

## 2012 Hauler Tower Safety Workshops: follow-on and resource material.

*To all Cable Harvesting Contractors,  
the following resource material is provided in good faith and on a without-prejudice basis to our cable harvesting contractors and is intended for you to use to create your own Hauler Tower or Swing Yarder Management Plan.*

### Core requirements for a Contractor's Tower Management Plan

#### Minimum requirements:

1. Written procedures for dead-man, and / or anchor (rock-bolt, tipping plate or screw-anchor) installations to suit your particular hauler. May be written as a direction to a sub-contractor.
  - Contractor's plans are to include master-sheet for the Tower Guy Layout and Anchor Location, with working copies for record keeping on the landing
2. Written procedures for daily tracking of the integrity of anchors (typically spray paint marks, etc)  
Contractor's plan to include master-sheet for daily Guy Anchor checks  
Contractors to maintain a log book on site using fields forms over the past month, and to keep the past 12 months of forms on file.
3. Written procedures for dating and replacement schedules for guy lines, blocks & working ropes etc
  - i. Log sheet to track both annual checks and replacement date. Each guy to be individually identified / identifiable.
  - ii. Wire Rope Register tracking supplier, length (m), diameter (mm), construction, type (guy, guy extension, etc).Refer attached sheets.
4. Definition of a Programmed Maintenance schedule that:
  - i. identifies safe working life for critical components – and sets dates or hours for replacement, ie well before failure occurs
  - ii. may utilise scheduled non-destructive testing (NDT) of critical components instead of early replacement
  - iii. tracks “end-for-ending” of working lines
  - iv. tracks repair & maintenance work identified as necessary in hauler tower recertification process
5. Written procedures to set skyline brake at appropriate pre-set tension to avoid exceeding the safe working load of the skyline
6. Written procedures for dealing with rope spool overrun and re-spooling (provides for use of a spooling tool)
7. Written procedures for calibrating skyline tension monitor (where fitted)
8. Written procedures to ensure all guards and covers are in place, and that any significant oil leaks are immediately rectified (alternatively the hauler to be shut down until leaks are corrected).  
Drip trays to be in place for minor leaks, and emptied into a sealable container at the end of each working day.
9. Contains a calculation sheet for Chute Length verification, with risk management options should landing configuration not offer sufficient space
10. Contains a daily check sheet for Tower rigging and anchors (refer : Hauler Setup Check sheet)

Each page of your Tower Management Plan should be dated, and the Plan to have a version number (to allow updates to be tracked).

**Note**

- Your Tower Management Plan should address the relevant requirements of Section 14 of the revised (2012) Approved Code of Practice for Safety and Health in Forest Operations (pages 87 to 93, Cable Harvesting).
- Those contractors employing Breaker-Outs will also need a documented process (ie a Plan) to determine and identify the safe retreat position for each line or day's work, taking into account the items listed in ACoP Rule 12.2.22.

Templates & resource material for towers & swingers are attached on following pages.

**Additional Resources**

An instructional video made by LIRO, the Logging Industry Research Organisation, in the mid 1990s is a useful teaching resource for staff training. The video is available on CD from Shayne Harvey, Ernslaw One forest engineer in our Bulls office (06 322 1558). The video includes Deadman installation, so is useful in training 3<sup>rd</sup> party sub contractors. (note that it does describe the "wrap and go back" technique which was implicit in a tower failure in our south island estate, so is not a favoured anchoring technique)

## Contractor Templates - (*minimum requirements*)

(Use either this diagrammatic form by modifying the following template to suit your machine)

### Form 1: Tower Guy Layout and Anchor Location check (field form)

(to be completed after every tower shift)

Not for Swing Yarders using mobile plant as guy anchors.

Crew: \_\_\_\_\_

Compartment: \_\_\_\_\_

Skid Number: \_\_\_\_\_

Person verifying setup: \_\_\_\_\_

Deadmen installed by: \_\_\_\_\_ (name subcontractor and or operator)

Date & Time of Shift: \_\_\_\_\_

Hauler type: \_\_\_\_\_ (specify here on master template)

Anchor 5	
guy line bearing to anchor	
guy line vertical angle	
D-Deadman S-Stump O-other Note diameter, (& depth etc)	D / S / O <i>Circle one</i>

Anchor 1	
guy line bearing to anchor	
guy line vertical angle	
D-Deadman S-Stump O-other Note diameter (& depth etc)	D / S / O <i>Circle one</i>

	Anchor 4	Anchor 3	Anchor 2
guy line bearing to anchor (deg)			
guy line vertical angle (deg)			
D-Deadman S-Stump O-other Note diameter (and for deadmen note for length & depth). <i>Circle one:</i>	D / S / O	D / S / O	D / S / O

Guy Angles. Vertical angles taken from stump to top of fairlead (using clinometer, abney or protractor)

*\*Specify controls if guy angle exceeds 45°*

Guy Distribution. Horizontal angles taken from stump to pole (using compass).

Note: Use 1 page per tower shift.

Daily guy line and anchor integrity checks to be separately recorded in log book (as is now required by Rule 14.1.2 of the Approved Code of Practice for Safety and Health in Forest Operations - the new "Bush Code" - MoBIE, 2012).

Guy lines, rigging & anchors to meet or exceed standards in Section 14 (Cable Harvesting) of the Approved Code of Practice for Safety and Health in Forest Operations

All records to be retained on site and be available for inspection.

(Or use a tabular type form by modifying the following template to suit your machine)

## Form 2: Tower Guy Layout and Anchor Location check (field form)

(to be completed after every tower shift)

Exception – Swing Yarders using mobile plant as guy anchors.

