6 March 2020

s 7(2)(a) - Privacy

Tauranga City Council
Private Bag 12022, Tauranga 3143, New Zealand

Mauao Base Track, Crack Observations and Recommendations

2-9B463.00

Dear s 7(2)(a) - Privacy

Further to your request we have inspected the crack that was recently noticed at the western end of the existing steps on the base track on the southern side of Mauao. This letter presents our observations and recommendations following our site visit on 26 February 2020. The crack is located approximately 15m west of the mount base track slip repair site.

Site Observations

During our time on site we noted the following observations:

- The drilling contractor first noticed the cracking at 9am on 25 February.
- The crack has an irregular (wavy) shape. Small holes in the track surfaces were also noted with an aperture of 10 to 20mm.
- The crack has a length of approximately 4.37m with no vertical difference either side of the crack.
- The slope below the track at the location of the crack is approximately 40 degrees and the slope above the track ranges from 50 to 60 degrees relative to horizontal.
- The slopes above and below the track, comprise undulating and hummocky ground which suggests it is colluvium material or is historic slip materials.
- There is a timber board retaining the down slope below the track near the crack location which suggests that there has been filling placed near the location.
- Above the track at this location is the head of a gully.
- The tension crack is about 1.5 to 1.7m from the toe of the upslope bank and approx. 1m from the down slope crest of the track.
- At the location of the crack the track width is 2.65m across.
- During our inspection we did not notice any evidence of any surface water flows. At the location of the crack surface water flows along the inside of the track via a small swale drain.
- There was 6.2mm of rain recorded in Tauranga on the 22 of February and otherwise has been in drought conditions for at least the last 30 days.

Crack formation mechanism and cause

The formation of tension cracks in soils above slopes may usually suggest the slope is unstable. Another common cause of cracking is due to the shrinking and swelling of soils and particularly clay soils.

Based on our recent observations, we believe that the crack may have been caused by the following factors.

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- Colluvium or loose fill materials have slipped below resulting in a tension crack. However, at the location of the crack there was not any noticeable vertical displacement on either side of the crack to suggest any vertical movement.
- Due to the wetting and drying effect of the soil, a desiccation crack may have formed in the track.

Risk Assessment

Due to the history of the site, there is an on-going risk of slips along the base track, however such landslips are usually triggered by heavy rainfall events or occur shortly after such events. From our inspection and review of rainfall records we believe the cracking is more likely related to shrink / swell of the soils as there was a period of wetting and drying prior to the crack being noticed.

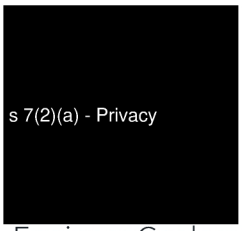
In terms of overall risk to the route, we anticipate that if the crack is indeed a tension crack then the likelihood of failure is high. The consequence of a slip is to reduce the width of the track, but it is unlikely to affect the whole width of the track. In the event of a slip when the soil in front of the crack is vacated, there would still be a remaining track width of 1.5 to 1.6m and room to carry out minor excavations for further widening if desirable.

Recommendations

Based on our observations and risk assessment, we would have the following recommendations:

- We would recommend that the track is undercut to approximately 200mm depth at the crack location and replaced with 200mm compacted track surfacing metal to seal the crack to prevent surface water entering.
- We would also recommend that the area is monitored for any signs of movement or extension. This could be carried out during our proposed inspection program for the base track slip repair as detailed in our offer of service dated 14 February 2020.
- We would also recommend that TCC commission the installation of bored horizontal drains below the track at this location to mitigate against excess pore water pressure in the slope.

Regards



Engineer Geology

Appendix A: Site Photographs and Observations

Site Inspection Photos

Photograph 1 – View of crack looking to the east

Photograph 2 – View of crack looking west

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Photograph 3 – View looking upslope

Photograph 4 – View of downslope

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