BCA Equipment and Techniques Committee

Meeting held at My Big Meeting Room, Pinvin on 5 April 2014 commencing at 11:05 am

Present: V Allkins (CCC) VA, Roger King (DCUC) RK, Bob Mehew (Rope Test Officer) BM, Jenny Potts (DCA, observer) JP, Stephan Natynczuk (ACI) SN, Nick Williams (Convenor) NW, S Wilson SW.

1. **Apologies for absence**: Faye Litherland (CSCC) John Duncan (SUI)

2. **Chairman's opening remarks**: NW welcomed SW who had been invited to the meeting by NW because of his work on alternative anchors.

3. **SUI membership of Committee**: NW noted that the Speleological Union of Ireland (SUI) which covered both the Republic and Northern Ireland was a member club of BCA and had adopted the BCA approach to anchors. Anchors and resin had been supplied to SUI via CNCC and the point had been raised as to whether SUI should be formally adopted onto the committee as a prelude considering whether they should be eligible for anchors under the scheme. NW took the view that they should be treated as an equivalent to a Regional Caving Council and become members and also be able to access the BCA anchor scheme, including the provision of free anchors and resin. He viewed it was likely that SUI would not need large quantities of anchors and given they represented a moderate sized group of members and that BCA members did frequently cave in Ireland, it was to the benefit of both sides. After a short discussion about the treatment of independent nations including Wales and Scotland, the committee agreed to SUI becoming a member of E&T Committee.

4. **Notice of items to be raised under Any Other Business**: NW noted that SW's work on anchors would be raised in AOB if not before.

5. **Minutes of the previous meeting:** SN noted that information on the Y hang work had not been passed to him. BM apologised and agreed to do so. Comment was made about the correct spelling of aid without an 'e'. The minutes were accepted and signed.

6. **Matters arising**:

4.1 RK to write up performance of Croll to sea water corrosion. RK noted his document had been circulate with the minutes. Reference was made to an announcement by Petzl on a Croll rope clamps, see http://www.petzl.com/en/pro/safety-information-croll-B16AAA . Action closed.

5.1 NW to seek advice from L Sykes on an appropriate description of the resin in use. NW noted that clarification had been acquired but subsequently ordering the approved KMR resin had revealed a deep drop in price (£13 to £4) which made him wonder if the product had changed. It was understood that when resin bonded anchors were developed by CNCC, Hilti had advised that they had no resin suitable for the caving conditions and a styrene based resin then manufactured by Exchem was selected. When Exchem ceased retailing the resin, it was confirmed that the KMR resin sold by Martyn Price was identical. He therefore felt it might be appropriate to consider proving an alternative resin was suitable for use.

SW noted that when he started looking at resins he had settled on Rawl resin. NW noted that CNCC had problems with Rawl R-KER Epoxy Acrylate Styrene free resin in their first test program on Bolt Product anchors on 5 Oct 2011. BM suggested that if we were to change resin, then we would need a program of work to show the proposed new resin was acceptable. VA commented that moving away from styrene based resin would mean avoiding the noxious fumes. NW noted that the Martyn Price KMR resin was not CE marked and thus there was no explicit claim of this resin being

Signed as a true record

2/11/14

manufactured under a quality assurance regime. He understood the styrene component was to enhance metal / resin bonding but noted that given the European prohibition of styrene based products, it was unlikely that we could find a CE marked source of styrene based resin.

SW responded to NW's question on his experience by explaining that he had consulted with a small company which did work on polymer metal bonded products. The advice he had received had lead him to undertake his first test on six anchors. Two anchors were cleaned using a solvent, two were grit blasted and two were grit blasted and then treated with a bonding agent. All six anchors were then set in concrete using a Rawl R-KER resin, chosen because it was readily available. The extraction forces spanned between 41.0 and 44.3kN with a mean value of 42.5kN (SD 1.2kN) with no obvious link between preparation and extraction force. He exhibited the six anchors and pointed out that the two solvent cleaned anchors showed effectively no resin remaining on the metal. The grit blasted anchors had a little resin remaining on the anchors and the grit blasted / bonding agent treated anchors showed a bit more resin stuck. None had 'large chunks' of resin stuck to them. He considered that the chemical bonding between metal and resin was probably not relevant to the failure mode, even though all six anchors failed at the resin / metal interface rather than in the concrete itself, or at the concrete / resin interface or in the metal itself.