Crew: \_\_\_\_\_

Compartment: \_\_\_\_\_

Skid Number: \_\_\_\_\_

Deadmen installed by: \_\_\_\_\_ (name subcontractor and or operator)

Date & Time of Shift: \_\_\_\_\_

Hauler type: \_\_\_\_\_ (specify here on master template)

Anchor # <i>Indicate Stump or Deadman or Other device (tipping plate, rock anchor, etc)</i>	Actual guy line bearing from anchor to Tower	Actual guy line vertical angle*	If Deadman used, note actual depth to top of log, <u>and</u> log diameter		If Stump used, note diameter, notch depth, <u>and</u> height of holding wood above the notch			Where anchor Bridle is used, note angle between legs	Initials of person verifying setup
			Depth m	Dia cm	Dia m	Depth cm	Hold cm		
S, D, or O	° from North	° from Horz						° separation	
1									
2									
3									
4									
5									
6									
7									

Guy Angles. Vertical angles taken from stump to top of fairlead (using clinometer, abney or Smartphone app)

*\*Specify controls if guy angle exceeds 45°*

Guy Distribution. Horizontal angles taken from stump to pole (using compass).

Note: Use 1 page per tower shift.

Daily guy line and anchor integrity checks to be separately recorded in log book (as is now required by Rule 14.1.2 of the Approved Code of Practice for Safety and Health in Forest Operations - the new "Bush Code" - MoBIE, 2012).

Guy lines, rigging & anchors to meet or exceed standards in Section 14 (Cable Harvesting) of the Approved Code of Practice for Safety and Health in Forest Operations

All records to be retained on site and be available for inspection.

(for Swing yarders using mobile machine as an anchor – modify this template to suit your machine)

### Form 3: Swing Yarders Layout and Anchor Location (field form)

(to be completed after every tower shift)

Crew: \_\_\_\_\_ Compartment: \_\_\_\_\_

Skid Number: \_\_\_\_\_

Anchor machine: \_\_\_\_\_

Hauler type: \_\_\_\_\_ (specify here on master template)

Date and time of Line or Tower shift	Actual guy line bearing from mobile anchor to swinger (° from North)	Lead within manufacturers tolerances  <input checked="checked" type="checkbox"/>	Actual guy line Vertical angle (° from Horizontal)				Initials of person verifying setup
			Guy 1	Guy 2	Guy 3		

Guy Angles. Vertical angles taken from stump to top of fairlead (using clinometer, abney or Smartphone app)

Note: Daily guy line and anchor integrity checks to be separately recorded in log book(as is now required by Rule 14.1.2 of the Approved Code of Practice for Safety and Health in Forest Operations - the new “Bush Code” - MoBIE, 2012).  
Guy lines, rigging & anchors to meet or exceed standards in Section 14 (Cable Harvesting) of the Approved Code of Practice for Safety and Health in Forest Operations.  
All records to be retained on site and be available for inspection.

**Chute Length Calculation Sheet** to be inserted in Plan

- Only needs to be done once per setting – *not daily*
- Ernslaw Harvest Plans to specify Tree Mean Top Height for pre-harvest inventory surveys or from modelling

**Chute Length verification – Uphill hauling**

Tower Height (m)		<b>Calculation</b>	
Tree Mean Top Height <b>MTH</b> (m)		<b>MTH * 0.5</b>	Required length (m)
Actual Chute length (m)			

If actual chute length is less than the calculated minimum, then plan should specify measures taken to assure safety of any breaker out working downslope of the chute

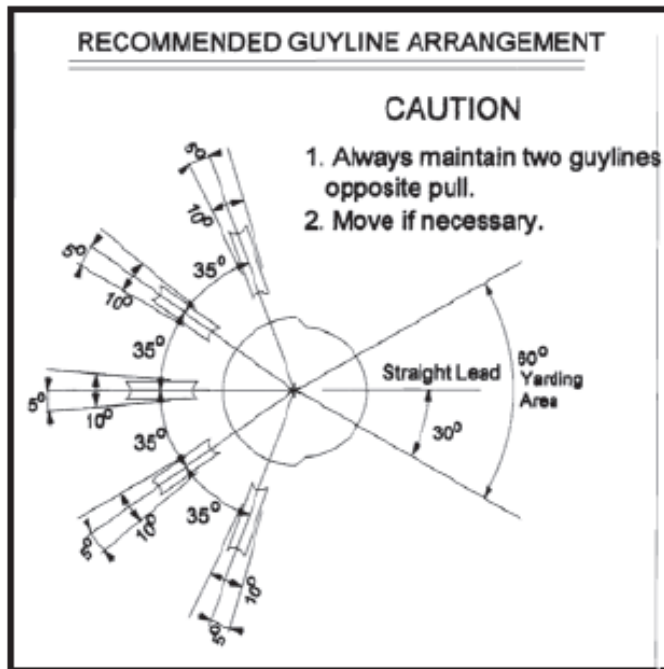
**Downhill Hauling**

Note rule in ACoP: 14.1.8 For downhill yarding, there shall be adequate flat chute area to land stems or logs without endangering the yarder operator or other workers.

### 5 Guy Hauler

– **Maximum yarding angle 30 degrees either side of centre**

- Guy separation is 35 degrees plus or minus 5 degrees



Note that a 5 degree tolerance is indicated in the above diagram.

The optimum guy arrangement for this particular hauler is to have 35 degrees between the guys, with no less than 30 degrees, and no more than 40 degrees between adjacent guys.

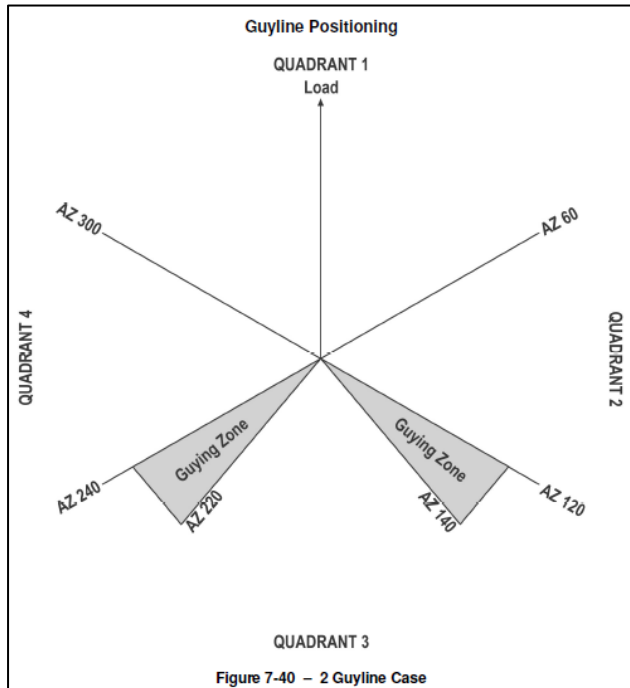
More information is available on line at:

