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TECHNICAL COMMITTEE MEMORANDUM TCM 12/09

Wild Country Technical Friends stem cable failures Incident Ref. 07/12/LHEI

SUMMARY

A Wild Country Technical Friend 1.0 and Wild Country Technical Friend 0.5 both failed a routine inspection and the owner sent them for examination. Both cams appear to have failed due to bending fatigue in their cables. These cases emphasise the importance of regular inspection of all climbing equipment. Users should also be aware that if equipment is used heavily, it may not last as long as the manufacturer's estimated life span.



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1. INTRODUCTION

This report relates to two separate camming devices – a Wild Country Technical Friend 1.0 (hereinafter Yellow 1.0) and Wild Country Technical Friend 0.5 (hereinafter Red 0.5). Both devices are covered in one report for conciseness and since they are similar devices, received together from the same owner, and appear to have failed similarly.

During an inspection the owner of these cams noticed a crunching sound when pulling their triggers. Inspection of the stem cables of each cam revealed that wires in the cables were breaking with each pull of the trigger. The owner continued to flex the Yellow 1.0 cam until the stem cable was completely separated from the head of the cam so that the trigger wires could be reused.

The owner sent both cams to Wild Country for inspection on 4 August 2012. Wild Country subsequently sent the cams to the BMC for further observation.

2. EXAMINATION

Red 0.5

The label sewn into the sling reads “Wild Country Friend 0.5 14kN 0120CE”, the head of the cam is stamped “614” – which indicates that the cam was manufactured in 1996 according to Wild Country.

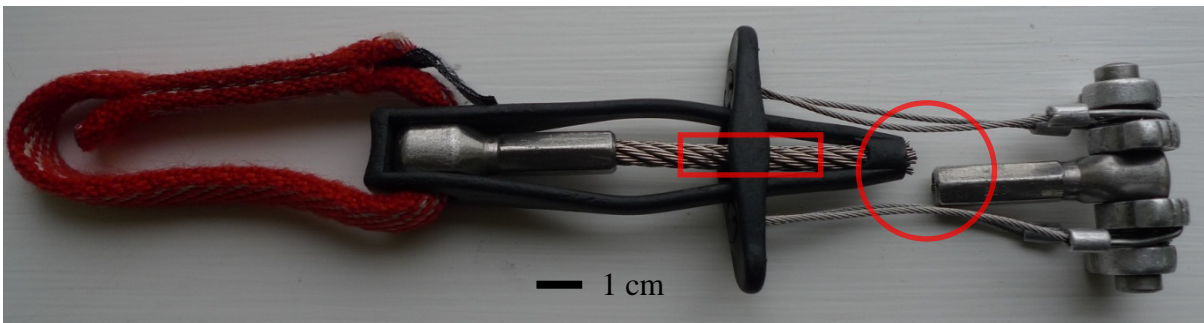


Figure 1: Red 0.5, location of failure circled, location of figure 2 marked by rectangle

