Chapter 5

The anchor and repositioning

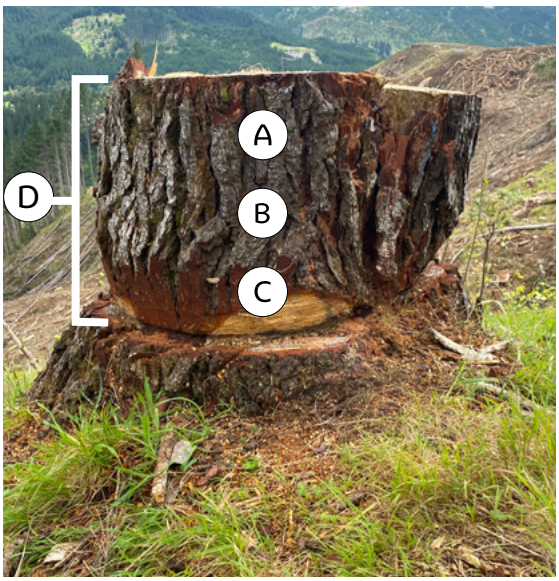
In this chapter you will find out:

- ✓ Different sorts of anchoring systems.
- ✓ Why anchors fail and how to stop this from happening.

Types of anchors

Stumps

Stumps have been very commonly used in cable logging operations and are an option for integrated winch-assisted SSH machines. Refer to section 14.3 of the ACOP. Regularly inspect stumps because they can work loose under shock loading. Stump monitors give the operator with an alarm signal should the stump start to move. There needs more research on stump anchoring for SSH machines as stump requirements have come from cable logging operations. For example, the need for notching stumps with synthetic strops for SSH application.



A Minimum stump diameter of 500mm
B Only use fresh stumps in strong soils
C All stumps must be notched
D 30cm of solid wood above the notch

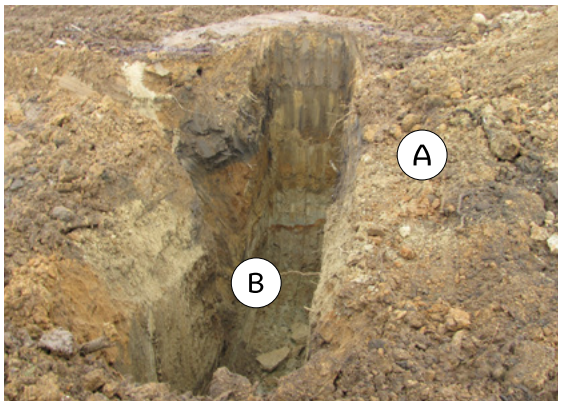
Also:

- A stump monitor alarm should be fitted.

Shock loading stumps can loosen or pull them out.

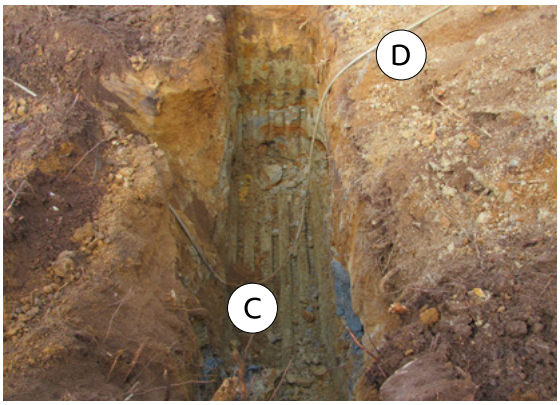
Deadmen

Deadmen, like stumps, can also be used to anchor integrated winch-assisted machines. Deadmen are typically strong if installed in accordance with section 14.3.5 of the ACOP.



