

Local Cave & Mine Leader Award

Ropework



Local Cave & Mine Leader: Ropework

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Local Cave & Mine Leader: Ropework

Introduction

This document has been produced on behalf of the Qualification Management Committee (QMC) of the British Caving Association. It has been written to support candidates preparing for the Local Cave and Mine Leader Award (LCMLA), which deals with horizontal cave and/or mine systems.

This document has been written by Richard Hill, with illustrations and editing by Gethin Thomas together with support from Trainer/Assessors of the LCMLA scheme.

The use of a rope within these systems should be considered as a means to guide clients away from hazards, help up, or down short awkward steps, or as an emergency technique. Within the remit of this award ropes should be considered as part of a fall prevention system (i.e. by keeping ropes very tight on clients during climbs) rather than fall protection system as is common within climbing activities. Those wishing to lead groups in more challenging vertical systems should consider the Vertical Leader award.

There are six requirements for ropework within the remit of the Cave and Mine Leader Award which this document will cover:

- Traverse line (clients clipped to a rope to prevent them from getting near a hazard)
- Handline (a rope for clients to help climb a short step, supported by spotting)
- Assisted handline (a method to provide help for a client to climb a short step)
- Lifeline (a very tight belay)
- Leader's self-protection
- Emergency techniques (improvised harness)

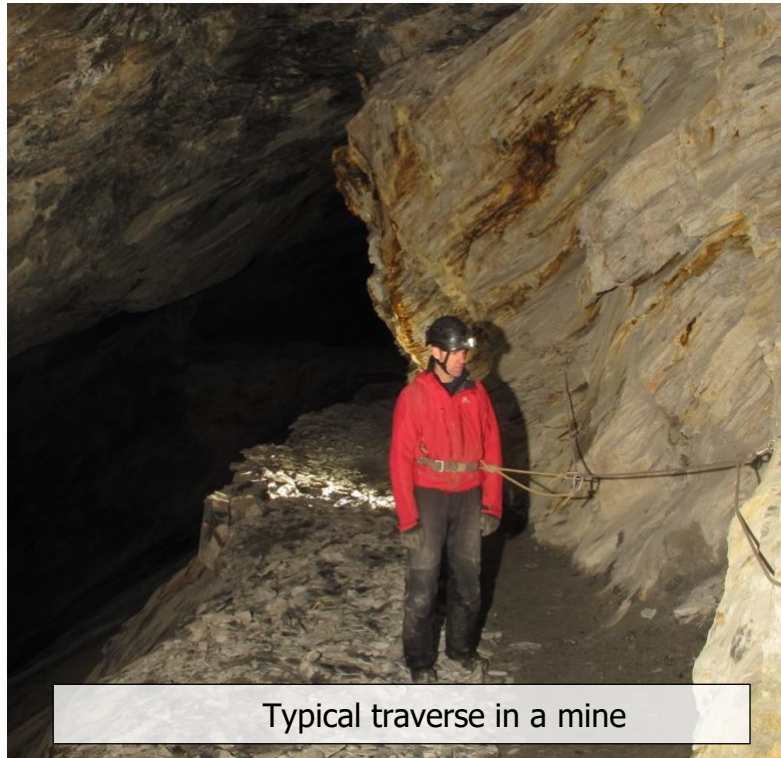
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Traverse Line

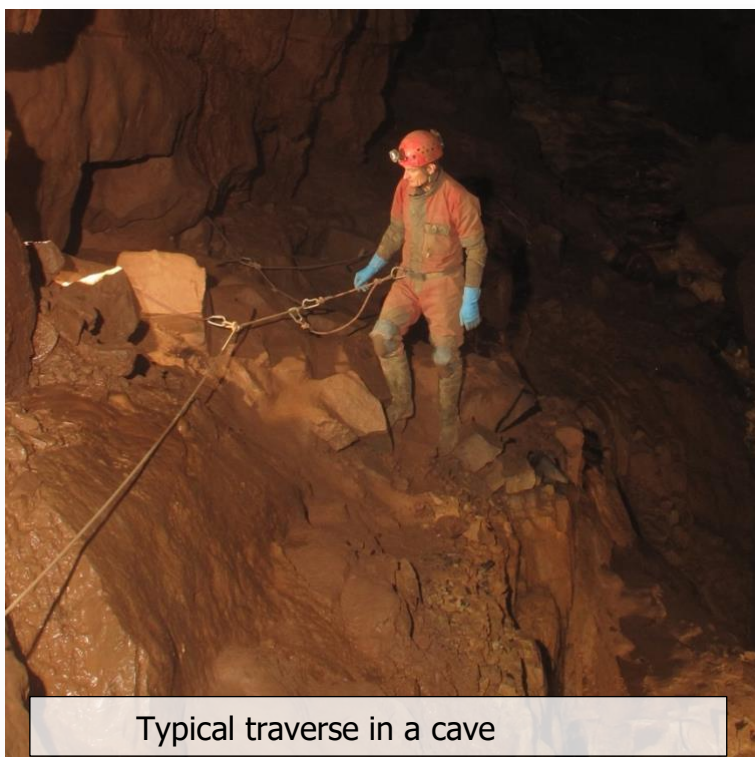
Within the remit of the Cave and Mine Leader award the traverse line is there as a means to manage clients around a hazard such as a large drop or deep water.

