



Subject: **RAPPEL SAFETY TECHNIQUES:**
A Review

Instructional Support

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Technical Note

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In 1984, John E. Williamson, editor of *Accidents in North American Mountaineering* made the following statement:

"This year has seen a resurgence of rappel accidents. In all cases, only one anchor point was in use and there was no belaying. While the latter is not always possible or desirable, the former can be corrected."

1989 saw a similar rash of accidents, while 1994 saw three rappel accidents in the Bow Corridor in Alberta alone! Consulting *Accidents in North American Mountaineering - 1995*, Table III will reveal that in the thirty five years between 1959 and 1994 a total of 2063 persons were directly involved in accidents while descending (Canada & US). The relative percentage of rappel accidents has increased in the last five years. "Failure of Rappel" was listed as the immediate cause of the accident in about 10% or 202 of these cases. In all likelihood this is a conservative estimate as many accidents are never reported.

In more recent years there has also been a startling number of rappel accidents whose cause was surprisingly simple and preventable. This review will address methods for reducing accidents during rappelling by employing belays and safeties. Before presenting the main body of this report, I would like to provide a short list of fundamental ways to prevent rappel accidents:

1. Use easier alternate descent routes that do not involve rappelling when possible.
2. Use a belay of some type on all rappels.
3. Use a bombproof anchor. **Never** rappel off

a single anchor point.

4. Remain clipped into your anchor until after your rappel rig has been connected.
5. Recheck all knots, slings and anchors before proceeding, even if your partner has already done so.
6. Protect the rope and anchor slings from sharp edges.
7. Always tie a knot at the end of the rope.
8. Wear a helmet.

These simple steps could have prevented most if not all of the rappel accidents reported in the last thirty five years. The following techniques which I am about to compare will show that a belay of one sort or another **is** always possible, albeit occasionally time consuming or impractical. The following methods will be discussed:

- *Stopper Knot*
- *Normal Rappel with Independent Belay*
- *Rappel on 1/2 line / Belay on 1/2 Line*
- *Guides Lower (Half Line Variation)*
- *Guides Lower From Below*
- *Prusik Safeties and Shunts*
- *Slingshot Belay from Below with Rope*
- *Tension Belay From Below*

*** **WARNING:** This is not an instructional article on how to perform any of the above maneuvers, but rather examines advantages and disadvantages of each. Persons not familiar with these techniques should seek instruction from a competent climber, instructor or guide. ***

Stopper Knot: One of the most common means used to safeguard rappels is to tie both ends of the rappel rope together or to tie each end in a bulky knot in an attempt to ensure that

the rappeller will not slide off the end of the rope. As an alternative, some climbers tie both rope ends together and rappel on both rope strands but clip a carabiner from their harness into only one of the two ropes such that they are attached in a large closed loop, and their harness will stop them once they reach the end of the rope. (see diagrams A-B).

Advantages

- easy and simple to use
- very quick to employ
- requires no extra equipment or rope
- can be used in conjunction with almost all other belays or safeguards
- keeps climber from rappelling off end of rope (knot alerts you to the end)
- can be used with any rappel method including body rappels
- using the alternative method, the rappeller cannot slide off the end of the rope

Disadvantages

- knot may slip through some rappel devices
- rappeller may slide / fall full rope length before reaching rope end
- difficult to assist injured climber from above
- does not safeguard against rope, anchor, harness or descender failure

Normal Rappel With Independent

Belay: This is again a common technique in which the rappel is set up as per normal and a second line is used to belay the rappeller. If this technique can be used it provides one of the best rappel safeguards. (diagram C)

Advantages

- easy and simple to use
- requires little extra gear
- can be used in conjunction with other belays or safeguards
- can be used with any rappel method including body rappels
- good control over rappeller if accident occurs
- easy to clear tangled rappel lines
- descending device, rappel or anchor can fail without serious consequences
- difficult to rappel off the end of the rope; if you do you are on belay
- independent belay and rappel anchors can be used for greater security
- if desired, the rappeller can retain a low rappel point with a high tie-in from the belay to prevent flipping upside down
- can be used to control the speed of inexperienced rappellers or increase friction to

aid weaker members on descent or when required on wet or icy ropes

Disadvantages

- requires additional rope
- can be time consuming
- extra rope may cause confusion with inexperienced persons
- the last person down must use an alternate technique to safeguard himself
- on long free rappels, if the rappeller is spinning, the belay line and rappel line may become intertwined and cause difficulties (this is not usually a problem in mountaineering but is more often seen in a caving environment)

