

NYLON HIGHWAY NO. 35



...ESPECIALLY FOR THE VERTICAL CAVER

NYLON HIGHWAY

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THE NYLON HIGHWAY

The Nylon Highway is published on a semi-annual basis pending sufficient material. It is the intent of this publication to provide a vehicle for papers on vertical work. All submitted articles containing unsafe practices will be returned to the author. With this issue, the Section has over 1100 members with a mail out of almost 1200 copies each issue.

Opinions expressed herein are credited to the author and do not necessarily agree with those of the Vertical Section, its members or its Executive Committee. Reprinted material must give credit to author and source. Letters to the editor are welcome.

From the Editor: Well another issue is nearly ready for the presses. As always, I've waited until the last moment to get this done. I guess I just work better under extreme pressure. You may notice some improvements with this issue. The major one is that we have a new printer and I'm hoping the quality will be much better than the last issue. Also, I have a new address. I moved to Marietta, Georgia the day after I dropped off the last issue of the *Nylon Highway* at the printer. I would like to thank all of the authors who have sent me material and the large number of articles I received on disk was a great help. As far as computer compatibility goes, I can deal with most IBM compatible files. Text files should be in either Word Perfect or Word Star or saved as an ASCII (text) file. At this point, I have less compatibility with graphics files but am trying to upgrade. I use a CAD program that can read an AUTOCAD .DXF or .SKD file. If you want to send graphics on disk and are not sure about compatibility, please call me at 404-427-8375 and we can figure out what is usable. I would also like to make a correction from the last issue, the Fritzke Alpine Box chest roller was discussed at the Fritzke Spring Box. Thanks again for all the great articles. With this type of writing, we can't help but have a great magazine.

Maureen Handler, Editor

DECEMBER 1992

NO. 35

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Cover: 20th Anniversary Logo of the Vertical Section
drawn by Linda Heslop

THE JOY OF YO-YOING

By Bill Bussey

Along with many other vertical cavers I've been often given no respect in the past for "yo-yoing" pits and cliffs. "All you do is "sport" vertical caving.", those who often do at best sporadic vertical caving will say. A cave club newsletter editor once told me that all of my trip reports were simply "We had fun going down and up the "xxx" foot pit." "Is that all you ever do?", she would ask. "Well, no." I would say. "But it was the most enjoyable and informative part of the trip."

The Glossary in *On Rope* defines "yo-yo" as 1. To go down a pit or drop and come right back up. Sometimes more than once. 2. A person who does #1. See, even in *On Rope* we yo-yo'ers don't get any respect.

First off, this definition for yo-yo is incorrect. The correct definition is:

Yo-Yo: To go down a pit or drop and come right back up multiple times.(period)

To truly Yo-yo a pit or drop one must ALWAYS go down and up more than once. To go down and up only once is a bounce, or some people may call it a bop or bob (which I've never heard anyone say in the field) In some cases, bounce would mean going down and up a drop once then going to another nearby pit and going down and up it once. There is a difference in yo-yoing and bouncing pits. Bounce becomes specifically a yo-yo when it is done more than once.

The joy of yo-yoing comes in the growing confidence of rappelling and climbing a drop multiple times. To me, rappels are always better the second time around. My first rappels of the day, even into pits and cliffs I've done many times in the past are usually tentative and cautious at best. Even though I've done them before, and know many of the nuances of the drop, there is still a bit of "getting to know" the pit again. I'm especially cautious if I've never done the drop before. The second and third rappels of any pit or cliff allow me to have fun and really enjoy the drop. I always rappel faster and more confidently the second and third time around. I don't really feel "the joy of rappelling" until after the first one. While I don't feel at all like this about climbing, I still feel slightly more relaxed on additional climbs of a pit or drop.

Yo-Yoing a pit or cliff allows one to see and experience more of the scenic quality of the drop. The first time down one doesn't know exactly what to expect. Even on familiar drops, the conditions might be wetter, the rope might be faster or slower, or even the rig-point may be different than a previous time. Confidently knowing what to expect this time around means that you can allow yourself to notice the other scenic aspects of the drop.

However, the main reason for yo-yoing is for the experience gained and skills learned. Bill Cuddington once told me that one should learn something on every rappel and climb. He said one should "change something or do it a little differently" each time on rope. With the challenge of "can I do this drop?" out of the way, one can concentrate on learning something. What would happen if I took higher steps on this climb out? Can I climb smoother? How far can I climb without resting? What if I shorten my bungee cord? How would it work if I rappelled with the rope between my legs like Maureen does? What happens if I took off a bar just under the lip? Can I still keep it under control? (Ask for a bottom belay, please!) Can I add another bar while still moving near the bottom? What is in that hole 2/3 the way up the pit? Can I stop spinning long enough to photograph that waterfall? How does Fred's new climbing system work for me?

One can answer these and many more questions when one takes the time to ask them when yo-yoing a pit or drop. Subconsciously, there is always that question of whether I can "do this," even on short, not particularly challenging drops. Once done, this question is answered. In most cases, if you can do it once, you can generally do it several times again. Use these multiple drops to learn, build and earn experience. This experience will be helpful when you need it. I think that most of the vertical caving accidents using modern vertical techniques and equipment during the last few years would have never happened if those that had them had taken more time to yo-yo more pits and cliffs earlier on. For all, the accident was usually the result of lack of experience with the situation. Safety is developed from experience. Experience comes from repetition. Yo-yoing is repetition.

The more rappels and climbs in the field, or just climbs you can do with a pulley in a tree, the more experience and knowledge you will have with your system and with Single Rope Techniques in general. By not having to be so preoccupied with keeping the basics straight you can concentrate on developing and achieving experience as a better caver capable of longer, more strenuous and challenging trips.

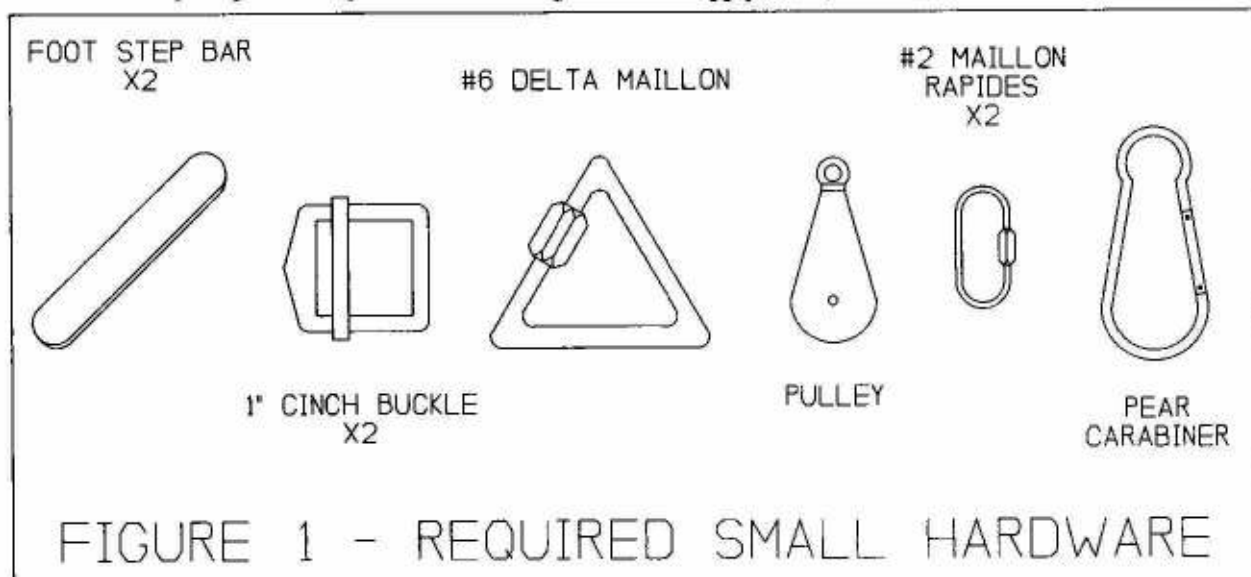
In summary, the real joy of any activity comes when you and others realize you can do it well. The biggest compliment one can receive is: "You make it look easy." Making it look easy requires being in good shape, plus a lot of practice and repetition. Yo-yoing pits and cliffs can help you achieve all three.

Double Bungie

Fabricating a System by Bruce W. Smith

After fabricating several double bungie systems for friends and myself, I've had the opportunity to take a close look at the fabrication of the system under a microscope and intend to lay out a blue print for building your own system. This system is designed for any climber. The only adjustment may be the boot loop size for kids, the Jammer wrap strap and safety ascender cord length.

- 1 - low attachment seat harness with seat harness carabiner
- 45" - 3/8" static kernmantle rope safety ascender cord
- 40" - 3/16" bungie cord
- 1 - #6 delta maillon screw link (2 1/8" major axis)
- 5 - 1/4", 30# test, plastic self locking cable ties (electric supply house)



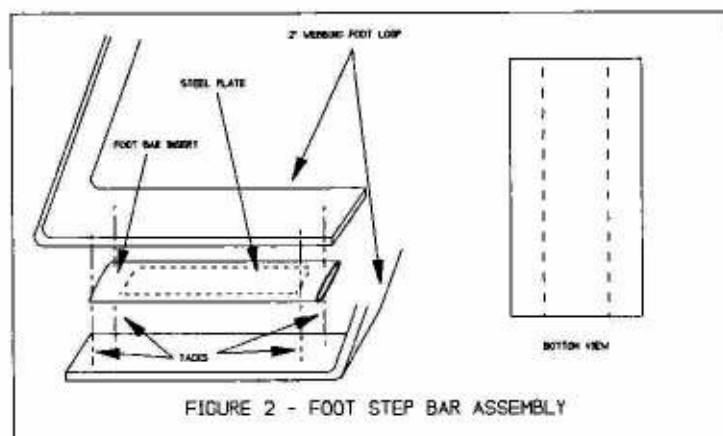
First, let's collect the necessary system components: (cut and seal (burn) the webbing and strap as you cut it.)

- 1 - Petzl Croll
- 1 - Petzl Jammer
- 1 - Petzl handled Jammer
- 2 - 2" x 22" foot straps
- 2 - 1" x 4 3/4" tubular webbing foot bar inserts (don't seal one end of each foot bar insert webbing yet.)
- 2 - 1" x 28" tubular webbing chicken loops
- 1 - 1" x 22 1/2" tubular webbing Croll wrap strap
- 1 - 1" x 58" tubular webbing Jammer wrap strap
- 1 - 1" x 4 3/4" tubular webbing Jammer protector loops (seal the ends so the tube remains open at both ends.)
- 2 - 1" cinch buckles
- 2 - #2 Maillon Rapides screw links (1" I.D.)
- 1 - small universal pulley (Ace hardware, 2" overall length, pulley wheel 5/8")
- 2 - 3 1/2" x 3/4" x 3/32" steel plate foot step bars (Ace hardware store)
- 1 - 3/8" cable protector
- 1 - small pear shaped carabiner (non-locking 1 1/2" I.D.)
- 1 - chest harness with single plate chest roller or double chest roller (will discuss the pros and cons of each later)

FOOT CROLL ASSEMBLY

STEP #1 - File, sand, round the ends and smooth the 2 foot step bars. Insert them into the 4 3/4" foot bar inserts. After inserting the foot step bars, seal the nylon with a stove eye or the like.

STEP #2 - Take one 22" x 2" foot loop and wrap it so it is doubled on the step portion of the loop. Insert and



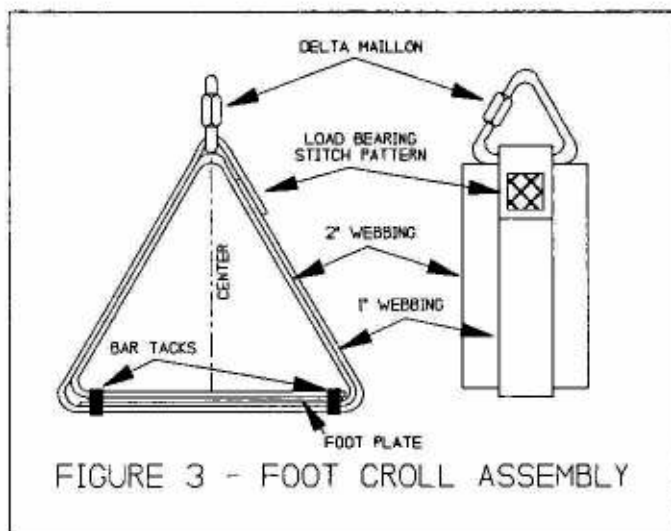


FIGURE 3 - FOOT CROLL ASSEMBLY

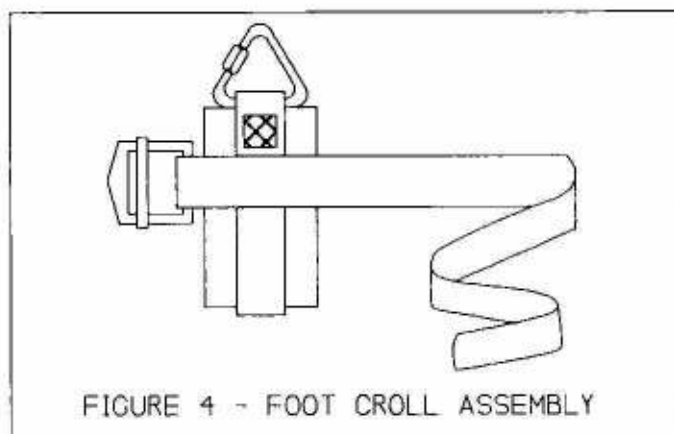


FIGURE 4 - FOOT CROLL ASSEMBLY

center the foot step bar inserts with the foot step bars inserted in between the 2" overlap. See Figure 2. Tack with a couple of stitches on both sides of the foot loop securing all three layers together.

