

Meeting opened 19:05

Location: Zoom

Present

Mark Sims (MS; convener)
Scott Bradly (SB; DCA)
Bob Mehew (BM; rope test officer)
Stephan Natynczuk (SN; ACI)
Richard Vooght (RV, DCUC)

Apologies

Andrew Atkinson (AA; CSCC)

1. CNCC rep

MS noted that the CNCC had proposed an rep. for the meeting the previous day, which would fill the gap left when Simon Wilson stepped down a couple of years ago.

2. Anchors

Background: MS had established it was now feasible to purchase IC anchors directly from Lima Engineering for a cost of ca. £6 per anchor for a batch of 650, which would provide access to the anchor for all regions. Currently only the CNCC have a stock of IC anchors.

SB noted that the DCA currently have a preference for BP anchors due partially to their formal accreditation and would not want to change anchors at this time. MS reiterated that a purchase of IC anchors would not be with a view to necessarily removing BP anchors from the scheme.

BM highlighted that an issue with IC anchors previously had been the labour-intensive nature of the finishing process to obtain the internal radius.

MS indicated that his understanding was that the price quoted included this finishing but would check.

SN pointed out that it would be worthwhile checking whether the cost of steel would be expected to rise significantly post-Christmas (Brexit).

All agreed in principle that purchase of a batch of IC anchors would be a good idea, with the caveats above (N.B. AA had also indicated support for this in writing prior to the meeting).

Action: MS to contact Lima Engineering to confirm cost included finishing process and to ask about cost of steel with view to making proposal of purchase to BCA Council.

3. Resins

Background: MS had highlighted that the CNCC had adopted an epoxy resin (Fischer Injection mortar FIS EM Plus 390 S) instead of the vinyl ester resin (Fischer FIS V 360 S) used prior. This was due to reports of loose anchors in the region that had been attributed to resin shrinkage. The epoxy resin compares favourably to the vinyl ester resin in almost all regards (see Appendix 1 for additional details):

- *The epoxy resin is stronger than the vinyl ester resin.*
- *The shrinkage of the epoxy resin is less than the vinyl ester resin.*
- *The epoxy resin is approved by Fischer for use in water-filled holes (unlike the vinyl ester resin).*

The CNCC had previously conducted a test of three IC anchors placed with the epoxy resin (see Appendix 2) to support their work. BM had queried whether this was sufficient for potential adoption by the E&T group, highlighting the paragraph below from the 05/04/14 E&T committee minutes:

“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.”

*MS noted that we would not be adopting a new anchor, but a new resin type. BM calculated that the peak forces determined from the CNCC tests (40.00 kN, 39.17 kN, 39.01 kN) give a mean value of 39.39 kN, a Standard Deviation of 0.53 kN, and a 5% fractile value of 36.57 kN ($39.39 - 0.53 * 5.311$ (k value)). Testing a further two anchors would be very unlikely to give a major change in the mean/standard deviation, and the k value would drop to 3.401.*

RV raised the potential issue of different rock types in Devon than the tests were carried out in. BM noted that substantial contribution to bond is mechanical. Agreed that it may be worth testing small number in different rock types. RV currently has no access to a test rig and BM currently has no access to load cell so testing would not be a quick process.

MS proposed that approval of the epoxy resin could be alongside the vinyl ester resin for now.

After discussion, all present were in favour of adopting.

Action: MS to draft/collate relevant documentation and data for approval.

Installers

Background: previous email discussion had highlighted that approval of installer trainers by the E&T committee seemed unnecessary, because the individuals were often unknown to most of the E&T committee. The question was asked as to whether it would be more appropriate for regional councils to approve installer trainers, rather than the E&T committee. The relevant section of the current anchor policy reads:

“Regional Councils shall take responsibility for the training of persons who will be authorized to place designated anchors on their behalf. The delivery of training and assessment will be undertaken by individuals already authorized by the E&T committee”

An alternative modified section suggested after email discussion within the E&T committee reads (modifications in bold):

*"Regional Councils shall take responsibility for the training of persons who will be authorized to place designated anchors on their behalf. The delivery of training and assessment will be undertaken by individuals **authorized by the appropriate Regional Council, who are already authorised to place anchors under the scheme. The Regional Council will pay particular attention to the ability of the proposed trainer to not only instruct candidates to install anchors but also to assess the candidates' competence for judging the location of new anchors and their SRT ability to safely install anchors on location.**"*

BM/SN/RV all raised the benefit of moderation in general, which was agreed by all, but a consensus was reached that moderation in the form of approval by the E&T group rather than a regional council would be very unlikely to prevent any issues arising.

All present were happy with modification of the anchor policy such that installer trainers would be approved by a regional council.

