

*Laurie Richards*The Old School House • Swamp Rd • Ellesmere
RD5 Christchurch • New Zealand

Rock Engineering Consultant

s 7(2)(a) † Privacy

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Project: 9902

s 7(2)(f)(ii)

Tauranga District Council
Private Bag
TaurangaLink
re: discuss

Dear s 7(2)(f)(ii)

MAUAO SLOPES: ROCKFALL RISK ASSESSMENT**INTRODUCTION**

1. This note is a follow-up to the site visit to Mauao made by the following:
 - s 7(2)(f)(ii) TDC
 - s 7(2)(a) † Privacy (Avalon Industrial Services)
 - LR
2. The purpose of the visit was to discuss the interim report from Avalon on their survey and cleaning of Mauao boulders¹. This work was carried out after the fire on the slopes of Mauao and an initial assessment by the writer². An earlier report³ includes detailed information on Mauao rockfalls and presents a risk assessment with respect to the main facilities on Mauao.
3. The objectives of the visit were to provide recommendations for the preferred options for the following areas:
 1. Remedial measures for large bluff above camp site (Camp Bluff)
 2. Requirements for safety fences above tracks
 3. Safety requirements on tracks
 4. Longterm monitoring and maintenance of Mauao slopes.

CAMP BLUFF

4. Avalon's inspection has highlighted concerns about the stability of the Camp Bluff. This comprises an outcrop of about 500 m³ with about seven main blocks ranging in size from 7 m³ to 70 m³. Survey markers have been established on these blocks to deformation monitoring to be carried out in future. Options for dealing with the bluff are in order of cost:
 1. Do nothing – but continue to inspect and monitor for potential distress or accelerating movements
 2. Provide restraint with cable lashing (tensioned cables stretched around blocks and tied back to rockbolts). See example on Figure 1
 3. Stabilisation of blocks with rockbolts (note: difficulties of ensuring adequate tensioning and corrosion protection of bolts with large voids between blocks, also potential problems of destabilising blocks with drilling)
 4. Provision of high capacity rock catch fence at junction between bush and paddock (unlikely to be viable option because high kinetic energy of large blocks will probably exceed practicable fence capacity). See Figure 2 for example of high capacity rockfall fence
 5. Removal of unstable blocks
5. There is a smaller block on the crest of the summit about 100m to the right of the Camp Bluff. This is only a few cubic metres and could readily be stabilised with a cable tieback.
6. LR/Avalon will produce an options report outlining the possible remedial measures. Avalon will provide an estimate of the cost of each option. Cable lashing may provide a reasonably priced and unobtrusive

¹ Avalon Industrial Services. *Mauao slope remedial works interim report (draft)*. Report to TDC, 21 March 2003.

² Richards L. *Mauao rockfall review*. Letter to TDC, 20 February 2003

³ Richards L. *Mauao stability assessment, Mount Maunganui, Tauranga*. Report to TDC, 31 May 1999

solution to the problem. LR will update the earlier risk assessment in terms of the risks posed to the campsite and tracks for each of the options.

ORUAHINE PATH

7. Avalon's report indicates that walkers on the Oruahine Path are at risk from small stones dislodged by rock climbers on the steep faces and gullies above the track. These rock fragments are generally small but with high velocity. Apart from signage and education as noted in the Avalon report, protection of the track could be effected at reasonable cost by providing catch nets in the gullies subject to this problem (see Figure 3). An outline design and costing will be produced for TDC's consideration.

BASE PATH

8. Rocks from the recent scaling have crossed some areas of the Base Path. Protection of the Base Path could be effected with high capacity rockfall fences but these are likely to be obtrusive and expensive (>\$2000 per metre). Warning signs should be erected in the areas at risk. The need for physical protection of the path can be assessed when the rockfall frequency has been assessed from regular inspections. The 1999 assessment indicated that even if rockfall frequency increased to 10 per year, the return period for a fatality would be of the order of 1000 years which is considered an acceptable risk by relevant organisations such as UK Health & Safety Executive.

MAINTENANCE AND MONITORING

9. The options report will also include recommendations for ongoing monitoring, inspection and maintenance of the slopes. The appointment of a fulltime ranger on Mauao will be of great benefit to the ongoing risk management of the mountain as this will enable a more systematic collection of boulder and rockfall frequency data which in turn will allow more focussed and cost effective solutions.

