BOLTS - CLEAN RIGGING

Understanding why the use of webbing or cord for bolt anchors is unnecessary and undesirable.

CANYONEERING KARMA

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Webbing is a ubiquitous anchor building material, found on single-point and multi-point natural anchors — tied around trees, arches, columns and boulders. It is used to create deadman anchors, chock stone and knot chock anchors. It is useful, but can be unsightly, especially when unnatural colors are left behind in natural places — like canyons. It gets worse when webbing accumulates.

Weathered webbing has been proven to be DEADLY!
Exposed to the elements it will deteriorate over time.

Don't trust the old blue webbing already in place on the anchor?
Back it up with your new red webbing.

Don't trust the old blue and red webbing already in place on the anchor?
Back them up with your new green webbing.

And on it goes.

STOP!

Please **carry a knife** with you to **cut out all of the old blue, red, green, yellow and pink webbing.** Haul it out as trash and replace it with your new sandstone brown webbing or granite gray webbing.

Not sure what color to use?
Start carrying and using nothing but black webbing.

Bolts connected by webbing

Webbing (or rope/cord) is needed when building NATURAL anchors.

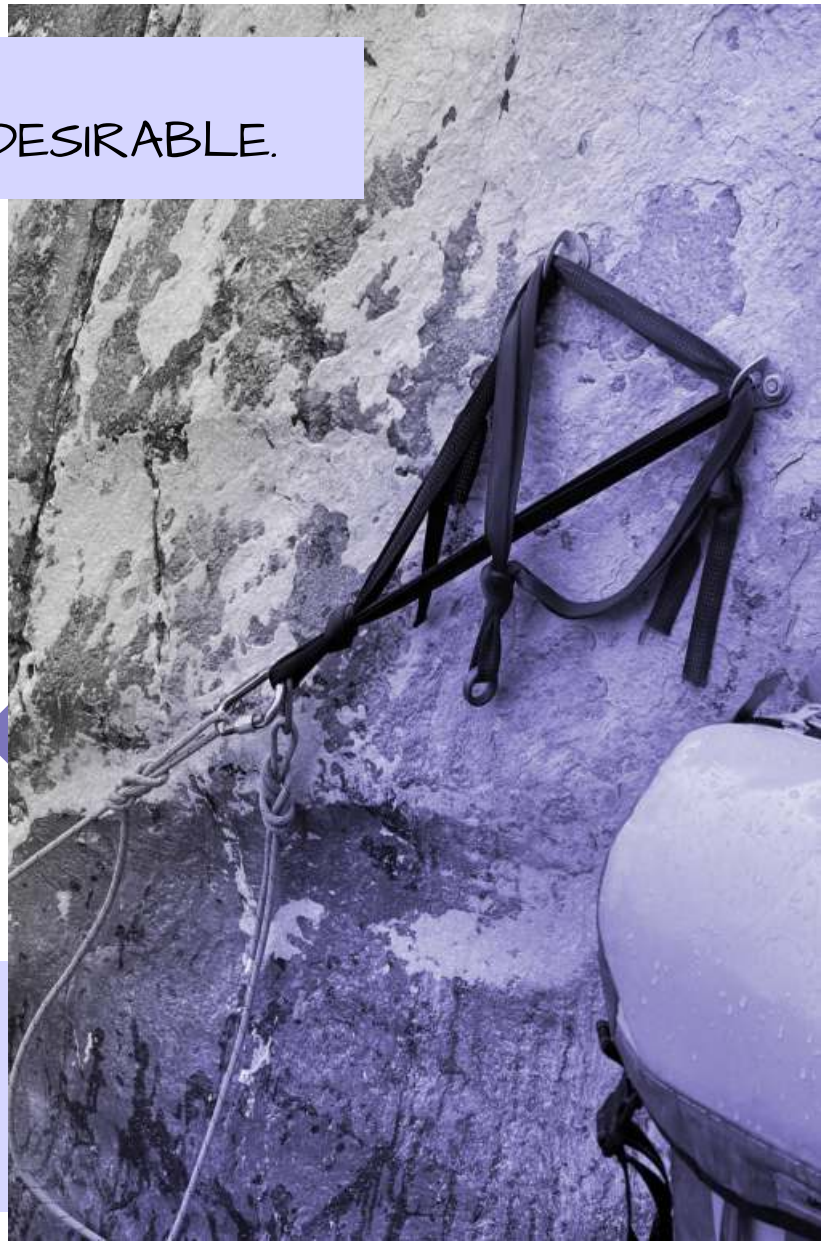
But is it needed for connecting bolt anchors?

