Local Cave & Mine Leader Award

Caving Belts

British Caving Association

Supporting document for the LCMLA Award Scheme

Disclaimer

Neither the authors nor British Caving Association assume any responsibility for the improper application of the techniques or principles outlined in this document. Use of these techniques are at the user's risk. The techniques illustrated in this document provide supporting information for the Local Cave & Mine Leader Award syllabus and should be read with the remit of that award in mind. This document is not a substitute for attending certified training courses.

Introduction

This document has been produced on behalf of the Qualification Management Committee (QMC) of the British Caving Association. Its purpose is to support candidates preparing for the Local Cave and Mine Leader Award.

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Caving Belts in Cave/Mine Leader Award Situations

Historically the Caving Belt was used to be either load-bearing or non load-bearing depending on the type of use it would receive. Often a simple non load bearing belt (25mm width) was worn for carrying a lamp battery. However, it was recognised that a belt could also be used as means of assisting people whilst spotting climbs, as a convenient place for an instructor to grab by hand providing assistance, or as a method for attaching cowstails or ropes on short climbs, slopes and traverses.


Photo 1: Belt used to prevent reaching to a hazard

In these situations, a belt capable of handling a load with relative comfort (45-50mm width) with a locking buckle system was required and manufacturers provided, what at the time was known as, the 'Load Bearing Belt'.

The BCA Award scheme allows leaders to take groups into situations where a fall may be serious.


Photos 2: Belt is use; preventing a fall

At Cave Leader or Mine Leader Award level the ground that the group is moving over should be simple enough that progress on steep or challenging ground can be safeguarded largely through spotting techniques. There may be times when groups may be near steep drops where a fixed handline rope could be secured to a belt to prevent a group member reaching the steep ground and falling (see photo 1).

Alternatively, there may be steps which are relatively straight forward, however the leader may not be able to safely position themselves at an awkward step to spot effectively, and so a belt together with a rope may be used to prevent a slip from turning into a fall (see photo 2).

Critically within the remit of the Cave/Mine Leader **a group member must never be suspended from a caving belt**.

For more details see the BCA Cave/Mine leader ropework document: https://british-caving.org.uk/documents/ropeworks-for-cave-mine-leaders/

Photo 3: Belts must NOT be used in this situation

At Vertical cave or mine Leader award level a slip may mean that the group member is suspended (see photo 3). If this is a possibility, then the group member must wear an appropriate harness NOT a belt.

For more details see the BCA Vertical Cave/Mine Leader ropework document: https://british-caving.org.uk/documents/vertical-leader-ropework/

Cave/Mine Leaders operating in an area where they feel an improvised harness may be necessary in an emergency/unplanned event should consider packing a suitable harness with their rope.

Belts & PPE

With the introduction of PPE, legistlation standards were drawn up, predominantly with the rope access industry in mind. Within industry there is a standard (EN358) for Belts (and lanyards) for work positioning or restraint.

At face value this standard would appear approriate to adopt for choosing a caving belt, however in practice these need to meet a range of criteria (such as requiring a back support, load bearing attachment points and a complex buckle arrangment) which make them impractical for caving.

There is no standard for a Caving Belt and those available to purchase are not defined as PPE.

Which Belt?

As there is no standard for a Caving Belt, leaders will need to make careful choices when selecting a belt approriate for use within the remit of the award scheme, such as

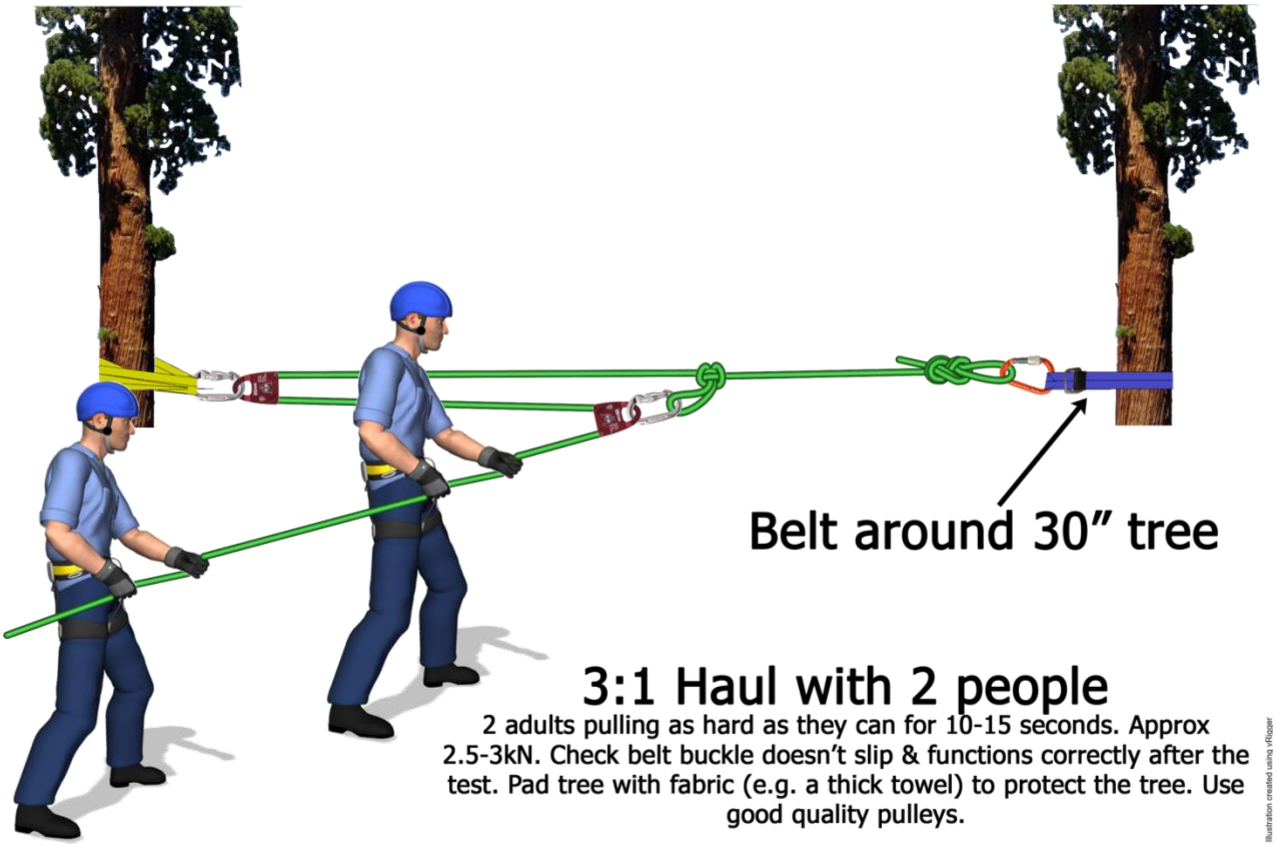
- Width of belt (to ensure they are reasonably comfortable in use). E.g. greater than 40mm
- Suitable adjustable buckle (which is suitably robust for its intended use, and cannot come undone through normal caving/mine exporation activities). E.g. metal lockable buckle
- Sourced from a reputable outdoor/caving dealer (preferably one that has been manufactured for use as a Caving Belt) to ensure there's confidence in the material selection and manufacturing process.