SW went onto point out that Fischer were offering their Highbond anchor (see http://www.fischer.co.uk/Home/tabid-1429/tabid-1434.aspx/cpage-details/pcategory-1001006286/usetemplate-productdetails/) with had a polished finish and a shaft which tapered such that the shaft offered no mechanical advantage to the system. (The shaft ended in three cones which formed the load transfer part of the anchor.) He noted they claimed very high extraction strengths which suggested that a polished finish may aid the strength of a resin bonded anchor system. NW noted that there were a large number of potential variables in the strength of resin bonded anchors which would make identifying what were the defining features quite complex.

NW went onto note that whilst often the call was for stronger anchors, perhaps there was an argument for a sufficiently strong enough anchor which facilitated other characteristics, such as ease of extraction for replacement. SW said that his concern was over reliability as expressed by the size of the standard deviation. BM noted that the standard deviation from SW's results were much better than those found with other anchors.

Note added post meeting – the table beneath provides those values.

Anchor Type	*No. tested*	*mean*	*SD*
DMM Eco	*23*	*39.8*	*9.45*
Pico trial batch	*33*	*33.6*	*5.2*
Pico batch 2 Horseshoe Quarry #	*30*	*27.9*	*4.07*
Pico batch 2 Ingleton #	*30*	*34.9*	*6.22*
Bolt Products / Rawl resin	*33*	*35.2*	*4.71*
Bolt Products / KMR resin	*32*	*44.9*	*8.7*
# excluding metal failures		*kN*	*kN*

SW expressed concern over the way the standard only expressed a threshold value. NW noted this was typical of most standards and that E&T were probably at the forefront of anchor development in considering the use of statistics in meeting threshold strength values.

NW noted that S Holding had indicated some expertise in related areas and would be worth consulting. NW went onto enquire if E&T could withdraw any specification of the resin. BM noted that this would not only be contrary to the requirements of BS EN 959:2007 but also would mean

E&T had no demonstration of why the resin was adequate to meet the standard. BM suggested that a trail should be set up with a test bed of some 30 anchors using Rawl resin under conditions reflective of caving use. VA suggested the quarry at Penwyllt could be used to conduct the tests. SW suggested that the Fischer resin should also be investigated. BM agreed to draft a program of work and circulate amongst members for comment. RK indicated that DCUC should have completed their work with the puller before the summer. NW concluded that it was reasonable to accept that the existing Martyn Price KMR resin was acceptable.

Action 6.1 BM to draft a proposal for a program of work to demonstrate Rawl resin was suitable for use in caves with BP anchors and circulate to members and others for comment.

6.1 RK to supply the number of HCR anchors required for Sweet Water Pot to NW. The number had been supplied to NW. Action closed.

6.2 NW to order sufficient HCR anchors from Bolt Products. NW had placed an order but no indication had been received from Bolt products on delivery times. Action closed.

8.1 RK to produce a paper covering a program of testing anchor by DCUC and costs. The program was now underway. RK enquired about stocks of resin. NW noted that BCA now had an account with Martyn Price and he held a stock of 10 tubes with him. RK requested some tubes which were handed over. NW asked if more tubes should be purchased given the use by date was October 2014. Following discussion of potential needs, NW said he did have a need for resin which need not be in date so he was prepared to acquire the out of date stock if it had not been used. It was agreed that NW would order a further batch of 10 tubes.

Action 6.2 NW to order 10 tubes of KMR resin.

11.1 BM to liaise with L Sykes with an objective of handing over the puller to DCUC in the New Year. BM reported that the puller had been handed over at Xmas. Action closed.

14.1 BM to reissue the draft fixed aids policy paper. BM reported that this had been done. Action closed.

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. NW reported that he had spoken with F Litherland and subsequently had received some material from her. Action closed.

7. Regional anchor installation procedures: BM stated that he had asked for the topic to be raised because he was concerned to ensure all regions had the relevant paperwork in place before the program of installing anchors lifted off.

NW noted that he now had a copy of CSCC's documentation from F Litherland. VA reported that CCC would be using the IPTD installation procedures as used by CNCC and DCA. RK indicated that he was interested in using CSCC's installation procedures as it was extremely onerous for cavers in Devon to attend training sessions in the north. NW agreed to pass a copy of the current CSCC documentation onto RK. It was noted that SUI's position was not clear. NW said that he had been advised that other persons within CSCC were developing record documentation. In response to a query from JP, NW indicated that anchor records should be passed to him from now on.

Action 7.1 NW to pass a copy of the current CSCC installation procedures onto RK.

The meeting adjourned for lunch at 12:55 and restarted at 13:30.