In short, NO. It is unnecessary and UNDESIRABLE.

Undesirable, in part, because the webbing tied between two bolts forms a "net" that can trap debris when the water is flowing. The force of the debris hitting the net can weaken the bolts.

Undesirable, because the cost of constantly adding and replacing webbing, cord and other material can add up quickly.

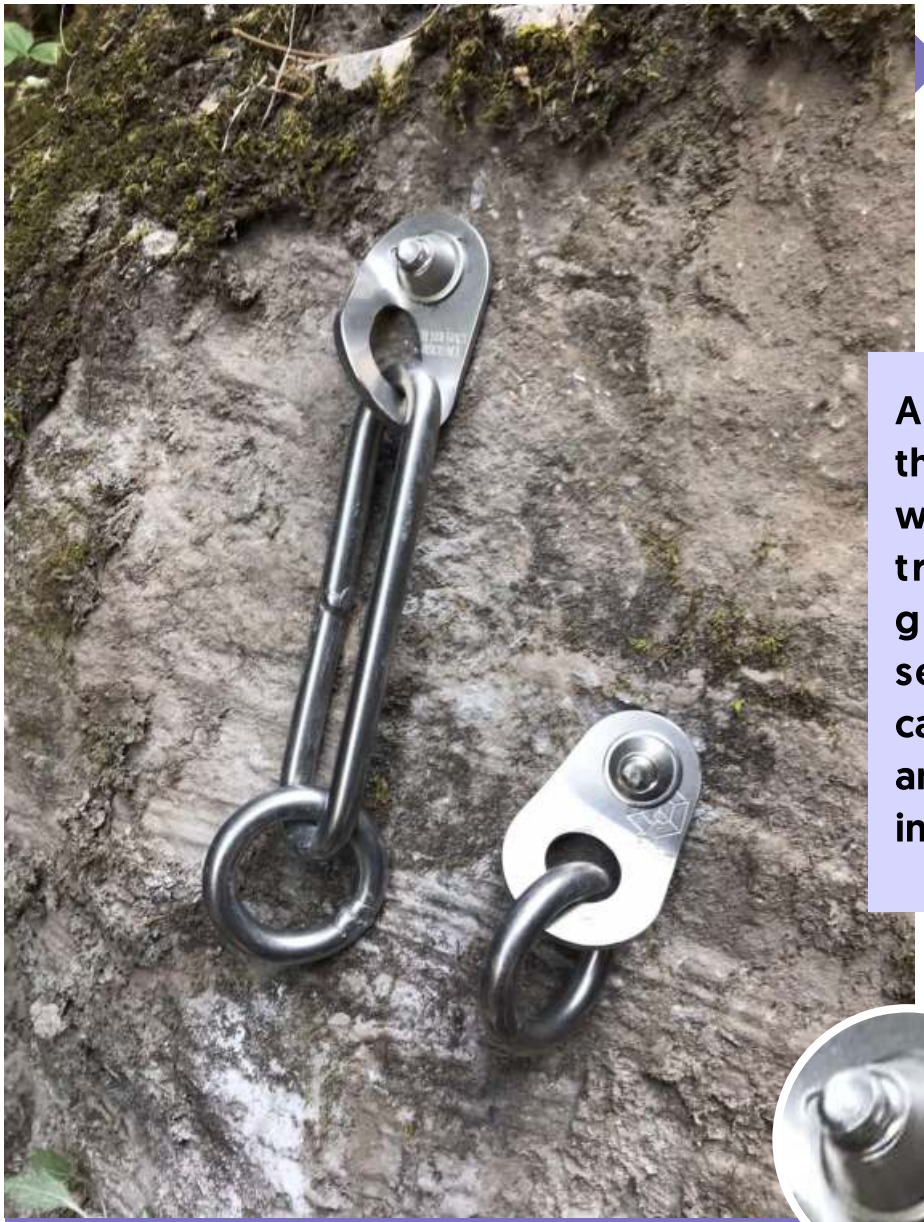
This photo was originally posted by Willie Hunt on the Canyon Rigging Facebook group. It illustrates how material is often added unnecessarily.