[www.cbs.state.or.us/external/osha/standards/div\\_7.html](http://www.cbs.state.or.us/external/osha/standards/div_7.html)

(medium sized file – 9 Megs)

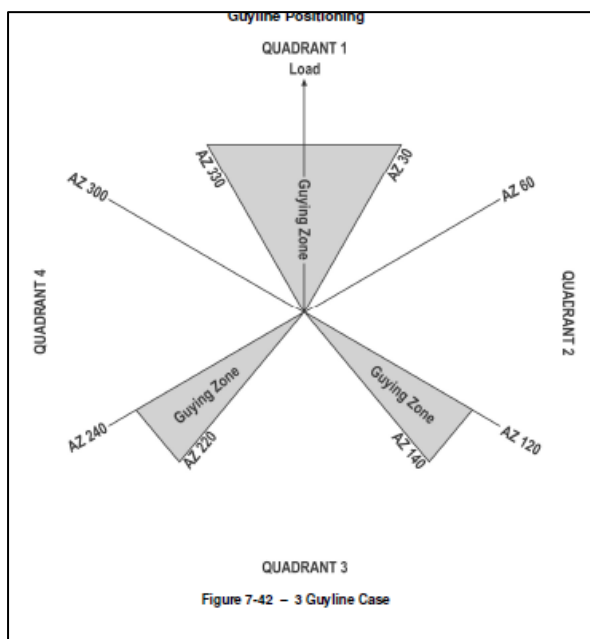
The following diagrams are from Appendix I (pages 252 to 262) of [www.cbs.state.or.us/external/osha/pdf/rules/division\\_7/div\\_7.pdf](http://www.cbs.state.or.us/external/osha/pdf/rules/division_7/div_7.pdf)  
(caution: large file to download - 26 Megs)

## 2 Guyline arrangements



Guy lines at 130 degrees and 230 degrees (plus or minus 10°), relative to the direction of load.

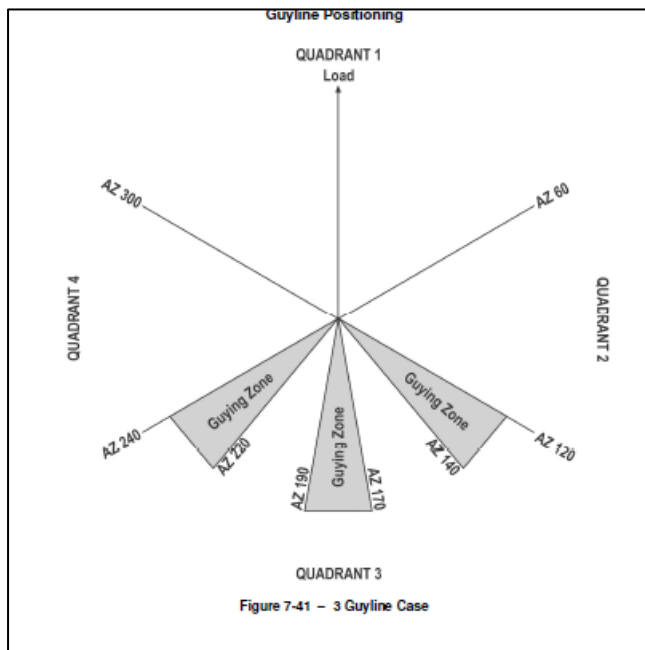
## 3 Guyline arrangements (2 guys opposing the load plus a snap guy)



Opposing guylines at 130 degrees and 230 degrees (plus or minus 10°), relative to the direction of load.

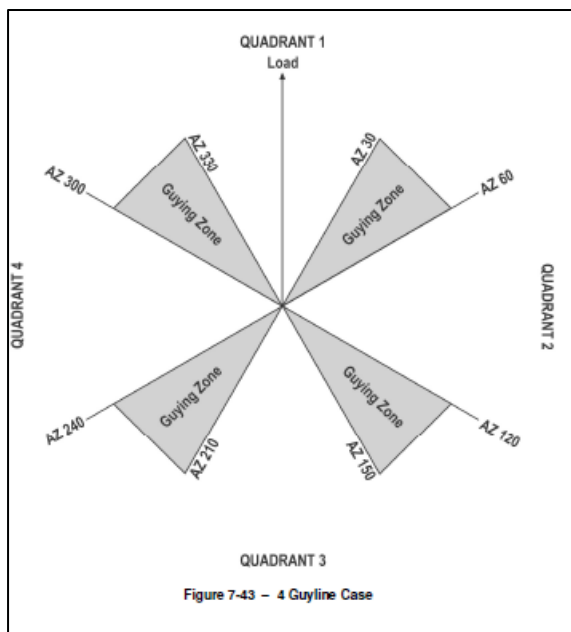


### 3 Guyline arrangements (all opposing the load)



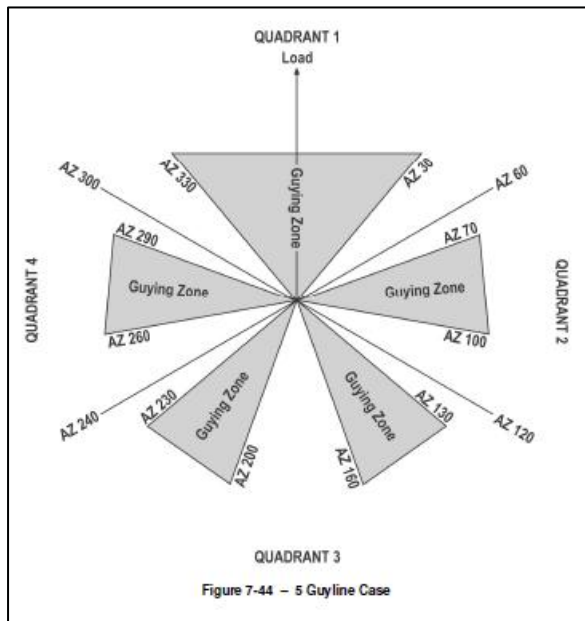
Guy lines at 130, 180 and 230 degrees (plus or minus 10°), relative to the direction of load.