Rappel On 1/2 Line / Belay On 1/2

Line: A lesser known technique in which half of the rappel line, a single strand, is used to rappel on while the second strand is used to belay the rappeller. It is very similar to the "Normal Rappel With Independent Belay" but is slightly more complicated and requires one less rope. (diagram D-G)

Advantages

- relatively easy to learn
- requires little extra gear; no extra rope
- can be used in conjunction with other belays or safeguards
- can be used with any rappel method including body rappels
- good control over rappeller if accident occurs
- keeps ropes separated
- easy to clear tangled rappel lines; only 1/2 of the rope is thrown down
- descending device, rappel or anchor can fail without serious consequences
- difficult to rappel off the end of the rope; if you do you are on belay
- rappellers can remain tied into the ends of the rope until the last man is down
- independent belay and rappel anchors can be used for greater security
- if desired, the rappeller can retain a low rappel point with a high tie-in from the belay to prevent flipping upside down
- can be used to control the speed of inexperienced rappellers or increase friction to aid weaker members on descent or when required on wet or icy ropes

Disadvantages

- slightly more complicated than rappel with independent belay
- requires prior knowledge of system and practice

- can be time consuming, particularly for inexperienced persons
- extra rope may cause confusion with inexperienced persons
- the last person down must use an alternate technique to safeguard himself
- on long free rappels, if the rappeller is spinning, the belay line and rappel line may become intertwined and cause difficulties (this is not usually a problem in mountaineering but is more often seen in a caving environment)

Guides Lower: This system is commonly used by guides and is almost identical to the above system but each client is lowered on a single line rather than rappelling.

Advantages

- requires little extra gear; no extra rope
- persons being lowered are always "on belay"
- does not require any effort from person being lowered
- keeps ropes separated; lines do not tangle
- persons being lowered can remain tied into the ends of the rope until the last man is down
- independent belay and rappel anchors can be used for greater security
- a high tie-in can be used to prevent flipping upside down
- easy to control the speed of descent or to aid weaker members on descent

Disadvantages

- slightly more complicated than rappel with independent belay
- requires prior knowledge of system and practice
- can be time consuming, particularly for inexperienced persons
- most people feel insecure as they are not used to being lowered
- the rope is usually subject to more abrasion than normal
- the last person down must use an alternate technique to safeguard himself

Guides Lower Variation: In a situation in which the more experienced person desires to proceed first (very inexperienced partner) he rappels down on a single strand while the second person is already tied into the opposite end of the rope, ready to be lowered when it is safe to proceed. The first person must be careful that he does not descend more than 1/2 a rope length or he will not be able to successfully lower his partner. (diagram H-1)

Advantages

- can be used in conjunction with other belays or safeguards
- requires little extra gear; no extra rope
- keeps ropes separated
- more experienced person can scan the route
- good control over second person
- easy for experienced person to learn (although much harder to master)
- an experienced person can lower another person in control from below
- very quick for an experienced person to use

Disadvantages

- can be confusing to inexperienced persons
- does not safeguard against rope, anchor or harness failure
- can be time consuming if not familiar with the system
- carabiner or rappel ring must be left behind
- rope receives much abrasion
- limits rappel to 1/2 rope length
- difficult to use if there are more than two persons in the party
- the first person down must use an alternate technique to safeguard himself
- the second person may not feel in control being lowered from below
- requires prior knowledge of system and practice in a safe location
- increases anchor loading slightly (up to twice body weight)
- best used when second person is in plain view at all times
- may expose belayer to rockfall

Prusik Safeties And Shunts: This is a technique whereby a knot such as a Prusik hitch or a mechanical device, such as a shunt or spelean shunt, is slid down the rappel line with the rappeller. In the event of an accident, etc., the knot or shunt is allowed to grasp the rope thus safeguarding the rappeller. Prusik safeties have been hotly debated in the past. Debate tends to center around the difficulty in releasing the knot on steep terrain and the documented failure of the knot to grasp on several occasions with drastic consequences.

