

**BCA Equipment and Techniques Committee**

Meeting held at My Big Meeting Room, Pinvin on 10 November 2013 commencing at 11:15 am

Present: V Allkins (CCC) VA, Roger King (DCUC) RK, Bob Mehew (Rope Test Officer) BM, Boyd Potts (DCA, observer) BP, Stephan Natynczuk () SN, Nick Williams (Convenor) NW.

1. **Apologies for absence:** Faye Litherland (CSCC)
2. **Chairman's opening remarks:** NW gave his thanks to SN for permitting the committee to use the room.
3. **Notice of items to be raised under Any Other Business:** NW noted he wanted to raise the topic of equipment for placing anchors.

**4. Minutes of the previous meeting**

**4.1 Agreement of Minutes:** The minutes were accepted and signed.

**4.2 Matters arising:**

**4.2.1** AL to identify and obtain permission for test site in N. Wales - A site has been found. RW accepted he would obtain information and arrange for a report back. Action on RW / CCC.

BM reported he had taken the BCA anchor puller to the N Wales site and in conjunction with G Thomas, D Procter and M Moulding, pulled 17 anchors. The range of results indicated that the slab of slate chosen could hold anchors up to 38kN but others extracted as low as 10kN. He would cover one key learning point under item 13. NW enquired where did this take the work. BM commented that he foresaw two areas of work, one relating to the placement of anchors for immediate use in an emergency and the other relating to placing resin anchors for normal use. He had been encouraging D Lloyd and G Thomas to make proposals for further work and apply to E&T for possible funding since the work would be of value to other caving regions.

RK noted he also wanted to make proposals for testing anchors for use in hard rock mines in Devon and Cornwall. VA noted he had a contact in mid Wales who had expressed a similar interest.

It was agreed that the action should be closed.

**4.2.2a** RM to forward design details of mod to puller to NW & RK.

BM reported that it had been done. The mod had been manufactured and is now in use. Action closed.

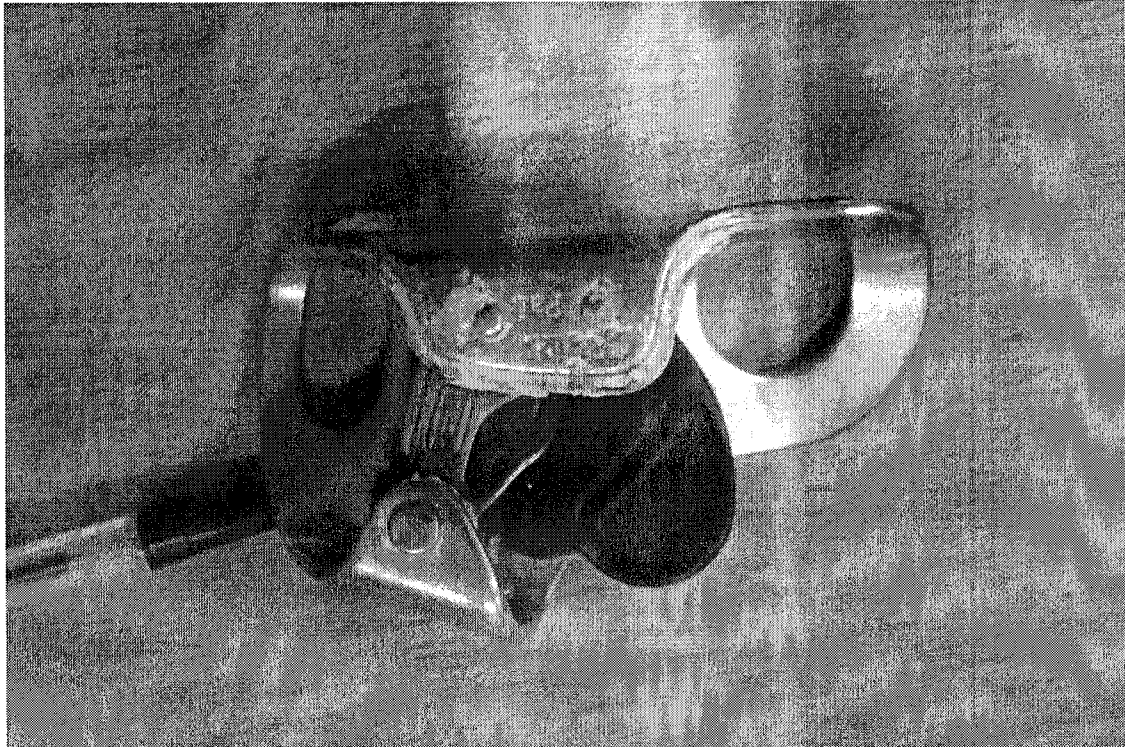
**4.2.2b** NW to advise L Sykes of plans. (Post meeting note – BM informed LS of intent during post meeting conversation and informed not a problem.) Action closed.