### 4 Guyline arrangements (two opposing the load)



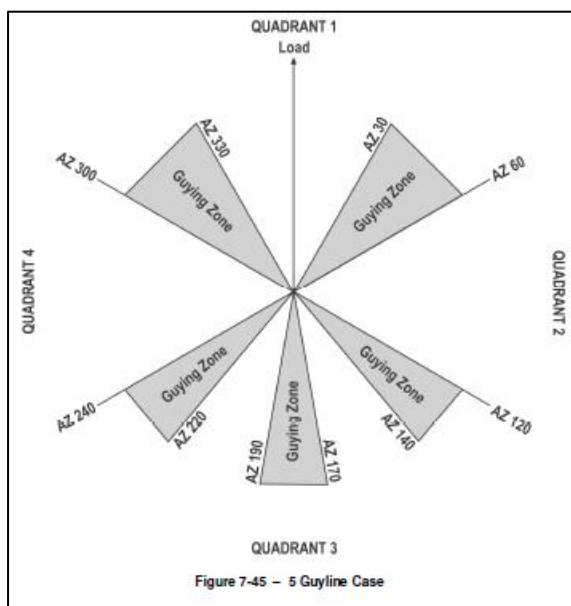
Opposing guylines at 135 degrees and 225 degrees (plus or minus 15°), relative to the direction of load.

## 5 Guyline arrangements (two opposing the load)



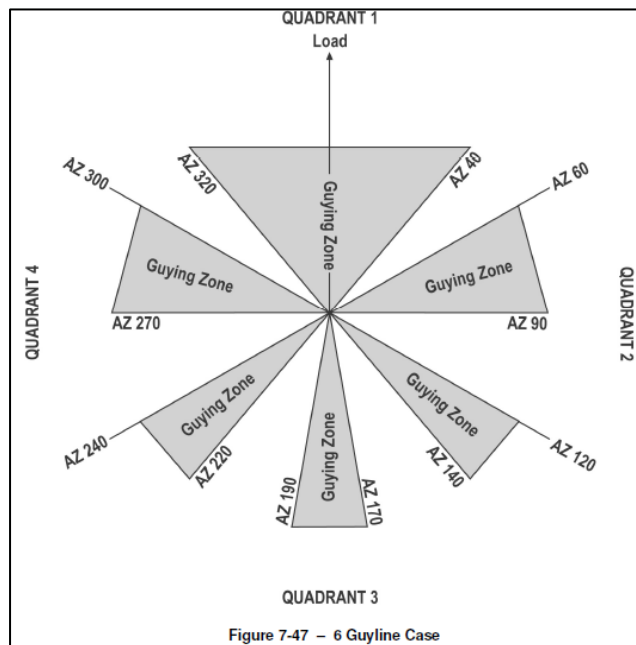
Opposing guylines at 145 degrees and 215 degrees (plus or minus 15°), relative to the direction of load.

## 5 Guyline arrangements (three opposing the load)



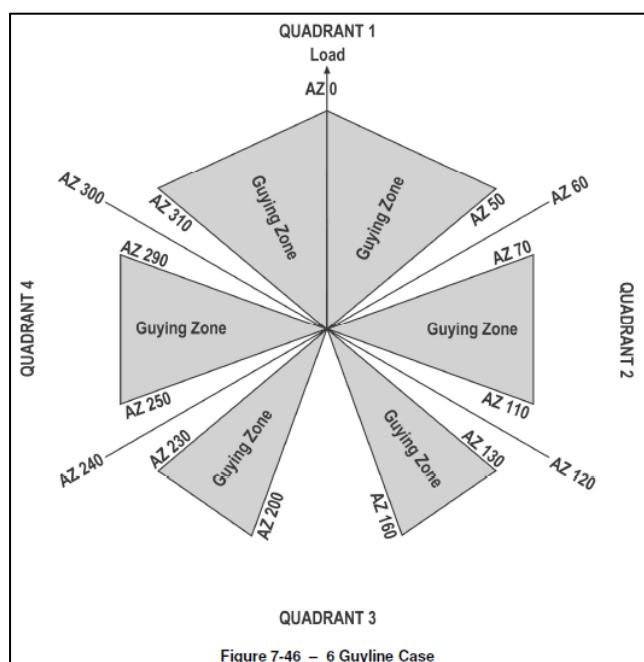
Opposing guylines at 130, 180 and 230 degrees (plus or minus 10°), relative to the direction of load.

### 6 Guy arrangements (3 guys opposing the load)



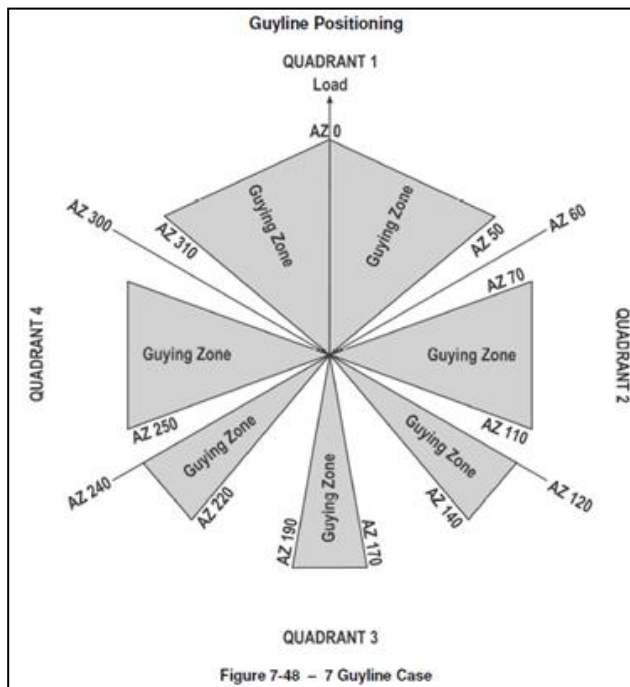
Opposing guylines at 130, 180 and 230 degrees (plus or minus 10°), relative to the direction of load.

