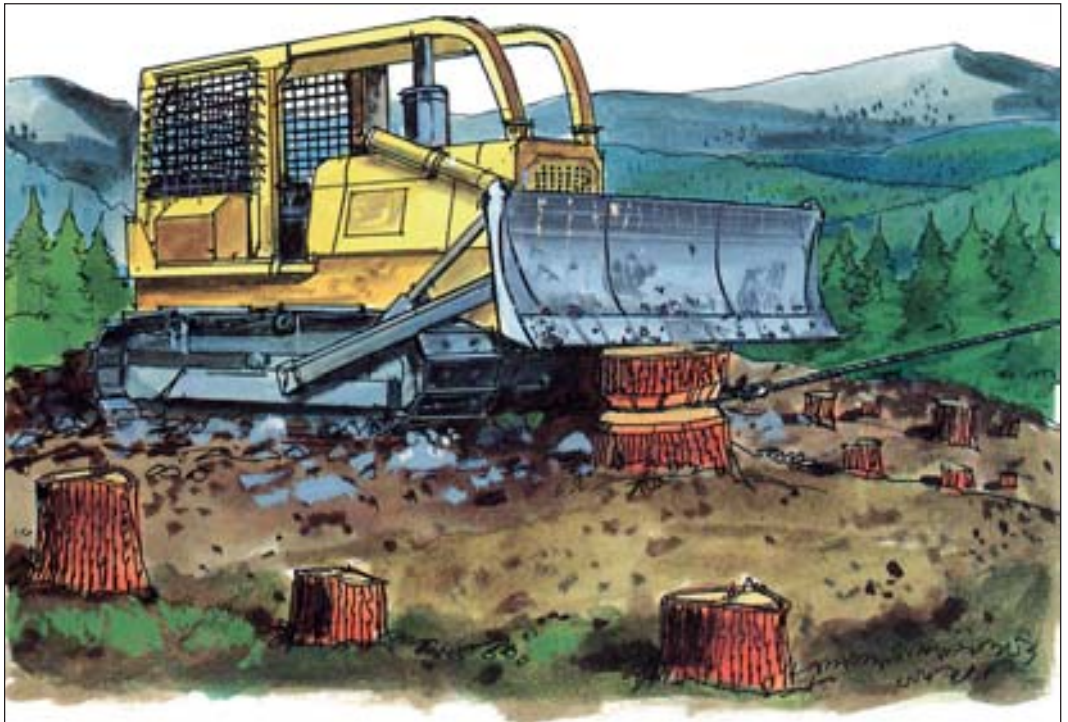
1. Select a suitable secondary anchor in front of and in lead with the anchor stump.
2. Cut a flat surface on each stump facing the other.
3. Cut a suitable log slightly longer than the distance between the two faces.
4. Drive the log into position between the anchors.



*A jill-poke can replace a twister.*

## Deadweight Anchors

Mobile equipment can provide additional support for securing a stump by placing the blade or track on the stump or root system.

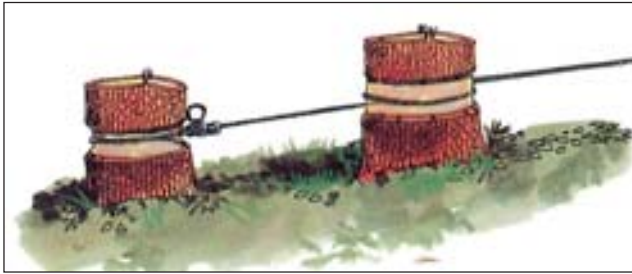


*Bulldozer blade adds support to stump.*

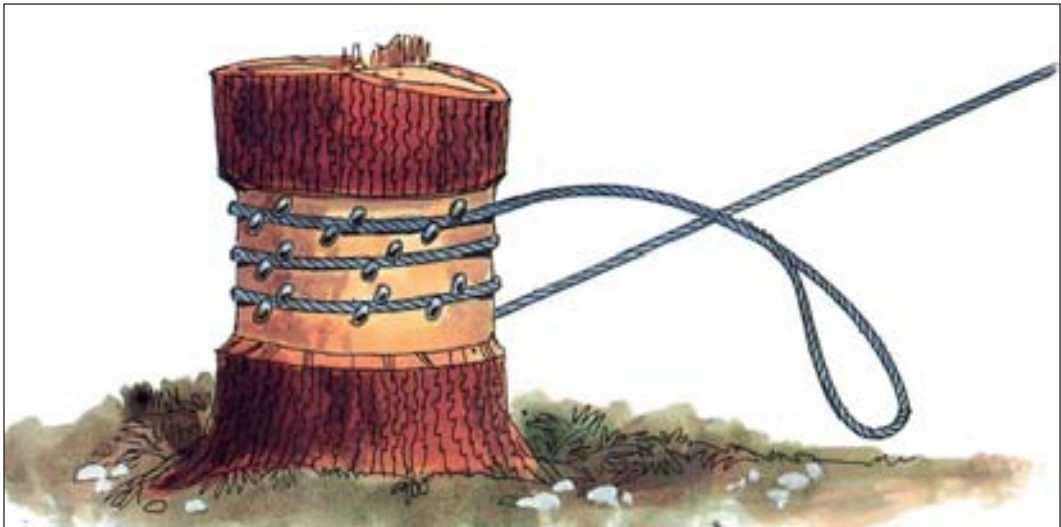
## SKYLINE ANCHORS

A skyline supplies lift for the rigging. With adequate deflection, the skyline need not be elevated at the back end; however, this method requires adequate

anchor holding power and tiebacks. When deflection is minimal, skyline tailholds may be located well beyond the setting boundary. To acquire lift or deflection, backspars may be used. This method requires specialized rigging, climbing gear, and training.



*A wrap and a choke.*



*Home spar spiked guyline.*

## BACKSPAR GUYLINES

### Rule of Thumb

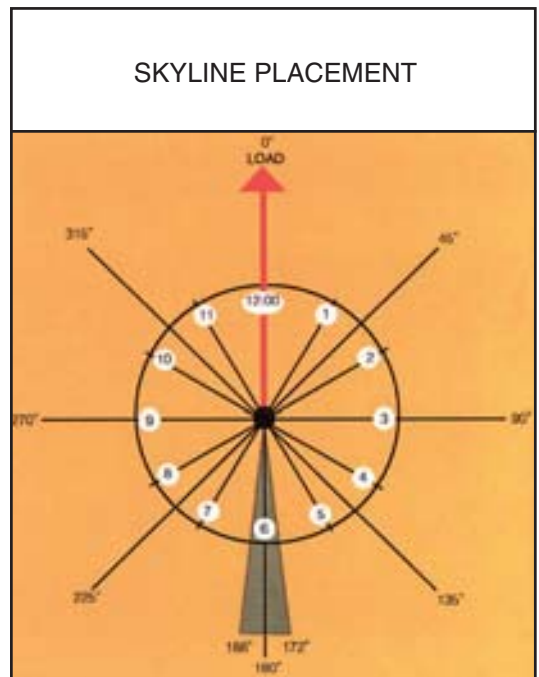
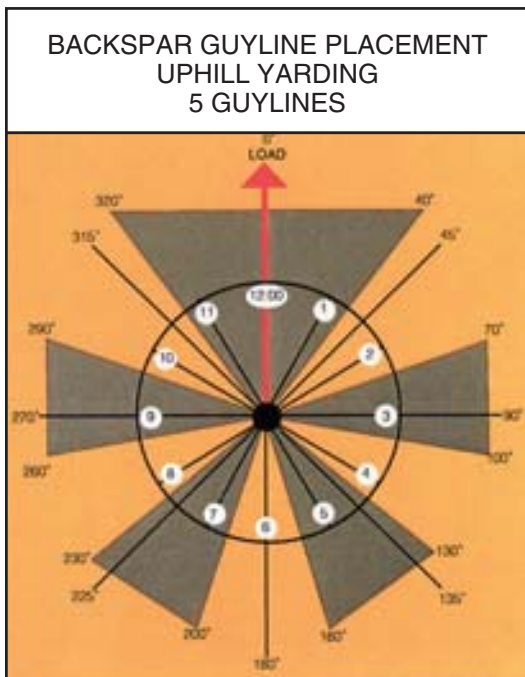
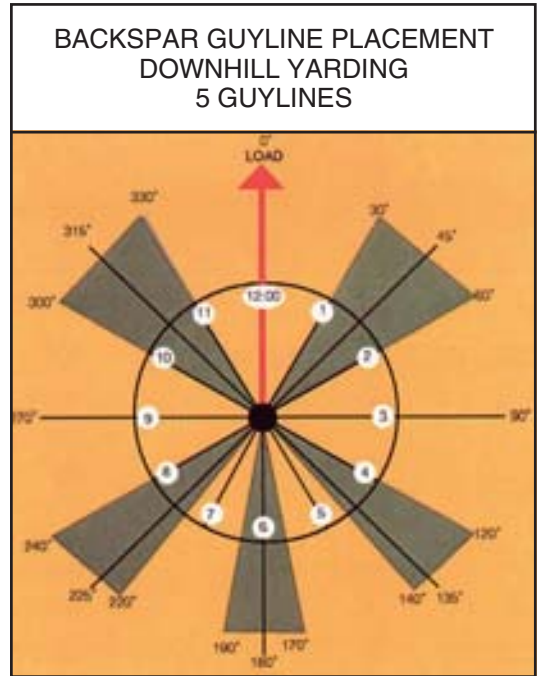
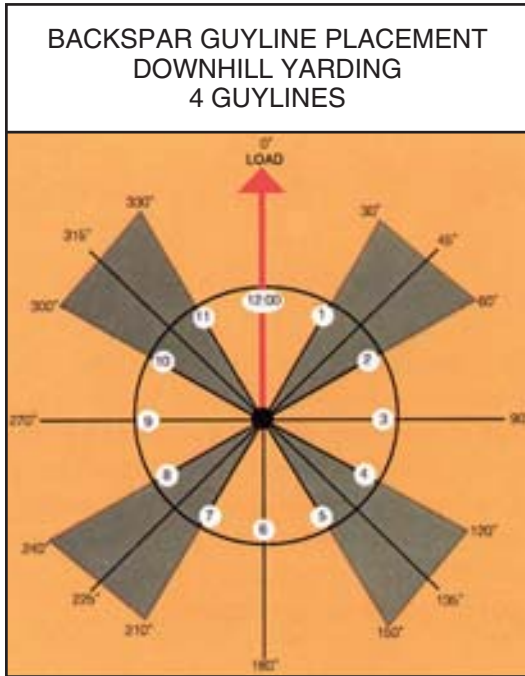
2.5 cm (1 in.) of slack in the guyline on the stump gives 30 cm (1 ft.) of slack in the belly of the guyline.

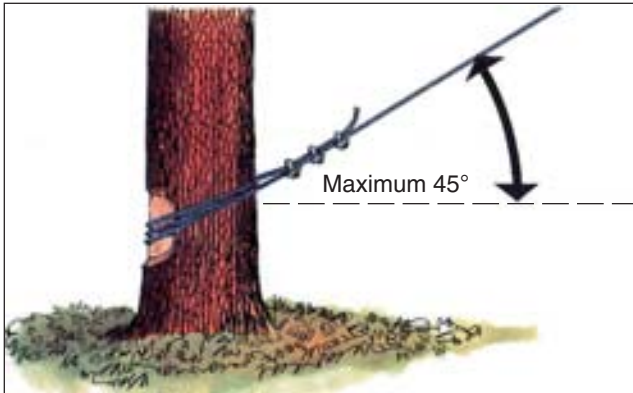
When a backspar is required, guylines must be used. Proper rigging practices for guylines also apply to backspars. A come-along may be used to tighten a backspar guyline; use a minimum of three spikes to secure the last wrap.

A guyline secured to a stump must be wrapped at least  $2\frac{1}{2}$  times. The top wrap must be secured with three spikes. The number and position of spikes should be adequate to ensure that the guyline will handle the imposed stresses.

Railway spikes should only be used with large lines and large stumps.

The following diagrams show acceptable guyline and skyline placement patterns.





Cable clips are acceptable for securing lines. The line must have at least one full wrap on the stump. Ensure that the required number of clips are properly installed and torqued.

*Backspar with cable clips.*

## **TIGHTENING SEQUENCE**

When yarding downhill from a backspar, the two front guylines must be tightened first. When yarding uphill, the two back guylines must be tightened first. Guylines should be tensioned to support the backspar adequately, and positioned so that the inside angle is less than 45 degrees to the horizontal. When this cannot be done, additional guyline support is required.



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# ALTERNATIVE ANCHOR SYSTEMS

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This chapter describes anchor systems not identified in the previous chapter, “Landing Layout and Guyline Placement.”

## EQUIPMENT ANCHORS

Where stumps have limited holding power, mobile equipment such as grade hoes, crawler tractors, and front-end loaders may be used.

Consider these points when using mobile equipment to secure stumps:

- Use softeners to prevent line damage.
- Use shackles for connections.
- Do not place the equipment on sheer rock or unstable ground.
- Ensure the stability of the equipment being used as an anchor by:
  - Placing the blade against a stump
  - Digging the blade into the ground
  - Tying the equipment back
  - Ensuring that the angle between the boom and stick is more than 90 degrees
  - Ensuring that the tractor blade is set at 90 degrees to the “C” frame

## EARTH ANCHORS

Where stumps are not available or are inadequate, earth anchors are an alternative. Installation requires specialized equipment. Earth anchors have

substantial holding power; however, two or more per application are often required.



*Pickets.*

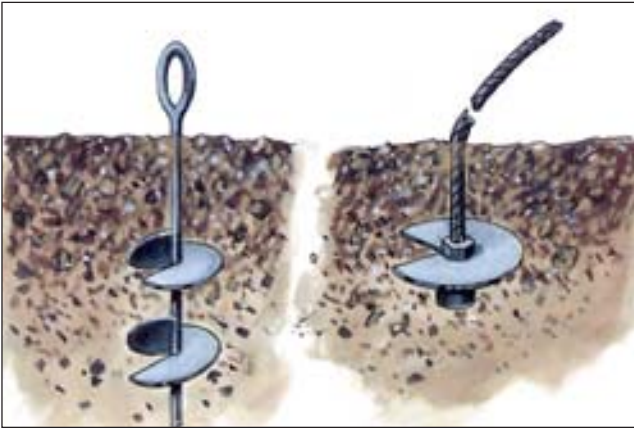
Earth anchors come in the following forms:

- Pickets
- Screw-in anchors
- Tipping plate anchors
- Bridle blocks
- Deadmen

### Pickets

Pickets are posts or pegs driven into the ground. They have limited holding power and are time-consuming to install.

## Screw-in Anchors

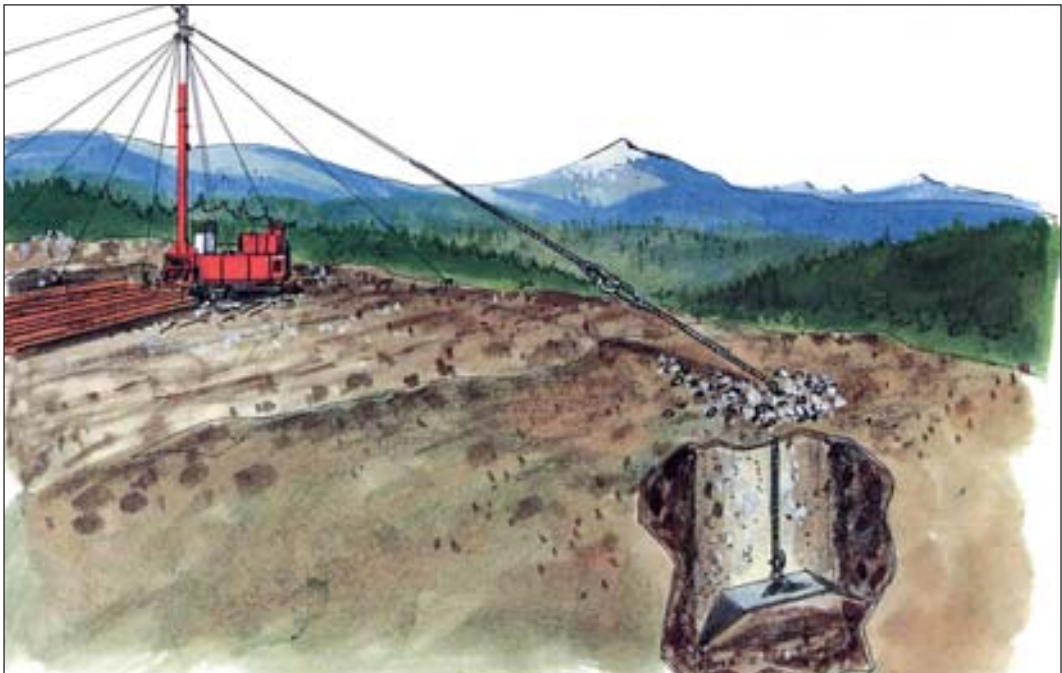


*Screw-in anchors.*

Screw-in anchors resemble augers. They require special equipment and are threaded into the soil to a depth specified by the manufacturer. Installed properly, these anchors are effective, but they are limited to clay, sand, or gravel soils.

## Tipping Plate Anchors

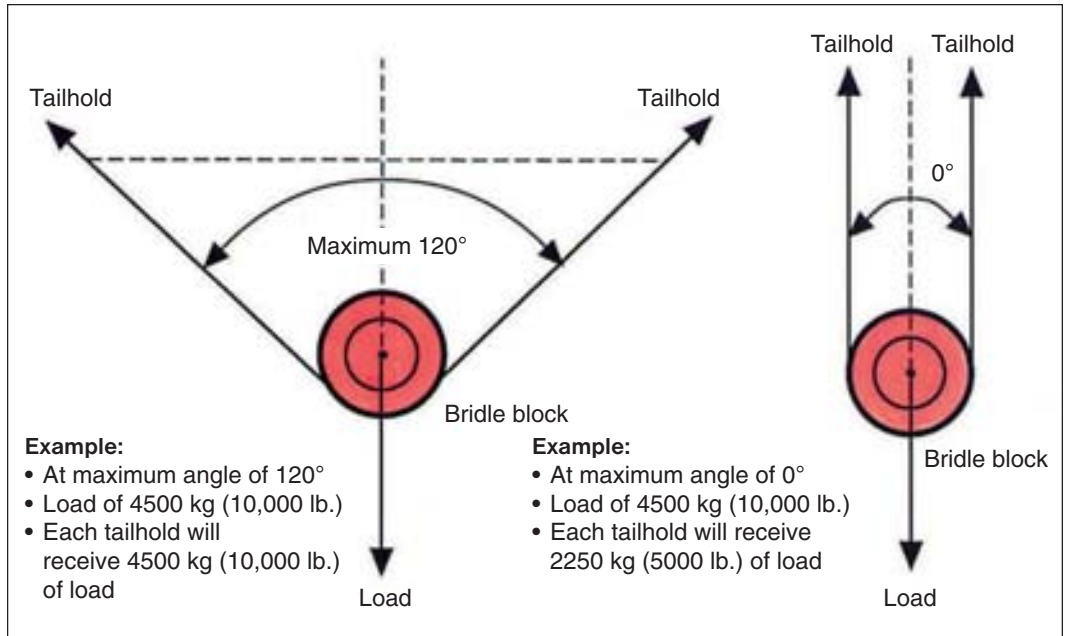
Tipping plate anchors are used in clay, sand, or gravel. Manufactured in a variety of shapes and sizes, they are effective when installed correctly. Depending on the soil conditions, pre-drilled holes may be required, with subsequent backfilling. Other models require special vibrating installation equipment that forces the anchor through the soil to a pre-determined depth.



*Tipping plate anchor.*

## Bridle Blocks

A bridle block may be used to distribute forces equally at a tailhold. The angle at the bridle block is critical and must not exceed 120 degrees. If the angle is greater than 120 degrees, there will be greater pull on each leg of the bridle than the original pull; **the less angle, the better.**



## Deadmen

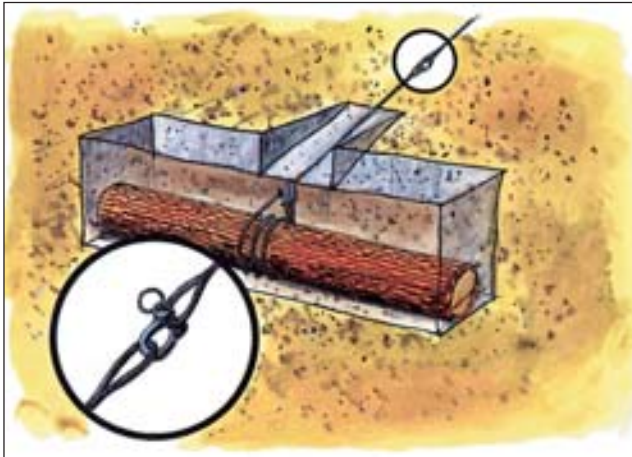
A deadman is a buried log or logs used for an anchor. Deadmen anchors are used when adequate stumps are not available. The holding power of a deadman depends on soil type, compaction in the front face of the trench, log diameter, and length.

Logs of strong species should be used, such as firs or pines. Avoid low-strength and soft species.

The following eight steps will assist in determining an adequate deadman:

1. Determine the maximum load (P) to be imposed on the deadman in kips – 1 kip (1,000 lb. force) = 4.45 kN.
2. Using the “Typical Wire Rope Specifications” chart on page 60 and the formula on page 59, determine the working load limit for the wire rope size.
3. Determine the angle of pull in percentage.
4. Determine the ground slope in percentage.
5. Determine the soil type and compaction.

6. Using the kip value from the first step, determine the correction factor for (P), using chart 1 on page 142.
7. Use charts 4 or 5 on pages 144 and 145 to determine the log dimensions required.
8. Use chart 3 on page 143 to determine minimum burial depth.



*Single-log deadman with connection shown.*

The most common method of securing a deadman is with the trench at right angles to the pull and the front wall as vertical as possible. To reduce the upward pull on the deadman, an exit lead trench should be excavated in the soil for the attachment line. The attachment line should be secured at the midpoint of the log, and angled up to the surface from the top of the log.

### Calculating Required Log Diameter

To approximate the log diameter required for a deadman, multiply the height of the spar in metres by 2.5 to determine the log diameter in centimetres.

For imperial measures, multiply the height of the spar in feet by 0.3 to determine the log diameter in inches.

#### Example — Metric

36.6-metre spar;  $36 \times 2.5 = 90$  centimetres.

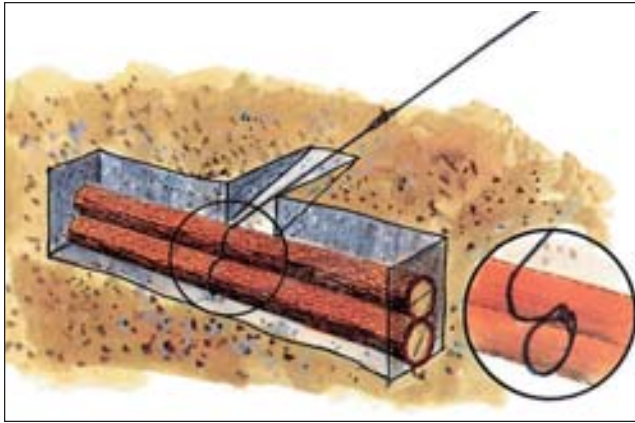
#### Example — Imperial

120-foot spar;  $120 \times 0.3 = 36$  inches.

**Any trench more than 1.2 m (4 ft.) in depth, into which a worker will enter, must be shored or sloped back to a maximum slope of 3 horizontal to 4 vertical.**

Before placing the deadman, secure the connecting stub to the log. Wrap the log at least three times with the wire rope. Secure the loose end with shackles, cable clips, spikes, or staples. Do not use an eye to choke the log, as it will chafe the rope and may cause wire rope failure. Place as little bight as possible in the connection to prevent cutting the line off.

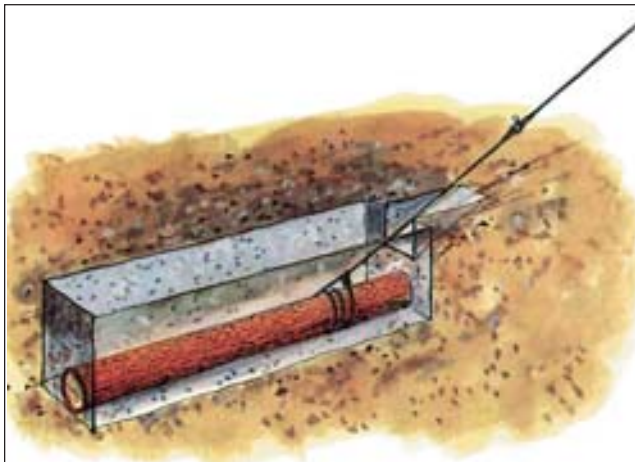
To give extra support to the deadman log, place a second log on top, and then bring the wire rope from behind and over this



*Deadman anchor with extra support log.*

log. This will reduce bending in the bottom log and distribute some of the load. Place the log in the trench and backfill.

An alternative method of installing a deadman is to place the log parallel to the direction of pull. Secure the wire rope approximately 60 cm (2 ft.) from the log end toward the machine. Dig a narrow lead trench for the attachment line toward the machine. Place the log in the trench and backfill.



*Deadman anchor parallel to direction of pull.*

In both types of deadmen, do not bury the connecting eye. Ensure that the end of the attachment line is above ground to allow for future inspection.

If the pull on the deadman is horizontal or downhill, secondary deadmen are usually not required. If the log available is small or there is a steep upward pull on the deadman, multiple deadmen may be required for the necessary additional holding power.

## ROCK ANCHORS

Where stumps are not adequate as tailholds and solid rock is present, rock anchors may be used. This type of anchor requires special equipment, training, and planning.

When using rock anchors, consider these factors:

- Type of rock – soft, medium, hard, fractured, or solid
- Vertical face or horizontal
- Loads to be imposed

Galvanized wire rope and steel pins are commonly used for rock anchors. Qualified persons must design and install these systems.

## Wire Rope

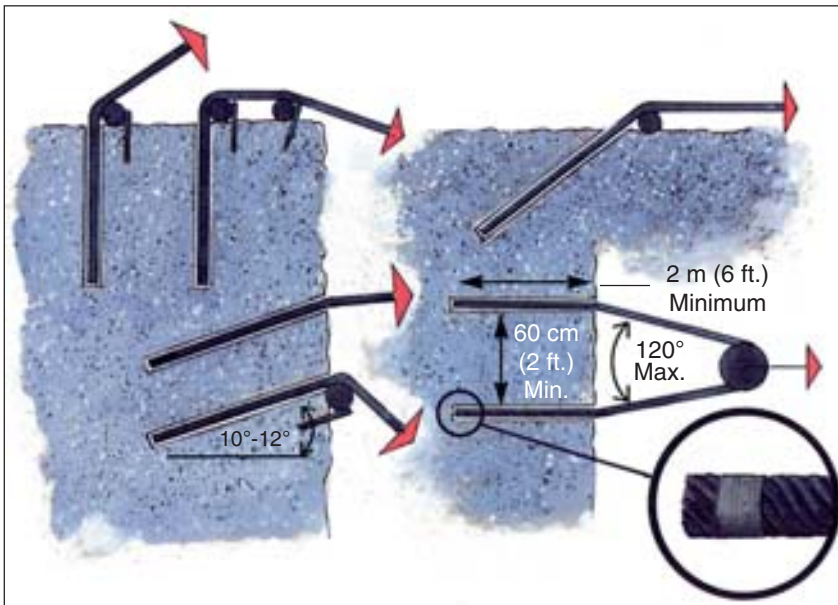


(a) Wedge socket. (b) Pressed ferrule.  
(c) Whipped end.

Regular wire rope should not be used for anchors, because it contains oil-based lubricants that would prevent grout adhesion. Galvanized wire rope, or non-lubricated wire rope, allows grout adhesion and is recommended for rock anchor use. Holes of various sizes can be drilled with a portable rock drill. Drilled holes, pins, and wire rope used for anchors must be compatible to ensure an effective anchor. First, determine the maximum loads that will be imposed on this anchor. If a single-hole anchor with wire rope is to be used, the wire rope must be as strong as or stronger than the wire rope it is connected to.

A shackle should be used to connect wire rope. Under all conditions, wire rope rock anchors must be grouted in place. To ensure a firm hold, the bottom end of the wire rope anchor should be moused (whipped), wedged, or fitted with a ferruled knob.

In rock with limited holding power, multiple anchors may be required. Bridle blocks should be used to distribute loads equally between anchors. When using bridle blocks, take care to calculate for adequate strength and hole placement. Where wire rope passes over a sharp or hard corner, place a softener under the rope for protection.



Grouted wire rope anchors in rock.

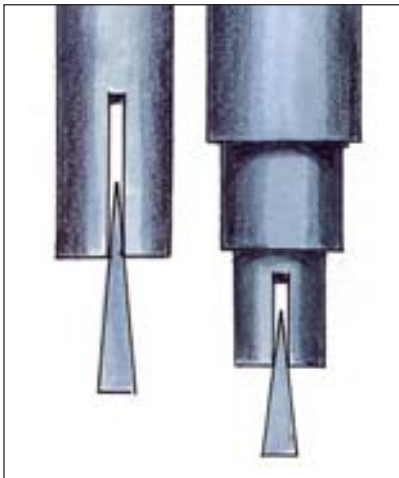
## Steel Pins



Rock pins must be made from mild steel. **Rebar is strictly prohibited.** If the pin has an eye, then the eye must be welded closed. Steel pin anchors may be wedged into position, grouted, or a combination of the two.

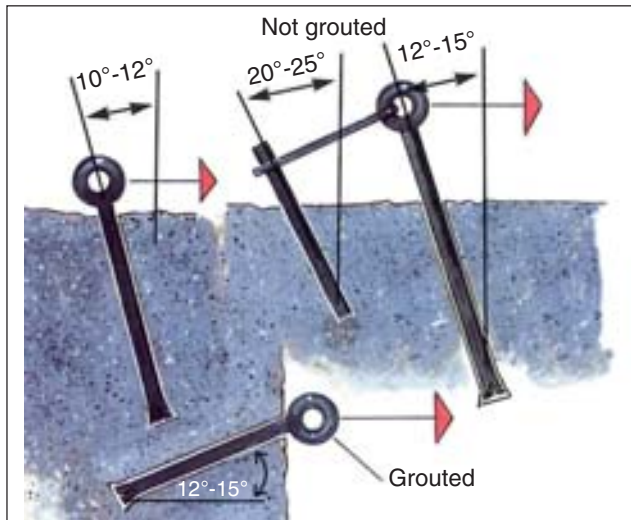
The bottom end of the pin should be secured by wedging or some form of knob. Drilled rock holes are seldom straight. In order to get a pin to the required depth, it is necessary to taper the bottom third of the pin.

