# Anchors in Earnest

**Basic Anchor Considerations for Experienced Trip Leaders**

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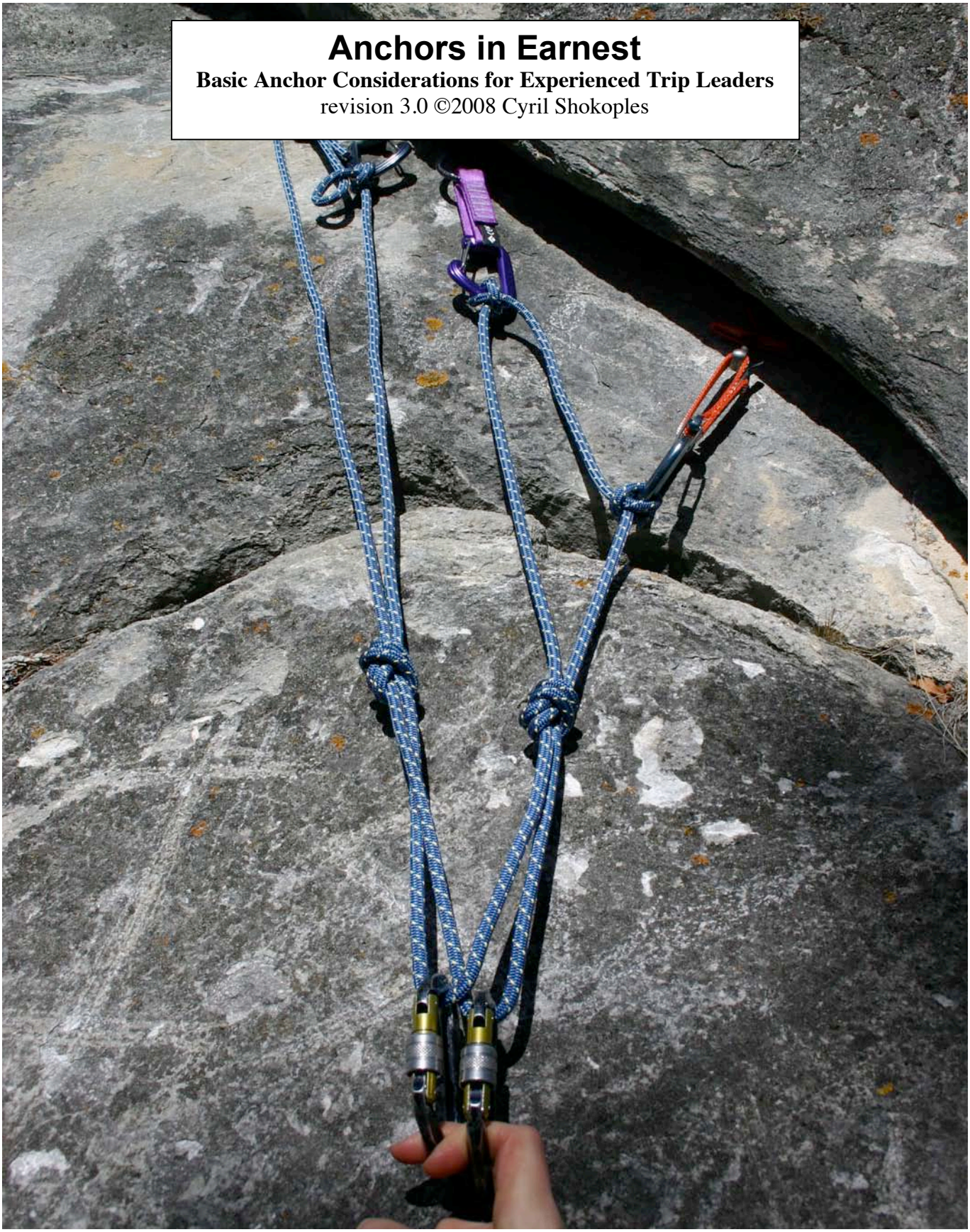

 

**Table of Contents**



 

# Anchors in Earnest

**Some Basic Anchor Considerations for Experienced Trip Leaders**

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***WARNING**: Failure to use any or all of the techniques or systems explained or illustrated in this article in an appropriate manner could result in property damage, injury or death. Expert instruction and constant practice are mandatory. This is not a stand alone instructional article. It is designed to accompany professional instruction and practice under supervision.*

## Introduction

> *The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn.*
>
> Alvin Toffler
> *Rethinking the Future*

This is the third major revision to this article in the last five years. This article should not be taken alone out of the context of the greater body of knowledge regarding climbing technique. This body of knowledge is rapidly changing at a rate that is faster than at most times in the past and requires us to be willing to evaluate our systems and employ critical thinking in deciding which type of rigging best suits our needs.

This article is written for the highly skilled intermediate, advanced or expert leader who is looking to lead groups of less experienced friends in a club or similar setting and will be leading most of the time on a given outing.

We will focus less on anchors common to recreational climbers in a party of two experienced individuals swinging leads. Instead we will look at some alternative methods of anchoring familiar to mountain guides and others. The use of a 6m length of 7mm nylon accessory cord figures highly in many of the examples. This versatile piece of gear is now becoming the norm on the average climbers rack and has come to be called a "*cordellette*" but old timers will still call it a Prusik sling or accessory cord.

Some of the techniques discussed are well known and others have not yet filtered down to the entire climbing community. This article will also review general considerations of common anchor types. It is assumed that the reader has an intimate knowledge of the use of chocks, camming devices, pitons, bolts and natural anchors and can make a determination if a protection piece or natural anchor is more or less likely to be sound.