How strong a Caving Belt needs to be is a challenging question. In practice a Caving Belt should never be used to support more than an individuals weight, and never in a dynamic situation. Considering a large caver of say 150kg, this would typically result in less than 1.5kN of force assuming the caver is not suspended from the belt.

However, some consideration should be made with regards wear to a belt, particularly in a caving environment, and so it could be argued that a belt should be able to support a load in excess of that which it's likely to be exposed to in normal use to provide some redundancy. The selction of a suitably robust belt manufactured from components simular to those used in a climbing/caving harness would be appropriate.

BCA & QMC completed a body of work (see appendix 1) testing a range of commonly available caving belts to confirm they were sufficiently robust for their intended use. All belts tested were shown to be significantly stronger than needed by a significant margin.

In addtion a simple and pragmatic test illustrated here can be used on all belts to check they are sufficently robust. This simple 3 to 1 haul system pulled by 2 adults as hard as they can will result in around 2.5kN to 3kN of force on the belt. This load is significantly more than a belt should be exposed to in normal use. This test could be made on all belts when first purchased to provide confidence in the strength of the belt, and can be used as part of periodic inspections if needed.



Further work by Cave & Mine Leader Traniner/Assessors during workshops or independently (see appendixs 2-4) further support the strength of many commonly used belts being more than sufficient for their intended role. Some of this work has also considered dynamic tests which belts should not be exposed to within the remit of the cave/mine leader.

Considerations in use

When in use leaders should take care as to where a buckle is positioned so that the webbing of the belt is not subjected to excessive wear, or cause discomfort to the group member. Buckles should be checked periodically, especially before use with any rope work techniques or spotting, as they may work loose through the rigours of a cave or mine exploration activity.

Leaders should also take are when attaching a karabiner or cowstails to a belt to ensure they are positioned in such a way so as not to affect the buckle and secured to an appropriate part of the belt (see photo 4).

Photo 4: Karabiner clipped to the webbing, buckle rotated out of the way, to the side

Care and Maintenance

Although Caving belts are not PPE, they should be inspected in a similar way to other textile technical equipment such as harnesses to ensure that they remain fit for purpose. In practice this should include pre-use checks together with 6 monthly and exceptional circumstance inspections; inspections should be visual, tactile and function tests.

Users may consider marking belts with a unique identifier, this can aid recording any PPE checks. If doing so this should be in-line with manufactures guidance on marking, i.e. avoid writing on the material section of the belt, rather on a label, printed section or by etching into the metalwork.

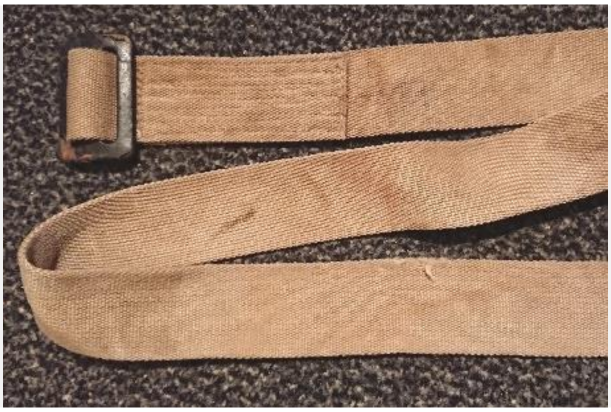
The belt should not be significantly frayed or damaged, and its components (i.e. buckle) should function correctly. Periodic tactile checks of the belt, and visual inspection of the stitching, webbing and buckles are recommended.

Dirty belts can affect their function. Belts can be cleaned similar to harnesses, e.g. in lukewarm (30°C max) mild soapy (e.g. pH neutral or household face/body soap) water, or on a delicate/synthetic wash cycle in a washing machine. Solvents, stain removers or degreasers are not recommended as they may damage the materials.