*Steel pins.*



Pins that will not be grouted or wedged must be angled away from the pull approximately 10 to 12 degrees from the perpendicular (100 degrees or more) to prevent the pin pulling out. Pins can be used on a straight pull, providing there is adequate bottom wedging and the rock is medium to hard and not fractured. Grouting provides added holding strength. The hole depth should be a minimum of 1.2 m (4 ft.). Accurate measuring of the hole depth is necessary so that the rod length can be matched. The rod length must allow for the eye to be close to or against the rock surface to allow adequate setting of the wedge at the bottom. The eye must be close to the surface so that a bending moment does not occur. The exception to this is when the rod protrudes above the surface for a cantilever-type tieback. Face the eye weld away from the pull.

*Wedged steel pins.*



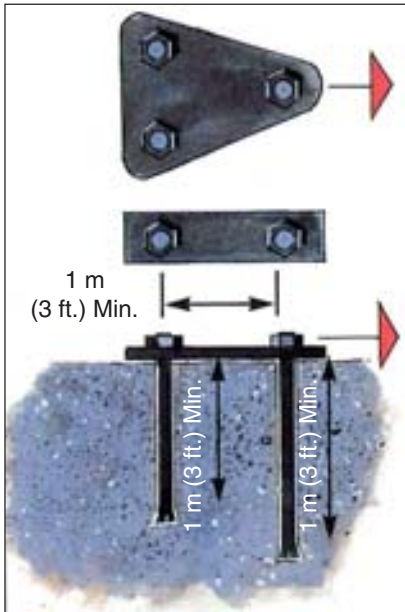
Rock anchor holes should be large enough to allow for the manufacturer's recommended amount of grout between the rock and pin surface. When grout is used, the drill-hole diameter should be approximately 2.5 cm (1 in.) larger than the pin or wire rope to be installed in the hole.

*Steel pin placement.*



For added holding power, tie back the front pin to another pin with a connecting plate.

*Steel pin plate.*



Another way to secure a line is to use a pin with a threaded end. Place the line against the rock with a plate or a large, heavy washer on top; then secure the plate in place with the nut. This method reduces bending movement and shear force on the pin because some of the holding power comes from friction of the line on the rock and washer.

*Plate holding two steel pins.*



*Steel pin plates.*

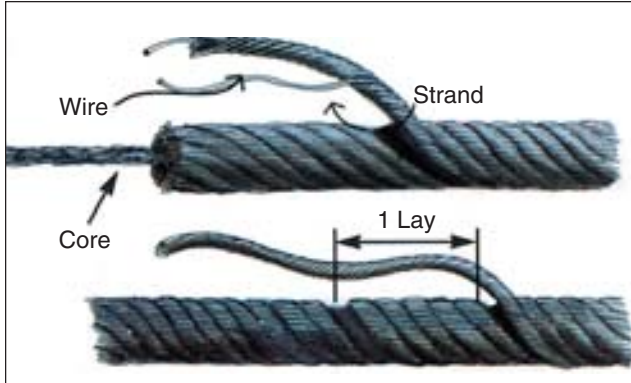


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# WIRE ROPE

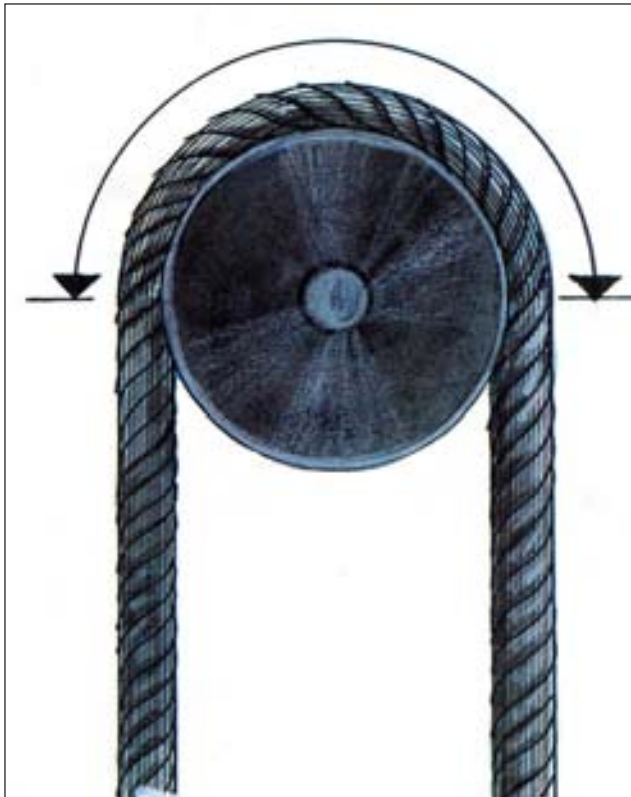
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This chapter describes grades and characteristics of wire rope and fittings, proper wire rope maintenance, and wire rope rejection criteria. It explains how to calculate safe working loads and line life.



A wire rope is a complicated system. A typical 6 x 25 rope has 150 strands. These move independently and together around the core as the rope bends. A rope is designed so that proper bearing clearances will exist to permit internal movement and adjustment of wires and strands.

*Wire rope selection is an important element in cable logging.*



*To illustrate the movement in wire rope, a 2.5 cm (1 in.) rope bent over a 76 cm (30 in.) sheave results in a difference in length of 7.9 cm (3<sup>1</sup>/<sub>8</sub> in.) from one side of the rope to the other.*

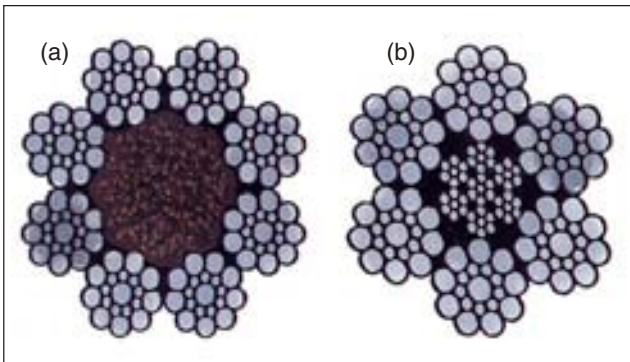
## GRADES OF WIRE ROPE

The common grades of wire rope are:

- Plow steel (PS)
- Improved plow steel (IPS)
- Extra improved plow steel (EIPS)
- Extra extra improved plow steel (EEIPS)

Each type has a different breaking strength. Finishes for wire rope include bright (uncoated) and galvanized.

The core is the foundation of a wire rope. The core is made of materials that will provide support for the strands under normal bending and loading conditions. The core may be a fibre core (FC), either natural or synthetic, or steel. If the core is steel, it could be either a wire strand core (WSC) or an independent wire rope core (IWRC).



(a) Fibre core.

(b) Independent wire rope core.

A typical wire rope is designated  $6 \times 26$  FW PRF RL EIPS IWRC. This designation means: a six-strand rope with 26 wires per strand ( $6 \times 26$ ), of filler wire construction (FW); with strands pre-formed in a helical pattern (PRF) and laid in a right-lay pattern (RL); using an extra improved plow steel (EIPS) grade of wire; and having strands laid around an independent wire rope core (IWRC).

## GENERAL CHARACTERISTICS OF WIRE ROPE

Every rope has its own characteristics with regard to strength, abrasion resistance, crushing resistance, and fatigue resistance.

### Strength

The strength of a rope is referred to as its breaking strength or catalogue strength. Strength is usually measured as a force in pounds, tons, or newtons — 1 kip (1,000 lb. force) = 4.45 kN.

### Abrasion Resistance

Abrasion resistance refers to the ability of the outer wires to resist wearing away. Abrasion resistance increases with larger wires and decreases with smaller wires.

## Crushing Resistance

Crushing resistance refers to the ability of the rope to resist being deformed. A rope with an independent wire core is more resistant to crushing than one with a fibre core.

## Fatigue Resistance

Fatigue resistance refers to the ability of the rope to withstand repeated bending without failure. Fatigue resistance increases with more wires and decreases with fewer wires. The term used to describe the ease with which a rope will bend in an arc is “bendability.”

When wire rope is bent around sheaves or any other objects, friction occurs, creating heat that causes the internal lubricant to deteriorate. Additional friction occurs as the rope stretches and contracts under load.

When stretched past its elastic limit, wire rope will reduce in diameter and not return to its original diameter or strength.

## BREAKING STRENGTH AND WORKING LOAD LIMIT

### Example

6 x 26 IWRC with a diameter of 25 mm (1 in.) has a breaking strength of 400 kN (45 tons). Use a design factor of 3 to get the working load limit when the wire rope is used as a standing line:

$$400 \text{ kN} \div 3 = 133 \text{ kN}$$

$$45 \text{ tons} \div 3 = 15 \text{ tons}$$

Wire rope has an assigned breaking strength (BS). Working load limit (WLL) is the line’s breaking strength divided by a design factor (also known as a safety factor). Engineering calculations and test results determine design factors.

Working load limit is based on a design factor of:

- 3, or  $\frac{1}{3}$  the breaking strength, for running lines
- 3, or  $\frac{1}{3}$  the breaking strength, for standing lines
- 10, or  $\frac{1}{10}$  the breaking strength, for lines used to lift workers

## Typical Wire Rope Specifications

The following table gives typical specifications for improved plow steel (IPS) with independent wire rope core (IWRC). Construction of wire rope in the logging industry is generally 6 x 26 for diameters 13 mm ( $\frac{1}{2}$  in.) and greater.

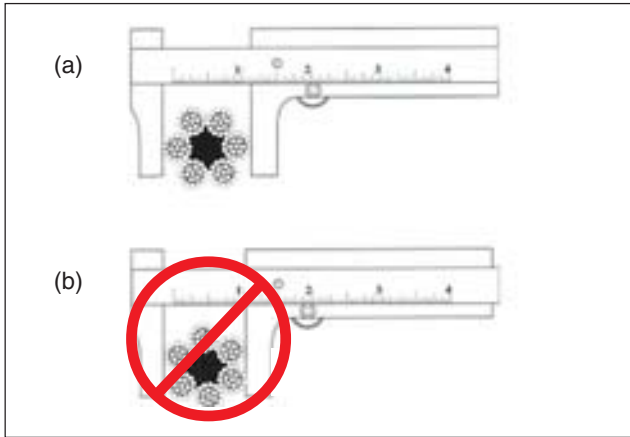
Swaged line is manufactured by running a nominal-sized line through a drawing die to flatten the outer crown and thus reduce the rope diameter. This compacted rope allows for increased drum capacity while still maintaining line strength.

Swaged compacted-strand line is made from individual strands that have first been compacted by drawing them through a drawing die to reduce the diameter. The compacted strands are then made into wire rope. The finished rope is then swaged, or further compressed.

## Typical Wire Rope Specifications

Diameter		6 x 26 Improved Plow Steel				6 x 26 Swaged				Swaged Compacted-Strand			
		Weight		Breaking Strength		Weight		Breaking Strength		Weight		Breaking Strength	
mm	inch	kg/m	lb./ft.	kN	tons	kg/m	lb./ft.	kN	tons	kg/m	lb./ft.	kN	tons
13	½	0.68	0.46	102	11.5	0.89	0.60	135	15.2	0.94	0.63	166	18.6
14	⅝	0.88	0.59	129	14.5	1.12	0.75	169	19.0	1.16	0.78	211	23.7
16	⅝	1.07	0.72	159	17.9	1.38	0.93	210	23.6	1.50	1.01	253	28.5
17	⅞	Not available				1.64	1.10	257	28.8	1.76	1.18	314	35.3
19	¾	1.55	1.04	228	25.6	2.04	1.37	308	34.6	2.10	1.41	376	42.2
21	⅞	Not available				2.32	1.56	352	39.6	2.43	1.63	439	49.3
22	¾	2.11	1.42	308	34.6	2.72	1.83	414	46.5	2.84	1.91	499	56.0
24	⅞	Not available				2.90	1.95	474	53.3	3.27	2.20	588	66.1
25	1	2.75	1.85	400	44.9	3.60	2.42	540	60.6	3.77	2.53	656	73.7
29	1⅝	3.48	2.34	503	56.5	4.36	2.93	669	75.1	4.42	2.97	827	92.9
32	1¾	4.30	2.89	617	69.3	5.24	3.52	826	92.8	5.70	3.83	997	112.1
35	1⅞	5.21	3.50	743	83.5	6.37	4.28	963	108.2	6.88	4.62	1145	128.6

## MEASUREMENT OF WIRE ROPE DIAMETER

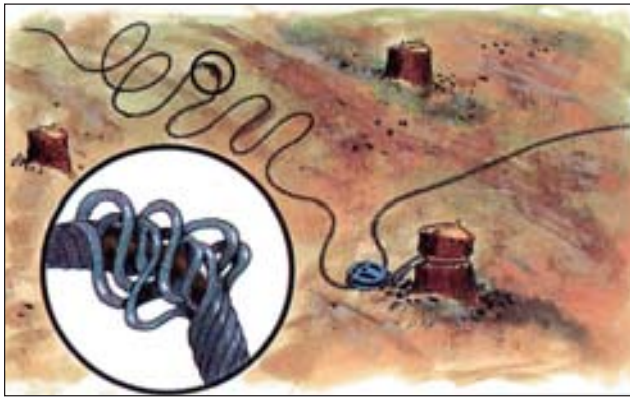


The diameter of wire rope must be measured accurately.

(a) *Correct method. Wire rope is measured across the crests of the strands.*

(b) *Incorrect method.*

## WIRE ROPE REJECTION CRITERIA



*Birdcaging.*

If any of the following deficiencies are observed, the line must be taken out of service:

- Broken wires
- Broken wires near fittings
- Severe surface wear and inter-strand nicking
- Drum crushing
- Bird caging
- Kinking

Non-running lines, such as standing lines and guylines, are often kept in service from four to five years because they may not

exhibit any external signs of excessive wear, other than rust. In such lines, periodic internal inspection may reveal a fractured or dry core. If so, check for other deficiencies, such as broken wires, excessive wear, or line deformation. If any of these are found, the line must be removed from service.

Lubricate lines periodically, in accordance with the manufacturer's specifications.

For more specific criteria, see "Wire Rope Rejection Criteria," Section 15.25 of the Occupational Health and Safety Regulation.

## FITTINGS

### Pressed Eyes

Pressed ferrules are used by the rope distributor to form wire rope eyes. A Flemish (Farmer's) eye that is secured with a pressed ferrule is generally used for lines that do not require matched lengths. Flemish eyes are 92–95 percent efficient.

Eyes formed with a pressed ferrule and not using a Flemish splice are used on lines requiring matched lengths. These eyes are 90–95 percent efficient. When you are inspecting this type of terminal, one broken wire above the ferrule is cause for rejection.

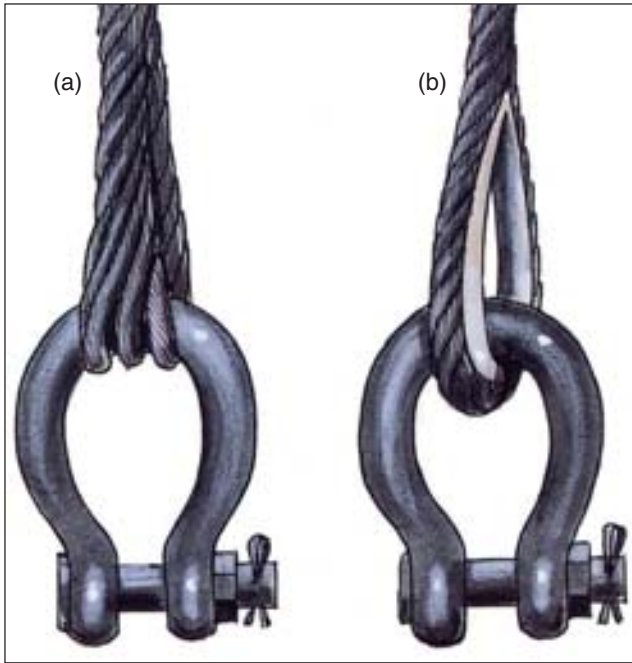
Do not use pressed eyes on standing skylines. Eyes are terminations and they should never pass over a sheave if a line is under load. The ferrules made of either steel or aluminum have been known to crack or break as a result of passing over tree jacks or sheaves. Do not bend guyline or skyline ferrules around stumps.

### Thimbles

Because thimbles cannot be run through blocks or fairleads, they can be used only in standing lines. A thimble protects the eye from wear, prevents flattening, maintains the cylindrical shape of the line, and minimize the loss in line strength where the line contacts a shackle or pin.



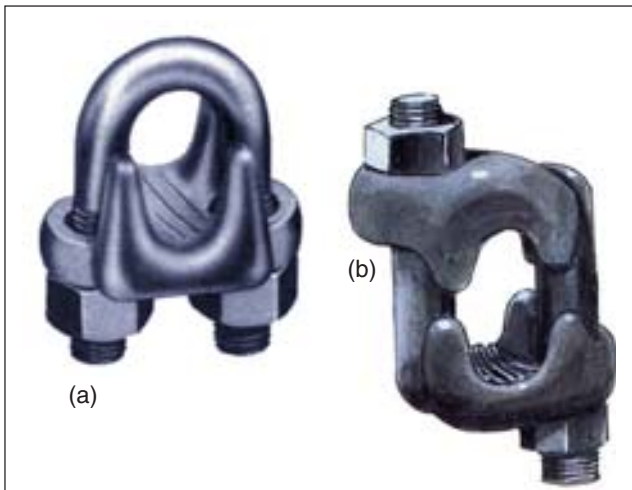
*Assorted thimbles.*



(a) Deformed eye. (b) Thimble installed.

Without a thimble, the line will deform as it goes around the shackle or pin. This deformation drastically weakens the line, with a possibility of failure.

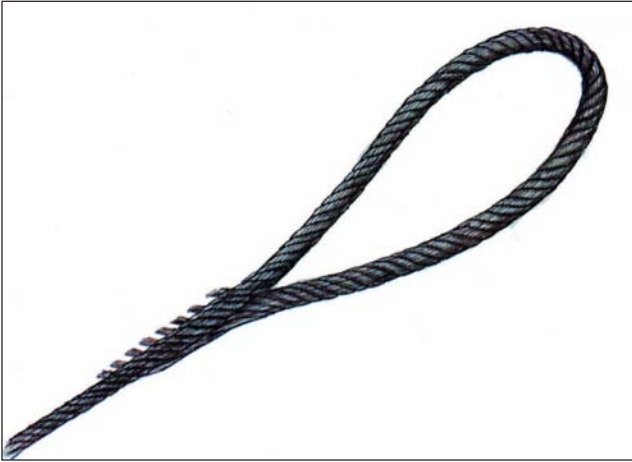
### Cable Clips



Cable clips: (a) single saddle, (b) double saddle.

Cable clips may be used to form terminals and eyes. When combined with the use of a thimble, this type of terminal can be up to 85 percent efficient. The saddle is always applied to the live line. Placing the U-bolt on the live side may reduce the effective line strength by 50 percent. If both sides are live, use a special cable clip that has two saddles.

## Logger's Eye Splice



*Skyline terminal eyes should be formed by a logger's eye splice.*

The logger's eye splice is the most common method of forming an eye. Produced by interweaving the strands with the use of a Marlin spike, this type of eye is less than 80 percent efficient if used without a thimble. Use of a thimble may add as much as 6 percent efficiency. Refer to the WorkSafeBC publication *A Manual on Splicing*.



## CHANGING LINE SIZES

At times, it may be desirable to change the size of an operational line. To determine the capacity of any drum for a given line diameter, use the following table and formulas. If the line size is changed, the sheaves must be adjusted accordingly.

Metric	Imperial																												
$L = (A + D) \times A \times B \times K$ <p>where <math>K = \frac{0.00314}{d^2}</math></p>	$L = (A + D) \times A \times B \times K$ <p>where K = nominal rope diameter (in.)</p>																												
	<table border="1"> <tbody> <tr><td>3.29</td><td>¼</td></tr> <tr><td>2.21</td><td>⅝</td></tr> <tr><td>1.58</td><td>¾</td></tr> <tr><td>1.19</td><td>⅞</td></tr> <tr><td>0.925</td><td>½</td></tr> <tr><td>0.741</td><td>⅞</td></tr> <tr><td>0.607</td><td>⅝</td></tr> <tr><td>0.428</td><td>¾</td></tr> <tr><td>0.308</td><td>⅞</td></tr> <tr><td>0.239</td><td>1</td></tr> <tr><td>0.191</td><td>1⅝</td></tr> <tr><td>0.152</td><td>1¼</td></tr> <tr><td>0.127</td><td>1⅜</td></tr> <tr><td>0.107</td><td>1½</td></tr> </tbody> </table>	3.29	¼	2.21	⅝	1.58	¾	1.19	⅞	0.925	½	0.741	⅞	0.607	⅝	0.428	¾	0.308	⅞	0.239	1	0.191	1⅝	0.152	1¼	0.127	1⅜	0.107	1½
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<p>where <math>A = \frac{H - D}{2} - C</math></p>																													
<p>A = depth of rope            L = rope length (capacity of the drum)            D = diameter of drum            B = width between flanges            C = desired clearance (one rope diameter)            d = nominal rope diameter            H = diameter of flange            K = factor</p>																													

## LINE LIFE

The service life of wire rope varies with maintenance procedures and conditions. Some factors that reduce the service life include:

- Abrasion
- Loss of lubrication
- Bending
- Kinking
- Excessive load
- Shock loading
- Inadequate maintenance
- Splices and end connections

The following table gives various wire rope sizes, uses, and approximate life expectancy under normal operating conditions. Line life is given in volume of wood hauled.

System	Use	Size		Line Life
		mm	in.	m <sup>3</sup>
Standing Skyline	Skyline	44	1¾	113,200–141,500
		38	1½	84,900–141,500
		35	1⅜	45,280–84,900
	Mainline	25–29	1–1⅜	84,900–113,200
		25	1	56,600–84,900
	Haulback	19–22	¾–7⁄8	45,280–67,900
Live Skyline	Skyline	38	1½	56,600–113,200
		35	1⅜	45,280–84,900
		25	1	33,960–56,600
	Mainline	25	1	56,600–84,900
		19	¾	45,280–67,900
		16	5⁄8	45,280
	Haulback	19–22	¾–7⁄8	45,280–67,900
		13	½	33,960–56,600
		Dropline	11	7⁄16
	22		7⁄8	16,980–28,300
	13		½	2,830
	High-Lead	Mainline	35	1⅜
29			1⅜	33,960–67,900

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# WORK PROCEDURES

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This chapter describes safe work procedures for landing and yarding operations. It can be used as a guide for developing written procedures, but will not necessarily cover all situations or circumstances.

## PERSONAL PROTECTIVE EQUIPMENT

Workers must wear the following personal protective equipment and clothing:

- Suitable clothing for protection against the natural elements and the hazards of the work; clothing should fit fairly close to the body and allow the worker to move freely
- High-visibility headgear – red or orange – to be worn by all yarding and loading crews
- High-visibility apparel, when workers are exposed to mobile equipment
- Caulk-soled boots, to be worn by all workers required to walk logs
- Hand protection
- Leg protective devices of a standard acceptable to WorkSafeBC, when the worker is operating a power chain saw
- Eye protection, when there is a hazard of eye injury, for example, when the worker is cutting cable, operating a chain saw, or moving through heavy brush
- Hearing protection, when the worker is exposed to noise levels in excess of permissible limits

## REQUIREMENTS FOR SAFE WORK PROCEDURES

The employer must ensure that:

- Every job has specific written work procedures
- Every worker is trained in these procedures

Firms may wish to define their own areas of responsibility, for various reasons. This must be communicated to all workers on-site.

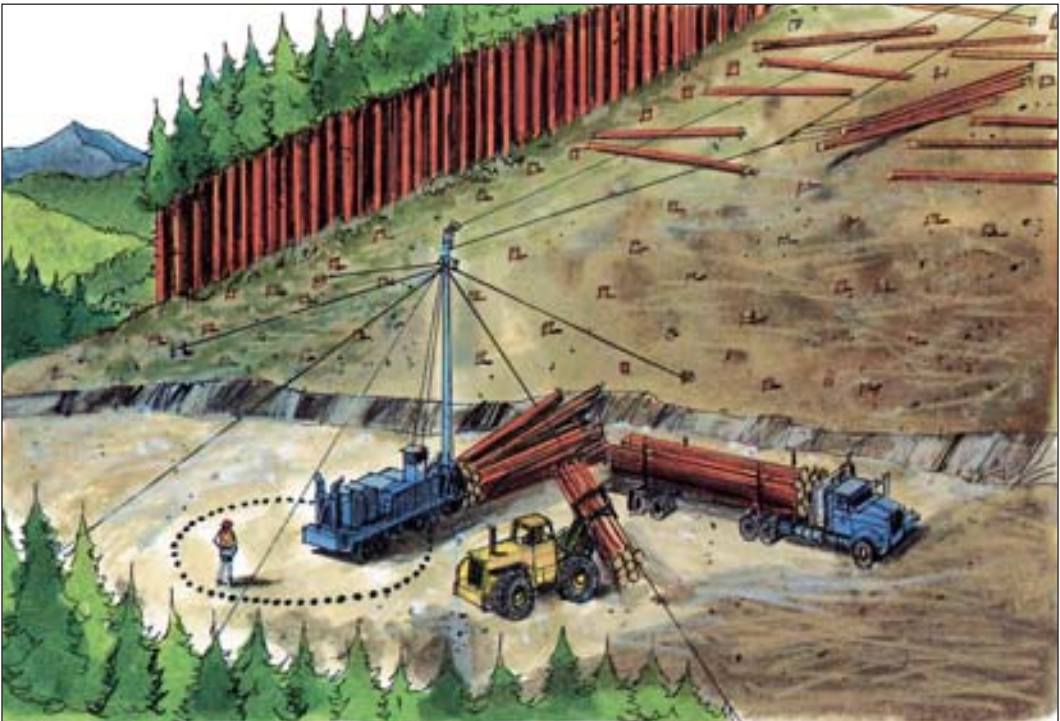
Responsibility for various aspects of work at the worksite may be assigned to other workers. This information must be written and communicated to all workers affected.

## LANDINGS

### Safe Area (In the Clear)

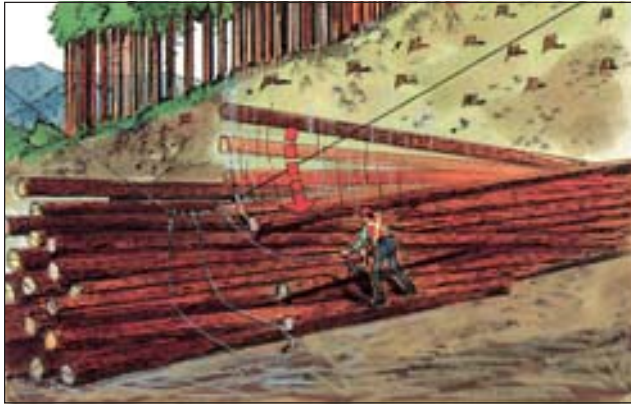
Remember these points when working in a landing:

- Do not stand underneath or close by the mainline during yarding.
- Stand clear of the incoming turn – logs could jill-poke, upend, or strike logs already in the landing.
- Do not stand beneath the guylines opposing the pull of the turn – the guyline could break, or the stump may slab.
- Do not stand in the bight formed by the running yarding lines.
- All landing workers must use designated safe positions, outside the work circle and visible to the machine operators.



*In the clear.*

## Hobo Logs



*Worker in hazard area.*

## Landing the Turn

- Adequate slack should be provided to unhook the chokers.
- The chaser should determine that the logs are stable and properly landed before unhooking the turn.
- Any equipment movement that could affect the safety of the chaser must cease while the turn is being unhooked.
- Logs must be landed straight and stable.
- When cold decking is required, a stable pile should be built. This is achieved by keeping all logs in lay and not allowing crossed logs in the pile.



*In the clear.*

Hobos are unchoked logs that ride in with the turn.

Hobos must be removed from the turn or be in a position where they will not roll on the chaser while the chokers are being unhooked.

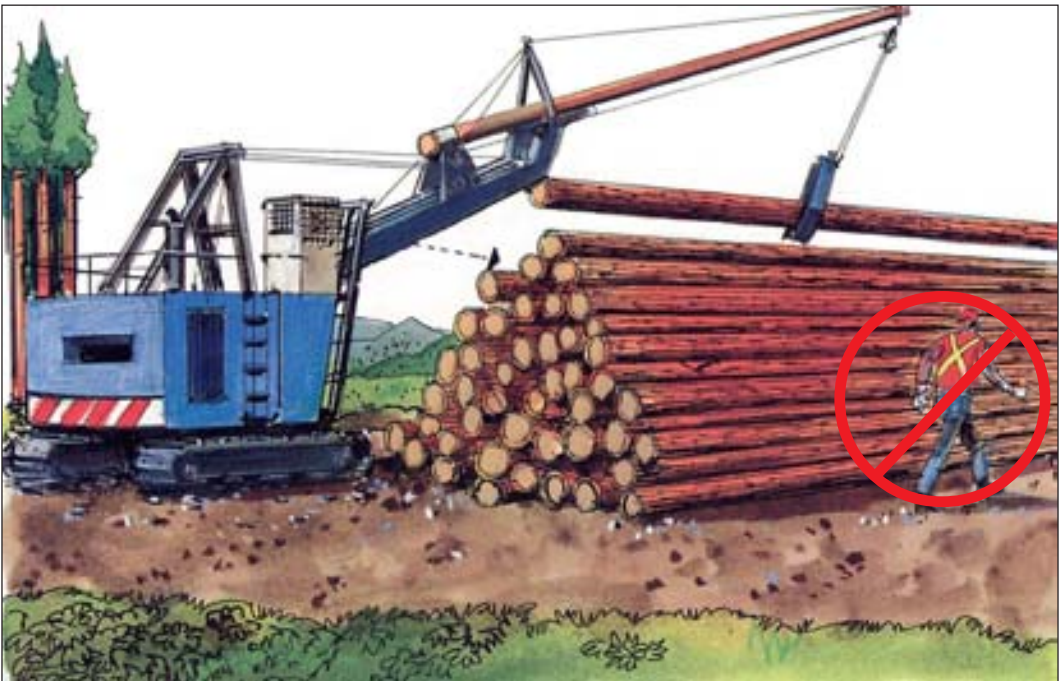
## Loading Area

- Swing machine operators must maintain a minimum clearance of 60 cm (2 ft.) between the counterweight of the loader and other obstacles. Operators must maintain this distance at all times.
- A procedure must be prepared and communicated to workers where it is necessary for a worker to enter a loading area.



*No counterweight clearance.*

- Workers must get the operator's permission before entering the machine work circle.
- Loader operators must not lift logs over workers' heads.
- Workers should remain in a designated safe area, visible to the operator, when not engaged in work activities.
- If the loader operator cannot see the ground worker, all work activities should cease.
- Log loaders must use accepted audible signals when moving forward or backward.



*Worker is not in the clear. Work must stop.*

- Stamping and Limbing the Logs**
- Logs must be stamped, trimmed, and limbed on the ground prior to loading.
  - Truck drivers and/or landing workers must remain in the clear and in view of the loader operator when loading trucks.
  - Truck drivers must, while out of the truck cab, wear safety headgear and high-visibility apparel.

