BRITISH MOUNTAINEERING COUNCIL

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TECHNICAL COMMITTEE MEMORANDUM TCM 10/04

DMM Ascent helmet, Head injury

Incident Ref. 08/10/F.KIN

SUMMARY

A young climber slipped and banged his head whilst being lowered from a climb, resulting in a head injury. Their parent was concerned that this may have been caused due to the design of the interior of the helmet, which has exposed plastic rivets.

There was no evidence that the exposed rivets would damage the head for a correctly fitting helmet under moderate impact. There was evidence that the rear retention system could cause injury during an impact. The manufacturer has indicated that improvements to the helmet design are being made as a result of this investigation, as part of their Quality Management system.

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Approved for issue by the EIP:	

1. INTRODUCTION

A BMC member was climbing with his young son at Neilston Quarry. Whilst being lowered down the route (Pinkerton's Corner), the 9 year old boy slipped and banged his head. On admittance to hospital the child was treated for a head injury, including a small puncture wound and skull fracture.

The helmet was sent to the BMC with the concern that the interior design of the helmet was the cause of the injury.

2. EXAMINATION

The DMM Ascent helmet was found to be generally in a good condition. Manufactured in the 2nd quarter of 2008, it is labelled as conforming to EN 12492. It is the larger of the 2 sizes this model is available in, and according to the labelling is suitable for head sizes from 54 to 62cm.

Inspection of the shell found several areas of scuffing and indentations on the right/rear area. These were found not to penetrate too deeply into the shell, indicating that they were probably caused by a relatively moderate impact.

No evidence was found elsewhere of any obvious damage to the helmet; in particular removal and inspection of the foam liner did not show any sign of compression or deformation.

The helmet is of hybrid construction, consisting of a relatively stiff plastic shell and an expanded foam liner. Four identical plastic mouldings act as headlamp clips on the exterior of the shell, each secured on the inside of the shell with two attachment points. These attachment points are additionally used to secure both an interior adjustable head cradle, and the chinstrap system. A photo of their location was taken. [Fig 1]

Examination of the 8 attachment points found that they have a small and almost hemispherical profile protruding into the interior of the helmet. To protect the head, four of the attachment points are covered by a layer of plastic backed foam which forms part of the interior cradle. The remaining four points have a semicircle of soft foam padding surrounding them.

A standard medium test headform had a thin patch of plasticene applied, the helmet was placed on top and the helmet was struck using a handheld hemispherical striker. The striking target was the right rear of the shell where scuffing had been noted. The severity of these blows could be characterised as moderate. The plasticene was inspected for any indentations. This test was repeated twice and photographs of the plasticene were taken. [Fig 2]

The sizing of the helmet was checked, using several mannequins. Conveniently one of these was exactly 54cm in circumference (the smallest size stated for this helmet). The helmet was a very sloppy fit on this mannequin, with obvious and sizeable gaps at the sides on the smallest setting.

3. ANALYSIS

It was not possible to mount the headform in such a way as to allow controlled energy impacts to be made to the impact area, without modifying the headform. It was, however, possible to obtain an idea of which areas of the helmet made contact with the headform during moderate impacts, by inspecting the plasticene after moderate impacts were applied.

The big surprise here was that there were no noticeable indentations left by the 8 obvious rivets. Further inspection gave a possible explanation for this. The four highest rivets are located close to the edge of the foam liner. Unless this liner is significantly compressed, then these rivets are unlikely to contact the head. The four lowest rivets are covered by a plastic sheet and soft foam. Whilst it seems logical to assume that under a major impact that this soft foam might compress and allow

one of these rivets to contact the head, this was not noted in our simulation which involved moderate impacts.

Looking at the geometry of the helmet, it appeared that a small head would fit closer between the edge of the cradle and foam, perhaps enabling easier contact with the shell and rivets during impact. Unfortunately the small mannequin we had access to was not of robust enough construction to allow the impact testing which may have confirmed this.

Noticeable indentations were left by two parts of the cradle system. The culprits were the plastic backing plate of the adjustment wheel, and a flat plastic rivet close to this, which allows the plate to articulate. Flexing the shell demonstrated that during impacts to the rear of the shell, the shell probably deforms and pushes these parts into the head. Inspection of several other different helmets indicate that they may also allow injury in a similar manner.

In common with many other helmet designs, the DMM Ascent offers very little protection from impact towards the rim. The expanded foam liner provides the majority of the impact protection. As a consequence, the effect of impacts which do not involve compression and deformation of this liner are unlikely to have been mitigated to any great degree by the helmet.

Whilst the degree of protection to be expected from impacts in this area is therefore very limited, the wisdom of allowing obvious protusions such as the exposed rivets to be present inside the helmet must be questioned. A limitation of the EN12492 standard is that not all areas are impact tested, and many helmet designs have protusions of the shell or parts of the cradle/retention system which could contact the head during impacts.

4. CONCLUSIONS

This type of helmet does not appear to provide much protection in the area where the impact occurred. It was not possible to produce puncture marks during simulated impacts when fitted to a medium size headform. It is possible that the small head size of the user may have allowed contact with the rivets during the incident. The nape adjustment may lead to injury during an impact.