Most manufactures will recommend a maximum lifespan of 10 years for material goods. Users should take this into consideration when considering the lifespan of a belt, however testing of old caving belts have shown they can hold loads far more than those expected within the remit of the cave/mine leader award. Wear and a loss in function (i.e., buckle not functioning correctly or webbing being too stiff) are of greater concern than age.

Local Cave & Mine Leader Award: Belts

Below are some examples of Caving Belts that may still be fit for purpose or may be reaching the end of their lifespan.

	A relatively new belt with only minor scuffs
	Fraying beyond repair. Needs retiring
	Age questionable, however no significant fraying. Buckle showing some corrosion. May be suitable for use but requires monitoring
	Minor fraying, belt would need monitoring but may be suitable for continued use.

Appendix 1: QMC Testing of Broad Caving Belts October 2021-22

Following discussions within QMC/BCA's Liaison Group it was decided some testing should take place on a range of commonly available caving belts to satisfy the BCA/QMC that the use of belts as outlined within the Local Cave and Mine Leader award was appropriate.

The aim of this project was:
1. Determine a typical load belt's may be subjected to in use
2. Provide a simple testing procedure award holders could conduct to satisfy themselves that a belt is fit for purpose within the remit of the Local Cave & Mine Leader Award, without damaging the belts

Literature Review

EN358 is the standard for Work Positioning or Restraint belts & lanyards. To satisfy this standard a Work Positioning belt is tested to 15kN, the same requirement for a climbing harness (although the standard for the belt section of a harness is 10kN). A Work Positioning Belt must be used with an approriate harness and approriate energy absorber, where there is a risk of fall, where as Work Positioning belts/lanyards used for work restraint (i.e. keeping a worker away from an edge) do not require the addition of a harness.

Survivable Impact Forces on Human Body Constrained by Full Body Harness, HSL/2003/09 (written for HSE by Harry Crawford in 2003) highlighted that a force of 4kN is likely to be the maximum force a smaller person (withn a 50-80kg range) could endure without injury. Larger people, in the 100-140kg range this could be increased to 8kN, with industry typically sighting 6kN as the maximum impact a worked in harness should/could be exposed to.

These figures could be used to help consider the strength requirement of a belt.

Expected loads in use

To determine the typical load a belt may experience in use a load cell was secured to a fixed point (a large tree), through a short length of rope and to a belt secured around a typical caver. In the first test the caver pulled away from the tree as much as physically possible for 10s and the load measured. This was repeated several times with two individuals. Caver one weighed approx. 70kg, caver two approx. 75kg. Caver one maintained an average load of 0.3kN, Caver two an average load of 0.4kN. Further tests with larger cavers resulted in slightly higher figures, the maximum being 0.7kN.

Following this both cavers dynamically loaded the load cell. Caver one peaked at 1.1kN and Caver two 1.5kN. Both cavers noted significant discomfort in these tests and would not recommend they are repeated with people!

Belt Pull Tests

4 types of belts commonly available and sold as caving belts were purchased. The belts purchased were:

- Lyon Lamp Belt
- Warmbac Square Buckle
- Warmbac Roll Buckle
- Adventure Vertical Speleobelt with alloy delta maillon

3 of each type were purchased.

In addition, several old caving belts were sourced (several having been retired from use). In total 17 belts were sampled.

Test 1 (3:1 haul by hand with 2 people)

The aim of the first test was to construct a practical test award holders could use to determine if a belt is fit for its expected use without the need for a load cell, or damaging the belt.

A sufficiently sized tree, approximately 30 inches in circumference, was selected and a belt secured around it (with the tree suitably protected with a fabric tree protector). Making use of another sufficiently robust tree of a similar size approximately 5m apart a simple 3:1 haul constructed using good quality rescue (high efficiency) pulleys.

A Rock Exotica enForcer load cell (set to its fast sampling mode, 500 samples a second) was secured to the belt and haul. 2 people hauled pulling for 10 seconds. The average load from each pull was recorded with average loads ranging from 2.5kN to 3.1kN. One of each of the purchased belt type were pulled in this way.

All belts were inspected both visually and tactile, no significant wear was noticeable. Buckles functioned correctly.

Test 2 (mechanical winch)

In the second test a wire mechanical winch was used to test one new belt of each type. These were pulled to 6kN. This was held for 30 seconds.

All belts tested were then inspected both visually and tactile. In some cases, there was localized hardening/glazing of the belt where the karabiner was attached to the load cell and belt. Both inspectors felt these belts would pass an inspection, however would require monitoring. Buckles functioned correctly after the test.

Test 3 (test to destruction)

For the final test all belts were sent off to be pulled to destruction, this approximately 11 months after the original pull tests. Observation notes were made at the breaking point. All belts (including the very old and retired belts) held above the 10kN standard for a harness with only belt number 5, an old unknown type, failing below 15kN.

All belts were destroyed, with one from each of purchased belts being new, one pulled to 6kN and a third subjected to a 3:1 haul by hand with 2 people hauling.

The tests to destruction showed no discernable difference between those that had been tested previously. In fact, some of the new belts not pulled in previous tests failed at lower loads than those tested earlier.

A summary of all test results is outlined below.