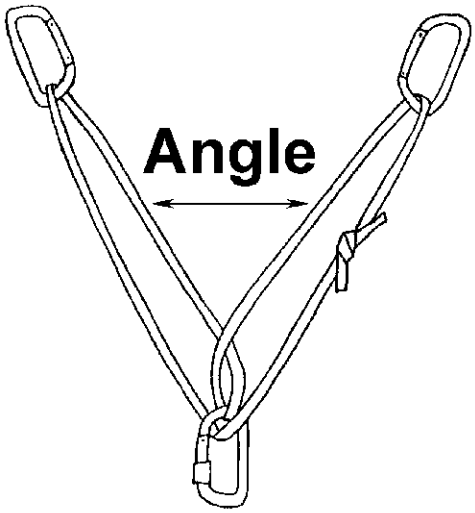
Let's begin by looking at some of the criteria to assess whether an anchor is going to be safe. Remember that this is a guideline and NOT an absolute set of rules. There may be many times in which one or another of the EARNEST criteria are maximized while another is minimized based on a given set of circumstances. Considerations such as the quality of the primary placements (large tree, new bolts, old rusty pitons or sketchy nuts in friable rock) and fixed vs. changing direction of pull can alter the final product. A good starting point is the EARNEST mnemonic.

## EARNEST

**E**qual tension
**A**ngles appropriate
**R**edundant
**N**on – **E**xtending
**S**trong
**T**imely

***Equal tension*** implies that in a multi-point anchor the load is shared relatively equally between the pieces within the anchor. This can be one of the most elusive of the considerations to actually achieve.

***Appropriate angles*** refers to the angles that the outside legs of a sling should make. Generally the angles should always be kept well below 60 degrees in a two piece anchor and absolutely less than 90 degrees in a three or more point anchor. Less is better. ***Strive for 25***.




***Redundant*** means that only in special circumstances would you use a single point anchor. The less you like the strength of the individual pieces in an anchor the more pieces there should be. I once made an anchor with five ice screws and both of my ice tools and still felt scared. We decided to retreat right after that!

***Non-extending*** means that if one of the points in your anchor should fail you should not have a situation where the entire anchor shifts a great distance with possible loss of the belay as the belayer may be pulled out of position or over an edge.

***Strong*** means that ***each primary placement in an anchor should be good or bombproof unto itself***. Avoid being satisfied with a multi-point anchor where each point is weak by itself. This can lead to catastrophic failures when all the pieces "*zipper*" or cascade out.

***Timely*** means that you should strive for safe simple anchor constructions that don't waste time. Wasted time in setting up belays can leave you out overnight or still trying to scratch your way to the summit as the afternoon thunderstorms start rolling in. Practice rigging is the best way to get fast! Be efficient and you will enhance your safety.

The EARNEST mnemonic does not include the consideration that some anchors must be multi-directional. So although EARNEST gets you a long way in assessing your anchors, there is more you should think about each time you clip in.

## SRENE and IDEAL

John Long argues that everyone should adopt the mnemonic SRENE for anchor building to keep a common terminology between climbers. French, German and Spanish climbers may find this doesn't fit well for them. The idea is sound in principle but difficult in practice. In order to allow climbers who are schooled in different locations to exchange concepts I have included the three most common mnemonics in Canada for comparison.

## EARNEST

**E**qual tension
**A**ngles appropriate
**R**edundant
**N**on – **E**xtending
**S**trong
**T**imely

## SRENE

**S**olid
**R**edundant
**E**qual Tension
**N**on – **E**xtending

## IDEAL

**I**ntegrity (of the overall anchor and each primary placement in it / also see below)
**D**oubled (or more, for redundancy)
**E**qual tension
**A**ngles appropriate
**L**oading (direction of pull considered)

Integrity of Primary Placements consists of:

- quality of the rock
- quality of the placement
- size of the gear (size matters! i.e. bigger gear is better than smaller gear)
- direction of pull considered
- reduction of leverage or multiplication of forces (i.e. rigid stem cams over horizontal edges)

IDEAL has been recently taught in the Association of Canadian Mountain Guides' training programs and may still be the mnemonic taught to aspiring guides in their Rock Guide program.

## Anchor Failure, Primary Placements and Material Facts

One thing that is often overlooked when leaders build anchors is the importance of the individual primary placements in the overall integrity of the anchor. Retrospective analysis of anchor failures have shown a few distressing shortcomings and some surprises that some may find unbelievable. Suffice it to say that a few people have died and many more have been injured allowing us to discover some of the following information:

1) Don't gamble on using a bunch of moderately tolerable placements for your main anchor. Use the biggest, strongest placements you can find and be sure your gear is placed in solid rock. Small to medium primary placements in anchors fail far more often than large primary placements. Of particular note is the fact that small or medium placements in horizontal cracks have a habit of being less bombproof than a few climbers have thought. Trying to equalize a bunch of weak placements generally gives you a weak anchor. Don't rely on equalization or load distribution. Use strong primary placements whenever possible instead.
2) Place a good bombproof piece of protection as soon after leaving the belay as you can possibly manage. Don't think of this as *just* your first runner as in fact it is really protecting your belay and is an integral part of your anchoring system. A few years ago I witnessed the aftermath of a climber taking a factor two fall directly onto the belay. The anchor failed and the two climbers plummeted 200 – 300 meters (700 – 1000 feet) down the V gullies on Mount Andromeda. Miraculously they both survived, albeit with significant injury. A bombproof first piece of protection may well have completely prevented the anchor failure.
3) DO NOT clip into your belay anchor with a daisy chain. In fact, don't even think of it. Despite what your sport climbing friends may have taught you at the crag, this is not a safe practice. Use the climbing rope instead. A daisy chain is a relatively static component. Several fatalities in the US have now been directly attributed to the use of daisy chains as the main tie-in point. A significant number of accidents have also been seen in Europe. All of the manufacturers of daisy chains recommend against it. Tests by Kirk Mauthner in British Columbia have demonstrated eye-opening failures in very short falls onto a daisy chain. In addition, it is possible to double clip a daisy chain in such a manner that very, very low loads can cause total failure. And if that is not enough, it may make it impossible for you to escape the belay in certain types of falls. Read the latest edition of *Climbing Anchors* for a more complete treatment of this topic.
4) A number of tests have now confirmed that 7mm nylon cord may be a better material for most types of anchor construction for climbing. It provides good dynamic qualities, has better edge resistance, lasts a long time, and is strong. Most of the new high tech fibers do not have all of these qualities, especially not in the area of dynamics. They also must be replaced more often and have poor cutting resistance over edges. Even though the new fibers may be strong, they still may let you down in certain applications.
5) Remember that falls may not be straight up and down. Consider direction of pull carefully and whether a swing or pendulum can occur. Rig accordingly.