INFORMATION REQUIREMENTS

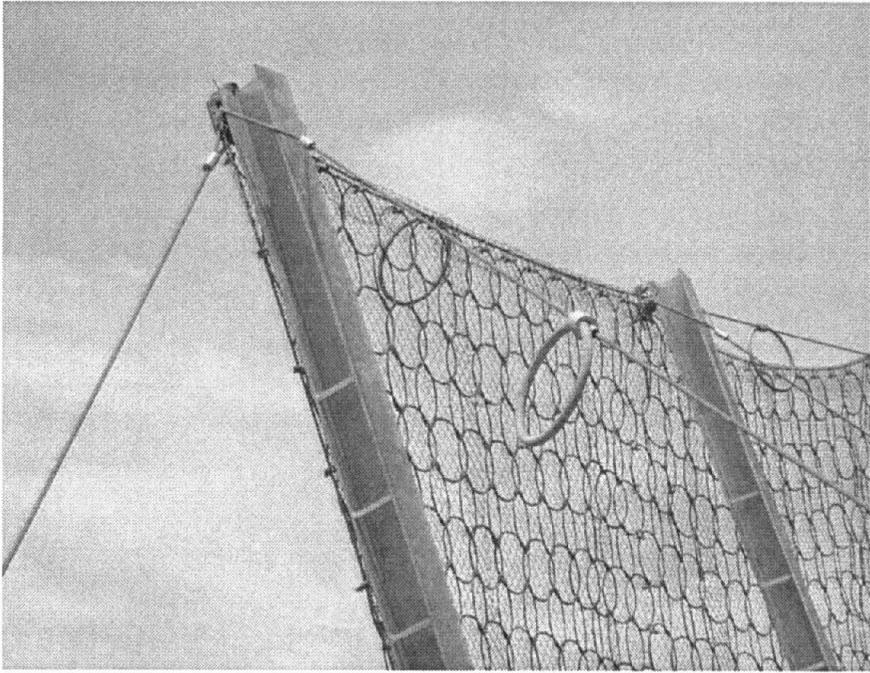
10. In order to carry out the above study, the following information is required from TDC:
 - Completion of Avalon slope survey and monitoring base report
 - Copies of most recent aerial photographs of Mauao
 - Most detailed/accurate topographical survey of Mauao (TDC has previously forwarded dxf file MtMaunganui1m.dxf (11 March 2003) – which is understood to be the latest contour survey)
 - Survey of rockfall trajectory for 17t block scaled off by Avalon in March 2003
 - Update on track usage (people/day) if this has changed significantly from 1999 survey
11. Avalon and LR to provide TDC with estimates for carrying out the work above.

Please let me know if you have any comments or queries on the above.

