

Ties and Rope (for non-technical terrain carry out)



Unit 22: Ties and Rope

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High Angle Environment Awareness



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Gravity is dangerous.

This course doesn't teach technical rescue.



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This course doesn't teach technical rescue.

Only foundation knots.

This course doesn't teach you how to operate in the high angle environment, just how to recognize it.

Knot tying skills are a foundation you can build on later with more training.



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There is hardware, metal things, and:

Software: Rope, Webbing.

Rope comes in lots of sorts. This is a natural fiber **laid rope**.

Fibers are twisted into bundles, which are then twisted into bundles. Fibers don't run the full length of the rope. Load bearing fibers are exposed to damage.

Natural fiber ropes can rot.

Neither laid rope nor natural fibers are used for life safety applications.



10.7mm dynamic kernmantle climbing rope
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This is Kernmantle rope.

Outer mantle provides abrasion resistance. Inner core (kern) of fibers that run the length of the rope and provide its strength.

Almost all modern climbing rope and life safety rope is kernmantle (made of various synthetic fibers).

Static and Dynamic Rope



Rope can be low stretch (bottom) or high stretch (top).

Climbers use high stretch, dynamic rope. They climb, putting their weight on the rock. When they fall, they are caught by the rope, and the rope stretches to absorb the energy of the fall.

Technical rescue almost entirely on static or low stretch rope – the system is rigged to hold the rescuers' and victim's weight on the rope all the time. Anchors and system hold the load all the time.

In High stretch rope, fibers in kernel twisted to have lots of stretch.

In Low stretch rope, fibers in kernel run much more in line with the length of the rope.

[Parenthetically, a distinction can be made between low stretch and static, not discussed here]

Webbing



Image: Public Domain 2008 by StromBer

Software also includes webbing – flat or tubular.

Ropes are easily damaged

- Never step on a rope.
- Keep ropes away from battery acid.
- Never touch a loaded rope with something sharp.



8mm half rope damaged in a leader fall.

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Watch where you put your feet around ropes.

Never ever step on a rope. Why? (grinds sand grains into kernel, these undetectably cut the strands in the kernel and weaken the rope).

Rope under load cuts very easily – needs edge protection running over sharp edges. Avoid having knives around rope systems.

Nylon rope is damaged by exposure to battery acid.

Important to learn to wash rope, inspect rope, care for rope properly. Inspect after each use, maintain a rope log.

(Image is of damaged kernmantle rope. Outside mantle is damaged, exposing the white core within.)



Sand Grain (*probably around 1mm across, no scale in source image*)

Can have small very sharp edges.

Want this inside your rope?

Stepping on a rope can grind sand grains (and such) into the rope. Sand grains in the core cut fibers in the core and weaken the rope.