The aim is to ensure that should a client slip they remain attached to the traverse line and away from the hazard, however they must not be suspended from the rope. As clients must not be suspended it would be appropriate for clients to use a broad, load bearing belt together with either a karabiner or cowstails.

These pictures show a typical traverse. There is a very easy ledge to walk along but the consequences of a slip are serious. The traverse line is



Typical traverse in a mine



Typical traverse in a cave

rigged from a series of well positioned anchors ideally keeping the traverse rope above clients' waist height and keeping the client away from the drop.

A simple traverse may only require a client to be clipped to the traverse rope with a karabiner onto their belt.

However, a more awkward traverse may require multiple anchors to guide clients safely. To manage a traverse such as this clients should use

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cowstails to ensure they can pass mid-point anchors without completely detaching themselves from the traverse rope.

This can be achieved by moving only one karabiner at a time. A good level of supervision would be expected from the group's leader in this scenario.

In this picture (right) the client has slipped, however is mainly suspended on the rock and partly supported by the rope. The client should easily be able to recover from this slip.

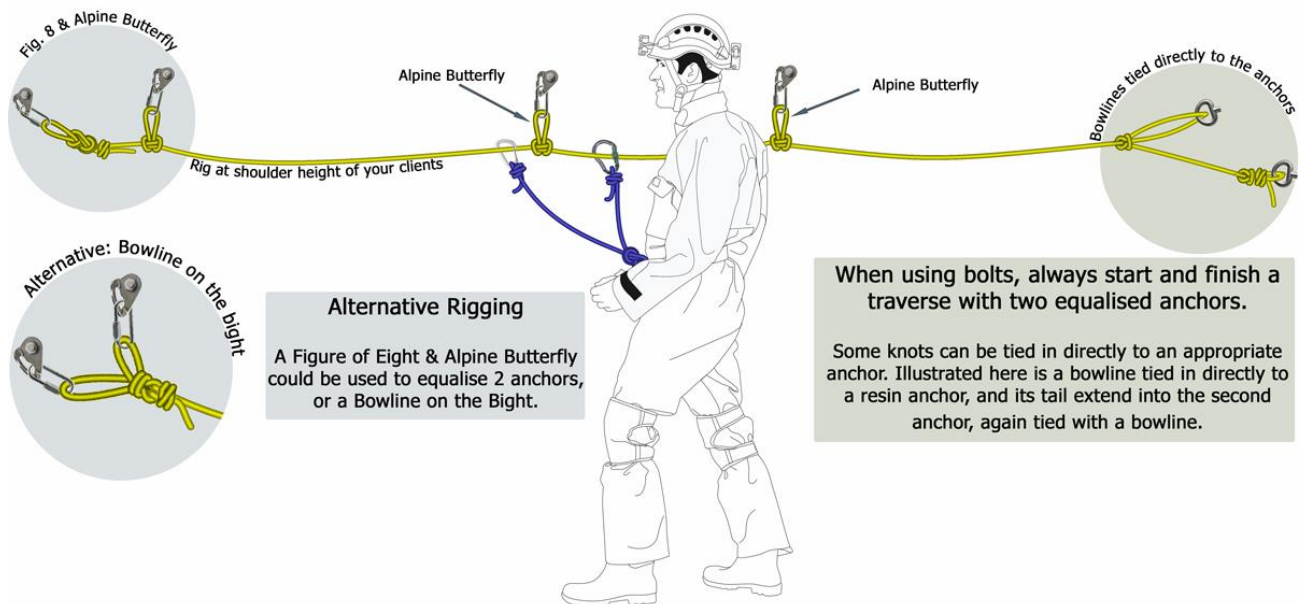
If this traverse had been rigged any looser, the client may well have slipped further and been suspended by the rope.

Making sure the traverse rope is well rigged is a key skill for the Cave & Mine Leader.