### Housekeeping



*Maintain good housekeeping.*

- Keep the landing area free of limbs, chunks, and other debris.
- Keep the end of the strawline secured to the base of the spar when not in use.
- Store all equipment, rigging, and tools not in use in a designated safe area, away from mobile equipment.

### Chain Saw Use



*Wear hand, eye, leg, and hearing protection when operating a chain saw.*

- Do not use a chain saw unless you are instructed and trained.
- Ensure the chain is properly adjusted for tension.
- Carry the saw with the bar at the rear.
- Shut off the saw when carrying it any distance.
- Be aware of the hot exhaust when filing or refuelling.
- Keep file tangs guarded.
- Keep two hands on the saw at all times.
- Stand to one side and not directly behind the chain.
- Know where the bar tip is at all times, to prevent kickback.
- Use a stable stance with the feet wide apart.
- Buck from the uphill side.
- Wear personal protective equipment.

## Cutting Wire Rope



*Do not use mushroomed hammers. Eye protection must be worn when cutting wire rope.*

- Always wear eye protection.
- Stand on the closed side when using a guillotine.
- Use a soft hammer. A soft hammer is marked with an “S.”
- Do not use a mushroomed hammer.
- Cut with the lay of the line when using a wire axe.
- Keep the cutting blade in the same position on the line to avoid flying pieces.
- Wear safety glasses when holding the line for another worker to cut. Screen-type eye protection is not acceptable for cutting line.
- Damaged wire-cutting tools must be removed from service.

## Landing Layouts



*Do not work below unstable logs.*



*Do not work below unstable debris.*

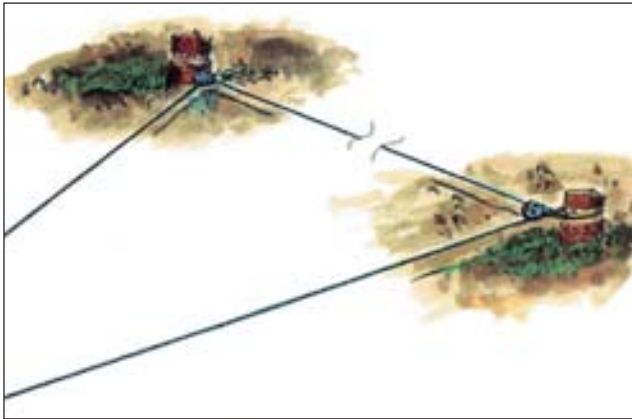
Consider the following points when evaluating landings:

- Landings should be of adequate size to safely accommodate all activities.
- The yarding sequence must be arranged to prevent the practice of yarding down on the machine.
- Unstable logs or gun-barrel logs overhanging the landing should be removed.
- Rocks and loose material may run into the landing.
- Root wads on the edge of the bank could be dislodged into the landing area.



## YARDING

### Hanging Haulback Blocks



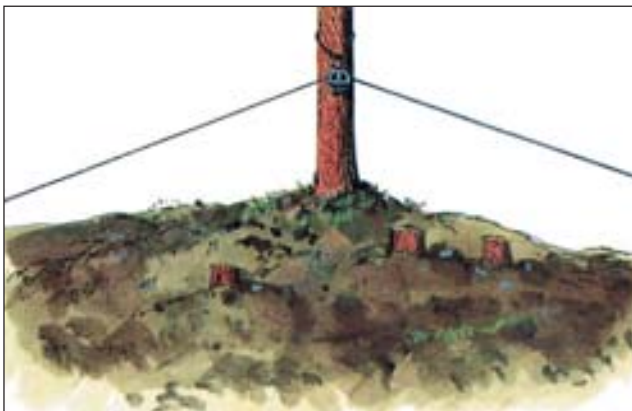
*Haulback blocks.*

- Notches must be deep enough to retain the haulback strap.
- The block must be hung from both eyes.
- Straps must be long enough to allow the block to align itself with the haulback.
- The stump must not be choked (threading one eye of the strap through the other).
- The heads of the pins should face the rotation to prevent the Molly Hogan end of the pin from being struck and knocked out by the butt rigging.



*Haulback block.*

### Directional Lead Block



*Directional lead block.*

Blocks may be hung from one eye of a strap or choker, providing there is no lateral stress applied to the block and it is used only to change the directional lead of a line. A choker bell or shackle must be used to secure the strap to the anchor.

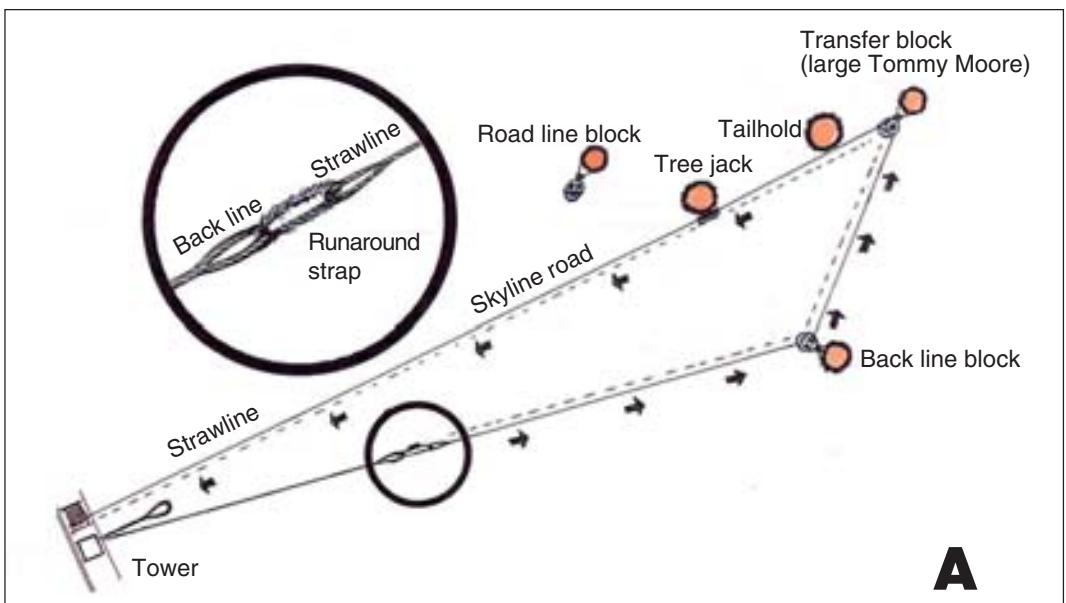
### **Work Procedure for Pulling Cable (Skylines)**

1. String the strawline out to the skyline anchor around through the haulback block and then through the transfer block (large Tommy Moore block) and backspare jack.
2. String the strawline down the skyline road line back to the landing.
3. Attach the strawline to the haulback eye, and use the strawline to pull the haulback around through the haulback block to the skyline tailhold and then through the backspare jack back to the landing.
4. Attach the eye of the haulback to the skyline eye with a cable connector.
5. Hang the transfer block behind the skyline tailhold. This will allow enough skyline slack to attach the skyline end around the tailhold.
6. Pull the cable end back to the transfer block behind the tailhold and stop.
7. Using the pass chain and finger link (or pelican hook) with snubbing strap, chain the cable to the anchor so the finger link (pelican hook) is positioned in front of the skyline tailhold.
8. Secure the haulback on the machine side with another pass chain below the haulback block (downhill side).
9. With the skyline (cable) chained, disconnect the haulback from the eye of the skyline.
10. Secure the end of the skyline around the skyline tailhold.
11. Use a skyline knock-out shackle with the pin up and with the bell of the shackle on the bight of the skyline.
12. Secure the pin to prevent accidental dislodgment.
13. Ensure the skyline is sitting in the notch and there is no excessive bight in the skyline.
14. Release the skyline chain and finger link (pelican hook) from the skyline. Stay out of the bight.
15. To ease off tension on the skyline pass chain, you can use a pass chain to a come-along or a block and tackle.
16. Have the operator tension the skyline to ensure it is well seated in the notch, and ensure the skyline tailhold is secure. Stand in the clear and out of the bight while picking up on the skyline.
17. Restring the back line and connect the back line to the pre-strung road line strawline through the road line and back line haulback blocks.

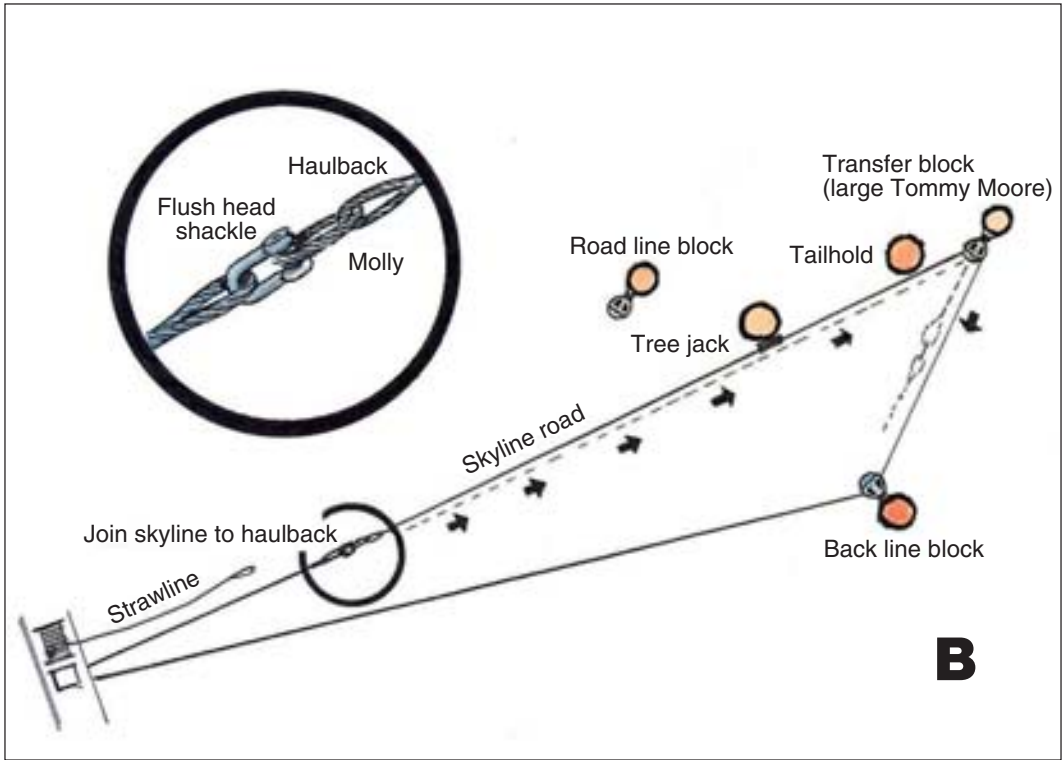
18. To take the chain off of the haulback, tension the strawline enough to pull slack.
19. Pull the haulback to the landing with the strawline.
20. Attach the haulback to the skyline carriage or rigging.
21. Clear the lines and ensure there are no siwashes.



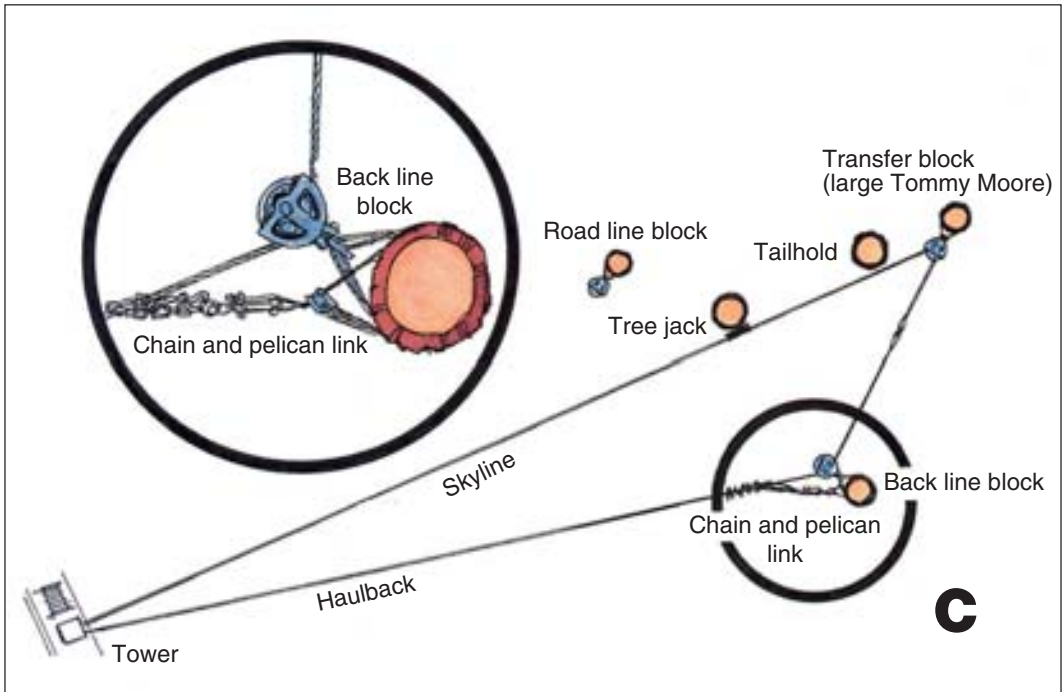
Equipment required at the tailhold.



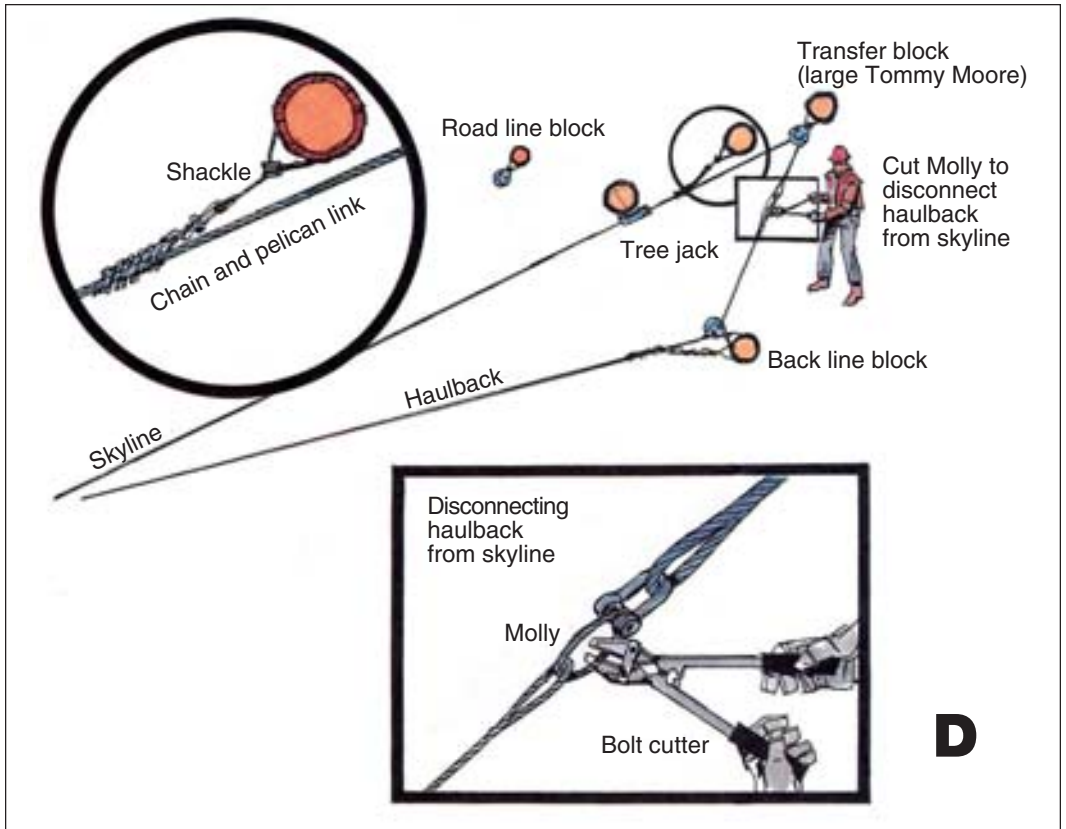
The haulback may be run around using a strawline connector. However, Molly Hogans are a more secure method.



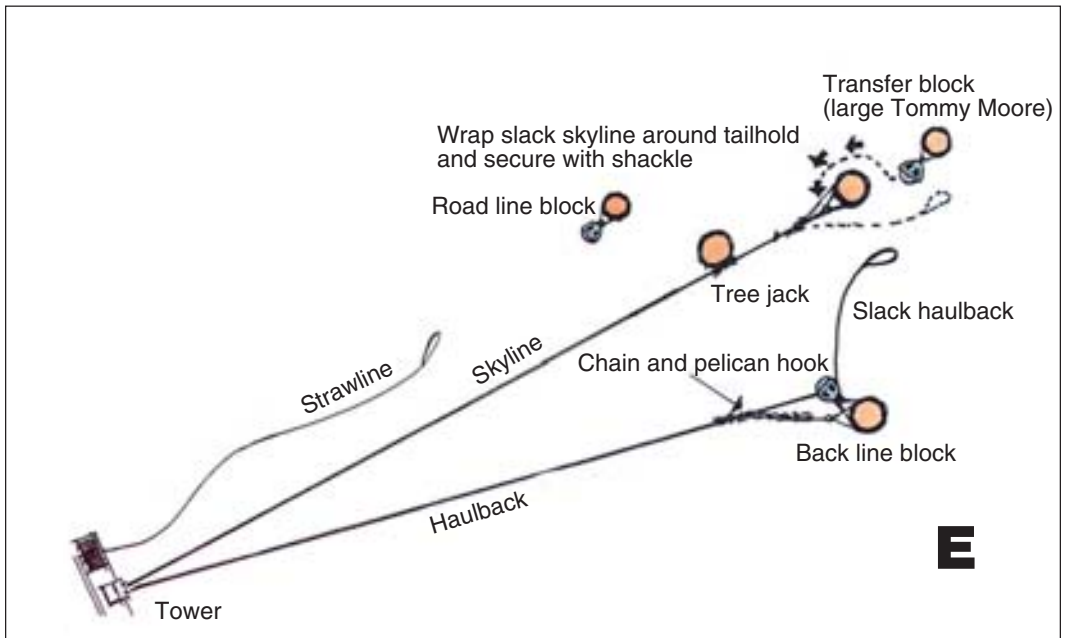
**B**



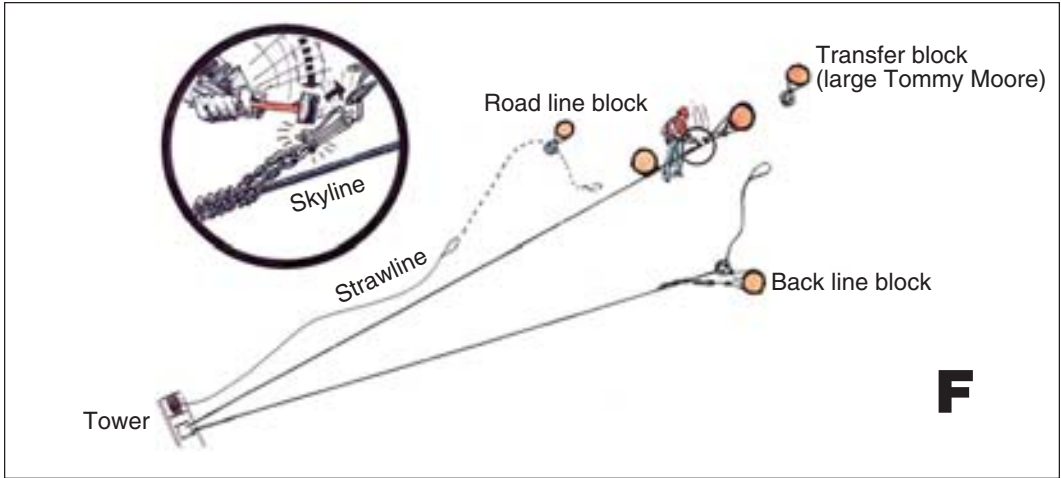
**C**



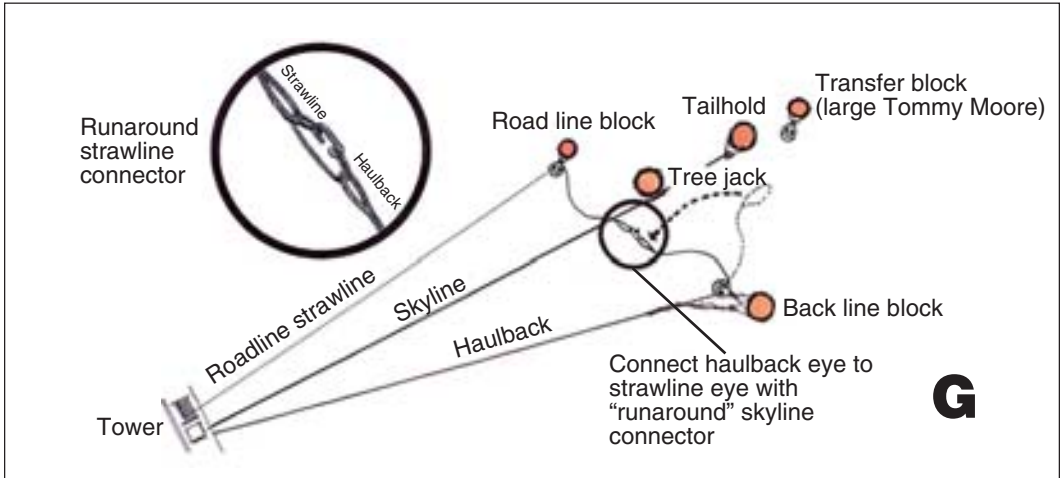
**D**



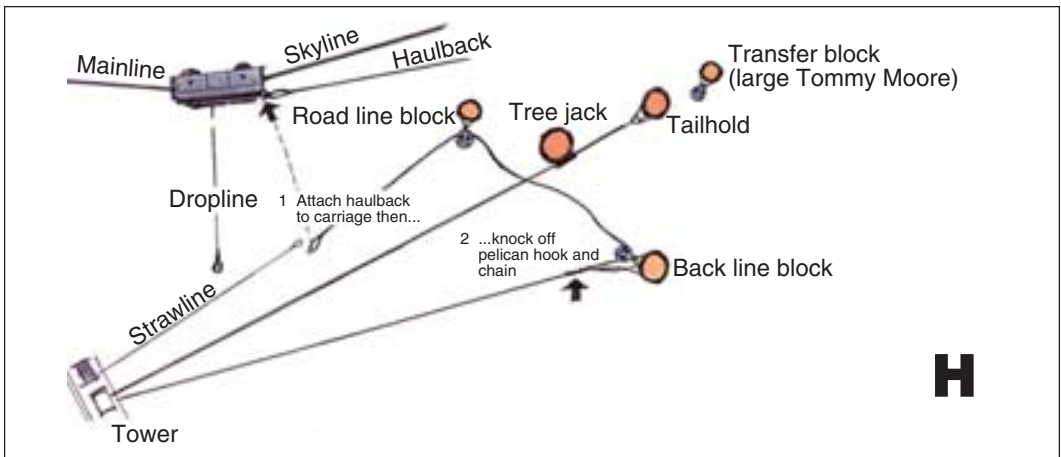
**E**



**F**



**G**



**H**

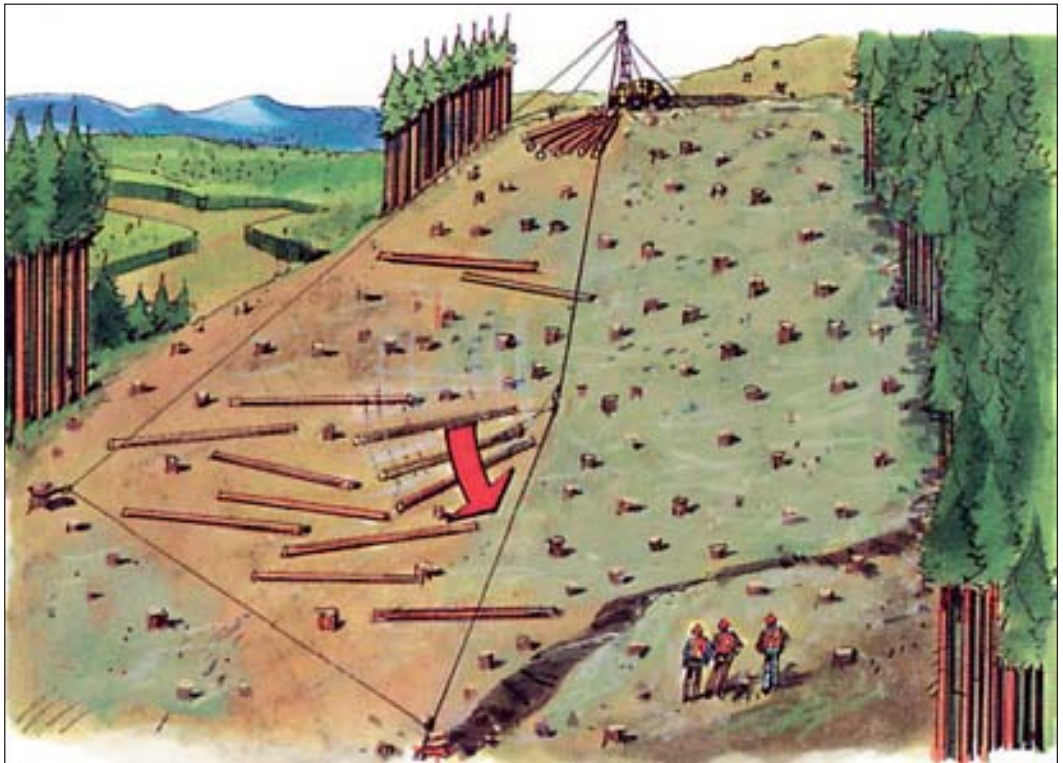
### **Snubbing the Skyline In**

The skyline should be snubbed in when yarding downhill. This will enable the yarding engineer to spool the cable in a proper manner. The strawline may be used for this; however, if the sidehill is extremely steep, then the haulback is recommended for snubbing.

### **Standing in the Clear**

#### **“In The Clear” Means:**

- In the logged-off area, if possible
  - Behind and to the side of the turn
  - Clear of swinging logs
  - Out of the bight
- Stand facing the rigging when it is moving.
  - Stand clear of flying chokers.
  - Spot the rigging where the turn is selected.
  - To stop chokers from swinging before entering the work area, slack down or pick up rigging until the choker bells are touching the ground.
  - When leaving the turn, ensure the crew is in the clear by having the rigging slinger be the last to leave.

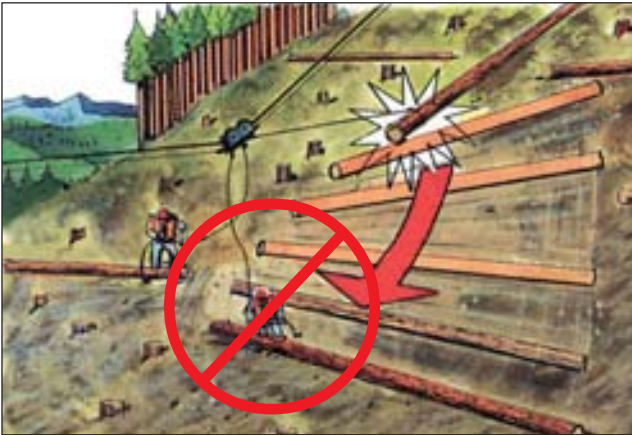


*In the clear.*

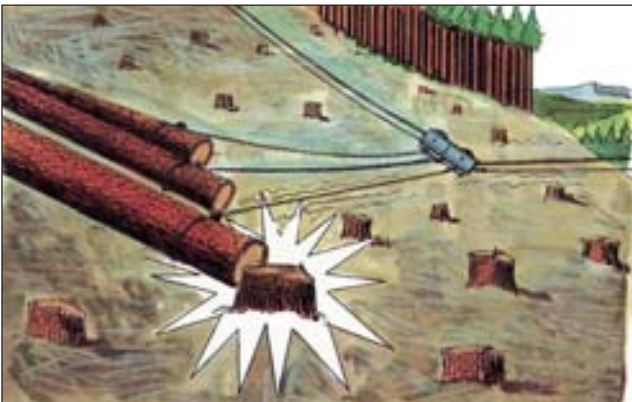
## Setting a Choker



*Set the largest log with the front choker.*



*Stand in the clear when moving the rigging.*



*Front choker under tension. Stand in the clear.*

Remember these points when setting chokers:

- Standing on the high side, always go over the top of the log with the knob of the choker.
- When pulling chokers, walk over and free the choker if it hangs up.
- Watch for unstable logs when setting chokers.
- Do not stand directly under the rigging. Equipment could fail; the rigging could hang up in a sapling or other object and break free, causing the rigging to drop.
- If the rigging does hang up in saplings or other objects, move the lines and rigging to clear it.
- Take the top logs first when selecting turns.
- Always set chokers from the upper side.
- Get in the clear, behind and to the side of the turn.
- Do not gut-hook logs.

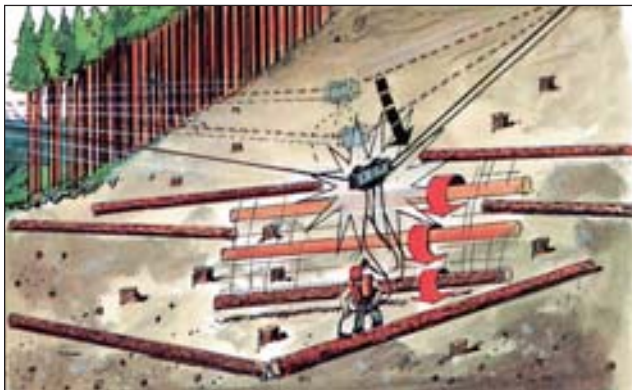


## Hot and Cold Chokers

Pre-setting chokers decreases the yarding cycle time by allowing workers to set chokers while the turn is being yarded. To minimize hazards to the rigging crew, the written safe work procedures must include the following points:



*Worker in the clear pre-setting chokers.*



*Do not pre-set chokers where there is a hazard above the worker.*

- Workers should not pre-set chokers in areas made unsafe by runaway logs, for example, within the yarding corridor.
- Selective logging or yarding around seed trees presents special hazards. Workers pre-setting chokers must remain clear of standing trees and saplings that could be pulled over by lateral yarding. Workers must also remain clear of upending and swinging logs.
- Before giving the “go ahead” signal, or before signalling for a repositioning of the carriage on the skyline, the worker guiding the turn to the corridor must:
  - Ensure that all workers are in the clear
  - Follow the last log to the corridor and stand well in the clear
- The mainline must be slacked before a worker goes in to check a hang-up.