STEP #3 - Repeat step #2 and set aside for the foot Jammer.

STEP #4 - Wrap the 22 1/2" Croll wrap strap around the 2" foot strap. Overlap and secure the delta maillon directly opposite the center of the foot step bar. See Figure 3. Bar tack all four layers on both sides of the foot step and sew at the top on both sides of the delta maillon with a load bearing stitch pattern. Because cavers tend to be somewhat hard on foot loops by walking on rocks, dirt and mud, this configuration of 4 layers has proven to last a long time. Without all the protective layers, the foot step bar tends to wear and force itself through moderate protection. **NOTE:** The STEP BAR innovation allows additional foot comfort and allows the climber to climb not only in boots, but comfortably in sneakers, dock shoes, duck boots and moccasins during backyard practice sessions. Try it, you'll love it.

STEP #5 - Attach the chick loop. Take one 1" cinch buckle and one of the 21" pieces of 1" webbing and overlap 2 1/2" to 3". Secure just below where the load bearing stitch pattern ends on one side of the delta maillon. At this point it doesn't matter which side. The Croll needs to be secured in such a fashion that the spine or flat part of the Croll aligns parallel with

the climber's shin bone and the chicken loop buckles should be located on the outside of the foot. Experience tells that when the buckles are located on the inside of the foot loop, the buckles catch on the other boot, pant leg and other buckles and loosen. This is not a fluke happening, rather almost on any climb the chances of the chicken loop buckles coming undone are better than 50-50. See Figure 4.

STEP #6 - Attach the Croll

FOOT JAMMER ASSEMBLY

STEP #7 - Take your second semi-completed foot loop and wrap the 58" Jammer wrap strap and extend 15" of the strap past the corner of the foot step bar. See Figure 5. Bar tack the four layers as done in Step #4 of the foot Croll assembly. Bar tack the wrap strap at the top center of the of the foot loop in three places.

STEP #8 - Slide the 4 3/4" Jammer protector loop over the long tail of the Jammer wrap strap. Insert the long tail through the bottom hole in the Jammer and slide it over the protector loop. With your foot in the loop, position the Jammer so the bottom of the Jammer is one inch above the top of the knee cap. This is one point where adjustment is necessary based on different leg lengths. It may be necessary to cut off some of the overlap as shown in Figure 5.

STEP #9 - Secure the chicken loop. Which side and manner of attachment does matter on this one. Assume the croll is to be put on your right foot and the Jammer on you left, position the Jammer's flat side parallel and closest to your extended knee (the ascender's open side is out). Be sure the webbing is not twisted. Attach the chick loop with a load bearing stitch pattern (buckle towards the heel and on the outside of the foot) next to the bar tack on the top of the foot loop. See Figure 5.

SEW THE BUNGIE CORD

STEP #10 - Make a 3 inch loop in the bungee cord and using a sewing awl, sew down the cord towards the bite. About 1" from the end, loop the awl thread and whip the entire sewn length of the seam. At the end, insert the whipping end and pull thread inside the whipping, cut and burn the ends. This attachment allows the entire length of the bungee cord to produce pull or spring as opposed to a know which will stifle bungee performance. See Figure 6.

STEP #11 - Insert the bungee cord over the roller of the pulley and sew the other end of the bungee exactly as the first end. Total length of the bungee cord may vary, but a good length to start with for an average 5' 2" to 5' 10" should end up being about 32 1/2" unstretched.

STEP #12 - Attach one small #2 maillon in each end of the bungee cord for the time being. Also attach the small bear shaped carabiner in the eye of the pulley. Put this assemble aside for now.

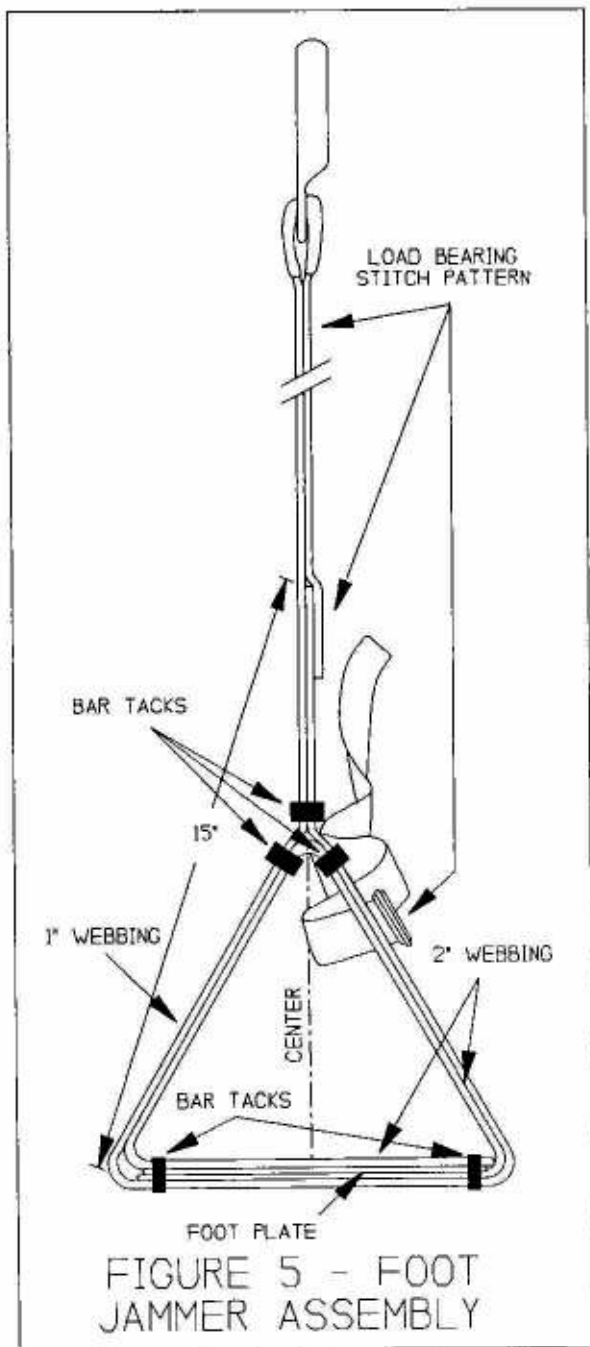
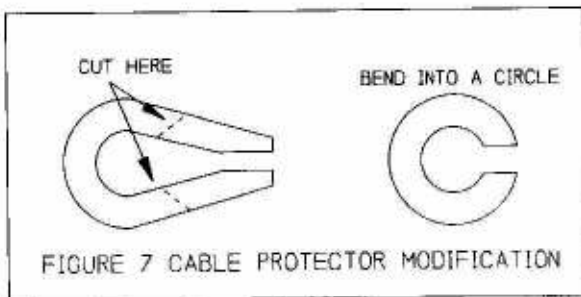


FIGURE 5 - FOOT JAMMER ASSEMBLY



PETZL SAFETY ASSEMBLY

STEP #13 - With a hacksaw, file and vice, modify the cable protector. See Figure 7. This modification will add at least one additional inch on the working length of the Petzl safety cord.

STEP #14 - Insert the cable protector through the eye of the handled Petzl and with the 3/8" kernmantle rope, tie the tightest bowline you ever tied. Then secure the knot in three places with the plastic self-locking cable ties. See Figure 8.

STEP #15 - Tie another very small bowline on the other end of the rope. This will eventually be connected to the seat harness so it doesn't have to be big. Keep the loop very small. With the last two cable ties, secure the loose end of the rope to the inside of the second bowline loop.

STEP #16 - Drill a 5/16" hole directly below the center of the roller(s) on your chest plate. The pear shaped carabiner on the bungee cord attaches through this hole.

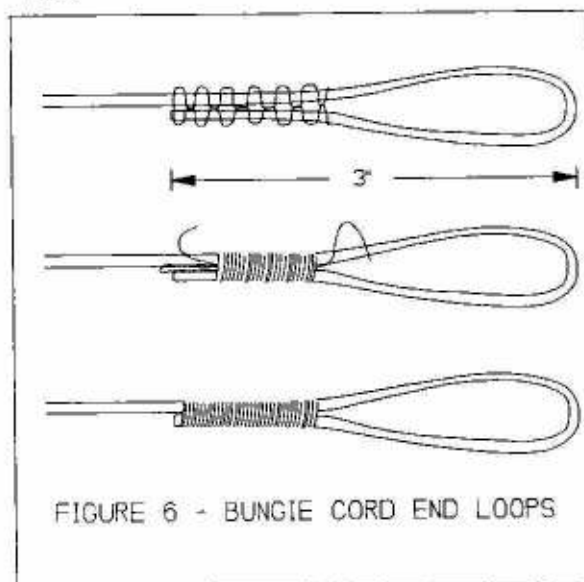
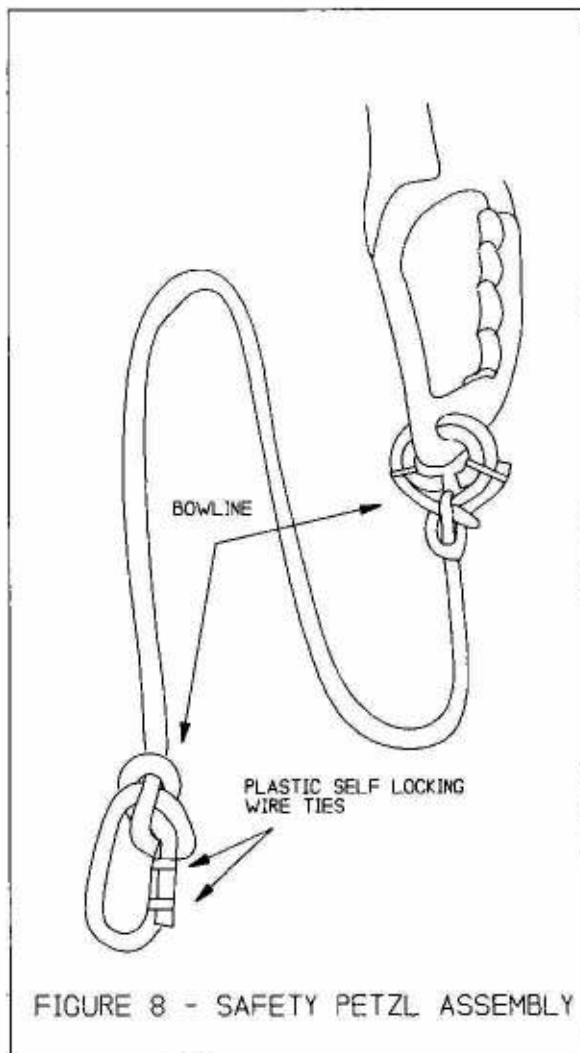


FIGURE 6 - BUNGIE CORD END LOOPS

LET'S CLIMB

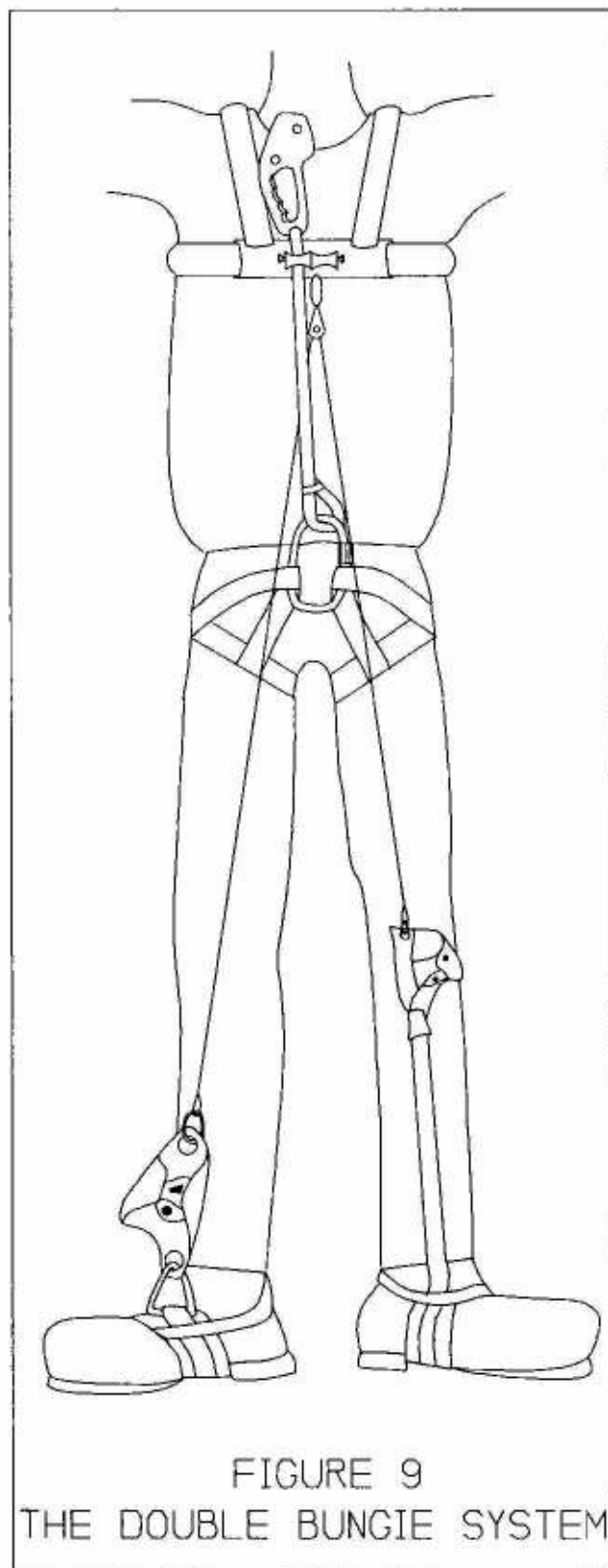
- Seat harness on? Figure 9 shows the whole system.
- Secure the foot Croll to your right foot flat side towards the ankle. Chicken loop buckles toward the outside.
- Secure the foot Jammer to your left foot. Flat side towards your knee. Chicken loop buckles towards the outside.
- Put the chest harness on.
- Attach the Petzl safety to the seat harness.
- Clip all three ascenders and chest roller(s) to the rope.
- Lastly, secure the bungee cord to the tops of the Croll and Jammer and thread the pulley with the pear shaped carabiner up and attach it to your chest plate (step #16). The bungee cord's orientation should never be inhibited from its intended function of pulling up each ascender and should end up between the rope and the climber's body -- never wrapped around the rope.



