Return to previous file: casn116a.pdf

OBJECTIVE 2: DRAINAGE CHARACTERISTICS OF THE RANGIHAU ROAD - CHRISTMAS CREEK AREA ON WHICH THE TRACK IS ALIGNED.

Introduction

A major problem is the occurance of numerous bog conditions which are unsuitable for walking and track construction. Boggy regions form from groundwater seepage faces that discharge out of down slope sections and pond in flat lying areas (Plates 1,2). Groundwater seepage is a permanent feature and during the winter and spring months higher rain falls can cause stream flows along the seepage zones. The diversion of groundwater seepage from the track would be a difficult and costly operation, but would be required before any future track upgrading. Ponding regions have characteristic layers of saturated muddy ash soils to depths of 1 m and are of low strength. Bedrock underlying this region is classified as Omahia Andesite, a dark basic volcanic rock that seems to provide an impermeable surface along which seepage occurs.

High rainfalls within the Kauaeranga Valley outline the need to adequately drain relevant sections of track. Drainage measures were not implemented during the original Moss Creek track construction which led to erosion. Evidence is seen in the field with the presence of slips, exposure of roots, and fallen trees. The original section of track from the Moss Creek / Rangihau road turn-off should be followed for approximately 300 m before reaching the new track turn-off. There is no better alternative to this section of track, as the terrain remains similar either side. In addition to this, large incised gullies on the southern side of the ridge cut almost to the top and would force any new track route that started from the turn-off back onto the ridge top.

OBJECTIVE 3: NATURE OF THE SOIL BOUNDARY.

The depth of soil thickness to bedrock within the region varies in relation to the angle of slope. Low angled slopes (0-10°) show soil depths upto 1 m decreasing to 40-50 cm with increased slope angle (10°-40°). The proposed new track route travels along the main ridge line where 40-60 cm thick soils can be expected. Corestones occur in a wide range of depths from 10-70 cm but at some sites it was difficult to distinguish between corestones and unweathered bedrock. It is this unweathered volcanic bedrock that provides the impermeable surface which when combined with a flat to concave topography prevents runoff and thus produces permanently boggy conditions.

OBJECTIVE 4: ROCK OUTCROPS THAT PROVIDE AGGREGATES SUITABLE FOR TRACK CONSTRUCTION.

Introduction

The Coromandel ranges are formed from a group of rhyolitec and andesite volcanoes, lying upon folded greywacke basement rocks. The lithology of the Coromandel Ranges varies from sedimentary argillites and greywackes, to igneous andesites, rhyolites, dacites and ignimbrites. There is no exposed greywacke within the Kauaeranga Valley. Unweathered greywacke is used extensively in New Zealand for roading.

Fieldwork

Eight rock outcrops were chosen as sample sites along the existing and proposed track, from which approximately 10 kg of fresh rock per site was taken. Sites were tagged with track marking tape for future identification. Two rock samples were taken from outcrops located off the Moss Creek track, and one sample was collected from exposed bedrock in Christmas Creek following the proposed new track line. The remaining five samples are from outcrops that boarder or underlay the existing track (Map 2). Rock sample one was taken from ~200 m above the Kauaeranga river within a large slip zone that extends almost across the entire valley side. Rock sample two was retrieved at the base of the slip adjacent to the river. Sample three was taken from a large rock fall, down stream from the Pinnacles Hut. The cliff face was over hanging and the presence of fresh rock falls indicates the unit is presently unstable. Sample four was retrieved on the Moss Creek track. The rock unit displayed a surficial frittery appearance and was located part way down the ridge that dissects the two Kauri groves. Sample five was taken from Moss Creek track a short distance below the twin power poles, leading down to the Kauaeranga river. Sample six was taken from an extensive rock out crop, located 30 m from the Rangihau road turnoff. The unit is situated 5 m from the track. Sample seven was retrieved from a section of Moss Creek track that leads down to the twin power poles and sample eight was taken from Christmas Creek (Table 1)

Field measurements of the intact rock strength of each outcrop were obtained using an 'N' type Schmidt Hammer. The test hammer measures the distance of rebound of a known mass impacting on a rock surface. Fifteen readings are taken and then averaged. calibration curves are used to convert the rebound figure into MPa (compressive strength) or psi (cylinder compressive strength). The test is used extensively in the concrete and quarrying industries to determine rock hardness. Results of the test are shown in Table 2.

