BEFORE	An Independent Commissioner appointed by Tasman District Council
IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of an application by CJ Industries Ltd for land use consent RM200488 for gravel extraction and associated site rehabilitation and amenity planting and for land use consent RM200489 to establish and use vehicle access on an unformed legal road and erect associated signage

EVIDENCE OF FRANKLIN SAAVEDRA FOR CJ INDUSTRIES LIMITED (CONCRETE ENGINEERING)

19 December 2022

1. INTRODUCTION

1.1 My full name is Franklin Andalicio Saavedra Aravena.

1.2 I am an independent consultant, based in Australia. I provide technical services to CJ Industries since 2017 in the concrete manufacturing field and I act as a plant engineer in accordance with NZS3104:2021 *Specifications for Concrete Production*. I oversee specifications of concrete manufacture, mix design, raw materials (cement, aggregates and admixtures) and I represent CJ Industries in the industry body ConcreteNZ. I assist CJ Industries to maintain its plant certification under the plant audit scheme (PAS) run by ConcreteNZ. I am registered under the Registered Engineering Associate (REA) since 2005. My registration number is #5790.

1.3 In this statement, I provide evidence in relation to the required specifications for rock used to produce concrete, and implications of using a hard rock source.

2. QUALIFICATIONS AND EXPERIENCE

2.1 I hold a National Diploma in Civil Engineering Level 6 awarded by Universidad Santa Maria, Chile in 1998. This diploma was assessed by New Zealand Qualification Authority on December 2004 certificate number # 101098.

2.2 I hold a Certificate in Concrete Technology and Construction awarded in 2008 by the City and Guild of London Institute.

2.3 I hold a Post-Graduate Diploma in Business awarded in 2014 by the University of Auckland.

2.4 I have 24 years of experience in the concrete & aggregate, cement and building industry in New Zealand and overseas. I worked 14 years in the concrete & aggregate industry in New Zealand. I worked for 10 years for one of the largest supplier of cement, concrete and aggregate. In my role as a Technical Engineer, I oversee the quality of concrete plants located in Auckland and Waikato including the quality of a hard rock quarry located in South Auckland.

2.5 I am an active member of the Victoria Technical Committee of the Cement & Concrete Aggregate Australia (CCAA).

2.6 Currently, I am based in Australia and I work in the cement and concrete industries in both New Zealand and Australia. I am qualified to act as a plant engineer in accordance with NZS3104:2021 Section 1.3

3. CODE OF CONDUCT FOR EXPERT WITNESSES

3.1 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014 and I agree to comply with it. My evidence is within my area of expertise, however where I make statements on issues that are not in my area of expertise, I will state whose evidence I have relied upon. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in my evidence. I acknowledge that I am not fully independent due to my contract for services with CJ Industries.

4. EVIDENCE

4.1 Particle shape: Alluvial aggregate provides a source of coarse rounded aggregate. This shape assists in reducing the water content in the concrete mix in the range of 10% to 15%. The particle shape has an influence on the workability of freshly mixed concrete, and hence may affect both the water demand and the water cement ratio (Cement and Concrete association of New Zealand and Standard New Zealand, 1999). By reducing the water content the overall water/cement ratio is reduced so it is possible to use less cement in the concrete mix and achieve the same strength of a crushed aggregate.

4.2 Cement is one of the largest sources of CO_2.. Approximately, 900 kg of CO_2 is emitted to the atmosphere per tonne of cement (Emad et al 2013). By using alluvial aggregate it is possible to reduce the cement content and contribute to the long-term sustainability target of the concrete and cement industry in New Zealand (Reference 3.0)

4.3 The current aggregate alluvial source provides a consistent concrete performance which is possible to use it for all type of applications including infrastructure work. From the mechanical property perspective, a consistent and proven source of aggregate is needed to supply for the building industry in New Zealand.

4.4 CJ Industries' Motueka plant exhibits a low coefficient of variation which is mainly due to the consistent aggregate source that CJ Industries uses to manufacture concrete. The current source of aggregate has demonstrated to be a proven material over the last 5 years.

4.5 The attached petrographic report on a coarse aggregate sampled from the Motueka river states that the river gravel is suitable for concrete manufacturing and is predicted to be durable. Recommendations are considered to be taken into account with appropriate mix and engineering (report #G2111502 attached).

4.6 In contrast, aggregate sourced from a hard rock quarry is mainly crushed aggregate in nature which requires a higher water/concrete content.

5. REFERENCES

New Zealand Guide to Concrete Construction, Section 3.8 *Joint publication of the Cement and Concrete association of New Zealand and Standard New Zealand. First published 1999 TM 35 NZPM 3100:1999*

Emad et al (2013) Journal of cleaner production, Vol. 51, pages 142-161
https://www.sciencedirect.com/science/article/abs/pii/S0959652612006129

Sustainability (concretenz.org.nz) , Introduction (concretenz.org.nz)

Franklin Saavedra

19 December 2022

Attachment 1.0: Petrographic report on a coarse aggregate sample (#2) from Motueka River aggregate

