Environmental
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Daracon Group Pty Limited

Martins Creek Andesite Quarry Geology and Blast Vibration Assessment

August 2014

Prepared by:

VGT Pty Ltd

For the:

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	Greg Thomson	Date

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Acronyms and Terms Used Throughout the Report

Through this document, a number of Acronyms and reference terms are frequently used. To assist the reader, the following lists are provided.

ACRONYMS	
Daracon	Daracon Group Pty Limited
AHD	Australian Height Datum

Geology Glossary

Word	Meaning
Alluvial Soil	Juvenile soils formed by deposition from still or moving water. Little pedological development beyond some accumulation of organic matter at the surface.
AHD – Australian Height Datum	A height of zero was assigned to the mean sea level determination at 30 tide gauges around the Australian Mainland coastline, measured over a three year period from 1966 to 1968. Ref 2.
Aquifer	A soil or rock layer or group of layers that is sufficiently saturated and permeable to yield significant quantities of water.
Andesite	A fine grained volcanic igneous rock ref 3. The term is derived from the series of mountains found along the west coast of South America, known as the “Andes”. These general form along convergent plate margins.
Arenite	Arena means Sand in Latin, being the material they threw onto the arena before the Gladiators fought. Arenite is a general term meaning sand based rocks.
Bed Rock	The unweathered rock that lies below loose surface deposits of soil and alluvium.
Conglomerate	Is a rock consisting of individual clasts within a finer grained matrix.
Earthworks	The process of extracting, moving and depositing earth during construction.
Embankment	A mound or bank of earth or stone formed to support a roadway, serve as a protective barrier, or the like.
Erosion	The natural process where wind or water detaches a soil particle and provides energy to move the particle.
Excavation	The act or process of digging out earth during construction.
Feldspar	Most important rock forming silicate mineral, either Plagioclase or Alkali Feldspar Group. Ref 3.
Hydrology	The study of rainfall and surface water runoff processes.
Ignimbrite	New Zealand geologist Patrick Marshall derived the term 'ignimbrite' from ‘fiery rock dust cloud’ (from the Latin *igni-* (fire) and *imbri-* (rain)), formed as the result of immense explosions of pyroclastic ash, lapilli and blocks flowing down the sides of volcanoes. Or sometimes known as Welded Tuffs. An ignimbrite is the deposit of an extremely hot pyroclastic ash, such that the edges of fragments can be seen to weld together. This term describes how the rock is formed not the chemical composition of the rock. Ignimbrites can only form as a result of sub-aerial volcanic activity

Word	Meaning
	Ref 3. Ignimbrites can be Rhyolite, Rhyodacite or Dacite in composition. Sometimes the crystals can appear flat to show a flow effect but this is due to a layering of the material as the material compacts and presses down on the hot beds.
Indurated	Heat affected rocks that are harder than normal and maybe even partially melted and recrystallised.
Latite	Or Trachyandesite – Intermediate volcanic rock, between Trachyte and Andesite. Ref 3
pH	A measure of the degree of acidity or alkalinity expressed on a logarithmic scale of 1-14, on which 1 is most acid, 7 is neutral and 14 is most basic.
Plagioclase	A type of sodium and calcium feldspar.
Porphyry	Is an igneous rock with large crystals set in smaller crystals.
Quartz	Chemically SiO_2 this mineral is very resistant to weathering which allows it to be the most common mineral on the surface of the earth.
Rehabilitation	The restoration of a landscape and especially the vegetation following its disturbance.
Remnant vegetation	Native vegetation remaining after widespread clearing has taken place.
Rudite	A word derived from Latin word “Rudus” which means crushed stone, debris or rubble. This is a general term for a sedimentary rock composed of rounded or angular pebbles, cobbles and / or boulders. Rudites are mostly composed of siliciclastic gravel known as Conglomerates.
Sand	Are categorised as particles that range between 0.0625 mm to 2.00 mm. Ref 1. These can be made from quartz, limestone, feldspar, basalts, latites, organic particles and olivine. These deposits are found on beaches, dunes, rivers, glacial outwash and volcanic slopes.
Sediment	Material of varying sizes that has been or is being moved from its site of origin by the action of wind, water or gravity.
Sedimentation basin	An area where run-off is ponded to allow sediment to be deposited. The longer the period that run-off is held, the smaller the size of the sediment deposited. Such basins have to be cleaned regularly.
Silt	Are categorised as particles that range between 0.0625 mm to 0.0039 mm. Ref 1
Soil	That part of the upper weathered layer of the earth’s crust that can support plant growth. Any naturally occurring loose or soft deposit forming part of the earth’s crust and resulting from weathering or breakdown of rock formation or from the decay of vegetation.
Soil Texture Group	An important attribute of soils that affects the effectiveness of sediment retention structures is the proportion of particles finer than 0.02 mm. Particles that are finer than 0.02 mm are relatively difficult to trap in simple sediment retention basins, while those that are coarser are not.
Tuff	A pyroclastic ash, originated from volcanoes. Ref 3.
T – Tonnes	Weight measurement being 1000 kilograms.
Volcano	A vent or fissure in the Earth’s crust through which molten magma, hot gases and other fluids escape onto the Earths surface.
Waste	Includes any matter (whether liquid, solid, gaseous or radioactive) that is discharged, emitted or deposited in the environment in such volume, constituency, or manner as to cause an alteration to the environment.