Fortunately, despite these concerns, prusik safeties have become one of the most common means of safeguarding rappels. Releasable prusik style hitches have been devised as well as releasable mechanical shunts but there are various problems with both of these options. A method which is currently gaining favor is use of

a standard Prusik hitch on the rappel line attached to the harness via a knot which is releasable under load. (see diagrams J-K)

Advantages

- easy to learn (although harder to master)
- can be used in conjunction with other belays or safeguards
- guards against failure of descending device and some human errors
- can be used with any rappel method including body rappels
- requires little extra gear; no extra rope
- safety is controlled by person on rappel
- does not require anyone above
- if used in conjunction with stopper knot it is almost impossible to rappel off end of rope
- does not require another knowledgeable person to safeguard descent
- allows stopping in mid-rappel to clear lines
- can be used by any party member
- very quick for an experienced person to use

Disadvantages

- does not safeguard against rope, anchor or harness failure
- can be time consuming if not familiar with the system
- requires prior knowledge and practice of technique
- can be confusing to inexperienced persons
- knot may get out of reach if attaching sling is too long
- prusik may slip if grabbed tightly and kept open by the person on rappel. If this occurs, the prusik may become glazed and melt through
- the prusik may be difficult to release. If the prusik locks on steep terrain, the rappeller must know the procedure for self extrication and release of the knot and preferably have practiced this procedure. A better alternative is to attach the prusik to the harness using a releasable configuration.
- prusik or shunt may get in the way of an inexperienced person
- if the rappeller is injured and the prusik or shunt locks, it may be difficult to raise or lower the rappeller in control unless another rope is available for rescue.

Slingshot Belay From Below With Rope: In this technique the rappeller is belayed from below with the rope passing through a runner at the rappel anchor. The rappeller thus has a rope belay with its' advantages, but can only rappel a 1/2 rope length. As well, an

additional rope is required. (see diagram L)

Advantages

- relatively easy to employ
- requires little extra gear
- can be used in conjunction with other safeguards
- can be used with any rappel method including body rappels
- good control over rappeller if accident occurs
- descending device failure or human error can occur without serious consequences
- difficult to rappel off the end of the rope; if you do you are on belay
- independent belay and rappel anchors can be used for greater security
- if desired, the rappeller can retain a low rappel point with a high tie-in from the belay to prevent flipping upside down
- can be used to control the speed of inexperienced rappellers or increase friction to aid weaker members on descent or when required on wet or icy ropes

Disadvantages

- requires additional rope
- can be time consuming
- limits rappel distance to 1/2 rope length
- extra rope may cause confusion with inexperienced persons
- the first person down must use an alternate technique to safeguard himself
- on long free rappels, if the rappeller is spinning, the belay line and rappel line may become intertwined and cause difficulties (this is not usually a problem in mountaineering but is more often seen in a caving environment)

Tension Belay From Below: Most persons who come to know this technique also hear of its military application in rappelling. This technique is based on the principle that if you increase the tension in the rope below a rappeller who is using a mechanical descending device you can bring his progress to a halt. In simple terms you pull on the rope below a rappeller and if you pull hard enough, he stops. Normally only a small amount of force is required. (see diagram M)

Advantages

- easy to learn (although much harder to master)
- very quick for an experienced person to use
- no extra rope or equipment is required
- can be used in conjunction with other belays or safeguards
- almost impossible to rappel off the end of the

rope

- good control over second person; an experienced person can lower another person in control from below
- can be used to belay the last man down
- can be used to control the speed of inexperienced rappellers
- can be used to aid weaker members on descent or to increase friction when required on wet or icy ropes

Disadvantages

- does not safeguard against rope, anchor, harness or descender failure
- the first person down must use an alternate technique to safeguard himself
- requires prior knowledge and practice in a safe location
- increases anchor loading slightly (usually less than 50 lbs.)
- must be used with a mechanical descender, cannot be used with a body rappel
- best used when rappeller is in plain view at all times
- may expose belayer to rockfall
- requires person below to be attentive at all times to avoid excessive time lag before tension can be applied, which may cause the rappeller to gain excessive speed.