8. **Adoption of 304 anchors**: BM referenced briefly the information in the attachment which had been circulated, see Appendix 1. He went onto admit that he had forgotten E&T's position on adopting anchors, see Appendix 2 which required a batch test of 32 anchors. BM noted that the adoption of 316 anchors had been based on 5 anchors (see work done by CNCC TG on 23 November 2013 in Appendix 3). In respect of 304 anchors, only one anchor had been tested in true axial mode (see work done by CNCC TG on 14 September 2013 re anchor BCA 67). So more needed to be tested. NW asked about the early Bolt Product batch. BM stated that the KMR Bolt Product batch tested (see Test 5 in report by CNCC TG report "Anchor Tests 2011" dated 15 November 2011) had been conducted on anchors supplied prior to the arrival of the '304' batch. He had not been able to determine whether these anchors had been made from 304 or 316 and thus had discounted them as being specific evidence for either type.

BM was of the opinion that the batch size requirement required changing; else BCA would always require to test 32 anchors. The value of 32 had been adopted because that would normally be a large enough sample to demonstrate normal distribution and hence validate the use of the statistical formula to calculate the 5% fractile value. But if there was already data showing normal distribution, then the batch size could be reduce to say 5. BM felt that given Test 5 data showed a normal distribution for 316 Bolt Product anchors with KMR resin, this was sufficient evidence to permit using a reduced sample size of 5 anchors for 304 and 316 Bolt Product anchors with KMR resin. BM noted that he had tested the data for all Tests reported in the CNCC TG report "Anchor Tests 2011" (excluding the 4 metal failure Peco results) plus the DMM Eco anchor data and found all bar the Bolt Product / Rawl resin Test 4 were normally distributed.

BM therefore proposed that the anchor adoption policy should be varied in that the last part, namely 'a batch test of a minimum of 32 anchors' be changed to 'a batch test of a minimum of 5 anchors provided there is supplementary information showing the distribution of results follows a normal distribution, else the minimum size of the batch test should be 32'.

SN commented that he felt demanding 32 in all cases was over the top. RK noted that the proposal seemed consistent. NW noted that a statistician had been consulted to confirm the process and that he agreed with the proposal. The meeting agreed to the anchor adoption criteria becoming

> *The standard for acceptance of an anchor type on the basis of an axial load is based on the 15kN axial load value as cited in Section 4.3.1 of the Mountaineering Equipment – Rock Anchors – Safety requirements and test methods BS EN 959 : 2007, as computed as the 5% fractile value as specified in Section 4.2 (3) of the Euro Code Basis of Structural Design Standard BS EN 1990 : 2002 from the results of a batch test of a minimum of 5 anchors provided there is supplementary information showing the distribution of results follows a normal distribution, else the minimum size of the batch test should be 32.*

NW commented that in respect of Chloride Stress Corrosion Cracking (ClSCC), given the expert view was that the minimum temperature criterion was way above that seen in caves, he felt that the proposed monitoring was excessive. In a short discussion, BM noted that there was no information on stress levels so that criterion could not be used. JP raised the point of salt run off from roads. NW commented that this was why Priddy Green Sink was a significant cave since not only was it by the road side but also took drainage from a nearby farm yard used for milking cows. It was accepted that the situation in mines would be mine specific. NW proposed that rather than using the criterion included in the ClSCC paper discussed at the last meeting on 10 November 2013, it should be for E&T to decide which were appropriate locations. BM asked if it were more appropriate for Regions to

decide on locations but the general view was not. The meeting then agreed to adopt the Bolt Products 304 anchor ref GP8-100-16A2 for locations approved by the E&T Committee subject to the test results from a batch of 5 anchors (which would include the single result so far obtained) meeting the 5% fractile criterion.

9. State of training and trainers for installation of anchors: RK said that he now had some interested cavers but was still seeking assistance from CSCC. JP reported that DCA's position remained as was reported at the last meeting on 10 November 2013. VA reported that CCC now had 5 trained installers plus himself as a trained trainer. After a short discussion, the Committee agreed that the key parts of the IPTD and CSCC installation documents were sufficiently similar that VA could act as a trainer for both anchor documentations schemes. RK noted that DCUC did have access to Chudleigh Quarry for testing. In response to a query, NW stated that whilst the travel expenses of trainees were to be covered by their Regional Caving Councils, the travel expenses of trainers would be covered by E&T.

10. SUI and anchors: In response to a query about which installation procedures SUI would adopt, NW reported that he had no information. He would contact SUI to make enquiries.