References

1. Pettijohn F.J, Potter, P.E. and Siever R. 1972 Sand and Sandstone.
2. G.C. Luton and G.M Johnson 2001
3. Penguin Geology Dictionary, Whitten and Brooks 1982

Section 1. Introduction

1.1. Introduction

Martins Creek Quarry is situated on Lots 5 and 6 DP 242210. Daracon extract Andesite from this site to produce aggregates for concrete, road, armour rock and manufactured sand applications.

VGT Pty Limited was engaged by Daracon to evaluate the regional geology of the Martins Creek Quarry, and adjoining neighbours, in particular those found in View and Wayaka Streets (see *Figure One).* This is in response to a number of complaints regarding blast vibration.

The principal goals for this evaluation are:

1. Determine if there is any geological linkage between the Daracon quarry and the residents,
2. Determine if there is any other reason why the properties in this area could potentially be damaged.

Figure 1 – Neighbours and Quarry

1.2. Methodology

A site visit was undertaken on 22nd August 2014, where a regional inspection of the site was undertaken, and then a site visit of the quarry with John Collins, followed by a community meeting at the 27 View Street residence. After the meeting a geological mapping program was undertaken with the assistance of the residents, sample and photographs were taken.

A clay sample was taken at the rear of the 27 View Street residence for a shrink swell test to determine how reactive the clay is. This was tested by Qualtest Pty Ltd.

Section 2. Geology

2.1. Regional Geology

The site is underlain by Carboniferous volcanic and sedimentary sequences. The quarry is underlain by the Martins Creek Andesite, identified as "Clnm" on the geology map see *Figure 2*. This unit terminates in the vicinity of the railway line to the north and the where the overlying sequences of Cln (Newtown Volcanics) and Clnv (Vacy Ignimbrite Member) commence.

Figure Two below shows the Newcastle 1:100,000 geology sheet overlying the Google earth map.