Summary: Eight techniques for safeguarding rappels or rope descents were examined. Advantages and disadvantages were presented for each. With each of the techniques reviewed there could be other advantages or disadvantages which were inadvertently missed by this author. Each of these techniques should be learned under the guidance of an experienced tutor. Many of these techniques if applied improperly could have fatal consequences.

It should be noted that no attempt to grade or rate these techniques has been made and their order is coincidental. Each has sufficient merit to justify adding them to even the learned mountaineer's repertoire of techniques. Many of the techniques are enhanced when applied simultaneously, thereby retaining their advantages but not adding appreciably to the disadvantages of the system as a whole.

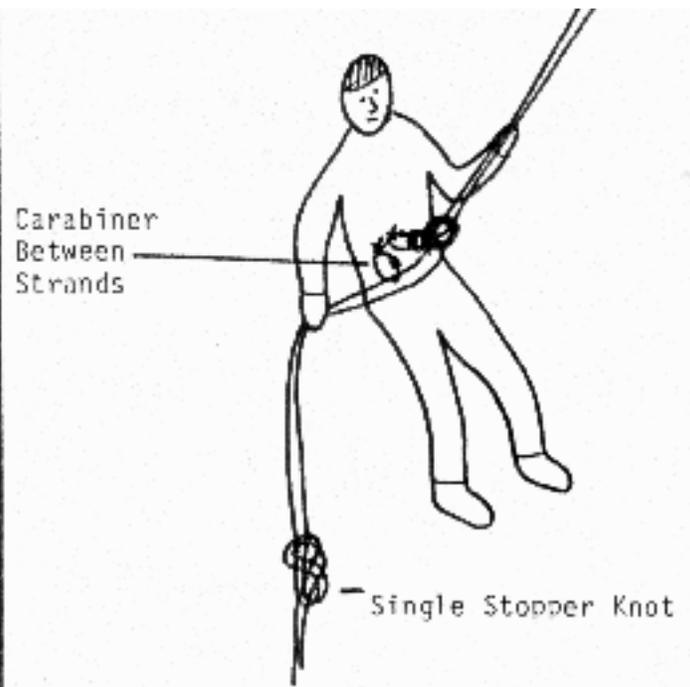
I hope that there is sufficient material contained in this article to stimulate conversation and perhaps help to eliminate the need for rappelling without a belay.

This is the fourth major revision of this article which originally appeared in the Alpine Club of Canada Edmonton Section Newsletter (1984), ACC Gazette (1985), and ACC Safety Binder (1985). It is reprinted courtesy of Cyril Shokoples. Cyril is an internationally certified Mountain Guide and has been a member of the Alpine Club and Edmonton Section since 1975. He became a Senior member in 1979 and received the Silver Rope Award in 1988. He currently resides in Edmonton 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 World Wide Web Site at - <http://www.compumart.ab.ca/resqdyn/>