## Single Point Anchors

We just reviewed a mnemonic that has as one of its premises that anchors should be redundant. Is there ever a time when we would anchor off a single point? Any experienced climber will tell you that indeed there is. So what do we need to think about when it comes to single point anchors?

- Is it bombproof and tested? If it's a large tree push it back and forth to see if it is well rooted or ready to fall over. Is the tree alive or dead? If it is a rock horn kick it repeatedly to see if it wiggles. If it's a large boulder kick it and yank on it repeatedly to be sure it is seated and not ready to slide away with you and your partner attached. (Don't drop it on anyone below!)
- Are the loads going to pull in a predictable manner and direction?
- Are the forces on the anchor going to be high or low?
- Are you going to be checking a slip or catching a fall?
- Are you braced and belaying off your body with the anchor as a back-up or are you belaying directly off the anchor?
- What is the probability of a fall?
- What are the consequences if the anchor fails?
- How experienced are you at assessing these types of situations?

An experienced guide or leader in some situations may belay off a single piton, ice screw or bolt but usually only after careful consideration of the above factors and more. That is not to say that single piece anchors should become your norm… far from it! They should be your exception in technical climbing. Be aware that not all situations are the same and the better and more experienced you are at looking at all the variables the more likely you are to make the right choice. Always assess the possible consequences of your decision. If you make the wrong choice, how much will you and your partner(s) have to pay?

Let us continue the anchor discussion by looking at single point tree anchors as the most obvious example of single point anchors. We will start with the basic assumption that we have chosen a reasonable sized well rooted live tree and tested it appropriately. We will reduce the leverage on it by anchoring low down on its trunk in most cases.

### Girth Hitch

A Girth Hitch around a tree is a fairly common practice in climbing circles but in fact it is ***not necessarily the best anchoring practice***. In all likelihood it will sustain the average fall, but it creates a higher load at the point where the sling runs over itself than we would like. If you pull off on the side of the Girth Hitch in the wrong way you also get the effect of a mini-pulley system increasing the load on the sling. So what else is there? Let's look at some good and bad alternatives to the Girth Hitch.

## Clipping into a Doubled Sling

This can sometimes be a reasonable thing to do, but in this particular case the ***bad angle of the sling*** around the tree is going to ***increase the forces*** in the sling and at the carabiner.


With an angle that big we also risk three way loading on the carabiner (more on that later) if things wiggle around a bit. This is a case of a good idea with poor execution! So far things don't look that great. Let's look at another example.

## Clipping into a Long Doubled Sling

In this case we have increased the length of the sling we are using and have gotten that nasty angle back down to where it is more manageable.

The ideal for this situation is to have the angle between the legs of the sling down to 25 degrees. This reduces forces and also makes the loading on the carabiner better. It also reduces the possibility of three way loading. To further reduce the risk of three way loading a DMM Belay Master™ carabiner is being used here which captures the rope and webbing in the appropriate positions.

## Doubled Sling with Master Point

In this case the sling is taken doubled around the tree and tied off in a figure eight knot to create a ***Master Point***. This master point eliminates the three way loading problem. It is great for situations where you are leading a group of less experienced folks on a climb as it gives them an identifiable point for clipping in to.

A common technique is to untie a knotted sling and then retie a single sling around the tree (not illustrated.) The final tree illustration we will show is rarely seen in recreational climbing but a necessity for organized rescue situations where large loads and low stretch ropes can create high impact forces.

## Wrap Three / Pull Two

This configuration is the way to get the most of your rope or webbing sling. The knot is effectively removed from the equation as it is a full wrap around a tree away from where the load is applied. The load is shared between two webbing slings with little angle and no three way loading problems. No wonder this is one of the anchoring methods of choice for rescue situations. It is time consuming and overkill for climbing, but it may be worth knowing as you never know when you need the ultimate bombproof tree anchor.

## Boulders as Anchors

Be certain that the boulder is large and very well imbedded into surrounding rock or soil. Before trusting it you should kick it and yank on it repeatedly to be sure it is seated. Make sure that the webbing does not slip up and over the boulder or get yanked off. Good strong webbing may be better than cord in applications such as this as cord may have a tendency to roll off, where the webbing may stay put. Take the time to be sure that this single point will be strong and secure. The photo shows a large boulder which required a 6m or 20' sling to go around it properly. This keeps the angle small. In the last 25 years at least six instances of single boulder rappel anchor failures have been recorded in "Accidents in North American Mountaineering". Recall that rappel anchors only have to hold 3.5 kN in an extreme situation. Climbing and lead falls can generate a lot more than that!

## Rock Horns as Anchors

Horns are one of the mainstays for climbers of classic alpine routes. When used properly they provide rapid secure anchors for both climbing and rappelling. As with boulders they must be tested well before use and backed up if required. Be sure the horn or flake you are using is actually attached to the mountain. Boulders and horns tend to be unidirectional anchors however and other constructions may be necessary for a truly multi-directional anchor.

The same considerations of webbing versus cord apply. With both boulders and horns you should be alert for sharp edges which could cut your webbing or cord. As with other anchors, keep the angles small.

## Natural Chockstones

Large rocks occasionally wedge into cracks and are called Chockstones. After proper testing a large lodged chockstone may also be slung as an anchor with due attention to the potential for cutting. Occasionally, you can create an artificial chockstone by wedging a rock into an appropriate constriction in a crack as shown at left. This particular chockstone would be good for a downward pull as one of the primary placements in a multi-piece anchor but would not be sufficient as a single point anchor.

