VERTICAL RESCUE TRAINING WORKSHOP
REPORT: EQUIPMENT TESTING

Bushwalkers Wilderness Rescue Squad and Volunteer Rescue Association
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Report author: Lucas Trihey

EQUIPMENT TESTING

As part of the workshop weekend some testing of rescue equipment was conducted. We borrowed a load cell and acquired equipment that could be destruction tested. We also did some slow-pull testing of rescue-rated belay devices.
The intention of the testing was to provide an illustration of the approximate strengths of some equipment and of the appropriateness of such equipment for use in vertical rescue. While the testing was done as consistently as we could manage in a bush setting it is worth noting that most tests were only done once. These test results can only be used as an indication of what could occur and MUST NOT to be used as scientific data. We hope that these tests stimulate discussion and review of current methods and possibly to encourage further testing of some items.

THE TESTING RIG

Load Cell – we borrowed a 25,000kg load cell from one of the Blue Mountains mines. The device is maintained by the owners for regular industrial use and has a digital readout that steps up in 20kg increments. The exact status of the calibration is not known although we did a basic check before starting with 60kg and 70kg loads and it seemed accurate (allowing for the 20kg graduations). Please note that the figures quoted in these test results should not be taken as gospel.
Winch – We used a loaned a 3 tonne Tirfor winch to generate the load forces. We were careful to ensure that the item being tested was the only item in the test rig that could absorb the test forces.

The testing set up, load cell on left and Tirfor cable on right. The carpet is wrapped around the cable and the old red rope was used to minimise the risk of injury from recoil.

Test items – Various individuals and organisations donated items for the belay and destruction testing. The gear was mostly second hand and the approximate condition is listed in each test.

Rope – The same type and brand of rope was used for all destruction tests. We used 11mm BlueWater II. The rope had been used for various tasks in the BWRS exercises and training. The rope was in good condition and had been properly stored and maintained. A new section was used for each test.

The following tests have been grouped for the type of test/device.

ASCENDER AND PRUSIK TESTS

The aim was to find the point of failure of mechanical and prusik cord rope grabs.

TEST 1
Camp Ascender (articulated handle model). J-style device. Stamped with a 650kg rating.
Condition: second hand, approx 15 years old. No obvious signs of wear. Functioning unit.
Result: Failed at 520kg when cam inverted (with some opening up of the J-section). Sheath completely severed and approx three of the core bundles.

TEST 2
SRT A2 Short Standard Ascender. J-style device.
Condition: second hand, approx 20 years old. No obvious signs of wear. Functioning unit.
Result: Failed at 860kg when it stripped the sheath off the rope. Very small amount of deformation of the body. Cam remained in normal position.

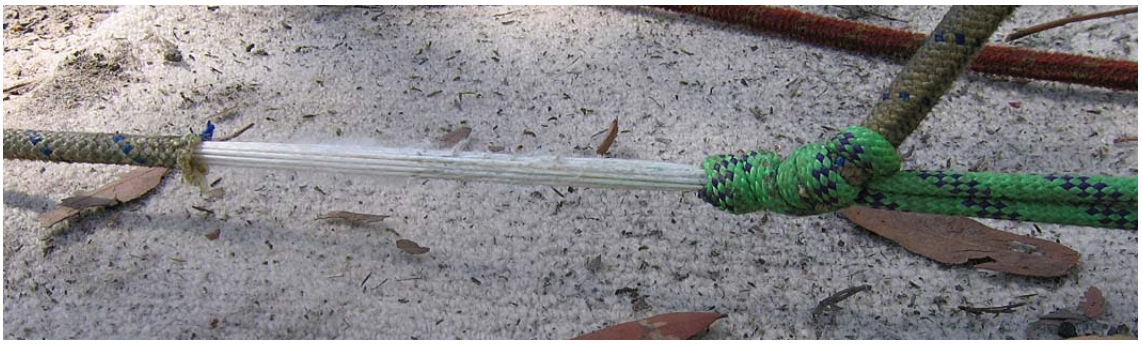
TEST 3
SRT A1 Explorer Ascender. J-style device. Stamped with a max load of 900kg.
Condition: As new unit. No wear marks evident.
Result: Failed at 980kg when the cam inverted and the rope began sliding thru the unit which then stripped the sheath off the rope.