**4.2.3** FL to issue her draft User Spec for comments ongoing, FL needs information on requirements/standard/spec for resin. Ongoing. – Still ongoing Action on FL

It was agreed that since we had now settled on a choice of anchor, the need for a user spec was limited. The action was closed.

**4.2.4** RK to report to next meeting on a potential corrosion concern with Petzl Croll.

RK produced the Croll which had been wrapped in a towel soaked in sea water and kept in his airing cupboard for months.



It showed some corrosion but not on the pins. He noted that another Croll which he took underground with him and treated as a normal piece of kit showed no similar sign of corrosion. RK agreed to produce a write up.

**Action 4.1** RW to write up performance of Croll to sea water corrosion.

**5.1** BM to report when tensile tester installed. (Post meeting note – tester installed and reported in Descent.) Action closed.

**5.2** NW to advise on the thickness of polycarbonate shielding required for the tester. (Post meeting note – NW advised 10mm would be sufficient.) Action closed.

**6.1** BM to produce a paragraph of principles for a fixed aides policy.

BM reported he had issued a paper in July but this was questioned as various members were confident they had not received it. The draft paper was to be discussed under item 14. Action closed.

**9.1** BM to deliver the 304 / 316 test kit to GJ / LS. (Post meeting note – this was done on BM's return journey north.) Action closed.

**9.2** RK to arrange for the return of the BP issued anchors to DCUC. (Post meeting note – this was done the following weekend.) Action closed.

**9.3** NW to arrange for the quarantining of the BP anchors. (Post meeting note – GJ was informed.) Action closed.

**9.4** BM & FL to produce a plan of action on dealing with the potential problem of Chloride Stress Corrosion Cracking.

BM noted a paper had been produce and would be discussed under item 5. The action was closed.

**9.4** NW to order batch of 200 316 anchors for immediate issue. – BP supplied 170 off 316 anchors. Action closed.

**15.1.1** RK & FL to send empty tubes of resin back to NW.

NW reported that RK had sent one tube. The action was closed.

**15.2.1** FL to recirculate CSCC Training document to all members.

BM noted the version on the web did not mention the use of Bolt Products anchors and expressed concern over the apparent absence of an up to date document. NW proposed the topic be discussed further under AOB. It was agreed to close this action.

**5. Chloride Stress Corrosion Cracking:** BM noted there were three thresholds required to be exceeded for chloride stress corrosion cracking to take place, stress, temperature and chloride ion. He had been unable to place a value on stress levels, so the prudent position was to assume stress in anchors exceeded the threshold. Whilst it was usually viewed that chloride stress corrosion cracking would not take place under 40°C, some research indicated a threshold of 25°C. Although he doubted if anyone would argue cave temperatures were above 25°C, there was little research evidence to affirm this. One minor caveat was anchors at entrances which might see temperatures rise above 25°C on very hot days. There was only a small amount of data on chloride ion concentrations in cave water, all from Mendip which were typically below 50ppm compared to the threshold of 200ppm for 304 Stainless Steel and 1000ppm for 316 Stainless Steel. He had obtained data from the Environment Agency which generally showed low concentrations. BM noted that it was his intention to do some further work to produce a paper hopefully able to go into Caves and Karst Science since he viewed the work warranted wide publicity.