Figure 2 – Geology and Air Photograph

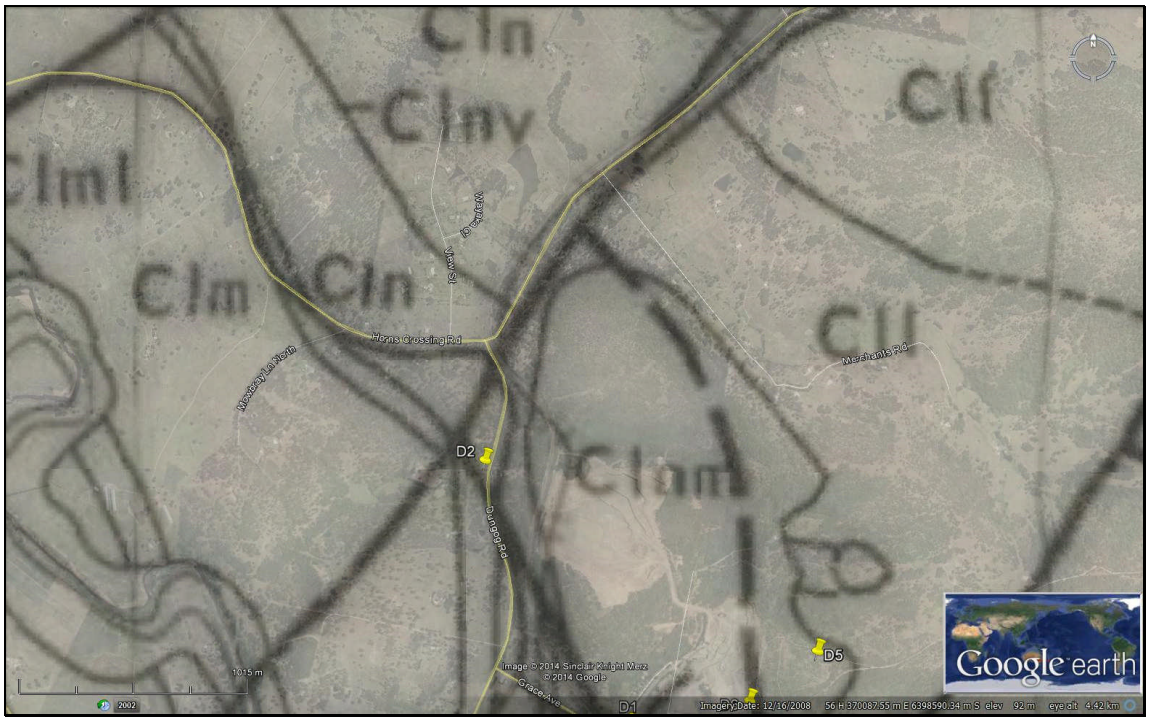


Figure 3 – Lithology codes for Carboniferous units for the Newcastle Geology Sheet

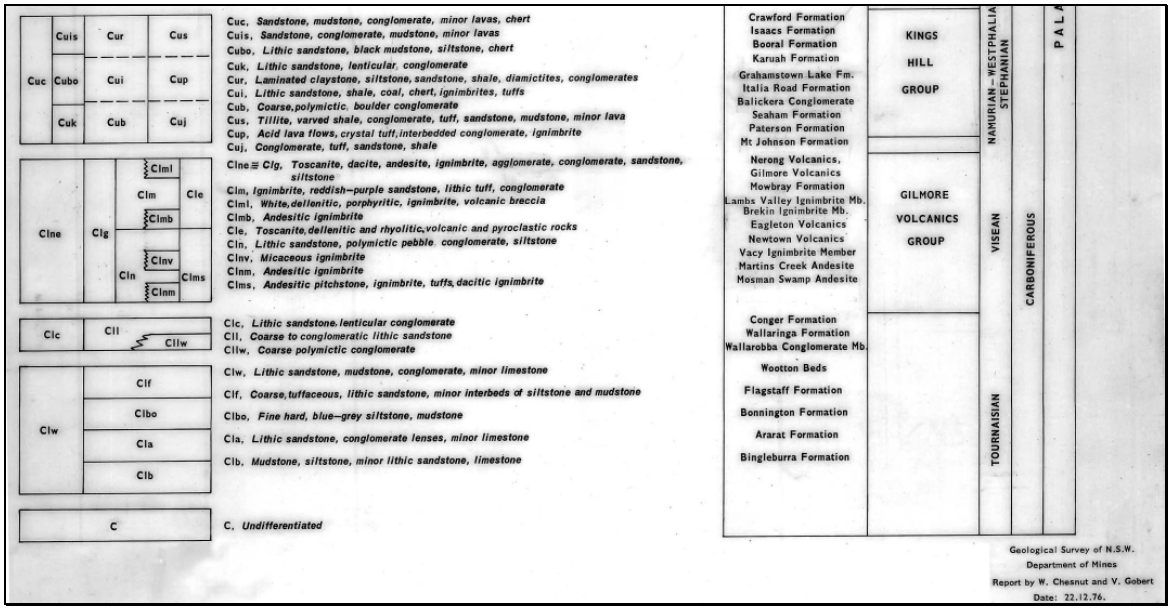


Figure 4 – Samples collected from Daracon Quarry and View Street

Samples below have been taken from the Daracon Quarry and View Street; the sample from 7 Wayaka Street was too small to be shown here.