A slip onto a traverse

Traverse Line

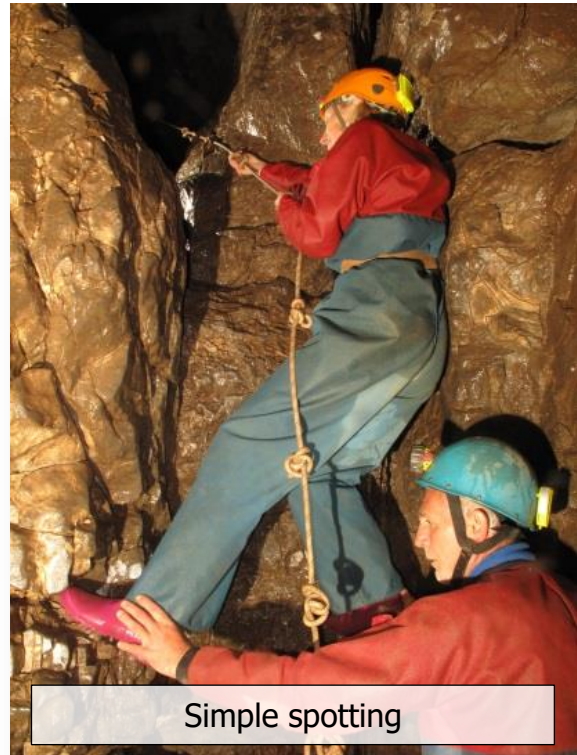


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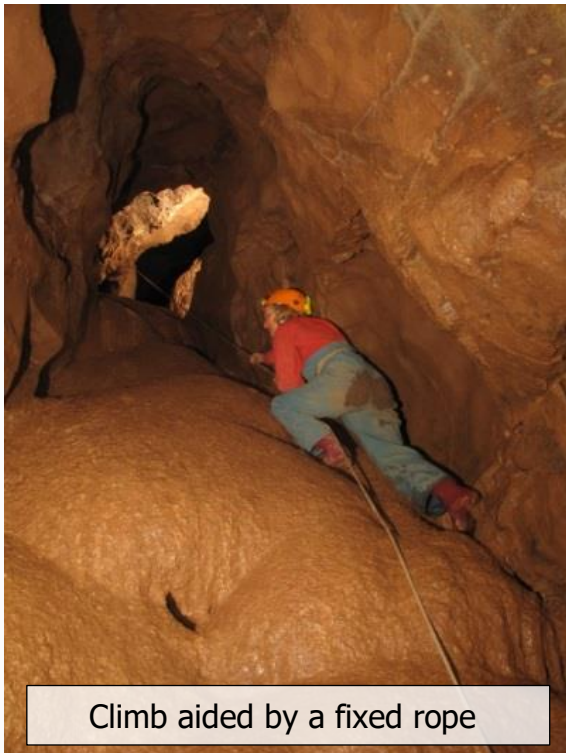
Handlines

In many instances it is helpful to rig a rope (knotted or un-knotted) for clients to pull on when climbing a short awkward step. In these situations it is important that the clients are proactively spotted as they climb to prevent a fall, for example physically supporting a client's foot on a hold as illustrated in this picture (right).

It is important to let your clients know what you're doing when spotting, taking care that any physical contact is appropriate to the situation. It would be sensible to have a discussion with your clients before setting off on a trip explaining the need to spot climbs so they know what to expect.



Simple spotting



Climb aided by a fixed rope

If the leader chooses to add knots (useful if the climb is particularly steep or awkward) then the knots on the handline should be small enough that the client can't get their hands in the loops and close enough together to be within easy reach. The client should hold the rope just above the knots. Many novice clients will lean back when using a handline so leaders should be prepared, particularly with novice clients with little upper body strength, to assist clients by pro-actively spotting them. Leaders need to be positioned in a safe area with a suitable stance to manage clients, without the risk of being knocked over themselves.

In this picture (above, left) the leader has placed a simple handline down a steep section of flowstone. The rope is of large diameter (10 or 11mm) so that the client can easily hold it. A doubled narrower diameter rope can provide a similar advantage.

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One issue here is whether the leader feels comfortable putting the rope up in the first place as there is no way to protect the leader once they are above spotting height.

As a broad reference, if a leader is uncomfortable climbing a pitch without the use of a rope, the pitch is probably beyond the remit of the Cave and Mine Leader award.

Once rigged the length of the climb in the previous photo makes it impossible to effectively spot clients. In this scenario the instructor will need to make a sound judgment call on the competence of their clients before committing to the pitch. It is wise to err on the side of caution and may be prudent to make use of the assisted handline to guide clients safely up this climb.

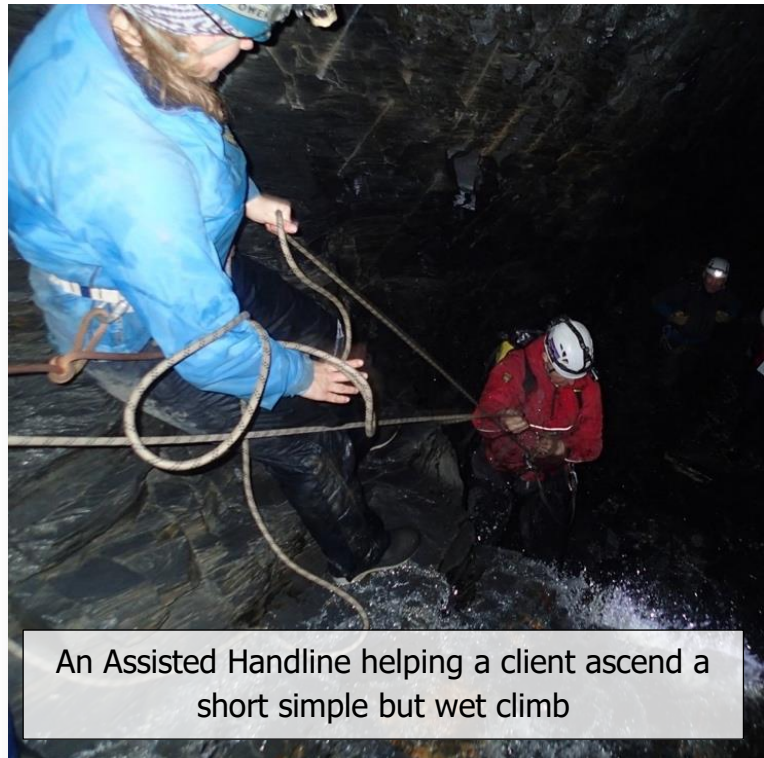
Assisted Handline

An assisted handline provides a client with a rope to pull themselves up on as well as giving the leader an element of control over the client, through a simple 2:1 mechanical advantage.