- Danger trees and partially pulled-over trees must be removed before yarding commences or continues in the hazardous area.
- Workers pre-setting chokers must be able to hear the audible signals.
- If dropped logs are being picked up, or if two lateral yarding operations are required to make a turn, workers should ensure the logs in the corridor are stable before going in to get the toggle. In some instances, it may be necessary to unhook the half-turn.
- Two signalling devices are recommended when pre-setting chokers on both sides of the skyline.

## Logs behind the Tailhold

Planning can minimize the practice of yarding behind backspars or tailholds. However, if this practice needs to be used, the turn should be yarded to the skyline before being yarded forward.

## Rigging Rating

Rigging should be selected and used according to the manufacturer's rating. Where low gear ratios or other devices are installed to increase line pull, the size of the rigging must be increased accordingly so that it will safely withstand the increased loads.

## Choker Size

The accepted industry practice is that the choker size is determined by the:

- Mainline size
- Timber size

The choker size must never be equal to or exceed the mainline diameter.

## Hang-ups

Hang-ups should be fought by repositioning the choker, rather than by repeated signals. Remember these points when fighting hang-ups:

- Slack the rigging before entering the area.
- Approach hang-ups from the upper side.
- Watch for saplings sprung ahead of the turn.
- Do not go below the turn.
- Get in the clear before signalling any line movement.
- Ensure you are well in the clear when upending or swinging a log; the log does not always swing in the intended direction.
- Consider moving the road line if hang-ups keep occurring in the same area.



*Rigging must be slacked before workers enter the turn.*

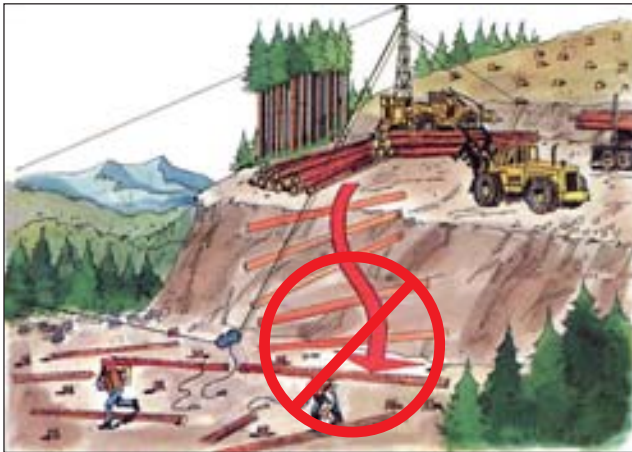
## Siwashes

A siwash is an unintentional bight in the line caused by trees, stumps, or other objects, preventing the line from running straight.



*Worker in the bight will be hit by a siwashed line.*

## Runaway Logs



*Do not work below log pile during loading.*



Remember to:

- Always string lines straight
- Clear siwashes immediately
- Never get in the bight of a siwashed line

Hazards created by siwashed lines include the following:

- Fire hazard
- Lines that do not run freely because they are cut into stumps, logs, or other material
- Objects thrown in the air, striking workers because the line is siwashed under a chunk or debris.

Runaway logs may be a danger during yarding:

- When workers are below the landing, logs, chunks, and other debris may be dislodged into their work area.
- During downhill yarding, turns may create runaway logs that go into the landing.

Follow these safe work practices:

- Always go in the clear and out of the bight.
- During downhill yarding, the logged-off side is generally the safest, as long as you are out of the bight.
- Where the hazard of runaway logs exists, do not place the yarder in a hazardous position.

*Workers should not stand in the bight below the turn.*

## Machinery Hitting Running Lines

When the rigging is out in the setting, log loaders should ensure they do not work where they may strike the yarding lines with logs or snorkels.



*Snorkel boom hits yarding lines.*

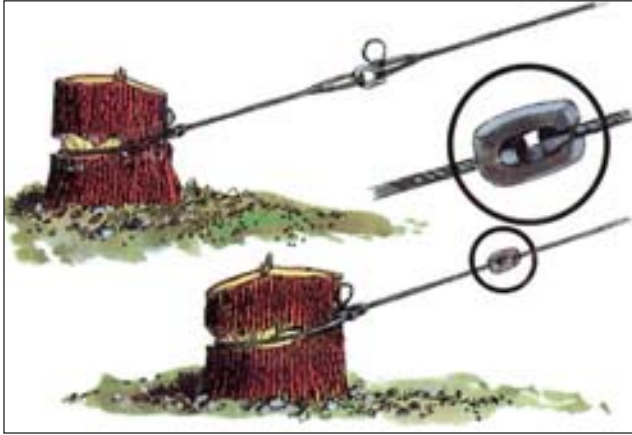
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# RIGGING

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This chapter describes and illustrates rigging equipment.

## GUYLINE EXTENSIONS

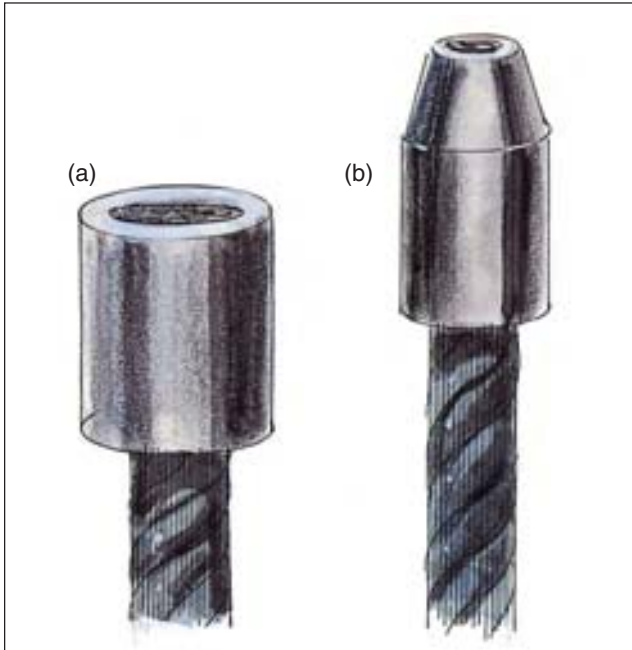


*Double-ended guyline connector.*

The guyline extension must be at least the same size as the guyline and in good condition. The extension must be attached to the guyline with either a guyline shackle or connector.

Molly Hogans must not be used to connect guylines, guyline extensions, or skylines.

## LINE TERMINALS

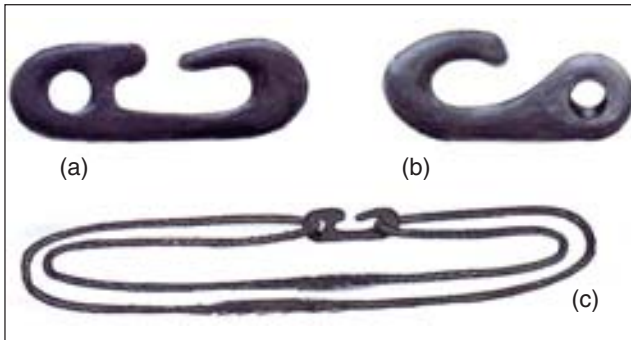


*(a) Babbitted.*

*(b) Pressed ferrule.*

Socket knobs or eye splices as shown in *A Manual of Splicing* must be used. Knobs used on guyline connections must be pressed or babbitted. Do not use spiral ferrules or wedged knobs on guylines or guyline connectors.

## STRAWLINE CONNECTORS



(a) Open hook. (b) Closed hook. (c) Strawline connection device.

- Inspect hooks for damage and wear.
- Ensure the hooks are the correct size for the lines used.
- When attaching the hook, ensure the hook will be facing in to ensure a secure connection.

## YARDING LINE EXTENSIONS

Yarding lines should be extended by the use of a long splice, short-long splice, or connecting shackle.

When used, Molly Hogans must be made with a single strand of the same size wire as in the connecting lines and must be made with six complete wraps. Molly Hogans must not be used to connect skylines, loading rigging, or any stationary lines.

## RIGGING SHACKLES

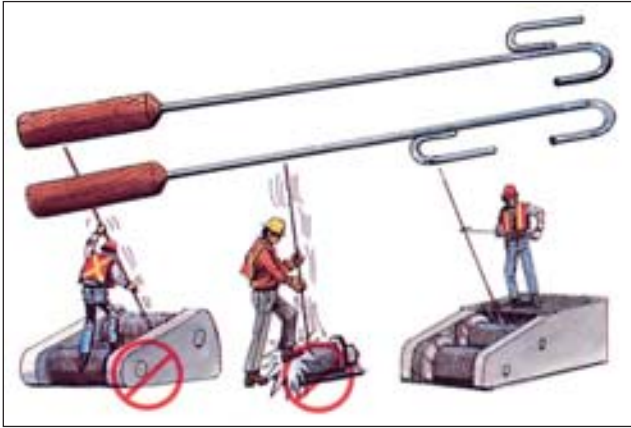


Rigging shackles.

- Shackles and other rigging must be inspected regularly.
- Screw shackle pins should be tightened securely and checked on a routine basis.
- Shackles used in overhead rigging must be secured against accidental dislodgment.
- Molly Hogans and cotter keys are commonly used to secure shackles.
- A Molly Hogan used for securing a guyline shackle should be made of a wire rope strand 13–16 mm ( $\frac{1}{2}$ – $\frac{5}{8}$  in.) in diameter.

## SPOOLING LINES

- Always use a proper spooling tool when spooling running lines. The use of hands or feet for spooling is prohibited.



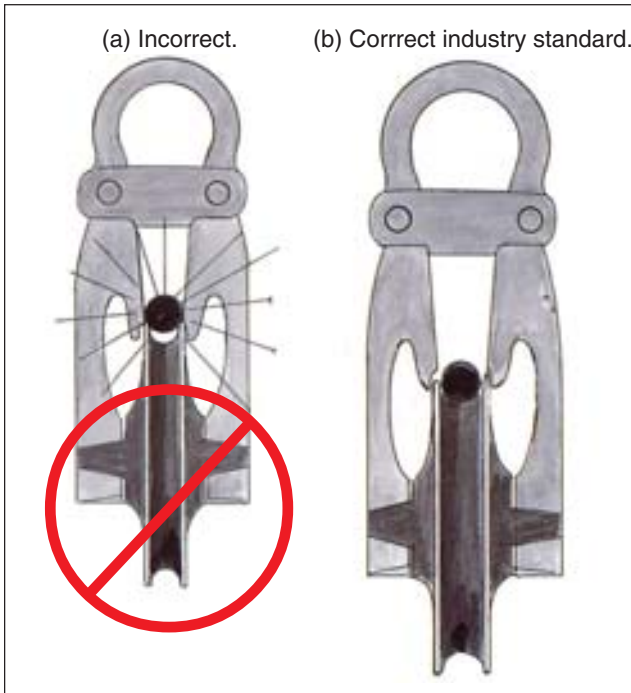
Top: Two examples of spooling hooks.  
Bottom: Proper and improper spooling techniques.

- All access routes and work platforms used when spooling lines must be covered with non-slip material.
- Avoid walking on metal surfaces in caulk boots.
- Stand with both feet on the platform.

## BLOCKS

All blocks used must be of a design and rating to withstand the loads imposed on them.

### Guide to Block Maintenance



(a) 14 in. block with 1 in. line. (b) 20 in. block with 1 in. line.

- The sheave sizes must be the correct diameter to minimize line wear.
- Check goosenecks for wear.
- Inspect line guards and check to see that they are used.
- Check for tightness of sheave and shells.
- Use proper pins.
- Grease the block regularly.
- Use proper-sized Molly Hogans in pin holes.

The industry standard for calculating the proper block size is to multiply line diameter by 20 and use the corresponding sheave size. Manufacturers recommend a ratio of 30:1 (line diameter to sheave size).

## BUTT RIGGING

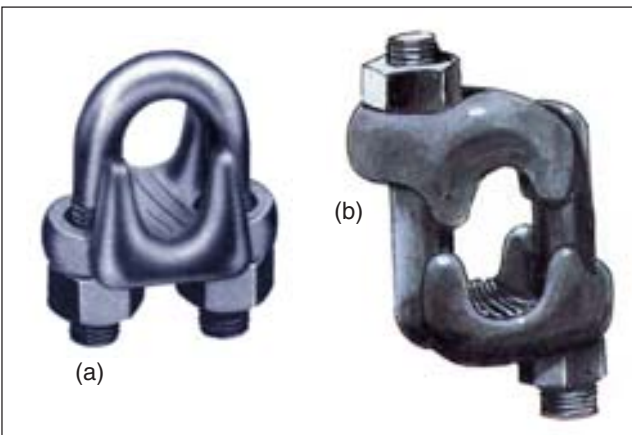


*Butt rigging with three chokers.*



*Choker and bell with tagline hook.*

## CABLE CLIPS (CLAMPS)



*(a) Single saddle.*

*(b) Double saddle.*

Chokers attach to the butt rigging. The butt rigging is a system of swivels, shackles, links, and tags that connects the haulback and mainline. Regular inspections must be carried out on all butt rigging and attachments.

- Cable clips, or clamps, must be matched to the size of line.
- The number and spacing of cable clips must adhere to the manufacturer's specifications for the size of line.
- Cable clips must be torqued to the manufacturer's specifications.
- Cable clips must be installed so that the U-bolt is on the short or "dead" end.

Remember:

**"NEVER SADDLE A DEAD HORSE."**



## PASS CHAIN (RIGGING CHAIN)

The pass chain, or rigging chain, is a specially designed chain manufactured using low-alloy, T-1 steel.

This chain was originally used for hoisting rigging such as blocks and straps up the tree to the high-rigger. The rigger also rode in the chain attached to the pass line when threading blocks.

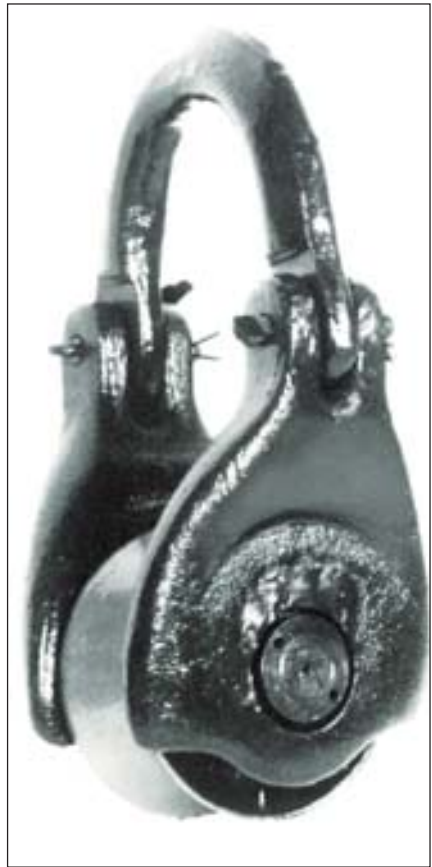
The pass chain is now used for pulling or securing wire ropes. This is done by wrapping the chain around the cable a minimum of three times against the direction of pull. The bight of the chain is then threaded back through the hook, and the chain is tightened.



*Pass chain wrapped at least three times against the pull.*



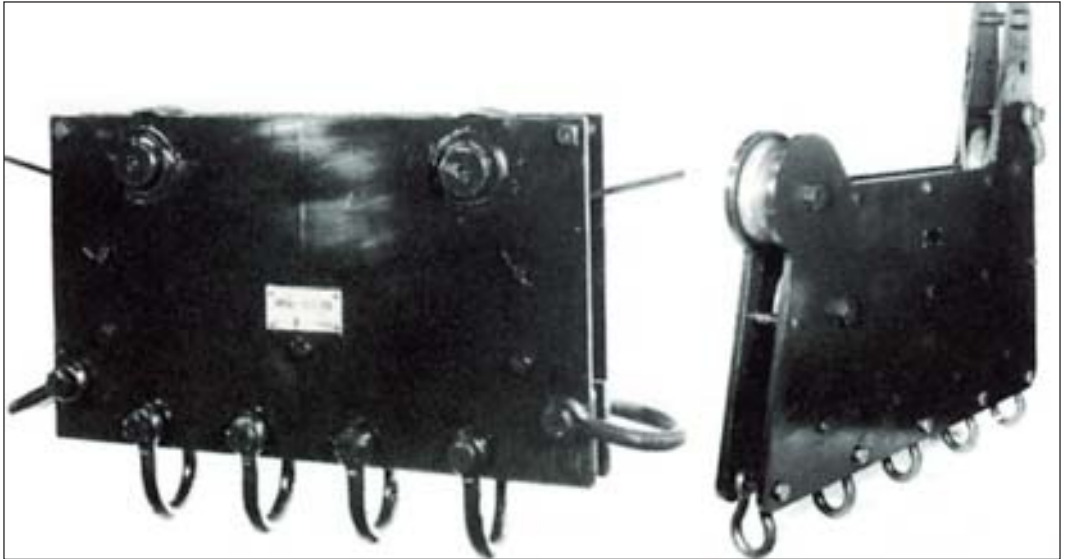
*Tommy Moore passline block  
(for strawline).*



*Tommy Moore transfer block  
(for skyline).*



*New tree jack with plastic or  
composition sheaves.*



*Gravity, or shotgun, carriage.*



*Roller backspar jack with aluminum sheave.*



*Homespar guyline shackle.*



*Pass chain, or rigging chain.*



*Bull hook with butterfly.*



*Finger link, or pelican hook.*

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# SKYLINE RIGGING AND CARRIAGE SYSTEMS

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This chapter describes skyline rigging, carriage systems, and various types of carriages.

## SKYLINE RIGGING

### Rigging Lift Trees

When rigging is placed on a running skyline lift tree, at a height greater than five times the diameter (at breast height) of the spar, guylines must be used to support the tree. The angle of the running line entering and leaving the lift blocks must be equal when under load.

### Guyline Attachment

Where guylines are hung in backspar trees, the guyline attachments must be either bell and knob, spliced eye, bell shackle, or backspar guyline hook. All fittings used on the backspar must be secured against accidental dislodgment through the use of Molly Hogans or cotter pins.

Guylines secured to anchors, stumps, and standing trees must be secured with appropriate cable clips, and torqued to the required specifications or track spikes, with 2½ wraps on the anchor stump.

### Backspar Topping

All backspars must be topped unless it is too hazardous to top them. In those cases, backspars may be used untopped, providing safe work procedures are made available to workers. Such written safe work procedures must ensure that workers are kept out of the area made hazardous by the untopped tree during the yarding process.

## Guyline Placement

Backspar guylines must be arranged to ensure that the stress in any direction is shared.

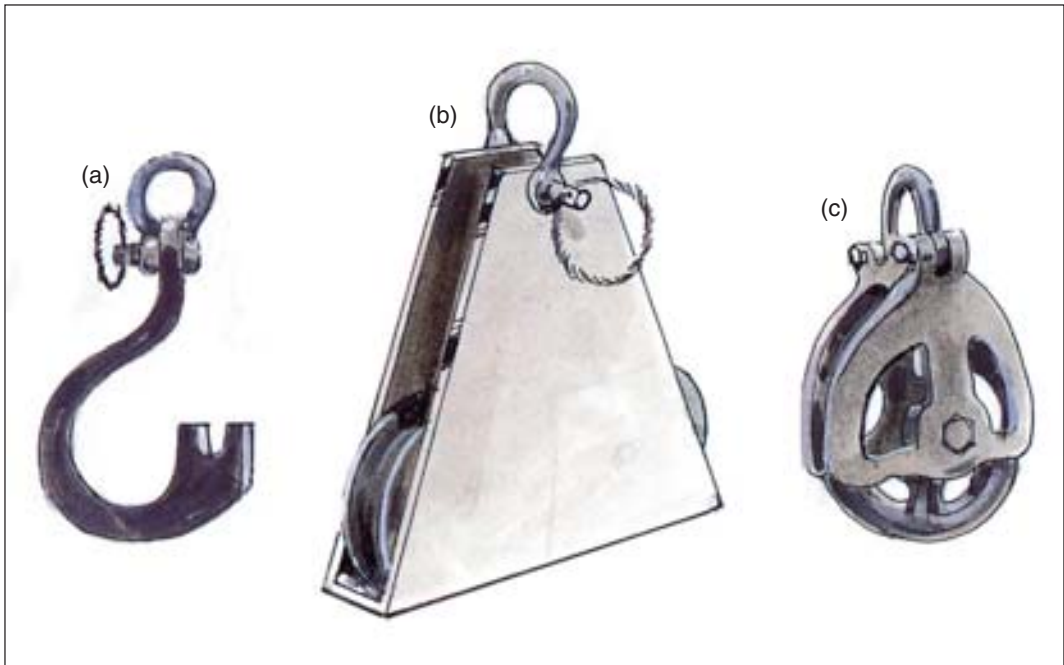
It is recommended that the interior angle between the guyline and the horizontal plane does not exceed 45 degrees. Where this angle cannot be maintained, additional guyline support is required.

The combined breaking strength of the two opposing guylines must equal or exceed the breaking strength of the skyline.

## Skyline Jacks

Steel sheave blocks must not be used for skyline jacks, because the steel sheave will break down the skyline where it is supported by the jack.

The jack or tree shoe must be of a material that is softer than the skyline. Hardwood or aluminum are acceptable materials for tree shoes.



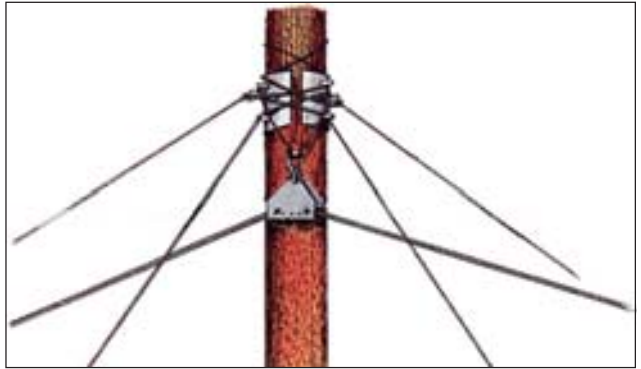
(a) Bypass jack. (b) Shoe jack with aluminum wheels. (c) Roller jack with aluminum wheel.

## Wire Rope Skyline Straps

### Example

One-inch skyline can be hung from a  $\frac{7}{8}$ -inch strap when the jack is hung in both eyes. Where the jack strap is wrapped, the strap must be aligned to ensure the strain is shared equally by both eyes.

Skyline jacks must be hung from both eyes when a wire rope strap is used. The strap must be  $1\frac{1}{2}$  times as strong as the skyline. Straps must not cut into the tree. To prevent this, tree plates must be used where the rigging is hung.

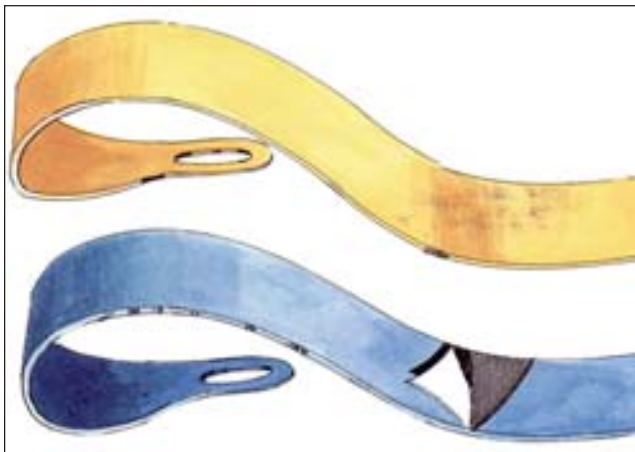


*Properly hung jack strap.*

## Fibre Straps

Fibre straps used as lift tree straps are acceptable for use on backspar. These straps must be “load-rated” – with the manufacturer’s safe working load permanently and legibly marked on the strap – to ensure that they will withstand the loads imposed upon them.

Fibre straps that have abrasions or tears in the exterior cover or broken fibres in the weaving of braided-type straps must be removed from service.



*Fibre strap construction.*

## Tree Plates

Tree plates must be used:

- If the diameter of the tree where the skyline is rigged is less than 15 times the diameter of the skyline.
- Where there is a possibility of the jack strap cutting into the tree; the plates must be designed to be secured to the tree and have an effective means of keeping the jack strap in position in the tree top



*Tree plates.*



## Climbing Equipment

Workers using climbing equipment must be properly trained in the use of the equipment. When a worker is up a tree, another complete set of climbing equipment and another trained worker must be on-site and capable of rescue.



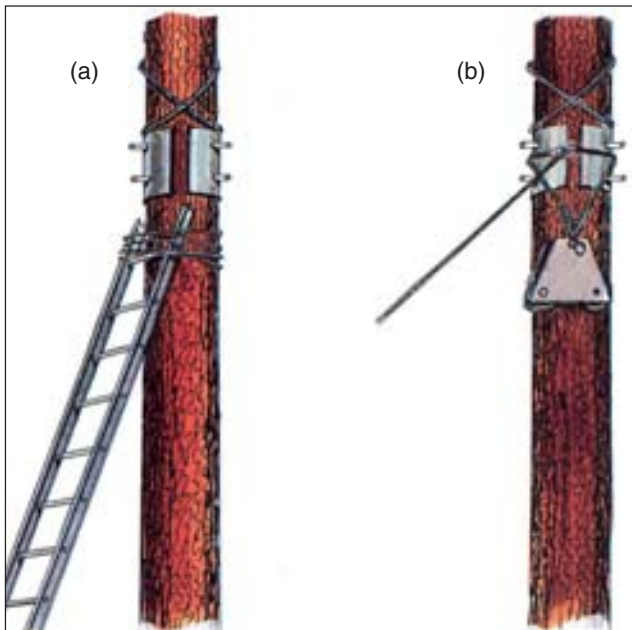
*Climbing equipment.*

All climbing equipment must be inspected regularly, and defective equipment must be removed from service.

Where there is a hazard of the climbing rope being severed, the climbing rope must be wire rope or a heavy rope with a wire core construction.

## Extension Ladders

When rigging small timber, an extension ladder may be used. It must be in good condition and properly tied off.



*(a) Secured ladder. (b) Correctly hung jack.*

When using ladders, the following length limits apply:

- Single ladders – 9 m (30 ft.)
- Extension ladders, two sections – 18 m (60 ft.)
- Extension ladders, more than two sections – 22 m (72 ft.)

The overlap on extension ladders must meet the manufacturer's specifications. When the worker is working at more than 3 m (10 ft.) elevation, the ladder must be tied off to the tree, and the worker secured against falling.

## Tree Climbing

A worker must use a safety belt and climbing spurs to climb a tree. The climbing equipment must be maintained in good order, and the worker must inspect it before each use. The safety rope must be cinched at appropriate intervals to prevent falling or slipping. A cat's-paw knot must be used to secure the rope to the tree. When climbing equipment is in use, a duplicate set of climbing equipment must be available for immediate use by a qualified worker in an emergency.

## Tree Topping



*Falling cuts for backspars.*

When it is necessary to top trees, the following safe work procedure is recommended:

1. A safety device made of chain or wire rope must be used to secure the tree below the topping cuts. This will prevent the tree from splitting.
2. Determine the direction of the fall, and then remove the sapwood with side notches.
3. The undercut should be one-quarter to one-third the diameter of the tree.
4. Clean the undercut out.
5. The backcut is slightly above the undercut and horizontal.

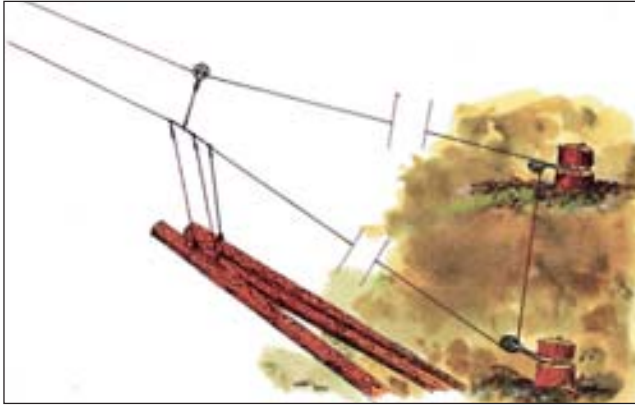
All standing trees used as backspars must be topped unless they are too hazardous to top. Standing trees used as backspars that are in standing timber need not be topped, provided that no worker enters the area made dangerous by the use of such a tree as a backspar.

The following is the suggested procedure for rigging a standard backspar (it may be amended to suit particular circumstances):

1. Limb the tree as you climb.
2. Hang the pass block and line.
3. Hang tree plates or a hang strap.
4. Hang the jack strap.
5. Hang the jack.
6. Hang guylines (using open-faced, pinned, flat hooks).
7. Thread the jack for the skyline.
8. Tighten and secure the guylines.

## CARRIAGE SYSTEMS

### Scab Skyline (Running Skyline)



*Two-block system.*

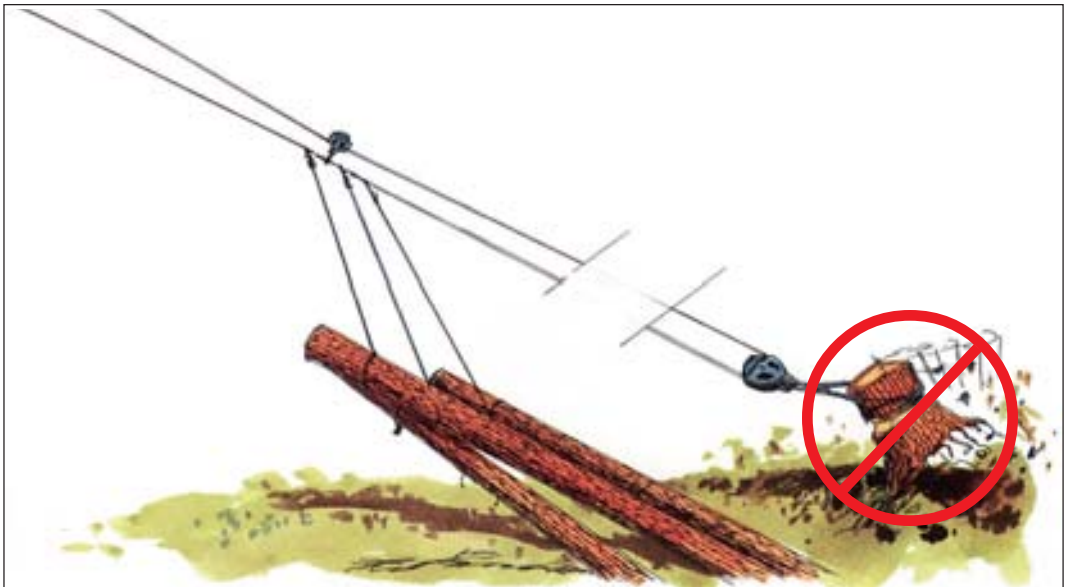
A scab line system involves the use of a rider block on the haulback, connected to the butt rigging with a short strap or chain.

There must be adequate deflection to use this system. A rule of thumb: If you can see at least two-thirds of the home spar from the back end, you have enough deflection.

