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Mauao Landslips – 29 January 2011

Concept Remedial Options for Large Slips affecting the Base Track

Presentation to:
Mauao Steering Group - 03 March 2011

Background

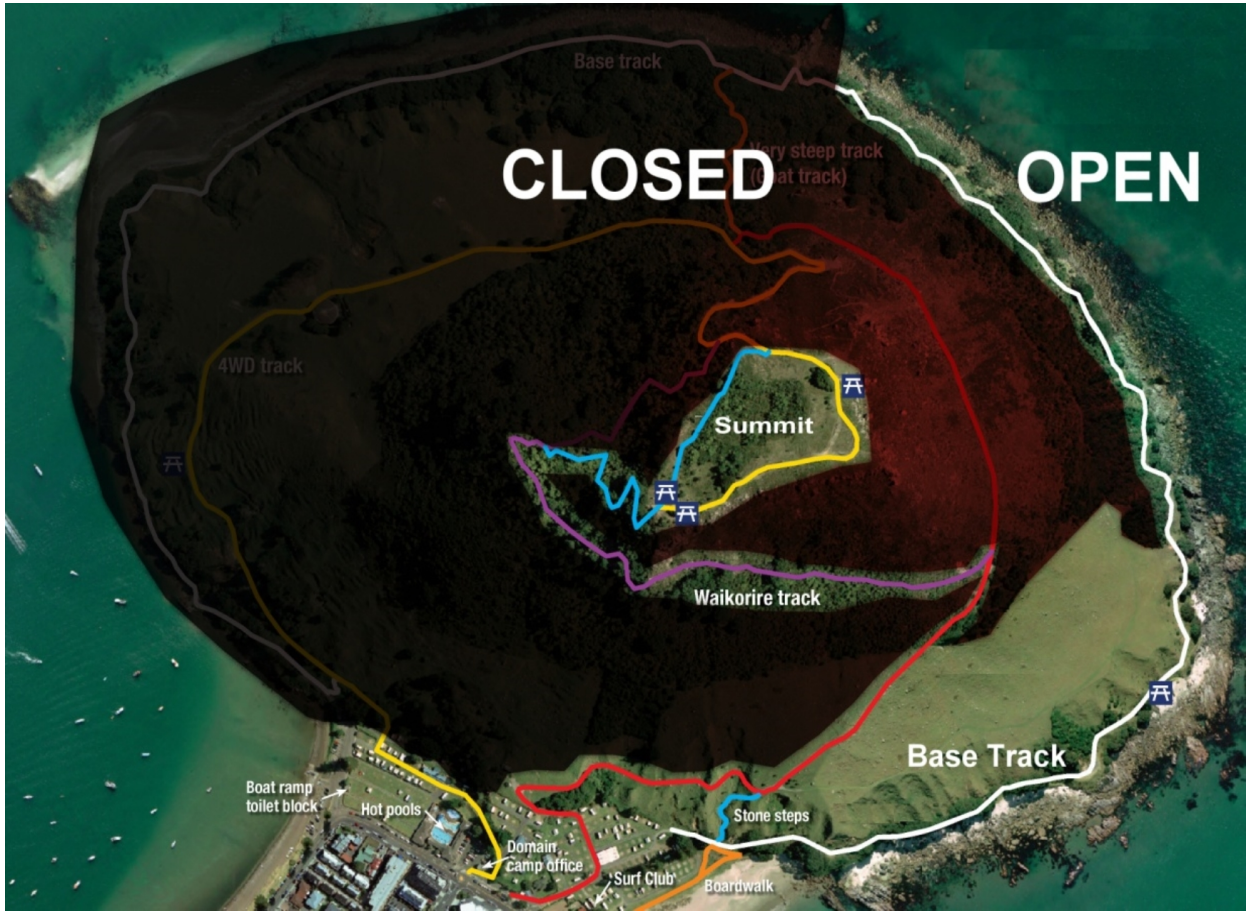
- Landslips occurred on 29 January 2011
- Initial Inspection by TCC staff - 30 January 2011
- Inspection by Tonkin & Taylor Ltd - 01 February 2011
- Presentation to Mauao Steering Group - 03 February 2011
- Landslips Classified by size:
  - 22 Minor (<1m^3 debris)
  - 20 Small (1 to 5m^3 debris)
  - 14 Medium (5 to 20m^3 debris)
  - 7 Large (20 to 100m^3 debris)
  - 2 Major (>100m^3 debris)

Mauao Base Track Large Landslips

Progress to Date

Re-opened 11 February 2011

- Base Track (ocean side)
- Stone Steps
- Lighthouse Track
- Wakorire Track
- Summit Track



Progress to Date...continued

- Four Wheel Drive Track – re-opened 28 February 2011
- Engineering designs for two Oruahine Track slips completed
  - construction likely to commence 14 March 2011
  - Oruahine Track re-opened by end of March / early April 2011
- Goat Track badly damaged by very large slip - not feasible to repair / re-open in near future (long-term?)