In response to this photo and many others like it, the talented staff at Canyons.mx undertook the task of illustrating some excellent alternatives.

Follow the link on the following page to learn more. ▶

Clean rigging configurations



This configuration uses anti-theft lock nuts.

This photo shows a configuration of asymmetrical anchors (respecting the distance between holes) With stainless steel material and with aligned rings to facilitate the recovery of the rope.

Alternatives to avoid the abandonment of webbing on hangers, trying to offer the greatest range of security and taking care of the aesthetics and low visual impact in canyons.

Abandonment of webbing in canyons

Post by CANYONS.MX

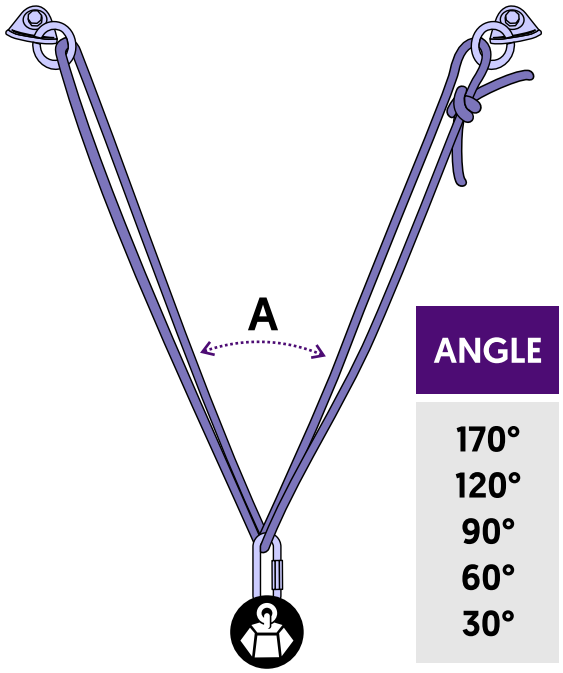
https://canyonsandcrags.com/knowledge-base/bolts-clean-rigging/

Bolts and the American Death Triangle (ADT)

One rational reason for not passing our rope directly through rings on two bolts is a concern about creating the dreaded American Death Triangle. It even has the word DEATH in its name. That can't be good. Compared to rigging webbing to form a "V", rigging it to form a triangle creates significantly more force on each anchor point.

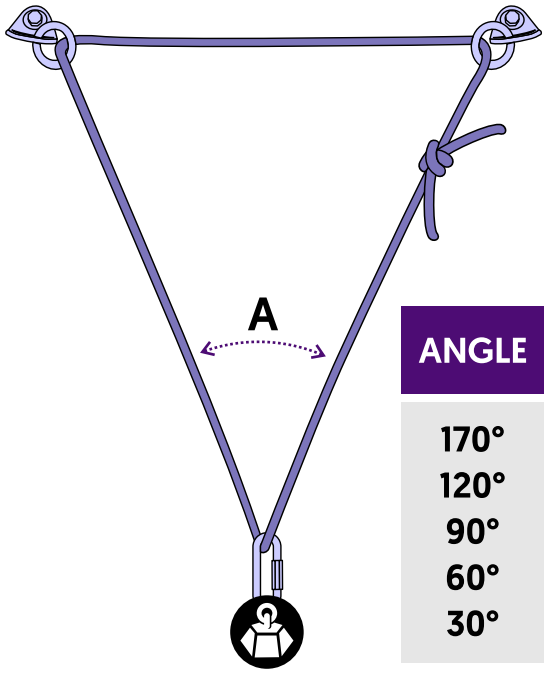
Share of total load held by each leg of an anchor using “V” vs Triangle configurations.

“V”



ANGLE	FORCES ON EACH BOLT
170°	574%
120°	100%
90°	71%
60°	58%
30°	52%

ADT RIGGING



ANGLE	FORCES ON EACHBOLT
170°	1148%
120°	193%
90°	131%
60°	100%
30°	83%

Looking at the chart you can see, if the angle between the two legs of the anchor is 90°, the force on each anchor point will be 71% of the load if the webbing is rigged to form a "V". The force jumps to 131% of the load if the webbing is rigged to form a triangle. The force on each anchor point is almost double that of a "V".