TEST 4
Altius (made in USSR) Ascender. J-style device. Stamped with a max load of 500kg.
Condition: A very well used ascender with some wear evident on the teeth and body.
Result: Failed at 520kg when the J-section deformed allowing the cam to invert and the rope slid through the device. The sheath was cut in a small hole-shaped area but was otherwise undamaged.

TEST 11
6mm prusik cord – single cord with 2 wraps
Slow pull test
Condition: 2nd hand cord but in good condition.
Result: Initially slipped 25mm then held until 1160kg when the prusik cord sheath parted at the carabiner which then pulled the complete length of the core out of the double fisherman's knot.

TEST 12
Bachman knot (carabiner wrapped) using 8mm cord and 3.5 wraps.
Condition: as new
Result: slipped at 120kg no damage to rope or cord.

TEST 13
Klemheist knot – 8mmm with 3 wraps
Condition: 2nd hand but in good condition.
Result: At 620kg the main rope was rolled over into a loop by the klemheist. There was some glazing of both the main rope and prusik cord (and some fusing of the two) but otherwise no damage. They could be separated and minor glazing was visible.



TEST 14
Standard prusik knot – single 8mm and 3 wraps
Condition: 2nd hand but good condition.
Result: Held until 1440kg when the prussic knot stripped the sheath off the main rope. The prusik sling did not break.

SUMMARY OF ASCENDER AND PRUSIK TESTS

Test	Device	Rated kg	Actual kg	Comments
1	Camp Ascender	650	520	Stripped sheath
2	SRT A2 Short Std	not avail	860	Stripped sheath
3	SRT A1 Explorer	900	980	Cam invert & stripped sheath
4	Altius Ascender	500	520	Cam invert & damaged sheath
11	Stand prusik 6mm/2 wraps		1160	Prusik sheath broke, core pulled
14	Standard prusik 8mm / 3 wraps		1440	Stripped sheath main rope
12	Bachman 8mm / 3.5 wraps		120	Slipped no damage
13	Klemheist 8mm / 3 wraps		620	Main rope rolled, some glazing

Note: these were slow pull tests

CARABINER TESTS

The aim was to find the point of failure when using 50mm webbing.

TEST 5
Stubai steel carabiner. Offset D-shaped. Rated at 34kN (approx 3400kg).
Test was conducted by connecting the carabiner to the test rig with a single wrap of 50mm tape webbing at each end.
Condition: Unknown age but of good condition. No obvious wear or damage.
Result: Failed at 2600kg when the gate side of the carabiner broke. This then caused the tape to tear as it was pulled over the sharp edge of the deformed and broken carabiner top notch.

TEST 7
HB aluminium alloy locking carabiner. Rated to 30kN.
Condition: 15 to 20 years old. Well used but no damage or wear grooves.
Test was conducted by connecting the carabiner to the test rig with a single wrap of 50mm tape webbing at each end.
Result: Failed at 1620kg due to failure of the body area that held the gate hinge pin. The carabiner then opened up and broke off at the spine/small end corner. One piece of the body was projected into the bush and couldn't be found.

SUMMARY OF CARABINER TESTS

Test	Device	Rated kg	Actual kg	Comments
5	Stubai steel carabiner (locker)	3400	2600	Tested with 50mm tape
7	HB Alloy carabiner (locker)	3000	1620	Tested with 50mm tape

WHALETAIL TESTS

The aim was to find what load an operator could hold using a Whaletail.

TEST 6 (five Whaletail tests)

Whaletail descender. 5 slot type.
Condition. As new with very minor wear of grooves.
Test was conducted to determine the holding power of one or two operators using the Whaletail to hold a large load. The device was placed in the test rig with the operator/s holding the rope as the load was slowly increased.

(a) Result: Operator DD (approx 65kg) started to slip at approx 280kg. Reset his hands with a wrap around one hand and held the load until about 320kg.

(b) Result: Operator LT (approx 70kg) started to slip at about 280kg, reset hands with a single wrap around one hand and was able to hold to about 360kg. By repositioning to the front of the Whaletail (and introducing a sharper angle on the 5th slot) was able to hold to about 560kg.

(c) Result: Operator DD and LT together on the rope. In conventional position (just behind device) they could hold 440kg. By moving to the front together they could hold approx 760kg.