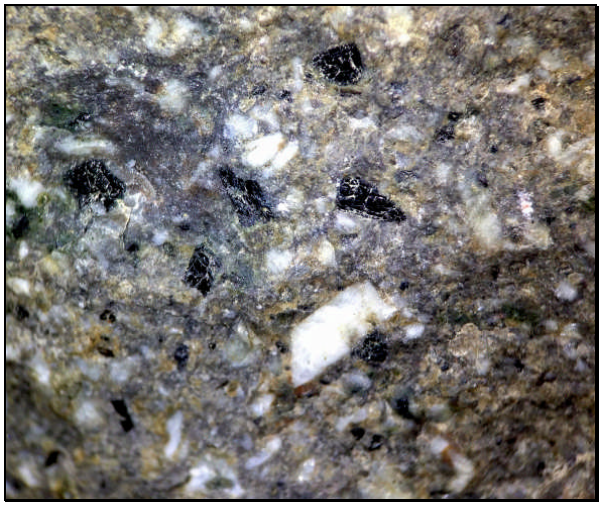
2.2. Quarry Geology

The quarry faces and floor is dominated by andesite rock. There are some exposures of underlying red sandstone and clay in parts of the quarry floor. This underlying sequence is most likely to be Cll the Wallaringar Formation.

Figure 5 – View of Daracon Quarry Floor and Faces

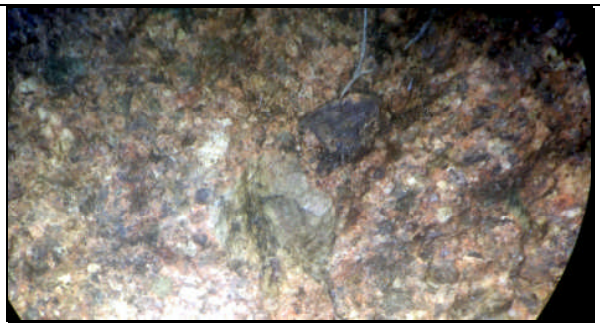
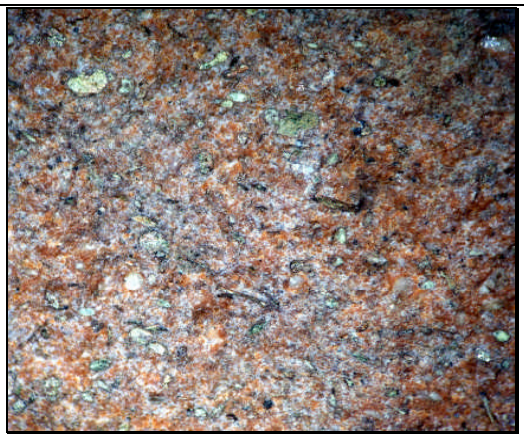
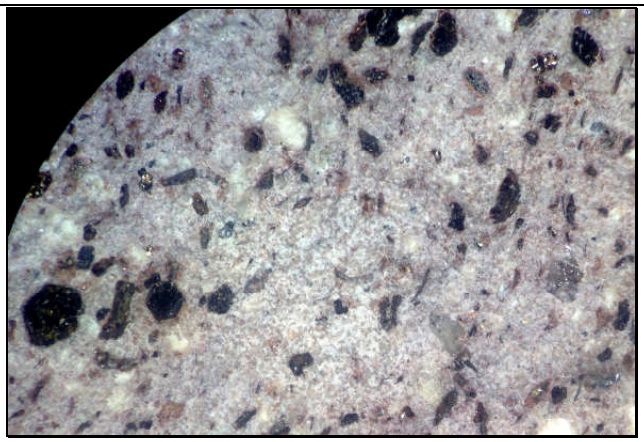
The petrological assessment of this rock has identified this as a Latite Tuff (see below sample). The large white rhombohedra crystal (plagioclase) is 3mm in length.

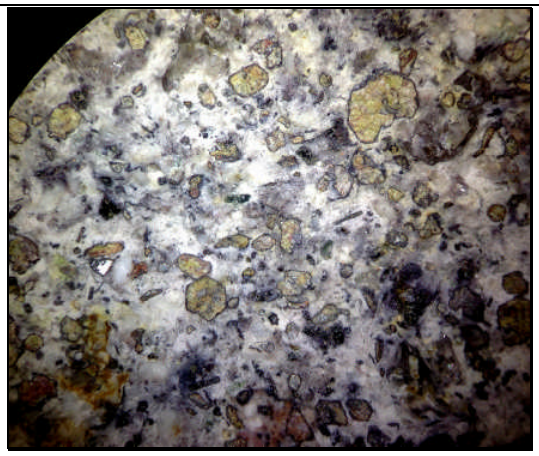
Figure 6 – Microscopic view of Latite Tuff



2.3. View and Wayaka Street Neighbourhood Geology

Mapping was undertaken with the assistance of neighbours.