It is recommended that two blocks be used at the back end. This reduces the amount of stress that would be placed on one

stump, specifically in a downhill situation where the haulback brake is used to control the turn. Using two blocks also reduces line wear caused by line wrap. The scab line system increases lift and gives better control on sidehill yarding.

When a single block is used, there is a full block purchase on the tailblock.



*One-block system on a stump that is too small.*

## **Do's and Don'ts When Using Scab Skylines**

### **Do's**

- Use a sufficient amount of tag between the scab block and the butt rigging.
- Use two corner blocks.
- Ensure that the scab block is fitted with a proper line guard.
- Make the rigging crew aware of the increased travel of the rigging when slack is given when using this system.
- Stop the rigging until the lines are free, if line wrap occurs.
- Secure the rigging when changing roads, to prevent any inadvertent movement.
- Consider leaving the turn hooked up when changing roads.

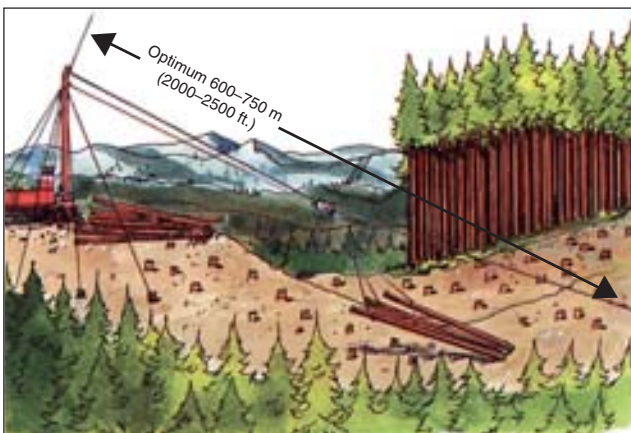
### **Don'ts**

- Don't run the rigging back near the tailhold stumps if the stumps are more than a few feet apart.
- Don't allow the chokers to flip over the lines and foul the scab block; clear the chokers immediately, or they will burn the haulback.

## **Shotgun System on a Live Skyline**

This is an uphill yarding configuration where gravity outhauls the carriage. In order to have the carriage closer to the ground, the skyline should be slackened.

One of the most hazardous work areas is directly under the skyline and carriage.



*Steel spar built for shotgunning.*

As with any yarding system, planning and setting layout are important. The crucial elements in shotgun yarding are chord slope and maintaining a recommended minimum of 10 percent deflection.

### **Advantages**

- The only power required for this type of yarding is during the inhaul mode because gravity assists on the outhaul. Fuel costs are substantially reduced with this system.
- Depending on the slope of the skyline and amount of deflection, yarding cycle time is faster than it is with powered outhaul.
- Rig-up time is reduced because there are no haulback or blocks to be set.
- Damage to logs is reduced.
- With the ability to adjust the skyline tension, deflection can be increased for heavy loads.

### **Disadvantages**

- With insufficient lift at the back end or backspar, chokers and/or rigging will be in ground lead, creating additional hazards.



*Chokers flail around when pulled over logs and through slash. Debris will be thrown in any direction. With excessive slack in the mainline, the carriage could move back unexpectedly. If the skyline is not fully supporting the carriage, the carriage could fall over.*

## Live Skyline and Carriage with Haulback Attached

With this system, the yarder operator controls skyline tension. The haulback is attached to the carriage for outhaul, and to hold the carriage when stopped. This configuration is used for downhill yarding as well as uphill yarding.



*This illustration shows the bight area.*

### **Advantages**

The live skyline and carriage with haulback:

- Is not restricted to only uphill yarding
- Allows the carriage to be spotted at any location
- Provides more control of logs being yarded
- Allows the bight of the haulback to be kept to a minimum
- Allows north bend and south bend configurations to be used

### **Disadvantages**

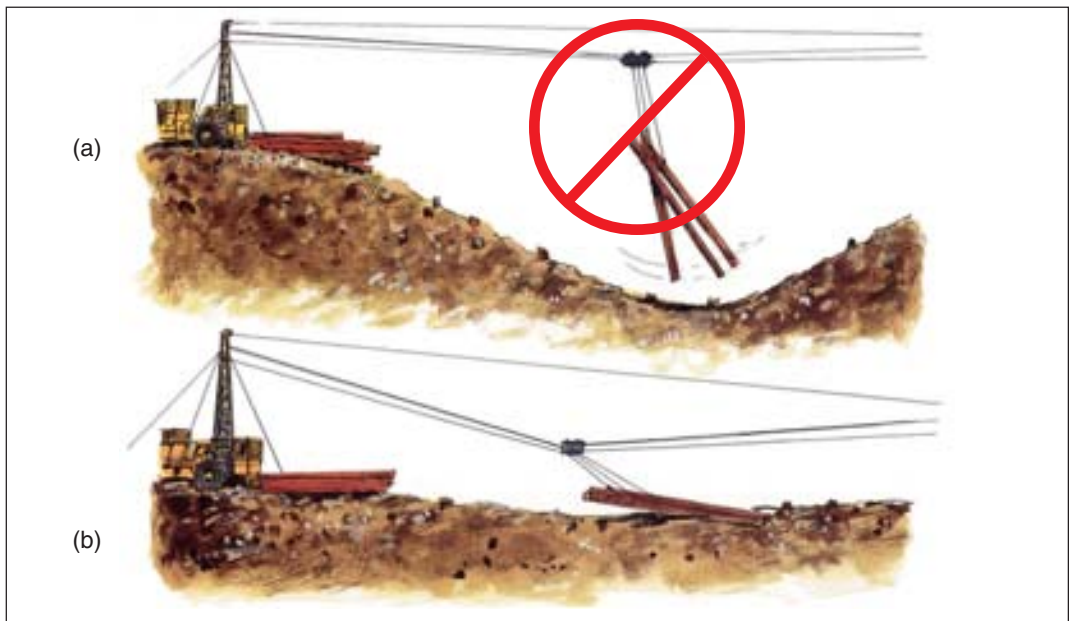
The live skyline and carriage with haulback:

- Increases hazards in the following areas:
  - Bight created by the haulback and the blocks
  - Inside area contained by a fall block, haulback, and mainline
  - Anywhere under the haulback, mainline, and skyline
  - Area within reach of any backspar or lift tree that could be pulled over
- Creates difficulty as the carriage approaches the back end, because (a) extra bight is placed on the skyline tree jack, (b) guyline stresses change, and (c) haulback corner blocks may have additional bight and stresses

## SKYLINE TENSION

For any skyline application, there should be adequate skyline slope and deflection on the outhaul to clear the carriage and chokers off the ground. Planning for skyline yarding should determine that deflection is adequate for full or partial suspension. Deflection lines should be calculated to ensure that the desired yarding method will be possible.

Excessive wire rope wear and stretching occurs when using less than 8 percent deflection. The minimum recommended deflection is 10 percent. When this cannot be attained, consideration should be given to rigging a backspar or the use of intermediate supports. See “Technical Information,” beginning on page 137, for information on how to calculate deflection.



(a) Unsafe – inadequate sag to move logs over uneven ground. (b) Safe – adequate sag.



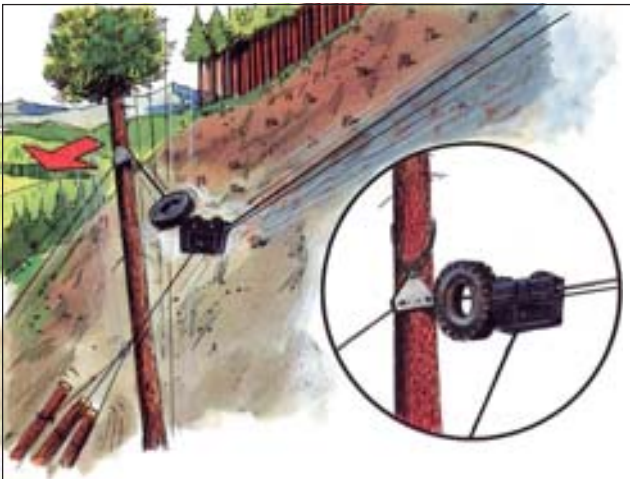
*Use of wrong machinery will cause lines to wrap and burn.*

Only machines designed specifically or modified for shotgun logging must be used. Some equipment is designed with the skyline fairlead as the topmost fairlead, with the pulling or skidding line below. This configuration prevents lines from wrapping and cutting off.

## UPHILL AND DOWNHILL YARDING

### **Uphill Yarding**

During uphill yarding, the two back guys take the critical loading. The front guys stabilize the tree when yarding logs from behind the backspar; the carriage will be brought back as far as possible. As the mainline/skidding line tightens, excessive bight occurs in the skyline at the jack.



*Location of bumper to prevent the carriage from damaging the backspar and the backspar jack.*

When the carriage stops at the backspar, the bight of the mainline/skidding line is brought back to the tailblock located behind the tree. The turn is then set. Before the inhaul action is initiated on the mainline/skidding line, the carriage should be moved ahead to prevent excessive purchase on the skyline and stress on the backspar. Guyline placement is critical. A bumper should be placed between the skyline jack and carriage.

Yarding logs from behind a backspar changes the direction of stress, and additional factors must be considered.





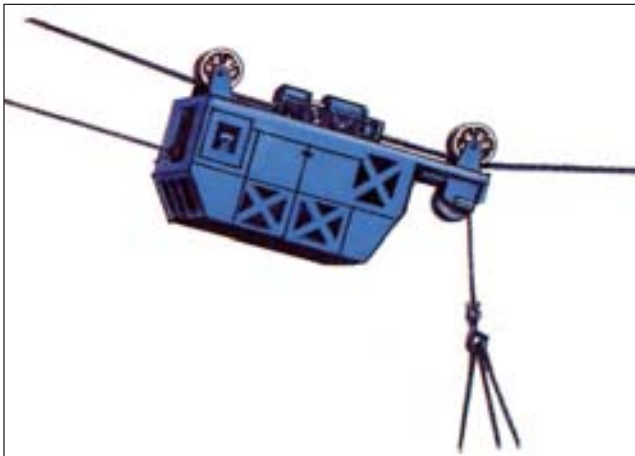
*Downhill yarding.*

### **Downhill Yarding**

During downhill yarding, the two front guylines take the critical loading. The back guys stabilize the backspar. In both situations, caution should be exercised to prevent damage to guylines, jack strap, and backspar.

## **TYPES OF CARRIAGES**

### **Motor-Driven Radio-Controlled Self-Clamping Carriage**



*Self-contained yarding system with a skyline clamp.*

This carriage is a self-contained yarding system that is remote-controlled by radio. It is equipped with a skyline clamp to facilitate lateral yarding.

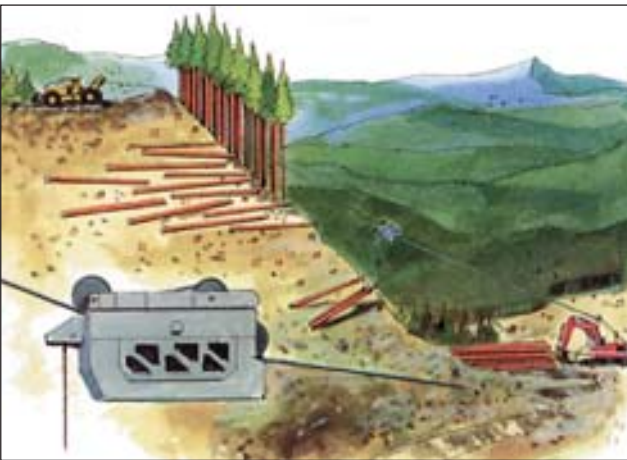
## Mechanical Accumulator Carriage



This carriage is equipped with a mechanical accumulator clamp.

*Shotgun carriage with accumulator clamp for downhill yarding.*

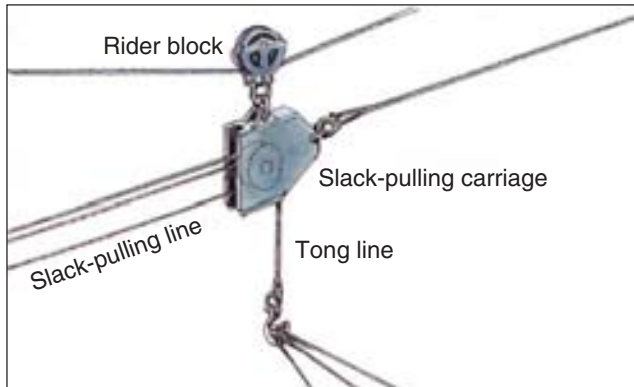
## Motor-Driven Self-Propelled Carriage



This carriage is a self-propelled, radio-controlled system operating from a skyline. Its on-board diesel power unit and hydrostatic drive eliminate the need for mainline or haulback, allowing for a very simple operation and rapid road changes.

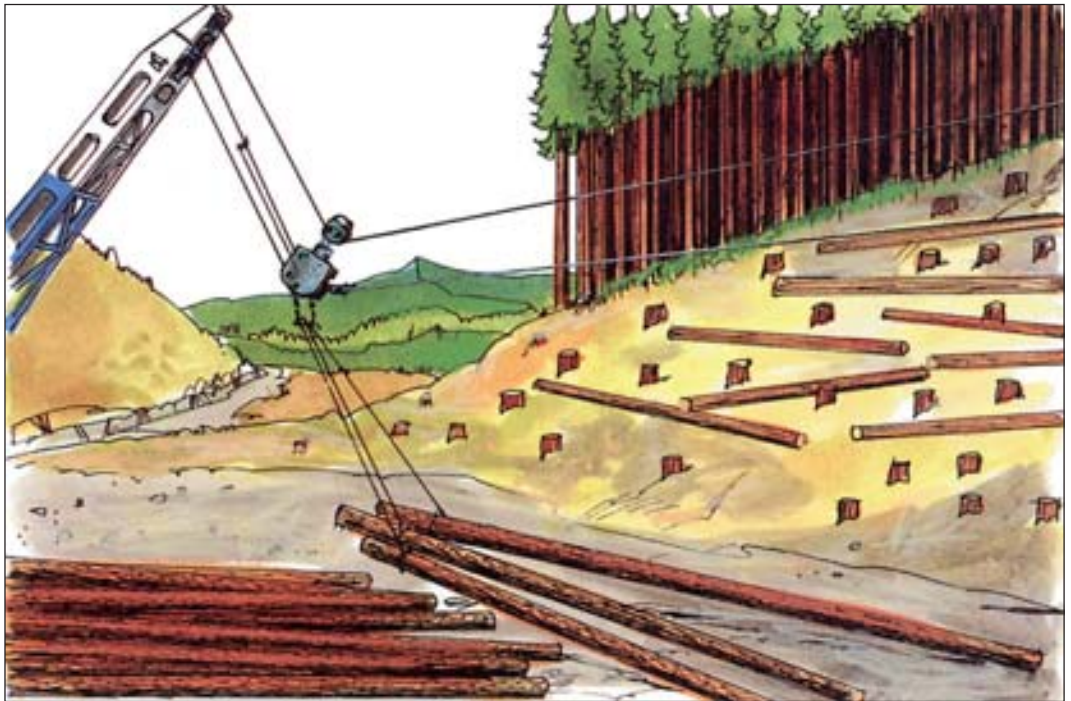
*Small wood yarding carriage.*

## Mechanical Slack-Pulling Carriage



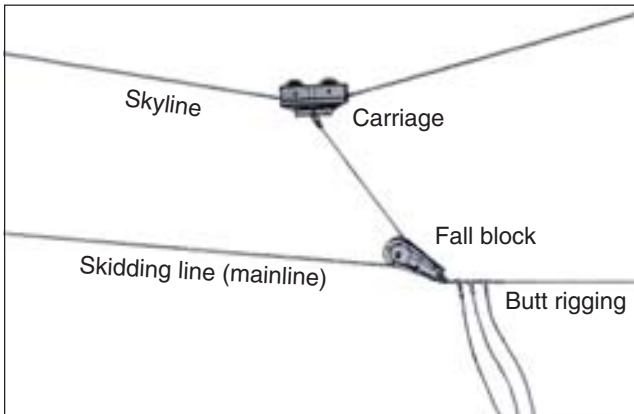
This is a type of log carriage that is held in place by the haulback. The yarder may be equipped with a slack-pulling drum, or the strawline drum is used to pay out the skidding line from the carriage. The mainline winds in the skidding line, and subsequently pulls the carriage to the landing.

*Parts of a mechanical slack-pulling carriage system.*



*Mechanical slack-pulling carriage on a live skyline.*

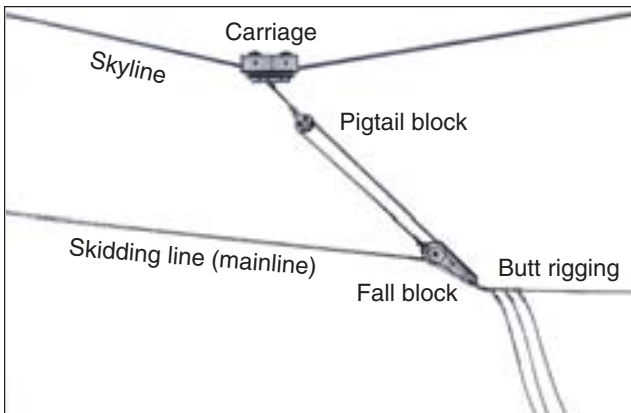
## North Bend–Rigged Skyline Carriage



*Parts of a north bend–rigged skyline carriage system.*

The north bend skyline system is primarily used when one-end suspension of the log is required. During the yarding process, the haulback can be tensioned and the turn can be lifted; if adequate deflection and clearance are available, the turn can be fully suspended. North bend systems work well in an uphill yarding mode or on a level or moderate downhill slope.

## South Bend–Rigged Skyline Carriage



*Parts of a south bend–rigged skyline carriage system.*

The south bend skyline system is mainly used in downhill yarding. The rigging is primarily the same as a north bend except that an additional block – the pigtail – is used. The mainline is passed through the fall block, up and around the pigtail sheave, and down to the carriage, where it is anchored. This manner of rigging applies additional purchase on the carriage, providing more lift during downhill yarding.

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## INTERMEDIATE SPARS

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*Bypass jack.*

This chapter describes the use of intermediate spars in both single-tree and double-tree support systems.

Intermediate spars, or multispars, help gain lift in skyline systems where little or no deflection is available. Their use requires a carriage that has the capability to pass over the support jack, much as a ski lift passes over a tower support system.

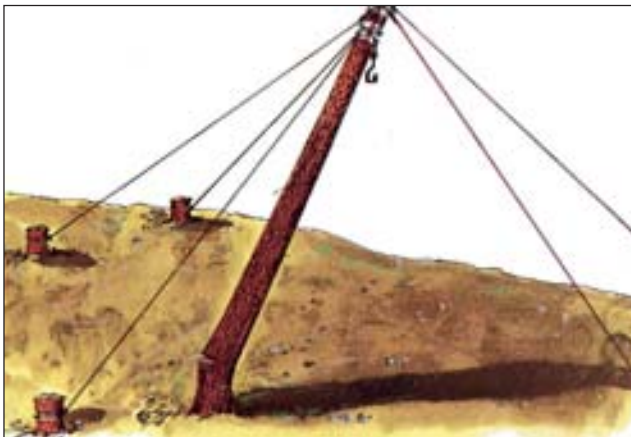
Intermediate spars can be divided into two groups:

- Single-tree support systems
- Double-tree support systems

When a bypass jack is rigged for intermediate spars, the skyline rests in the jack. The skyline is not secured to the jack but is free to slide through it. This, in turn, allows the skyline carriage to pass over the jack and the turn to bypass the intermediate spar.

### SINGLE-TREE SUPPORT SYSTEMS

In a single-tree support system, the tree may be a standing tree rigged in the established manner, using a jack designed for a pass-over carriage. The main problem with this is that there is little room for the turn of logs to pass by the base of the tree.



*Leaning intermediate support tree.*

Alternately, the tree can be rigged to lean out, allowing the skyline to hang clear of the base of the tree. This can be done by putting an undercut in the side of the tree in the direction in which you want the tree to lean. Before backcutting, ensure that proper support guys are rigged in a manner consistent with good rigging practices. Backcut the tree a sufficient amount to provide the lean. Leave enough holding wood to ensure the tree remains attached to the stump – 20 percent of the tree wood.

## Tree Selection

Intermediate support trees must be carefully inspected for defects. They should be:

- Firmly rooted
- Sound
- Straight
- Green
- Of sufficient diameter to withstand the stresses likely to be imposed on them

Intermediate support trees should be topped. In situations where it is hazardous to top them, they may be used untopped, providing safe written work procedures are made available to workers. Such work procedures must ensure that workers are kept out of the area made hazardous by the untopped tree during the yarding process.

## Guylines

For skylines 1½ inches in diameter or smaller, a minimum of two back or support guys and one snap guy on the low side is required.

For skylines larger than 1½ inches in diameter, a minimum of three back or support guys and two snap guys on the low side of the tree is required.

The guys must be:

- Anchored so that the load is shared equally by all guys other than the snap guys
- Securely attached to the top of the tree
- Securely attached to sound anchors in a manner consistent with good rigging practices

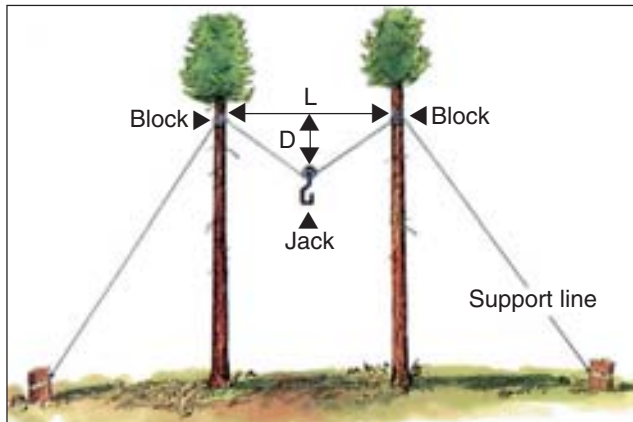
## Wire Rope Straps

Wire rope straps used to hang skyline jacks must provide 1½ times the strength of the skyline that the jack supports.

Wire rope straps used to hang skyline jacks must be hung from both eyes.

If the jack wire rope strap is wrapped, the strap must be aligned to ensure the strain is shared equally by both eyes.

## DOUBLE-TREE SUPPORT SYSTEMS



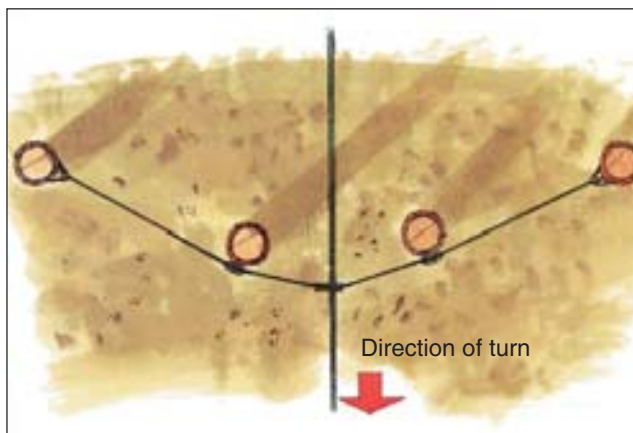
*Front view.*

The double-tree support system is an engineered design. It provides lift when there is little or no deflection, usually on a knoll or hump. It is used mainly in small wood harvesting.

The two trees must be rigged in such a manner that column vertical loading is imposed equally on both trees.

$D = 0.25 \times L =$  minimum distance

$D = 0.5 \times L =$  maximum distance



*Plan view.*

On a steep profile break, the jack will be forced uphill by the yarding force. Guylines will need to be positioned accordingly to support the backspar.

## Tree Selection

The selection of trees is dictated by the need to provide lift where there is little or no deflection, generally on a knoll or hump. Where a series of lift trees are needed, planners should consider the correct alignment of the skyline corridor in relation to the landing.

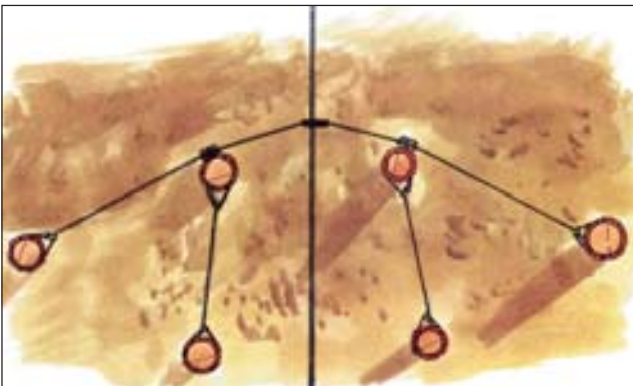
Intermediate support trees should be carefully inspected for defects. The trees should be:

- Firmly rooted
- Sound
- Straight from the ground up to the point of strap attachment
- Green
- Able to withstand the stresses likely to be imposed on them

## Guylines

Double-tree support systems must be guyed according to the following points:

- For skylines 1½ inches and smaller, no guylines are required. Jack support lines provide support, as shown in the illustrations on the previous page.
- For skylines larger than 1½ inches, the supports must be guyed as shown in the illustration below.
- Double-tree support systems must be rigged with a single-strap jack line ½ inch larger than the dropline.



*Double-tree support system with additional guylines.*



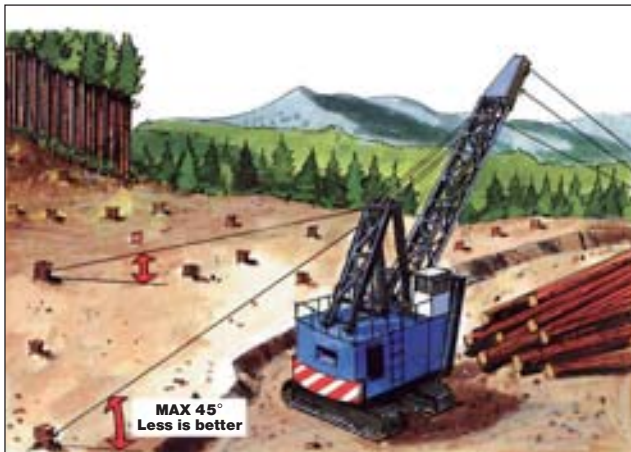
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# SWING YARDERS

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This chapter describes the use of swing yarders.

A swing yarder is a regular mobile yarder with a swinging upper works. Swing yarders are usually self-propelled, and the carriers can be rubber-tired, track-mounted, or mounted on the back of a truck. Swing yarders are manufactured in many sizes and configurations, and with various numbers of winch drums.



*Swing yarder with guylines.*

Modern swing yarders are highly mobile and efficient, have high winch speeds, and are used in many different types of yarding systems:

- Regular high-lead
- Skyline
- Running skyline
- Dropline
- Shotgun
- Grapple systems

## MANUFACTURERS' SPECIFICATIONS

Manufacturers build equipment to standards such as the Canadian Standards Association and the American National Standards Institute. Manufacturers set their own standards of maintenance and operation. The Occupational Health and Safety Regulation requires that these standards be complied with; for example, number of guylines and use, and outrigger use.

## GUYLINES

Due to the fast speeds of modern swing yarders, it is difficult for the operator to see or anticipate potential hang-ups. When hang-ups occur, the machine may tip. When required by the manufacturer, guylines must be used.

## **OUTRIGGERS**

The operator must block outriggers when yarding. The ground selected to deploy the outrigger must be solid enough to support the stresses imposed on it. During yarding, at least two outriggers must share the load.

## **COUNTERWEIGHT**

The counterweight presents several hazards:

- Worker may be crushed between the counterweight and other objects, such as logs, rocks, banks, or other equipment. To eliminate this hazard, be sure that the area of swing is kept clear of hazards. Whenever 60 cm (2 ft.) counterweight clearance cannot be maintained, the area must be barricaded off to prevent entry.
- The upper works swinging over the stationary carrier creates a shear hazard.

## **LANDINGS AND SAFE WORK AREA**

Landings should be arranged to provide enough room to allow workers on foot and equipment to move safely.

If this cannot be done without undue risk, the employer must develop other work procedures. This may mean that the yarding process is halted while bucking or loading takes place.

In roadside logging, log piles should be maintained in a stable manner.

The employer must provide workers with a safe area to store their tools and equipment. Splicing and chain saw filing should take place only in this area.

All workers should stay out of the area made hazardous by the swing yarder's work circle. Landing workers should be visible to the operator. The operator should ensure the landing workers' well-being at all times.

## **RUNNING LINES AND BIGHTS**

Swing yarders create additional hazard areas due to their ability to swing; lines that are lying straight when slacked down suddenly create a deadly bight when tightened because the boom swings into lead.

Workers must be made aware of the hazards of bights and of running lines that can flip up chunks, logs, and debris.

***Stay in the clear.  
Stay out of the bight.***



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# TRANSPORTING MACHINES

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This chapter describes safe ways to move machines and equipment.

## ROUTE PLANNING

The plan for the move should be based on the best route. Keep the following points in mind when planning a route:

- Bridges and culverts should be able to withstand the load stresses.
- The road should be wide and solid enough to handle the weight and length of the load.
- The route should minimize the need to negotiate adverse and steep downhill grades.
- For longer sections of roadway over 10 percent grade, the move plan should include effective pulling, pushing, and snubbing equipment.
- All equipment operators should be kept aware of the time frame of the move.

## POWER LINES AND OTHER OVERHEAD OBSTRUCTIONS

High-voltage power lines can come into contact with steel spar yarding units while the machines are transported. Other power line contacts can occur as equipment is walked to the yarding site.

Where road building, transporting of equipment, or logging is to take place near power lines, the employer must contact the Properties Division of BC Hydro, and follow the guidelines in *The Secondary Uses of BC Hydro Rights-of-Way*. In addition, the employer must adhere to the guidelines in BC Hydro's *Safety Procedures for Logging in the Vicinity of HV and EHV Power Lines*.

Equipment may also contact overhead obstructions in built-up areas that are unfamiliar to the crew.

Common overhead obstructions include:

- Low-voltage power lines in built-up areas
- Guylines and other overhead logging lines
- Service bay areas

If contact with an electrical conductor is made, workers must not try to clear the fouled power line by lifting it off or over the machine, by hand or any other means. Never climb on or off the machine. A worker who touches the equipment and the ground at the same time can be electrocuted.

To prevent contact with overhead obstructions, remember the following points:

- Every overhead obstruction must have height indicated plainly on a sign on each side of the obstruction.
- The operator should know the height of each machine.
- New or altered equipment should be measured for height.
- Equipment operators should stop as they approach an overhead obstruction and proceed on signal from a watchman.

No steel spar or tower for cable logging may infringe upon any of the required minimum distances from live conductors. In British Columbia, these minimum distances are:

over 750 V to 75 kV	3 m (10 ft.)
over 75 kV to 250 kV	4.5 m (15 ft.)
over 250 kV to 550 kV	6 m (20 ft.)

If a supervisor or operator is not sure of the line energy, the utility company will advise them by telephone or send a line supervisor to the site to provide the necessary guidance.