## Threads or Pinches

Occasionally natural rock features allow a sling to be threaded through a natural hole or tunnel to provide a point of protection or anchor. The same considerations discussed above regarding testing and sharp edges apply. The thread shown in this photos is likely inadequate as a single point anchor on its own, but could be used as part of a multi-point anchor system where two or more pieces are joined to make an EARNEST anchor.

## Two Point Anchors

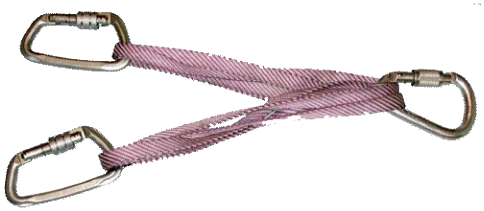
There are many situations in which you are presented with two great pieces of protection with which to make an anchor; two solid pitons, two good bolts, etc. There are some rapid and reasonable ways to configure a two point anchor.

### Sliding X Equalizer

When using two strong secure pieces of protection such as bolts or well placed pitons it may be appropriate to go with a "*self equalized anchor*". (They have also been know as *"equalizers", "sliding knot", "sliding-X*" or "*magic-X*" anchors.) They are often considered when the direction of pull will be changing or when it is very difficult to assess the actual direction of pull. Let's examine a few pros and cons of equalizers.

Some experts object to the words "self equalizing" as research has shown that when the load shifts, the anchor does not truly equalize the load because of friction and pinching of the sling on itself. Many three point "equalizing" setups are particularly bad in this manner and won't be discussed further here. Many have chosen to now call these "pseudo-equalizing anchors" or "load distributing anchors" to identify their true nature. I have chosen to continue to use the traditional and widespread term "equalized" even though it is technically not 100 percent accurate.

Equalizing setups are also sometimes used to try to share the load between marginal pieces. Use this concept with caution as rapid loading of the single remaining piece may follow failure of the first piece. The resulting extension of the sling may allow a belayer to be left dangling over the edge of the ledge having let go of the belay rope. If you want to reduce extension there are several possible answers.



Shorten the sling by doubling it up in its entirety. This will effectively halve the length of any possible extension. Be aware that if the angle between the two legs is increased by doing this you may have partly defeated your purpose of creating an EARNEST anchor. You may need to try an alternate strategy to limit the extension that we'll discuss in a moment.

Besides significant extension which may result in the belayer being pulled off a small ledge, the other significant problem with "*self-equalizing*" anchors is that they are not truly redundant in that failure of the sling itself would lead to total failure of the anchor. In what sort of the situation could this possibly happen? Just imagine using a knotted webbing sling or a knotted cordellette in which the bend or knot joining the two ends comes loose or was tied incorrectly or with tails much too short. Once the knot comes undone the entire anchor fails.

This has occurred on several occasions in rappel anchors with serious or fatal consequences and has been reported in "Accidents in North American Mountaineering". A similar potential for total failure exists if the sling is cut over a sharp edge. Some folks consider this lack of redundancy to be a major weakness, particularly when using non-sewn slings where knots will be a constant concern. What can be done to mitigate these circumstances?

## Limiting Knots

These two knots are great to reduce the amount of extension while retaining the benefits of equalization.

You can keep your sling long to keep the angles and forces low as well as allowing for a changing direction of pull. By adjusting the actual locations of the knots you can decide the actual range of movement that is allowed by your anchor. Let's examine the affect of the two limiting knots in this photo on the previously discussed shortcomings of the sliding equalizer. Let's look at each of the possible failure scenarios in turn.

1. What if a knot in webbing or a cordellette comes untied for whatever reason? We get 8 cm of extension (3 inches) and the second piece takes the load.
2. What if one of the two anchor pieces fails? We get 8 cm of extension and the second piece takes the load.
3. What if the sling gets cut? We get 8 cm of extension and the second leg takes the load.

How bad a 'shock load' is caused by that amount of extension? With a statically applied load it is less than or equal to the typical range of forces expected in a very short top-roping fall. Even in a dynamically applied load the "shock-load' per se is negligible but the actual load may be double the force that the leg originally held if the anchor was distributing the load well. Recent testing suggests that our past concern with shock – loading may have been dramatically overstated.

Our choices for a two point anchor will not often include the sliding equalizer alone as it has no real redundancy and has excess extension if one piece of the anchor fails. If that is a concern you can use independent slings, a cordellette with a master knot, a sliding equalizer with two limiting knots or perhaps… the NEW Equalette. None of these alternatives is really complicated! In some limited cases a single limiting knot may be used. When one leg of an anchor is dramatically longer than another only **one limiting knot** may be used to create your equalized setup.

## Independent Slings

You can use two independent slings when you are fairly certain of the direction of pull and you need to build a two point anchor with limited gear. The lengths often need to be adjusted to create distributed tension. An Example of an anchor using independent slings along is shown next.

On the left we have two totally bombproof pieces that we wish to join together to make a simple anchor to bring our partner up from below.

The quick draws are interconnected at right with non-locking carabiners in this case being connected in an opposite and opposed fashion. A locking carabiner could just as easily be used. We clip ourselves in and prepare to belay provided that we are certain that the direction of pull is going to be at the correct angle. If it is not then we need to rectify the situation before going any further.

This is a fast and simple solution providing that your two pieces are bombproof and you watch for possible three way (triaxial) loading of the carabiner(s). The greater the angle between the slings, the more likely three way loading becomes.


## Three Way Loading and Cross Loading

These evil twins can reduce the load a carabiner can hold to a third or less of its strength compared to the gate closed strength of a carabiner along the major axis. (The major axis is along the spine of the carabiner). These evil twins should be avoided like the plague!