This is achieved by securing the rope to sound anchors at the top of the climb and dropping a loop of rope to the client which is clipped into his/her belt (this does not work as well with a harness, as the high attachment point can cause clients to trap their hands between the rope and karabiner when climbing). The client can pull themselves up on the side of the rope secured to the anchors, with the leader supporting the client by pulling the rope through the client's karabiner as they climb.

Instructors will need to manage the ropes carefully at the top of the climb ensuring ropes are coiled or dropped out of the way of the client, avoiding knocking off any loose rocks or having the rope tangle or snag during use.

This technique is particularly useful on slightly extended steep (but not vertical), broken or wet climbs (as pictured, above).



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Instructors need to maintain good visual and verbal communication with clients when managing these stances and be aware of the limitations of this technique.

Leaders must ensure they are secure at the top of the climb so they do not get pulled down themselves. An instructor can achieve this by clipping a cowstail to an appropriate knot in the rigging. It's normally preferable to clip to a knot rather than an anchor direct (if using bolts for example) as the rope loop can be adjusted for length, is flexible, and isn't reliant on a single anchor. Instructors should have at least one locking gate karabiner on their cowstails for this purpose.

Alternatively, the instructor could tie an extended loop to the rope at the top of the pitch and use this to attach directly to their own load bearing belt.



In some situations, such as on steeper slopes or when managing a larger client, it may be appropriate to bring the rope the leader is pulling back up through another karabiner at the top of the climb (as pictured here, left).

This can help as it adds a little more friction into the system, making it easier for the instructor to hold the rope in just their hands. Also, should a client slip or the rope be loaded, the instructor

holding the rope would be pulled up (rather than down the climb), which can make managing the climb a little more comfortable for the instructor.

If the instructor was concerned that they couldn't hold a client in just their hands the instructor could use an Italian Hitch in the karabiner at the top of the climb, further supporting the client and providing the instructor the option to tie off the Italian Hitch if needed.

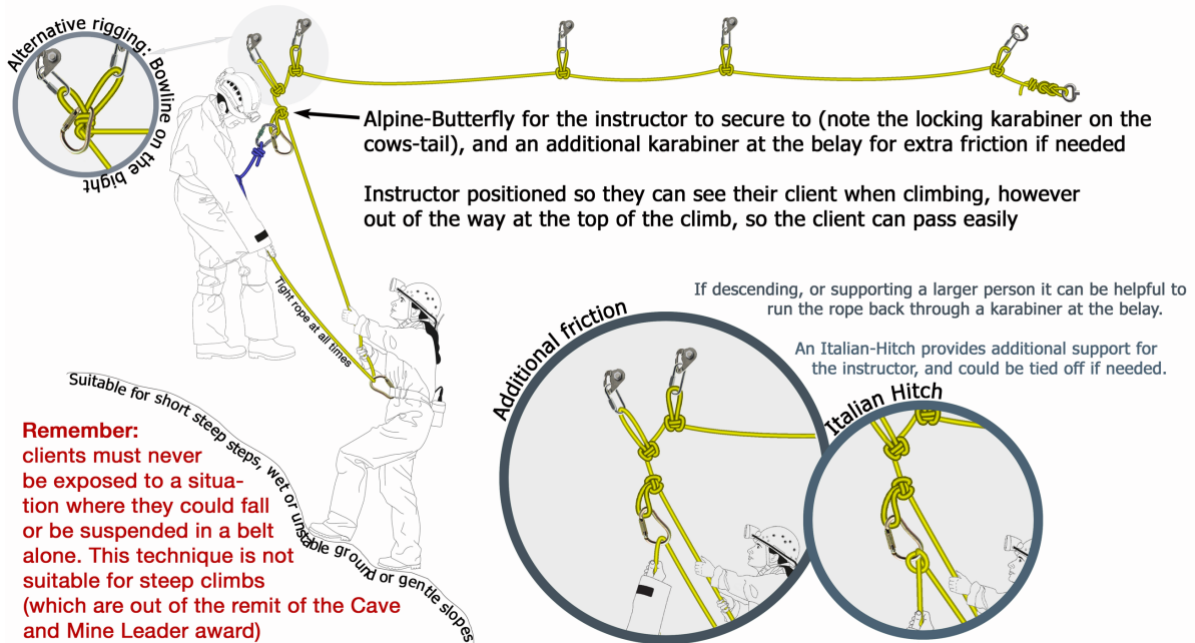
Adding an additional karabiner at the head of the climb can however make it challenging for the client to identify which rope they should be pulling on themselves, as both ropes run parallel to each other. It can also introduce twists into the system which will reduce efficiency and can make it difficult for the instructor to maintain a tight rope on the client. Maintaining good visual and verbal contact with clients is

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necessary to minimise these problems. **Ropes must be kept tight at all times when using an assisted handline.**

Depending on the climb, instructors may also need to consider how clients can safely make their way from the top of the climb to safe ground. It may be necessary to rig a short traverse at the top of the climb which clients could clip into using their cowstails. Various options on how an instructor may rig this are illustrated here.

Assisted Hand-line



When managing a climb, instructors should consider where they would be best positioned to ensure they can see clients as they ascend/descend, and not hinder client's progress on or off the climb.

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Lifeline

In some situations, it may be more appropriate to belay clients up or down a climb in the more traditional climbing style.

For example, if there are already fixed aids for the instructor and client to use, such as a large diameter rope, chain, or ladder. Or if a descent/ascent is too narrow (such as a tight squeeze in a cave) for the assisted handline to be of any benefit.