### 6 Guy arrangements (2 guys opposing the load)



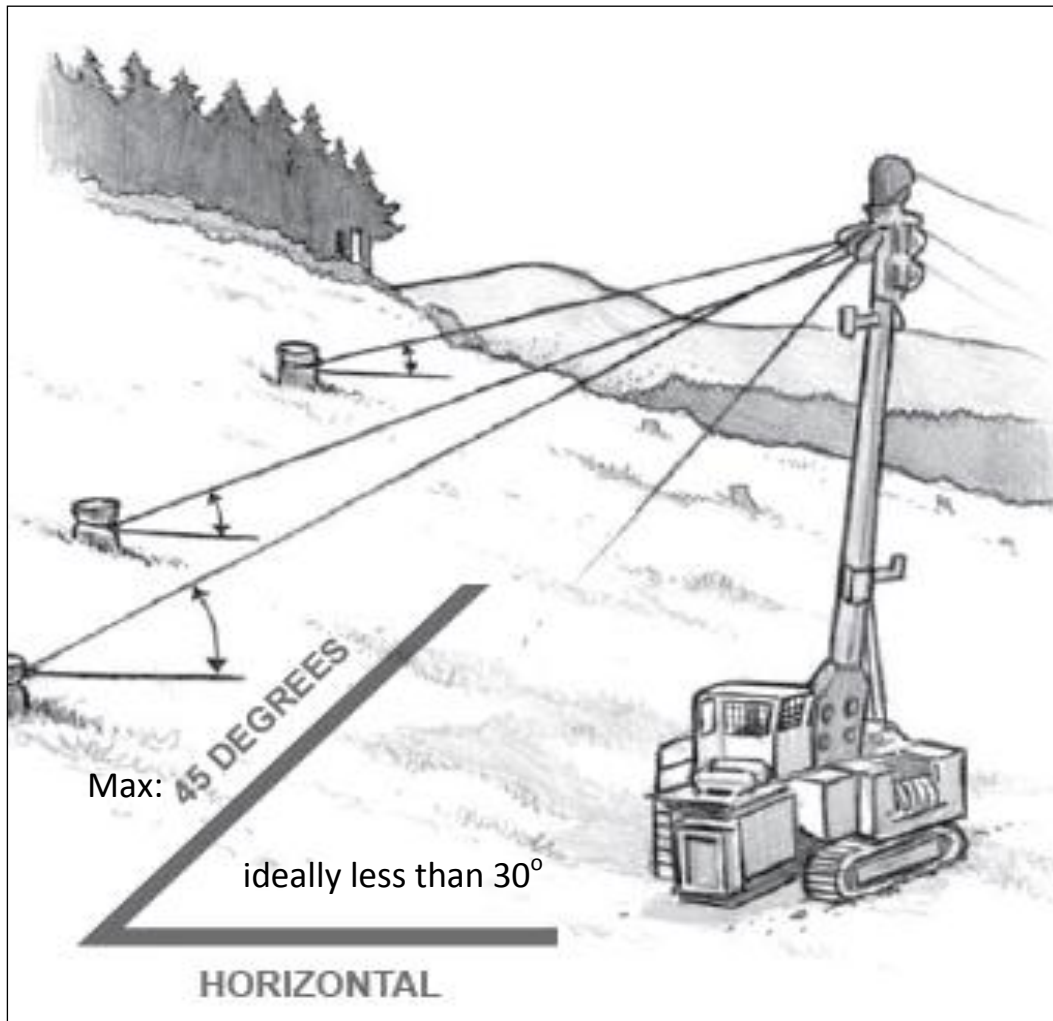
Opposing guylines at 145 degrees and 215 degrees (plus or minus 15°), relative to the direction of load.

## 7 Guy line arrangement (3 guys opposing the load)



Opposing guylines at 130, 180 and 230 degrees (plus or minus  $10^\circ$ ), relative to the direction of load.

## Guy line Vertical Angle:



### The Plan

The angle of the guy line, measured from the horizontal, should be no more than 45 degrees, and ideally less than 30 degrees. (Lower angles put less strain on anchors).

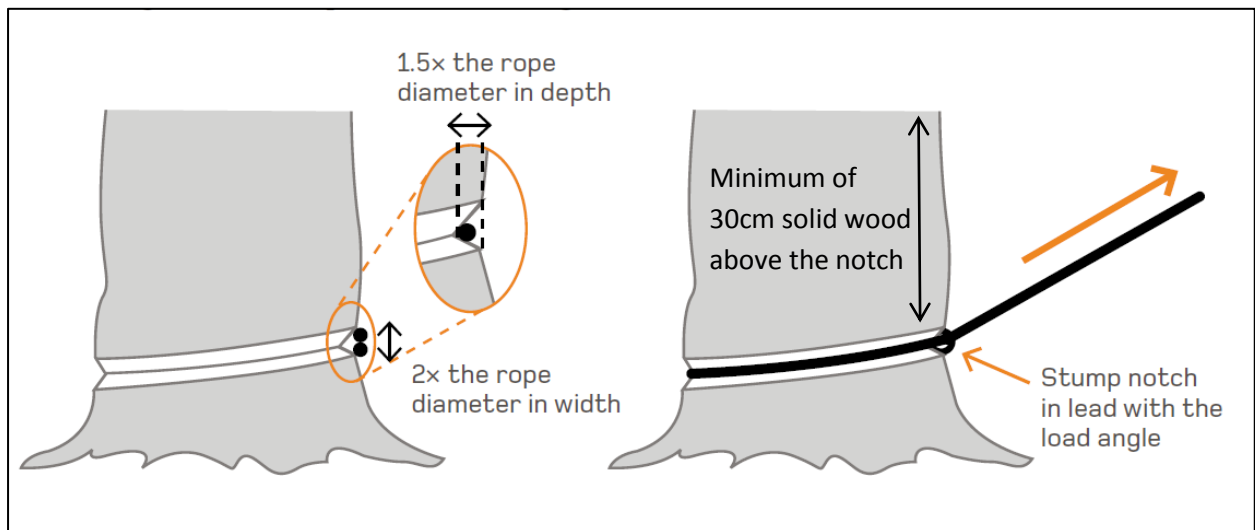
As a rule of thumb, the length of guys should never be more than 5x the height of the tower

The Plan should specify measures that can be taken to assure stability of the Tower if site constraints dictate that any actual Guy Angle is greater than 45 degrees from horizontal, (eg reduce payload or reduce the tower height if the machine allows it, or move to heavier guys if manufacturer's specification allows). Note that the upwards (pull-out) forces on anchors increase rapidly as guy angles exceed 45 degrees).