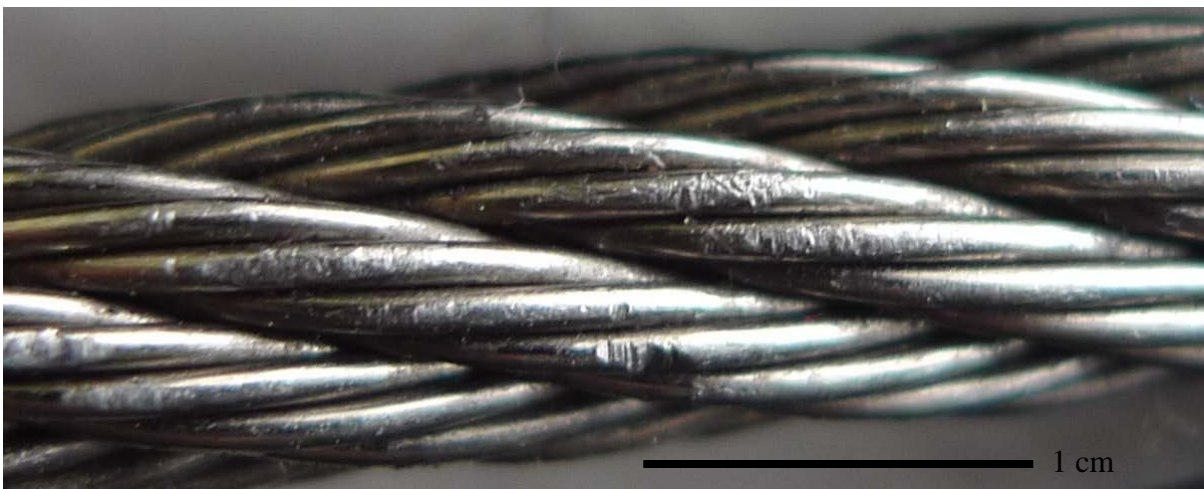


Figure 2: Red 0.5 cable abrasion

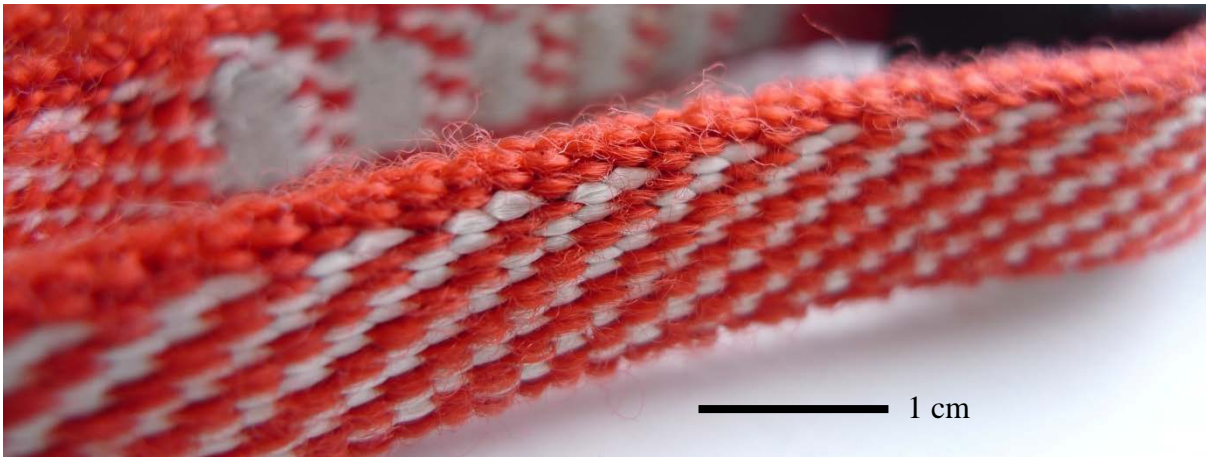


Figure 3: Red 0.5 sling

Yellow 1.0

The label sewn into the sling reads “Wild Country Friend 1.0 14kN 0120CE”, the head of the cam is stamped “334” – which indicates that the cam was manufactured in 2003 according to Wild Country.



Figure 4: Yellow 1.0, location of failure circled, location of figure 6 marked by rectangle