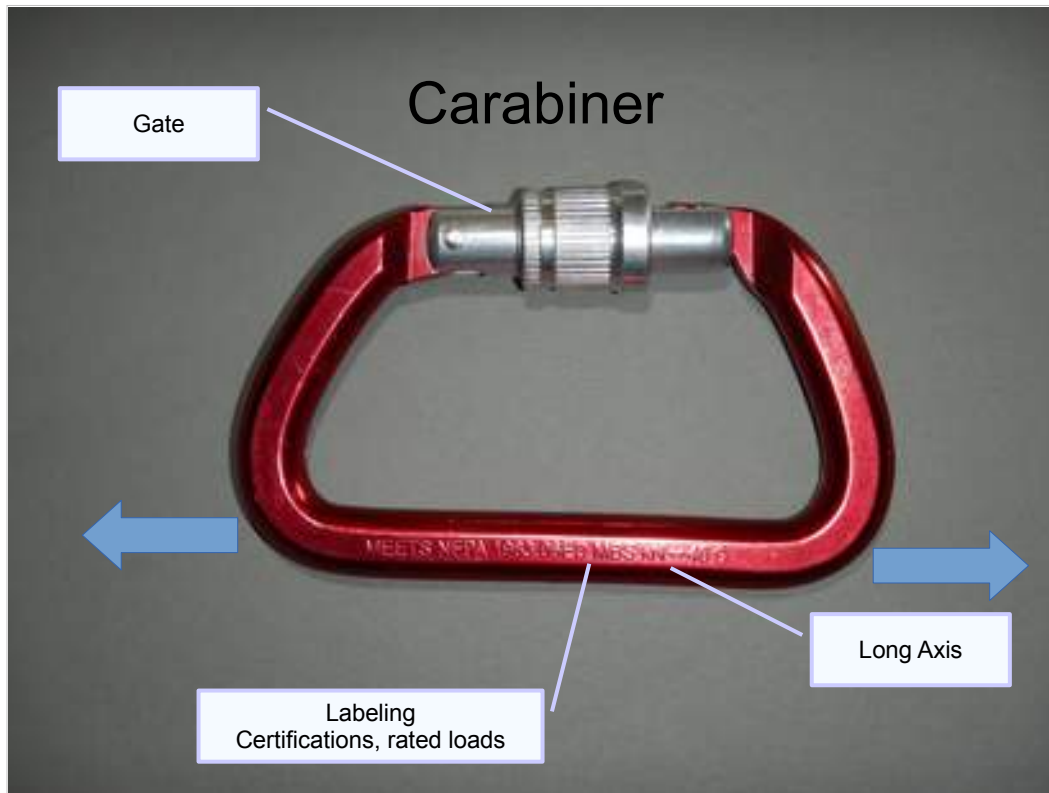


Rope, webbing, harnesses are software.

Then there is hardware. Carabiners and all sorts of specialized hardware.

Designed for specific loads in specific directions. Will fail if you load it improperly.

(Example: Load carabiners on their long axis, ensure the gate is closed and locked.)