NW noted that the paper provided good evidence that both 304 and 316 could be used in caves. He went onto to report an event in Derbyshire several years ago involving paper pulp which had been stored over a sink linking to Peak Cavern which had resulted in considerable ingress of the pulp into the system. Concern had been expressed over the potential for 'free' chlorine being present in this pulp. BM agreed with NW that given the reactivity of chlorine, it would have combined with other material such as the organic material in water and thus become 'combined' chlorine. In addition, BM confirmed that the taste and odour thresholds for free chlorine in water were 5ppm and 2ppm. The threshold level for free chlorine to cause chloride stress corrosion cracking was 20ppm. Given no one had reported concerns over the taste or odour from free chlorine, it was therefore considered extremely unlikely that free chlorine was present at a sufficient concentration to be of concern. Access to an analytical report had been obtained by B Dearman which indicated the level of chloride ion in pulp was around 140ppm. BM noted that the typical level of chloride ion in soil was around 50ppm and given the typical concentration of chloride ion in drinking water was around

10ppm, he did not see how pulp could contribute sufficient chloride ion to exceed the threshold values.

SN sought clarification on the difference between 316 and 304 stainless steel. NW replied that 316 contained a small amount of molybdenum to suppress corrosion.

BP noted that DCA had questioned why a need to move to 304 stainless steel anchors. BM stated that he had written the document from a view point of seeking to show 304 could be used in caves so as to create a win win situation with Bolt Products who had incorrectly delivered 304 anchors to BCA. Both NW and BM accepted the expressed view of both CNCC and DCA to remain with 316 anchors and were not seeking to argue against it. BM noted that the previous meeting had adopted the Bolt Products 100mm long 8mm diameter 316 Stainless Steel twisted anchor (reference GP8-100-16A4) when used with KMR resin as the designated anchor system. He went on to report that there was a hitch in that the material of the anchors used in the test was now in question. It had not proved feasible to test the pulled anchors, so L Sykes and G Jones had placed a new test bed of known 316 anchors which was awaiting testing.

NW noted that the returned tube of resin was labelled 'Martin Price' and not 'KMR'. He questioned if the resin descriptor should be changed. It was agreed that this should be followed up with L Sykes.

**Action 5.1 NW** to seek advice from L Sykes on an appropriate description of the resin in use.

BM proposed that given the Committee had already formally adopted 316 Bolt Product anchors, the Committee should be content to leave the designation in place until the next meeting unless the results of the testing yet to be done were not positive. The Committee accepted the situation.

NW commented that BM had undertaken a considerable amount of work in clarifying the problem and he proposed a Vote of Thanks. The Committee accepted the proposal nem com.

**6. Choice of anchor material:** NW noted that having agreed to the use of 316 anchors for most caves, the report had recommended the use of HCR stainless steel for caves beside the sea. This was a duplex stainless steel of EN number designation 1.4462 which is understood to have even higher resistance to corrosion in a marine environment. (Post meeting note – 316's EN number designation is 1.4401 and / or 1.4436 whilst 304's is 1.4301, see [http://www.euro-inox.org/technical\\_tables/index.php](http://www.euro-inox.org/technical_tables/index.php).) BM observed that he had a concern that BCA needed to have confidence that the correct material was supplied and wondered if tests should be conducted to confirm this.

RK reported that DCUC needed some HCR anchors for rigging a quarry cliff access right by the sea to Sweet Water Pot at Berry head near Torbay. He also sought some HCR anchors for various mines with known acidic water problems. BM suggested the discussion should keep the sea cliff request separate from mines since there were potentially substantial differences. It was agreed that RK would supply the number of HCR anchors required to rig Sweet Water Pot to NW so NW could order them. BM noted that HCR anchors needed a test bed of 5 anchors to confirm they were acceptable for use with KMR resin.

**Action 6.1 RK** to supply the number of HCR anchors required for Sweet Water Pot to NW.

**Action 6.2 NW** to order sufficient HCR anchors from Bolt Products.

RK noted that he would like to test some 304 anchors in the mine rock to obtain a feel for their performance. BM asked what anchors were currently in use. RK stated that currently expansion anchors were used and removed from the cave after each trip. RK admitted that some the mines had acidic water which would require analysis to indicate its corrosion potential of 316 and HCR anchors. BM suggested testing a batch of the expansion anchors in the rock.

**7. Dealing with existing 304 stock:** NW reported that he had emailed Bolt Products of the view of various regions and received a reply indicating that the anchors would be replaced with ones made from 316. As yet he had had no indication of dates for delivery of the replacement 316 anchors. It was agreed that some 304 anchors would be kept for testing different rock types. (It was noted that the Committee had previously agreed that training of installers could be undertaken using the PECO anchors.)