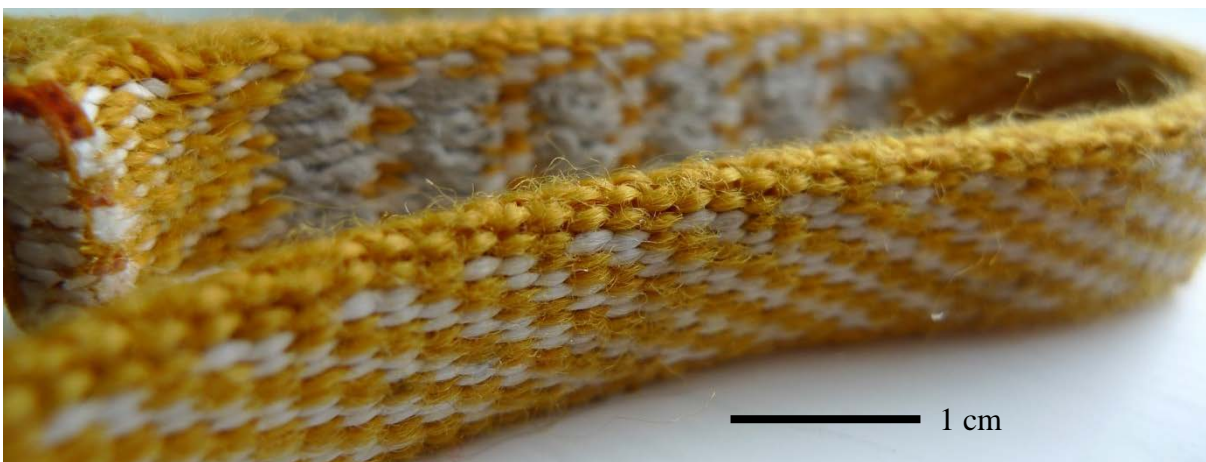


Figure 5: Yellow 1.0 sling



Figure 6: Yellow 1.0 cable abrasion

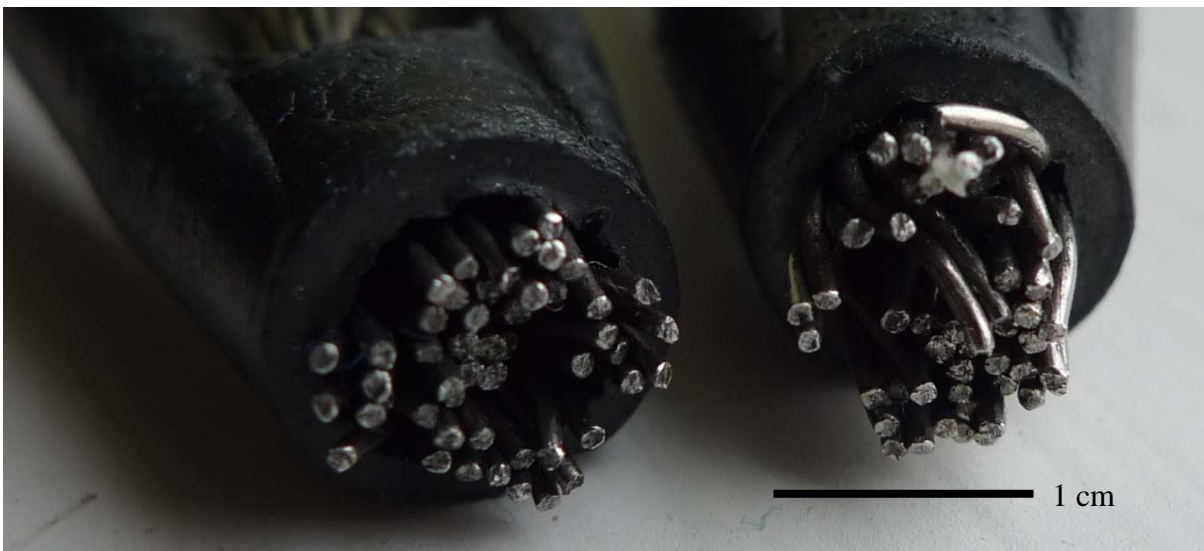


Figure 7: The cable side of the broken wires – looking towards the trigger side; Red 0.5 on left, Yellow 1.0 on right