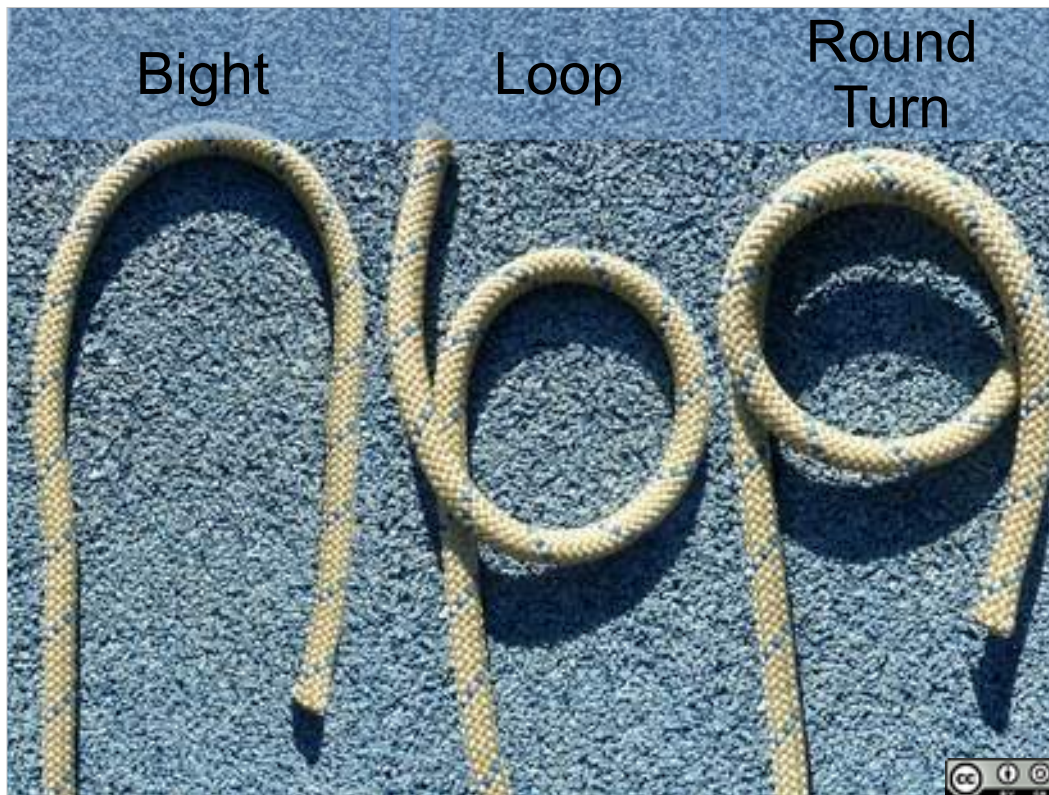


Parts of a locking Carabiner:

Gate.

Load along the long axis.

Labeling informs strength ratings, allowing rope technicians to choose appropriate hardware when designing and building a rope system.



Names (again) to help us see things.

Bight: just a 180 degree bend in the rope.

Loop: Keep going to form a closed loop, with the rope exiting the opposite direction from where it entered the loop.

Round turn: Keep going, there's a full loop, and the rope exits from the same direction that it came in on.

“Knots”

- Tie:
- Knot:
- Bend:
- Hitch:



Tie = technical term for what we mean by knot in everyday language.

Three sorts of ties:

Knot = tie that forms a stopper knot.

Bend = a tie that joins two ropes (or two ends of the same rope) together.

Hitch = a tie that attaches a rope to something else.



Running End = Working End – the end you tie a knot in.

Standing part – the rest of the rope, usually the part under load.

Practice Ties

- Figure 8.
- Figure 8 on a bight.
- Figure 8 on a bight, with barrel knot safety.
- Figure 8 follow through (tie in), with barrel knot safety.
- Water knot.
- Half Hitch.
- Clove Hitch.
- Girth Hitch.



Hand out rope and webbing, demonstrate and have everyone tie each of these ties.

Images of each follow. *[You can use the images while teaching the knots if that is helpful, there are some comments on the knots in the speaker's notes]*