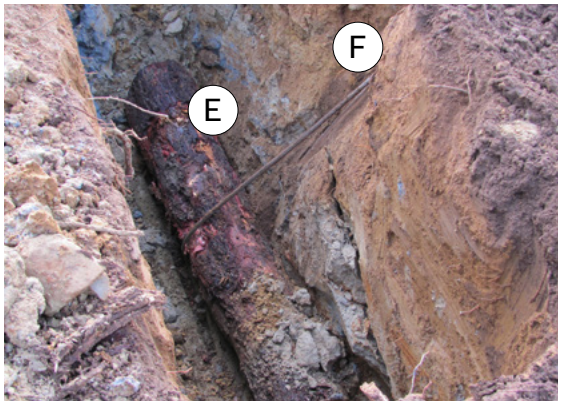
A Dig the trench at right angles to the pull

B Make at least 4 m deep and about 7 m long



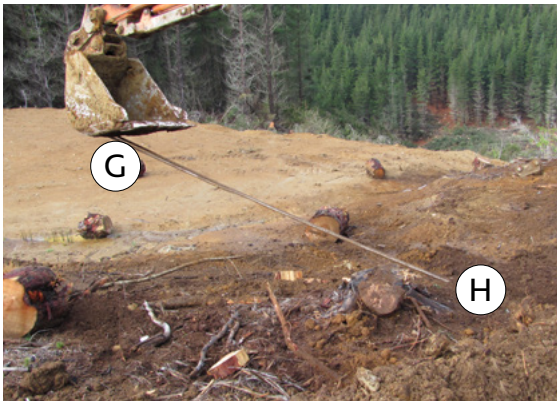
C Lay a strop in the trench

D The strength rating of the deadmen strop should be at least equal to the winch rope



E Use green logs at least 50 cm in diameter

F The notch stops the log being pulled straight up



G The two strop ends must be equal before shackling

H Compact as you backfill

Rocky soil and fill can cause strops to wear and fail. Always use suitable fill and periodically check strops.

Anchor machines

These are either bulldozers, excavators, or purpose-built winch anchors. Machine anchors are popular because they are mobile. This means the steep slope harvesting machine can quickly shift between winch-assist and other operations without modification.

The most common anchor in New Zealand is an excavator. The winch(es) are mounted at the machine's rear, with the wire rope(s) coming up over the top of the boom.

The two largest excavator-based winch-assist manufacturers, DC Equipment and EMS, have an additional sheave mounted on the boom just above the bucket to bring the rope close to the ground and significantly reduce any lateral instability issues. The bucket is dug into the ground to provide the extra holding strength required to make it a safe anchor. A significant advantage is that they can lift the rope for a line shift.

Bulldozer anchors have a sturdy base and low centre of gravity. The blade must be pushed into the ground to provide the extra strength as a solid anchor. If positioned correctly, the bulldozer blade will move deeper into the ground if pulled forward, so the holding strength increases with minor movement.

Left: the single winch DC Equipment's Falcon winch assist. Right: The twin drum EMS Tractionline. Below left: the Remote Operated Bulldozer (ROB). Below right: Eco-Forst T-WINCH 10.2.

Why anchors fail

The following things can make anchors fail:

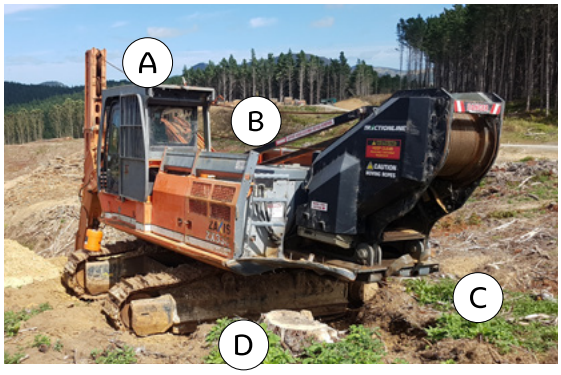
- Poor anchor positioning, including an anchor machine not on level ground and blade or bucket not dug in correctly.
- Weak soil strength.
- Overloading the anchor.
  - Anchors aren't strong enough.
  - SSH machine pulling from a too wide lead angle.
  - Shock loading from the steep slope harvesting machine.