An interesting solution to reduce the possibility of three way loading is the use of a DMM Belay Master™ carabiner. It holds everything neatly in place, but of course if you don't have one of these carabiners you might as well be on Mars for all the good it will do you. Any other ides?

Right… **Knot the independent slings together**. A simple and ingenious solution that also gives us that master point that we discussed earlier with the tree scenarios. The chance of three way loading is gone as well. But if you are going to go that far you might as well consider another alternative that makes it quick and easy to get some load sharing within a narrow range of loading angles without a lot of fussing around. Grab a long sling or cordellette.

## Knotted Sling With Master Point

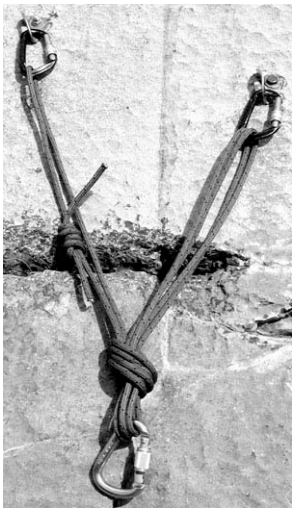
Using a single long sling or cordellette, pull in the direction of the expected loading to get the strands under equal tension then tie a knot to make the strands independent and there you have it. Quick and dirty. This reduces the chance of any extension, but is a hard to get the load distribution quite right if you cannot accurately predict the direction of pull.

It also turns out that if the legs of a knotted sling are drastically unequal the load will also be unequal. What it amounts to is that the knotted sling with master point is quick and simple but not great if the direction of pull shifts or is unpredictable.

On many alpine climbs you may have a limited selection of slings with which to build anchors. What if the sling you have available is a 6m long, 7mm diameter cordellette and you want to join two secure pieces into the anchor with a known direction of pull? How do you deal with all that excess length in a quick and tidy manner?

The simplest is to use another quick sling trick. Join the ends of your cordellette with an appropriate bend (double fisherman's / grapevine, etc.) Clip one end of the sling into one of the two anchor points. Drop the remaining end of the sling through the other anchor point and make the ends come out even as in the photo at left.

Now use an appropriate knot (overhand, figure of eight) to create a master point to join all the strands together as shown in the photo at right. Voila! You have a super fast way of creating a shorter anchor.



## Equalette – Two Point

The two point equalette is simply a slight modification on the sliding X. Tests as early as the 1980s showed that a sliding X style equalizer could actually bind up and prevent true equalization. Add this to ordinary friction and often only one of the two legs of a two point anchor takes most of the load.

More recently, tests reported in the 2006 edition of *Climbing Anchors* validated the earlier results and a better configuration dubbed the **Equalette** was born. In its simplest form two carabiners are placed into the master point of a sliding X configuration. One is placed on each strand instead of using an "X". This eliminates the binding and reduces the friction and thus far better load distribution results. Alas, you need two carabiners!

A more detailed discussion of the relatively new equalette will follow in the section on multi-point anchors. It is conceivable that the equalette may emerge as one of the better constructions for many two, three and four point anchor constructions. Given some of the recent testing, we may find that knotted slings with a master point and independent sling constructions may be used less often than in the past with the equalette gaining prominence in situations where direction of pull is uncertain and may change plus in situations where better load distribution is desired.

## Quad

John Long advocates a further variation on the Equalette theme for use in bolted top roping situations where you want a bombproof top anchor for having a herd of folks yo-yo up and down on a route. It is simply a two point equalette made with a doubled cord and limiting knots. You now will have four strands coming down to the master point. You clip three of the four strands with three carabiners opposite and opposed to create a ridiculously beefy anchor that any paranoid would feel safe on. See his book for photos.

## Death Triangle

One type of two point anchor should be avoided. It has been called the **death triangle**, although I am unsure that anyone has died using it. Be that as it may, this simple arrangement of slings and carabiners has the potential to load your pieces more than you expect in unexpected directions. There is no redundancy in the event of the sling failing (if it is cut or a knot slips or unties). In any case, it is best to steer clear of this stinker.

# Multi – Point Anchors

## Load Distribution and Equalization in Anchors

It has been know for quite some time that the sliding X equalizing anchor had a tendency to bind up and not equalize in some situations. It is also well known that a knotted sling does not equally distribute the load if the pull is more than ten degrees off axis.

For a long time it was widely believed that if the pull on a multi-point knotted sling anchor configuration was in the axis for which the pull was intended, the sling would generally distribute the load fairly evenly provided that the rigger was careful in the construction. Recent test showed surprising results if the legs of a knotted sling were of unequal length. The longest leg would hold far less load than the shortest leg due to the stretch in the anchor building material.

If the legs of the sling were of relatively equal length, the rigger was attentive to making sure that the legs were under relatively equal tension to begin with and the direction of pull was accurately determined then the load may be somewhat reasonably distributed. If these conditions are not met then there may be radically unequal load distribution of the load onto the primary placements.

The worst case scenario could see successive failures of each individual placement in a zipper-like failure. Having taken a zipper fall (or two) in my younger days as an aid climber, I can attest to the fact that many pieces can fail if they each take the load in succession rather than sharing the load together.

Around 2004 a new anchor configuration came onto the scene as the result of some testing on anchor configurations. (For a detailed discussion of the tests, see John Long's *Climbing Anchors, 2006 edition*.) These tests demonstrated some weaknesses in some of the anchor configurations discussed elsewhere in this article. In particular, the ability of inline anchors and cordelette anchors with a tied master point to distribute the load equally to the legs of the anchor has been called into question in certain situations. Even the classic sliding X equalizer does not truly equalize.

## New Multi – Point Anchor – The Equalette

Some folks have actually know about the lack of equalization in "equalizing" anchors since the early 1980s when Arnor Larson from Wilmer, British Columbia did some ingenious test on multi-point equalizing anchors and deduced they don't actually do what their name implies!