Address	Rock type (visual VGT)	Rock description (visual VGT)
27 View Street	Altered Andesitic Ignimbrite?	Brown, coarse interlocking grains, brittle in hand
		
32 View Street	Pink volcanic porphyry	Pink ground mass with plagioclase crystals, hard.
		
55 View Street	Micaceous Ignimbrite?	Pink Grey Volcanic, with 10% sub-rounded mica clasts, hard.
		

Address	Rock type (visual VGT)	Rock description (visual VGT)
57 View Street (grey)	Grey volcanic Porphyry	White cream groundmass with altered inclusions, plagioclase and micaceous crystals, hard.
		
57 View Street (pink)	Pink volcanic porphyry, Rhyodacite?	Pink and cream groundmass, with quartz and plagioclase crystals
		

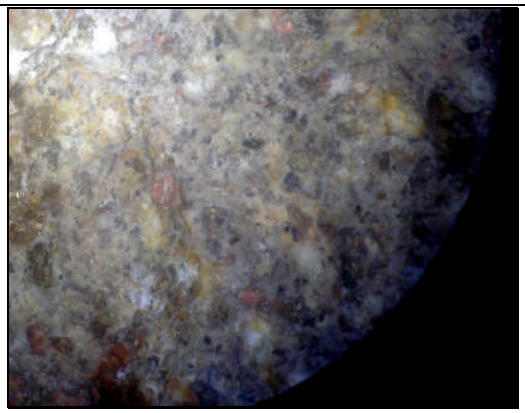
Address	Rock type (visual VGT)	Rock description (visual VGT)
58 View Street	Grey Volcanic Porphyry	Grey ground mass with plagioclase and quartz crystals
		
7 Wayaka Street	Pink Volcanic Porphyry	Pink cream ground mass with quartz and plagioclase crystals
		

Figure 7 – Sampling Locations

2.4. Geology Summary and Conclusion

This assessment sought to find any geological linkages between the Daracon Quarry and the neighbours in View and Wayaka Streets. The Newcastle 1:100,000 geology sheet shows that the quarry is situated on the Martins Creek Andesite and the neighbours to the north are located on the overlying sequences of Cln (Newtown Volcanics) and Clnv (Vacy Ignimbrite Member). A significant geological boundary is evident paralleling the railway line and Horns Crossing Road, between the Daracon Quarry and the residents in View Street (see *Figure Two*).

The samples found in View Street are of a volcanic nature, but are visually different to that found in quarry as seen in the hand specimens and under the microscope.

In conclusion, utilising the Newcastle 1:100,000 geological map and samples found on site there does not appear to be direct geological linkage, between the quarry and the residents.

Section 3. Community Discussions

Discussions with the locals brought the following items to the author's attention.

1. Why has blasting impacts increased in the last 18 months?

The drill and blast contractor changed from Orica to Precision Drill and Blast, around 2 years ago, this could be a reason but Daracon feel nothing significant has changed over this period of time.

2. Has the active quarry face moved closer to the houses?

The aerial photos from 2012 were reviewed and the blast face appears to have not moved closer to the houses.

3. Will the active face move closer?

This will be subject to the consent modification and the EIS

4. What depth is the quarry floor now?

The current floor level is 49m AHD

5. Has the quarry floor gotten deeper in the last 18 months?

No

Section 4. Clay Investigation

A clay sample was taken by VGT from the back yard of 27 View Street, see *Figure 7*, and this was tested at Qualtest Laboratories for shrink / swell to determine if the sub surface strata could cause cracking in the ground and potentially in the houses.

Figure 8 – Clay Sample Hole

The results of the test are found in Appendix A, shows that the clay has a moderate potential to crack during shrinkage, with a shrink swell index of 3.4. Discussion with Qualtest's Principal Alan Cullen, he noted that the result shows that the clay has a moderate to high potential to cracking when dry.

