

ACC Vancouver Top Rope Anchors Climbing Course

Overview

Setting up safe anchors for top roping is one of the most basic skills any rock climber must be familiar with. In fact, competence in top rope anchor building is a prerequisite that must be mastered before progressing to more advanced skills (lead climbing, for example). If you are unable to build a secure top rope anchor and/or evaluate the safety of an anchor, moving on to more advanced skills safely is not an option.

This two-day course is intended to teach club members how to build anchors for top roping. The objective is to give participants a chance to learn how to build different types of anchors and to practice what they learn in a controlled setting. Evaluation of anchors with respect to security criteria is an important part of the course. Additionally, participants will learn how to rappel using a personal prusik for backup. Techniques for belaying a partner from above will also be covered.

Prerequisites

- Indoor top-rope climbing experience
- Competence in belaying

Curriculum

EARNEST Anchors

The EARNEST mnemonic is a set of criteria to evaluate anchors:

E	equalized
A	angles
R	redundant
NE	non-extending
S	strong
T	timely

Equalized implies that in a multi-point anchor the load is distributed relatively equally between the components of the anchor.

Angles refer to the angle between the slings (or cords) at the focal point. This angle (see Figure 1) should always be smaller than 90° degrees, better is less than 60° degrees. At 120° degrees the forces in a two-point anchor become equal negating any advantage of a multi-point anchor. If the angle is close to 180° degrees, the force in the legs of the anchor approaches infinity – such an anchor is more dangerous than a single-point, non-redundant anchor. This is frequently overlooked when placing slings around a tree or bolder – see Figure 2.

Redundant - a redundant anchor does not fail, when any one of its components fails. Single-point anchors are acceptable only under exceptional circumstances.

Non-Extending means that if one of the anchor components fails, this must not result in a large movement of the focal point that would result in shock-loading the anchor.

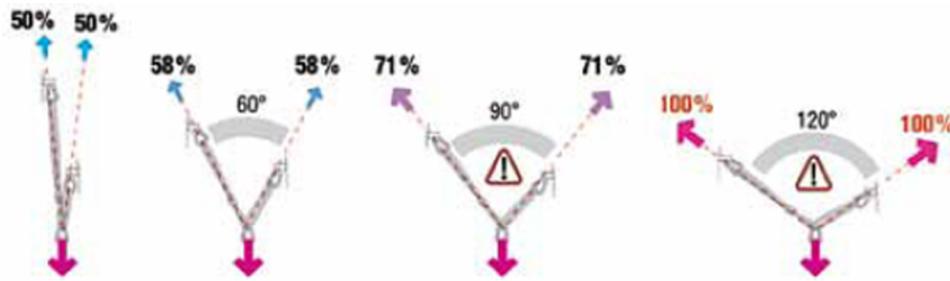


Figure 1: Effect of the angle between slings at the focal point on the load on the anchor points

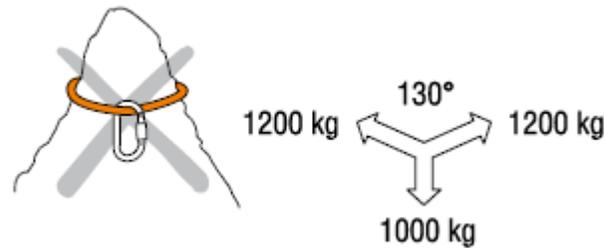


Figure 2: relevant angles when slinging a horn, tree, etc.

Strong means that the anchor should be “full strength”, i.e., be able to withstand a force of at least 20kN. This is first and foremost a requirement for the primary placements of the anchor. A multi-point anchor built out of well equalized components each of which has marginal strength will result in a marginal anchor: the danger exists for a cascading failure where one component fails after the other. Check every primary anchor point (tree, bolts, etc.) whether they are well attached to the ground, rock, etc. The individual components of the anchor also need to be strong enough. Carabiners show the strength on the biner: they are full strength only when closed and when loaded along the long axis. Slings typically have a strength of about 22kN. Knotted slings are weaker than sewn slings, but can still be regarded as full strength. The strength of a cordelette (static cord) depends on the diameter: only 9mm or thicker static cord has full strength (the exception is techcord, which is full strength as well); a 7mm cordelette has a strength of about 10kN – static cord with a diameter less than 7mm should not be used for anchor building. Nylon equipment (ropes, slings, harness, etc.) loose strength when aging – this equipment must be replaced at least every 5 years.

Timely – while time is not much of a security concern when setting up top rope anchors (it becomes important for multi-pitch climbs though), an anchor that can be setup efficiently and quickly is often safer than an elaborate construction with many components – the 'KISS' principle (keep it simple, stupid!) is valid here as well.