5. RECOMMENDATIONS

The BMC should remind climbers to choose the correct size of helmet, and to ensure it is a good fit for the user. The helmet manufacturer should consider improving the design of this particular helmet, even though there is nothing to suggest that it does not meet the required EN standard. Encouragingly, DMM have already stated that they will do this as part of their Quality Management system.[1]

6. REFERENCES

[1] Letter from DMM (attached)

Fig 1. Internal rivet location

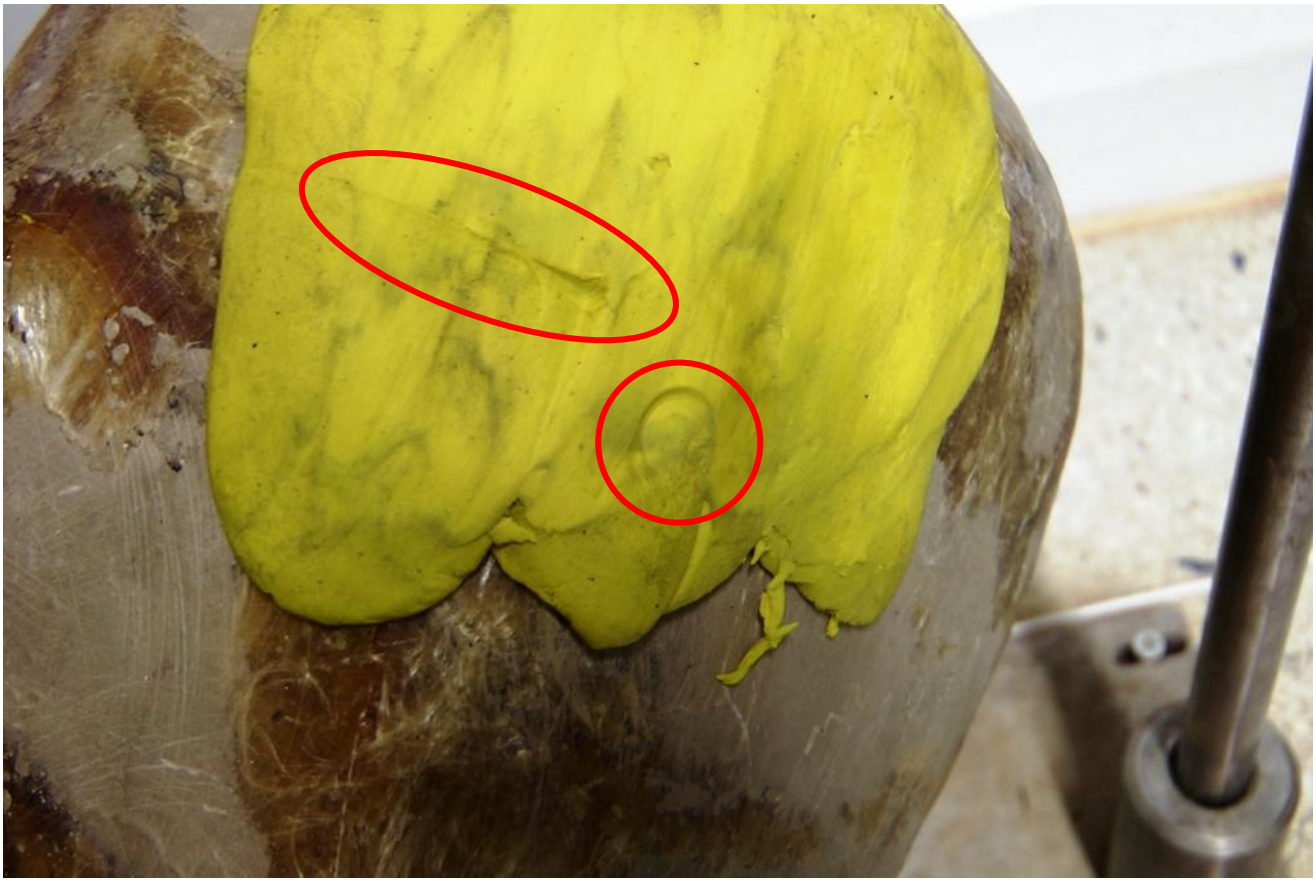

Fig 2. Marks left after the plasticene test

12/11/2010

RE: DMM Ascent Helmet

Dan Middleton: BMC Technical Officer.

Dear Dan

Thank you for notifying us of this incident. We are sorry to hear that the climber was injured as a result of his fall and hope that they make a fast and full recovery.

We have tried to recreate this incident with both human and foam heads – at one extreme we attached the helmet to a foam head and then hit the helmet at various points on and around the rivets with a hammer. We could not get the rivets to mark or indent the foam head.

We have also been in touch with the manufacturer and he has categorically stated that this is the first time he has had a report of such an incident.

However as part of our ISO9001:2008 registered Quality Management System we are constantly reviewing our product range with a view to making improvements to the product and as a result of investigation into this incident we are proposing making a modification to our helmets which will help prevent the type of injury sustained happening again. The manufacturer is investigating alternative methods to attach the cradle and straps to the helmet and expects to ship us a modified prototype early next week.

Once we have received the sample we will evaluate the changes made and subject the helmet to the tests as required in EN12492:2000 "Mountaineering Equipment, Helmets for Mountaineers, Safety Requirements & Test Methods" and also to stringent field testing via our team of experienced climbers.

When we are satisfied that the required modifications have been made and the integrity of the product is complete then we will approve for production.

In the meantime we feel that we should reinforce the message regarding the correct selection of PPE for mountaineering & related activities by ensuring correct fit and adjustment.

If you need any further assistance, please feel free to contact me anytime

Bill Cannock

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