A lifeline may also be necessary if a client is not wearing an appropriate belt (for example in an improvised or emergency situation) but needs additional support ascending or descending a climb. In this scenario it's possible to tie a loop (a bowline is great for this) around a client's waist/chest. However, this will need to be adjusted so it's snug for each person, which can be a challenge if the instructor needs to belay clients up a climb when positioned at the top of that climb.

In these photos the leader has attached the rope to a bombproof single anchor with a bowline.



A Lifeline rigged with from a large spike using an Italian Hitch



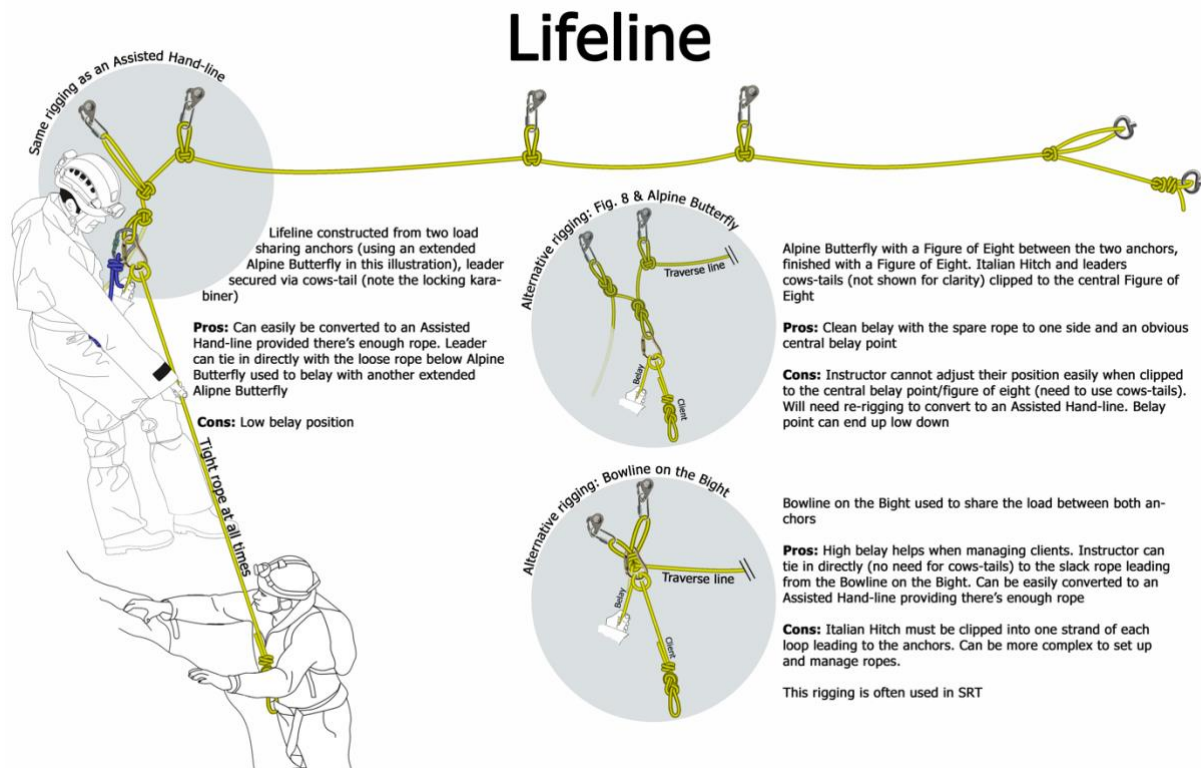
Lifeline with an Italian Hitch

Closer to the head of the climb a double figure of eight on the bight has been tied with one long and one short loop. The long loop is attached to the leader's belt via a karabiner. The short loop has a large/HMS karabiner in it with an Italian Hitch which connects to the client's belt via a karabiner (pictured, left).

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Within the Cave and Mine Leader award this technique is appropriate when the slope is steep but not vertical so, provided the leader keeps a very tight rope on the client, should they slip they would not fall or be suspended on the rope. Steeper ground would fall under the remit of the Vertical award where harnesses rather than belts would be necessary.

There are several variations in lifeline rigging, some alternative belays are illustrated below.



Instructors need to be very cautious when life-lining, ensuring clients are kept on a very tight rope as a fall onto only a belt or rope loop will likely injure the client.

Instructors also need to be mindful that some clients will pull on the belay rope in the absence of any other hand holds generating slack rope between the attachment point on the belt and the rope held by the instructor. In this scenario, a slip could generate a significant fall, again likely to injure a client.

Another challenge with this technique can be getting the rope back down to other clients at the base of the climb. One solution (providing a long enough rope is available) is for the knot that clients clip themselves into to be tied in the middle of the rope, so one end remains on the ground once the climber reaches the top of the climb. The remaining clients can then pull the rope back down before clipping themselves into the rope and starting their climb.

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Leader Protection

In all situations where the leader has decided to use a rope to protect their clients the leader needs to consider their own safety.



An Italian Hitch used to support the Instructor during their descent

On a steep climb down, that the group is not going to return to, the leader could use a double Italian Hitch to assist their descent (pictured, left). This is not a true abseil as the ground would be steep but not vertical within the remit of the Cave and Mine Leader award.