As a result of this most recent round of testing a new configuration called the "equalette" came into existence. It has now been gaining popularity after its inclusion in the 2006 edition of John Long's *Climbing Anchors*. The Equalette does not solve all of our problems, but it does give us another valuable tool to help us deal with two, three and four point configurations. It is being discussed first as it is the newest anchor construction and has tremendous potential for many situations.

## Three Point Equalette

Since many of the illustrations in the multi-point anchor section of this article show three point anchor configurations, I will begin with a three point equalette with which you can compare the other configurations that will be shown.

Note that the "master point", if I may call it that, is rigged similarly to a two point sliding X equalizer except that two carabiners are used instead of one. Each carabiner is clipped into a single strand of the master point. This is a key element to ensure a better load distribution.

Can it be clipped in to a single locking carabiner just like a sliding X with limiting knots? Of course it can in a pinch, but that reduces the effectiveness of the equalizing ability of this new form of rigging.

The left leg is knotted off to isolate the length of the leg and create some redundancy in case of cutting of the cord. The right legs are each independently tied off with a clove hitch. Care must be taken to try to adjust the hitches so that the load is shared roughly equally between the two right legs in this case.

The left leg of the anchor in this situation will bear roughly half of the load while the right legs collectively will bear roughly the other half shared between the two of them.

If the load comes on to the anchor in the anticipated direction, the right legs may feel roughly a quarter of the load each. If the pull comes from some other direction, the left leg will still receive about half of the load while one of the rightmost primary placements may receive the other half of the load entirely. Meanwhile the third protection piece (also on the right) may receive no load at all unless the other right placement fails.

Since this load sharing is not entirely equal and the 'doubled' leg generally takes half of the load, it may be wise to always try to clip the doubled leg in to what you perceive to be the best of the three primary placements in your anchor.

In the photo above, it is easier to see how each of the independent pieces are rigged.

At left we have a close up of the master point created with one carabiner clipped into each strand. The two carabiners do not bind like the sliding X and provide for better equalization.

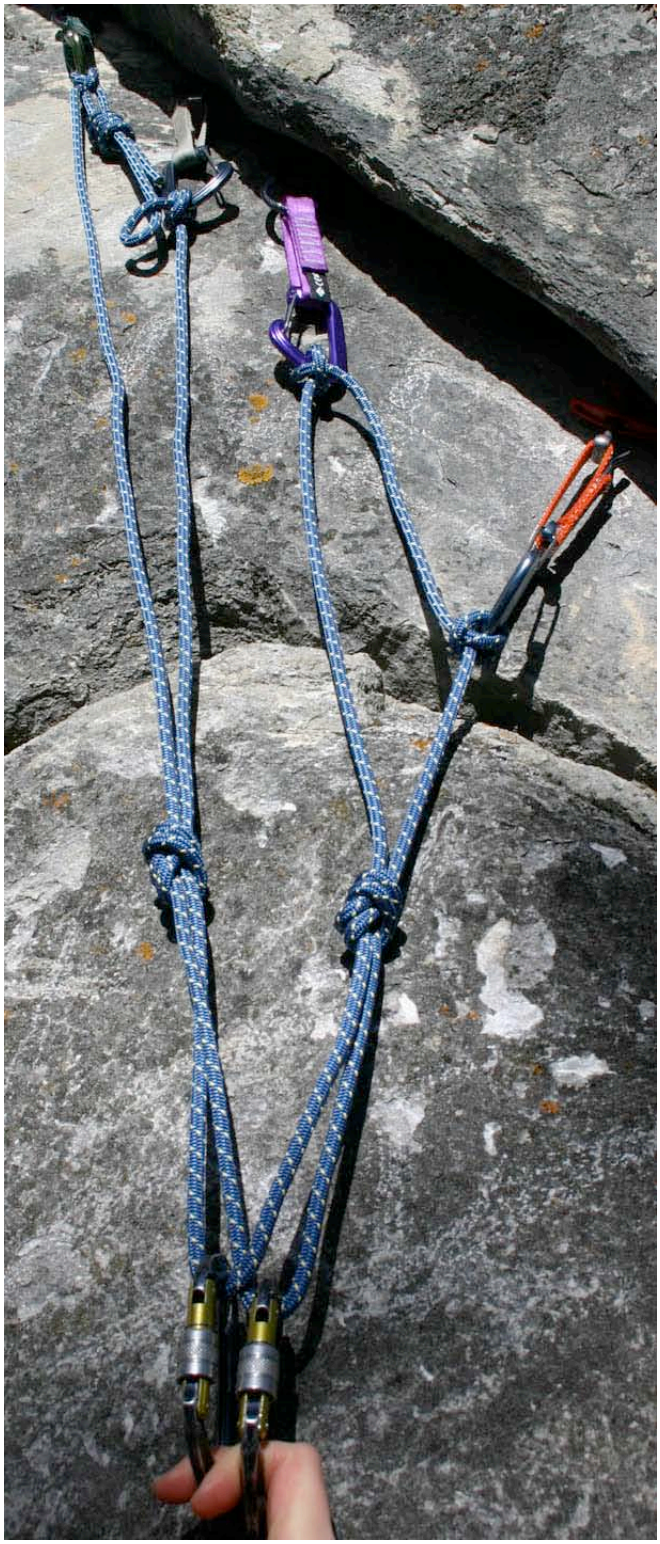
In the event of failure of a single leg there are also two independent carabiners, neither of which will be likely to be loaded along the gate side, unlike the possible scenario with a simple sliding X. Of course, the downside is two locking carabiners are required at every anchor…

If four primary placements are used in situations where the primary placements are less than stellar, it is a simple matter to change the rigging to include a fourth piece.

The equalette requires a 6m length (20') of 7mm diameter cord to rig in the manner shown in this article. Since this is one of the standard lengths for cordelettes, it will likely not require a change to your rack.

## Four Point Equalette



Given our discussion on the previous two pages, it should be obvious that each of the four primary placements in a four point equalette is rigged onto a single strand leg of the equalette with a clove hitch.