Action 10.1 NW to contact SUI to sort out which anchor installation procedures they were adopting.

11. Regional anchor installation programs: RK reported that he was progressing with the testing program and had received ten 316 anchors from NW at the meeting. VA reported no anchors had so far been placed.

12. Fixed Aids Policy: NW reported that he had had no feedback from any Regional Caving Council. VA noted he had had one comment on the policy which he was forwarding to BM. JP noted DCA had had a policy since 1998 and were considering revising it.

JP asked whether there was a list of fixed aids used in regions. BM reported that he had trawled his information and had identified the following:

horizontal pole across pot hole
chain
wire running belay
rope hand line
scaling pole
sky hook (endless wire loop)
ladder
anchors

JP noted that DCA had adopted a cable and ring device for use as a top rope belay point; the 10cm ring being free to rotate so it did not see wear at any specific point. In response to query about use of rope for traverses, reference was made to a wire rope used in Kingsdale Master Cave traverse which was routinely changed out and taken away for expert inspection. JP enquired if liability for design and installation was specifically dealt with in the insurance scheme. NW stated that the topic was not specifically mentioned.

BM expressed his disappointment over the lack of responses and asked if it was worth continuing to pursue the topic. SN and RK supported continuing with the work. The Committee agreed that the draft policy should be forwarded to Council for their consideration at the October meeting.

JP asked if there was a potential conflict in caves where fixed aids were placed by different bodies. She was thinking of anchors and other fixed aids as used in Peak Cavern as an example. No one could why such might arise.

13. Ladders and Rope guidance notes: BM briefly covered his document, see Appendix 4 and highlighted the two recommendations:

a) produces a list of kit used as fixed aids from which the Committee can identify the most pressing case for development of a standard; and
b) authorises the launch of a consultation on "Dos and Dont's" to produce some advice in the mean time.

NW observed that a consultation exercise would be better conducted by involving interested parties rather than setting up an open discussion on ukCaving forum. He observed that Appendix 4 in the discussion document on British Standards concerning ladders had missed the BS EN 131 series. BM asked that given anchors and ropes were effectively dealt with by the relevant BS EN standards, should the next item be ladders? NW noted that E&T would have to develop its own document for ladders given the state and diversity of the standards on the topic.

NW felt that a quick and dirty approach was more likely to produce something of value rather than follow a process of achieving engineering excellence. BM stated that whilst he acknowledged that there were few if any other useful standards which could be easily adopted to cover other types of fixed aids, he was not persuaded by such an approach.

It was agreed that the list of types of fixed aids of possible greatest interest for a Dos and Don'ts list were:

Anchors
Ropes
Ladder
Chain
Wire cable

It was suggested that another item should be added to the list which related to "Don't use / do this". The Committee agreed to contribute Dos and Don'ts against the list. NW agreed to invite external comment.

Action 13.1 All Committee members to provide contributions of Dos and Don'ts for the items listed (Anchors, Ropes, Ladder, Chain, Wire cable).

Action 13.2 NW to issue an invite to cavers for contributions to the process of producing a Dos and Don'ts list.

14. BCA supply of anchor placing equipment: BM sought clarification of what items was it legitimate to claim for. NW replied that he wished to keep advice at a high level so claims would not be turned down for a technicality. He noted that he had not so far refused a claim.

15. Rope Test report: BM apologised for not issuing a report but he had been busy with other matters and there was little to report. He was on top of testing submitted samples. Work on the static test rig had not progressed.

SW enquired about jet washing of rope. BM noted the short discussion on ukCaving forum (see http://ukcaving.com/board/index.php?topic=16406.0) and that he had been having discussion with another caver about the physics of the set up. He noted that with the typical internal pressures being quoted for domestic pressure washers of 10MPa (100Bar), calculations had suggested fairly

low impact damage. NW noted that the definition of domestic pressure washers in BS EN 60335-2-79:2012 covered pressures up to 35MPa (350Bar) which certainly hurt.

16. Any other business

16.1 Anchor Development: SW indicated that he had developed a theory as to why the Bolt Product anchors were damaging the rock. If one looked at the axial profile of them, then one could see a straight portion of the shaft which gave way to the twisted part at around a centimetre down the shaft. He suggested that with this expansion of the cross section so close to the surface, then the stress being applied in extracting anchor was being fed back out into the rock in the near surface zone. He noted the Fischer Highbond anchor FHB II-A L had its expansion zone close to the bottom of the shaft, as did the DMM Eco anchor. He had moved on from his initial design to produce a second version where the cross sectional expansion was larger but also located towards the bottom of the shaft. He noted a previous comment about over strength and was pondering about going for a performance of around 30kN for the 5% fractile value. He sought E&T comments on his anchor development work.