Discussion

Rock outcrops are a viable source of material for track construction. Presently DOC staff use explosives to blast rocks that obstruct track development. Aggregates produced from the blasting are then used on the track. Recently constructed tracks in the Kauaeranga Valley followed old bulldozed routes that removed the top soil exposing bed rock. Tracks constructed on rock can be expected to be long lasting. The new Moss Creek track will be constructed on a relatively low gradient, on deepish soils with little exposed bedrock. All eight rock sample sites are recognised as possible locations of source rock for track construction. Sites 1 and 2 are located in a large slip zone, and could provide favourable high strength andesite rock, suitable for track construction (Table 2). The entire slip face incorporates a number of rock types whose strengths range from weak ignimbrites suitable as binding material for rock paving to high strength rhyolites suitable for base core material. The slip is large enough to provide helicopter access. Site 3 is an unstable cliff face where extensive amounts of rock fall are easily accessible sample 3 is a hornblende dacite. Sites 4, 5, 6, and 7 are located on the existing Moss Creek track between the Webb Creek track junction to approximately 300 m past the Rangihau road turn-off ; this section of track will not be changed. Site 8 is located in the Christmas Creek clearing and is therefore an important source of rock being in close proximity to the future track.

OBJECTIVE 5: TO IDENTIFY EXISTING OR POTENTIAL SLIP ZONES WITHIN THE AREA OF THE EXISTING OR FUTURE TRACK ALIGNMENTS AND THE INFLUENCE THESE HAVE ON THE CHOSEN ROUTE.

Introduction

A major feature of landslides is the correlation between landsliding and the weather patterns. Storm events have the effect of increasing soil pore water pressures at the soil to bedrock interface. Buoyancy effects of increased water build up can thus lead to mass failures especially on steep slopes. Accelerated erosion in the form of slips do occur on the bush clad hills of the Coromandel, especially after such extreme events as Cyclone Bola. In general slips occur down slope from ridge crests. These factors were taken into account when planning the new Moss Creek track. The potential for slips cannot be ignored but areas of geothermally altered rocks should be avoided.

OBJECTIVE 6: WHAT IS THE BEST COMBINATION OF ROCK TYPE AND AGGREGATE SIZE TO MAXIMISE TRACK DURABILITY .

Introduction

The Kauaeranga Valley is situated in a large range of volcanic rock types of varying texture and mineralogical composition. Of particular significance is the range of rock types that can occur within spatially small areas. For example, crystal poor, flow banded rhyolites and crystal rich, porphyritic rhyolites are commonly found in the same lava flow within a few metres of each other.

The rocks within the Kauaeranga Valley have been subjected to significant hydrothermal alteration, especially the older basal rock units. Hydrothermal alteration generally leads to the following changes in rock strength : A decrease in rock hardness, a decrease in cohesion, an increase in porosity, the loss of primary structures (bedding and jointing), and the formation of clays and slickenslided surfaces. Hydrothermally altered regions can be identified by the presence of multicoloured clays (whites, yellows, pinks and oranges). Rock units identified in this report show no signs of hydrothermal alteration and care must be taken in the future not to use altered rock for track construction.

Fieldwork

Eight rock samples each representative of a rock outcrop were collected from the field for the Los Angeles (LA) abrasion test. This test measures the resistance of rock to wear by traffic or by trampers. 10 kg of rock was taken from each outcrop. Fresh rock showing little evidence of weathering was selected and a number of Schmidt hammer readings were recorded (Table 2)

Lab work

The L.A abrasion test subjects a graded sample to attrition due to wear between rock pieces and also to impact forces produced by an abrasive charge of steel spheres. Prior to testing each rock sample was crushed to produce 1250 g +/- 25 g of aggregate ranging in size between 45 mm and 23.4 mm. This sized aggregate conformed to grading 'A' and 12 metal spheres were used (NZS 4407:1991).

Test procedure

a) Weigh the test specimen to the nearest 1 g and record as M1

b) Place the test specimen and the appropriate abrasive charge in the Los Angeles machine and rotate it at a speed of 30 to 33 revolutions per minute for 500 revolutions.

c) Discharge the material from the machine and make a preliminary separation of the specimen on a sieve coarser than the 1.70 mm sieve.

d) Sieve the finer portion on a 1.70 mm sieve until not more than 1 % of the material on the sieve passes during 1 minute.

e) Wash all the material coarser than the 1.70 mm sieve and oven dry it to substantially constant weight. Weigh to the nearest 1 g and record M2.