If the load is applied in the anticipated direction of pull you will have each of the four primary placements sharing some degree of the load, typically no more than 50 percent and potentially as little as zero. With careful rigging and some degree of luck you may end up with each placement holding about 20 to 30 percent of the load.

If the load is applied in some direction far off axis, it is possible that two of the four legs take roughly half of the load each while the other two legs act as non-loaded backups which will only come in to play with some small amount of extension taking place before loading occurs. The amount of extension will entirely depend on which legs get loaded and which leg fails.

Each of the primary placements here could be replaced with one or two placements connected together in a mini – anchor and providing a mixed configuration similar to some of those illustrated at the end of this article.

## Using Cordelette & Variations

Occasionally our needs may not be met by an equalette and our solutions need to be ingenious to keep things simple and timely, particularly when we find ourselves short on gear at the end of a pitch. We will now look at some traditional 'old-school' configurations for when multiple protection pieces are spread out horizontally as well as when they are in-line as in a vertical crack scenario. We could always mix and match an independent sling with a knotted sling (with a master point) and use some tricks to make each leg of the anchor roughly equal tension. This can sometimes be a great solution and at other times it can be a tremendous waste of time. The risk of three way loading creeps into the situation again. As things become more "inelegant" it is time to look elsewhere for clean and timely anchor construction ideas. Consider the equalette or…

Shown here is the **classic three point anchor using a 7mm diameter cordellette**. It is simple, fast and versatile. The cord should be 5 – 6m long and 7mm in diameter.

Note that recent tests show that if the legs going to each primary placement are of unequal length, the loading will also be unequal due to stretch of the cord. You should be certain of the direction of pull or the load may not be distributed at all. With an off–axis pull of more than 10 degrees a zipper–type failure may result as each placement fails in sequence.

The knot to create the master point need not be a figure eight knot as the radius of the bends in this configuration even in an overhand knot are nice and large. Like the equalette, this technique is that it requires a fairly long piece of cord. A 6m length of 7mm nylon makes things work out most often. An advantage of this configuration is that there are actually three places where you can attach to the anchor. They are called the *master point*, the *knot* and the *shelf*.

**Carabiners at the knot and the master point** are shown in this photo. Have a knowledgeable instructor show you exactly where the carabiner goes into the knot. It may be a good idea to put a carabiner in the knot in any case as it makes a good handle for undoing the knot if it comes under high loads.

It is also a good place to clip yourself personally which leaves the master point clear for belaying with a Munter Hitch or clipping in your rope team members when they get up to you. You have to remember to clip into the knot before it comes under load as it is nearly impossible to do so once it is fully loaded.

If you have forgotten to clip into the knot and now you want two separate attachment points, you can always clip into **the shelf and the master point**. Clip one strand of cord coming from each of the anchor points when you do this. Have a knowledgeable instructor show you exactly where the carabiner goes onto the cords. Clipping into the shelf may put unusual loads on a carabiner so better to use it as a personal attachment point rather than as the attachment point for a belay device.

On rare occasions you may find uses for all three of the points simultaneously. Just don't get them mixed up. What if single cordellette doesn't quite have the length to bring it all together?

Sometimes the anchor construction involves more than three protection pieces or multiple slings or cordelettes may make up the anchor with two knots coming down to two master points instead of one. The need for a strong anchor and a limited amount of material may necessitate this type of construction. The angles at which the slings come together once again have us running the risk of three way loading. Fortunately for us, a few relatively simple solutions exist to eliminate the three way loading and keep things working well. As discussed previously, you may be able to knot the independent slings together. Try that first.

At other times you may want to **interlock the master points** by threading the master point from one sling through the knot of the other. This now aligns both the master points so that the pull is along a single plane and can eliminate the risk of three way loading in many situations. This can be done with both cord and webbing slings but you should be careful that the manner in which you have interconnected things will not destroy the integrity of the knots you are using. The example shown here of an interlocking master point shows

the webbing threaded through the knot in the cord. You may also consider threading a cord through a knot in webbing. You will have to decide which is cleanest and most appropriate for each situation. The cleaner and simpler you can keep things with multi-point anchors the better off you will be as complex configurations often eat up a large amount of time.

## Inline Anchors

An **inline anchor** can be used when everything lines up in a straight line. The farthest away piece is clipped in with the cordellette. Each closer piece is attached in turn with a clove hitch. The sling is then knotted at the end to form your master point. As you can see, it often doesn't take up much cord.

The photo at left shows an inline anchor in which four pieces have been integrated into the anchor. (The uppermost piece is out of the picture at the top.)

You can see the clove hitches that connect each of the pieces to the anchor. Note that the lowest piece in this anchor is placed to resist an upward pull as may occur in a leader fall after the leader has placed protection.

Before using the anchor, try to equalize the tension in all of the strands, then tighten the master point knot (which in this photo still seems a bit loose.)

Inline anchors can be quick and simple to set up once you have practiced them a few times, but it can be difficult to get the tension equal among all of the pieces. This is the most difficult anchor type we have discussed thus far in regard to getting equal tension on all pieces.

Have a knowledgeable instructor show you exactly how to set up anchors in the inline configuration and spend time practicing with them so you don't waste time figuring things out during your climbs.

Sometimes neither the horizontal configuration with a cordelette nor an inline configuration seem to be able to connect all of the pieces in an acceptable manner. It is possible to mix the two anchor types together to get a good quick multi-directional anchor arrangement.

## Mixed Configurations

The **mixed anchor** shown at left is using a cordelette in which the left leg is acting like an inline anchor while the right leg is rigged as per normal. A similar situation can be constructed using webbing instead of cord. In addition, each leg of an anchor could be configured in an inline fashion with a master knot joining the legs together. A longer sling is mandatory in that case.

With our discussion of mixed anchor types we have completed this brief review of "Anchors in Earnest". The following pages contain several diagrams of anchors incorporating various elements discussed. They show some of the many ways in which primary placements can be linked together creatively and quickly to make solid anchors. Some of these examples could be readily replaced with the new equalette!