When site constraints dictate that more than one actual guy angle exceed 45 degrees, the Plan should require the Contractor to advise Ernslaw's Harvest Planner of the site constraints encountered, and further require the Hauler Operator or site foreman to advise Ernslaw's supervisor of the measures in place to assure both tower stability and security of any deadmen or stump anchors.

## Anchors

Refer: Best Practice Guidelines for Cable Logging (FIT, 2000), Anchors & Guy lines (p123-159),



*Remember that*

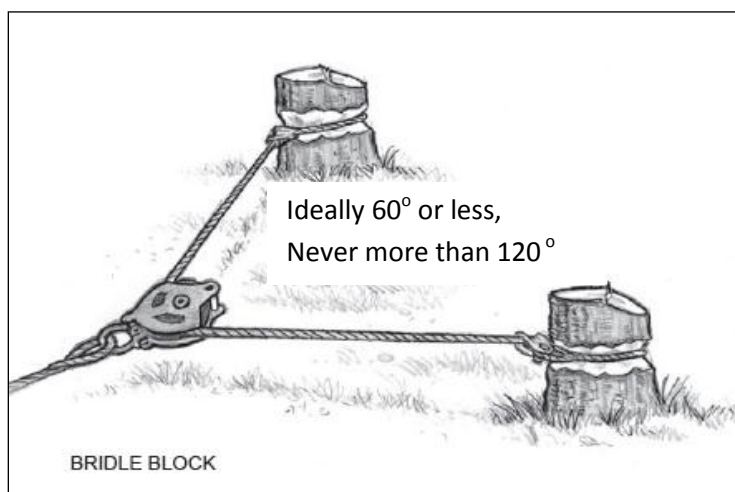
*The holding capacity of stumps increase with the size of the stump (roughly with the square of the diameter)*

*Fresh stumps have greater holding capacity when pulled uphill (older stumps are unreliable)*

*LIRO recommended that 50 to 80cm of wood should be left about the notch, to prevent wood "slabbing off"*

☞ Caution: Use deadmen or machines when stumps are suspected to be of doubtful holding capacity

## Guyline Equaliser Bridle Block:



Never exceed an angle of 120 degrees between the two legs of the strap.

Ideally 60 degrees or less.

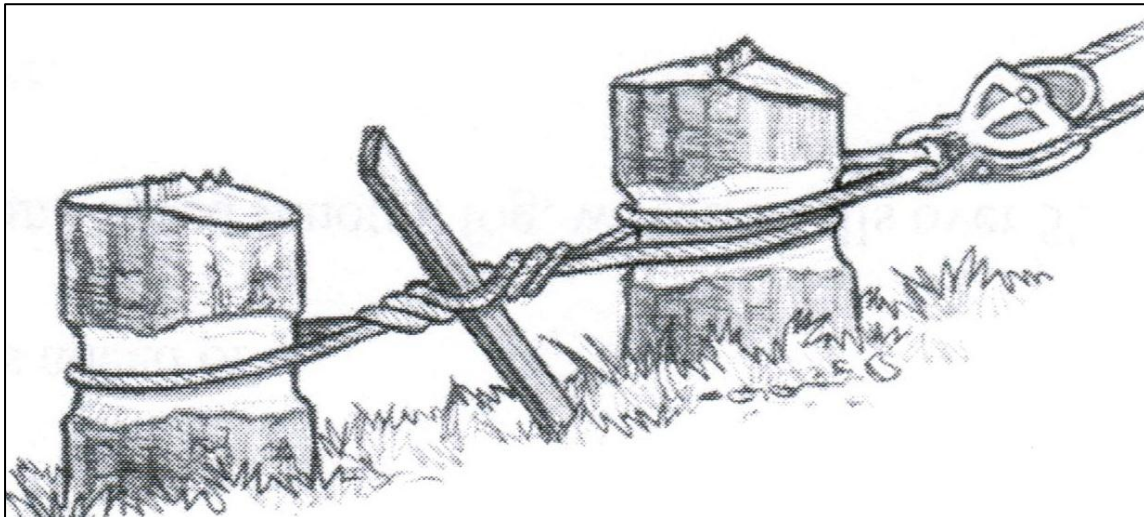
Wider angles increase the force on each stump. Angles more than 120 degrees produce a greater force than the original load.