		Pull tests on trees		Pull to destructions	
No.	**Belt**	**Haul Type**	**Load (kN)**	**10kN +**	**Note on failure mechanism**
1	Warmbac Roll Buckle	3 to 1 by hand	2.6	Yes	At peak load the webbing started slipping and the bar popped out
8		Mechanical winch	6	Yes	Slippage of webbing and deformation of buckle
14		n/a		Yes	At peak load the webbing started slipping and the bar popped out
2	Lyon Lamp Belt	3 to 1 by hand	2.9	Yes	Buckle deformed but belt webbing snapped where webbing rounded shackle
9		Mechanical winch	6	Yes	Deformation of buckle but webbing snapped where it rounded shackle
15		n/a		Yes	Webbing snapped where it rounded the shackle
3	Warmbac Square Buckle	3 to 1 by hand	2.5	Yes	Buckle deformed and webbing slipped
10		Mechanical winch	6	Yes	Buckle deformed and webbing slipped
16		n/a		Yes	Deformation of buckle and slippage of webbing
4	Adventure Vertical Speleobelt with alloy delta maillon	3 to 1 by hand	3.1	Yes	Webbing slipped through the buckle
11		Mechanical winch	6	Yes	Webbing slipped through the buckle
17		n/a		Yes	Webbing was pulled through the buckle
5	Black twin buckle possibly Warmbac (very old). Significant fraying	3 to 1 by hand	2.6	Yes	Webbing snapped where it rounded the shackle
6	Yellow twin buckle, possibly caving supplies. Very old. Stiff	3 to 1 by hand	2.8	Yes	Webbing failed at buckle
7	Blue roller buckle, Troll. Old, significant fraying	3 to 1 by hand	2.6	Yes	Webbing snapped where it rounded the shackle
12	Dragon blue belt with traditional climbing buckle. V. Old	Mechanical winch	6	Yes	I was unable to double back the webbing through the belt. At peak load the webbing started to slip through the buckle
13	Blue roller buckle, Troll. Old	Mechanical winch	6	Yes	Webbing snapped where it rounded the shackle

Conclusion

In normal use, that within the remit of the Local Cave and Mine Leader award, a belt is unlikely to be exposed to a load in excess of 0.7kN

In a dynamic situation the load a belt may be exposed to could be in the region of 2kN.

Children are likely to be injured if exposed to an impact (fall into a belt or harness) more than 4kN, whereas larger adults can endure more. **Falling onto belts must be avoided**.

All belts pulled to destruction indicated they were more than capable of holding the loads expected within the remit of the Local Cave and Mine Leader award syllabus. All belts tested performed above the standard expected of a Work Restraint Belt.

A 3:1 haul, hauled by 2 people, rigged between two sufficiently robust trees results in a load exceeding that anticipated in normal use. This test could be used to check belts purchased for cave/mine exploration within the remit of the Local Cave and Mine Leader Award are sufficiently robust for their intended use. This test is unlikely to cause any lasting damage to the belt, and so could be used as part of a periodic inspection.

The hauls should be held for 10-15 seconds with the belt buckle monitored for signs of slippage or deformation during the haul (it may be necessary for a third person to observe the belt/buckle while two others haul). After the haul the belt should be inspected both visually and by feel, for signs of wear, damage or excessive stiffening. Any deformation of the buckle or excessive wear would indicate the belt is unsuitable for use.

Appendix 2: 'Heavy Duty ' Caving belt testing LCMLA Trainer/assessor workshop 12/12/15

A range of belts were tested during a LCMLA trainer/assessor workshop (12/12/15) held at Hagg Farm Outdoor Education Centre Derbyshire.

The belts were subjected to a drop test of an approximate fall factor 0.5 (with a drop of about 1.75m) with a mass of 55kg (photos 1 and 2). A load cell was included in the rig which gave an impact force of around 4.4kN (diagram 1)