Individual Stopper Knots

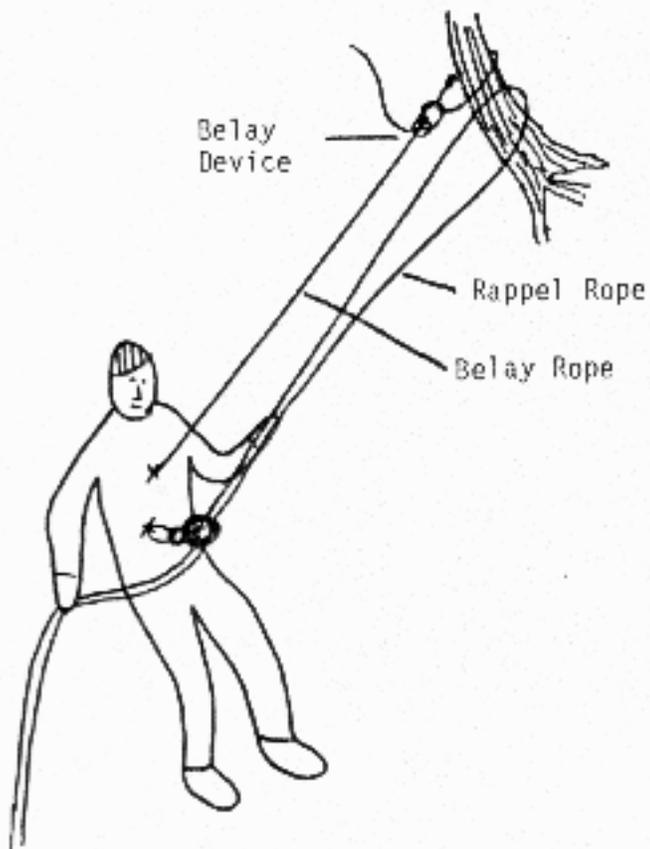
DIAGRAM "A" - STOPPER KNOT



Carabiner
Between
Strands

Single Stopper Knot

DIAGRAM "B" - STOPPER KNOT

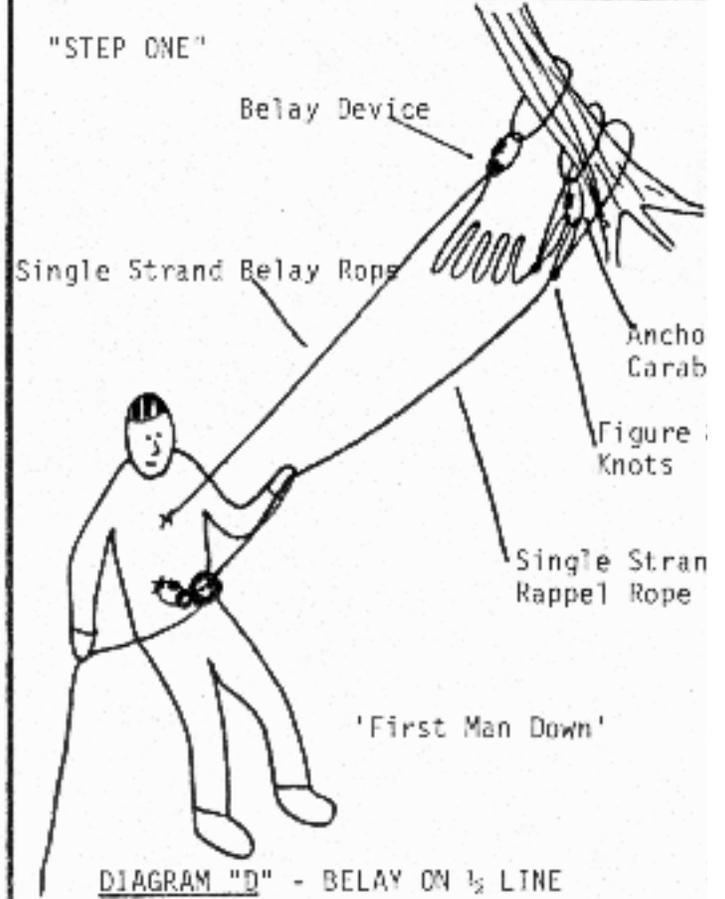


Belay
Device

Rappel Rope

Belay Rope

DIAGRAM "C" - INDEPENDENT BELAY



"STEP ONE"