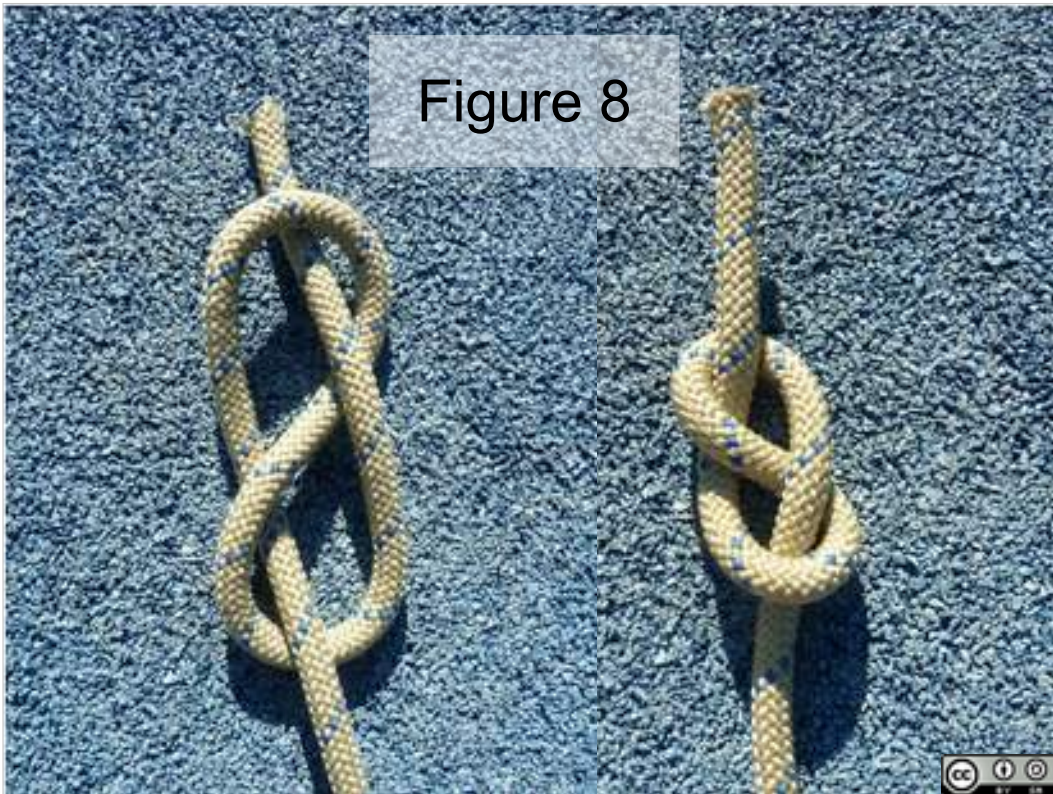


Figure 8 stopper knot.

Foundation life safety knot. Easy to recognize , easy to see that it has been tied correctly.

The Figure 8 family of knots all take a lot of rope, and can be hard to untie after being heavily loaded.

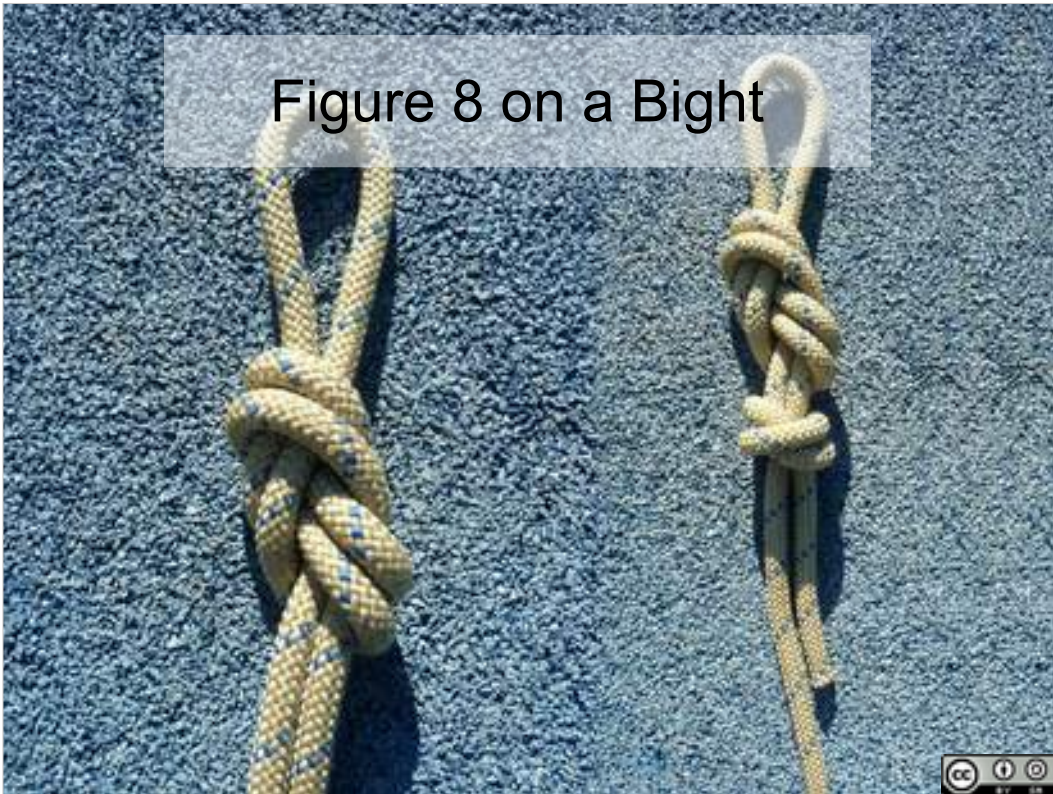


Figure 8 on a bight.