SINGLE ROLLER VS. DOUBLE ROLLER CHEST BOX

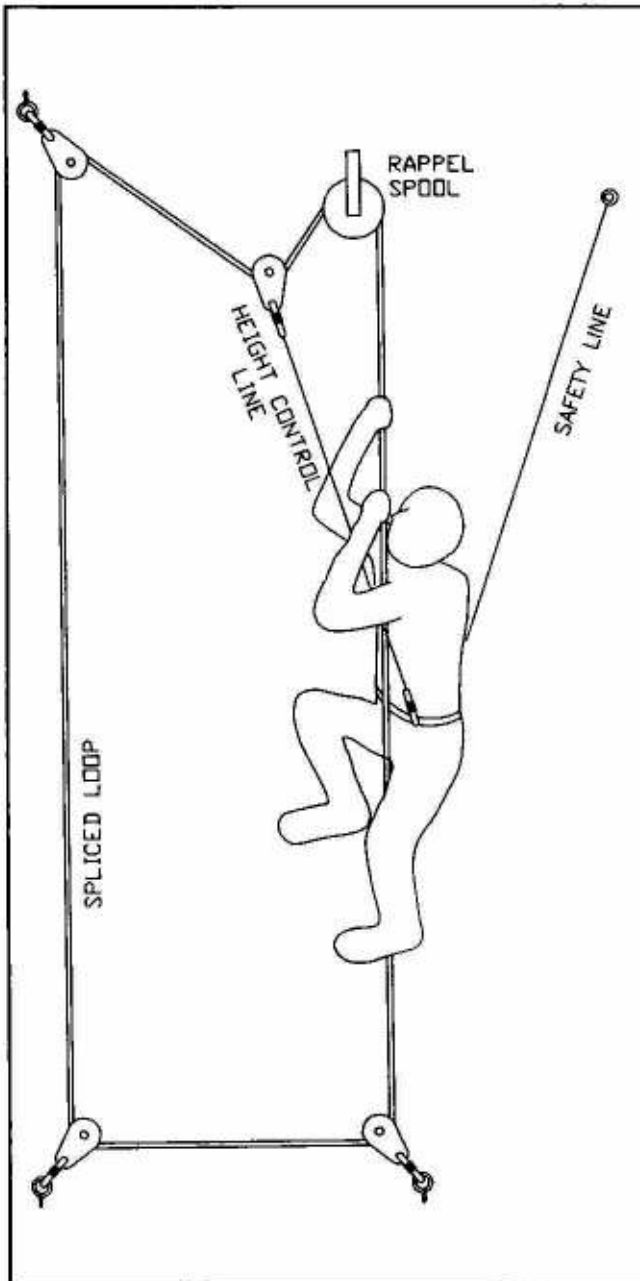
The basic system only requires a single roller. A single roller is lighter and less expensive, however, the double roller affords the climber a second roller to put your safety through and leaves you with the option of expanding the system to a Mitchell design.

See Maureen Handler's articles in *Nylon Highways* #28 and #29 for a complete account of system operation and special points about the system that will allow for great ascents.



CLIMBING TREADMILL

by Pete Sauvigne
VPI 193, NSS 17410R



For years I have been interested in development of this type of system, but a continuous loop of rope is required, and only recently have I discovered a splice that works well. My rig has been used for about 10,000 ft of

climbing, or about 400 revolutions of the 25 foot loop. Although I am still improving the design, I have learned enough to warrant sharing the information.

I use a spool as the primary friction device, but a piece of pipe works just as well. The entire loop is tensioned, with a line from the climber's waist to a floating pulley providing height control. The splice limits the overall strength of the system, therefore: **ALWAYS BACK-UP THIS SYSTEM!!** Variations of this splice have broken repeatedly with no warning.

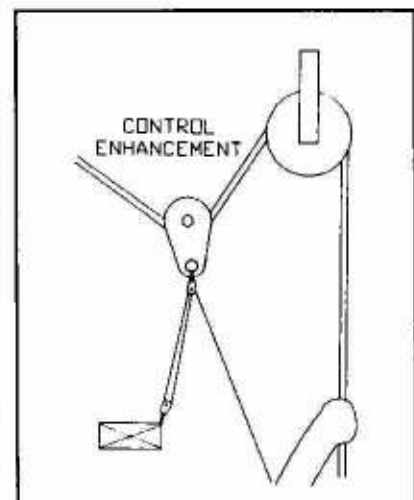
This limitation actually helps in some ways. I use retired rescue pulleys and hardware store variety pulleys and eye bolts freely since I know that the system is **FULLY BACKED-UP**. All pulleys must be large spool type (2 inch or so) to avoid snagging on the splice. Unfortunately, this rig requires greater than the standard 8' ceiling. Mine goes between the trusses in an open garage ceiling and is 10 feet, about minimum.

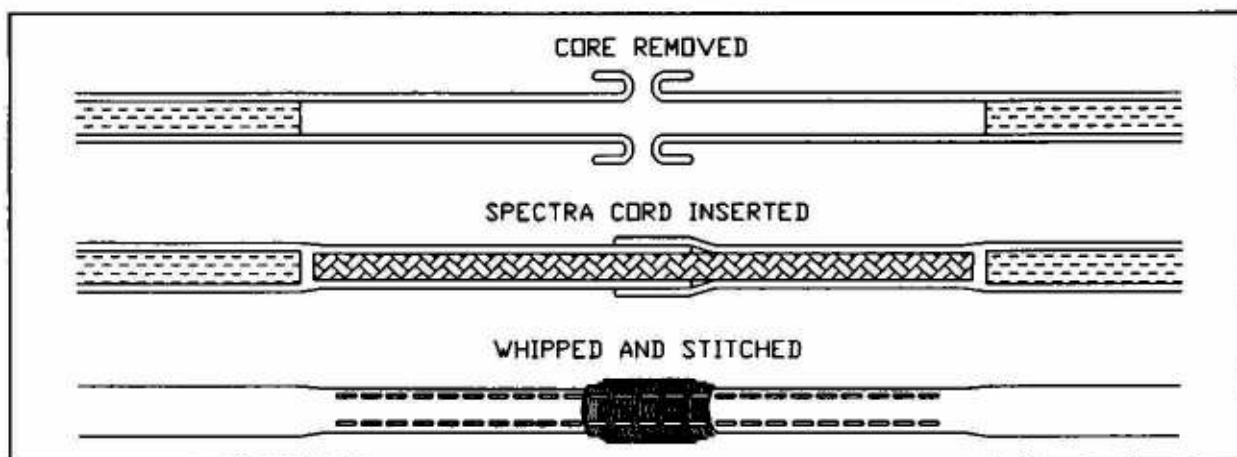
The only rig point that will sustain full body weight is the one that holds the spool. The rig point below the climber should be located so that the pulley will be directly below the spool to keep the rope truly vertical. All other pulleys can be located for convenience, and to assure proper tension in the rope. A cord from the climber to a pulley near the spool will directly control the height of the climber. In my system, this height control line is tuned with a small 3-to-1 pulley system. This provides smooth control while keeping the tension on this line acceptably low.

Making the splice is critical to the success of this system. A kernmantle rope is required, I use standard PMI. On each end of the loop piece: Pull out the core about 10 inches by aggressively sliding the sheath along the core. Cut off this piece of core, and slide the sheath back to its original position leaving a rope with hollow ends.

It is helpful to fold back about 1 inch of the sheath and tape the end to keep it from fraying. Then insert a 12" piece of 5.5 mm Spectra cord into the holes.

The Spectra cord should bottom out against the original core. When it does, tack it down





with a sewing awl to keep it in place. Take one end of the sheath, remove any tape and tie it to the Spectra cord with heavy awl thread about 1 inch past the center of the splice. Smooth out this side of the sheath and cut off any excess. Now overlap the other end of the sheath and tie it down with about 1 inch overlap. Again cut off any excess. Now whip the splice for about 1 1/2 inches over the sheath lap. Stitch through the sheath and the Spectra cord over the entire 12 inch length, including through the whipping. Make two stitching passes, 90 degrees apart.

The splice will require periodic inspection and re-whipping every 200 revolutions so. DO NOT USE 6mm nylon in place of the Spectra cord. Such splices break at about 30 revolutions, while my Spectra cord splice still holds after about 400. A rack will work for the rappel device, but it will tend to wear the splice more quickly. There are probably many acceptable design variations to suit location and availability of a spool or pipe.

It will take some effort to put it all together, but for me it has been well worth it.

Freefall From Pisa by Mark Jancin

I am not an historian of frictional rope-descending devices, but one of the earliest published examples of such a device, of which I am aware, was conceived and designed by Galileo Galilei. When I first ran across the following passage, I figured that since it made me smile, it probably cause other cavers to smile.

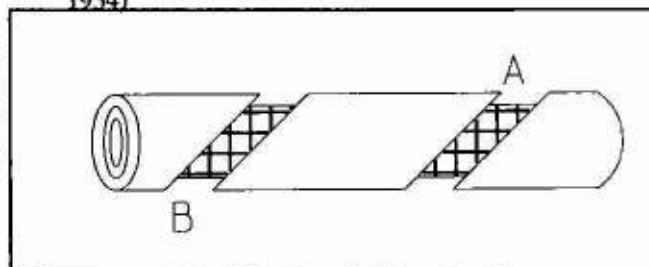
This passage is from Dialogue Concerning Two New Sciences, by Galileo Galilei, which originally was published in 1638. The format of this book is more or less a conversational argument between three guys (a so called dialectic). The immediate context of the following passage is as follows. These guys are trying to figure out why hemp ropes, 100 cubits in length, composed of constituent fibers 3 cubits in length, fail under tension or torsion such that the constituent fibers break, rather than slide past one another...

SAGREDO: "What you say has cleared up two points which I did not previously understand. One fact is how two, or at most three, turns of a rope around the axle of a windlass cannot only hold it fast, but can also prevent it from slipping when pulled by the immense force of the weight which it sustains; and moreover how, by turning the windlass, this same axle, by mere friction of the rope around it, can wind up and lift huge stones while a mere boy is able to handle the slack of the rope. The other fact has to do with a simple but clever device, invented by a young kinsman of mine, for the purpose

of descending from a window by means of a rope without lacerating the palms of his hands, as had happened to him shortly before and greatly to his discomfort. He took a wooden cylinder, AB, about as thick as a walking stick and about one span long; on this he cut a spiral channel of about one turn and a half, and large enough to just receive the rope which he wished to use. Having introduced the rope at the end A and let it out again at the end B, he enclosed both the cylinder and the rope in a case of wood or tin, hinged along the side so that it could be easily opened and closed. After he had fastened the rope to a firm support above, he could, on grasping and squeezing the case with both hands, hand by his arms. The pressure on the rope, lying between the case and the cylinder, was such that he could, at will, either grasp the case more tightly and hold himself from slipping, or slacken his hold and descend as slowly as he wished."

SALVIATI: "A truly ingenious device."

From page 10 of a modern translation by H. Crew and A. de Salvio, Dover Publishing Inc., New York, 300 p., 1954)



A Disturbing Incident

KEEP YOUR RAPPEL RACK ATTACHED TO SEAT HARNESS WHILE ON ROPE

by Bill Bussey

An incident which took place at the Vertical Section Rebelay Course has convinced me that the rack should not be removed or be detached from the seat harness when rappelling around rebelay and knots.

In this incident, a Rebelay Course participant was standing on a beam about eight feet up rigging their Rappel rack into a "down" rope in the middle of one of the courses made up for the event. The participant had completed most of the course already, and thus had very recent experience moving the rack around rebelay while tethered to the course line using a cows-tail.

The incident occurred when the participant took off the cows-tail, and put weight on the rack, which was apparently not attached to the seat harness. The participant fell, eerily silently, doing a heel hang within three feet of a group who had already done the course. The participant said something, the group turned around, incredulously saw what had happened, and immediately gave assistance. A "rescue" was initiated, getting the participant back on the beam, and down from it, with what was initially thought to be no more than a cut and a bruise or two.

The most unsettling thing about this was the rack was still properly attached on rope at the top. The locking carabiner was still in the rack eye. The participant thought the rack was attached to their seat harness. This sounded disturbingly a lot like what was described to have happened to Chris Yeager in Cueva Cheve a couple of years back. His rack also was found properly attached to the rope at the top of the drop.

For many, standard procedure in crossing knots on rope is to remove the rack from the seat harness after securing oneself to the rope with at least two ascenders. One then threads the rope through the rack while it is detached, and then attaches the rope to the seat harness carabiner or preferably Maillon Rapide Quick Link (hereafter referred to as a Quick Link). This is apparently what occurred in the incidents described above. Both presumed their locking carabiner was secured and locked to their seat harness when they again began their rappel, as it had been at the top of the drop.