Belay Device

Single Strand Belay Rope

Ancho
Carab

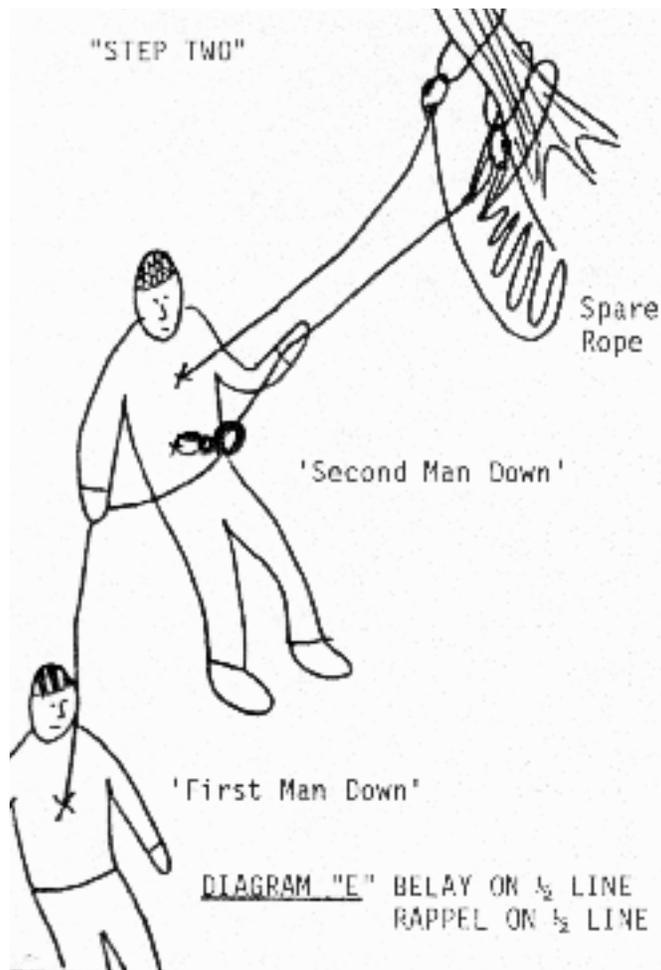
Figure
Knots

Single Stran
Rappel Rope

'First Man Down'

DIAGRAM "D" - BELAY ON $\frac{1}{2}$ LINE
RAPPEL ON $\frac{1}{2}$ LINE

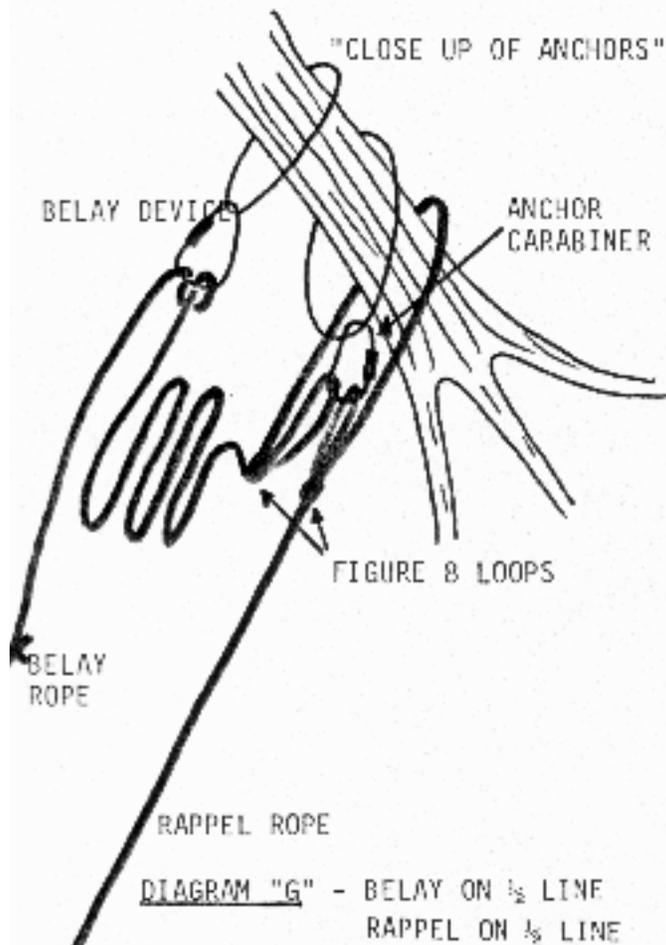
"STEP TWO"



"STEP THREE"



"CLOSE UP OF ANCHORS"