Dress your knots. That is important for their strength.



Barrell knot safety (on a figure 8 on a bight).

Make the loop on your figure 8 just large enough for its purpose.



Figure 8 bend.

Bend – joins two ropes together



Figure 8 follow through

Exactly the same knot as the figure 8 on a bight, but tied in a follow through (to attach to a harness or some other closed ring).

Starts with a figure 8 in the working end, then pass the working end through the closed ring, then trace the 8.



Figure 8 follow through, finished knot

Exactly the same knot as the figure 8 on a bight, but tied in a follow through (to attach to a harness or some other closed ring).



Tied in webbing.

Overhand knot family.

(can show:

overhand knot: stopper knot

half knot: binding knot (half of square knot)

half hitch: hitch

All same topology, but with object passing through tie in different places).

Water Knot (Ring Bend)



Water Knot – bend to tie in webbing.



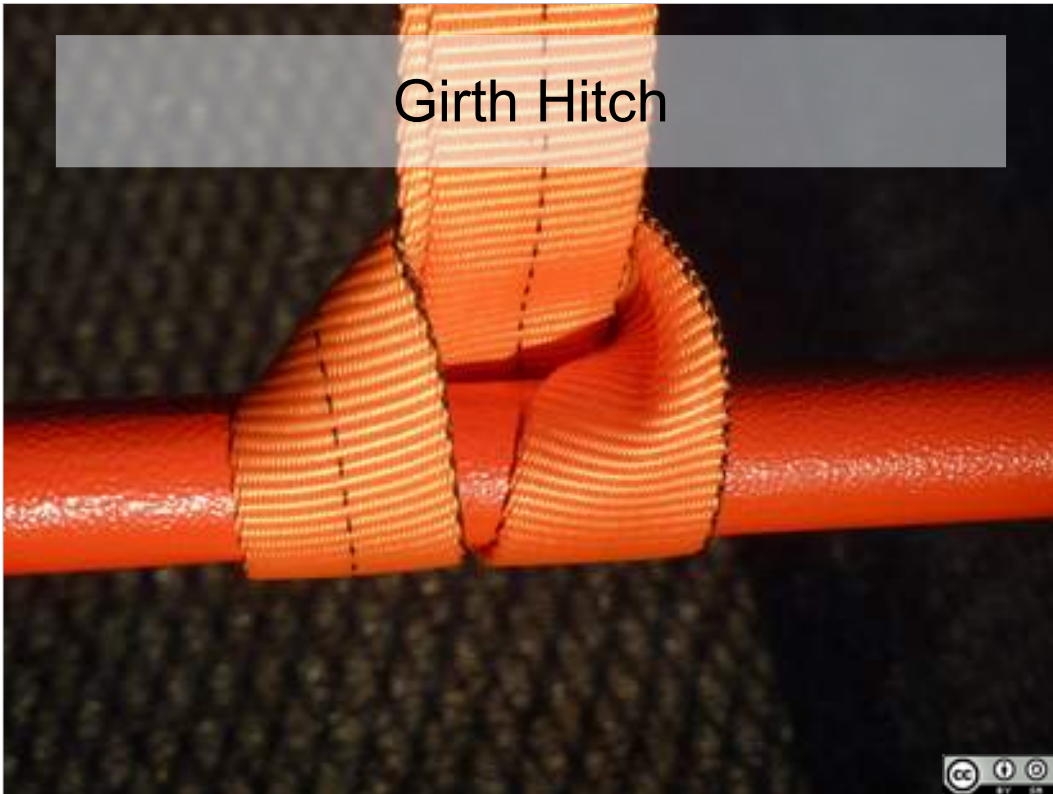
Clove hitch tied in webbing.

Clove Hitch



Clove hitch slightly easier to see tied in rope.

Two ways to tie (in the air and drop onto something, or around something).



Girth hitch.

[Girth Hitch and clove hitch can be used to attach webbing to a litter]



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