The less angle the better

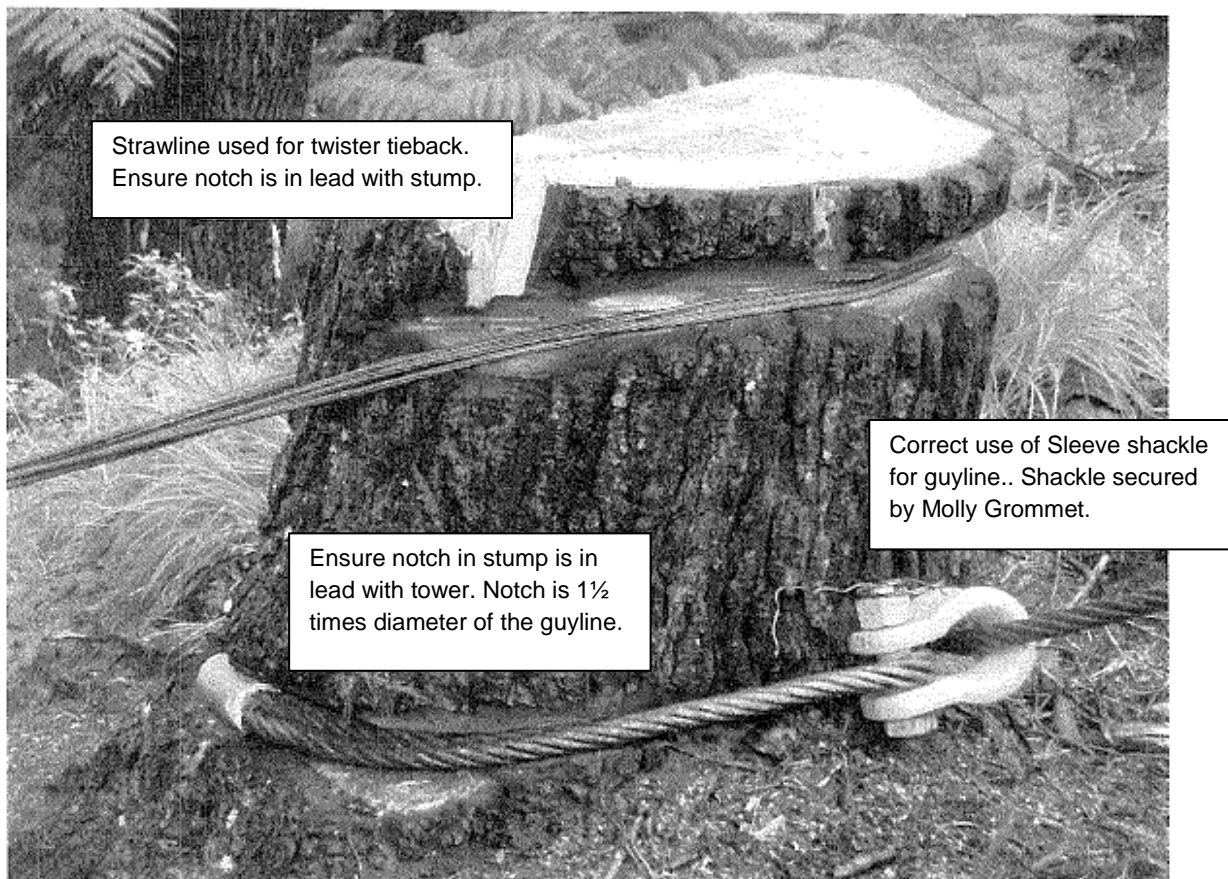




## Twister



Sometimes photos with annotations are easier to work with than drawings, as per the example below



*Credit: Harvest Pro NZ Ltd; Reproduced with Permission and shared to produce a safer workplace, with thanks*



## Hauler Set Up Check list (modify this template to suit your machine)

Crew name		Hauler type		Forest	
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This form must be completed and signed off each time the tower is moved, BEFORE hauling can start.

Any problems are to be notified to the Contractor, with any structural or mechanical fault in the Tower that had potential to caused serious harm notified to Ernslaw One's supervisor.

	Checks / Action	<input checked="" type="checkbox"/>	comments
1	Grease all sheaves and moving parts (including guyline blocks)		
2	Check all shackles on tower top for wear and tension		
3	Check that all shackles are safety shackles & all have mollies or split pins		
4	Check Tower (and carriage or grapple) for cracks and defects		
5	Check all moving parts for signs of fatigue, cracks or wear		
6	Check all locking dogs in place		
7	Check guy line extensions for kinks or broken strands		
8	Check that guy line extensions are the correct diameter & type		
9	Check that any static rope across a road is clearly flagged (and signed if less than 6m above ground when slack)		
10	Check skyline extension for kinks or broken strands		
11	Check that skyline extension is the correct diameter & type		
12	Check that Deadman installation is adequate and sound		
13	Check that position of all eyes on Deadmen and Stumps correct		
14	Recheck position of eyes on Deadmen and Stumps after 4 drags		
15	Check that Tower locking dogs are engaged		
16	Check all guy drum locking dogs are engaged and drums are seated against dogs		
17	Check all hoses for leaks, kinks or chaffing		
18	Check all braking systems and airlines and air horn		
19	Check fire extinguishers		

Daily Guyline checks – all anchors (Stumps or Deadmen) to be checked		
	Anchor type S/D <input checked="" type="checkbox"/>	Vertical Angle *
1		
2		
3		
4		
5		
6		
7		
8		

*\*Specify controls if guy angle exceeds 40°*

Guyline configuration (Sketch)

### Chute length

Tower Height (m)		Calculation	
Tree Mean Top Height <b>MTH</b> (m)		<b>MTH * 0.5</b>	Required length (m)
Actual Chute length (m)			

**Sign Off:** Tower set up to be signed off by a hauler operator, (or alternatively hook tender, foreman or other competent person on site) having the appropriate Unit Standard (eg 26799 Plan for, manage, and perform quality control on a cable harvesting operation), and in accordance with the designers and manufacturer's specification.

name

Signature

Date

*Credit: Modified after Harvest Pro NZ Ltd; Reproduced with permission and shared to produce a safer workplace, with thanks.*

*(modify this template to suit your machine)*

## End for Ending of Wire Rope

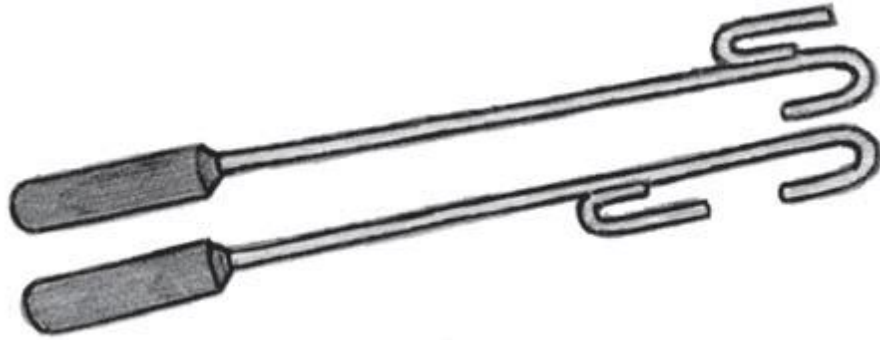
Enter details every time a wire rope is end for ended

[illegible]

*Credit: Dewes Contractors Ltd, Reproduced with permission and shared to produce a safer workplace, with thanks.*