NW noted that BCA had on order some 2000 anchors so there was no pressing need for an alternative. BM pointed out that so far we had only received around 800 316 anchors. SW asked if he could show a batch of 32 anchors meet BCA's requirements then could they be approved for use. It was noted that whilst E&T could adopt anchors, it could not tell Regions which to use.

VA asked if SW's anchors suffered cold working. SW explained that his source material was hot rolled 316 sheet which was then laser cut to shape so the problem did not arise. Furthermore ~~by using hot rolled material he had a higher strength metal.~~ hot rolled plate is a more suitable material.

BM asked what support did SW need for his work. SW identified that he was reliant on borrowing a load cell. NW offered to loan his own load cell subject to being able to retrieve it if his business required it. SW accepted the offer.

NW concluded that he felt E&T should support the work SW was undertaking, recognising the advantages of having an alternative supplier.

16.2 Date/location for next meeting: The Committee agreed to Saturday 18 October. NW asked if the committee would accept moving the location of the meeting slightly further north. RK noted that he had the longest distance to drive from the south but was able to stop over night in Worcester so had no objection.

The meeting closed at 1615.

Action List

Action 6.1 BM to draft a proposal for a program of work to demonstrate Rawl resin was suitable for use in caves with BP anchors and circulate to members and others for comment.

Action 6.2 NW to order 10 tubes of KMR resin.

Action 7.1 NW to pass a copy of the current CSCC anchor documentation onto RK.

Action 10.1 NW to contact SUI to sort out which anchor installation procedures they were adopting.

Action 13.1 All Committee members to provide contributions of dos and donts for the items listed (Anchors, Ropes, Ladder, Chain, Wire cable).

Action 13.2 NW to issue an invite to cavers for contributions to the process of producing a Dos and Don'ts list.

Appendix 1 Adoption of 304 anchors

It is now clear that some 304 Bolt Product anchors were placed in caves before the difference in steel was recognised. Because of the nature of at least one cave, it is considered prudent to not replace them as little space is left for replacement anchors. Following some discussion on a suitable monitoring program, it is proposed that

That BCA E&T Committee adopt the Bolt Products 304 anchor ref GP8-100-16A2 subject to a pre assessment on potential chloride sources linked into the criteria of:

a) The cave is not near significant potential sources such as engineering works, mining or estuary locations, or

b) The cave is not next to the sea.

and that a batch of anchors is located in the cave for monitoring by dye penetrant testing on a periodic basis.

The pre assessment criteria are those cited in the paper on Chloride Stress Corrosion Cracking (ClSCC). Recent work has taken place to check on a suitable method for monitoring for ClSCC. Dye penetrant tests on a batch of 304 anchors indicate that no cracks are present. The proposed monitoring scheme is thus simply placing a batch of say 3 or 4 anchors out of the way somewhere within the cave and removing them every few years to undertake a dye penetrant test to show no cracks have developed. The dye penetrant test is non destructive so the batch can be replaced for continued monitoring. Dye penetrant testing is an acknowledged method for testing for ClSCC in the HSE paper on the topic (see http://www.hse.gov.uk/research/rrpdf/rr902.pdf).

Appendix 2 Anchor adoption policy

Taken from Minutes of E&T Committee 17 March 2012.

The standard for acceptance of an anchor type on the basis of an axial load is based on the 15kN axial load value as cited in Section 4.3.1 of the Mountaineering Equipment – Rock Anchors – Safety requirements and test methods BS EN 959 : 2007, as computed as the 5% fractile value as specified in Section 4.2 (3) of the Euro Code Basis of Structural Design Standard BS EN 1990 : 2002 from the results of a batch test of a minimum of 32 anchors.