Considering all of the gear attached to the seat when using Rebelay methods, this confusion is easily understandable. Attached to the seat harness Quick Link, each with their own carabiner, are the rack, a safety ascender, usually a cows-tail, and often while caving, a pack or rope on a sling hanging below the rappeller. That's at least three if not four carabiners all tightly crammed next to each other at waist level. This is a lot to keep up and work with. Checking to make sure that each carabiner remains locked through all moves, especially if fatigued, can be difficult.

Once Attached, Don't Remove!

Thus, the caver should not have to remove or add any life dependent devices from the seat harness on either rappel or climb. Once locking carabiners (or Quick Links preferably) are locked, they should stay locked until the caver is safely off rope. An exception to this would be in rescue situations. You will notice that the Bobbin, developed specifically for crossing rebelay and knots, has a spring loaded gate which allows the device to be opened to it to be disconnected and connected from the rope without removing or unlocking it from the seat harness. One doesn't see cavers experienced in Rebelay methods removing their Bobbins from their harness while on rope.

To be fair, texts describing North American Vertical techniques usually state that one should attach the rack to the seat harness carabiner with a locking carabiner to give some flexibility and "room to work" the rack when crossing knots or changing over. However, anyone who has tried this knows that typically they get the rack jammed immovably when attempting (especially for the first time) to again put their weight on the rack. It sure is easier to remove the rack and thread it!

A solution might be to add another carabiner, in fact making a chain of two carabiners, in order to gain more flexibility. However, this adds more metal, bulk, and confusion in this already crowded area, places the rack higher on rope, which might affect placement of the safety ascender or cows-tail.

As most vertical techniques instructors recommend, the cheap and easy solution is to practice the technique on rope in a tree or under similar controlled conditions. Changing over with one carabiner between the seat harness and rack can be done, if the caver knows what to expect and how to work around it. The caver may not do it right the first time, or second, or third, but with some experimentation and practice it can be done.

Carabiners - The Weak Link

Remember that the carabiner is the weak link in all Vertical gear. After *On Rope* was published, co-author Bruce Smith noted that several rock climbers had mentioned to him they thought the biggest flaw of the book was the drawings showed everything attached to the caver with locking carabiners. In rock climbing, the belay rope is always tied directly to the seat harness itself, or at worst, the seat harness Quick Link or carabiner.

While we cavers have reasons of our own to use carabiners the way we do, (at least we use **locking** carabiners!) they do have a good point. Carabiners usually have the lowest breaking strength of any life supporting equipment. In addition, carabiners can be removed easier from the rope or harness easier than any other hardware with possible exception to some ascenders.

A solution. Use Quick Links instead of locking carabiners in life support situations, like holding the seat

harness together, rack or other gear attachment to the seat harness. Quick Links don't open easily on their own, that is when rubbed by flexing webbing. In fact, they take a bit of work to remove when you do want them off. They can be safely loaded in all directions when screwed closed. They are easily inspected to determine if open or closed. They are even cheaper than carabiners.

The problem is that the only Quick Links of suitable stock diameter - at least 9 or 10mm - that are carried by US caving vendors in late 1992 are ones that are triangular or semi-circular in shape. These shapes work well for holding seat harnesses together, but are bulky and shaped improperly for connecting racks and slings to harnesses. What is needed here are oval Quick Links, with a stock diameter of 9 or 10mm, shaped similarly to the locking carabiners so familiar to us all.

The largest stock size in an oval link most vendors now sell is 5 or 7mm in diameter. These smaller oval Quick Links do not open enough to hold a rack eye attached to a seat harness, nor are they of sufficient length or strength to serve as a substitute for carabiners.

What can you and I do? Ask caving vendors and other vendors who sell Vertical equipment to start carrying

these large Quick Links, and then buy some from them. All we need to do is ask (and then buy) in large enough numbers, so that no vendor worth their salt can again make any excuses for not carrying some hardware which might help improve vertical safety.

In Summary

To summarize, people using Single rope techniques should consider their descender as a non removable part of the seat harness. Descenders should not be removed or detached from their seat harness while on rope in order to cross knots or rebelay. This is because it is often difficult to determine whether carabiners reattached to the seat harness while on rope are actually securely attached. Locking carabiners can still be used to attach a descender to the seat harness. However, they should not be unlocked or removed while on rope. A large Oval Quick Link with a stock diameter of at least 9 to 10mm provides a suitable method of attaching a rack to a seat harness. Once attached and the gate screwed into place, Screw Links are secure, are easily inspected, and take some effort and useful thought to remove.

Charter Members of the NSS Vertical Section

1992 is the 20th Anniversary of the formation of the Vertical Section of the NSS. At this time we thought it would be appropriate to list the charter members. These people signed up to initially form the Vertical Section at the 1972 NSS Convention at White Salmon, Washington. These were listed in **Nylon Highway #1** by NSS Number. They are listed alphabetically here.

Those marked with a (*) have maintained their membership on a continuous basis since 1973 according to the section records. All have remained very active in Vertical Section and NSS activities. Those marked with a (+) let their memberships lapse at least once over the twenty years, but are active Vertical Section members today. These have been the core group which has helped keep the Vertical Section going. Be sure to offer your congratulations when you see them next. The Secretary/Treasurer apologizes in advance for any errors in this listing and urges members to contact him with any corrections.

Name	NSS #	Name	NSS#	Name	NSS#
+Ivy Atherton (McLane)	13560	*Jim Gossett	595	David Mitchell	8200
Frank Binney	10816	*Marilyn Gossett	950	*Bill Mixon	5728
Steven Bittinger	11276	+James E. Hall	10997	David Neslon	9464
Craig Bittinger	11236	*William Halliday	812	*Allen Padgett	10371
Richard Breisch	9352	Russel Harmon	10991	William Peters	14114
Ken Brolsma	14103	Blake Harrison	12101	*D.C. Province	8752
+Don Broussard	9514	*Steve Hudson	11444	Jon C. Resager	9207
James M. Chester	6946	*Kyle Isenhardt	12327	Victor Rodriguez	12856
John Cole	8633	Ray Jameson	14134	Peter Strickland	8298
*Bill Cuddington	2177	*Karen Kingston (Padgett)	13184	Richard Tarangleo	11678
*Miriam Cuddington	13078	Hans L. Lindblom	10796	*Robert Thrun	8752
Paul H. Damon	2939	+Karen Lindblom	10797	Nora White	14338
Paul Duncan	12533	*Kirk MacGregor	9801	Tom Wright	12817
Barry Fergusson	12436	*Roger L. McMillan	9659	Ron Zawislak	9899
Charles Gibbs	10089	David Mischke	9390		

BAD ROCK BOLTING

by H. Daniel Gebauer, Germany

PROBLEMS AND SOLUTIONS TO ROPED ACCESS IN THE INCONSISTENT SEDIMENTS OF THE MUSTANG DISTRICT CAVE CONGLOMERATE, NEPAL.

Within the last decade, Single Rope Techniques have been applied to fields they were not initially intended for. Roped access was used to wrap a bridge in Paris with cloth just for the sight of it, or to collect unknown insects from treetops in the Amazon before they are turned into budget-priced food for independent citizens, or to load the leaning tower of Pisa with measuring devices to detect changes in it's progress. The tracks along Nylon Highway, known among Europeans as Ariadne's thread, is leading to unexpected fields not necessarily safe for everyday use. An archaeological project undertaken by the German Research Council in the Mustang district of Nepal is exploring artificial caves in cliffs of unstable sediments. The stairs, steps, and galleries formerly con-

necting the caves with the fields below are gone a long time. First carbon datings indicate that these caves might have been inhabited well before the Tibetan people reached Tibet.

BACKGROUND: Here [in Tibet] the great, famous priest known as Milarepa, Lord of The Yogis, carried on the ideas of Bhuddist philosophy. Maintaining humility, he practiced austerity and was as accustomed to living in caves as man is to wearing a hat... read the opening lines of the foreword of the Stories and Songs from the Oral Tradition of Jetsan Milarepal. (The anonymous compilation "rJe-btsun Mi-la-ras-pa'i rDo-rJei-mGyur-druk

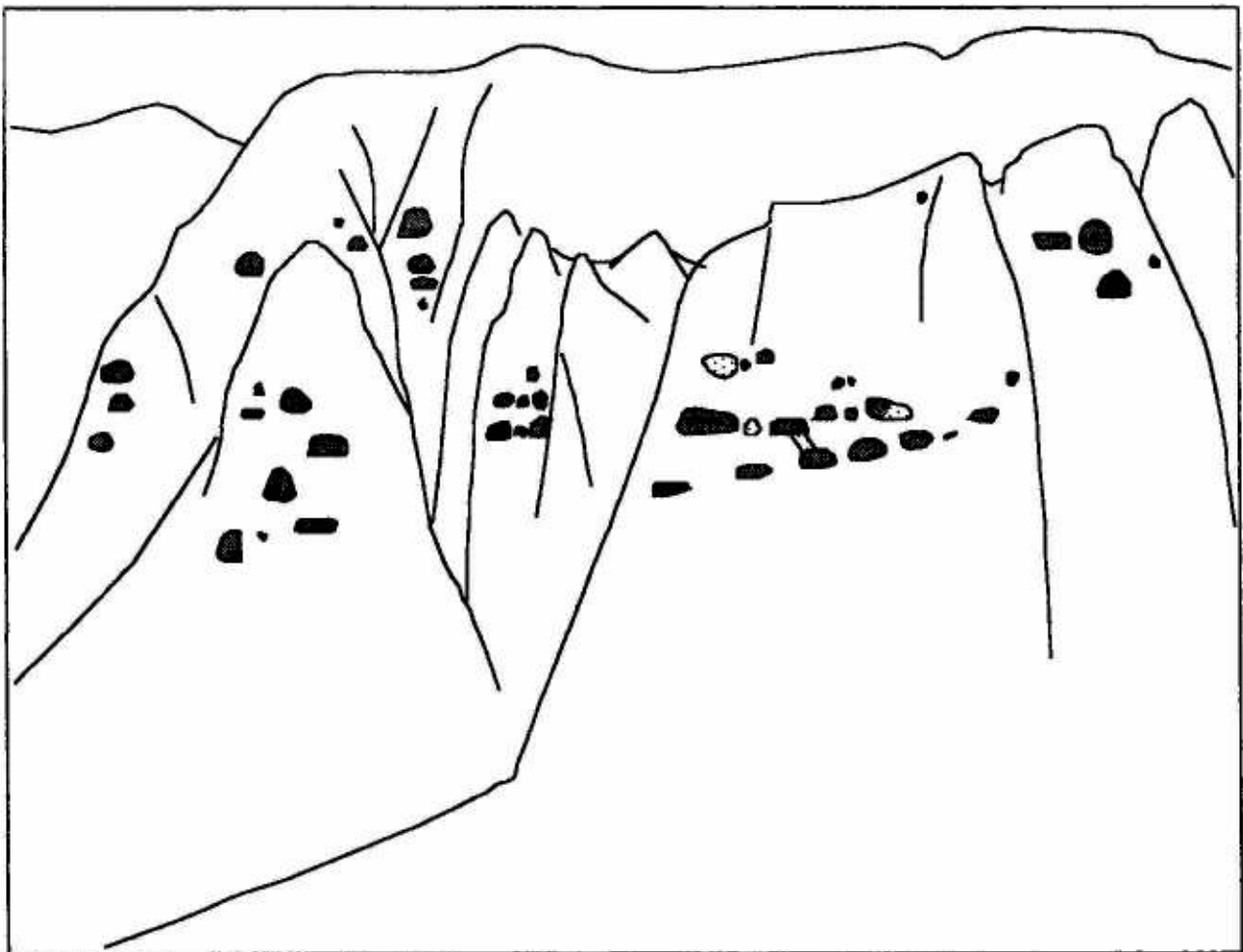


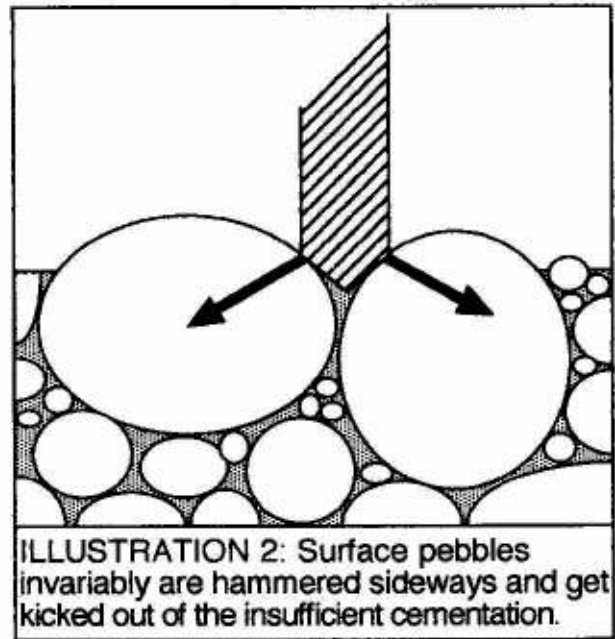
Figure 1 - Artificial caves cut out of conglomerate cliffs in the Mustang district of Nepal

sogs-gsung rGyun-t'or-bu pa-ag'a" was printed at the late 15th or early 16th century at bKra-shis aKhhyil [Trashi Gyil], Amdo, Tibet.

The yogi Milarepa (1052-1135) used Himalayan caves as retreats to practice meditation. But the thousands of Buddhist hermits from the middle ages up to the present were only the last to value the shelter of these caves. All along the southern rim of Tibet and northern Nepal, literally hundreds of cave settlements are dug into cliff faces of loosely consolidated sediments. Quite often, dozens of difficult access entrances are grouped together to form subterranean settlements situated in vertical walls of glacial and fluvial deposits (Fig. 1).