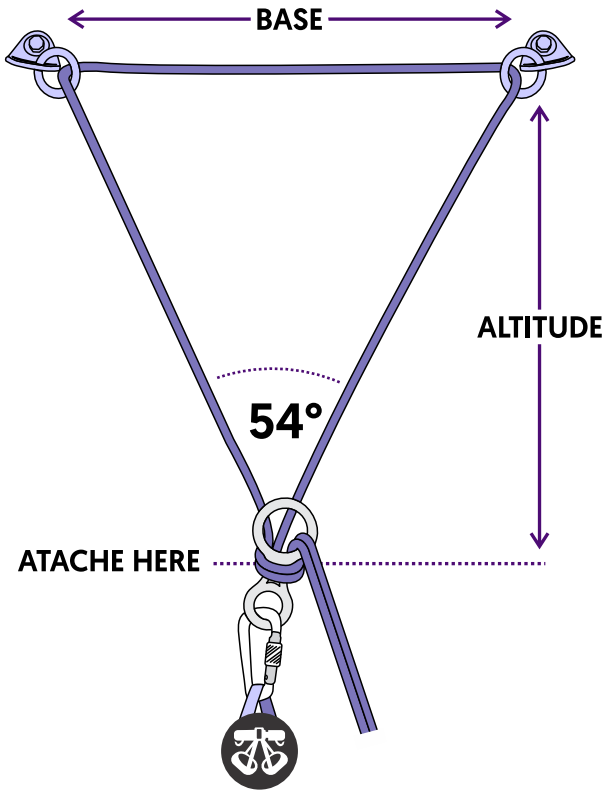
Load Sharing vs Redundancy

If two anchor points are being used because there is a concern that neither point is strong enough to hold the load on its own, you want the two points to share the load. Understanding the forces created by rigging the American Death Triangle (ADT) is important when using marginal natural anchors. In such cases, it is best practice to use "V" rigging instead.

It is less important when the anchor points are bolts capable of holding 100% of the load. Two bolts are used primarily for redundancy, not because they are needed to share the load. A well-placed bolt is strong enough to hold a typical one-person or even two-person.

Looking at the chart in Illustration #1 again, you can see, if the angle between the two legs of the anchor is 60°, the load on each anchor point will be 100% of the load. Best practice will be to rig for rappel low enough that the angle is less than 60°. The angle will become smaller as you move farther down the rope.

Short of carrying a protractor with you to check the angle, simply rig for rappel at a distance below the anchor equal or greater to the distance between the bolts. If the bolts are 30 cm (12 inches) apart and you rig for rappel 30 cm below the bolts, the angle at the apex will be 54°. That is less than 60° so you will be putting less than 100% of the load on each bolt.



Supplemental Anchor System (SAS)