Appendix 3 CNCC TG work

The Equipment & Techniques Committee

Destruction Test on Bolt Products 316 stainless Steel Anchors

Test date: 23 November 2013

Location

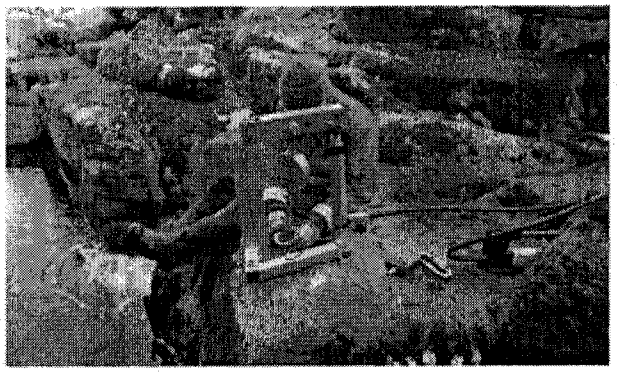
Yordas Gully NGR. SD 7044279170

Introduction

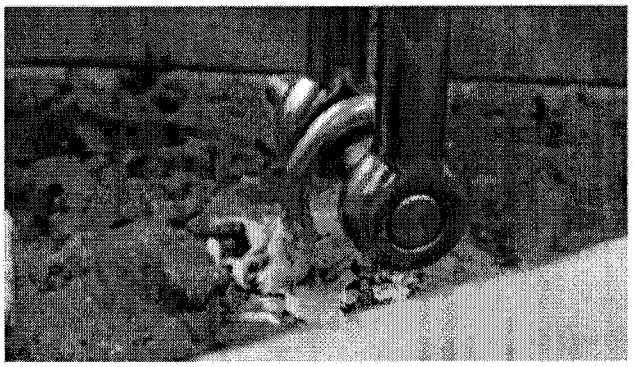
This test report is for the Bolt Products anchors manufactured from 316 stainless steel. Five anchors were installed as requested by British Caving Association Equipment & Techniques Committee. The anchors were installed using KMR-RES (Resifix 3+) chemical anchor mortar.

Method

The Bolt Products anchors were installed on 19 October 2013. During the installation the hole was drilled vertically into a block of limestone at the side of the river bed close to the top waterfall. The anchors were installed to the IPTD version 5 dated 13 December 2011.



Test results



BCA 08
15kN head of the anchor lifted from the substrate in the direction of the load.
24kN elongation of the attachment eye.
32kN the anchor started to twist out of the resin in a clockwise direction.
34kN maximum load applied.
30kN was required to remove the anchor from the placement.

BCA 06

15kN head of the anchor lifted from the substrate in the direction of the load.
24kN elongation of the attachment eye.
31kN the anchor started to twist out of the resin in a clockwise direction with spalling of the substrate.
33kN maximum load applied.
19kN was required to remove the anchor from the placement.

BCA 07

15kN head of the anchor lifted from the substrate in the direction of the load.
24kN elongation of the attachment eye.
41kN the anchor started to twist out of the resin in a clockwise direction.
43kN maximum load applied.
35kN was required to remove the anchor from the placement.

BCA 02

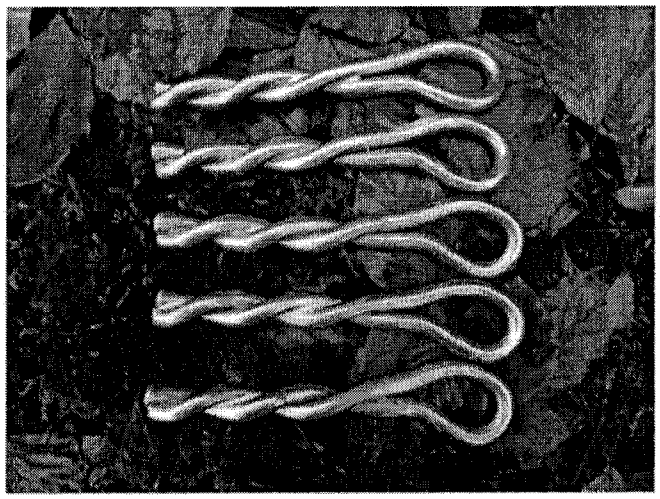
15kN head of the anchor lifted from the substrate in the direction of the load.
24kN elongation of the attachment eye.
37kN the anchor started to twist out of the resin in a clockwise direction.
40kN maximum load applied.
25kN was required to remove the anchor from the placement.

BCA 26

15kN head of the anchor lifted from the substrate in the direction of the load.
24kN elongation of the attachment eye.
31kN the anchor started to twist out of the resin in a clockwise direction.
35kN maximum load applied.
17kN was still required to remove the anchor with 60mm of anchor pulled from the substrate.

Additional information
This test was requested by BCA Equipment & Techniques Committee to confirm the suitability of the KMR-RES resin and the 316 stainless steel anchors.

While testing the anchors; prior to visual egress and the anchor twisting out of the resin there was a 'crack' sound, we presumed that this was the resin to anchor bond fracturing as there were no other visual observations at the site of the anchor placement to account for the sound.