The sediments of the Thetang and Kag Formations deposited in the Mustang district are scarcely consolidated. The sublithified conglomerates and fanglomerates of late cenozoic and quaternary age consist of polymictic rocks ranging from sand to head-sized rocks with very few interspersed boulders of larger size. The solid rock fractions are inconsistently cemented and isolated from each other by fine-grained silts of glacial origin. Rock anchors placed are very insecure and easily removed by axial loads (pulling forces). When loaded with radial loads (shearing forces) the reliability of rope anchors varies from one place to the other in the centimeter scale. The firmness of this kind of "rock" depends on its local composition, grain size, and its discontinuous grades of cementation.

To rappel down from above to the cave entrances below would be the most elegant approach but impossible at



most places because the cliff walls are topped with huge and instable piles of loose debris where even birds cause substantial rock-falls and dusty avalanches. Anybody moving on a rope which touches the convex cliff profile is likely to wear out several helmets per hour. To climb

Fig. 3a - In the Kag formation, sound pebbles are cemented by instable matrix

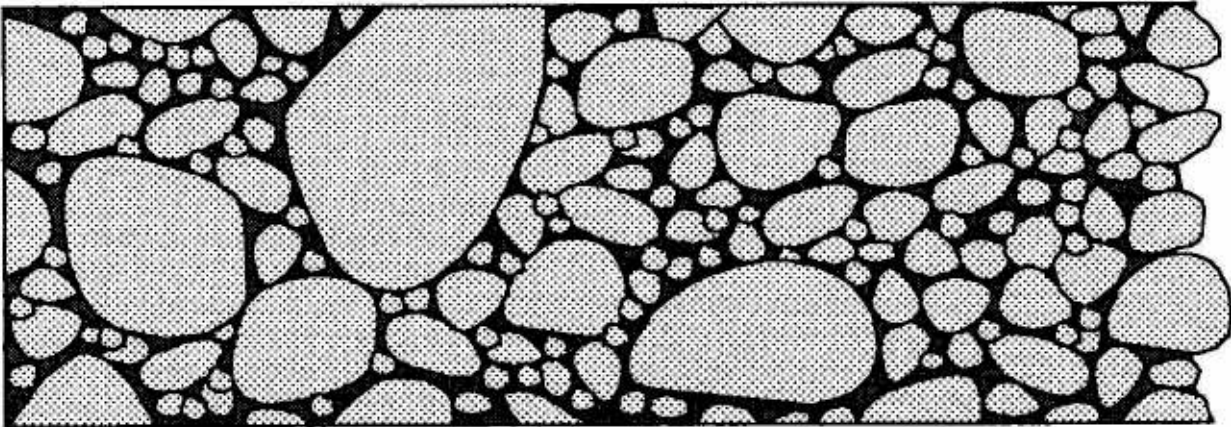
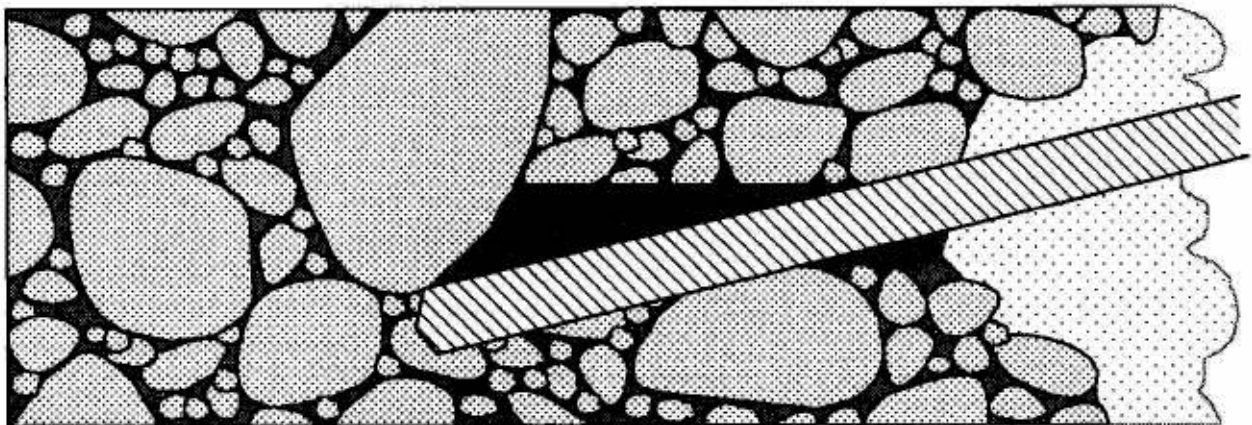


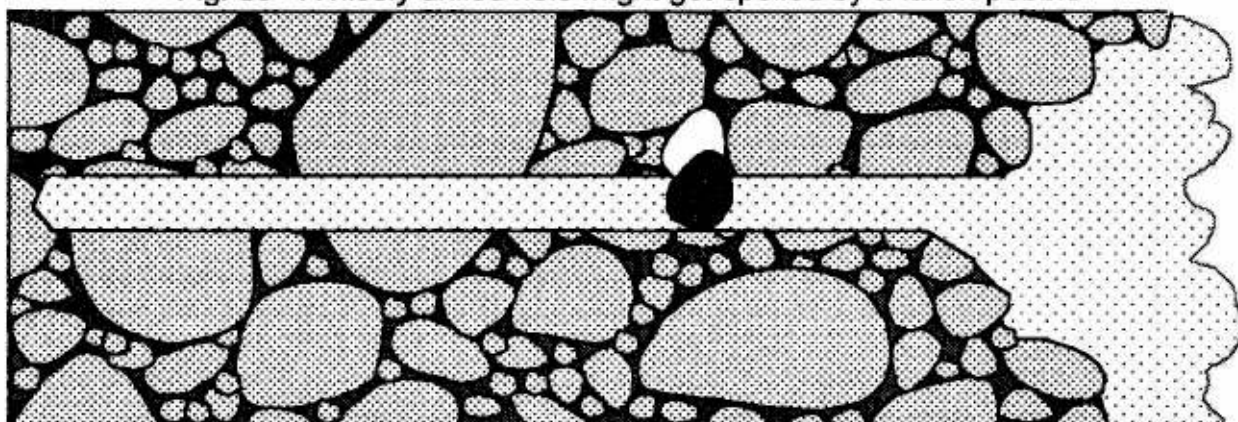
Fig. 3b - Solid particles deviate the drill into less resisting areas



up from below is not recommended either because while a large number of holes can be drilled with a single tank of fuel, their relatively long construction period in combination with long drills makes them quite uncomfortable when used overhead while bolting up a vertical cliff. Thus the RYOBI gasoline powered hammer drill was preferred in secure positions or when no electricity to recharge the batteries was available.

Drilling holes into the Mustang Cave Conglomerate (Fig. 3a) is a tricky undertaking right from the start. From the surface of the rock, solid rounded pebbles protrude while the interstices are filled with weak cementation. When starting to drill, the tool's point invariably jumps into the nearest hollow between neighboring pebbles (Fig. 2). The hammering energy is distributed to the flanks of the protruding pebbles and they get kicked off. Instead of a sharp edged hole the result is a hand-sized bowl.

Fig. 3c - A nicely drilled hole might get spoiled by a fallen pebble



Continuing drilling at the bottom of the bowl, less and less pebbles are kicked off because the deeper the drill proceeds the more surrounded the hampered pebbles are by clamping neighboring ones. But still smaller particles are torn off the drill hole's wall resulting, to a smaller or larger extent, in a varying hole diameter.

The solid stone particle's resistance to drilling is much greater than the resistance of the weak cementation. The drill, seeking it's easiest way of progress, often deviates into the weak cementation when substantial rocks are tangentially hit (Fig. 3b). Consequently holes too wide to allow the bolts to get a hold are created.

Quite often a resisting pebble is kicked loose at the bottom of the drill hole and jumps to and fro in accordance with the blows received by the hammer drill. Distributing blows on all surfaces again has a strong tendency to crumble away the drill hole walls. Both no-tech and low-tech approaches of mountaineering tend to be somewhat frustrating when the climber keeps falling down in a cloud of dust spiced with an assortment of rocks. Except for the arduous method of building new stairs, the only way to negotiate access to the caves is by European style rope techniques and by rigging dozens of rebelay which guarantee never to let the rope touch the surface of the instable cliff faces.

When trying to drive usual mountaineering hooks into the cliff face, the rock simply splits. Bolts, which are placed in drilled holes and commonly used in caving techniques are by far too short to distribute applied loads

to a sufficiently sized mass of conglomerate and long bolts are safe only when loaded radially. Depending on the varying solidity of the Mustang Cave Conglomerate, large sized 8 mm collar-stud bolts (Fig. 4) were used as well as 8 mm screws with Nylon sheaths originally designed for porous building materials.

HOLE PROBLEMS

The bolt lengths necessary, unfortunately make machine aided hammer-drilling an unavoidable prerequisite. Battery powered hammer-drills suffer from restricted energy despite of their heavy batteries. Nevertheless they are preferred in caves, because gasoline powered hammer-drills pollute and are nasty to start in awkward positions. Of the four in-cave tested brands (BBS, BOSCH, HILTI and MAKITA) of battery powered hammer-drills available in Europe the shortest is the MAKITA 8015 DW, which is also preferred due to its

effectiveness and easy handling. Small gasoline powered hammer-drills like the RYOBI ER 160 are able to drill a larger

holes. During drilling loosened pebbles enlarge the bottom of the hole to a size too large for the spreading devices of the bolt to grip. The nastiest behavior of the "jumping pebble" is to split apart and become wedged in between the hole's wall and the drill bit itself. Consequently drill, machine, and climber as well are trapped in their probably awkward position. The only way out is to unclutch the machine from the drill bit - an action requiring two hands - and grip the trapped drill bit with strong pliers to apply, in accordance with the current state of entrapment, sensitive feeling or brute force.

Even a hole with a perfect drilling record can be spoiled in consequence if a pebble falls unnoticed from the hole's roof after the drill bit has been removed (Fig 3c). Especially collar-stud type bolts, which expand when tension is applied, are liable to become trapped and useless half way in.

BOLT PROBLEMS

In the open air of the Mustang district, with it's semi-arid climate (125 mm rain/a) corrosion is a negligible factor. Anchors made of stainless steel are superfluous and require too large a drill hole to be a suitable choice.

Low quality rock, combined with jagged drill holes are the perfect environment for adhesive anchors. Unfortu-

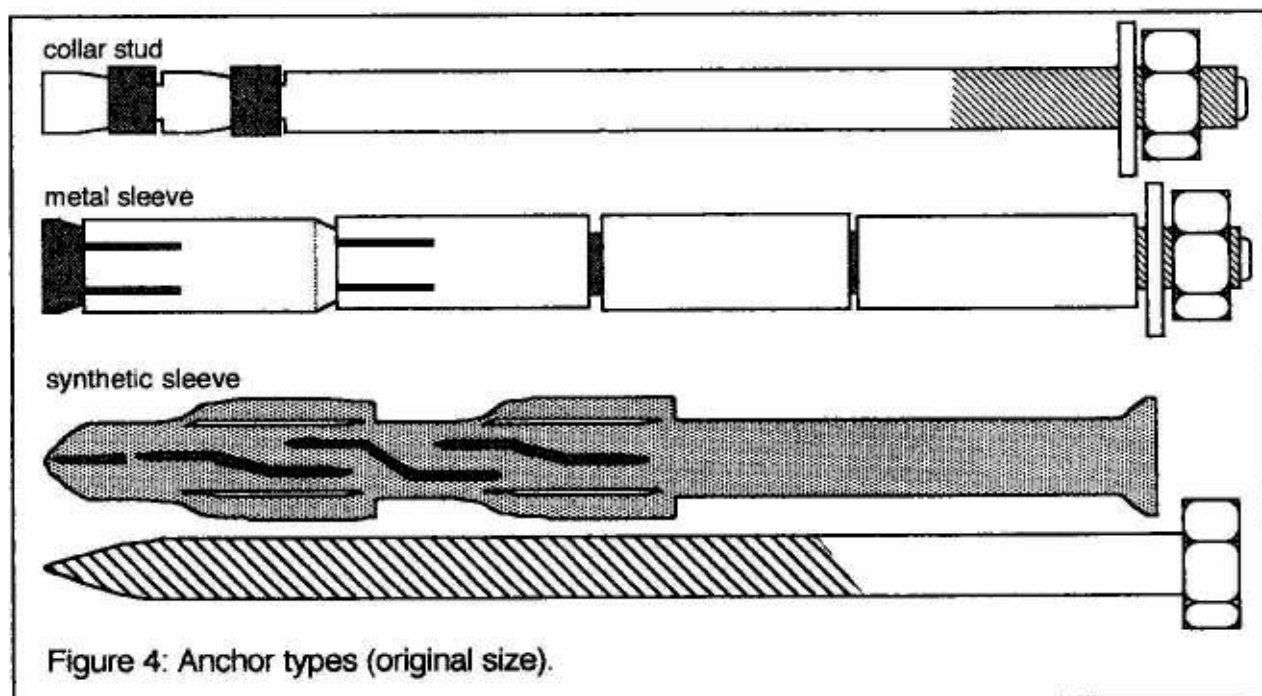


Figure 4: Anchor types (original size).

nately, they are too time consuming for bolting a vertical wall when a just placed anchor is immediately needed to set the next one. Adhesive anchors are doubtless the best choice for final anchors at the top of a long row of intermediate ones.