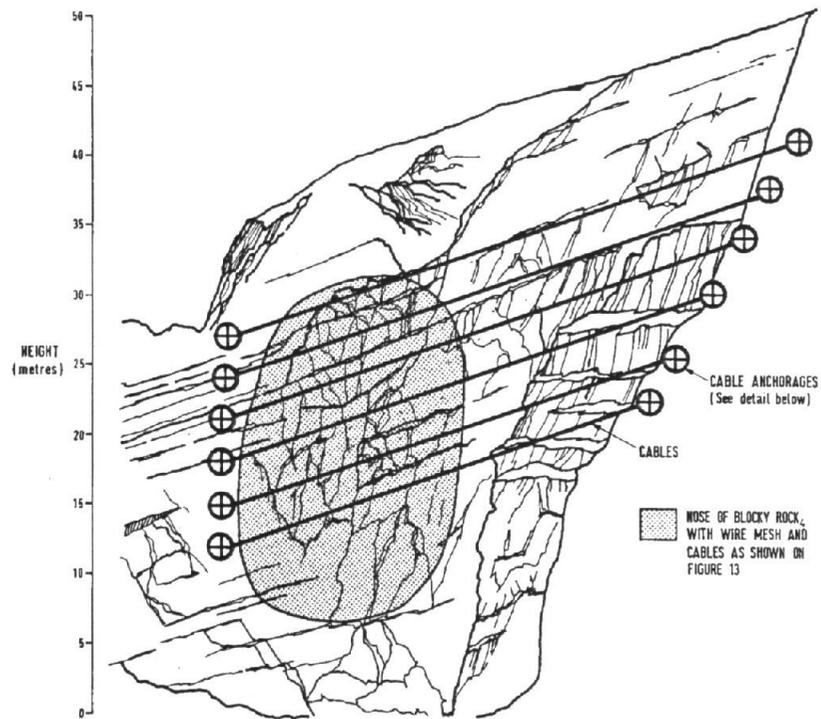
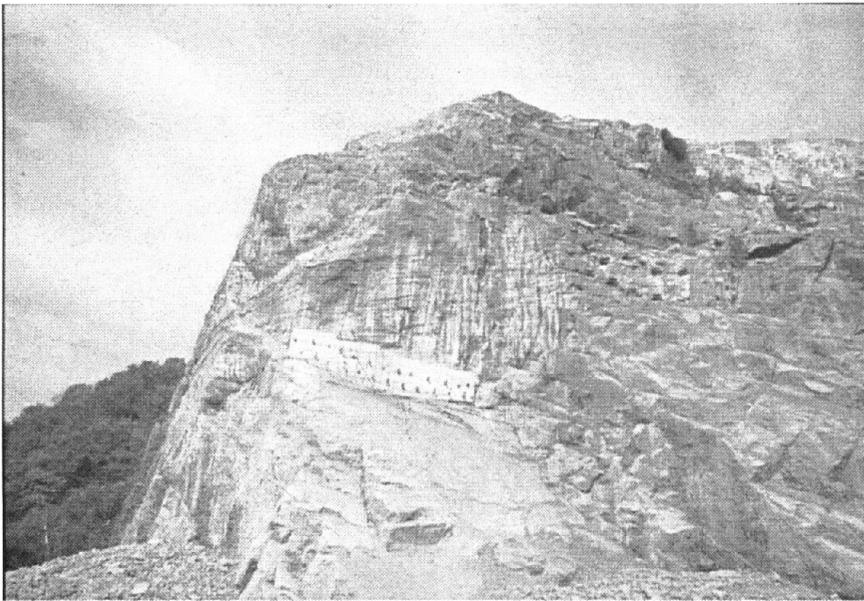
Best regards

s 7(2)(a) † Privacy

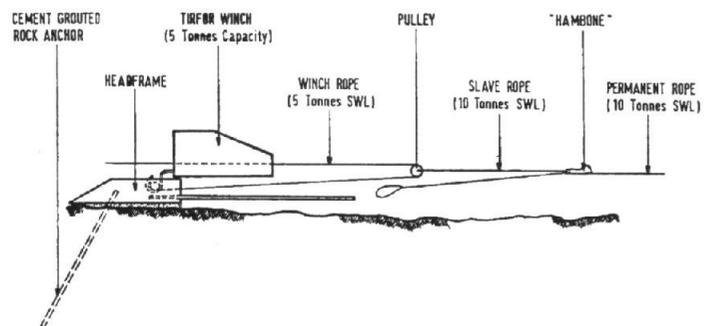
Laurie Richards



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Figure 2: High capacity rockfall fence

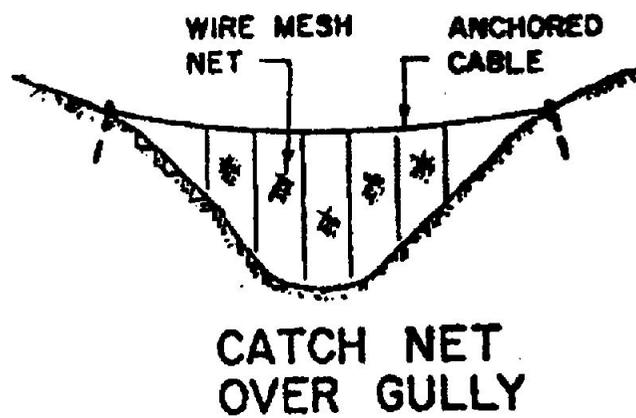


(a) ELEVATION OF FACE



(b) DETAILS OF CABLE ANCHORAGES AND TENSIONING SYSTEM

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Figure 1: Example of cable lashing of 30,000T block



*Wire mesh net = doubled layer of Maccaferri gabion mesh
Net hung from anchored cable and allowed to drape freely on to slope
Net requires periodic clearing away of trapped debris*