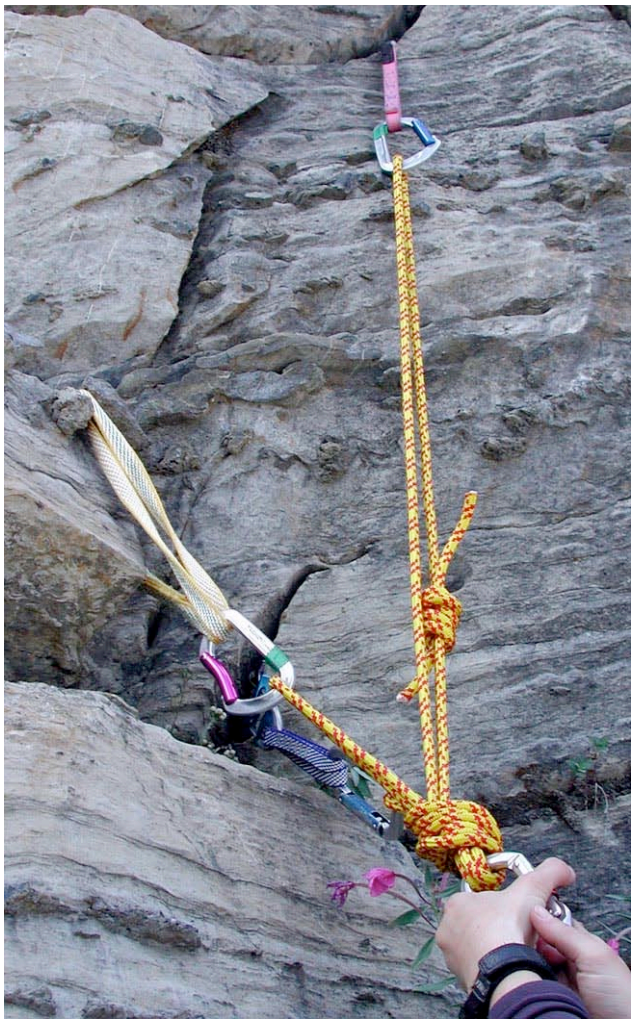
**Example #1**

Here we have a classic inline anchor configuration.

It may be difficult to see but there are actually three separate pieces that are being linked together with the cordelette. The upper two are fairly close together while the lower piece is farther away.

This anchor is not configured to take an upward pull at this point.



**Example #2**

Here we have a cordelette being used in the classic manner to connect three pieces. The leftmost piece is a sling thread and is pretty bombproof and multi-directional. The carabiner connecting this piece to the cordelette may be accidentally opened if it is pressed against the rock, so you may have to re-orient the carabiner, add a second carabiner in an 'opposite and opposed' fashion or use a locking carabiner.

The lowest piece has had a small sling added as an extension since the cordelette was not quite long enough in this instance to link everything together well. The carabiner here may also have the same issue as its mate to the left.

All in all, this should be a pretty good anchor setup for bringing up your partner from below.

**Example #3**

Here is a mixed configuration using webbing. The lower leg is constructed with two pieces inline while the upper leg has its own piece to itself. Try to avoid having a knot pressing directly on a carabiner as in the upper leg. This anchor may be able to sustain loads from multiple directions.

**Example #4**

This is another type of mixed anchor incorporating several elements from the article.

The left-hand leg of the anchor is a three piece inline configuration. The upper two pieces can take a downward pull, while the lower piece can take both an upward and a downward pull.

The right-hand leg is a piton (multi-directional) connected to a long sling. The sling is interlocked with the master point of the inline anchor to avoid a three way pull on the master carabiner. This sling also has a knot tied along its length to better create equal tension in the anchor.

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There is far more involved in building anchors than appears here! Read "*Freedom of the Hills*" for a general treatment on mountaineering, but more importantly get a copy of the new 2006 edition of "*Climbing Anchors*" by John Long. It is not the last word on anchor building and contains a few concepts that are still the subject of lively debate in the climbing community but it is as modern and progressive a treatment of anchors as we have available at this point. Get good instruction, preferably from an ACMG or IFMGA certified guide, then get out and practice!

 

## About the Author

Cyril Shokoples is an internationally certified Mountain Guide and Past-President of the Association of Canadian Mountain Guides. He has been a member of the Alpine Club of Canada and Edmonton Section since 1975 and became a "Senior Member" in 1979. He received the Silver Rope award in 1988 and the Distinguished Service Award in 2002. He also received the Distinguished Service Award from the Association of Canadian Mountain Guides in 2003. In 2005, the Edmonton Section of the ACC awarded Cyril with the George Stefanick Legacy Award (only the second time this award has been presented).

Cyril has been teaching mountain leadership for over two decades and he continues to broaden his background and skills into many related areas of safety and rescue education. He trained Emergency Medical Technicians for over a decade and is a life member of the National Association for Search and Rescue (US). He has been training the Canadian military Search and Rescue Technicians in mountain climbing and mountain rescue for twenty years. He created the Parks Emergency Responder program for National Park Wardens and has taught that program across Canada for nearly two decades. He is a PADI Open Water Scuba Instructor and a DAN Dive Emergency Specialist. He is also a professional member of the Canadian Avalanche Association, a CSIA Ski Instructor and a licenced Advanced Amateur Radio Operator. Cyril has taught courses and seminars in BC, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Nunavut, The Yukon and North West Territories.

Cyril currently resides in Edmonton, Alberta, Canada and is the proprietor of the firm Rescue Dynamics, which is involved in climbing, rescue and safety instruction, as well as mountain guiding.

Further information on courses as well as additional copies of this and other technical notes in this series can be obtained directly from Rescue Dynamics. On the internet, visit the Rescue Dynamics Website at – http://www.rescuedynamics.ca

 