Conclusions
All the anchors twisted out of the resin in a clockwise direction, the range was 31-41kN. Elongation of the attachment eye was initiated at 24kN which was consistent across the test bed.

All the placements required a sustained force post peak load force in the range 17-35kN to fully extract the anchor from the placement; interestingly BCA 26 was measured at 60mm egress from the placement and still requiring 17kN to fully extract it from the placement.

From this relatively small test sample of BP 316 100mm anchors it is evident that the mode of failure is consistent with that of BP 304 100mm anchors. It is also evident that the resin to anchor bond strength is also consistent with the resin bond strength of BP 304 100mm anchors.

Operatives:- L. Sykes (CNCC), G. Jones (CNCC)
Report compiled by L. Sykes
Photographs G. Jones

anchor no	Force kN				
	lift off	eye elongation	start twist	**max force**	removal
02	15	24	37	40	25
06	15	24	31	33	19
07	15	24	41	43	35
08	15	24	32	34	30
26	15	24	31	35	17
mean	15	24	34.4	37	25.2
SD	0	0	4.4	4.3	7.5
5% fractile				23.9	
using 3.04 based on Fischer					
anchor data taken from CNCC TG work 23 Nov 2013					

Appendix 4 Discussion Document on Advice for Inspecting Fixed Aids

In November 2013 Nick circulated an email containing a brief list of inspection points, see Appendix 1. I ducked commenting on the list at the time to focus on the draft policy but promised to provide comment. The big problem I have with this list is that it sets no initial bench mark for the item of kit. So take for example Nylon / Textile fixed aids. In setting up the fixed hand line experiment in 2012, I drafted guidance on inspection of the hand lines which I attach in Appendix 2. But underlying this guidance was the knowledge that the rope supplied was 11mm and met BS EN 1891:1998 for low stretch kernmantel ropes. Clearly if for example the rope had been say 8mm accessory cord to BS EN 564:2006, then a more strict approach would need to have been adopted. (If only because where as a new 1891 rope will survived at least 5 FF1.0 drops of a 100kg mass, 8mm 564 cord may only achieve 1 when new - I don't recall having tested 8mm but some 9mm Type B rope will only survive 4 such drops.) I would therefore recommend against producing guidance on inspection of a specific item without having set a standard for the item to be installed.

We could adopt some of the British Standards produced for mountaineering equipment for caving kit. I append an initial list in Appendix 3. However some other pieces of kit would not be so simple as for example ladders. A trawl of British Standards came up with the list in Appendix 4. I have not tried to investigate the requirements of the standards listed in the Appendix to draw out some underlying principles as before I even consider whether to volunteer to do so, I would like the committee to discuss whether cavers would even listen to such advice. My experience suggests to me that cavers will just press into use whatever ladder is available without thought as to its suitability. I suggest a similar case could be argued for many other items of kit. Which brings into question the value of such work.

I was going to suggest we could make a start at looking into alternative anchors. But it occurs to me that other possible items of kit might be of more pressing concern. So I would suggest that producing a list of the different types of kit used as fixed aids may be the best first step, followed by an assessment of which has the most pressing need for development of a standard and then advice on inspection and also any testing and maintenance requirements.

Some considerable while ago I recall a suggestion being made of producing a list of dos and don'ts for fixed aids as an alternative approach. A classic example would be "Don't have different metals in contact" (so as to avoid electrolytic corrosion). A more complex example would be only use stainless steel, but I can see arguments arising that a sufficient mass of mild steel would be more than adequate to cope with corrosion over an extended (say 10 or 20 year) period of time. No doubt members could come up with a range of suggestions. There might be value in launching a thread on ukCaving forum for contributions for a list of dos and dont's and then sifting them.

I therefore recommend that the committee:

c) produces a list of kit used as fixed aids from which the Committee can identify the most pressing case for development of a standard; and
d) authorises the launch of a consultation on "Dos and Dont's" to produce some advice in the mean time.

Appendix 1 – Brief List of Inspection Points

All metal fixed aids
- No gross corrosion
- No aluminium in contact with other metals in any load bearing situation
- Fasteners/bolts tight

Fixed Ladders
- Sections securely bolted together
- Fastened so as to prevent them coming away from the wall
- Supported down length to prevent excessive flexing
- No loose rungs
- No electron ladders
- Separate belay point for lifelining to be available

Nylon/textile fixed aids
- No textiles in contact with metal except stainless steel or aluminium

Bolts/anchors
- Hangar plate firmly attached and held against rock (not loose)
- Any threads in good condition
- Anchor firm (no rotation or wobble)
- No sign of cracks in rock in near vicinity to anchor

Appendix 2 – Guidance on Inspecting Hand Lines Note – this value was set for an 11mm rope.