Collar-stud bolts (Fig. 4), with a diameter of 8 mm are an economically feasible choice when the amount of bolt material and drilling energy wasted is taken into account. Short collar-studs of 35 mm length are often used in limestone caving and in the Cave Conglomerate of Mustang they have proved to be comfortable and quickly placed bolts in the occasional erratic boulders of larger size. Collar studs in lengths of 90, 120, 165, and 210 mm are good enough in the better cemented areas of the Mustang Cave Conglomerate. They were also placed in poorer cemented areas as unsafe preliminary anchors which were carefully loaded only once to reach a better anchoring site.

Metal sleeve-anchors, especially when used in extensive numbers, are more costly when compared with collar-studs and require more energy to drill the relatively large diameter holes. Their slightly larger ability to expand makes their use advisable in those sections of the Mustang Cave Conglomerate where the diameter of the holes drilled tends to become more irregular. Of all bolts, their reliability is easiest controlled because their tightness of fit is easily checked by sensing the momentum necessary or most chargeable to tighten the nut.

Synthetic sleeve-anchors designed for porous building materials and consist of screws (with a threading to catch in wood) in combination with a flexible and tough sheath made of Nylon or other sturdy polyamides. They seem to be the most befitting choice for rock anchors in poorly consolidated and inconsistent rocks. They are inexpensive, come in an extensive variety of sizes, and their flexible and versatile adapting synthetic sheath is best compatible with the irregularities of the drill holes. Their

only and minor disadvantage is the demanding labor necessary to turn the long screws into the long sheaths, which is significantly eased by greasing with wax or dry soap.

Ice-screws and plain wood-screws grip only in very dry unconsolidated sediments of entirely fine grained composition. Even in dust-dry cave mud they are sometimes amazingly strong, but, of course too insecure to propagate their application.

ANCHOR PROBLEMS

Anchors in good, stable rock (Fig. 5; top) are secured in tightly fitting holes and a large compressive force is developed along the anchor-rock interface (except for the adhesive types). This provides the friction that resists pull-out (axial loading, tensile force). Most of the normal short anchors used in good rock are stronger in the pullout direction than in perpendicular or radial (shear force) loading.

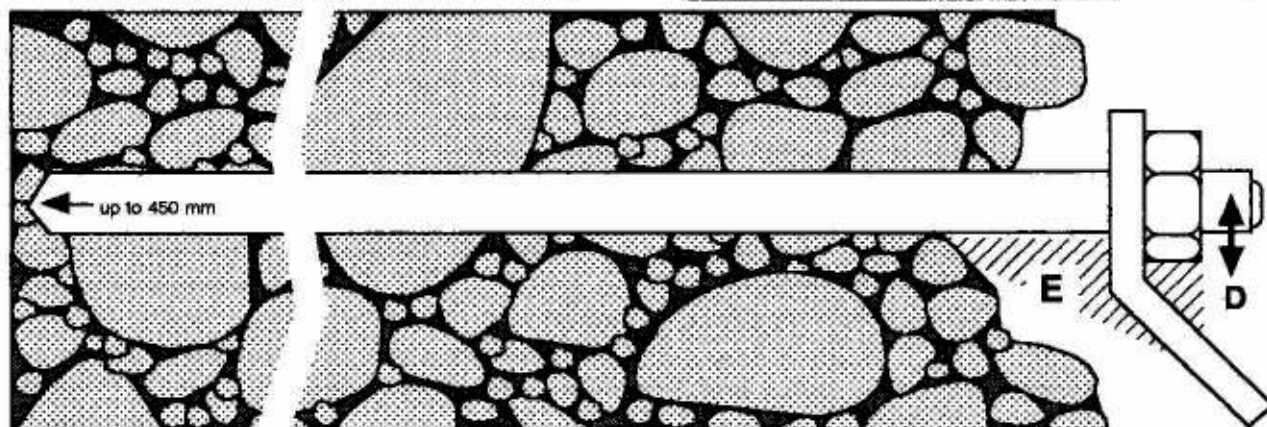
When the nut or bolt is torqued down, squeezing the hanger against the flat rock surface, the tensile pre-load causes a frictional interface between the hanger and the rock wall.

In the case of short anchors, where shear stress is distributed over a very small bearing area only (actually knife edge size), it is well advisable to deviate the shear stress to the frictional interface between hanger and rock surface, which supports part of the load.

Holes drilled in inconsistent rock (Fig. 5, bottom) provide moderately fitting holes at their best. The possibility of building up a reliable compression between anchor and hole is limited and liable to stress the unstable rock.

Consequently most of the long anchors used in bad rock are weaker in the pullout direction than in the perpendicular or radial (shear force) direction. Without regard to the bolt chosen, all anchors in bad rock should be

Fig. 5: To provide friction (F) between hanger and flat rock face a preload (P) is built up by torquing down short anchors. When the coupling is perfect, shear stress (S) is deviated to the rock face. When the coupling is bad, the shear stress is distributed over a knife-edge sized plane between rock wall and hanger. In the case of long anchors shear stress is distributed over the large area of the entire bolt. An elbow room (E) between hanger and rock provides space for the bolt head / hanger to move in a spring like fashion and compensate loads by elastic (normal) or destructive (catastrophic) deformation (D).



placed and loaded in such a way that the loading forces pull exclusively (or at least almost exclusively) radially (Fig. 6). Pulling along the axis of a bolt placed in unstable rock will pluck it as easily as a tent pin is drawn from the ground.

In the unstable rock of the Mustang Cave Conglomerate, it is impossible to squeeze the hanger against the uneven rock surface. Because the surface around the drilled holes tends to have been crumbled away, it is almost always impossible to build up a frictional interface between the hanger and the rock wall. The lack of frictional support is compensated by the very large bearing area of extremely long bolts.

In the case of long anchors, where shear stress is distributed over a relatively very large bearing area (actually the whole bolt length), it is not necessary to deviate the shear stress to a frictional interface. This "lack" is sufficiently compensated by elbow room between hanger and rock surface which provides space for the bolt head/hanger to move in a spring like fashion up and down. Usual loading while ascending results in elastic deformation of the bolt. However, extreme loads due to a fall, the failure of another anchor, or possibly high loads during climbing causes destructive deformation.

RELIABILITY PROBLEMS

Nobody can tell how strong anchors placed in the Cave Conglomerate of Mustang actually are. Out of curiosity, simple loading tests were made with the help of a torque-wrench. These did not prove much more than that the considerable variety in strength and reliability of the rock

anchors is dependant on the considerable variety of consistency and firmness of the substrate. It is plainly shocking to see how easily anchors are uprooted by pulling along their axis. Though not a single anchor in unstable rock can be claimed to be safe, it is amazing to experience how much long bolts resist lateral loading.

Tangential loaded anchors of sufficient length (and of sufficient length only!) do not become as easily uprooted

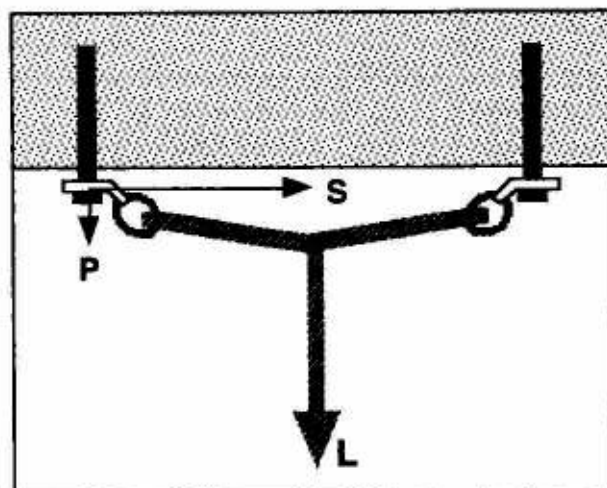


Figure 6 - The load L is deviated from pulling (force P) to shearing (force S).

and seem to be as strong as the bolt head's resistance to shearing without much regard to the bolt's placement in high grade limestone or in low grade unstable sediment.

The reluctance of each individual rock anchor to be pulled out of unstable and inconsistent rock is not predictable in exact numbers. While working in the unstable cliffs of the Mustang Cave Conglomerate the reliability of the anchors was judged by the following:

- considering the drilling record of the hole (did the drill encounter resistance or did it sink like a knife into butter? Has it hit a deeply buried solid rock? Was it deviated? Does the drilling debris consists of dust, coarse sand, or pebble shards?).
- by analyzing the resistance while introducing the bolt. (Was a series of hammer blows necessary to drive the bolt in or was there no resistance at all?).

- and by diagnosing the anchors behavior when the nut is tightened (Does the bolt immediately grip or does it turn when screwing the nut? Does the nut become tight or is the bolt withdrawn by trying to tighten the nut?).

After having placed a large number of rock anchors in the unstable Cave Conglomerate of Mustang it is possi-

ble to say that about every 5th to 10th drill hole is too misshapen to be trustworthy. Approximately every 10th anchor already placed is better not loaded. Out of roughly 400 anchors placed so far, actually only 3 came off while climbing.

Three factors not quantified govern the production of a useful anchor in unstable rock: skillful craftsmanship, a feeling for the materials you work with, and experience. Safety is dependant in the first case on how one works with the materials and second only on the materials themselves.

SOURCES:

John GANTER and William STORAGE (1991): Artificial anchors for the present and future.- Cave Science 18:111-117.

John GANTER and William STORAGE (1990): Artificial anchors for the present and future.- NSS News.

Robert M. PIRSIG: Zen and the Art of Motorcycle Maintenance.-

To the Editor

Dear Madam,

Please allow me to take this chance to tell you what an exceptional good job you do by editing the NYLON HIGHWAY. It has become such a nice piece since you do the editing.

I send you a contribution on bolting bad rocks. I am aware that you will probably refuse to publish it in the NYLON HIGHWAY since it does not cope with the American way of safety at all. Don't hesitate to burn the paper to ashes and to feed the disc into a good shredder to erase approaches like mine from the face of the World. The stuff will be published in Germany anyhow.

On the other hand, you might like to show around the unbelievable extent of possible madness. I personally think the developing approaches to negotiate bad rock by intelligent bolting are not too far out to inform newcomers on how to avoid pioneer's mistakes, and to give them a chance to learn about exotic difficulties which can be encountered.

If you want to use the text then I have to excuse myself for burdening you with my sort of Germ-lish language. **Please feel absolutely free to shorten, rewrite and extend the text to any extent and as much as you like.** I might be wise to let a real bolting-expert proof read the whole stuff, since I quite likely have mixed up some technical terms. Perhaps John Ganter remembers what I am after.

I will be absent on Madagascar, Uzbekistan, Nepal and China projects for most of 1992. But in between, I will answer to letter sooner or later.

Best Wishes!

Daniel Gebauer

Editor's Note: You'll find Daniel's article on the previous pages of this issue of the NYLON HIGHWAY. It is an interesting outline on some of the unique problems that can be encountered while bolting a wall. Overall, I found it very useful on how to avoid 're-inventing the wheel' should similar problems be encountered underground.

Pit Nomenclature

by Peter Sprouse

Reprinted from the Texas Caver, October 1992

There are many different terms in use to describe vertical caves and drops. These are usually interchangeable to a greater or lesser extent. We tend to choose among them on an intuitive level, without strict definitions as to their use. However, certain characteristics can be assigned to each of these terms, which I will attempt to do here. Naturally, I tend toward a Texas caver's viewpoint, and cavers in other parts of the world would likely compile a different list. Included are a number of specifically Mexican Terms. Many of the dozens of Indian languages have their own terms for pits, and this is certainly not a complete list.

Pit - The most commonly used term for a vertical drop, both in-cave and entrance drops.

Drop - This term is used synonymously with pit, although rarely used for entrance pits.

Shaft - Synonymous with drop, this term is more commonly used in Britain, and, by extension, Canada. Used at time to describe an entrance pit, but rarely as a proper name. Example: Elephant Shaft, Cueva Cheve, Oaxaca.

Well - This term seems to be used to describe pits which are often circular or have a generally uniform diameter down their entire length, alluding to their similarity to a drilled well shaft. An example would be Natural Well, Alabama.

Abyss - Not commonly used in caving, and generally synonymous with chasm. It has been used to describe large in-cave drops or climb-downs with are wider than they are deep. An example would be the Major Abyss, Cueva del Tecolote, Tamaulipas.

Rift - A crack which is long, narrow and tall. This would be a pit if you came to it from the top, or could simply be a canyon that you traverse horizontally. This term is commonly used by British cavers.

Sinkhole or Sink - This term usually is synonymous with dolina or depression. However it seems to have been used at times in decade past to describe entrance pits in Texas, i.e., Devil's Sinkhole or Emerald Sink. It is still used by geologists in reference to collapse pits.

Hole - Occasionally seen used for entrance names, i.e., Dead Man's Hole, Texas.

Pothole or pot - Strictly a British term for entrance pit. In Texas, a pothole is an annoying irregularity in a road surface.

Ramp or Rampa (Spanish) - An inclined shaft, not a term commonly used by U.S. cavers.

Sotano - A Spanish word generally meaning 'cellar', it is commonly used in Mexico referring to vertical entrances. It is synonymous with the English work pit only when referring to an entrance. Sotano is the diminutive for occasions used for small or shallow entrance pits.

Pozo - A Spanish work which generally refers to a well or shaft; not to be confused with a poza, a pool or well of water. In scattered parts of Mexico this term seems to be more commonly used by locals than is sotano. Cavers have used it as an equivalent to the caving use of well.

Hoya - Spanish term for large pit or closed valley, used sporadically in Mexico. The masculine term, hoyo, means hole.

Sumidero or Resumidero - A Spanish work meaning 'drain'. It is commonly used in Mexico to refer to a horizontal or vertical entrance which takes water.

Sima - A Spanish work meaning pit or abyss. It is occasionally used for naming an entrance pit.