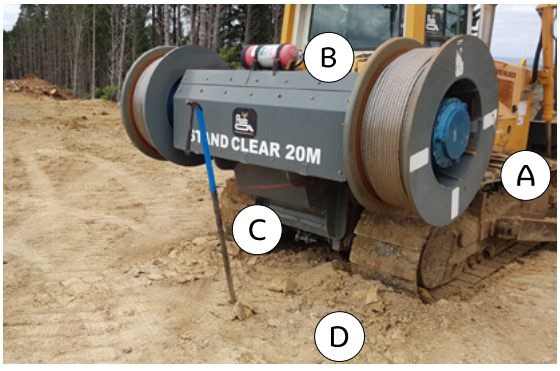
If the soil is weak, there are three common ways to strengthen the anchor:

- Put the blade into the ground behind a stump. The holding strength of the stump will improve anchoring. Not too close behind the stum. Otherwise, the root system could get cut, and this gives the stump its strength.
- Tie off to a stump behind the machine.
- If an excavator, reposition the bucket deeper or in a different location.

Most anchoring failures are a combination of factors – poor machine positioning or cable angles, and high loading.

Guidance for safe machine anchoring





A Install a tension monitor that relays to the steep slope harvesting machine operator

B Use camera(s) to show steep slope harvesting machine operator cable spooling

C Use an anchor movement alarm

D Position safe and securely, eg. avoid soft road or landing edges

Do not exceed the anchoring capacity of the anchor machine. Improve by anchoring back to stumps as well.

Don't move the anchor and steep slope harvesting machine at the same time. One machine needs to be stationary and stable during line shifts.

This bucket and blade should have been in deeper.

Additional guidance for excavator anchors

A Dig bucket into firm soil so it won't pull out

B Bucket can be normal way or reversed

C Lead angle within manufacturers limits

D Low cable exit points to prevent overturning

E Boom and stick angle between 90-110 degrees

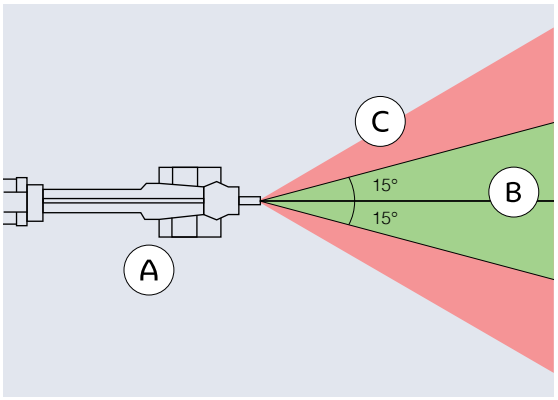
Machine anchors do move. Put the blade or bucket behind a stump. Check the anchor is holding each set up. Do a straight pull test.

Repositioning the anchor

The anchor often needs repositioning to help keep it in line with the steep slope harvesting machine as the block progressively gets felled.

Anchor lead angle

The lead angle is typically the angle from the anchor's fairlead to the steep slope harvesting machine.



A Reposition the anchor or use rub trees to maintain correct lead angle

B Maximise in-line pull. Minimise the amount of side pull

C Follow any manufacturer's specifications about the horizontal and vertical lead angle

Guidance on the lead angle for an excavator

There's no one answer. It depends on the site and the current conditions, the machine, and how the machine is anchored. Follow the manufacturer's specifications on the horizontal and vertical lead angle of the cable exiting the fairlead.

Lead angle	Soil type	Comment
Up to 15 degrees	Loose or uncompacted fill	Maintaining bucket stability is a limiting issue.
Up to 30 degrees	Good	Keep to this limit when operating for longer periods as the soil may loosen over time. Also, for steep slopes when higher shock loading might be expected.
Up to 40 degrees	Good	The anchoring hole is deep enough (approx. 1.25m), the soil is strong, and the machine is designed for the forces.
Up to 90 degrees	Very strong	Increasing sideways forces could generate forces large enough for failure on the bucket/boom/ sheave unless manufacturers have modified their equipment design to accommodate such large angles.