Surface cracking was found at the side of the road as seen by Peter Bellairs and Greg Thomson, at the location seen in Figure 7 and Figure 9 shows the typical cracks found at this location.

Figure 9 – Clay Surface Cracking

Section 5. Conclusion

Upon receiving complaints from residents alleging their houses were being damaged by blast vibration, Daracon engaged VGT to evaluate if there:

1. Is any geological linkage between the Daracon quarry and the residents, and
2. Is there any other reason why the properties in this area could potentially be damaged.

The geological assessment showed that there was no direct geological linkage between the quarry and residents, which may create a direct pathway for ground vibration.

The clay assessment of the area showed that there was surface cracking along View Street and the shrink swell test showed a moderate level of cracking during shrinkage.

Appendix A: Shrink Swell Index Report

QUALTEST Laboratory (NSW) Pty Ltd
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Shrink Swell Index Report

Report No: SSI:NEW14W-2079--S01
Issue No: 1

Client: VGT Pty Ltd
Unit 4/30 Glenwood Drive
Thornton NSW 2322

Principal:
Project No.: NEW14P-0091
Project Name: 27 View Street, Vacy

Accredited for compliance with ISO/IEC 17025
NATA WORLD RECOGNISED ACCREDITATION
Approved Signatory: Alan Cullen
(Principal Geotechnician)
NATA Accredited Laboratory Number18686
Date of Issue: 10/09/2014

Sample Details

Sample ID:	NEW14W-2079--S01	**Client Sample ID:**	-
Test Request No.:		**Sampling Method:**	Sampled by Client
Material:	BH1	**Date Sampled:**	25/08/2014
Source:	On-Site	**Date Submitted:**	25/08/2014
Specification:	No Specification		
Project Location:	Vacy, NSW		
Sample Location:	27 View St, Martins Creek		
Borehole Number:	TP1		
Borehole Depth (m):	0.05 - 0.35m		

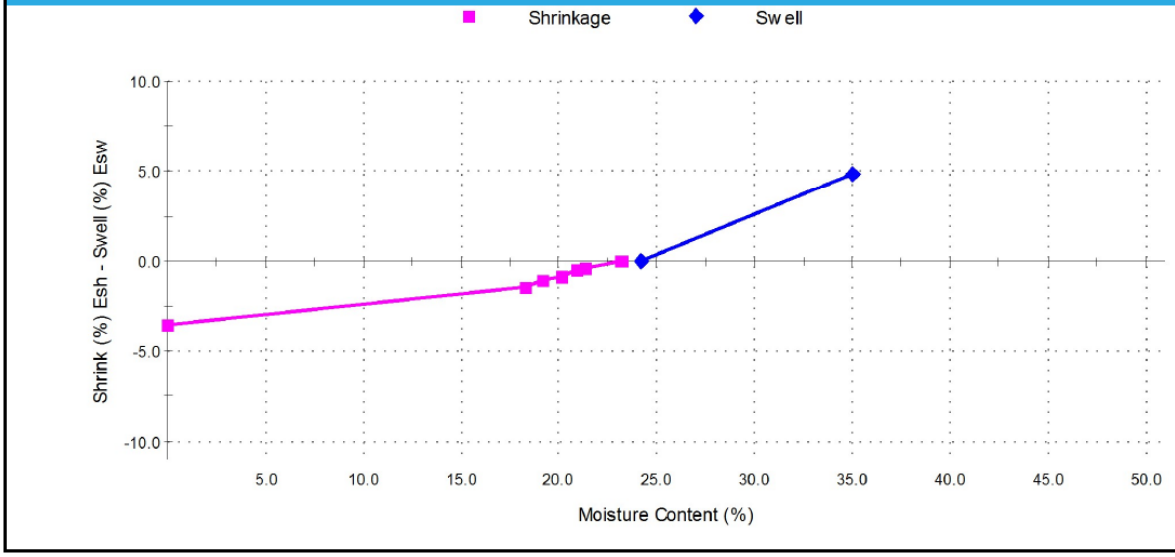
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	4.8
Moisture Content before (%):	24.2
Moisture Content after (%):	35.0
Est. Unc. Comp. Strength before (kPa):	400
Est. Unc. Comp. Strength after (kPa):	100

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	3.6
Shrinkage Moisture Content (%):	23.2
Est. inert material (%):	3%
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 3.4

Comments