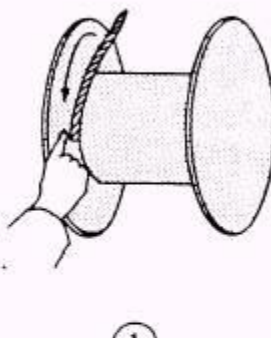
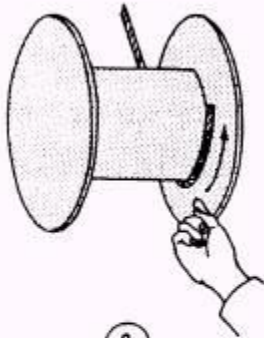
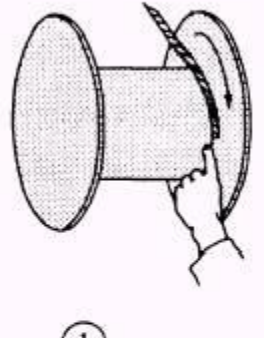
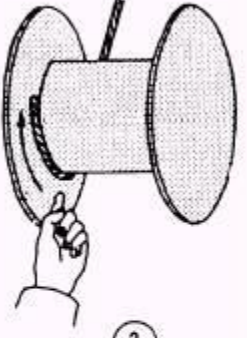
## Spooling tools



Never use your foot to guide a rope.

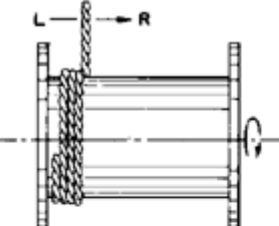

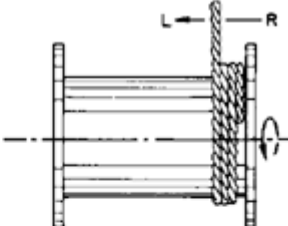

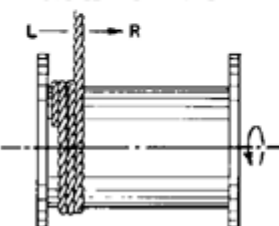

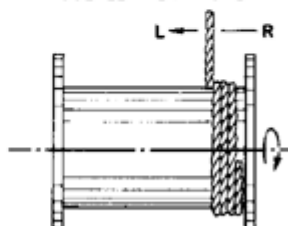

Watch for entanglement in the Skyline tension device.

## Drum Winding & Rope Spooling Instructions

FOR RIGHT LAY ROPE (USE RIGHT HAND)		FOR LEFT LAY ROPE (USE LEFT HAND)	
			
FOR OVERWIND ON DRUM:	FOR UNDERWIND ON DRUM:	FOR OVERWIND ON DRUM:	FOR UNDERWIND ON DRUM:
<p>The palm is down, facing the drum.</p> <p>The index finger points at on-winding rope.</p> <p>The index finger must be closest to the left-side flange.</p> <p>The wind of the rope must be from left to right along the drum.</p>	<p>The palm is up, facing the drum.</p> <p>The index finger points at on-winding rope.</p> <p>The index finger must be closest to the right-side flange.</p> <p>The wind of the rope must be from right to left along the drum.</p>	<p>The palm is down, facing the drum.</p> <p>The index finger points at on-winding rope.</p> <p>The index finger must be closest to the right-side flange.</p> <p>The wind of the rope must be from right to left along the drum.</p>	<p>The palm is up, facing the drum.</p> <p>The index finger points at on-winding rope.</p> <p>The index finger must be closest to the left-side flange.</p> <p>The wind of the rope must be from left to right along the drum.</p>

If a smooth-face drum has been cut or scored by an old rope, the methods shown may not apply.

[www.tpub.com/eqopbas/170.htm](http://www.tpub.com/eqopbas/170.htm)

			
UNDERWIND LEFT TO RIGHT USE LEFT LAY ROPE	LEFT LAY UNDERWIND	OVERWIND RIGHT TO LEFT USE LEFT LAY ROPE	LEFT LAY OVERWIND
			
OVERWIND LEFT TO RIGHT USE RIGHT LAY ROPE	RIGHT LAY OVERWIND	UNDERWIND RIGHT TO LEFT USE RIGHT LAY ROPE	RIGHT LAY UNDERWIND

[www.stren-flex.com/wire-rope-handling.aspx](http://www.stren-flex.com/wire-rope-handling.aspx)

## 2012 ACoP revision

### Key changes (from FITEC)

The following is a summary of some of the main changes between the old Code of Practice (April 2000) and the reviewed Code of Practice (December 2012).

### Section 12: Breaking Out

- ☐ Audible signals specified for rope and rigging movement – rules 12.2.5 and 12.2.6, pg 79.
- ☐ Additional responsibilities assigned to the Head Breaker-out – rules 12.2.8, 12.2.9, 12.2.10, pg 80.
- ☐ New rule added for minimum distance from moving ropes during outhaul – rule 12.2.11, pg 80.
- ☐ New rule added to clarify when breaker outs can enter the hook on area – rule 12.2.13, pg 80.
- ☐ New rule added about not clearing stems from the chute until the breaker outs are in the safe position – rule 12.2.17, pg 80.
- ☐ New rule added about the requirement to have service brake applied while breaker outs are under the rigging – rule 12.2.18, pg 81.
- ☐ New rule added about dealing with foaled drags – rule 12.2.20, pg 81.
- ☐ New section added for planning, determining and using the safe retreat position – rules 12.2.21 – 12.2.24, pg 81.

### Section 14: Cable Harvesting

- ☐ Requirement added to document guyline anchor and rigging checks – rule 14.1.2, pg 88.
- ☐ New rule added about being able to safely land drags in a downhill yarding situation – rule 14.1.8, pg 88.
- ☐ Additional detail added on tail spars – section 14.7, pg 92.
- ☐ Additional detail added on yarder inspections, id plates and signing off on modifications and repairs – rules 14.8.1, 14.8.2, 14.8.3, pg 92.
- ☐ Addition of the requirement for yarder to have FOPS and OPS cabs – rule 14.8.4, pg 93.