Results are shown in Table 2.

Discussion

For a rock of uniform hardness the ratio of loss after 100 revolutions to the loss after 500 revolutions should be not more than 0.20. Samples 1 and 2 showed the lowest percentage wear both after 100 and 500 revolutions. The ratio of loss for these samples suggests accelerated amounts of wear towards the end of the test. Both samples are classified as spherulitic rhyolites containing a large amount quartz crystals, these rhyolites are stronger than flow banded rhyolites which are characterised by few crystals. Sample 8 and sample 3 show similar amounts of wear. The % loss after 100 revolutions is only 1-2 % more than samples 1 and 2, and 10 % more after 500 revolutions. The ratio of loss for samples 8 and 3 suggests wear increases at an exponential rate towards the end of the test. Sample 8 is a Omahia Andesite; a dark, basic, flow banded, highly porphyritic rock. Sample 3 is a plate structured dacite coming from a well jointed lava. Sample 5 is a weakly flow banded rhyolite of uniform hardness. This rock is weaker than samples 8 and 3 and shows similar amounts of wear to sample 6 after 100 revolutions, and 15 % less wear after 500 revolutions. Samples 6 and 4 are the same rock type and the results reflect this. Both samples are flow banded rhyolites and have a tendency to fail along flow planes characterised by a different mineral assemblage. Sample 7 is a weakly welded Coroglen Ignimbrite that forms extensive sheets throughout the region. The rock is extremely weak and is not suitable as base core material for track construction.

TABLE 1

SAMPLE No	ROCK TYPE	LOCATION	COMMENTS
1	RHYOLITE	200 M UP RIGHT HAND SLIP FACE LOOKING FROM BASE	CRYSTAL RICH SPHERILITIC RHYOLITE
2	RHYOLITE	BASE OF SLIP ADJACENT TO THE KAUAERANGA RIVER	CRYSTAL RICH SPHERILITIC RHYOLITE
3	DACITE	ROCK FALL DOWN STREAM FROM PINNACLES HUT	PLATY DACITE FROM AN UNSTABLE JOINTED LAVA
4	RHYOLITE	MOSS CREEK TRACK BELOW KAURI GROVES	FLOW BANDED RHYOLITE SLIGHTLY HYDROTHERMALLY ALTERED
5	RHYOLITE	MOSS CREEK TRACK BELOW THE TWIN POWER POLES	WEAKLY FLOW BANDED RHYOLITE
6	RHYOLITE	MOSS CREEK TRACK 30 M PAST RANGIHAU ROAD TURNOFF	FLOW BANDED RHYOLITE SLIGHTLY HYDROTHERMALLY ALTERED
7	IGNIMBRITE	MOSS CREEK TRACK ABOVE TWIN POWER POLES	OBSIDIAN,RHYOLITE,AND ANDESITE LITHICS WITH GREY AND YELLOW PUMICE, PARTIALLY WELDED
8	ANDESITE	CHRISTMAS CREEK	A DARK, BASIC, HIGHLY PORHPRYTIC ROCK WITH FLOW BANDING AND LARGE PLAGIOCLASE MINERALS

TABLE 2

			LA TEST AT 100 REVS	AT 500 REVS		SCHMIDT HAMMER	
SAMPLE No	SITE No	ROCK TYPE	% WEAR	% WEAR	RATIO OF LOSS	MPa	psi
1	1	RHYOLITE	7.6	22.5	2.0 : 5.7	60	8500
2	2	RHYOLITE	6.8	23.7	1.8 : 6.0	42	6000
8	8	ANDESITE	8.5	31.7	1.8 : 6.4	49	7000
3	3	DACITE	9.5	32.9	2.0 : 6.7	69	>8500
5	5	RHYOLITE	13.3	35.4	3.4 : 9.0	45	6500
6	6	RHYOLITE	13.4	49.8	2.3 : 8.4	42	6000
4	4	RHYOLITE	16	50.4	1.0 : 3.2	37	5250
7	7	IGNIMBRITE	50.7	98	3.2 : 6.5	17	2250

PLATE 1: SHOWING SEEPAGE ALONG EXISTING TRACK.