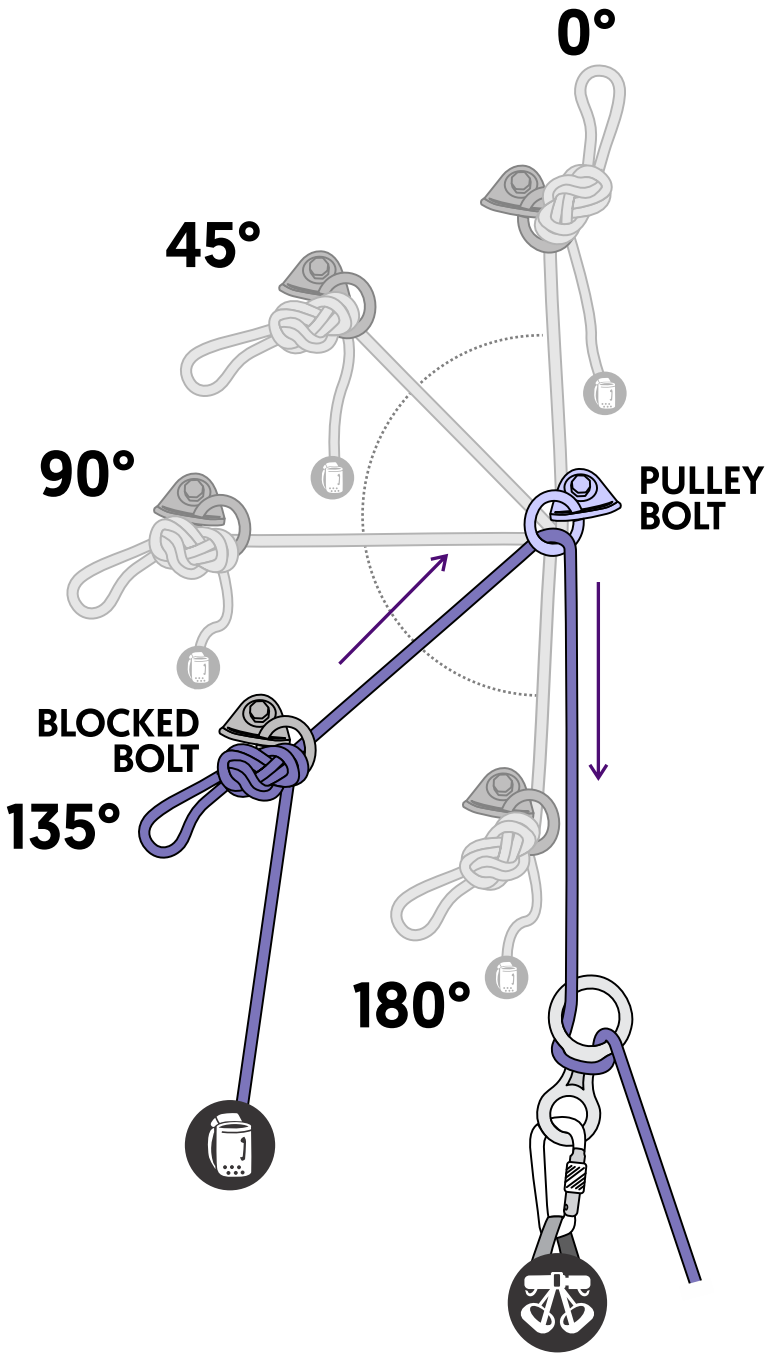
A temporary (SAS) can be used to provide a focal point for top rope belay, releasable contingency system, rescue, etc. Illustrated in this photo is a quad, popular with rock climbers.

Blocked Rope Systems - Deviation Angles

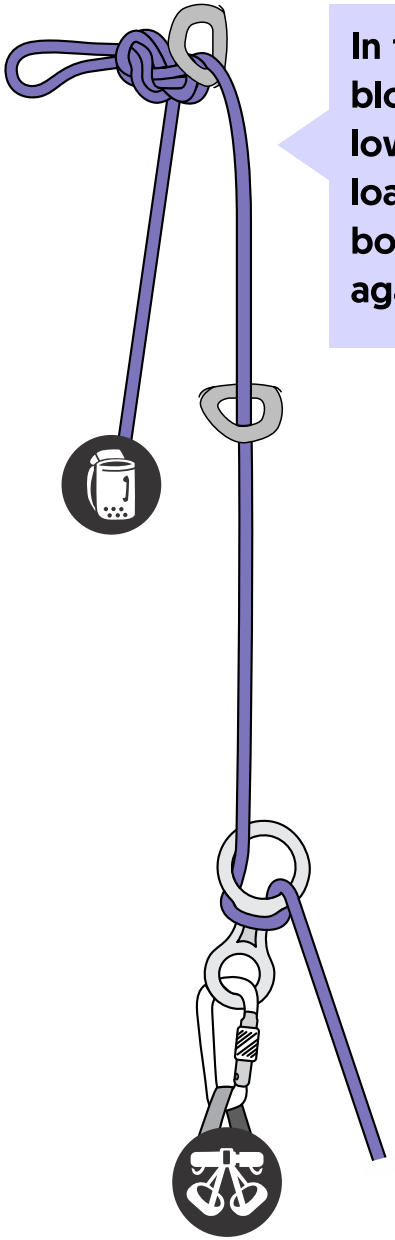
Two-bolt anchors can also be rigged with blocked rope systems - both static (knot blocks, carabiner blocks) and releasable (figure 8, Totem). The diagram illustrates a block against one bolt ring with a second bolt ring basically functioning as a deviation pulley.

ANGLE	FORCES ON PULLEY BOLT
0°	0%
45°	77%
90°	141%
135°	185%
180°	200%

The forces shown assume the pulley is 100% efficient, in which case the force on the blocked bolt would always be 100%. But the pulley is not 100% friction-free. Friction will provide some holding power, reducing the forces on the bolts, so the forces shown are maximums.