Rappel Ring
Figure 8 Loop
Carabiner

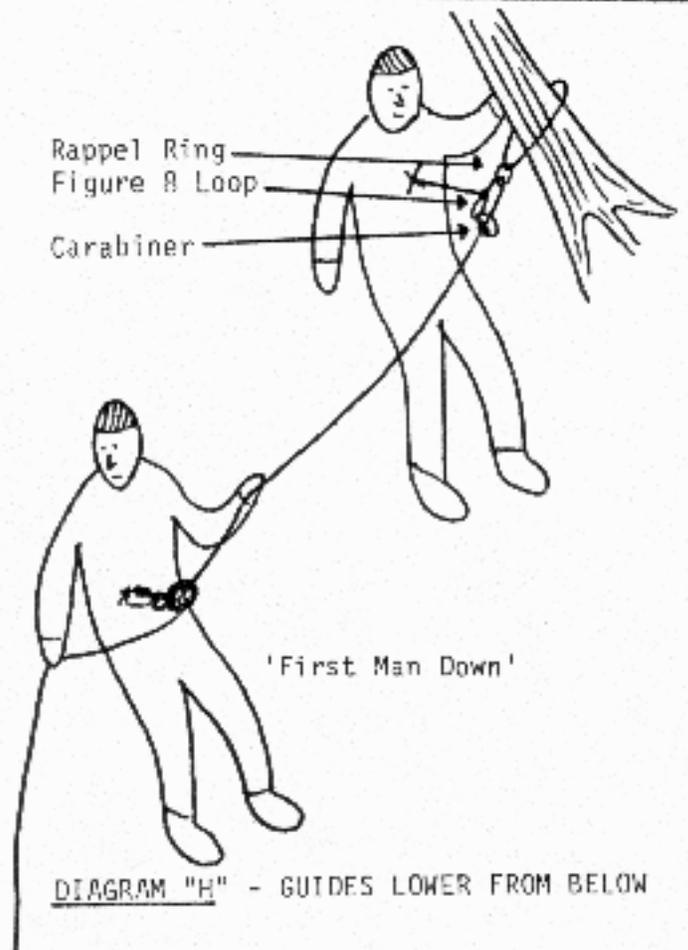


DIAGRAM "I" -
GUIDES LOWER FROM BELOW

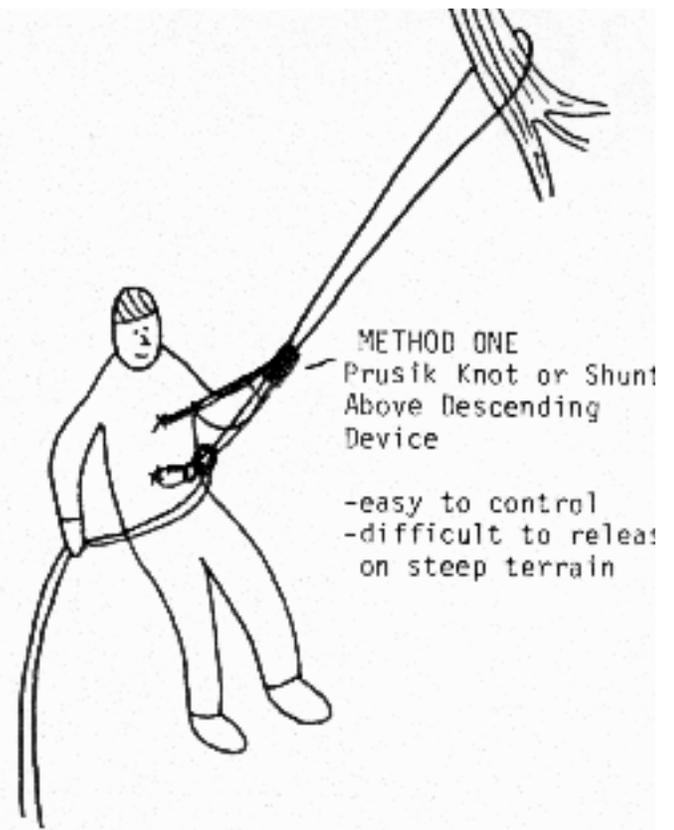
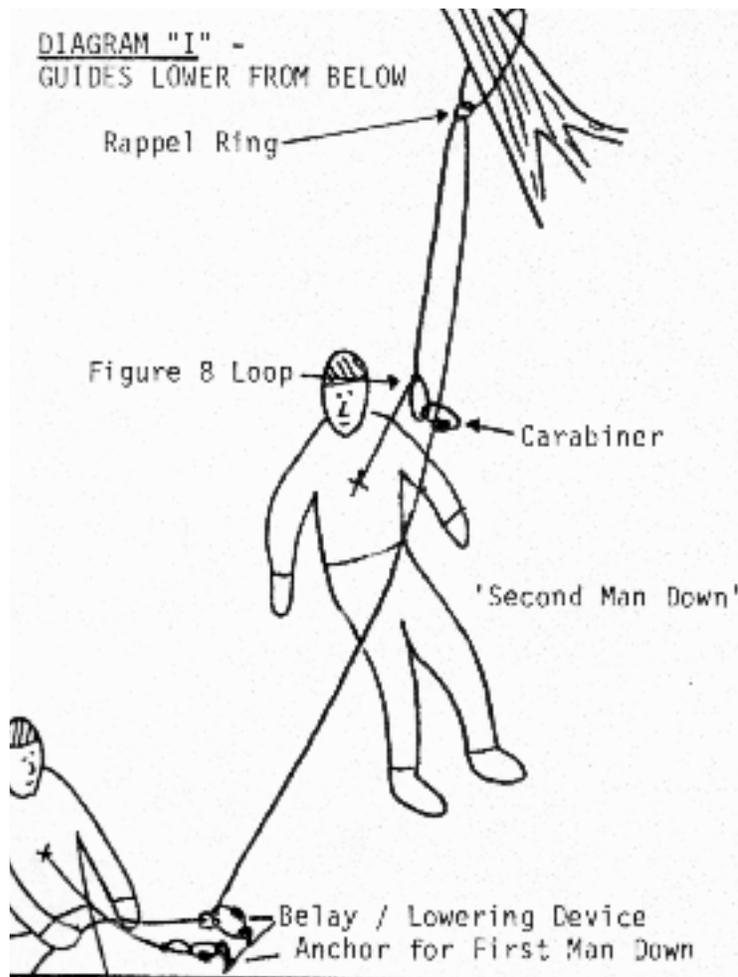