Alternatively, it may be appropriate for the leader to simply wrap the rope around his/her arms and back to provide some additional support at they descend often referred to as "Angel Wings" (pictured below). Gloves are

advisable if using this technique to descend the rope. Again, this is a useful technique for sloping ground, but would not be appropriate for steep or vertical terrain.

If the rope can be threaded around a large spike or through two appropriate (resin for example) anchors then once the leader has descended he/she can pull the rope down.

If an assisted handline has been used to protect the clients down a climb, and the group are planning to return the same way, it makes sense to leave a rope in situ for the return trip.

Clients, or a competent second, can help protect the

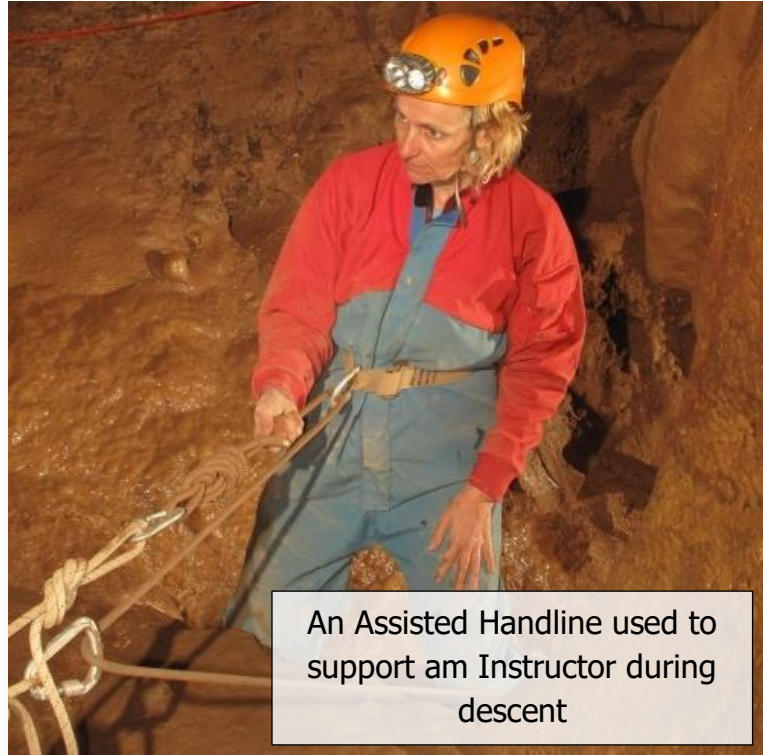


"Angel Wings" descent provides the instructor a little more grip on the rope when descending

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leader as he/she descends by making use of a re-directed assisted handline. The leader would need an assessment about the group's competence before committing to this.

In this picture (right) the instructor has rigged an assisted handline with an additional karabiner at the head of the climb. The group, or a competent assistant, can help protect the leader from the base of the climb by holding the rope (provided it's long enough) as the leader descends or ascends the climb making use of the assisted handline.



An Assisted Handline used to support an Instructor during descent

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Emergency Techniques

It may be necessary for a leader to improvise a harness as an emergency technique to get an injured or struggling client to a safe place.

In any emergency situation instructors should be mindful of their limitations and look to get an injured client somewhere safe and seek assistance, rather than embarking on an ambitious solo rescue. It should be emphasised that these are emergency techniques and should not be used for any planned activity.



Sling used together with a broad belt to construct an improvised harness

If a client is wearing a broad caving belt it is possible to improvise a harness by crossing a tape sling to form a figure of eight shape and have the client step into each loop of the sling (pictured). The sling can be shortened with a simple overhand knot at one side and clipped into the belt. If the instructor has no sling the same can be achieved by tying a bowline on the bight to create 2 small loops for the legs, and an alpine butterfly to secure the rope to the belt.

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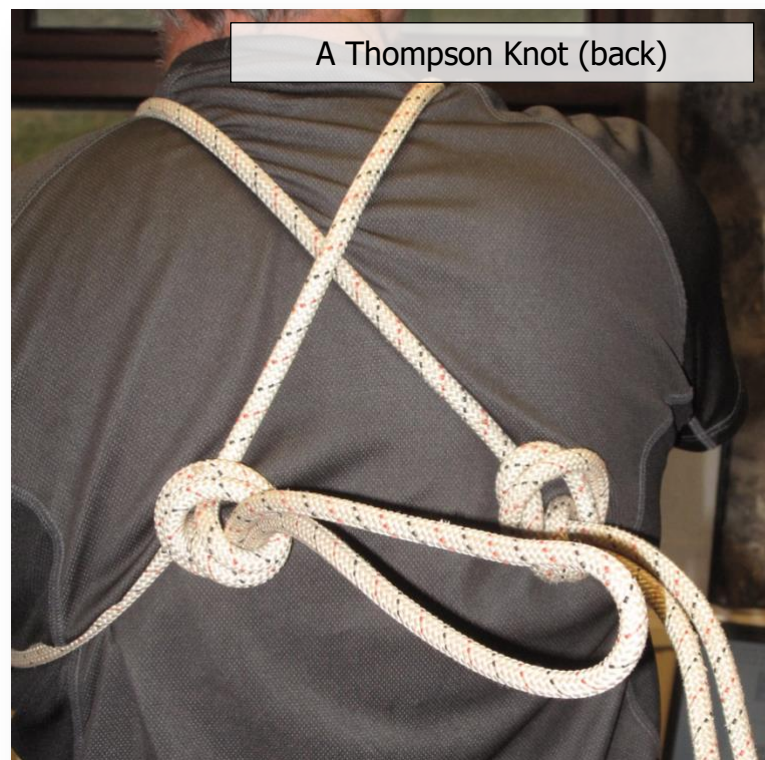
If clients are not wearing an appropriate (or any) belt it is possible to construct an improvised harness from a rope (providing it is long enough) by tying a Thompson Knot (pictured, left). The rope is flaked to form four loops, one for each limb. The whole bundle of rope is then gathered together, and a large overhand knot tied in the middle, resulting in four loops. Legs are passed through two of the loops with the other two loops

passed over the arms and crossed on the client's back.