Socavon - Spanish term occasionally used for a cave or mine tunnel. In Mexico, it seems to be used for pits, such as Socavon de Santo Tomas, Chihuahua.

Grieta - Spanish term for crevice or fissure. This is not commonly used as a caving term.

Xol - Huastecan term for pit, used locally in the Tamaulipas, SLP area. It is pronounced like the English 'hole' and is possibly related to the Guatemalan Highland Maya term Jul.

Chen - Mayan work for pit or well, i.e., Bolonchen, Yucatan.

Cenote or Dzonot - Mayan term for a flooded entrance, often a water-filled entrance shaft.

A Lesson Well Earned

by Maureen Handler

On a recent caving trip to Mexico, I had the opportunity to re-learn a valuable lesson while bouncing Sotano de Puerto de los Lobos, a nearly 600' narrow shaft, open air pit. I had been to this particular pit before, but due to a comedy of errors, was not able to photograph the shaft. I was determined to try again and since I had my main flash man (Mike Palethorpe) with me, this seemed like an opportune time. My rope was 620' long, which I had been told was of sufficient length to do the pit. I should have realized, it being April Fool's Day, that I was in for a surprise.

April 1, 1992, Sotano de Puerto de los Lobos, S.L.P

What a hell of a day! We rolled out of SLP at 9:30 this morning and headed straight up into the mountains. We arrived at the parking spot for Los Lobos and proceeded to get all of our equipment ready. Finally, off we went to find the pit. I thought I could walk right to it, but it took a little bit of searching, which can be arduous with 600+ feet of rope over your shoulder. Mike found it first. Responding to his calls, I trudged in the direction of his voice. I had brought all of my photo gear, since last time I was there, I had taken it into the pit and didn't take a single photo of the drop. I rigged the drop the same way I had done it before. (Last time we used a 500' and a 285' tied together, having to pass a knot and hence the previous comedy of errors.)

Ready for a great photo trip, I rigged onto the rope and started my rappel. I quickly realized that my seat harness was not set properly and I had a terrible pain in an unmentionable spot. As I descended, the pain became worse and worse. I rappelled faster and faster, just wanting to get to the bottom. In my pain, I started getting reckless and smashed my knee into the wall. I cried out, but continued my descent. Suddenly, I saw that end of the rope swinging off the floor. I was short rigged!!! As I neared the end of the rope, I could see it was 10' off the floor. Just a little too much to drop off of. Even if I could make it to the floor, I wasn't sure I could communicate to Mike the need to re-rig the rope. I was exhausted and sweating from the pain of my rappel. Hooking my knee ascender to the rope took the weight off of my seat harness and I was able to readjust the webbing for a little more comfort. I did not want to change over and climb out without a rest. I wanted to get off rope. I sat back down to contemplate my situation and wasn't paying attention to my immediate needs and the knee ascender jammed into the rack. Now I was exhausted and stuck. I was having a terrible trip. I tried to communicate to Mike that I was short rigged and would have to climb out. However, the narrowness of the pit made echoes and he could not understand me. Finally, I just yelled 'climbing!' and heard a confused 'OK' from the top.

I completed my changeover after some struggle to free the knee ascender from the rack and started climbing. I was still exhausted, plus an altitude of over 5000' didn't help, so I climbed slow. I felt sick and as I looked up the pit, felt I would never make it, but I persevered. My knee was throbbing as I climbed and the sweat was pouring off of me every foot of the way. Finally, after over an hour on rope, I crested the lip with no energy to spare. I considered re-rigging the rope and trying again. However, Mike looked at my condition and said he did NOT feel like doing the pit anymore. My knee was red and swollen and I laid in the field trying to regenerate for the hike back to the truck. Some friends showed up from SLP just as we were heading up the trail. They showed us the proper rigging for the length of rope we were using and proceeded to bounce the pit.

The Lessons

The lessons learned were definitely earned by the experience. Always check a map if one is available to make sure your rope is long enough. Don't rely on someone else's say so. Look for the most appropriate rigging for the length rope you are using. Always exercise caution on rappel no matter how bad the pain! And, always pay attention to what you are doing, especially when executing a change over. It is too easy to get tangled and stuck. A week later, I was back at Los Lobos (this time without Mike). I was able to bounce the pit with no further problems and got an excellent photograph of this beautiful shaft.

NSS VERTICAL SECTION - MEETING MINUTES

August 5, 1992

The 1992 NSS Vertical Section meeting was held on Wednesday, August 5th, 1992 at the Salem Middle School in Salem, Indiana. Executive Committee members present were Chairman Gary Bush, Secretary/Treasurer Bill Bussey, Contest Coordinator Bill Cuddington, Miriam Cuddington, *Nylon Highway* Editor Maureen Handler, Angela Morgan and Ed Sira. Vertical Techniques Workshop Coordinator David McClurg joined the meeting later. Approximately 90 Vertical Section members were in attendance.

Gary Bush called the meeting to order at 1:07 PM by introducing the Executive Committee. Secretary's Report: We have 1107 members. Would mail 1180 *Nylon Highways* as of May 31st. Had 127 members desiring representation in the NSS Congress of Grottos.

Treasurer's Report:

Total Income: \$10,018.00 Expenses: \$8710.27 Net Income: \$1307.73 Balance of \$5409.48 Reasons for income included the November 1, 1990 dues increase from \$3 to \$5 per year came fully into effect, smaller issues of *Nylon Highway* were published with printer also giving us a better deal, post office understood their new rates better costing us less, and there were no Soviet Exchange program expenses.

Editor's Report:

Maureen can produce a *Nylon Highway* with now around 20 hours (editor's note: 20 hours is layout only) of work. Will purchase a registered copy of the page layout software used. Will be checking on rates for a full color photograph cover. Always needs articles!

Chairman's Report:

Section is getting more involved in vertical caving instruction. As we are not currently considered fully under the NSS Non-Profit corporate umbrella, thus we will move toward incorporating the Vertical Section.

Vertical Session Report:

Angela Morgan reported on the planned presentations and asked for more. Bill Cuddington will talk about Optimum Rack Operation, Bob Handley will discuss new design for top bar of Rappel Rack, Dan Legnini plans talk about the Bachli rappel device, Butch Feldhaus is presenting a safety enhancement of the curled eye of the Rappel Rack, Joe Ivey will discuss the Mexican Ropewalker, Ed Sira has Figure 8 update.

Contest Chair Report:

Bill Cuddington thanked PMI for its donation of 300 and 600 foot lengths of rope. We cannot do contest without volunteers working hard. He thanked Chuck Henson who had made another heavy duty long rack for contest use. The long rack works better than the spool. Elaine Hackerman was thanked for building a time reporting board which was used in the contest. When polled, the membership thought the contest should begin on Monday instead of later in the week. There was discussion about requiring climbers to be ready to climb when called or be placed at bottom of list. Chuck Henson received a chuckle when he mentioned that people waiting a while to climb means more to help with the contest. Bill C. said he was open to suggestions.

Vertical Techniques Workshop Report:

Have 40 students signed up with at least ten on the waiting list. Need several more Frog systems because they take a long time to put on.

Rebelay Course Report:

Gary Bush reported the first day of the Rebelay course went well. Two ropes, up from one last year, allowed more participation. Will use three tomorrow. He thanked Marc Tremblay for setting up the course and giving a fine clinic.

20th Anniversary Report:

Bill Cuddington reminisced on the reasons for organizing and the early history of the Vertical Section. Bill Bussey read list of Charter members of the Vertical Section. The many charter members in attendance were recognized and congratulated. Dale Lofland noted that the vertical caving accident rate has dropped dramatically, while the number of people using vertical techniques has greatly increased, largely due to actions of Vertical Section members. This is something we can all be proud of.

Caver Information Series Updates:

Have four articles in the works. The Knots System and the Frog System articles are essentially complete, now holding for original illustrations by Linda Heslop. The Rappel Rack and Gossett System articles will be reviewed soon by the Vertical Section Executive Committee.

Soviet Caver Sponsorship:

Maureen has not heard from Valeriy Rogozhnikov - not surprising as he speaks no English. Alexander Klimchouk has been receiving *Nylon Highway* and appreciates them. He is translating them and sharing with others.

Training Outlines:

Will publish in an upcoming *Nylon Highway* a general topic list of items grottos should include in their Basic vertical training programs.

New Business:

Miriam Cuddington and the membership discussed issues about using and purchase of display timer clock for the Climbing Contest. Though expensive to purchase, we might be able to rent or build one cheaply. Membership indicated in a straw poll that they would very much like to have a display timer at contests if it could be reasonably obtained.

The membership supports continued use and dedicated staffing of Elaine Hackerman's time display board in the contest. This board conveniently shows the official time of the climber who was last on the indicated rope.

Gary Bush led discussion about the Vertical Section Executive Committee approval of the Vertical Section publishing a booklet on suggested vertical training techniques and how to run a vertical training class. This is viewed as a complete Training manual and would be the first Section self publishing venture outside of *Nylon Highway*. Dan Legnini and Angela Morgan agreed to chair this effort.

Ed Sira initiated discussion on a Vertical Instructors Forum to be held at the NSS Convention. This would serve as a discussion roundtable for vertical instructors - and would be instructors - from around the country. Ed encourages members to write him with any ideas for this.

A discussion on the Section hosting a first Vertical Training camp was led by Gary Bush. He noted the Vertical Section Executive Committee wants to host this first camp in Spring 1993 in or around Chattanooga, Tennessee. Gary will lead the effort to make this happen.

Editor Maureen Handler noted she will start work on a *Nylon Highway* "Digest" featuring the best articles from past issues. This will help to satisfy demand for past articles without having to continually reprint back issues. She wants help.

Ed Sira moved and Dick Desjardins seconded that: The Vertical Section authorize Allen Padgett and Bruce Smith to prepare research and edit material for a 2nd Edition of *On Rope*. The motion passed with Bruce Smith and Allen Padgett abstaining.

In announcements, Bruce Smith thanked the Section for the plaque he received two years ago recognizing his fifteen years of editing *Nylon Highway* and his service to the Section.

In response to a question by Snake Owen, Bill Cuddington explained that Vertical Contest official "World Records" could only be set at the Vertical Section run contest at NSS Conventions. We call records "World Records" because they are open to anyone who registers for convention, and are run on ropes measured in meters, which is recognized worldwide as the standard unit of length.

In elections, Bill Bussey was re-elected Secretary/Treasurer. Maureen Handler was re-elected Editor of *Nylon Highway*. Gary Bush, Ed Sira, Angela Morgan and Bruce Smith were elected At-Large Executive Committee Members.

The meeting was adjourned at approximately 2:45 PM.

Later that week, the Executive Committee met and selected Gary Bush as Chair. Bill Cuddington was re-appointed Contest Chair and David McClurg was re-appointed Vertical Techniques Workshop Chair. Both will serve on the Vertical Section Executive Committee. Bruce Smith, as the newest EC member, will organize and emcee the Vertical Session at the 1993 NSS Convention.

Respectfully Submitted,

Bill Bussey

Guidelines for Introducing and Studying Vertical Caving Techniques and Equipment

Prepared by a Committee of the Vertical Section of the National Speleological Society

This document presents an organized, step-by-step outline for the student or teacher to use as a starting point or checklist when deciding how to implement a program to accomplish his or her specific goals. No attempt is made to establish dogmatic standards of teaching or practice. On the contrary, the "answers" are rarely given, in that the relevant and important topics are listed, but details and the "right" or "best" way is left for the reader to judge or seek out on his own. Regional, personal and other factors may result in placing more or less importance on certain sections or a different emphasis at different times. The reader must realize that no single source can cover all aspects of a field as complex as Vertical Caving, or will equipment, techniques or attitudes remain unchanged. Therefore, while comprehensive, it is presented solely as an aid for organizing individual or group study.

I. Equipment

Module I covers the basic component parts common to most vertical caving systems and procedures. It focuses on presenting, describing and comparing the things a vertical caver will need to use and maintain.