DIAGRAM "J" - PRUSIK SAFETIES & SHUNTS

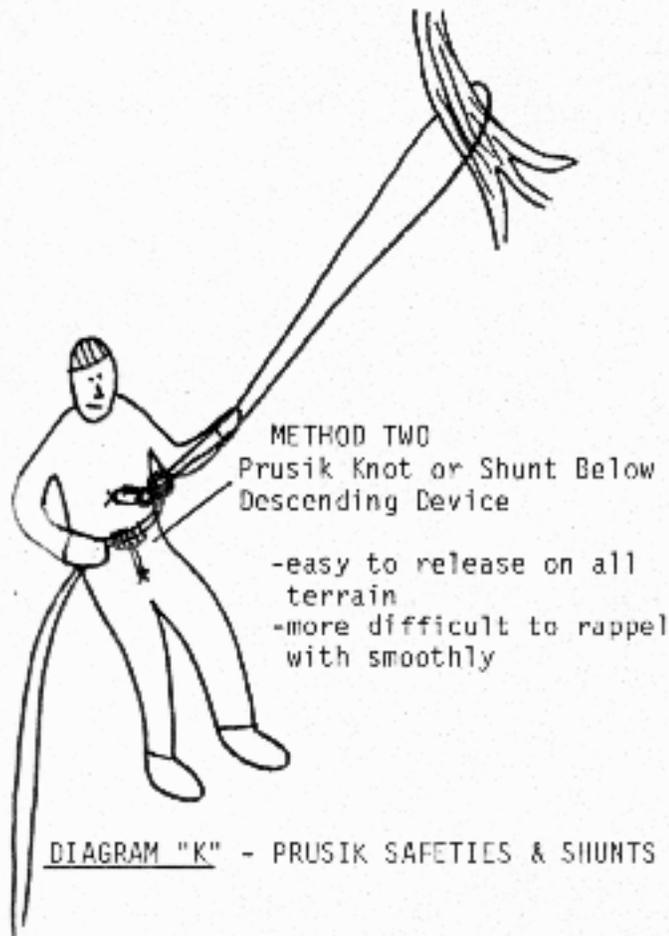


DIAGRAM "K" - PRUSIK SAFETIES & SHUNTS

DIAGRAM "L" - BELAY FROM
BELOW WITH ROPE