Loops can be shortened by overhand knots (pictured, right).

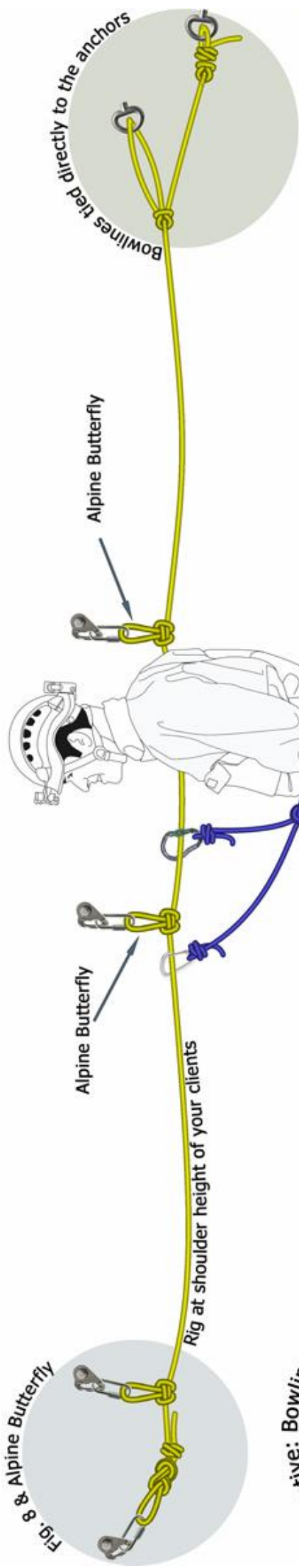
The aim should be to have the central knot around chest height on the client with all loops as short as possible.

Bear in mind these improvised harnesses will be uncomfortable at best with clients and may rely on a belt which is unlikely to be rated for any significant load.



Traverse Line

Fig. 8 & Alpine Butterfly



Alternative Rigging

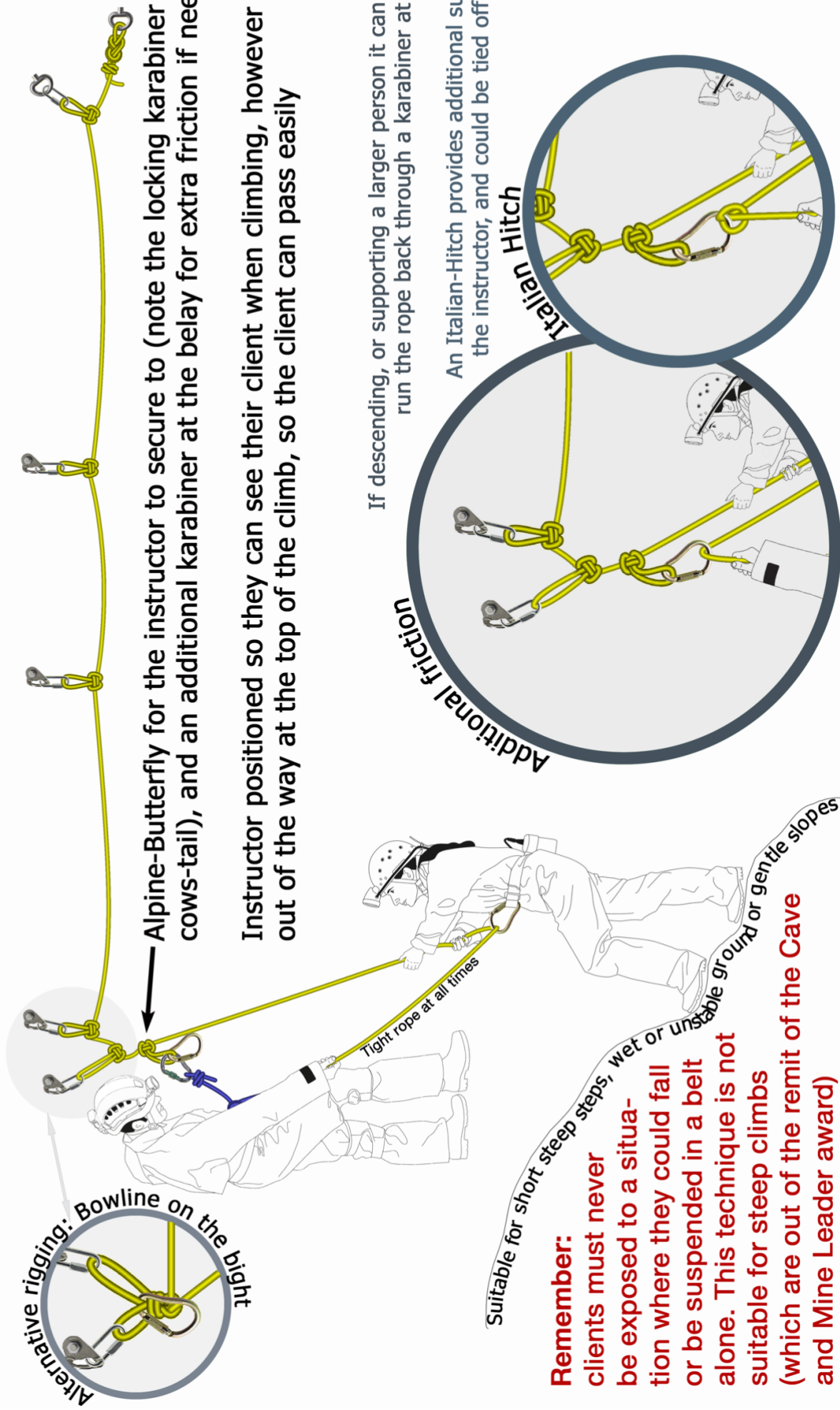
A Figure of Eight & Alpine Butterfly could be used to equalise 2 anchors, or a Bowline on the Bight.