Safety Considerations

Quite often the climber will have to work on top of a cliff fairly close to the edge to setup a top-rope anchor. Therefore it is essential that the person who sets up the anchors is safely secured to prevent a fall over the edge. A common method is to attach a leash of some kind to the harness (e.g., girth hitch a double length sling through the harness) and clip the other end of the leash into the anchor using a locking carabiner. Be very careful when using this method: if you fall when standing above the anchor the leash will break. Slings or other types of leashes are not designed to protect you against such a fall*.

* Falls with a so-called fall factor of 1 or larger: the fall factor is defined as the ratio of the height of the fall divided by the length of the leash/rope, etc. Any fall where the tie-in point is above the anchor point has a fall factor larger than 1. A detailed discussion of fall factors is beyond the scope of this course.

Instead always sit down at the anchor and keep the leash tight to prevent shock-loading. If the anchor is located right at the edge you may have to lower yourself below the anchor and hang off the leash before you can build the anchor. **If you do not feel comfortable building an anchor close to the edge of a cliff, secure a rope or static line (rope extension) to a tree, etc. away from the edge and then rappel to the anchor.**

Types of Anchors

Single-Point Anchors: Single point anchors are not redundant and consequently equalization is a moot point. Nevertheless, there are situations when a single point anchor is appropriate. However, this requires that the primary anchor point must be bombproof:

- a large tree: check whether it is alive and well rooted – shake it to make sure. Also, how shallow is the soil? This is a concern on ledges, etc.
- a rock horn: is it solidly attached to the rock? Can the sling slip off?
- a large boulder: make sure that it does not move. Even large boulders can topple over.
- a hydro tower – quite common in Squamish.

Even when using a single point anchor, all other components (slings, carabiners, etc.) should still be redundant.

Two-Point Anchors: These are the most common anchors for a top rope setup. In areas where top roping is common a pair of bolts can often be found at the top of popular climbs. One of the easiest but nevertheless secure setups under those circumstances is to clip one carabiner into each bolt, clip a long sling (double length, 120cm) into both carabiners, pull the sling between the two bolts down into the direction of the expected pull and tie a knot (overhand or figure-8; the latter is easier to untie later, but requires more length, i.e., leads to somewhat larger angles) at that point that creates the focal point of the anchor. Clip two carabiners into the focal point with the gates opposite and opposed. The resulting anchor (see Figure 3) is easy to setup and fulfills all EARNEST criteria as long as the pull does not deviate too much from the direction the anchor was setup for.



Figure 3: top rope anchor using 4 carabiners and a double length sling knotted at the focal point
If the direction of the pull cannot be estimated accurately or when wide swings of the

rope are expected, a self-equalizing anchor setup can be used, see Figure 4. Here, again a double length sling is used and clipped into both bolts. However, instead of placing a single knot at the focal point two “limiter” knots are placed on either side where the focal point is expected. Then two carabiners are clipped, opposite and opposed, one into each strand of the of the sling at the focal point. These biners now can slide between the two limiter knots and the anchor adjusts itself depending on the direction of the pull. Note, that any self-equalizing anchor is not completely non-extending: when one of the anchor points fails, the focal point will slide to the limiter knot on that side. That is the reason why these knots are called limiter knots: they limit the extension when one of the anchor points fails – see Figure 5.

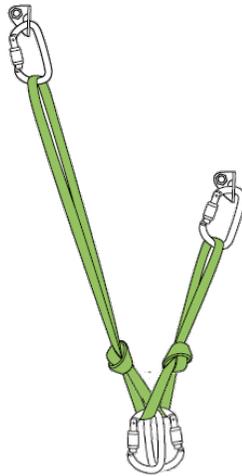


Figure 4: self-equalizing anchor

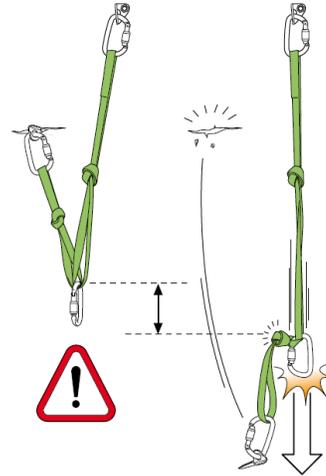


Figure 5: shock-loading of a self-equalized anchor in case of failure

Anchor Building Material

- carabiners: at least 4 are needed for each anchor, two of which must be locking; the other two at the focal point can be locking or non-locking (opposite and opposed)
- slings: a selection of length – double length and a few longer slings
- cordelette: 7mm – 5m or 6m long (Prusik cord)
- rope extension: static line – 9mm, about 30m long

Practice

- set up anchors using various anchor points and different materials: single point anchors, two point anchors, statically equalized anchors, self-equalizing anchors, anchors from slings, cordelette, rope extension, etc.
- adhere to safe anchor building practices
- evaluate anchors according to EARNEST criteria
- set up anchors for rappelling
- practice rappelling with backup Prusik
- practice belaying from above