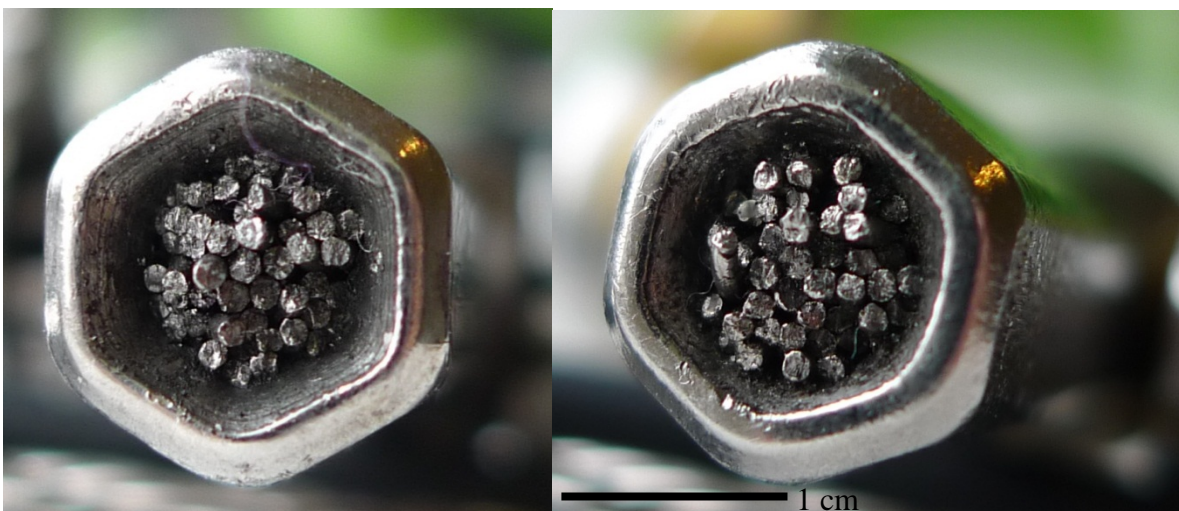


Figure 8: The solid stem side of the broken wires; Red 0.5 on left, Yellow 1.0 on right



Figure 9: Left Red 0.5, and right Yellow 1.0 cam lobes

The slings on both cams show significant wear (Figures 3 and 5), with slightly more visible abrasion on the Red 0.5 cam. The plastics sheaths which partially cover the stem cables are in similar condition on each cam, showing numerous small nicks and scrapes and significant abrasion. The stem cables are in very similar condition with noticeable abrasion (Figures 2 and 6). The cam lobes on the Red 0.5 cam show very high wear, with significant rounding and loss of material (Figure 9). The lobes on the Yellow 1.0 show high wear, although slightly less severe than the Red 0.5.

The stem cable on each cam has failed where the cable connects to the solid head of the stem (Figures 1 and 4). Viewing the cable side of the broken wires end on (Figure 7), the wires in each of the cables are located fairly centrally. The axial location of the breaking point in each wire, in both cams, is within the solid stem and embedded at a distance of between 0-2mm from the open end of the solid stem (Figure 8). The more central wires tend to have broken slightly higher (that is, towards sling end of the cam), while the outer wires are broken at a point deeper within the solid stem, possibly due to the stem acting as a stress concentration on the wires.

There is no visible corrosion on either cam. It appears that none of the wires have pulled out from the socket in the solid stem.

Microscopic examination of the failed cable ends was attempted but did not produce usable results due to the low depth of field at high magnification. However, inspection by the naked eye reveals what appear to be fracture surfaces which are roughly perpendicular to the axis of the wires. There is no visible necking, however – examinations of the surfaces by the naked eye are limited because of difficulty in seeing details on such a small scale without magnification.

3. DISCUSSION

The Red 0.5 cam was manufactured in 1996, so it could have been in use for up to 16 years before failure. The Yellow 1.0 cam was manufactured in 2003 so it may have been in use for up to 9 years before failure. Wild Country's Product Instructions [1] for their cams state that "it is difficult to be precise [when giving an obsolescence date] but a conservative estimate for this product is that it has a life span of 10 years from the date of first use for metal components". The owner states "I can't recall [these cams] being strained more than others. We do quite a lot of climbing – summer and winter, but tend not to fall of very often at all. However, I do recall a few years ago another red 0.5 starting to break in a similar way."