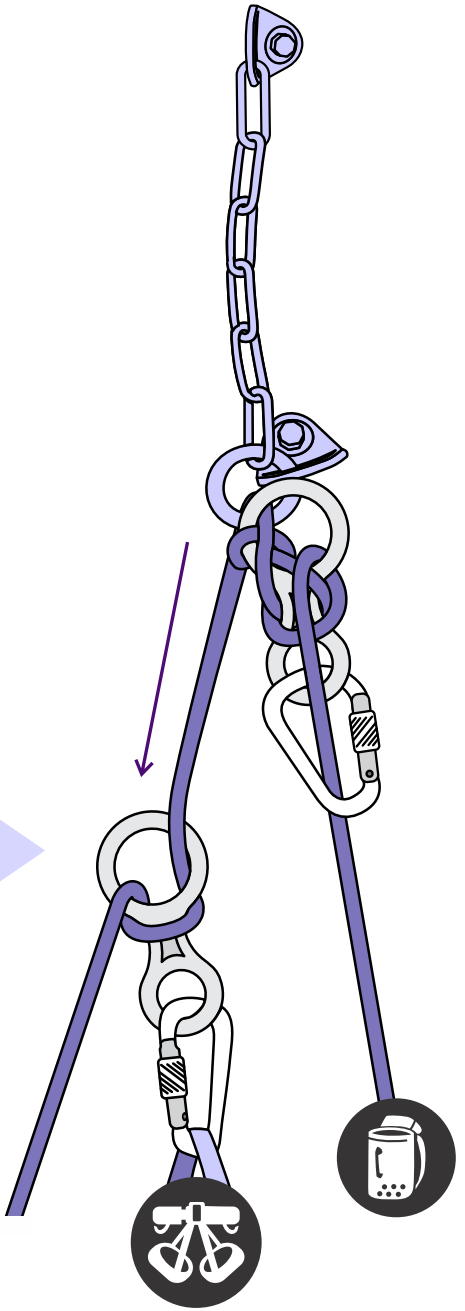


Blocked Rope Systems



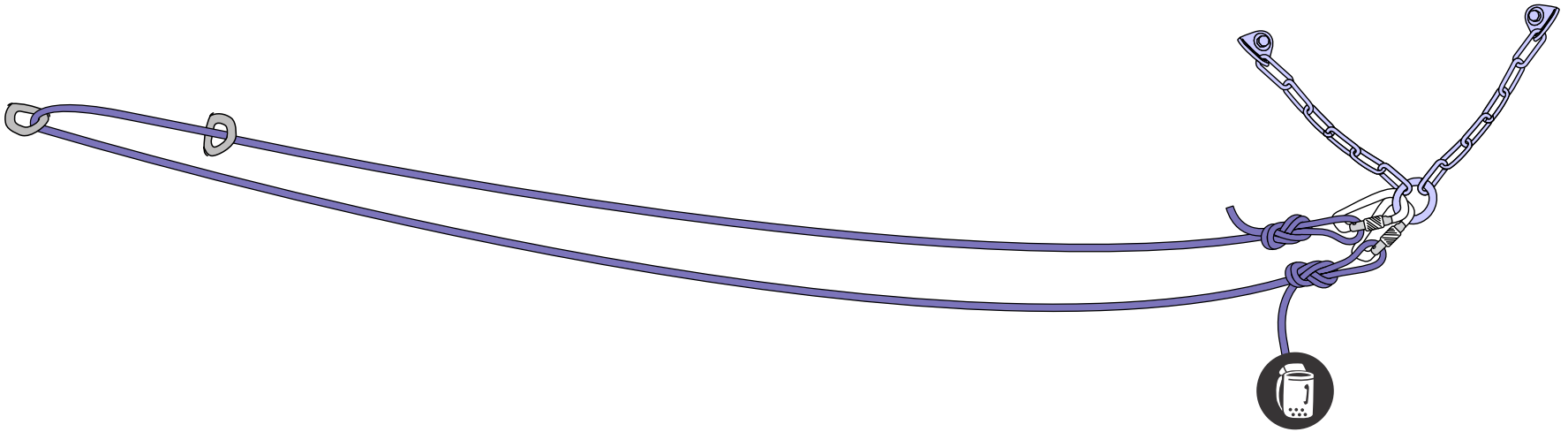
In the configuration illustrated here, the knot is blocked against the upper bolt ring only. The lower bolt is used only as a backup; it will not be loaded unless the upper bolt fails. If the upper bolt does fail, the knot will drop before it blocks against the lower bolt.