**8. Future anchor requirements across regions (including maximum and minimum stock levels):** VA requested 80 anchors for setting up a rigging training facility. (Post meeting note, VA increased his request to 150 in total.) BP reported that DCA had assessed their future needs at 150 over and above the 50 already with them. RK noted the previously discussed HCR and 304 requirement, plus expansion anchors. He also requested 12 PECO anchors for training purposes. RK agreed to produce a short paper covering a proposed test set up and costs. The Committee authorised NW to seek the Treasurer's approval for a spend to cover a program of work on testing anchors by DCUC.

**Action 8.1** RK to produce a paper covering a program of testing anchor by DCUC and costs.

The Committee agreed that priority would be given to those who had ordered anchors at this meeting.

It was noted that CNCC, CSCC, Grampian SG, FoD, N Wales, Mid Wales and NAMHO would need to be informed that anchors should be becoming available. It was agreed that NAMHO would cover any mines within their organisation which were not under the remit of the Caving Council.

BM had asked that the question of designating a minimum stock be considered by the Committee. He had done so in order to allow the automatic replenishment of anchors when stocks ran low. The Committee took the view that this was not necessary given that 1000 anchors were on order.

**9. Anchor scheme admin report:** The meeting noted G Jones report, see Appendix 1.

**10. Installation of anchors in substrates other than limestone (Proposals for new work):** It was considered that this topic had been covered under item 6.

**11. Use of Anchor Puller:** It was noted that there was still one test bed in Yorkshire yet to be pulled plus an intent to test some maillons. It was agreed that if possible the puller would be handed over to DCUC in the New Year. RK noted he often came north to Droitwich and BM noted he often came south to Hereford so it should prove possible to effect the transfer. BM volunteered to coordinate with L Sykes.

**Action 11.1** BM to liaise with L Sykes with an objective of handing over the puller to DCUC in the New Year.

**12. Anchor Training Schemes (report from regions):** Numbers of trained installers were provided in Appendix 1. BM noted that no report had been received from CSCC.

RK noted he had approached CSCC to provide training for DCUC candidates but had had no response. NW suggested making direct contact with CSCC's trainers. BP reported that DCA was looking for another trainer. VA indicated he wanted to acquire a training capability within CCC and had asked if he could become the trainer. But he had not heard anything back from his request. NW advised VA to come back to him if nothing resulted from further pursuing his request. BM noted that CCC would also have to produce a range of documentation and that the CSCC documentation was a suitable model, bar the absence of Bolt Product anchors.

**13. Rope test report (Bob Mehew to report):** BM said that he wanted to amplify on one aspect of his report, see Appendix 2, being a significant learning point from pulling anchors in N Wales. The observation of one out of three expansion anchors with hangers failing at the metal head of the through bolt instead of simply pulling out had caused him to investigate the theoretical situation. Some what to his surprise, he had concluded that once the hanger had been lifted off the surface of the rock, then the location of the fulcrum had changed from the edge of the hanger to the edge of the sleeve of the anchor. This change in location meant that for the geometry of the experiment, the level of force subjected on the anchor through bolt had increased by around a factor of four. This increase in force was sufficient to switch the failure mode from simple pull out to metal failure. The testing of the anchor to EN 959 which is done in concrete, reported failure modes of above 27kN compared to 10kN load for this metal failure. But given the force on the anchor was possibly as much as 40kN, it was not surprising that the metal had failed. NW commented that the point was obvious once it had been pointed out but he had not appreciated the significance until BM had spelt it out. BM said there were two points, one is the change in failure mode as the anchor came loose and the second is that a loose hanger means the anchor is potentially much weaker. The Committee expressed the view that the point needed wider circulation. BM said he had an intent to write the experience up but he had other priorities.

NW noted the finding request and the Committee authorised the spend.

SN asked for clarification on the Y Hang work. BM said that the parameter 'drops survived' was not sufficient to clearly differentiate between different Y Hang knots. He agreed to send SN a copy of his work.