Generally speaking, both cams show very high wear and have clearly been heavily used. There is significant abrasion on the stem cables and plastic cable sheaths. The most likely cause of this would seem to be the cables and sheaths rubbing against rock surfaces when the cams were placed in use. In order for the cable to abrade while the cam is anchored in place, the cable must bend. The significant abrasion on the cables would therefore seem to suggest that the cables have been bent many times. There are many possible causes of cable bending in use; for example during placement (i.e. when a placement is checked by yanking on it), during climbing (e.g. when the rope pulls against the cam due to rope drag), due to 'static' loads (e.g. sit rests, abseiling, lowering, etc.) or due to falls.

The owner has confirmed that the cams were used often. This information, coupled with the fact that the Red 0.5 and Yellow 1.0 cams are 16 and 9 years old respectively, and also in view of the significant cable and sheath abrasion, suggests that the cam cables are likely to have undergone a very large number of bending cycles.

In each cam, when the stem cable is bent, the part of the cable adjacent the solid stem is forced to bend around a very small radius formed in the outer edge of the solid stem. This will increase bending stress in the cable at this location and therefore accelerate fatigue in the cable.

It is well known that repeated bending loading of wire cables can cause fatigue failure [2]. Given the likely high number of bending cycles, and the fact that the failure is located at the point of highest bending stress in the cable, it seems highly probable that the cables in both cams failed due to bending fatigue.

Although there have previously been examples of similar failures [3] [4], these failures are not commonly reported to the BMC. It therefore seems notable that two cams, belonging to the same owner, failed at similar times – in spite of a large gap in their manufacturing dates. It is also interesting to note that the owner recalls having another cam fail in a similar manner in the past. One explanation, for this apparent propensity for fatigue failure in cams belonging to this owner, may be the sheer amount of use the cams are subject to. Both of the cams examined presently were very well used and also old, with one just shy of the manufacturer's recommended lifetime and the other well beyond the recommended lifetime.

4. CONCLUSION

The Red 0.5 cam and the Yellow 1.0 cam both appear to have failed due to bending fatigue in their stem cables.

5. RECOMMENDATIONS

It is crucial that users inspect their climbing equipment regularly. If you see *any* broken wires in a cam cable you should stop using the cam immediately. In this case, the owner of these cams discovered a problem with them during a pre-trip inspection – if the owner had not inspected them they may well have failed in use.

Unfortunately, inspecting the cables on many types of cam is not straightforward. Many have plastic sheaths which add rigidity so that the cables do not bend when the triggers are pulled. However, these sheaths also often prevent the user from being able to see the cable – making inspection difficult or sometimes impossible. It is crucial that manufacturers design their cams so that the stem cable can be inspected.

In the present case, the Red 0.5 and the Yellow 1.0 Technical Friends have 'open' sheaths which can be retracted by pulling apart the two parts of the sheath to reveal the junction between the cable and the solid stem.

Users should also be aware that if equipment is used heavily, it may not last as long as the manufacturer's estimated life span.

5. REFERENCES

1. Wild Country Helium Friends Product Instructions, available online: http://www.wildcountry.co.uk/download/files/Instruction_Booklets/V5129_WC_Helium_Friends_V82.pdf Instructions for Technical Friends were not available, therefore Helium Friend instructions were consulted.
2. Theory of Wire Rope, George A. Costello, Springer-Verlag New York Inc., 2nd Edition, 1997.
3. British Mountaineering Council TCM 02/06, Wild Country Technical Friend with broken stem.
4. British Mountaineering Council TCM 07/03, Rock Empire Cam snapped wire cable.