If the above limits of approach cannot be maintained, the supervisor or operator must complete a form 30M33 and submit it, before the move, to the power authority controlling the electrical system. This form is available from [WorkSafeBC.com](http://WorkSafeBC.com), or from the power authority controlling the electrical system.

## GRADES

### Snubbing, Pushing, or Pulling a Lowbed or Other Machine

Each year, dozens of preventable incidents occur because management does not have a well thought-out policy for assisting a lowbed, a machine mounted on rubber, or track-mounted equipment up or down a grade.

The decision to snub, push, or pull is usually left to the supervisor and/or operator. The supervisor usually bases the selection on previous experience and the operator's advice.

Problems arise when:

- The supervisor's experience is limited
- Shortcuts are taken to save time
- The operator does not know the limitations or the gradability of the lowbed or equipment
- Members of the drive or brake components have deteriorated because of poor operating procedures, poor maintenance, or age

The decision-makers must have the following information:

#### ***Lowbeds and Tractors***

- Load capacity
- Condition of the tires
- Braking capacity at normal speeds
- Braking capacity on downhill grades
- Condition of tractor unit – new or used
- Power and traction capability of tractor unit on uphill grades
- Effect of any modifications to the lowbed or tractor unit

#### ***Wheeled and Tracked Machines***

- Gradability of machine – uphill and downhill
- Condition of the equipment – new or used components, including:
  - Tracks
  - Tires
  - Drive chains
  - Brakes

If a decision is made to snub, push, or pull equipment, the capability of the equipment doing the snubbing, pushing, or pulling should be known. The assisting equipment should have sufficient power and traction. Doing something “because that’s the way we’ve always done it” does not mean it is the best way.

The supervisor and operators should have a clear understanding of:

- The push or pull of a crawler tractor on a firmly packed gravel road
- The holding power of an off-highway truck when it is half-loaded and used to snub a machine down a hill
- The effect of tire wear on holding power
- Whether tire inflation affects the assisting equipment
- The pull capacity of a log truck with trailer
- The push capacity of a log truck with trailer
- The maximum percent grade for snubbing, pushing, or pulling, for crawler tractors or trucks, if the road is frozen or there is ice or snow

This information should be provided in written form to the supervisor and operators.

## **DRIVER QUALIFICATIONS**

The driver is fully responsible for the safe operation of the equipment. The driver must be trained and certified for the equipment used – for example, air brake certification – and experienced with the specific work practice (snubbing, pushing, or pulling) and the hazards involved.



## LOADING EQUIPMENT

The lowbed should be adequate for the load to be carried, and the total weight of the lowbed and load must meet local road restrictions, where applicable.

Once the plan for the equipment move has been communicated to the crew, the machine can be loaded onto the lowbed. A qualified person must supervise the walking of the machine onto the lowbed. This person should direct the operator to ensure proper centring of the machine.

The ground where the machine is loaded should be as flat as possible. This means no uphill slope, and especially no side slope, to the grade. A slight downhill slope is desirable for easier loading.

Once the loading ramps have been lowered and cushioned with proper blocking, the machine may be walked onto the lowbed. The signaller directing the operation should be positioned in clear view of the operator. The signaller directs every movement of the machine.

Once the machine is properly centred on the lowbed, any part of the machine that can reduce the overall height should be lowered. This reduces the sway on corners. The machine car bodies should be secured to the lowbed with adequate turnbuckles, cinches, or other suitable rigging, and the brakes should be set.

## THE MOVE

Before the equipment is moved, the lowbed operator and the driver of the pilot vehicle should run through a quick check of the plans, to ensure the following:

- Radios working
- Overhead obstructions located
- Route capable of handling the load
- Snubbing equipment lined up
- Unloading site suitable
- Adverse weather conditions – snow and/or ice – taken into account
- Bridge capabilities assessed

Once under way with the lowbed, the pilot vehicle operator should drive at a speed that respects the road conditions and power train of the lowbed tractor and meets the posted speed limits.

## UNLOADING EQUIPMENT

Unloading the equipment is the reverse procedure of the loading exercise. Remember these key points:

- Choose a suitable site with little or no side slope and especially no uphill grade.
- Set the maxi-brakes on the lowbed and tractor unit.
- Chock the wheels.
- Remove the tie-down rigging, and place it where it will not be run over or forgotten.
- Designate one qualified person to supervise the unloading of the equipment. That person will signal directions to the operator. The operator, in turn, must follow those directions precisely.
- Keep all unnecessary crew transportation vehicles and workers clear of the unloading area so the signaller and operator are not distracted.

The unloading area should provide sufficient room to turn the lowbed around without having to back it into or over a bank, through slash, or over saplings.

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# FIRST AID AND EMERGENCY PROCEDURES

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This chapter describes first aid requirements, emergency evacuation procedures, and crew transportation. This chapter also describes the employer's responsibility to provide a means of checking a worker's well-being.

## FIRST AID REQUIREMENTS

Forestry operations may require supplementary first aid supplies and services because of the rugged terrain and long distances from central first aid services. Worksites may be a hike of 45 minutes to an hour from landings.

The Regulation requires that an assessment of every workplace be conducted to determine the level of first aid service that must be provided.

The employer's responsibility includes the following:

- Under section 3.16(2) and (3), conduct an assessment to determine the level of first aid service that must be provided for a workplace. See the step-by-step method in OHS Guideline G3.16-2.
- Provide adequate and appropriate first aid equipment, supplies, facilities, attendants, and services, as required by section 3.16(1).
- Develop written first aid procedures as required by section 3.17. See OHS Guideline G3.17.

The tables in the supplementary materials of the OHS Guideline Part 3 set out the recommended first aid requirements for high-risk industries. Note that a work location that is more than 20 minutes surface travel time from central first aid is considered a separate workplace. It must have a separate assessment conducted, and the level of first aid service indicated as a result of that assessment must be provided.

In addition, some remote workplaces may have lodging for workers provided by the employer at or near the workplace. In such remote workplaces, the level of first aid service described in the guideline must be based on the total number of workers, both on and off shift.

Skyline yarding crews require at least one worker trained to the appropriate level of training and equipped with the corresponding first aid kit (including blankets). The equipment must be kept clean and dry. When the crew is more than a 20-minute walk from the landing, the supplementary first aid equipment must be on the hill and readily accessible to workers. This is necessary in case an accident prevents the equipment from being sent out on the rigging, and it ensures prompt delivery of first aid.

## **EMERGENCY EVACUATION**

### **Emergency Transportation Vehicle**

An emergency transportation vehicle (ETV) should be provided if there are six or more workers. The ETV must be capable of transporting an injured worker to medical assistance and must be capable of travelling on the existing roads. The ETV must be maintained and inspected regularly. A record of vehicle maintenance must be kept, and the operator's licence must be adequate for the vehicle used.

### **Air Evacuation**

In some places, air transport may be the primary or only means of transporting an injured worker to medical assistance. If you do rely on air transport, the employer must make prior arrangements with an air service company, with aircraft capable of carrying a stretcher patient. The air service company must be kept up-to-date on the location of the operations. In case air evacuation is required, the following equipment is needed:

- Spine board capable of fitting into helicopter.
- On-site radio communication with central first aid.
- Designated landing areas must be used. If using helicopter pads, the pads must be clearly marked and identified so the pilots can see them. Occupational first aid attendants must know the location of the heli-pads.

If the weather restricts the use of aircraft, an alternative written procedure for the care and transportation of injured workers must be established, where practicable.

## CREW TRANSPORTATION

All vehicles and vessels used to transport workers must meet the current Occupational Health and Safety Regulation and Coast Guard requirements. The number of workers transported in specific vehicles will require a competent and fully licensed driver meeting all requirements of the *Motor Vehicle Act*.

- Seat belts, where installed, must be used.
- All tools, equipment, and rigging must be kept in a separate compartment to protect workers.
- Where the material is flammable or otherwise harmful to workers, the storage compartment must have an approved firewall separating it from the crew compartment.

These vehicles must meet current safety standards and be inspected on a regular basis.

## CHECKING WORKER'S WELL-BEING

### Example

Check to see that the power saw is being used, and not just idling.

### Example

Check to see that the worker is just resting, and not sitting or lying down because of injury.

The employer must provide a means of periodically checking the well-being of a worker, where the worker is employed under conditions that present a significant hazard of disabling injury, and when the worker might not be able to secure assistance in the event of injury or other misfortune.

All jobs in logging are sufficiently hazardous to require checking a worker's well-being. Checks must be made at such intervals and by such means as are appropriate to the nature, hazard, and circumstances of the employment.

It is the employer's responsibility to provide a procedure and to ensure that the procedure is followed. This procedure must be in writing and must list in detail the intervals between checks, the responsibilities of each worker, and procedures to follow if workers cannot be contacted.

Visual checks are preferred, but audible checks are acceptable. In both cases, the well-being of the worker must be determined.

Merely providing a worker with radio or telephone communication to call for assistance in the event of injury is not sufficient, as the nature of the injury or other circumstances may prevent the worker from calling.

Radio or telephone checks are acceptable if the checker is directed to call the worker at predetermined intervals and confirm the worker's well-being. This should be logged in writing by the checker – for example, a log book with times that can be checked off.

It is not expected that a check system will provide the security afforded by working in pairs. It is possible that an injury could occur shortly after a check. Any checking interval is, therefore, a compromise. The risk to the worker and the circumstances of the situation will determine the exact intervals; however, the following can be used as guidelines:

- Twice a day (such as morning and afternoon) would be the *minimum* number of checks allowable for any logging job and may be acceptable for relatively low-risk jobs, such as engineering, forestry, or supervisory personnel (provided they are not using power equipment), or a worker ditching with a back hoe.
- Checks must be made *at least* every two hours for users of power equipment where a substantial risk exists, such as riggers, crawler tractors, hydraulic evacuators pioneering right-of-way, skidders working off-road, or road graders.
- Checks must be made *at least* every half hour for workers using chain saws and in jobs where hypothermia may be a factor.

As part of the requirements, a check at the end of the work day must also be included.

## OCCUPATIONAL FIRST AID

First aid procedures keep the injured person breathing and the bleeding controlled until medical help arrives.

When necessary, remove yourself and the injured person from any further threat of injury. Change the person's position only if necessary in order to administer survival techniques. Keep the injured person warm. Move the injured person only if necessary.

Follow these essentials of occupational first aid:

- After making sure that there is no danger to yourself or further danger to the patient, determine level of consciousness.
- Make sure that breathing is present and adequate. If breathing is absent, administer mouth-to-mouth resuscitation with a pocket mask.
- Check for pulse. If no pulse can be detected, begin CPR at once and continue until medical assistance is obtained or until the pulse returns.
- Check to see whether bleeding is present. If so, apply pressure over the wound to stop the blood flow. Apply a pressure dressing.
- Get help as soon as possible.





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# CONTROL PROCEDURES

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This chapter describes the following control procedures:

- Notice to Airman (NOTAM)
- Avalanche control
- Weather
- Traffic control

## NOTICE TO AIRMAN (NOTAM)

Where suspended cables may create a hazard to aircraft, the employer must notify NAV Canada and a NOTAM will be issued to all aircraft operators that would use the area made hazardous by suspended cables or other activities.

## AVALANCHE CONTROL

Where logging will be affected by avalanches, planners must institute effective controls and follow the OHS Guideline G21.85(1) *Board acceptance of procedures for avalanche control*.

## WEATHER

Planners must calculate the impact of weather and the season on the operation. Cold, snowy, and excessively wet weather have the most impact on development plans, but the impact of these factors decreases as the planning efforts increase.

### Logging Sensitive Areas during Heavy Rain Seasons

- Scarring of the duff on the hillsides causes extreme site degradation through erosion.
- Workers may be exposed to the hazards of mud and rock slides.
- Establish rainfall shutdown criteria.

### Logging Moist Areas before Freeze-Up

- Yarding activity and equipment movement cause excessive site degradation.
- Haul roads get punched out, making log hauling difficult.
- Crew buses and emergency transportation vehicles cannot negotiate the roads.

## Logging during Periods of Excessive Snow

- Logs buried beneath the snow are sometimes missed, resulting in the need for re-logging when the snow is gone.
- Gut-hooked logs and logs frozen in the snow often break.
- Hazards of walking in the felled and bucked timber, impaired visibility, and the hazards of moving equipment increase.

## Logging in Excessive Fog

- Crew cannot see the lay of the logs, increasing the hazard of upending and swinging logs.
- The haulback dislodges logs, roots, and stumps that the crew cannot see.

## Logging during Electrical Storms

- If lightning strikes the lines or equipment, the crew is exposed to the hazard of electrocution.

## Frost Boils

- Frost boils on the road can cause machines that are being moved to become stuck or roll over. The road condition will deteriorate in a very short time.

## TRAFFIC CONTROL

Where active logging takes place adjacent to or over travelled roadways, effective traffic control procedures and equipment must conform to current applicable regulations, such as:

- The Occupational Health and Safety Regulation and safe work procedures
- Requirements of the Ministry of Forests
- The Ministry of Transportation and Highways' *Manual of Standard Traffic Signs*
- Company operational rules and procedures

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# RESPONSIBILITIES FOR SAFETY

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This chapter lists each worker's responsibility for safety.

## MANAGER/ SUPERINTENDENT

The manager/superintendent, as the most senior representative of management in an operation, must demonstrate the employer's commitment to safety.

The manager/superintendent's responsibilities for safety include:

- Providing the safest workplace possible through effective planning and taking into account any unusual features or dangers of a particular worksite
- Ensuring that new workers arriving at a worksite are competent and receive adequate training and that follow-up job-training programs are conducted and adequately maintained
- Initiating, maintaining, and publicizing a comprehensive occupational health and safety program
- Ensuring that first aid facilities and services are adequate for the size of the operation and its location
- Ensuring that potentially serious near-miss incidents are investigated
- Ensuring that accidents resulting in serious injury or death are investigated and reported to WorkSafeBC
- Knowing and enforcing the Occupational Health and Safety Regulation and the employer's safety rules and policies
- SETTING A GOOD EXAMPLE

## SUPERVISOR

The supervisor is responsible for yarding and loading activities in a logging operation. Safety rules and policies set by the employer must be relayed through the supervisor to the workers.

The supervisor's responsibilities for safety include:

- Training new workers
- Assisting in planning setting layouts
- Ensuring that safe work procedures are developed, carried out, and updated as required

- Investigating accidents and incidents and taking action to correct unsafe conditions or acts
- Knowing and enforcing the Occupational Health and Safety Regulation and the employer's safety rules and policies
- Organizing and implementing an effective safety program for work in the logging operation
- Ensuring that personal protective clothing and equipment are provided and used
- Identifying and informing workers about specific dangers in the workplace
- Advising workers about an employee and family assistance program where such programs are available
- SETTING A GOOD EXAMPLE

## WORKER

The worker's responsibilities for safety include:

- Knowing and enforcing the employer's safety rules and policies
- Knowing and enforcing the Act and the Occupational Health and Safety Regulation
- Ensuring that only trained and authorized workers operate machinery – including chain saws
- Inspecting the worksite for hazards and taking action to eliminate or control them
- Reporting to the supervisor all accidents involving injury to workers and any serious near-misses
- Ensuring that equipment is kept in safe operating condition
- Referring to the employer any worker who is physically or mentally unfit to do the job
- Taking corrective action on reported unsafe conditions and acts
- Using safe work procedures to deal with the hazards encountered
- Ensuring that landings are organized and kept clear of unnecessary debris
- Wearing appropriate personal protective equipment and clothing
- Identifying and informing workers about specific dangers in the workplace
- SETTING A GOOD EXAMPLE

## **HOOKTENDER/RIGGER**

The hooktender's responsibilities for safety include:

- Knowing and enforcing the employer's safety rules and policies
- Knowing and enforcing the Occupational Health and Safety Regulation
- Ensuring that only trained and authorized workers operate machinery – including chain saws
- Inspecting the worksite for hazards and taking action to eliminate or control them
- Reporting to the supervisor all accidents involving injury to workers and any serious near-misses
- Ensuring that equipment is kept in safe operating condition
- Referring to the employer any worker who is physically or mentally unfit to do the job
- Taking corrective action on reported unsafe conditions and acts
- Using safe work procedures to deal with the hazards encountered
- Ensuring that landings are organized and kept clear of unnecessary debris
- Wearing appropriate personal protective equipment and clothing
- Identifying and informing workers about specific dangers in the workplace
- SETTING A GOOD EXAMPLE

## **YARDER OPERATOR**

A yarder operator's responsibilities for safety include:

- Knowing and enforcing the employer's safety rules and policies
- Knowing and enforcing the Occupational Health and Safety Regulation
- Following the landing worker/chaser's signals when landing logs
- Ensuring that workers and equipment are in the clear before line movement is initiated
- Ensuring the yarder is rigged and maintained in a safe operating condition, in accordance with the manufacturer's specifications
- Ensuring a minimum of 60 cm (2 ft.) clearance is maintained between counterweight and obstacles
- Ensuring that signalling devices function properly
- Identifying and informing workers about specific dangers in the workplace

- Stopping all lines when a signal is not understood
- Wearing personal protective equipment and clothing
- SETTING A GOOD EXAMPLE

## **CARRIAGE OPERATOR/ RIGGING SLINGER**

The carriage operator is responsible for the safety of the choker setters and the safe and proper operation of the carriage.

The carriage operator/rigging slinger must:

- Know and understand the specific yarding signals for the type of carriage or rigging used, for example, hand signals and audible signals
- Know and understand radio signalling operations
- Ensure that the radios function properly
- Ensure that all workers are in the clear before initiating any line movement
- Ensure that equipment is maintained in a safe operating condition
- Know and enforce company safety rules and policies
- Know and enforce the Occupational Health and Safety Regulation
- Wear personal protective equipment and clothing
- SET A GOOD EXAMPLE

## **LANDING WORKER/ CHASER**

The landing worker's responsibilities for safety include:

- Knowing and enforcing the employer's safety policy and rules
- Knowing and enforcing the Occupational Health and Safety Regulation
- Knowing and following correct work procedures
- Standing in a safe location visible to equipment operators
- Controlling vehicular traffic through the landing
- Wearing personal protective equipment and clothing
- Ensuring that the minimum clearance of 60 cm (2 ft.) is kept between the counterweights and other obstacles in the immediate area

- Reporting any unsafe act or condition to a supervisor
- Maintaining good housekeeping in the landing
- Keeping tools in serviceable condition
- Identifying and informing workers about specific dangers in the workplace
- Building a stable log pile
- SETTING A GOOD EXAMPLE

## **CHOKER SETTER**

The choker setter works under the direction of the carriage operator/rigging slinger. The choker setter's responsibilities for safety include:

- Knowing and enforcing company safety rules and policies
- Knowing and enforcing the Occupational Health and Safety Regulation
- Wearing appropriate personal protective equipment and clothing
- SETTING A GOOD EXAMPLE





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# TECHNICAL INFORMATION

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## COMMON CONVERSIONS

Imperial	Conversion factor	Metric
inches	x 2.54 =	centimetres
centimetres	x 0.39 =	inches
feet	x 0.305 =	metres
metres	x 3.28 =	feet
pounds	x 0.45 =	kilograms
kilograms	x 2.2 =	pounds
kip (1000 lb. force)	x 4.45 =	kilonewtons

## SKYLINE TENSIONING

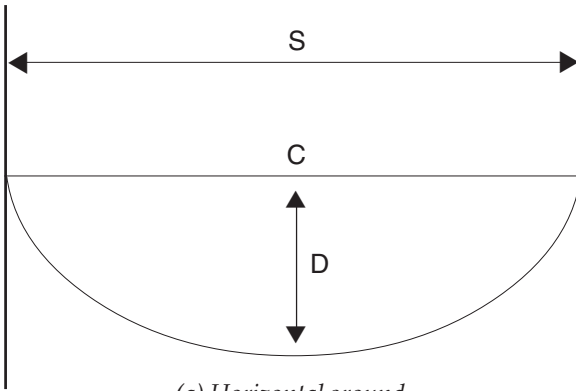
### Deflection

Deflection is the measure of the amount of sag in a line. Deflection is usually expressed as a percentage of the span.

### Deflection Lines

Deflection lines are the “line of sight” measurements from a potential landing to tailhold locations. Forestry engineers or trained workers take these lines to establish a ground profile for determining whether adequate clearance or lift is available in order to log the area with a cable logging system.

## HOW TO CALCULATE DEFLECTION



(a) Horizontal ground.

Horizontal span  
(in feet)

$S, S_1, S_2$

Chord

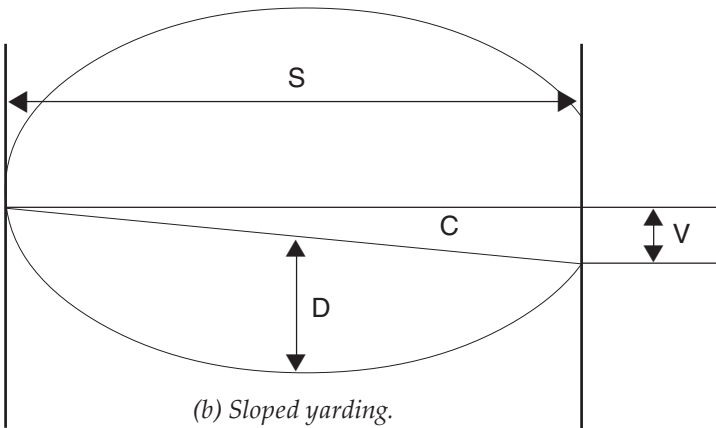
$C, C_1, C_2$

Sag (in metres or feet)  
at midspan

$D, D_1, D_2$

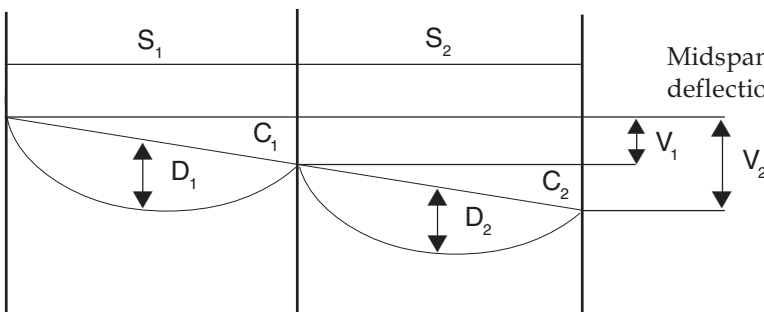
Vertical distance  
(in metres or feet)  
from head spar to  
tailhold

$V, V_1, V_2$



(b) Sloped yarding.

$$\text{Slope} = \frac{V \times 100}{S}$$



(c) Multispan.

Midspan  
deflection (%)

$$= \frac{D \times 100}{S}$$

The following is a metric approximation of the table below, giving the deflection in metres.

<b>Deflection (in Metres)</b>							
<b>Span (in metres)</b>	<b>Deflection Percent</b>						
	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>12</b>	<b>14</b>	<b>16</b>
305	21	24	27	31	37	43	49
381	27	30	34	38	46	53	61
457	32	36	41	45	54	63	72
533	37	42	48	53	64	74	85
610	43	49	55	61	73	85	98
686	48	55	62	69	82	96	110
762	53	61	68	76	91	106	122
838	59	67	76	84	101	118	134
914	64	73	82	92	110	128	146
991	69	79	89	99	119	139	158
1067	75	86	96	107	128	149	171
1143	80	92	103	115	137	160	183
1219	85	98	110	122	146	171	195

The following table gives deflection in feet at various spans, and percent of deflection.

<b>Deflection (in Feet)</b>							
<b>Span (in feet)</b>	<b>Deflection Percent</b>						
	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>12</b>	<b>14</b>	<b>16</b>
1000	70	80	90	100	120	140	160
1250	87	100	112	125	150	175	200
1500	105	120	135	150	180	210	240
1750	122	140	157	175	209	245	279
2000	140	160	180	200	240	280	320
2250	157	180	202	225	269	315	359
2500	175	200	225	250	300	350	400
2750	192	220	247	275	329	385	439
3000	210	240	270	300	360	420	480
3250	227	260	292	325	389	455	519
3500	245	280	315	350	420	490	560
3750	262	300	337	375	449	525	601
4000	280	320	360	400	480	560	640

## HOW TO CALCULATE TENSION

Tension is the stress on a line. Tension must be monitored to maximize payloads without exceeding the safe working load and to maintain wire rope integrity. Skyline tension can be determined:

- Electronically
- Mechanically
- Through data calculation

### Electronically

A load cell is located in the skyline sheave pin. This cell sends a reading to a meter, allowing instantaneous tension monitoring.

### Mechanically

This method uses a combination of physical properties of the wire rope and the time it takes for an induced vibration to return. To determine tension using this method, the following information is required:

- Line weight per metre
- Distance from the strike point to the carriage or spar
- Exact time for wave round trip

### Through Data Calculation

#### Wire Rope Specification Chart for Tensioning Skylines

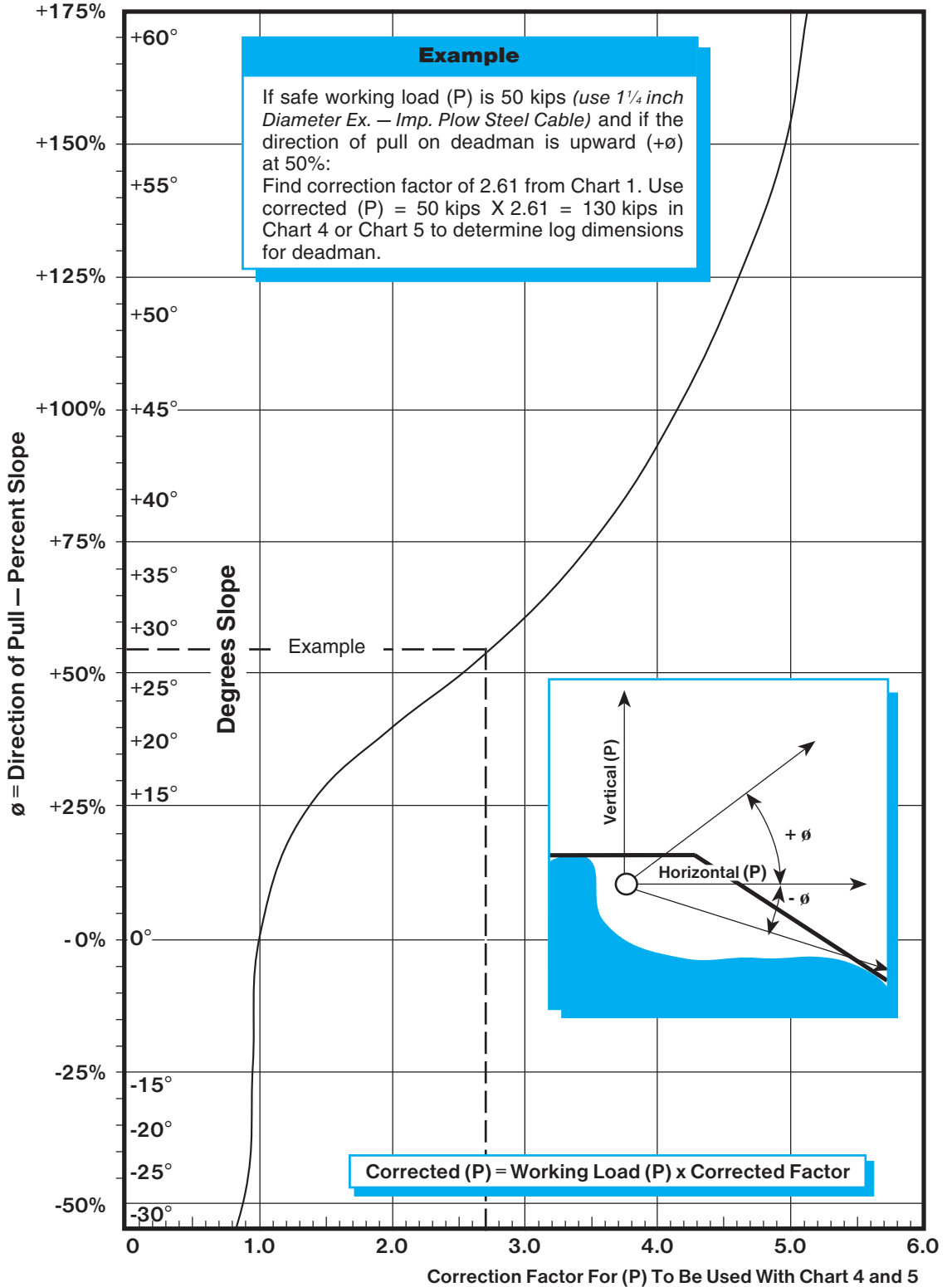
Metric	Imperial
$T = \frac{4 \times L^2 \times W}{9.8 \times R^2}$	$T = \frac{4 \times L^2 \times W}{32.2 (R^2)}$
$R^2 = \frac{4 \times L^2 \times W}{9.8 \times T}$	$R^2 = \frac{4 \times L^2 \times W}{32.2 \times T}$
T = Skyline tension	
L = Skyline length	
W = Weight/unit of skyline	
R = Wave round trip time	

The following formulas will assist in determining the line tension and size of wire rope required for a particular load.