A. Rope

1. Purpose and Use
2. Properties of a Good Caving Rope
 - a. Static
 - b. Abrasion Resistance
3. Construction
 - a. History
 - b. Materials
 - c. Methods
 - d. Size
 - e. Strength
4. Care and Maintenance
 - a. Minimize dirt, transport in bag
 - b. Wash with water
 - c. Store in dry place
 - d. Know history
 - e. Inspect, test, retire if necessary
5. Hazards
 - a. Acids and other chemicals
 - b. UV from sun
 - c. Sharp objects, especially when loaded
 - d. Dirt and grit cuts filaments internally
6. Rope Pads
 - a. Purpose and Use
 - b. Styles
 - c. Construction
7. References
 - Look 'em up and insert here

B. Webbing or Tape

1. Uses
2. Construction
 - a. Materials
 - b. Methods
 - c. Size
 - d. Shape

- c. Strength
3. Care, Maintenance and Hazards
 - a. Same as rope
4. References
 - Look 'em up and insert here

C. Carabiners and Links

1. Purpose and Use
2. Styles and Construction
 - a. Parts
 - b. Locking vs. non-locking
 - c. 'Biners vs. links
 - d. Oval vs. 'D'
 - e. Steel vs. aluminum
 - f. Size, weight and strength
3. Care and Maintenance
 - a. Wash with water
 - b. Little or no oil
 - c. Avoid dropping or throwing
 - d. Know history
 - e. Inspect, test, retire if necessary
4. References
 - Look 'em up and insert here

D. Ascenders

1. Theory of Operation
2. Prussik and other Knots
3. Jumars, Jammers, etc.
 - a. Spring-actuated camming
4. Gibbs
 - a. Lever-actuated camming
5. Construction
 - a. Parts
 - b. Construction methods
 - c. size, weight, strength
6. Care, Inspection, Retirement
7. References
 - Look 'em up and insert here

E. Descenders

1. Theory of Operation
 - a. Diminishing friction on device due to:
 - b. Surface contact with device, and
 - c. Internal friction from bending and twisting
2. Rack
 - a. Types of frame
 - b. Types of bars
 - c. Assembly
 - d. Rigging to rope
 - e. Varying friction
 - f. Locking off
3. Figure Eight
 - a. Types
 - b. Rigging to rope
 - c. Varying friction
 - d. Locking off
4. Bobbin
 - a. Types
 - b. Rigging to rope
 - c. Varying friction

- d. Locking off
- 5. Advantages and Disadvantages
 - a. Rack offers more control and versatility due to variable friction
 - b. Racks good on long drops since rope weight varies
 - c. Eights are small and light
 - d. Eights are tougher to lock off, vary friction
 - e. Bobbins designed for thinner and often cleaner rope
- 6. Construction
 - a. Parts
 - b. Construction methods
 - c. Size, weight, strength
- 7. Care, Inspection, Retirement
- 8. References
 - Look 'em up and insert here

F. Helmets

- 1. Purpose
 - a. Protect head from falling objects
 - b. Protect head from caver falls
 - c. Attach lamp(s)
 - d. NOT for storage of tools and equipment
- 2. Properties of a good caving helmet
 - a. Tough, rigid, rounded shell
 - b. Good ventilation
 - c. Stays on
 - d. Comfortable, doesn't interfere with sight or hearing
- 3. Styles
- 4. Suspension and Shock Absorption
 - a. Foam type
 - b. Strap type
- 5. Beware of Modifications
 - a. Exposed rivets, screws, etc. inside
 - b. Weakening shell with excessive holes
 - c. Effect of paints and adhesives on shell
- 6. References
 - Look 'em up and insert here

II. Knots, Anchors and Rigging

Module II is concerned with the knots and procedures used to attach rope and other equipment to points of support. It includes some of the considerations for evaluating the situation and choosing appropriate application of equipment.

A. Knots

- 1. Parts of a Rope
 - a. Working or 'sharp' end
 - b. Standing part
 - c. Running end
 - d. Bights and loops
- 2. Types
 - a. End
 - b. Mid
 - c. Joining
 - 1. Same diameter
 - 2. Different diameter
 - 3. Webbing
- 3. Strength
 - a. All knots weaken rope
 - b. Depends on application - some better than others

- 4. Steps
 - a. Choosing the right knot
 - b. Tying
 - c. Dressing (aligning)
 - d. Setting (tightening)
 - e. Backups
 - 1. Overhand
 - 2. Half double fisherman
- 5. Specific Knots
 - a. Overhand
 - b. Overhand on bight (water knot)
 - c. Figure eight
 - d. Figure eight on bight (figure eight follow thru)
 - e. Bowline
 - f. Bowline on a coil
 - g. Double fisherman
 - h. Figure nine
 - i. Butterfly
 - j. Double eight, double bowline, French bowline
- 6. Qualities of a Good Knot
 - a. Easy to tie
 - b. Easy to recognize
 - c. Easy to untie
 - d. Versatile
 - e. Remains strong in particular application
- 7. References
 - Look 'em up and insert here

B. Anchors

- 1. Natural
 - a. Trees
 - b. Boulders
 - c. Cave walls and formations
 - d. Hazards
- 2. Artificial
 - a. Chocks
 - b. Bolts
 - c. Hazards
- 3. Qualities of a Good Anchor
 - a. Safe
 - b. Small Angles
 - c. Remains strong in particular application
- 4. Anchor Systems
 - a. Failure is not Catastrophic
 - b. Partial failure doesn't over stress other parts
 - c. Self-equalizing systems
- 5. References
 - Look 'em up and insert here

C. Rigging

- 1. Tensionless Anchor
 - a. Eight, overhand, bowline
 - b. With 'biner vs. follow thru
 - c. Direction for wrapping the anchor can matter
 - d. Allows for potential lower
- 2. Knots for Clipping into Anchor
- 3. Effect on Difficulty of Passing Lip
 - a. Rig high
 - b. Directionals
 - c. Where is the pad?
 - d. Separate assist/safety line
- 4. Lowering Rope
 - a. Slowly
 - b. Rappel with rope bag if necessary

- c. Safety knot and foot loop at end
- 5. Rope Stretch and Motion
 - a. Sharp edges, abrasion and the need for padding
 - b. Positions of greatest vulnerability
 - c. Positioning pad
 - d. Allow for adjustment and check periodically
- 6. References
 - Look 'em up and insert here

III. Harnesses and Systems

Module III describes the equipment specifically intended to attach and support the human body during vertical caving operations. It includes an overview on the differences in design and implementation of a common set of goals and requirements when applied to the most popular systems.

A. Harnesses

- 1. Purposes and Use
 - a. Attach body to climbing system
 - b. Provide redundancy
 - c. Allow carrying equipment
- 2. Styles
 - a. Components (seat, chest, foot, etc.)
 - b. Specific for climbing system
 - c. Incorporating hardware (box, ascender, buckle)
 - d. Closure and security
 - e. Center of gravity, balance, fit
- 3. Construction
 - a. Materials
 - b. Methods
 - c. Strength
- 4. Care, Maintenance and Hazards
 - a. Same as rope and webbing
- 5. References
 - Look 'em up and insert here

B. Sit-Stand

- 1. Texas
 - a. Basic design
 - b. Mechanical
 - c. Prusik
 - d. Variations
 - e. References
 - Look 'em up and insert here
- 2. Frog
 - a. Basic design
 - b. Variations
 - c. References
 - Look 'em up and insert here
- 3. Advantages
- 4. Disadvantages

C. Walker

- 1. Mitchell, Gossett
 - a. Basic design
 - b. Variations
 - c. References
 - Look 'em up and insert here
- 2. Rope-Walkers
 - a. Basic design
 - b. Classic 3-Gibbs with shoulder strap

- c. Race-walker with plate and box
- d. Spring-action ascender, double bungee, other variations
- e. References
 - Look 'em up and insert here
- 3. Advantages
- 4. Disadvantages

IV. Techniques for Minor Obstacles

Module IV introduces techniques for overcoming vertical obstacles and hazards which do not require the use of full rappelling and climbing gear. Although they are usually carried out with a minimum of equipment, they require the same respect and familiarity as any other techniques. They are often both the first to be encountered by the newcomer and among the most heavily relied on by 'push' cavers.

A. Free Climbing

- 1. Caving is not Rock Climbing
 - a. Different equipment
 - b. Different environment
 - c. Some techniques same, but limited
- 2. Basic Free Climbing Techniques
 - a. Chimney
 - b. Stem
 - c. Mantle
 - d. Canyon-walk

B. Belays

- 1. Purpose
- 2. Use of Static Rope
- 3. Friction Devices
 - a. Descender
 - b. Sticht plate
 - c. Muenster hitch
- 4. Rigging the Belayer
- 5. Rigging the Climber
- 6. Communications and Responsibilities
- 7. Technique

C. Handlines

- 1. Rigging
- 2. Rappelling without Equipment
- 3. Self-Belayed Climbs

D. Etriers

- 1. Construction
- 2. Rigging
- 3. Technique
- 4. Hazards

E. Traverses

- 1. Attachment of Safety
- 2. Movement
- 3. Handling Falls
 - a. Stress on rigging
 - b. Recovering and continuing

F. Ladders

- 1. Construction

- a. Parts
- b. Methods
- 2. Rigging
- 3. Belays and Communication
- 4. Technique
 - a. Free
 - b. Against wall
 - c. Resting
 - d. Equipment catching on cables
- 5. Inspection, Maintenance, Storage

G. Practice on Slopes and Short Climbs

- 1. Descending
- 2. Ascending

H. References

- Look 'em up and insert here

V. SRT: Descending

Module V focused on those aspects of Single Rope Technique which are concerned with lowering persons and equipment safely down a rope. Emphasis is on proper selection and use of different devices for control during all phases of the descent as well as communications and emergency procedures.

A. History

B. Communications

- 1. When
- 2. Voice
- 3. Whistle, etc.
- 4. Bottom Belay

C. Preparing for Descent

- 1. Clip in whenever near lip
- 2. Safety Checks
 - a. Anchors and rigging
 - b. Personal gear
 - c. Loose equipment, clothing
- 3. Gardening the drop
- 4. Who Goes First, Last
 - a. Experienced members at top and bottom if possible
 - b. Someone at top at all times if possible
 - c. Leap frog

D. Technique

- 1. Rigging Descender
 - a. Position and stance
 - b. Adjusting friction with attachment technique
 - c. Avoid slack
- 2. Shunt
 - a. Assembling and attaching
 - b. Setting and releasing
 - c. Testing for 'dead man' protection
- 3. Lips
 - a. Stance
 - b. Protecting rope, descender, hands
 - c. Passing and checking pads
- 4. Control (depends on descender)

- a. Position of control hand
- b. Position of cradle hand
- c. Start with extra friction
- d. Adjusting friction
- 5. Long Descents
 - a. Heating and speed
 - b. Harness comfort
 - c. Diminishing rope weight
- 6. When Down
 - a. Removing descender
 - b. Flaking and protecting rope
 - c. Protecting yourself
 - d. Communications
 - e. Untie safety knots

E. Practice

- 1. Somewhere with Access to Top and Bottom by Foot
- 2. Two Ropes - Side by Side
- 3. Experienced Belay

F. References

- Look 'em up and insert here

VI. SRT: Ascending

Module VI continues the presentation of Single Rope Technique with detailed discussion of a few of the many schemes devised for getting up a rope. The systems introduced in Module III are analyzed, with hints for construction and use.

A. General

- 1. Fitness
- 2. Coordinated Movement
- 3. Speed (pacing)
- 4. Pack Position
- 5. Self Starting
- 6. Passing Pads
- 7. The Lip

B. Workshop on Sit-Stand

- 1. Overview
- 2. Construction
- 3. Variations
- 4. Specifics of Technique

C. Workshop on Walker

- 1. Overview
- 2. Construction
- 3. Variations
- 4. Specifics of Technique

D. Practice

- 1. Pulley in a Tree
- 2. Supervised Cliff or Pit with Bottom Access

E. References

- Look 'em up and insert here

TREASURER'S REPORT

NSS VERTICAL SECTION

FOR PERIOD BEGINNING JUNE 1, 1991 AND ENDING JULY 27, 1992
JULY 27, 1992

INCOME:

Memberships	\$5067.00
Subscriptions	373.00
Back Issue Sales	1315.20
Symbolic Item Sales	2084.85
Vertical Techniques Workshop (91)	490.00
Soviet Exchange Program Contributions 1991-92	250.00
Bank Interest	437.95
Total Income	\$10,018.00

EXPENSES:

Editor:

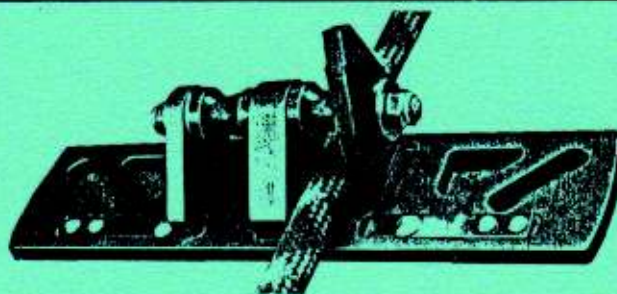
Printing <i>Nylon Highway</i> #33	1405.69
Mailing <i>Nylon Highway</i> #33	
International	68.48
Domestic	132.34
Resends	8.07
Total Mailing NH #33	208.89
Printing <i>Nylon Highway</i> #34	1776.56
Mailing <i>Nylon Highway</i> #34	
International	77.19
Domestic	166.22
Resends	0.00
Total Mailing NH #34	243.41
Dues Renewal Postage	163.34
Other Postage	40.75
Graphic Arts Salon Fee	3.00
Bulk Permit & PO Box Rental	85.50
Mailing Envelopes	167.83
Supplies	7.00
Total Editor Expenses	4,101.97

Secretary-Treasurer:

Postage	641.20
Supplies	
Dues Renewal Notice	88.97
Envelopes	33.92
Copies	93.22
Mail Labels	12.52
Other	91.46
Total Supplies	320.09
Vertical Techniques 91 Workshop Expenses	472.11
Vertical Techniques Workshop Long Term Gear	358.15
Binding <i>Nylon Highway's</i> 1-30 for Sale	121.10
Symbolic Items Cost	2303.88
Ads (For both 1991 & 1992-3)	180.00
Refunds	30.00
Rebelay Course Equipment	157.66
Check Charge & Service Charge	18.79
Other	5.32
Total Secretary-Treasurer Expenses	\$4,608.30

TOTAL EXPENSES	\$8,710.27
NET INCOME	1,307.73

BALANCE AS OF MAY 31, 1991	4,101.75
NET INCOME	1,307.73
BALANCE AS OF JULY 27, 1992	\$5,409.48



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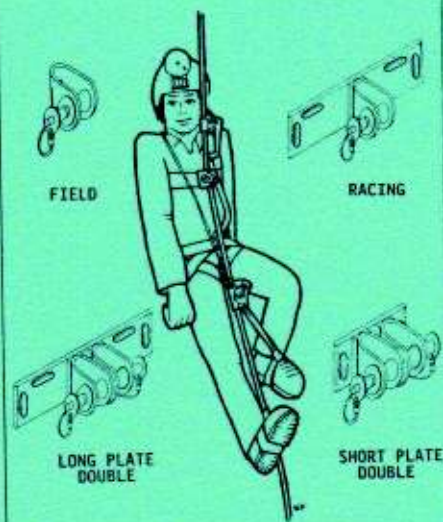
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