Base Track – Harbour Side

- Slips to be repaired include:
  - 7 Minor
  - 7 Small
  - 3 Medium
  - 3 Large
  - 1 Major
- Two small slips affect down slope side and require engineering structures to support track
- Minor, small and medium slips all need to be repaired / debris cleared to provide plant access to undertake remedial works on large and major slips

Base Track Large and Major Slips

Failure Mechanisms

Slips 3, 4 and 5

Notes:

- Head scarps are up to 12m high, 16m wide with debris run out distances >100m, debris volumes >200m^3.
- There are similar size historic slips all around the base of the Mauao – these are nothing unusual

Remedial Options – Slips 3, 4 and 5

- General Philosophy
  - Ongoing regression of recent (and historic) slips during prolonged and/or intense rainfall events is inevitable
  - Major engineering works required to prevent this – very expensive and major impact on Mauao environment
  - Historic equivalent slips which did not reactivate during recent storm are equally likely to fail in the future
  - Main focus is to keep Mauao accessible and safe to visitors
  - Major slips only likely to occur during / following large rainfall events – temporary track / Mauao closure may be considered during such events?

Remedial Options – Slips 3 and 4

- Track largely undamaged
- Clear debris from slips, track and foreshore (vegetation, incl. unstable trees?)
- Line scour channels with boulders from slip debris
- Hydroseed and planting on slip scars to reduce visual impact
- Reinstate track and stormwater control
- Include erosion protection measures to reduce risk of future damage to track
- Fence off head scarps or include warning signs where readily accessible to visitors
- Accept risk of future regression of slips and associated damage to Mauao and tracks

Remedial Options – Slips 3 and 4...continued

- Reduce potential impact of future land slips
  - Include a debris barrier (rock/soil bund or timber posts) with stormwater control
- Cross section of Slip 3 showing debris bund / timber poles with vegetation

- Reduce likelihood of further significant slope failures
- Cross section of Slip 3 showing head scarp regraded to 1V:2H and removal of trees?

Remedial Options – Slip 5

- Track badly damaged
- Reinstatement of track requires significant engineering works:
  - Retaining structure to support track – down slope side high (7-8m), steep and unstable
    - Concrete crib wall
    - Gabion wall
    - Anchored timber wall
    - MassBloc wall, rock protection

- Cross section through Base Track showing crib wall option

Remedial Options – Slip 5

- Trimming back slope difficult (access), destructive (large number of mature trees)
- Allow future failures to occur but reduce risk to track / visitors

Footbridge

Plan view of footbridge possible locations

Concrete culvert

Cross section of track showing outfall

Mauao Base Track Large Landslips

Remedial Options – Slip 5…continued

Option	Advantages	Constraints
Footbridge	• High level of safety • Built off site – short timeframe • Minimal works to slip required • Less disturbance to natural system • Feature / Aesthetic • Education • Re-use boulders to line channel	• High Cost • Foundation construction • Future maintenance / inspection costs • Aesthetic
Culvert	• Reduced risk to users • Minimal works to slip required • Less disturbance to natural system • Minimal maintenance • Availability of existing culvert(s)?	• High Cost • Construction of gabion walls or similar to support track either side of culvert • Rock protection below to dissipate stormwater runoff • Future maintenance – debris clearance • Aesthetic • Requires hand rail
Retaining Structure	• Minimal maintenance	• High Cost • Safety – doesn't reduce potential risk from future slips • Import of materials to site • Requires hand rail

Slip 6

- Loss of surface material from existing slip – 24m high, very steep (50-60°), 12m wide
- Immediately adjacent to track, but track not badly damaged
- Remedial options
- To achieve an equivalent level of safety as prior to 29 January 2011
    - Minor works including scaling of slip face, debris clearance, track reinstatement, hydroseed to reduce visual impact
    - Can be completed quickly to re-open further section of Base Track to Slip 5