<b>Deflection</b>	
$D = \frac{S \times \%}{100}$	$\% = \frac{D \times 100}{S}$
<b>Tension due to Loads</b>	
$T = \frac{L \times S}{4 \times D}$	
<b>Tension due to Rope Weight</b>	
$T = W \times S \times 4$	
<b>Total Tension</b>	
$T = \frac{L \times S + T_w \times D \times 4}{4 \times D}$ or $T = \frac{L \times S}{4D} + \frac{WS^2}{8D}$	
<p>L = Weight of load including carriage, logs, and haulback (if used)            S = Span in metres or feet            D = Deflection in the same units as S            W = Weight of rope per metre or foot            % = Percent deflection            T = Tension</p>	

# DETERMINING AN ADEQUATE DEADMAN

Chart 1 — Correction for Pull Direction



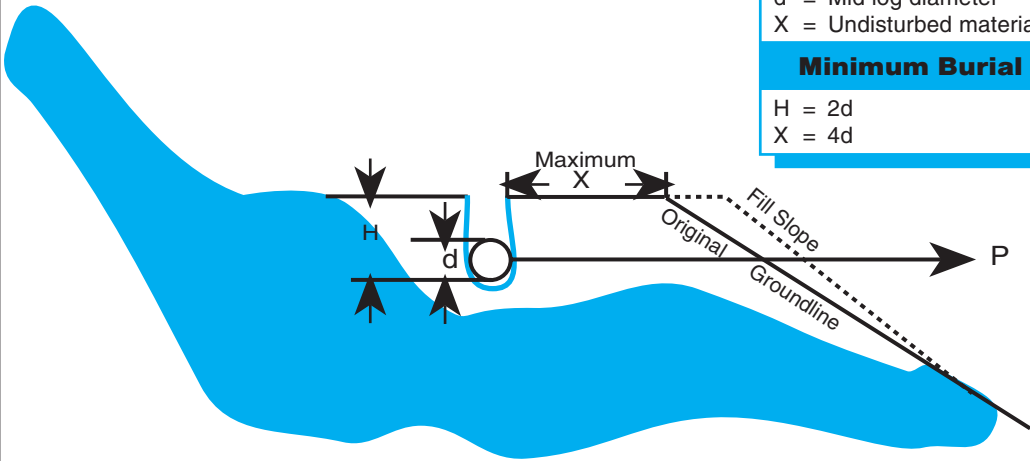
**Chart 2 – Deadman Burial**  
 Spur Road, Level Ground, or Ground Sloping Upward in Direction of Pull

**Legend**

H = Depth of trench  
 d = Mid log diameter  
 X = Undisturbed material

**Minimum Burial**

H = 2d  
 X = 4d



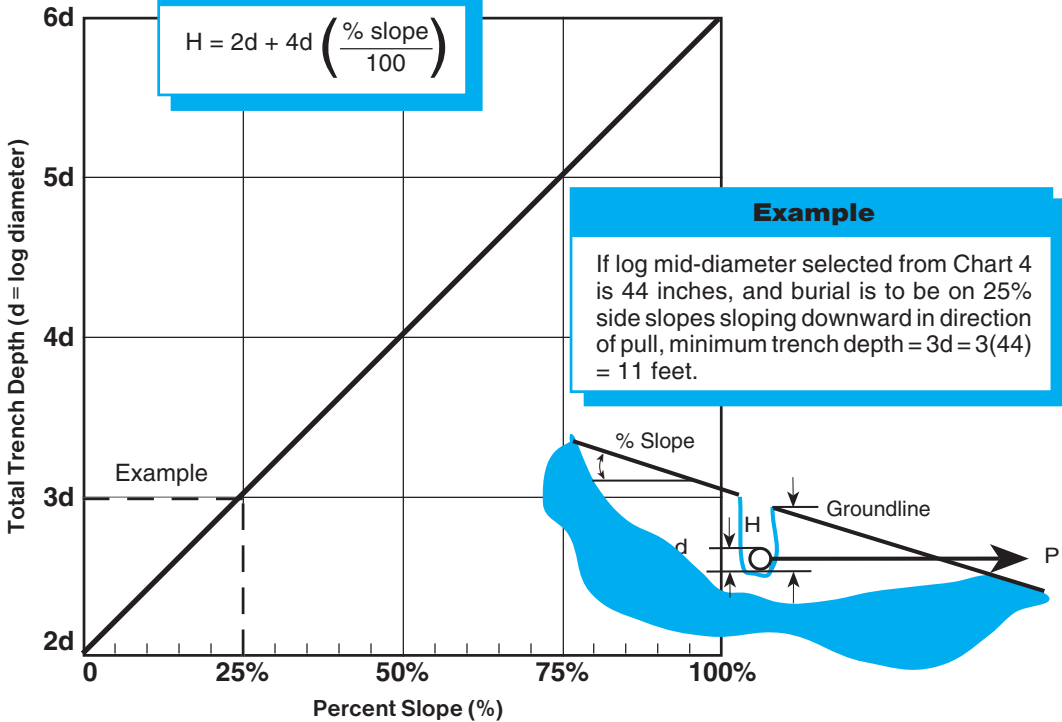
**Chart 3 – Ground Sloping Downward in Pull Direction**

**Minimum Burial**

$$H = 2d + 4d \left( \frac{\% \text{ slope}}{100} \right)$$

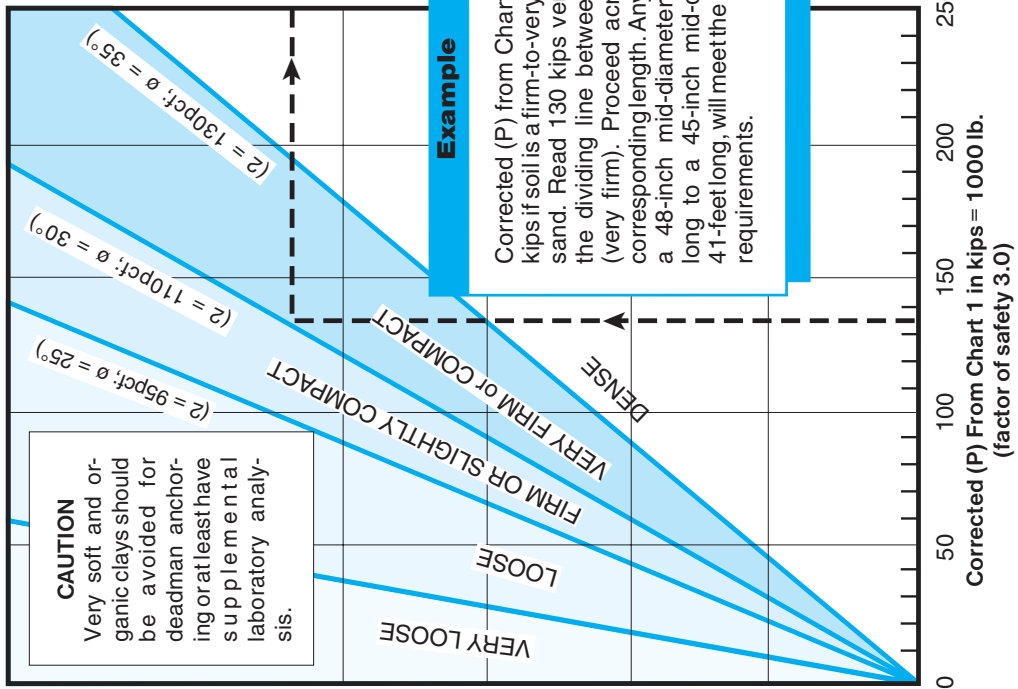
**Example**

If log mid-diameter selected from Chart 4 is 44 inches, and burial is to be on 25% side slopes sloping downward in direction of pull, minimum trench depth = 3d = 3(44) = 11 feet.



# Chart 4 — Granular Soils (P) Corrected vs. Deadman Log Dimensions

(for use with inorganic silt and gravel above the watertable)



**CAUTION**  
Very soft and organic clays should be avoided for deadman anchoring or at least have supplemental laboratory analysis.

**Example**  
Corrected (P) from Chart 1 is 130 kips if soil is a firm-to-very firm silty sand. Read 130 kips vertically to the dividing line between (firm)–(very firm). Proceed across to a corresponding length. Any log from a 48-inch mid-diameter, 36-foot long to a 45-inch mid-diameter, 41-foot long, will meet the minimum requirements.

**CAUTION**  
Use of lengths in the shaded area may exceed allowable bending or shear strengths of the log and result in failure.

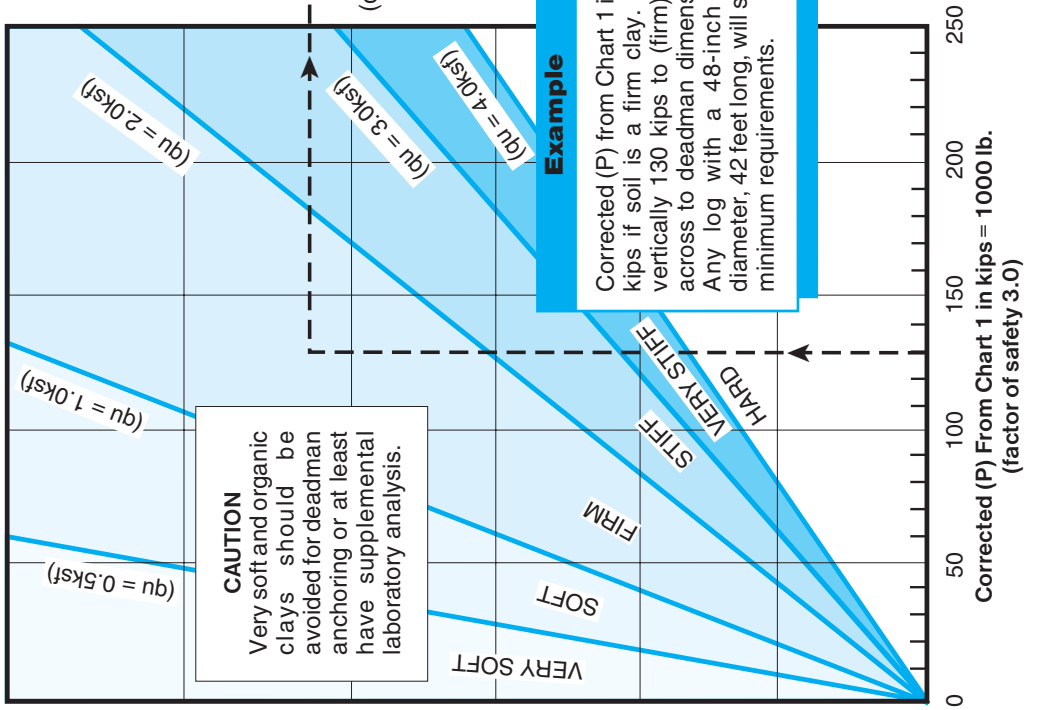
SOIL DENSITY	STANDARD PENETRATION RESISTANCE	FIELD ESTIMATE USING 1/2-INCH REBAR
very loose	0 – 4	easily penetrated pushed by hand
loose	5 – 10	
firm	11 – 20	easily penetrated driven with a 5-lb. hammer
very firm	21 – 30	
dense	31 – 50	penetrated a foot driven with 5-lb. hammer

Measured with a 1.4 inch I.D. 2 inch O.D. sampler driven 1 foot by 140 lb. hammer falling 30 inches.

Example  
 $\phi$  = angle of internal friction  
 2 = inplace density

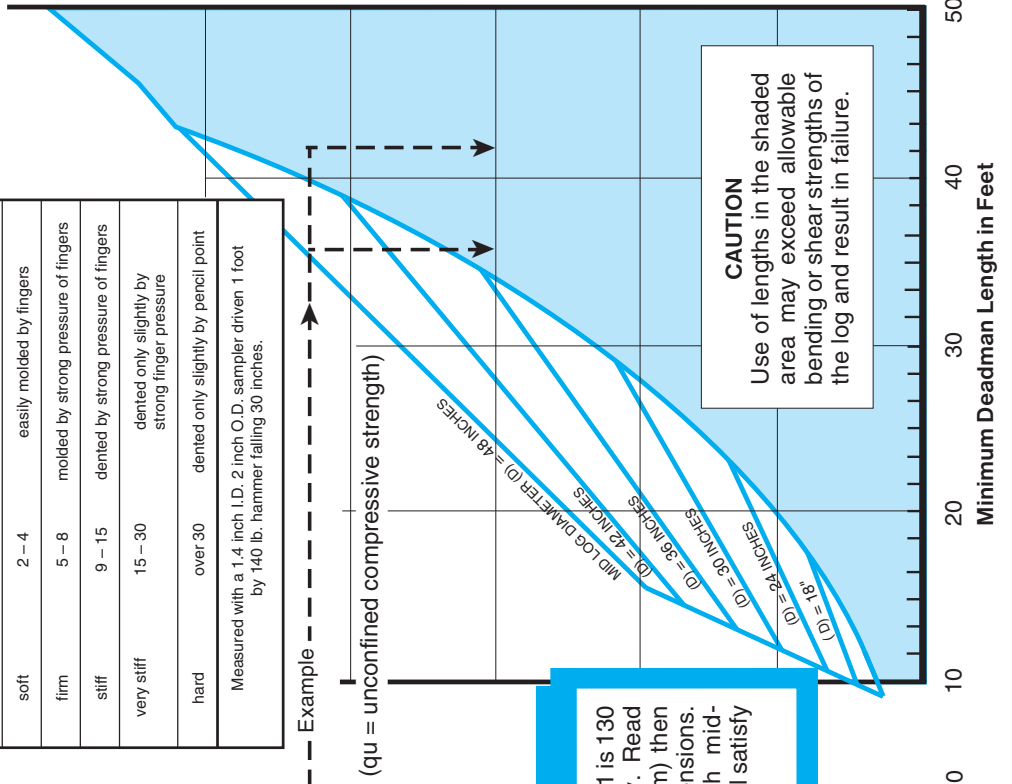


**Chart 5 — Clayey Soils (P) Corrected vs. Deadman Log Dimensions**  
(For use with inorganic clays above the watertable)



SOIL STRENGTH	STANDARD PENETRATION RESISTANCE	FIELD ESTIMATE USING 1/2-INCH REBAR
very soft	0 – 1	squeezes between fingers when fist is closed
soft	2 – 4	easily molded by fingers
firm	5 – 8	molded by strong pressure of fingers
stiff	9 – 15	dented by strong pressure of fingers
very stiff	15 – 30	dented only slightly by strong finger pressure
hard	over 30	dented only slightly by pencil point

Measured with a 1.4 inch I.D., 2 inch O.D., sampler driven 1 foot by 140 lb. hammer falling 30 inches.





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# LOGGING SIGNALS

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This chapter identifies radio signals, standard audible signals, and hand signals used in logging.

## VHF/UHF

There are two acceptable means of controlling the movement of lines on cable yarding systems, other than hand signals.

The first is very high frequency (VHF) radio whistle signalling devices. These are radio transmitters, usually worn around the waist, that activate a whistle on the yarder when a button is pushed. Each required movement of the line has a specific audible whistle signal, which is the same on every yarding site in the province. The unique combinations of short and long whistles ensure controlled movement of yarding lines at all times.

The second means of communicating line movement is with ultra high frequency (UHF) voice radios. A worker tells the operator what line movement is required. The worker directing line movement must use WorkSafeBC-approved verbal commands, which describe the VHF radio whistle signals.

When a voice radio is used, any worker who may be affected by the line movement must be able to hear the verbal command. If a worker cannot hear, radio whistles must be used.

To meet this requirement, there are three alternatives:

- All workers are equipped with radios.
- An amplifying speaker is mounted on the outside of the yarder; the speaker clearly broadcasts each verbal command.
- The operator repeats each verbal command with a radio whistle signal.

## VHF Radio Whistles and UHF

**Skyline Yarder Radio Equipment** To ensure that radio equipment, used to replace hand signals, provides reliable, non-ambiguous, uninterrupted signals, the radio equipment must meet the current WorkSafeBC requirements.

WorkSafeBC officers inspecting workplaces where cable yarders are used will ensure the following:

1. All necessary documentation must be available at the workplace, either in an office located on the workplace or in the cable yarder, including:
  - Industry Canada radio licence for the current year. Licences expire on April 1 of each year.
  - Confirmation letter from WorkSafeBC, which states:
    - Company name, address, division and contact person
    - Geographical co-ordinates and area name,
    - Assigned frequency and tones
    - Manufacturer and model of radios
    - Company radio identifier and co-ordinating agency radio code and number
    - Transmitter power output

If this documentation is not available or is out of date, the officer will issue an order requiring the frequency to be licensed and co-ordinated.

Transmitters must be removed from service until they are licensed and co-ordinated. If this documentation has been misplaced, confirm the co-ordination by calling the Engineering Section radio frequency co-ordinator at 604 276-5112 or toll-free 1 888 621-7233, ext. 5112.

2. Radio signalling devices, either hand-held transmitters or equipment-mounted radios used in logging operations, must be clearly marked with the name of the manufacturer, serial number, assigned operating frequency, and specified tone frequency.
3. Radio signalling devices must have the following:
  - Power limits of:
    - Grapple yarder radios – ¼ watt
    - High-lead radio whistles – ½ watt
  - Permanently enabled tone-encoded squelch

- Only one frequency per radio. Where multi-channel radios are used, the selection switch must be disabled so that only an authorized person can change the operating frequency.

## **INTERFERENCE ON RADIO FREQUENCIES**

Radio signals replace audible signals for the movement of equipment in logging. Interference by other radios on the same frequency can seriously endanger workers. If radio interference is encountered on a frequency co-ordinated by WorkSafeBC, use of the affected equipment must be discontinued until the interference is controlled. Contact the WorkSafeBC frequency co-ordinator at 604 276-5112 or toll-free 1 888 621-7233, ext. 5112 to report interference.

## **STANDARD AUDIBLE SIGNALS**

The following audible whistle signals are presently in use in B.C. In addition, carriage operators often use verbal signals with large machines. Verbal signals are derived from the following whistle signals.

## Audible High-Lead Signals

Operational Signals		
Start work	1 long	—
Stop any movement	1 short	•
Ahead* on mainline	3 short	• • •
Slack the mainline	5 short (minimum)	• • • • •
Ahead* on the haulback	2 short, 2 short	• • • •
Slack the haulback	2 short, several short	• • • • • •
Tightline	3 short, 2 short	• • • • •
Tightline on inhaul	3 short, 2 short	• • • • •
Cancel tightline on inhaul	3 short	• • •
Ahead* on strawline	3 short, 1 short	• • • • •
Slack the strawline	3 short, 1 short, several short	• • • • • • • •
Pick up the guyline	2 short, 2 short, 2 short, 1 short	• • • • • • •
Slack the guyline	2 short, 2 short, 2 short	• • • • • •
Extreme hazard present (runaway log, etc.)	1 long, sustained until hazard has stopped or hazard cleared	_____
Accident	7 long	-----
Fire	1 long, several short, repeated	— • • • •

\*"Ahead" means haulage line moves toward machine

## Audible High-Lead Signals

When Butt Rigging Is at the Landing		
Check the rigging	5 short (minimum)	• • • • •
Send out strawline extension	3 short, 1 short, and 1 short for each extension	• • • • •
Send out strawline in the haulback eye	3 short, 1 long	• • • —
Chokers required	2 short and 1 short or long for each choker required	• • • • •
Put on/take off scab block	1 long	—
Calling foreman	4 long	— — — —
Calling hooktender	3 long	— — —
Calling hooktender and crew	3 long, several short	— — — • • • •
Calling for water bag	1 short, 1 long	• —
Calling for block and strap	1 long, 1 short	— •
<ul style="list-style-type: none"> <li>• Any regular signal preceded by a long signal is a “slow” signal.</li> <li>• Any signal that the engineer is not sure of is a “stop” signal.</li> </ul>		

## Audible Slackline Signals

Refer to the standard high-lead whistle signals for most line control signals. The following are additional whistle signals to be used for slackline operations.

Operational Signals		
Stop outhaul and slack skyline	1 short	•
Pick up the skyline	1 short, 2 short	• • •
Slack the skyline	5 short	• • • • •
Pick up skyline on inhaul to clear obstruction	2 short	• •
Pick up skidding line after obstruction is cleared	3 short	• • •
Slack the skidding line	3 short, several short	• • • • • • •
Carriage on Outhaul		
• “Slack skidding line” signal given as “skyline is slacked” means “slack both lines at the same time.”		
Hold skidding line tight, keep coming back until stop signal is given	3 short	• • •
Hold skidding line tight, slack skyline, keep coming	2 short	• •
Slack skyline faster	2 short	• •
When Carriage Is at Head Spar		
Send strawline out in choker bell for a dead line	3 short, 1 short, 2 short, 2 short	• • • • • • •
Send out that many coils	3 short, 1 short, 1 short for each coil needed	• • • • • • •
Calling second rigger	2 long, 1 short	— — •



## Skyline Carriage Signals

All standard high-lead and slackline whistle signals apply to carriages.

<b>Gravity/Shotgun Carriage</b>		
<ul style="list-style-type: none"> <li>Standard slackline whistle signals will apply.</li> </ul>		
<b>Dropline/Accumulator Carriage</b>		
Ahead* on carriage skidding line	3 short	• • •
Slack the carriage skidding line	3 short, several short	• • • • • • • •
<b>Mechanical Slack-Puller</b>		
Ahead* on slack puller	1 long, 1 short	– •
Ahead* on dropline	2 short	• •
<ul style="list-style-type: none"> <li>When the haulback is used as a running skyline, standard high-lead signals apply.</li> </ul>		
<b>Radio-Controlled Motorized Self-Contained Yarding Carriage</b>		
<ul style="list-style-type: none"> <li>This system is similar to the “radio-controlled motor-driven slack-puller, skyline lock” carriage, but does not have a skyline lock.</li> <li>Any signal preceded by a long signal is a “slow” signal.</li> </ul>		
Slack the dropline	3 short, several short	• • • • • • •
Stop the dropline	1 short	•
Ahead* on dropline	3 short	• • •
If fitted with engine controls:		
Stop engine	1 short, 1 long	• –
Start engine	2 short	• •

\*“Ahead” means haulage line moves toward machine

## Radio-Controlled Motor-Driven Slack-Puller, Skyline Lock

- These carriages are fitted with and controlled by an on-board computerized radio control system.
- This radio system is operated independently through a transmitter separate from that of the yarder.
- The yarding and carriage frequencies must be separate, registered, and co-ordinated through the WorkSafeBC co-ordination system to ensure that one does not interfere with the other or with another operation. Contact the WorkSafeBC Engineering Department for more information.
- An audible signal must be sounded at the carriage and not at the yarder. This signal must have a tone different from that of the yarder signal.
- Carriages with variable dropline speeds must have a special signal for the speed changes. These signals must be different from standard yarding signals.

Lock/unlock skyline clamp	2 short	• •
Slack the dropline	5 short	• • • • •
Stop dropline	1 short	•
Ahead* on the carriage skidding line	3 short	• • •
If fitted with engine controls:		
Stop engine	1 short, 1 long	• —
Start engine	1 long, 1 short	— •

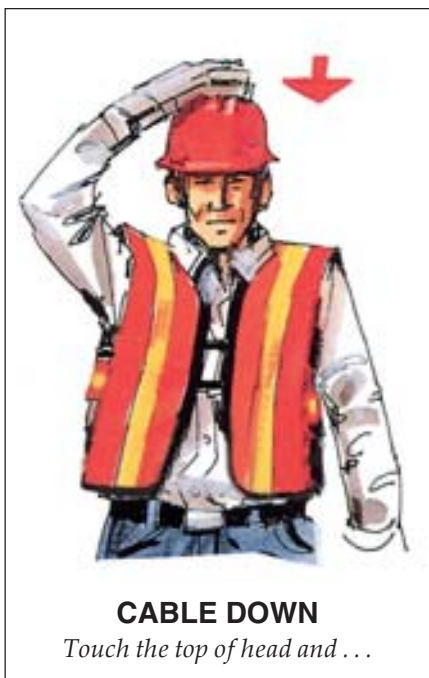
## Loading the Skyline Yarder Signal

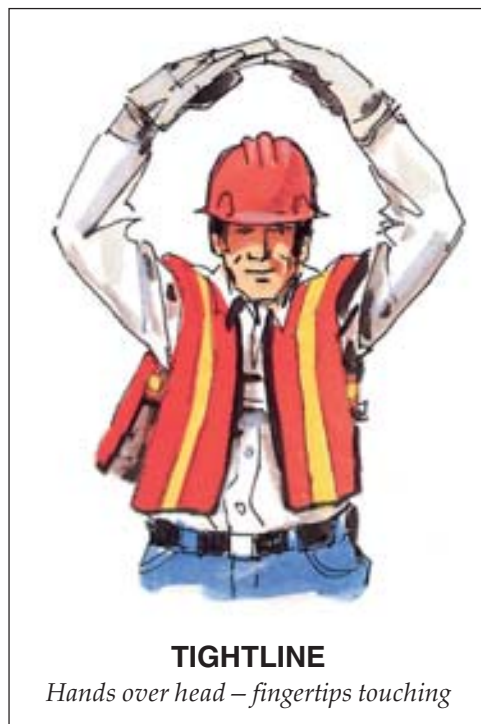
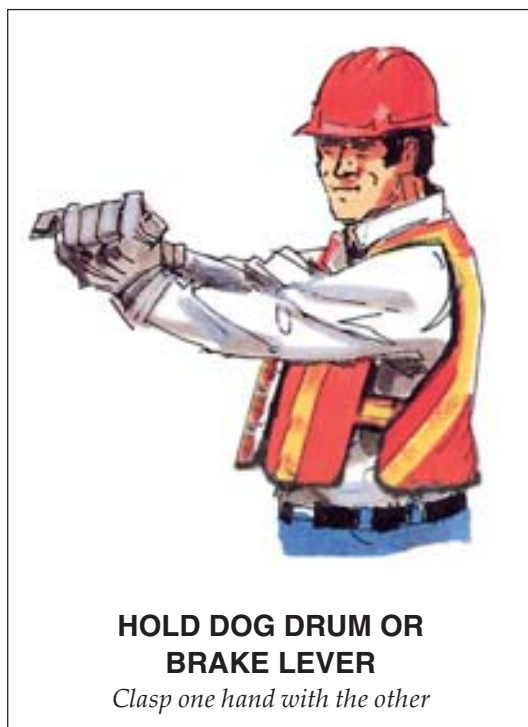
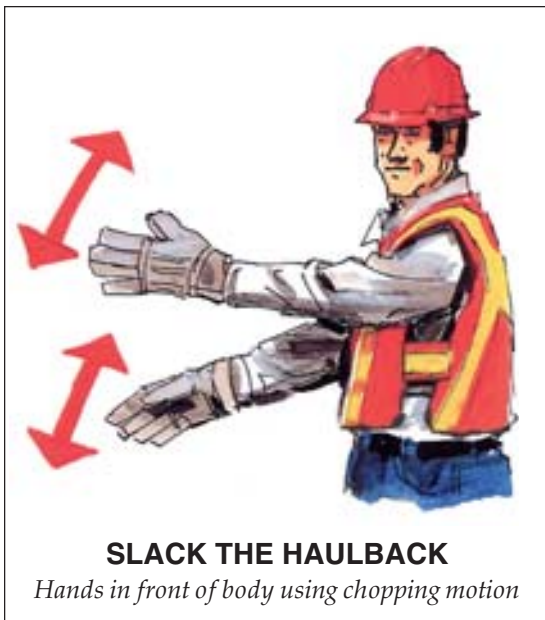
- This signal is to be used for alerting the landing workers that the skyline is about to be loaded.

Skyline being loaded	2 short	• •
----------------------	---------	-----

\*“Ahead” means haulage line moves toward machine

## HAND SIGNALS







**MAINLINE AHEAD NORMAL**

*Raise one arm*



**MAINLINE AHEAD**

*One arm raised, hand fluttering*



**SLACK MAINLINE ALL OFF**

*Arm extended at side, flipping wrist*



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# GUARDING INSPECTIONS

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This chapter describes inspections of operator protective structures and critical parts.

## GUARDING

Operator protective structures must meet the following WorkSafeBC requirements:

- *Operator Protective Structures, G600*
- *Standard for Log Loader and Log Yarder Raised Cabs, G602*
- *Standard for Log Loader and Log Yarder Window Guards, G603*
- *Log Loader and Yarder Backstops, G605*

Operator protective structures are safe and secure; they are designed to protect against flying limbs and broken cables. Door openings must be closed and guarded. A secondary means of escape must be provided.

## CRITICAL PARTS INSPECTION

A critical parts inventory can be compiled for each yarder. Guides for this can be the manufacturer's manual and the fabricator that has done any modifications to the machine.

The critical parts inventory may show:

- What parts are considered critical
- When the part was installed
- How long the part can be used safely
- When the part should be changed

An example of a critical part would be the "topping line." This line is so critical that, should it fail, serious structural damage and worker injury could result.





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## DEFINITIONS

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### A

<b>Adverse grade</b>	The uphill travel or grade on a road.
<b>A-frame</b>	A steel or A-shaped structure used to secure and support guylines on a snorkel or to elevate yarding lines.
<b>Air track</b>	An air-propelled, track-mounted rock drill.
<b>Anchor</b>	Any stump, tree, deadman, or rock to which a skyline, guyline, or rigging blocks are secured.
<b>Anchor log</b>	A log buried in the ground used to secure a guyline. Also called a “deadman.”
<b>Anchor pin</b>	A steel rod, 4–5 cm (1½–2 inches) in diameter, with an eye or threaded end sometimes grouted or wedged into a rock hole, used as a guyline anchor.
<b>Anchor tree</b>	A tree used as an anchor.

### B

<b>Babbitt</b>	An alloy composed of several soft metals, used to secure a device to a wire rope end to form a terminal.
<b>Back bead</b>	The choker on the butt rigging farthest from the yarder. Usually the responsibility of the newest crew member.
<b>Back corner</b>	A location where the tailblock on the haulback side turns the haulback around the corner.
<b>Back end</b>	The farthest point away from a landing or yarder in a setting; usually refers to the tailblocks. The farthest active logging area away from camp. The end of a road system.
<b>Back guy</b>	The guyline opposite to the pull and lead of the mainline. It takes most of the pull.
<b>Back line</b>	That part of the haulback between the home tree and the corner block.
<b>Backspar</b>	A tree rigged at the back end of the work area to provide lift for yarding lines, used primarily in skyline applications. Must be rigged with guylines. Also called a “tail spar.”

<b>Bald-headed</b>	Outhauled without chokers; refers to butt rigging.
<b>Ballast</b>	Rock or gravel hauled in on a sub-grade for road building.
<b>Bar</b>	Carries the cutting chain on a chain saw.
<b>Barrel swivel</b>	A swivelling device in the butt rigging.
<b>Bead</b>	A choker.
<b>Beehive</b>	When a strand of a line under tension breaks and is pushed back, it takes the shape of a beehive.
<b>Bell</b>	The component that slides on the choker cable between the two knobs. When a worker chokes a log, the bell secures the knob.
<b>Belly</b>	A sag in any line.
<b>Bight</b>	The hazardous zone contained within lines, either slack or under tension. The area made hazardous when slack cable is tensioned. An unintentional bend or deviation in the line caused by trees, stumps, or other obstacles preventing the line from running straight.
<b>Bind (bound)</b>	Compression created in a falling or bucking cut due to uneven terrain or contact pressure from other trees or logs.
<b>Binder</b>	A wire rope placed around the load on a log truck or rail car and secured by a cinch to prevent spillage of logs. Also called a "wrapper."
<b>Birdcage</b>	Twisting of wire rope causing several strands to separate from the others, creating a cage-like effect.
<b>Blaze</b>	To mark a tree with an axe for layout identification.
<b>Block</b>	A metal case, enclosing one or more sheaves, provided with a hook, swivel, or gooseneck for attachment to an object and used to change the wire rope's direction.
<b>Block purchase</b>	Use of one or more blocks for mechanical advantage.
<b>Blowdown</b>	A stand of trees blown down by wind. Also called "wind throw."
<b>Bluff</b>	An abrupt rise of rock on the terrain.