In the configuration illustrated here, the releasable figure 8 is blocked against the lower bolt ring only. The upper bolt is used only as a backup; it will not be loaded unless the lower bolt fails. If the lower bolt does fail, there will be a slight extension before the chain connected to the upper bolts takes the load.



Rigging retrievable traverse safety lines

When using natural anchors that are located away from the edge of the rappel, the space between the anchor and the edge can provide a safe staging area to deploy the rope and rig for rappel. It is common for experienced canyoneers to set up what is known as “courtesy rigging”, so everyone in the group can take advantage of this staging area, except the last person who adjusts the system for easier rope pull, and deals with a difficult rappel start.



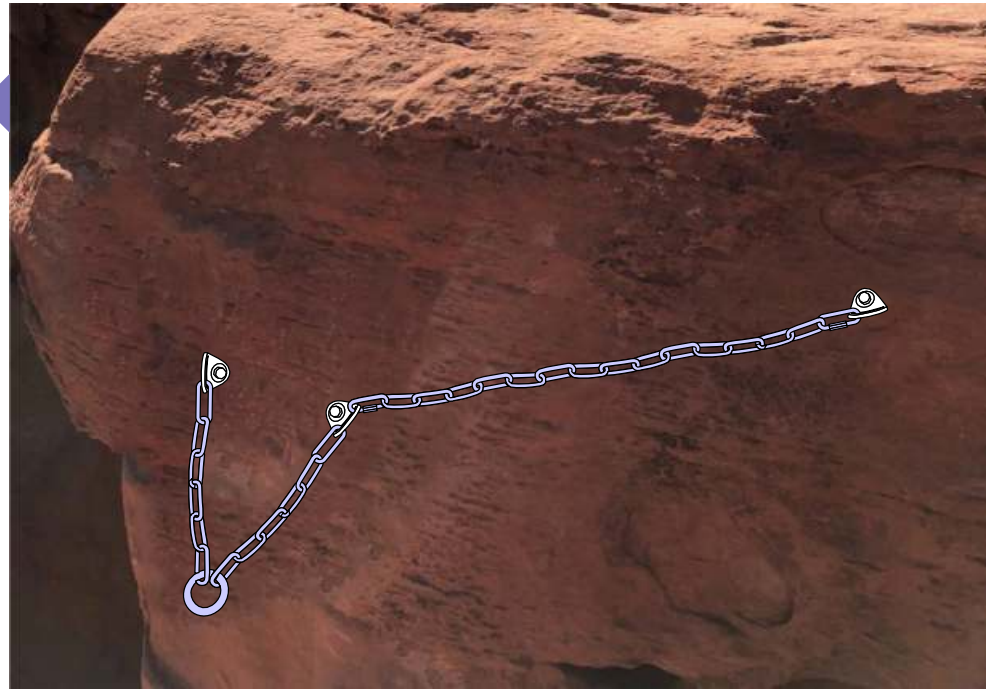
One of the advantages gained with the use of bolts for anchors is the ability to place them in strategic locations for easy rappel starts, easy rope pull, operation of releasable contingency rigging and ease of rescue. This usually means the bolts are placed near the edge, so best practice is to protect the approach to the rappel anchor with a traverse safety line.

There are several ways to set up traverse lines that are retrievable from the rappel anchor. Once the traverse line is established by the first person across, other members of the group are protected by clipping the carabiner on the end of their lanyard to the traverse line.

Setting up a traverse safety line with chain

This photo shows an excessive amount of chain rigged between two bolts so the chain can function as both rappel anchor and safety line. Note the two rapides that are clipped to the chain to provide for the rappel rope.

Until more canyoneers learn how to rig bolt anchors with retrievable traverse safety lines, providing fixed chain might be a reasonable option. However, the chain should be rigged with three bolts as illustrated here, so the traverse line and the rappel anchor are independent of each other.