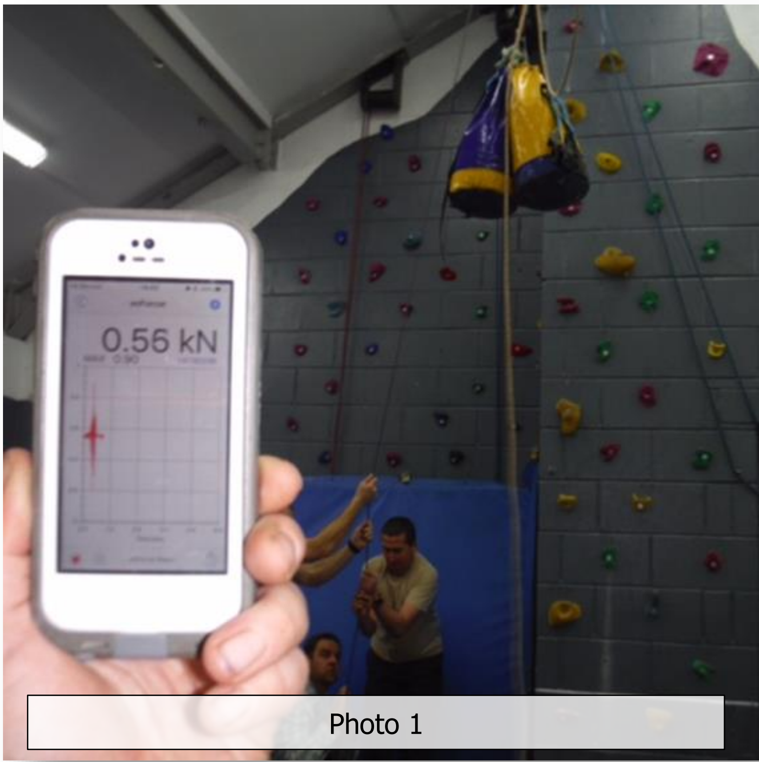


Photo 1

Photo 2

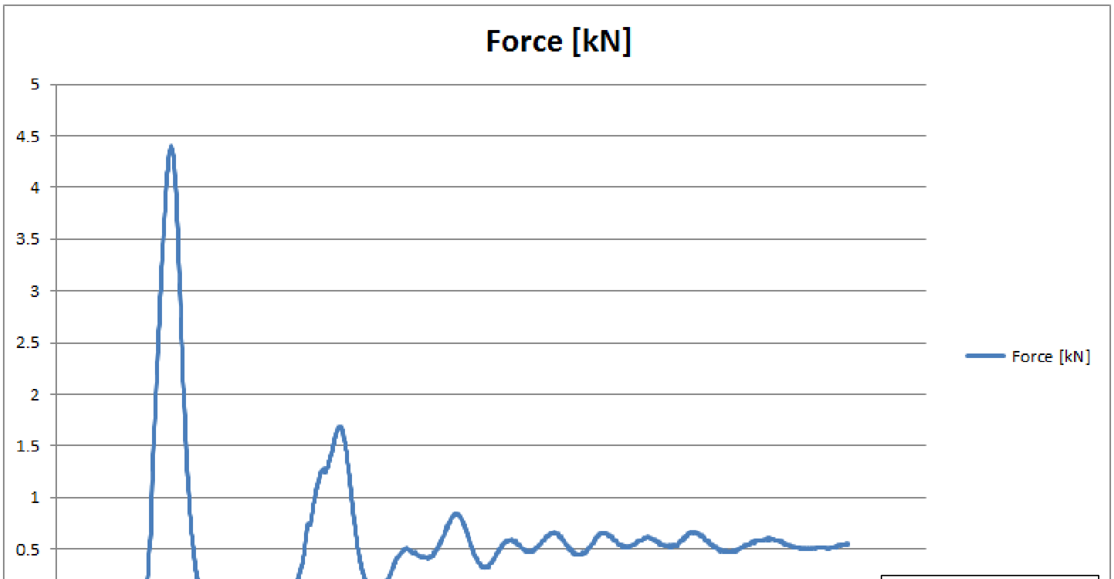


Diagram 1

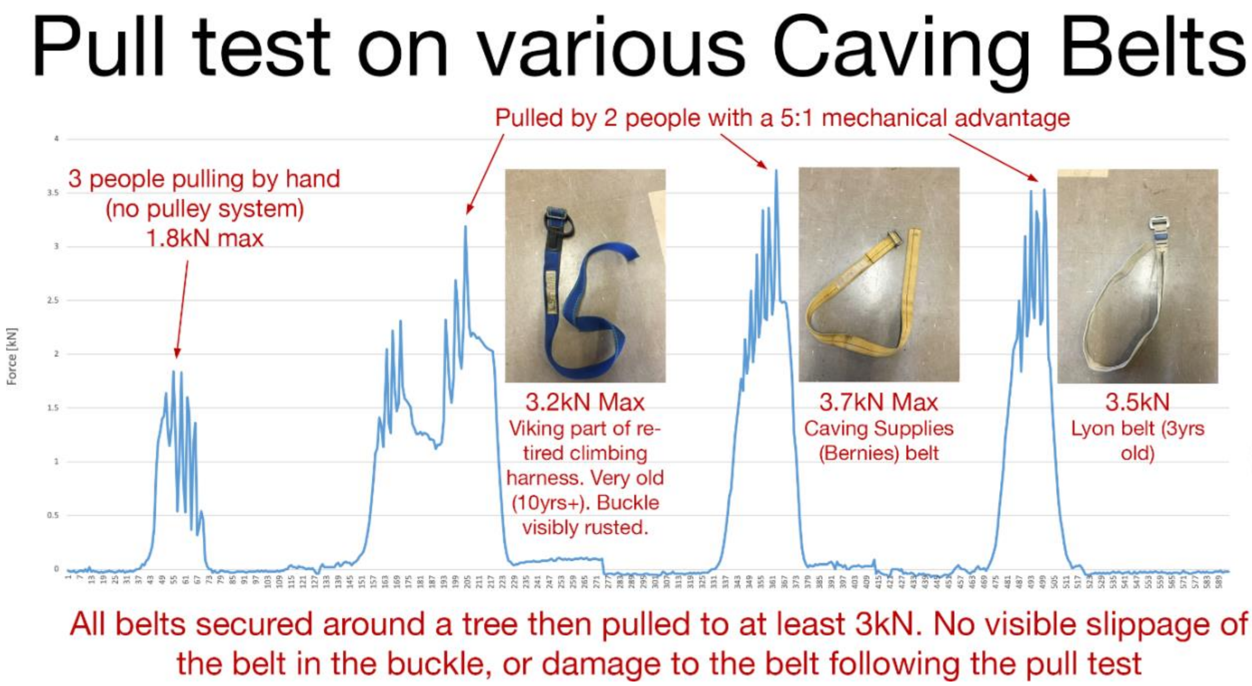
Insulation tape was placed up against the buckle to measure any slippage and the belts inspected afterwards for damage. The belts were subjected to one drop only. The loads were considered to be far in excess of those experienced in any normal use by LCMLA/CIC holders in a working capacity.