(d) Result: Whaletail was rigged with the rope going from the 5th slot through a carabiner clipped into the front hole of the Whaletail and then back to the operator LT. Operator could hold comfortably until approx 450kg load and to a max of 620kg for a short time.

(e) Result: Two Whaletails rigged in series with one operator LT. Could hold until about 500kg comfortably and to a max of 700kg for a short moment.

SUMMARY – PETZL WHALETAIL TESTS

Test	Device	Actual kg	Comments
6 (a)	one operator/5 slots	280	Held to 280 (max peak 320 with hand wrap)
6 (b)	one operator/5 slots	280	Held to 360 with hand wrap. Front held 560
6 (c)	2 operators/5 slots	440	Held 440. front held 760
6 (d)	OneO/5 slots & front crab	450	Held to 450 (max peak 620)
6 (e)	2 whaletails in series	500	Held to 500 (max peak 700kg)

Note that “actual kg” amount was the load that could be held for some time. “max peak” could not be held for more than a second or two.

RESCUE BELAY DEVICE TESTS

The aim was to find the load when the device started slipping

TEST 8
Traverse 540 (made in Canada) Rescue belay device.
Belay device slow pull test
The purpose was to see how much load this belay device held before slipping occurred.
Condition: new device
The test was done without operator input (relying solely on the auto-locking functioning of the device).
Result: Slipped at 660kg. We could not use the handle to get the device to release until we backed the load off to about 140kg.

TEST 9
SRT No Worries Two Way Stop (ascender and rescue belay device).
Belay device slow pull test
The purpose was to see how much load this belay device held before slipping occurred.
Condition: As new device. No wear visible.
The test was done without operator input (relying solely on the auto-locking functioning of the device).
(a) Result: started slipping at 550kg, held again then slipped finally at 580kg. We suspected a too-rapid loading caused this early slipping so we repeated the test.
(b) Result: Slipped at 640kg and one operator could use the handle to release the load from the peak load.

TEST 10
Fallrite Auto-stop (rescue belay device) stamped 400kg SWL / 30kN MBL
Belay device slow pull test
The purpose was to see how much load this belay device held before slipping occurred.
Condition: New device.
The test was done without operator input (relying solely on the auto-locking functioning of the device).
Result: slipped at 640kg and one operator could use the handle to release the load from the peak load.

SUMMARY OF RESCUE BELAY DEVICE TESTS

Test	Device	Actual kg	Comments
8	Traverse 540	660	Could not release under load
9	SRT No Worries TwoWayStop	640	Released with handle under full load
10	Fallrite Auto-stop	640	Released with handle under full load

Note that the “actual kg” amount was the point at which the device started slipping.

TEST 15
Tree testing
Aim: to determine if tree anchor selection judgment matches actual strength.
The 800kg proof load was based on a two X SWL.
The first tree selected (diameter 150mm at base) was considered the minimum size that may withstand a rescue load. The tree passed the proof load test of 800 kgs, as no noticeable movement in truck or root system was observed.
As the 150mm diameter tree passed the proof load test, the second test was to determine if a 75 to 100mm tree could pass. Unfortunately there were not many specimens to choose from in this range. The selected tree was poorly rooted. This tree failed the proof test as trunk & root movement occurred at about 150kgs.
As there are so many variables in tree anchor strength, no conclusions can be drawn from the one test specimen.

Drop test result – 200kg dropped factor 1/2 fall (3m of rope and 1.5m drop) Sheath parted on the edge. The wire rope in the photo was used to raise the load for the test.

DROP TEST OF 200KG LOAD
This test was conducted but no meaningful data came of it because we couldn't get the load cell to record the peak load. The top of the rope was tied off to a fixed anchor. We did a factor 1/2 fall (1.5m fall onto 3m of rope, with a rounded cliff edge in the system) and it stripped the sheath off the rope but the core was undamaged.

The following VRA and BWRS members participated in this workshop: Dave Drohan, Doug Floyd, Glenn Horrocks, Ian Cross, Kevin Dawson, Lucas Trihey, Paul Campbell-Allen, Phil Whiting, Tony Greenwood.

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Photos courtesy Paul Campbell Allen and Lucas Trihey