When using bolts, always start and finish a traverse with two equalised anchors.

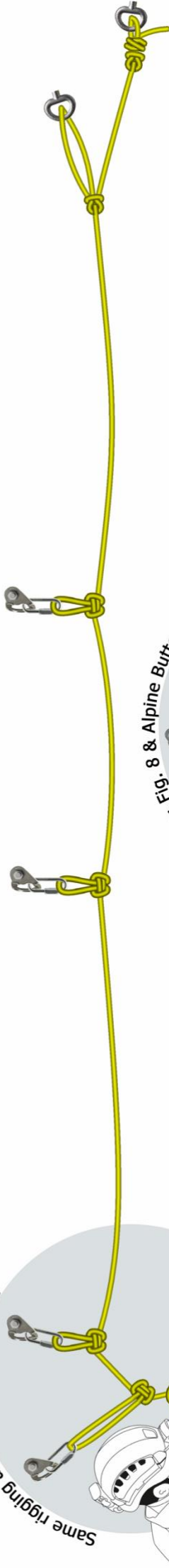
Some knots can be tied in directly to an appropriate anchor. Illustrated here is a bowline tied in directly to a resin anchor, and its tail extend into the second anchor, again tied with a bowline.

Assisted Hand-line



Lifeline

Same rigging as an Assisted Hand-line



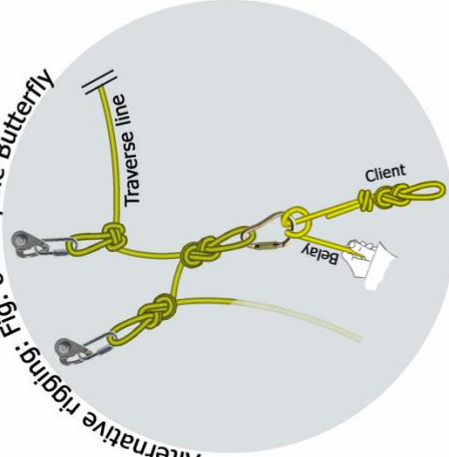
Lifeline constructed from two load sharing anchors (using an extended Alpine Butterfly in this illustration), leader secured via cows-tail (note the locking karabiner)

Pros: Can easily be converted to an Assisted Hand-line provided there's enough rope. Leader can tie in directly with the loose rope below Alpine Butterfly used to belay with another extended Alpine Butterfly

Cons: Low belay position

Tight rope at all times

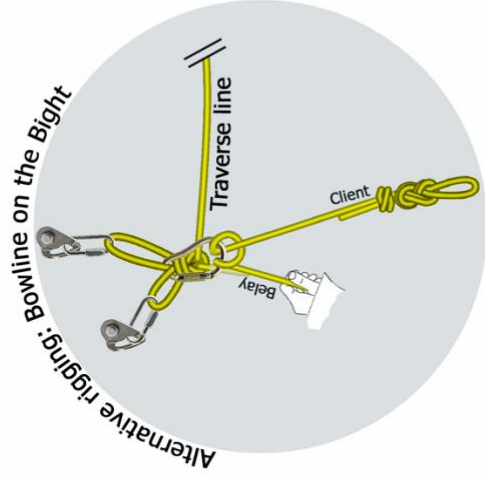
Alternative rigging: Fig. 8 & Alpine Butterfly



Alpine Butterfly with a Figure of Eight between the two anchors, finished with a Figure of Eight. Italian Hitch and leaders cows-tails (not shown for clarity) clipped to the central Figure of Eight

Pros: Clean belay with the spare rope to one side and an obvious central belay point

Cons: Instructor cannot adjust their position easily when clipped to the central belay point/figure of eight (need to use cows-tails). Will need re-rigging to convert to an Assisted Hand-line. Belay point can end up low down



Bowline on the Bight used to share the load between both anchors

Pros: High belay helps when managing clients. Instructor can tie in directly (no need for cows-tails) to the slack rope leading from the Bowline on the Bight. Can be easily converted to an Assisted Hand-line providing there's enough rope

Cons: Italian Hitch must be clipped into one strand of each loop leading to the anchors. Can be more complex to set up and manage ropes.

This rigging is often used in SRT