BM asked whether the revised version is readily understandable? MS suggested running the proposed change in wording via the exec. as a check.

Action: MS to send proposed changes to the BCA executive and get back to the E&T committee with any feedback.

AOB

HCR anchors

Background: it had become apparent that the high corrosion resistance anchors were no longer sold by Bolt Products, meaning the BCA no longer has a source of anchors for sites for use in potentially corrosive environments. RV reported that DCUC are not currently desperate for them, but that it would be useful to have a source of them for when they are needed.

MS stated that the only commercially available anchor he was aware of that might fulfil the requirements was the Fixe Hely anchor, but that the datasheet seemed unavailable from the Fixe website so the exact grade of steel could not be determined.

BM suggested asking Lima Engineering to see if they could source the same steel (1.4462 duplex) as used in the previously available Bolt Products anchors. That may enable production of corrosion resistant IC anchors, providing an already approved anchor made from a material that had already been accepted under the scheme.

BM also suggested that the BMC could be contacted to see what anchors they use for sites with potentially high levels of corrosion.

Action: MS to contact Lima Engineering to ask about anchor production in corrosion-resistant steel.

DCA drill

Background: SB had indicated that the DCA drill (originally purchased by the BCA) was coming to the end of its life and asked about a replacement, suggesting a Hilti TE 6-A36 plus batteries and chargers.

SB said cost would be about £850 (excl. VAT) for the suggested replacement.

All agreed that it would be a sensible purchase

SB raised the merits of service contracts (starting from ca. £15 pcm for 18-24 months) but stated DCA were in favour of purchasing. All agreed that purchase is probably the simplest option currently.

BM asked if drills should be purchased for all regions? MS said that as far as he was aware, CNCC installers tended to use their own drills so it may be unnecessary to purchase a further drill (although personally owned drills should not be relied upon or assumed). BM proposed offering to all regions.

Action: MS to remind all regional E&T reps that requests can be made for hardware such as drills to be purchased.

Loose anchors

BM queried the whereabouts of loose anchors mentioned during the discussion of resins.

MS said he had access to some info via the CNCC records and could probably circulate info to the E&T reps for interest.

BM raised previous discussions of what constitutes a loose anchor, and noted a conclusion was never reached. Should we amend advice?

MS suggested circulating possibilities to ask for views.

Action: MS to email E&T committee with possible revised loose anchor advice for feedback.

Record keeping

BM raised questions about current status of record keeping and whether duplicates should exist.

MS mentioned that CNCC records are on a shared online spreadsheet.

SB/RV said their respective regions' records were also online.

BM asked if the E&T convener should have access to anchor records and whether the CSCC and CCC records are online?

Action: MS to check which records are online and whether any regions still have records in hard copy.

Meeting closed 20:20

Appendix 1: Resin comparison

Information relating to Fischer FIS V 360 S resin (polyacrylate/vinyl ester) and Fischer FIS EM Plus 390 S resin (epoxy)

Table 1 Information taken from Fischer website (21/02/19)^{a,b}

Injection mortar FIS V 360 S	Injection mortar FIS EM Plus 390 S
The versatile injection mortar for anchorings in masonry and cracked concrete	The powerful injection mortar for rebar connections and cracked concrete
<p>The fischer high-performance mortar FIS V is the universal all-rounder for the highest requirements. The styrene-free vinyl ester hybrid mortar with its numerous fixing elements is approved for fixations in cracked and non-cracked concrete as well as in masonry. However, the injection mortar is also used with the approved system components for rebar connections, the fischer remedial wall tie VBS 8, the fischer weather facing wall tie FWS II, and the stand-off installation system Thermax. The variant FIS VS LOW SPEED enables an extended processing time at higher processing temperatures or a greater drill hole depth. The shorter hardening time of the variant FIS VW HIGH SPEED enables swift work progress even at low temperatures.</p> <p><u>Top Features:</u></p> <ul style="list-style-type: none"> - First injection mortar system worldwide with approval for all relevant building materials. - Maximum load absorption for much greater security. - Extensive range of system accessories. - ETA approval for reinforcement connection. - Expansion-free fixing for small spacings and edge distances. 	<p>The fischer injection mortar FIS EM Plus is a high-quality epoxy mortar for top load-bearing capacity in cracked and non-cracked concrete and for seismic applications in performance categories C1 and C2. It is suitable for fixations of shear connectors for concrete layers, tall shelvings, and heavy steel constructions both inside and outside. The injection mortar is processed with the approved system components fischer threaded rod FIS A with variable anchorage depths and fischer internal threaded anchor RG M I as well as with reinforcement bars. The epoxy mortar is ideally suited for rebar connections that are installed with a large drill hole diameter and a high anchorage depth. It can also be used for diamond-drilled and water-filled drill holes.</p> <p><u>Top Features:</u></p> <ul style="list-style-type: none"> - FIS EM Plus with optimised formulation for improved load values in cracked and non-cracked concrete. - For rebar connections from diameter 8 to 40 mm. - Can be used with threaded rod FIS A or internal threaded anchor RG M I for temporary and removable fixing points. - FIS EM Plus is to be processed at temperatures down to -5°C. - More safety due to approvals for diamond drilled and water-filled drill holes as well as seismic applications of performance categories C1, C2.