Test results

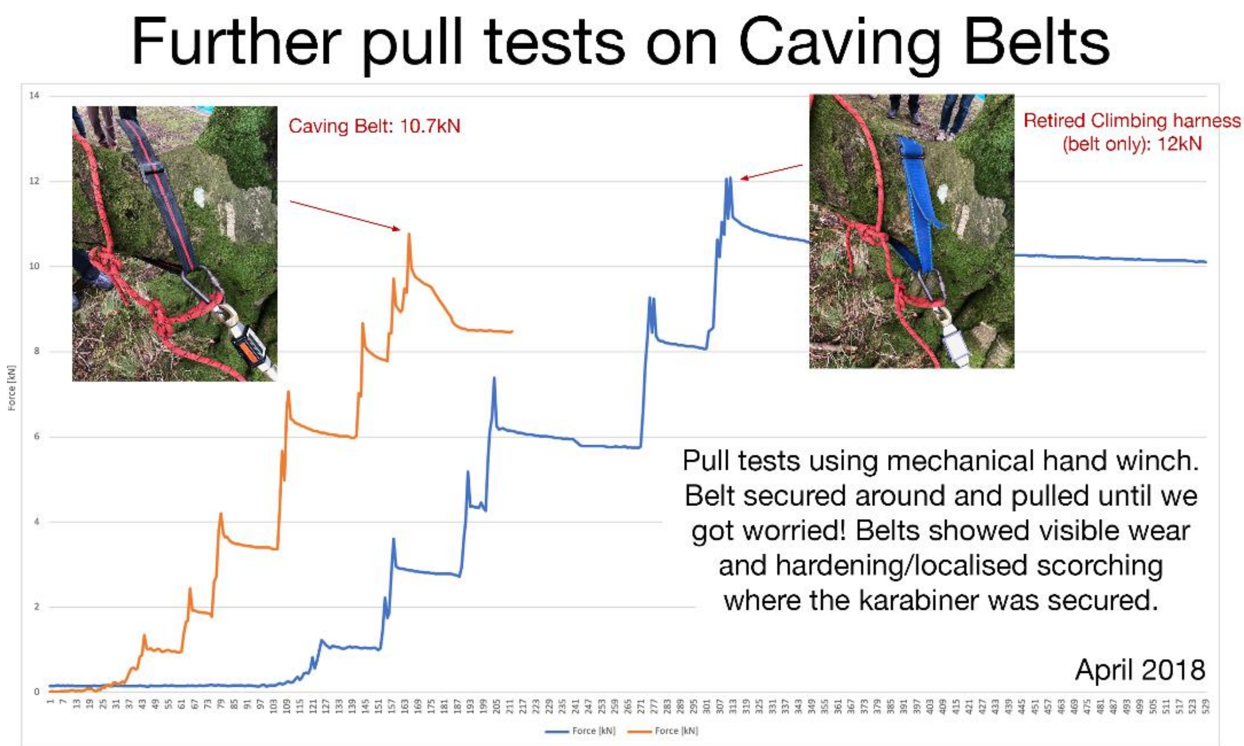
Belt	Age	Slippage	Visible damage?
Dragon	used	4mm	none
Warmbac	new	10mm	none
Troll	very old	none	none
Caving Supplies (yellow)	very old	none	none
Caving Supplies	new	10mm	some deformity and glazing in buckle area (photo 3)


Photo 3

Appendix 3a: Belts tested at a North Wales BCA workshop. April 2014
www.train4underground.co.uk

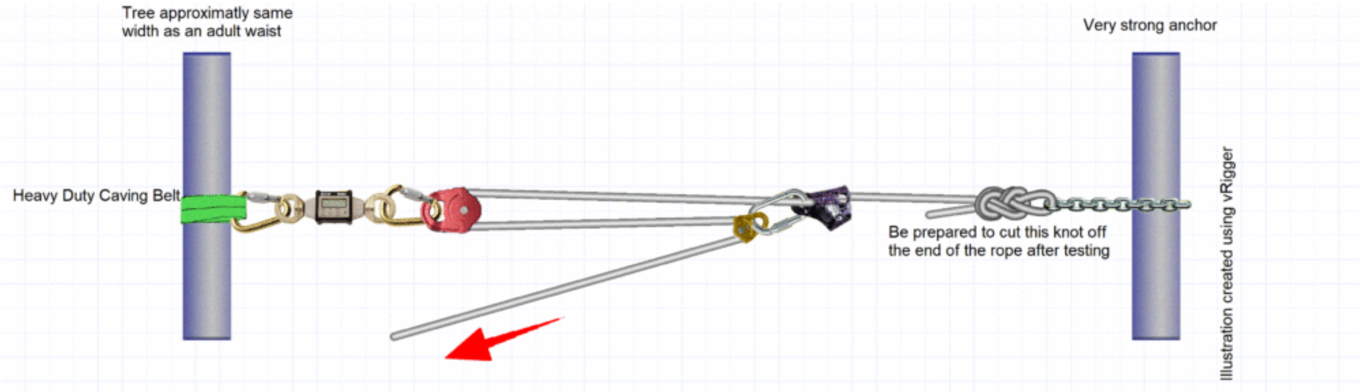


Appendix 3b: Further tests on Caving Belts April 2018
www.train4underground.co.uk



Appendix 4: Testing the strength of heavy duty caving belts
www.peakinstruction.com

Posted by Pete Knight. 5th September 2017



A Method of Testing the Strength of Heavy Duty Caving Belts

The aim of this was to establish a method to test the strength of heavy duty caving belts that did not rely on having access to a load cell. I hoped to produce a simple system that needed very little equipment and that would deliver a test load to a belt that exceeded the minimum strength requirement for its use.

What strength does a belt need to be?