<b>Branch road</b>	A haul road into a logging area.
<b>Breaking strength</b>	The point of failure of wire rope or chain.
<b>Bridle</b>	A method of choking a log from opposite sides by using two chokers. A method of securing a guyline to two stumps with a block and strap.
<b>Brush</b>	Any type of undergrowth.
<b>Brush out</b>	To clear an area of limbs, saplings, and debris.
<b>Buck</b>	To saw felled trees into log lengths. To cut.
<b>Bucker</b>	Worker who saws felled trees.
<b>Buckle</b>	To bend under strain.
<b>Buckskin log</b>	A log that has no bark.
<b>Bug</b>	A signalling device, carried on a belt, used to transmit signals to a yarder.
<b>Bull block</b>	A high-lead block used on wooden spars for the mainline.
<b>Bull gang</b>	Workers who erect and rig the home spar. Also called the “rig-up crew.”
<b>Bull hook</b>	A heavy hook on the butt rigging to which chokers are attached. Also called a “butt hook.”
<b>Burl</b>	A half-spherical growth on a tree.
<b>Burn</b>	A burnt-over area of timber or slash.
<b>Burr</b>	A rough edge or mushroom effect on the striking surface of a hammer, wedge, or chisel.
<b>Butt</b>	The large end of a log. Usually refers to large end of the first log felled.
<b>Butt hook</b>	A heavy hook on the butt rigging to which chokers are attached. Also called a “bull hook.”
<b>Butt rigging</b>	A system of swivels, chain-like links, shackles, and bull hooks that connect the haulback and mainline and to which chokers are fastened.

## C

<b>Cable clip</b>	A U-bolt cable connector.
<b>Cable cutter</b>	A hydraulic, mechanical (guillotine), or powered abrasive wheel tool for cutting wire rope.
<b>Cable logging</b>	A yarding system employing winches, blocks, and cables.
<b>Carriage</b>	A wheeled device that rides on a skyline, used for hauling logs.
<b>Cat-face</b>	A scarred tree trunk with no bark on it, caused by internal rot or damage.
<b>Cat's-paw</b>	A simple, non-slipping knot used on fibre or wire rope, where the line is run through an eye and looped back on itself to make a quick connection.
<b>Caulks</b>	Short spikes driven or screwed into the soles of boots to prevent slipping while a person is walking on wood or logs.
<b>Chain saw</b>	A gas-operated power saw.
<b>Change roads</b>	To move rigging and running lines in order to yard logs progressively from the next unlogged area in the felled and bucked timber.
<b>Chase</b>	To unhook chokers at the landing.
<b>Chaser</b>	A worker who unhooks chokers at the landing. Also called the "landing worker."
<b>Cherry picker</b>	A log loader that loads roadside logs left by the road builders.
<b>Choke</b>	To pass a line or choker around a log or other object and pull it tight.
<b>Choker</b>	Any line used to choke a log or object. A noose of wire rope used to choke a log to be yarded.
<b>Choker line</b>	The short piece of line that closes a grapple.
<b>Choker setter</b>	A rigging crew member who sets chokers under the direction of a rigging slinger.
<b>Chunk out</b>	To remove log chunks, branches, and debris from a landing or work area.

<b>Clearcut</b>	The cleared area after all trees and saplings of a logging area are felled, bucked, and removed.
<b>Clevis</b>	The portion of any fastening device, usually a terminal, provided with holes at right angles through which a pin can be placed. A chain end or rope eye is placed in the “U” and secured by the pin.
<b>Climbing equipment</b>	Irons with sharp spurs, strapped to the legs at the ankle and below the knee, and a heavy, leather safety belt with a wire-cored manila rope. Used by riggers to climb trees in order to top and rig them. The buckle sections are reinforced with a nylon backing.
<b>Clinometer</b>	A hand-held instrument for measuring angles of a slope.
<b>Coil</b>	A rolled-up length of wire rope.
<b>Cold deck</b>	A pile of yarded logs left for later transportation.
<b>Come-along</b>	A small, manually operated winch.
<b>Core</b>	The centre strand of a wire rope that maintains the rope’s round shape. Usually the core is wire rope, but it can be fibre rope.
<b>Corner</b>	The corner formed by the side and back lines of a setting.
<b>Corner block</b>	A block used to guide the haulback line at the back end of a yarding area; used to change the direction of the haulback. Also called “tailblock.”
<b>Corridor</b>	A cleared strip for a skyline or guyline.
<b>Counterweight</b>	Extra weight added to the back of any mobile equipment to increase lifting capacity.
<b>Counterweight clearance</b>	The distance from the counterweight to any stationary object.
<b>Crib (cribbing)</b>	A log lattice built to support the end of a bridge, road grade, or equipment.
<b>Crummy</b>	A vehicle used to transport crew to and from the woods.
<b>Cutting bar</b>	A grooved bar on a chain saw that carries the chain.
<b>Cut-up</b>	A tree or log left standing or suspended with the falling or bucking cuts not completed.

## D

<b>Dangerous tree</b>	Any tree that is hazardous to workers because of location or lean; physical damage; overhead hazards; deterioration of limbs, stem, or root system; or a combination of these. Also known as a “danger tree” and formerly as a “snag.”
<b>Deadman</b>	A log, pipe, or other apparatus buried in the ground, used to secure a guyline. Also called an “anchor log.”
<b>Deck</b>	To store logs. A pile of yarded logs.
<b>Dee</b>	A D-shaped steel item used to connect a wire rope eye or shackle to a knob-type line terminal.
<b>Deflection</b>	The sag in the ground profile. The amount of sag in a line measured at midspan, expressed as a percentage of the horizontal span length.
<b>Dog</b>	A pawl used as a stop on a ratchet wheel. Located on the chain saw body, dogs are pointed teeth against which pressure is applied so that the teeth dig into the tree or log to aid in cutting. Also called a “pawl.”
<b>Dog it</b>	To stop movement, to secure a machine winch or other equipment, to apply brakes, or to not initiate any action. To perform an action at the slowest pace.
<b>Dog leg</b>	An angle away from a straight line; crooked.
<b>Donkey doctor</b>	A heavy-duty mechanic.
<b>Donkey puncher</b>	A spar operator.
<b>Drag</b>	A turn of logs. Usually refers to the use of skidders or crawler tractors.
<b>Drum</b>	Reel, spool, or winch for holding wire rope.
<b>Dutchman</b>	A block arrangement used to alter the lateral placement of a line or pull the bight of a line to assist in landing logs. A flat area produced when the two horizontal cuts of an undercut do not meet at a point.

## E

<b>Elastic limit</b>	The tension limit of wire rope whereby it will return to its original length after tension is released.
<b>Engineer</b>	A registered professional engineer who lays out settings and road systems for a logging operation. The operator of a yarder.
<b>Extension</b>	A line added to another line to increase its length. A 75 m (250 ft.) piece of strawline.
<b>Eye</b>	A loop at the end of a wire or fibre rope, spliced or press-fitted.
<b>Eye splice</b>	A loop formed by turning the rope back on itself, interweaving the strands to make an eye.

## F

<b>Fairlead</b>	A permanently mounted, swivelling roller or sheave arrangement used to permit reeling in a cable from any direction. The area between the two front quarter guylines.
<b>Fall</b>	To cut down trees in a predetermined and controlled manner.
<b>Fall block</b>	A long, narrow block with a thick shell, a small sheave at one end, and a gooseneck at the other. It is used in north and south bend systems to add mechanical advantage for lifting the turn to the skyline.
<b>Faller</b>	A worker whose primary purpose is to fell trees and buck them to length for yarding.
<b>Farmer's eye</b>	An eye splice formed by unravelling three strands of wire rope, forming a loop, then rewinding the strands together to form a fast, temporary eye. Also called a "Flemish eye" or "Flemish splice."
<b>Felled and bucked</b>	Timber that is felled and bucked, ready for yarding.
<b>Feller-buncher</b>	Mobile equipment designed to hold, cut, and then pile the trees for yarding or skidding.
<b>Ferrule</b>	A metal sleeve or collar, babbitted or pressed to the ends of wire rope to make a terminal knob.
<b>Final drive</b>	The last reduction assembly on any drive train before the tire or track.
<b>Finger link</b>	A substantial temporary connector used to secure pass chains or line-stringing equipment that must be disconnected when under tension. Also called a "pelican hook."

<b>Fire break</b>	An unfelled stand of timber between two clearcut areas, left to slow the progress of a fire. Also called a “leave strip.”
<b>Fire guard</b>	A narrow clearing to bare soil around the perimeter of a fire to prevent it from spreading.
<b>Fire watch</b>	A worker who remains at a logging site for approximately two hours at the end of the day to watch for possible fires caused by the logging activities. Also called a “spark chaser.”
<b>Fleet angle</b>	The angle formed by a line drawn from the centre of a sheave to the centre of the reeving drum and the centre of the same sheave and the right or left side of the reeving drum.
<b>Flemish eye, Flemish splice</b>	An eye splice formed by unravelling three strands of wire rope, forming a loop, then rewrapping the strands together to form a fast, temporary eye. Also called a “farmer’s eye.”
<b>Flying chokers</b>	On the grapple rigging, yarding with a choker.
<b>FOPS</b>	Falling object protective structure for mobile equipment. Protects the mobile equipment operator from falling objects.
<b>Four-way swivel</b>	A universal-type joint used for hanging blocks on a machine to eliminate wear of block components.
<b>Friction blocks</b>	Blocks or pads used to apply friction to a drum to transmit rotating energy. Use the same principle as brake shoes.
<b>Frictions</b>	Any friction block and drum drive assembly.
<b>Front end</b>	The logging area closest to the yarder.
<b>G</b>	
<b>Goon spoon</b>	A hand shovel. Also called a “muck stick.”
<b>Gooseneck</b>	The yoke of a block.
<b>Grade</b>	The quality of a log. A roadbed. The slope of a road.
<b>Grapple skidder</b>	A skidder fitted with a grapple rather than chokers to hold and handle logs.
<b>Green timber</b>	The uncut forest.
<b>Ground</b>	The terrain on which a logging operation is carried on. To place rigging or grapple on the ground.



<b>Ground-lead</b>	Yarding with no lift for the rigging or logs.
<b>Grouser</b>	The gripping attachment on any crawler track.
<b>Guillotine</b>	A piston-type line cutter.
<b>Gut-hook</b>	To grapple or choke a log in the middle.
<b>Guyline</b>	A wire rope from a yarding spar fastened to an anchor, used to raise and/or secure the spar in a vertical position.

## H

<b>Handyman</b>	A worker who is skilled at and performs various jobs as the need arises.
<b>Hang a block</b>	To place a block in position when rigging up.
<b>Hang strap</b>	A wire rope strap choked onto a spar, used to support a jack strap.
<b>Hang the rigging</b>	To rig up an A-frame, head spar, or backspar.
<b>Hang-up</b>	Logs stuck behind a stump or other obstacle when yarding. Rigging fouled in some manner so as to prevent logging.
<b>Haulback</b>	The line used to outhaul the rigging or grapple.
<b>Haulback block</b>	A block through which the haulback runs.
<b>Haulback drum</b>	The winch drum on a yarder that holds the haulback.
<b>Haywire</b>	Any unsafe or slipshod work procedure. Another name for “strawline.”
<b>Head spar</b>	The spar to which logs are yarded. Also called the “home spar.”
<b>Highball</b>	To go ahead fast. To do anything at a hurried pace.
<b>High-lead</b>	A cable logging system using a spar to obtain lift for yarding logs.
<b>Hobo</b>	An unchoked log that is carried to the landing by the choked turn.
<b>Home spar</b>	The spar to which logs are yarded. Also called the “head spar.”
<b>Hooktender</b>	The worker in charge of a yarding site. Also called the “hooker.”

<b>I</b>	
<b>Inhaul cycle</b>	Ahead on the mainline. Mainline coming in to the landing. Bringing in a turn of logs.
<b>Interlock yarder</b>	A device that incorporates a means of coupling the mainline and haulback drums so as to maintain a consistent tension on the two lines while yarding without the application of foot brakes by the operator.
<b>Intermediate support tree</b>	A tree or trees used to elevate skylines in a multispan system.
<b>J</b>	
<b>Jack</b>	A hanger device used to support a skyline.
<b>Jackpot</b>	Unstable logs crisscrossed or difficult to break free. Trees tied together or leaning into one another that create a hazard for fallers.
<b>Jagger</b>	A broken wire that juts out of a wire rope.
<b>Jill-poke</b>	A log that has been driven out of a pile, creating a hazard. Also, log driven into position between two anchor stumps, used to increase the stumps' stability and holding power.
<b>Juicer</b>	A hydraulic loader.
<b>K</b>	
<b>Kink</b>	A sharp bend in a wire rope.
<b>Knob</b>	A ferrule attached to the terminal end of a line by babbitt, wedges, or hydraulic pressure.
<b>L</b>	
<b>Land</b>	To place or drop logs in a landing during yarding operations.
<b>Landing</b>	The area where logs are landed by a yarder. Logs are also sorted and prepared for transport by the loader in this area.
<b>Landing buckler</b>	A worker who bucks logs at a landing.
<b>Landing worker</b>	A worker who bucks, limbs, and trims log ends, unhooks chokers, and assists in hooking up trailers to log trucks. Also called the "chaser."

<b>Lang lay</b>	A type of wire rope.
<b>Lay</b>	The type or shape and frequency of spiral in a wire rope. The position of a log in a pile, on a load, or in the felled and bucked logs.
<b>Layout</b>	A logging plan that includes settings and road systems.
<b>Lead</b>	The direction in which the lines run out from the yarder. The amount of lift above ground that the running lines have at the yarder, for example, high-lead or ground-lead. The alignment of sheaves and winches.
<b>Lead block</b>	A block used to change the direction of a line pull.
<b>Lean (leaner)</b>	The angle at which a tree naturally stands. Can be referred to as heavy or slight.
<b>Leave strip</b>	An unfelled stand of timber left on purpose. Sometimes called a "fire break."
<b>Lift tree</b>	A tree used for the purpose of elevating running lines. The lines must run through tailhold block(s) located so as to minimize stress on the lift tree. The lift and tailhold arrangement must be rigged and located so that if it were to be pulled over, workers would not be endangered. It is used mainly in high-lead or grapple yarding applications.
<b>Light plant</b>	A generator unit on a loader or grapple yarder that supplies power to boom-mounted lights for night loading and yarding.
<b>Limb</b>	To cut branches off trees or logs.
<b>Line</b>	Wire rope. A survey line. A setting boundary. A verbal stop signal when line is being pulled by hand.
<b>Line change</b>	Changing the rigging from one yarding road to another.
<b>Line horse</b>	Line storage winch, usually mounted on a truck carrier, used to transfer lines.
<b>Load</b>	To load logs. A load of logs. The stress placed on a wire rope or piece of equipment. To place explosives for blasting.
<b>Loader</b>	Any machine used for loading logs.
<b>Log</b>	The cut-to-length sections of felled trees.
<b>Log deck</b>	A pile of yarded logs.

<b>Log dump</b>	A central unloading area for loads of logs.
<b>Logger</b>	A worker employed in the production phase of the logging industry.
<b>Logging</b>	All or any part of turning trees into logs and transporting them to an unloading area.
<b>Long butt</b>	The short section cut off the butt end of a felled tree in order to remove cull or excessive sweep.
<b>Long splice</b>	A splice, approximately 18 m (60 ft.) long, used to join a broken line. It passes through blocks easily because it does not increase line diameter.
<b>M</b>	
<b>Mainline</b>	The yarding line(s) on a grapple yarder. The main hoisting line on a loader, used to lift logs.
<b>Marlin spike</b>	A steel, spike-shaped tool that tapers to a flat point, used in splicing wire rope.
<b>Mat</b>	A log or lumber-type block placed under the foot of a hydraulic jack to increase surface area, give extra height, and compensate for ground irregularities for stability. Also called a “pad.”
<b>Mobile backspar</b>	A crawler tractor or hydraulic excavator at the back end with a fairlead or short spar mounted on it, used to hang tailblocks or to simplify and speed up road changes.
<b>Molly Hogan</b>	A single strand from a wire rope rolled into a circle with six wraps, used in most pin shackles in place of a cotter key. Also used as a temporary method of connecting the eyes of two lines.
<b>Monkey wrench</b>	To repair a machine or piece of equipment. A pipe wrench.
<b>Mousing</b>	Wrapping the opening of a load hook to prevent dislodgment of the load.
<b>Muck stick</b>	A hand shovel. Also called a “goon spoon.”
<b>Multispan</b>	A skyline with one or more intermediate supports.

## N

<b>Necktie</b>	A choker.
<b>North bend</b>	A yarding method where the mainline passes through a fall block, then connects to the carriage. This configuration allows side blocking and gives extra block purchase for lift.
<b>Notch</b>	A wedge-shaped piece cut out of a stump to prevent a guyline or block strap from lifting off.
<b>O</b>	
<b>Off-highway</b>	A log truck used exclusively on logging roads and not legal for use on a public highway because of weight, width, and rigging restrictions.
<b>Old growth</b>	Virgin timber.
<b>On-the-fly</b>	Doing any activity while in motion on mobile equipment, for example, eating lunch while driving a pickup.
<b>Operation</b>	A logging operation.
<b>OPS</b>	Operator protective structure for mobile equipment. Protects the mobile equipment operator from falling objects and if the machine rolls over.
<b>Oregon block</b>	A stump instead of a block used to change direction of a line.
<b>Outhaul cycle</b>	Moving the butt rigging, carriage, or grapple away from the spar tree.
<b>Out of lead</b>	When sheaves are out of alignment or lines will not spool properly onto a winch.
<b>Outriggers</b>	On mobile equipment, the hydraulic side jacks used to increase width for stability.
<b>Overburden</b>	The top layer of earth, usually over rock.

## P

<b>Pad</b>	A log or lumber-type block placed under the foot of a hydraulic jack to increase surface area, give extra height, and compensate for ground irregularities for stability. Also called a "mat."
<b>Parbuckle</b>	A method of locating and setting a choker to overcome a yarding difficulty. Dumping a log truck by having the load in the bight of a pair of lines, picking the lines up to force the load sideways and slide off the truck.
<b>Pass chain</b>	A chain with an open hook at one end and a ring at the other, used to grip wire rope that is to be pulled. Also called a "rigging chain."
<b>Pawl</b>	The stopping device in a ratchet system. Also called a "dog."
<b>Peeler</b>	A large log without defects, suitable for making plywood.
<b>Pee-wee</b>	A small-diameter, merchantable log.
<b>Pelican hook</b>	A substantial temporary connector used to secure pass chains or line-stringing equipment that must be disconnected when under tension. Also called a "finger link."
<b>Pendant lines</b>	Straight pull support lines for a boom. Always in pairs, these lines do not go through sheaves, but terminate at a babbitted knob and dee.
<b>Pile</b>	A pile of logs.
<b>Pioneering</b>	The first stage of roadbuilding with mobile equipment, in which felled logs, vegetation, and top soil layers are removed.
<b>Pipe</b>	A steel spar.
<b>Plennar</b>	An island of clearcut within the forest. The cutting around the edges of these islands is extended after regeneration has been established.
<b>Powder</b>	Explosives.
<b>Power saw</b>	A motor-powered chain saw.
<b>Pressed</b>	Wire rope eyes or knobs secured to the line by crimping either directly or with a metal sleeve. These pressed-on connections replace an eye splice.

<b>Pulaski tool</b>	An axe-type of tool with an axe head on one side and a mattock blade on the other.
<b>Pull rigging</b>	The work done by a rigging slinger.
<b>Pump can</b>	A 20 L (5 gal.) water can with an attached, hand-operated pump, used to extinguish small fires.
<b>Purchase</b>	The mechanical advantage gained when rope passes over a sheave. Varies with amount of sheave contacted.
<b>Purchase block</b>	A block used in rigging to obtain greater pull on a line.
<b>Push</b>	Any supervisor or boss.
<b>Q</b>	
<b>Quarry</b>	A rock pit.
<b>Quarter</b>	The work area of a faller. The area that a guyline supports, for example, back quarter.
<b>R</b>	
<b>Radio whistles</b>	A transmitter/receiver signalling system used by workers for yarding operations.
<b>Raise a tree</b>	To stand up a spar. Also called to “raise the pipe,” when referring to a steel spar.
<b>Raise the pipe</b>	To stand up a steel spar.
<b>Raising guy</b>	One of the two guylines on a mobile spar used to raise the spar.
<b>Ram</b>	A hydraulic cylinder.
<b>Ratchet</b>	Usually a circular, toothed device combined with a pawl, used to secure a winch when under tension.
<b>Reef</b>	To pull hard.
<b>Reeve</b>	To thread a line through several blocks or a carriage.
<b>Reeving drum</b>	Any winch or drum used for pulling in wire rope. Normally the topping line drum.
<b>Reeving line</b>	Any line pulled in by a reeving drum.

<b>Relog</b>	To log a setting again because it was not logged clean enough the first time.
<b>Rhubarb</b>	The brush and debris at roadsides. A term used for the roadside when you accidentally drive off the road.
<b>Rigging</b>	Lines, blocks, chokers, and all gear used in cable logging systems. Performing rigging jobs.
<b>Rigging chain</b>	A chain with an open hook at one end and a ring at the other, used to grip wire rope that is to be pulled. Also called a “pass chain.”
<b>Rigging crew</b>	Workers who set chokers.
<b>Rigging slinger</b>	The supervisor of the choker setters who directs which logs are to be choked.
<b>Right-of-way</b>	A clearing made through the woods through which a road is built. Usually 20–30 m (66–100 ft.) wide.
<b>Rig up</b>	To fit a machine with required rigging. To string lines and hang blocks once a yarder is in position.
<b>Rig-up crew</b>	Workers who erect and rig the home spar. Also called the “bull gang.”
<b>Riparian zone</b>	Timber left standing on lake and river banks to give shade and protection.
<b>Road</b>	The haul road. An area the width of a choker on both sides of the mainline from the yarder to the back end.
<b>Road protrusion</b>	Any lump or protruding rock left in a road surface after it has been graded.
<b>Rock bolt</b>	A steel rod placed in drill hole in rock to be used as a line anchor.
<b>Roll</b>	Placing a choker on a log in such a way as to cause the log to roll to free a hang-up.
<b>Root wad</b>	The torn-up mass of dirt and rock caught in the root system of an uprooted tree.
<b>ROPS</b>	Rollover protective structure for mobile equipment. Protects the mobile equipment operator if the machine rolls over.
<b>Running line</b>	A moving wire rope in logging operations.



## S

<b>Saddle</b>	A support that the snorkel rests on, located approximately 3 m (10 ft.) from the snorkel pocket. The liveline support section of a wire rope clip.
<b>Safety strap</b>	A short piece of wire rope secured to a block or other rigging to prevent the block or rigging from falling into the work area due to a connection failure.
<b>Sag</b>	See “deflection.” The vertical droop in the bight of a line.
<b>Sapling</b>	An immature tree that is not normally harvested.
<b>Scab block</b>	A block hung between the butt rigging and bight of the haulback to give extra lifting capacity.
<b>Scab strap</b>	A short piece of line or chain that secures the scab block to the butt rigging.
<b>Schoolmarm</b>	A tree whose stem branches into two. The area of this tree where the two main stems join.
<b>Scrub</b>	Poor, unmerchantable timber.
<b>Second growth</b>	Young timber that grows after the mature timber is removed.
<b>Second loader</b>	A worker who assists a loader operator in loading a log truck.
<b>Selective logging</b>	Logging an area taking out only specific types of trees, leaving the rest standing.
<b>Set</b>	To place a choker around a log.
<b>Setting</b>	The area logged by one yarder.
<b>Shackle</b>	A clevis or U-shaped, heavy steel device fitted with a pull-out or screw pin, used to secure rigging or lines together.
<b>Sheave</b>	The grooved wheel or pulley of a block that wire rope runs over.
<b>Shell</b>	The outer framework of a block.
<b>Shotgun</b>	Rigging outhaul by gravity.
<b>Show</b>	A logging operation.
<b>Shutdown</b>	A work stoppage for any reason. To shut off a machine.

<b>Side</b>	A logging unit, including the workers that are rigging and yarding.
<b>Sidewinder</b>	A tree that is pushed over to the side. A type of boom boat.
<b>Signals</b>	Audible, hand, or verbal signals used to direct the movement of logs or equipment.
<b>Siwash</b>	An unintentional bight in a line caused by stumps or other objects, preventing the line from running straight. A line not running in a straight line by being bent around a tree, stump, or rock.
<b>Skid</b>	The act of moving logs with a skidder or crawler tractor. Logs placed under equipment or structures to allow moving them.
<b>Skidder</b>	A rubber-tired piece of mobile equipment designed and used for yarding logs.
<b>Skidding line</b>	The main haulage line from a carriage to which chokers are attached.
<b>Skid road</b>	The path or trail a skidder or crawler tractor uses to move logs on. Also called a "skid trail."
<b>Skins</b>	Tires used on mobile equipment.
<b>Skyline</b>	The line on a yarder that supplies lift for blocks, rigging, carriage, and logs.
<b>Slackline</b>	A skyline yarding system where the skyline can be tensioned at the operator's discretion.
<b>Slash</b>	Debris left on the ground after logging is complete.
<b>Slash burn</b>	A prescribed burning of slash and debris left by logging operations.
<b>Snare</b>	A choker.
<b>Snatch block</b>	A block that can be opened on one side to receive the bight of a rope.
<b>Snipe</b>	To bevel the leading edge of a skid log so it will not hang up.
<b>Snub</b>	To lower anything. To assist one machine down a hill by holding it back with another that is connected by a line.
<b>Soft hammer</b>	A hammer made of mild steel marked with an "S" that is used for cutting line.

<b>Spark arrester</b>	A screen or baffle device placed over the end of an exhaust pipe to reduce the number of sparks given off.
<b>Spark chaser</b>	A worker that remains at a logging site for approximately two hours at the end of the day to watch for possible fires caused by the logging activities. Also called a “fire watch.”
<b>Spike</b>	A railroad-type spike used to secure wire rope when splicing.
<b>Spike bar</b>	A sturdy, steel pry bar used to extract spikes from a log or stump.
<b>Spike it</b>	To stop or hold it.
<b>Spike top</b>	A tree with a dead top, usually without branches.
<b>Splice</b>	To join ends of rope by interweaving strands.
<b>Spool</b>	A drum to hold cable. To wind wire rope smoothly on a winch.
<b>Spooling iron</b>	A tool used for spooling line onto a winch so that hands are not placed directly onto the line.
<b>Spur road</b>	A short or new road off a branch road.
<b>Square lead</b>	Right angles to the yarding machine.
<b>Staged pants</b>	Work pants with the cuffs cut off to prevent limbs from catching the cuffs and tripping the worker.
<b>Stamp</b>	The identification/code mark embedded into a log end that indicates the setting it came from.
<b>Stamp hammer</b>	The hammer used to place a stamp.
<b>Stand</b>	An area of timber.
<b>Stillson wrench</b>	A pipe wrench.
<b>Strand</b>	One of six spiral groups of wires in a wire rope. To break one or more strands.
<b>Strap</b>	A short piece of wire rope with an eye in each end, used to hold blocks.
<b>Strawline</b>	A small-diameter wire rope used in rigging up or moving larger lines or blocks. Sometimes called a “haywire.”
<b>String line</b>	To pull a line by hand in preparation for yarding.
<b>Strip</b>	To remove lines, blocks, and other rigging from a spar.

<b>Stub</b>	An extension to another line. A very short spur road.
<b>Stump rig</b>	To hang blocks on stumps at the back end.
<b>Sub-grade</b>	The roadbed onto which the finished road is laid after the first pioneering.
<b>Swaged</b>	Pressed.
<b>Swaged line</b>	Wire rope that has been reduced one size in diameter by a pounding action to replace the same nominal-sized rope but have a greater strength. This rope appears to be normal rope that is evenly worn.
<b>Swamp out</b>	To clean out.
<b>Swing</b>	To haul or yard logs from one landing to another.
<b>Swinging</b>	To haul or transfer logs from one landing to another.
<b>Swing tree</b>	A spar to which logs are yarded for temporary storage, then swung to another landing.
<b>Swing yarder</b>	Any yarder that swings on a turntable, as opposed to a stationary spar yarder.
<b>Switchback</b>	A sharp turn in a road constructed on very steep grade.
<b>Swivel</b>	A line connector that allows torsional energy to be removed from lines by pivoting freely.
<b>T</b>	
<b>Tag</b>	The joining of two or more chokers end to end for extended reach.
<b>Tailblock</b>	A block used to guide the haulback line at the back end of a yarding area; used to change the direction of the haulback. Also called a “corner block.”
<b>Tailhold</b>	The point of anchor of the skyline. A stump or tree used to secure back line blocks.
<b>Tail spar</b>	A tree rigged at the back end to provide lift for a skyline or yarding line. Also called a “backspar.”
<b>Terminal</b>	The end of a rope or chain provided with an eye or attaching device.

<b>Thimble</b>	A formed or cast steel fitting placed in the eye of a rope to retain the round shape, give support, and protect it from wear on the pin.
<b>Thread</b>	To reeve a line through blocks or carriage.
<b>Tie back</b>	To use a twister.
<b>Tightline</b>	To obtain maximum lift on yarding lines by holding one line back and pulling on another. To take the sag out of a line.
<b>Timber hitch</b>	A type of knot used for twisters.
<b>Tommy Moore</b>	A small block with a wide throat, usually used with the strawline as a lead block.
<b>Tongs</b>	A hinged set of hooks used for picking up or pulling logs.
<b>Tree jack</b>	A device used to support the skyline or maintain the skyline in an elevated position at a backspar.
<b>Tree paint</b>	Spray paint that will stick to wet bark and wood for the purpose of identification.
<b>Tree plate</b>	A J-shaped plate spiked to a spar tree to prevent cutting of the wood by wire rope at the point where guylines and straps are hung.
<b>Tree shoe</b>	A device used to support a skyline on a backspar.
<b>Tuck</b>	To pass one strand under another in splicing.
<b>Turn</b>	One or more logs that are yarded to the landing at one time.
<b>Turnbuckle</b>	A line-tightening device with a rod at either end, one with a right-hand and one with a left-hand thread.
<b>Turnout</b>	A wide spot on the side of a road, built to allow two vehicles to pass.
<b>Twister</b>	A line that supports a tailhold stump or tree that does not appear to be strong enough. This is done by connecting the tailhold to another stump or tree opposite by wrapping the two with a line. This line is then tightened by placing a piece of large-diameter limb between the wrappings and twisting them together.

## U

- Undercut** The first cut made, when falling or bucking, which forms a notch.
- Upend** Swapping of wire rope ends on a yarder or loader to distribute wear. To cause a log to flip end for end, either intentionally or inadvertently by coming in contact with a stationary object.

## W

- Waist line** The portion of haulback between the two haulback blocks.
- Whistle** A radio transmitter signalling device, used to communicate line movement or requirements to a machine operator in the yarding of logs.
- Widow maker** A loose limb or broken top, or anything loose in a tree that may fall on a worker.
- Winch** A powered drum onto which line is pulled. A machine having one or more winches used for yarding or hoisting.
- Windfall** A tree felled by wind. See “wind throw.”
- Wind throw** A stand of trees blown down by wind. Also called “blowdown.”
- Wire axe** A tool used to cut wire rope or wire rope strands.
- Working load limit** The maximum weight or force that a wire rope is authorized by the manufacturer to support.
- Wrap** One turn of a line around a winch or stump.
- Wrapper** Wire rope placed around the load on a logging truck or rail car and secured by a cinch to prevent spillage of logs. Also called a “binder.”

## Y

- Yarder** A machine that pulls in logs.

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