PLATE 2: SHOWING PONDING REGION

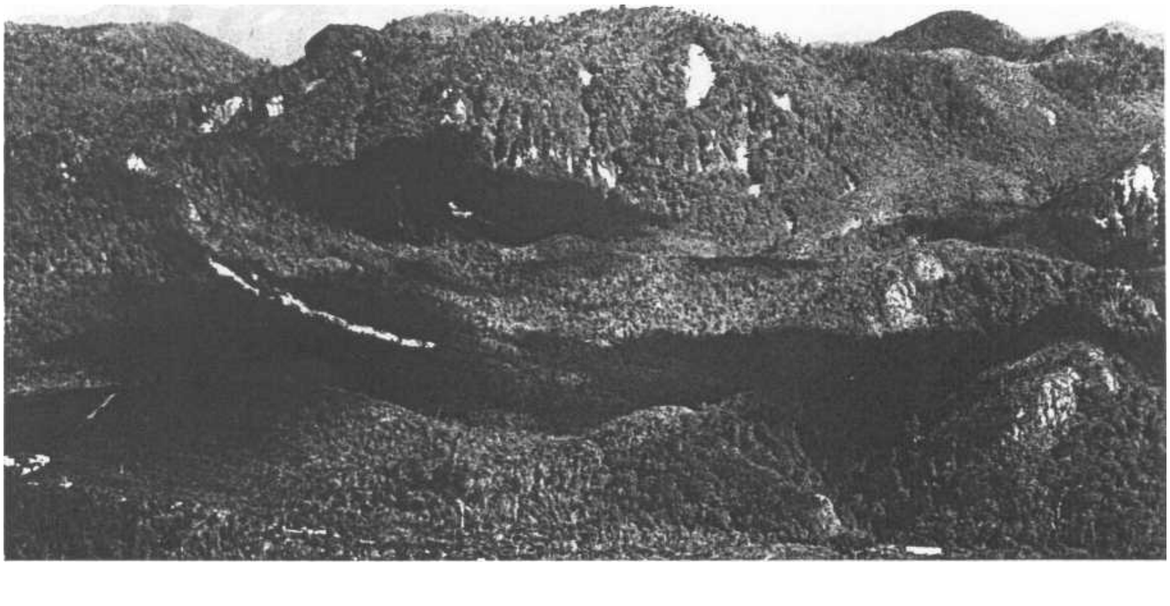

PLATE 3: SHOWING THE 'HIGH POINT', SADDLE, RIDGE LINE AND SLIPS.

RECOMMENDATIONS

* Upgrade the existing section of track from the Rangihau Road turn-off to the new track turn-off.
* Construct a new track along recommended marked route after due consultation with Allan Bernstein.
* Remove top 10-20 cm of soil "A" horizon along the new track
* Cut track into existing geology where possible.
* If a hard base cannot be found then 'import' suitable boulders for base core construction.
* Where possible use fresh rock from marked sites 1,2,3,5,8. Preferable use rock from sites 1,2 and 8 that provide the most durable rock types (spherulitic rhyolites and andesite) for track construction.
* Avoid using rock from site 7 which is a weak ignimbrite
* Rhyolite from site 6 shows 50 % wear. However, the unit is easily accessible and could be used after due consultation.
* Utilise 'corestones' for track construction. Corestones have been identified at all pit sites along the new track.
* Bench new track around the 'high point' enabling a less steep descent onto the saddle.
* Avoid long stretches of medium gradient track (> 1/7) because of risk of accelerated erosion.
* All tracks should be constructed with appropriate drainage eg : culverts, intercept pipes, mounded track design or flat construction using a base of large paved rocks overlain with smaller aggregates and infilled with coarse gravel mix with drainage channels running on either side of the track.

SUGGESTED FUTURE WORK

* Track monitoring programme to assess track persistence / sustainability.
* Assess track erosion after major storm events.
* Evaluate the best type of track construction for a particular terrain.
* Assess track wear in relation to number of trampers.
* A detailed investigation into soil and rock physical characteristics.
* A detailed investigation into mass wasting (slips,slumps) in relation to existing tracks.
* Develop a long term model for track sustainability
* Possible future research at the MSc level with the Earth Sciences Department of the University of Waikato with respect to some or all of the above - contact person Dr Richard Chapman.