Well, this one is a potential can of worms…. Let's be clear, the manufacturers do not condone the use of their heavy duty belts for taking any load at all beyond hanging your battery or lunch box from it. There is a historical use in cave and mine exploration that involves using the belt for the purpose of slip prevention and security on steep ground when combined with a rope belay or cowstails. If you were intending to use it for this purpose, especially as a leader of others, you'd need to be 100% sure that the belt was strong enough for that role. The manufacturers do not state this type of use is approved or list any strength rating on the product or the literature accompanying it. You must conduct your own test and risk assessment if you are to use them in this way.

If you want an item that has a standard for this type of use, use a climbing harness, caving harness or EN358 work positioning/restraint belt.

For anticipating loads that could be applied to a belt in use, I have used a mass that is comparable to the maximum user weight ratings on some of the common PPE equipment at the time of writing: 120kg (Mass)

The caver has a short dynamic rope lanyard of 50cm length, fixed from their belt to an anchor.

If they climb above the anchor, until the lanyard is tight, then ignoring all stretch or slack in a system, a possible FF2 fall of 1 meter can occur (Height FF2).

This FF2 fall will likely result in injury and, as a rule, cavers avoid putting themselves in a position where this kind of drop can be taken. By not climbing above the attachment point of their lanyard, the resulting fall cannot exceed FF1, or 50cm in this case. (Height FF1).

When using dynamic rope cowstails, the UIAA standard permits stretch up to 40% of original length. For a 50cm cowstail, this is 20cm, or 0.2m (Impact Distance).

For a fall factor 2 (1m drop on to 0.5m cowstails)

$$\text{velocity} = \sqrt{(\text{distance x acceleration due to gravity x 2})}$$

$$v = \sqrt{(1 \times 9.81 \times 2)}$$
$$v = 4.43 \text{ m/s}$$

$$\text{Kinetic energy} = 0.5(\text{mass x velocity}^2)$$

$$Ke = 0.5 (120 \times 4.43^2)$$
$$Ke = 1177.5 \text{ Joules}$$

$$\text{Impact force} = \text{Kinetic energy / Impact distance}$$

$$IF = 1177.5 / 0.2$$
$$IF = 5887.5 \text{ N}$$

Impact Force = 5.89 kN

This is clearly a very serious amount of force and is only a hair under the threshold that the work at height industry uses as a maximum safe force the human body should be subjected to. An impact of around 6kN on the body will cause injury in a lot of cases and should certainly never be taken on a heavy duty caving belt. It is beyond anything we should ever do when wearing belts and is included only to demonstrate the risk of improper use. A FF1 drop is still something to be avoided, but is more realistic of a potential real world scenario.

For a fall factor 1 (0.5m drop on to 0.5m cowstails)

$$\text{velocity} = \sqrt{(\text{distance x acceleration due to gravity x 2})}$$

$$v = \sqrt{(0.5 \times 9.81 \times 2)}$$
$$v = 3.13 \text{ m/s}$$

$$\text{Kinetic energy} = 0.5(\text{mass x velocity}^2)$$

$$Ke = 0.5\,(120 \times 3.13^2)$$
$$Ke = 587.8 \text{ Joules}$$

Impact force = Kinetic energy / Impact distance

$$IF = 587.8 / 0.2$$
$$IF = 2939 \text{ N}$$

Impact Force = 2.94 kN

So, a 0.5m drop on to a 0.5m dynamic lanyard may produce a force of around 3kN for a 120kg caver. This does not take into account any stretch or bounce. This figure seems pretty reasonable, but we should seek more evidence to reinforce this for our follow up testing.

When considering the use of caving belts, can we can compare it to something done in another industry? Well yes, work restraint systems often make use of padded restraint belts instead of harnesses. One of the critical requirements for this system is that a user may not be permitted to go into suspension on this system. That seems very close to how we should be using heavy duty caving belts. When consulting BS8437 – *Code of practice for the selection use and maintenance of personal fall protections systems and equipment for use in the workplace*, we can identify that restraint belts need to conform to EN 358. Accessing this standard is expensive and no doubt the items conforming to this standard will have a very high safety factor. What we can get from BS8437 is the recommended strength of anchor points for use in a work restraint system. **This is 3 x the mass of the user.** A correctly installed and utilised work restraint system is only required to have an anchor of 3 x user's mass. For our 120kg caver, this would be 360kg, or 3.6kN in force.

For our 120kg fictitious caver, we can mathematically predict a theoretical force of just under 3kN for a FF1 drop. We can also see that an anchor of 360kg (3.6kN) would be required if using similar techniques in work restraint. The figures are not exactly a match, but are comparable. **Taking the worst case figure is probably the safest option going forward, so our belts must be capable of taking a force greater than 3.6kN for a scenario that does not involve wildly inappropriate use.**

Safety Factor?

Apply to this any safety factor you wish. The 3kN figure from the math's is indicative of the maximum possible force generated in a FF1 drop on 50cm cowstails, the real world figure will be far lower due to stretch and slippage of the belt on the body and the sagging of the rope the caver is connected to. The BS8437 figure is a 3 x safety factor over the user's mass anyway. You could easily argue that belts tested to 3.6kN would be sufficient as an indicator of appropriate strength if you never operated with cavers heavier than 120kg.

Belt Strength

Accepting all this, we are left with the figure of 3.6kN as a minimum requirement for the strength of the heavy duty caving belt for any user we might encounter regularly (3 x 120kg based on BS8437).