^a <https://www.fischer.co.uk/en-gb/products/chemical-fixings/injection-mortar/injection-mortar-fis-v-fis-vs-low-speed-fis-vw-high-speed>

^b <https://www.fischer.co.uk/en-gb/products/chemical-fixings/injection-mortar/injection-mortar-fis-em-plus>

Table 2 Permissible loads of a single anchor in cracked normal with a thickness of 110 mm or more. Anchor used is threaded stainless steel. Data from Fischer Load Tables.^{a, b}

Rod size	Depth / mm	Permissible tensile load / kN		Difference	
		FIS V	FIS EM plus	Absolute / kN	Percentage
M10	60	5.4	6.7	+1.3	+12%
M12	70	7.5	10.0	+2.5	+33%

^a https://ugfds005.blob.core.windows.net/media/Load%20Tables/Load%20Tables%20fischer/LT_01_FIS-V_F_%23SEN_%23AIP_%23V2.pdf

^b https://ugfds005.blob.core.windows.net/media/Load%20Tables/Load%20Tables%20fischer/LT_01_FISEM1_F_%23SEN_%23AIP_%23V4.pdf

Table 3 Permissible loads of a single anchor in non-cracked normal concrete with a thickness of 110 mm or more. Anchor used is threaded stainless steel. Data from Fischer Load Tables.

Rod size	Depth / mm	Permissible tensile load / kN		Difference	
		FIS V	FIS EM plus	Absolute / kN	Percentage
M8	60	7.9	9.9	+2.0	+25%
M10	60	9.9	11.2	+1.3	+13%
M12	70	13.8	14.1	+0.3	+2%

^a https://ugfds005.blob.core.windows.net/media/Load%20Tables/Load%20Tables%20fischer/LT_01_FIS-V_F_%23SEN_%23AIP_%23V2.pdf

^b https://ugfds005.blob.core.windows.net/media/Load%20Tables/Load%20Tables%20fischer/LT_01_FISEM1_F_%23SEN_%23AIP_%23V4.pdf

Table 4 Characteristic bond resistance of standard threaded rods in uncracked C20/25 concrete using standard drill bit. Data from ETA-02/0024^a and ETA-17/0979^b.

Rod size	Hole condition	Bond resistance / N mm ⁻²		Difference (FIS EM plus – FIS V)	
		Fis V ^c	Fis EM plus ^d	Absolute / N mm ⁻²	Percentage
M10	Dry/wet	11.0	17	6	+55%
	Flooded	-	14	-	-
M12	Dry/wet	11.0	17	6	+55%
	Flooded	9.5	14	4.5	+47%

^a https://ugfds005.blob.core.windows.net/media/Certification%20Documents/ETA%20European%20Technical%20Assessment/fischer/ZD_ETAB_F_02-0024_%23SEN_%23AIP_%23V4.pdf

^b https://ugfds005.blob.core.windows.net/media/Certification%20Documents/ETA%20European%20Technical%20Assessment/fischer/ZD_ETAB_F_17-0979_%23SEN_%23AIP_%23V5.pdf

^c50°C / 80°C

^d50°C / 72°C

Table 5 Characteristic bond resistance of standard threaded rods in cracked C20/25 concrete using standard drill bit. Data from ETA-02/0024^a and ETA-17/0979^b.

Rod size	Hole condition	Bond resistance / N mm ⁻²		Difference (FIS EM plus – FIS V)	
		FIS V ^c	FIS EM plus ^d	Absolute / N mm ⁻²	Percentage
M10	Dry/wet	6	7.5	1.5	+25%
	Flooded	-	7	-	-
M12	Dry/wet	6	9	3	+50%
	Flooded	5	7	2	+40%

^a https://ugfds005.blob.core.windows.net/media/Certification%20Documents/ETA%20European%20Technical%20Assessment/fischer/ZD_ETAB_F_02-0024_%23SEN_%23AIP_%23V4.pdf

^b https://ugfds005.blob.core.windows.net/media/Certification%20Documents/ETA%20European%20Technical%20Assessment/fischer/ZD_ETAB_F_17-0979_%23SEN_%23AIP_%23V5.pdf