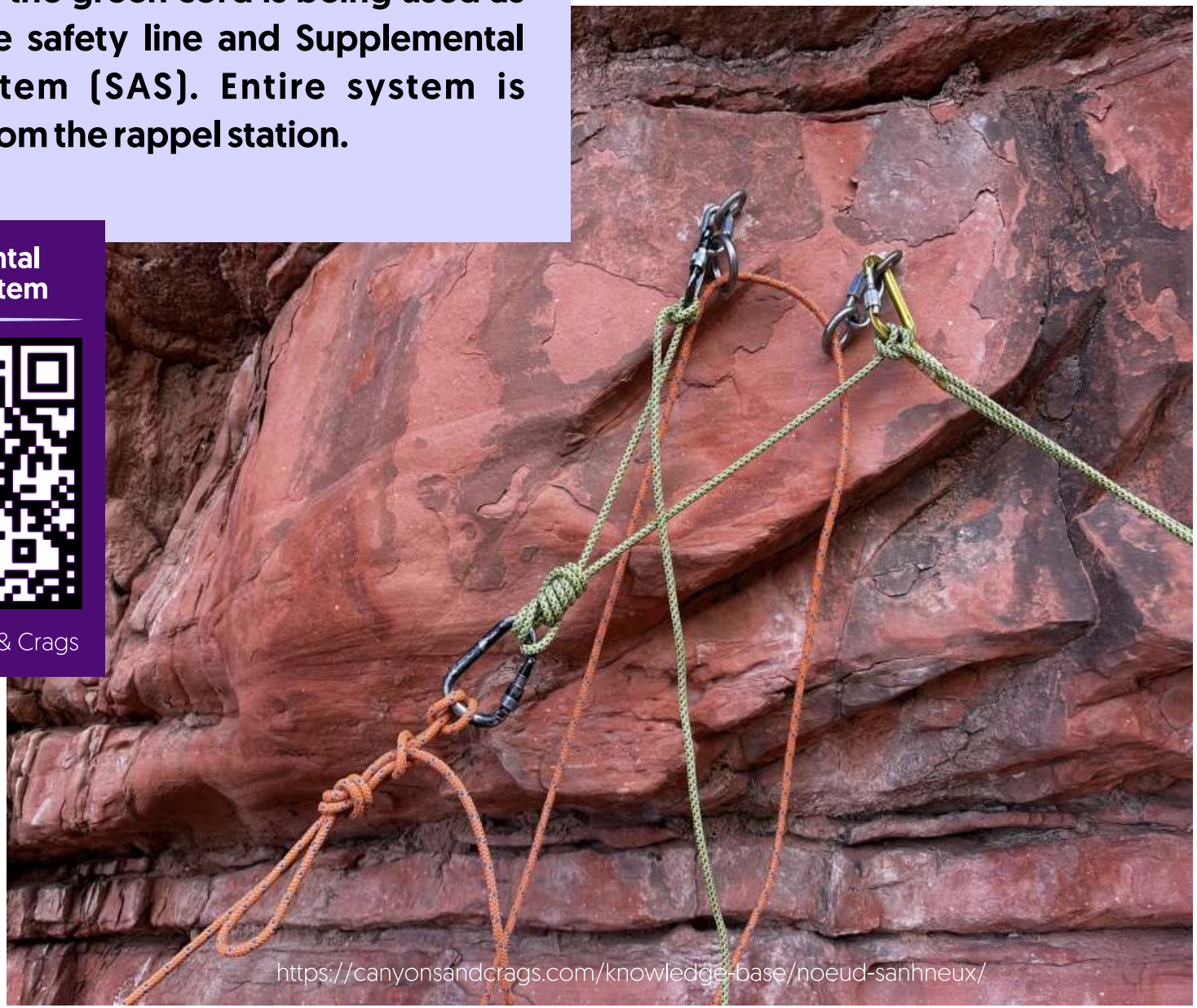


SAS + Traverse safety line

In this photo, the green cord is being used as both traverse safety line and Supplemental Anchor System (SAS). Entire system is retrievable from the rappel station.

Supplemental Anchor System

Post by Canyons & Crags



CANYONEERING KARMA

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Facebook group
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Canyoneering Karma exists as a place to share your passion for canyoneering and to discuss ways we can all channel that passion and our blessings toward serving others.

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