**14. Development of policies for fixed aids other than anchors:** BM stated that he had sent out the draft on 5 July. NW checked and confirmed he had not received the paper. Nor did the link mentioned in the agenda work. BM apologised for the non reception of the work. It was agreed that BM would recirculate the paper and seek comments by the end of November. BM proposed that subject to comments then he should then circulate it to the secretaries of Regional Caving Councils for discussion within RCCs. The Committee agreed to this approach.

**Action 14.1** BM to reissue the draft fixed aides policy paper

**15. Date/location for next meeting:** The Committee agreed to Sunday 13 April 2014 at Pinvin. (Post meeting note – NW proposed the meeting date be moved to 9 March which had been accepted by those present.

## 16. Any Other Business

**16.1 CSCC's anchor documentation:** BM stated that his concern related to the non availability of an up to date training document which incorporated Bolt Product anchors which used a different sized hole, plus the absence of a report on training. He felt that given the request was now outstanding for over 6 months, that prompt action should be taken by seeking agreement from Council to conduct a paper audit of their anchor scheme to ensure it did meet the BCA policy requirements and operate to them. During a discussion a question was asked as to where the 50 anchors already sent to CSCC were going to be located. RK also noted the lack of a response to his request for help. The Committee agreed to NW following up these points by phone with F Litherland in the first instance and consider the need for subsequent action.

**Action 16.1 NW** to call F Litherland to follow up on the points raised in the first instance and consider the need for subsequent action.

**16.2 Anchor placing equipment:** NW asked about the availability of drills in CCC & DCUC. VA reported that the existing drill was knackered. NW suggested that if the drill could not be sold with the money going to the local cave rescue, then he would be prepared to take it for spares. VA went on to report that N Wales were able to make use of the N Wales CRO drill whilst Mid and S Wales used personal drills.

RK reported that they now had an ex CNCC drill but their was concern over the state of the battery. NW suggested that if needed, the battery could be replaced by 7Ahr lead acid batteries.

NW also mused on how to recompense people for using their own drills for placing BCA provided anchors. A suggestion was made that an offer of paying for drill bits could be made.

The meeting closed at 2.37pm.

### Action List

4.1 RW to write up performance of Croll to sea water corrosion.

5.1 NW to seek advice from L Sykes on an appropriate description of the resin in use.

6.1 RK to supply the number of HCR anchors required for Sweet Water Pot to NW.

6.2 NW to order sufficient HCR anchors from Bolt Products.

8.1 RK to produce a paper covering a program of testing anchor by DCUC and costs.

11.1 BM to liaise with L Sykes with an objective of handing over the puller to DCUC in the New Year.

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16.1 NW to call F Litherland to follow up on the points raised in the first instance and consider the need for subsequent action.

Appendix 1 Anchor Scheme Admin Report

**Anchor Stock;**

170 316/A4 anchors have been received and have been distributed as follows;  
DCA; 50 anchors (101 - 150) together with 3 tubes of resin and 5 nozzles  
CSCC; 50 anchors (51 - 100) together with 2 tubes of resin and 4 nozzles  
CCC: 14 anchors (31 - 40, 8, 9, 10 & 11) together with 2 tubes of resin and 4 nozzles

Anchors numbered 1 to 7\* and 26 were have been posted to CNCC and installed in Yordas Gorge for testing, which it is hoped (weather depending) will be accomplished before the end of November.

\*The package was damaged in the post and two anchors were missing on receipt.

CNCC; 49 anchors ( 12 -20, 21 - 30\*, 41 - 50, 151 - 160 & 161 -170) together with 3 tubes of resin and 5 nozzles

\*anchor numbered 26 was initially posted to NW for 316 testing and then installed in Yordas Gorge.

**Accredited Anchor Installer Update;**

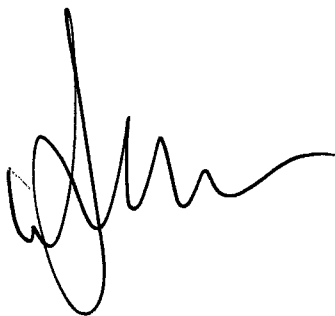
DCA: currently have 5 indate accredited installers

CCC: currently have 5 indate accredited installers

CNCC: will be revalidating 10 installers before the year end

CSCC: no information provided

DCUC: all 7 installers are now due for revalidation



5/4/14.