^c50°C / 80°C

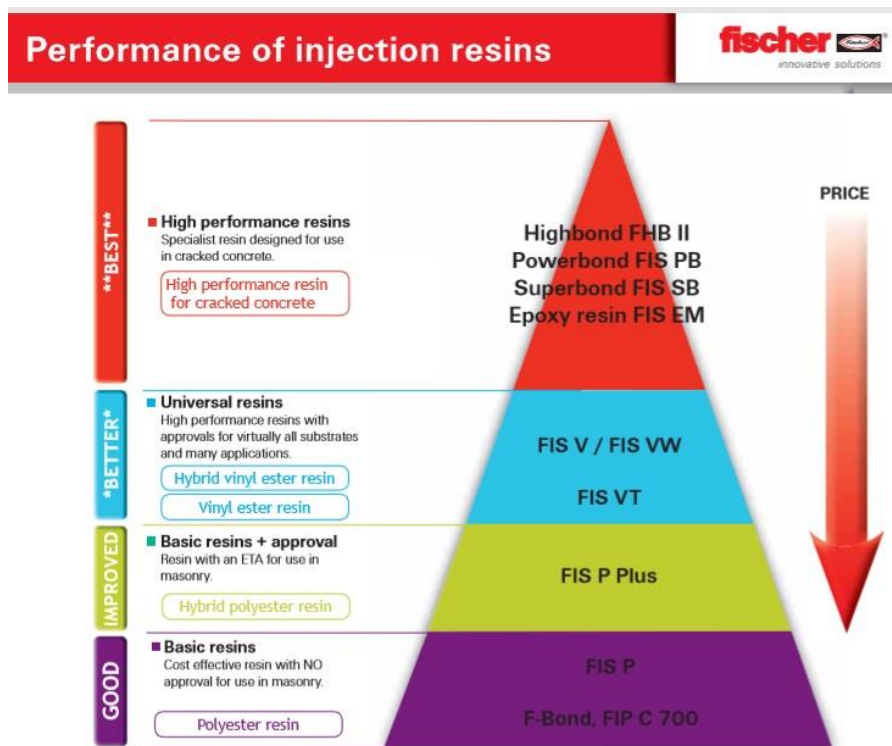
^d50°C / 72°C

Appendix 2

(from “Reports for Committee meeting 19th January 2019”; www.cncc.org.uk/doc/1234)

Request for the CNCC to approve the use of Fischer FIS EM in fixing anchors.

It was hoped that the more efficient design of the IC anchor combined with the use of Fischer FIS V resin would mean that we experience no more loose anchors but some IC anchors have come loose. Investigations led me to the view that there were probably several factors causing anchors to come loose but probably the main one was resin shrinkage. All of the various resins used in the past by the CNCC and the BCA have been polyester or vinyl-ester resins that are known to have significant shrinkage. Fischer FIS EM is a pure epoxy resin which Fischer state to be a high performance resin with very low shrinkage.



As performance increases so does the price. We have been paying around £14 per tube for FIS V and the price of FIS EM is £18. However, the epoxy resin has a much longer working time which when installing multiple anchors will economise on both resin and nozzles. FIS V remains useable in the nozzle for around 15 minutes whereas FIS EM is useable for 2 hours which is enough time to move to another site and install an anchor. The extra cost of the resin will be offset by the economy provided by the increased working time.

The IC anchor was designed with vinyl-ester resin in mind and has the optimum strength with that resin. The extra strength of the epoxy resin is not desirable but we will have to accept it. FIS EM is approved for use in diamond-drilled holes, in water-filled holes and underwater. These are all advantages over FIS V. FIS EM has a longer shelf life; tubes bought in December 2018 have an expiry date of October 2021.

The change of resin will be straightforward because the new resin uses the same guns and nozzles.

More information can be found on the Fischer website and there is a link to the European Technical Approval which provides the most detailed information.

<https://www.fischer.co.uk/en-gb/products/chemical-fixings/injection-mortar/injection-mortar-fis-em-plus>

I have load tested three IC anchors using FIS EM and all three anchors pulled out cleanly leaving a reusable hole. The peak loads were 40.00 kN, 39.17 kN and 39.01 kN which is about 10% greater than the characteristic load using FIS V.

Fischer approves FIS EM for use in overhead positions which tells us that it should not run out of the hole. It does not tell us if it will support the weight of an anchor. I have placed one IC anchor in an upwards hole and it did not fall out to any amount discernable with the naked eye. Installers will have to be wary about overhead installations until we have established that they are sound in all situations.

Simon Wilson.