So as long as we can apply a test force of 3.6kN or more to the belt, we can be assured that the item can hold the greatest possible force we can apply to it in proper use. The only remaining factor of concern is that would applying this force in test render the belt unsafe to use again, in essence, are these tests destructive? Only 1 way to find out…..

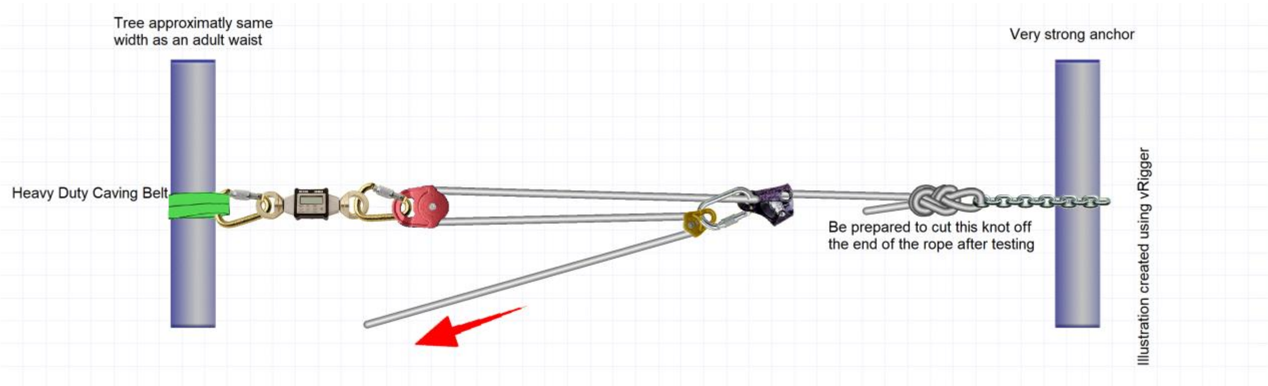
Testing

Using 1 very large Corsican Pine and a good sized Birch tree, we set up a pull testing rig with a simple 3:1 theoretical configuration. I used a Rock Exotica load cell to get live feedback on the testing here but if you copy the method, you would not need to use one.

For the estimation of test force, we regarded each person capable of pulling 50kg (see Gethin Thomas' work on Tyroleans). Through a theoretical 3:1 MA system that would be 150kg per person. With 5 undertaking the pull reaching 750kg and 6 equaling 900kg or approximately 7.5kn and 9kN respectively.

Kit used (minus load cell): Petzl rescue pulley, Petzl Basic jammer, Petzl Partner pulley, Lyon wire sling for tree, assorted karabiners, 20m rope.

Due to the force expected to be placed on the rope, I did not anticipate that I would be able to untie the end knot (fig 8 loop). This was accurate and the knot had to be cut from the rope end. Bare this in mind with your own rope!



We also used a Petzl Rollclip to redirect the angle of pull to make it easier to stand on the tarmac of the road alongside the trees.

Initially we had 5 people pulling the first test on a Lyon roller-buckle belt (brand new). This produced a force of 5.9kN with no damage or slippage. This is lower than expected but there was a lot of tightening in the knot and stretch in the rope coupled with a general timidness of the pulling team.


The remaining tests used 6 people to pull. This one was conducted on my 10 year old Caving Supplies square buckle belt (already retired). This belt has nicks, fluff and rust and comfortably took a force of 7.74kN showing no damage or slippage. Next came my current AV belt, with its central maillon removed and directly attached to the pull line. This belt held 7.7kN without failure or slippage. Finally, the pulling team seemed at their most confident that nothing was going to break and send shards of metal and wood at them so they really gave the last belt some pain. This Warmbac square buckle belt was subjected to 8.64kN with no damage or slippage noted at the time.

It is not surprising that the force exerted by the pulling team was less than the theoretical 3:1 system implied. In practice with the loss of friction due to bearings and turns in the rope a 2.5:1 is a more real world figure and so our 5 x 50kg pulling average adults could be expected to make 625kg/6.25kN using this system.

On this test we pulled the belts to a far higher force than would be needed in a periodical strength test to simply demonstrate that this lower level of testing would not damage the belts. Using 4 people to pull on a 3:1 MA (2.5:1 actual) system in a reasonable way with un-gloved hands, would produce a force exceeding 3.6kN. This would not require a load cell to demonstrate if the method was followed correctly. Using 3 strong people on the same 3:1 (2.5 actual) system would probably be reasonable too.

50kg x 4 people = 200kg x 2.5 mechanical advantage = 500kg or 5kN
50kg x 3 people = 150kg x 2.5 mechanical advantage = 375kg or 3.75kN

Conclusions

Using a system like the one shown here, with 4 people pulling at average strengths, you can apply a force greater than 3.6kN to your test belt.
Once the test is complete you should thoroughly examine the belt like any other item of textile PPE to see if any damage or slippage has occurred. Any that do show signs of damage should be retired. Any slippage may be down to the buckle, but if the belt comes off or strap slides through the buckle under load, it should be deemed as having failed. If a belt has taken the test load and shows no damage or deformity then you can be comfortably sure that the belt will be fit for its intended use whilst still in that condition.

Final inspection of belts:

Belt	Max load	Observations
Lyon roller buckle	5.9kN	No damage
Caving Supplies square buckle	7.74kN	No damage
AV maillon closed harness buckle	7.7kN	No damage
Warmbac square buckle	8.64kN	No damage, slight curvature to webbing now when hung vertically which indicates over stretching or broken fibers down one side.

Again, this level of force was beyond what you would test to, but demonstrates that the 4 person 3:1 pull will not damage a belt that is not already fit for the bin.