Pre Requisite

Can one see the individual strands within the sheath so as to be able to make a judgement about how many have parted (i.e. how furry it is) and thus show wear. So a rope must be cleaned before inspection if individual strands within the sheath cannot be seen.

Inspection

Visual – any exposed core; general wear to sheath resulting in more than quarter of surface yarns being cut within an 1cm square area; damage such as a nick or break covering more than one fleck in the sheath; gross elliptical (diameter's at right angles exceed 5% difference c.f. for 10mm rope, outside of 9.75mm and 10.25mm as measured at right angles to each other); glazing penetrating into sheath depth over more than few cm length; marks of unknown origin covering more than one fleck of the sheath; rust marks covering more than 5 sq cms; sheath bulging over area equivalent to more than two flecks.

Tactile – lumpiness in the rope (gross diameter's at right angles exceed 5% difference or a sharp change at a specific location).

Rolling loop – noticeable deviation from the natural loop produced by making a coil in the rope which is as small as can easily be created given rope stiffness.

Knots – remain in reasonable shape and show no sign of having been excessively tightened (viz bulging loop within knot or profile of the first bend on the active rope within the knot is less than an estimated 7mm [See Note] thick, nor no obvious distortion of rope along the length of the loop)

Appendix 3 – Possible Mountaineering Equipment Standards of use in Caving

BS EN 12276:2013. Mountaineering equipment. Frictional anchors. Safety requirements and test methods
BS EN 567:2013. Mountaineering equipment. Rope clamps. Safety requirements and test methods
BS EN 12275:2013. Mountaineering equipment. Connectors. Safety requirements and test methods
BS EN 892:2012. Mountaineering equipment. Dynamic mountaineering ropes. Safety requirements and test methods
BS EN 12492:2012. Mountaineering equipment. Helmets for mountaineers. Safety requirements and test methods
BS EN 15151-1:2012. Mountaineering equipment. Braking devices Braking devices with manually assisted locking, safety requirements and test methods
BS EN 15151-2:2012. Mountaineering equipment. Braking devices Manual braking devices, safety requirements and test methods
BS EN 12278:2007. Mountaineering equipment. Pulleys. Safety requirements and test methods
BS EN 959:2007. Mountaineering equipment. Rock anchors. Safety requirements and test methods
BS EN 12277:2007. Mountaineering equipment. Harnesses. Safety requirements and test methods
BS EN 564:2006. Mountaineering equipment. Accessory cord. Safety requirements and test methods
BS EN 565:2006. Mountaineering equipment. Tape. Safety requirements and test methods
BS EN 566:2006. Mountaineering equipment. Slings. Safety requirements and test methods
BS 3104:1970. Specification for polyamide (nylon) mountaineering ropes
ASTM F1774 - 99(2005). Standard Specification for Climbing and Mountaineering Carabiners
BS 7323:1990. Specification for sit harnesses for rock climbing
BS EN 1891:1998. Personal protective equipment for the prevention of falls from a height. Low stretch kernmantel ropes

This list is not exhaustive nor have I checked each included standard for its appropriateness. Some items included may on further consideration be inappropriate for caving. I accept that many of the items would not be considered to be within the definition of a fixed aid.

Appendix 4 – List of some British Standards covering ladders

BS EN 1147:2010. Portable ladders for fire service use
BS 4211:2005+A1:2008. Specification for permanently fixed ladders
BS EN 14396:2004. Fixed ladders for manholes
BS EN 13101:2002. Steps for underground man entry chambers. Requirements, marking, testing and evaluation of conformity
BS 2037:1994. Specification for portable aluminium ladders, steps, trestles and lightweight stagings
BS EN 12951:2004. Prefabricated accessories for roofing. Permanently fixed roof ladders. Product specification and test methods
BS EN 12346:1999. Gymnastic equipment. Wall bars, lattice ladders and climbing frames. Safety requirements and test methods
BS 6037-2:2004. Code of practice for the planning, design, installation and use of permanently installed access equipment Travelling ladders and gantries
BS EN ISO 14122-4:2004+A1:2010. Safety of machinery. Permanent means of access to machinery Fixed ladders
BS EN 13451-2:2001. Swimming pool equipment Additional specific safety requirements and test methods for ladders, stepladders and handle bends