GEOCHEMPET SERVICES

ABN 25 065 630 506
PETROGRAPHIC, GEOLOGICAL & GEOCHEMICAL CONSULTANTS

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Clontarf, QLD 4019

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www.geochempet.com

PETROGRAPHIC REPORT
ON A COARSE AGGREGATE SAMPLE (#2)
FROM MOTUEKA RIVER GRAVEL

Prepared for

CJ INDUSTRIES LTD
MOTUEKA, NZ

Purchase Order: N/A

Invoice Number: G2111502

Client Ref: Tim Corrie-Johnston

Issued by

K. E. Spring B.Sc.(Hons), MAppSc
4 November, 2020

GEOCHEMPET SERVICES BRISBANE

Sample Number: #2 Coarse Aggregate — **Date Sampled**: 21/09/2020

Product Type: River Gravel — **Date Received**: 21/09/2020

Sample Source: Motueka River

Work Requested: Petrographic analysis in relation to suitability for use as concrete aggregate; petrographic assessment of potential for alkali-silica reactivity

Methods Account taken of ASTM C295 *Standard Guide for Petrographic Assessment of Aggregates for Concrete*, the AS2758.1 – 2014 *Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B)*, the AS1141 *Standard Guide for the Method for sampling and testing aggregates* and of the content of the 2015 joint publication of the Cement and Concrete Association of Australia and Standards Australia, entitled (HB79-2015) *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*

Identification Pebbles of meta-greywacke and minor other rock types

Description

The sample consisted of fairly clean, rounded, sub-rounded and platy, obviously water-worn, hard and robust pebbles. The most common colours are light to medium-grey. Most pebbles are densely but finely crystalline; a few percent of the pebbles carry some weathering pores.

Plate 1. Photograph of Motueka River gravel sample.

A sliced subsample of nineteen random fragments was incorporated in two thin sections to permit identification and detailed microscopic examination in transmitted polarised light.

Metamorphic Rock Fragments (73%)

47% meta-greywacke pebbles (12% moderately-strained quartz; 3% finely microcrystalline quartz)
16% quartz meta-sandstone pebbles (13% quartz)
10% mica-quartz schist (7% quartz)

Basic and Ultramafic Fragments (27%)

16% peridotite
11% basalt pebbles

The pebbles consist of meta-greywacke and related meta-siltstone with variations in composition and alteration. In essence, the pebbles display numerous tightly packed, angular to sub-rounded, poorly sorted, lithic clasts and mineral grains of sand and silt size dispersed through a finely quartzo-feldspathic murky matrix that is variably altered to mainly epidote and chlorite. The lithic fragments are dominantly of volcanic type, including intermediate volcanic rock (probably partly epidotized and chloritized andesite) and devitrified and sericitized acid welded tuff/acid volcanic rock. The mineral clasts are plagioclase (variably sericitized), angular and equant mildly to less commonly moderately stained quartz (former phenocryst or phenoclasts) and sparse grains of wholly or partly leucoxenized opaque oxide. There are also noticeable biotite and less commonly muscovite flakes which appear to be detrital in origin. Within the thin interstitial spaces, the murky matrix contains silt grains of quartz and feldspar, now devitrified to finely microcrystalline feldspars and quartz (finer than 0.01 mm); finer components have recrystallized to chlorite, leucoxene and epidote. The rock is partly cemented by epidote and chlorite, but its induration seems to be attributable mainly to interlocking of the margins of very finely recrystallized lithic clasts. Irregular fracture veins are composed of quartz, epidote, chlorite and sericite. These pebbles are considered to be in an essentially hard and strong condition.

The sectioned meta-sandstone pebbles are robust, non-friable, non-porous rock with moderately or well sorted arenaceous textures and tight cementation. Grain sizes vary from one fragment to another but are regarded as metamorphosed quartz-rich sandstone. The most abundant detrital grains are mainly mildly to moderately strained quartz. Labile components comprise feldspar grains. There are also some detrital heavy mineral grains, including mica, zircon, rutile and ilmenite. Most commonly the sandstone has been tightly cemented by substantial quartz overgrowths, supplemented by sericite, chloritized biotites and limonite. These pebbles are considered to be in a hard and strong condition.

The unsectioned pebbles of schist are considered to consist mainly of quartz and muscovite mica occurring as flakes which is largely concentrated along foliation as well as slim flakes of biotite mica subtly aligned along foliation. Equant grains of unstrained to faintly strained quartz and minor finely clouded or sericitized feldspar collectively amount to about a half of the rock. These pebbles are considered to be in an essentially hard and strong condition.

The sectioned pebbles of finely crystalline, igneous textures of basaltic and ultrabasatic style are regarded to be hard and robust. The main framework of the rock is formed by small clinopyroxene and orthopyroxene grains and laths of plagioclase feldspar, accompanied by interstitial grains of generally smaller mafic minerals, which are now leucoxenized. In the groundmass, the small grains of clinopyroxene (titanaugite) are fresh or altered to actinolite. The orthopyroxene appears to be rim-altered to brown smectite clay. The plagioclase feldspar grains are mostly twinned laths partly altered to fine epidote. Opaque oxide grains are now altered to sphene. These pebbles are considered to be in a hard and strong condition.

The sectioned pebbles of ultramafic rock are dominated by hornblendes or pyroxenes and can be described as hornblendites or pyroxenite. The pyroxenite consist of clinopyroxene and orthopyroxenes occurring as anhedral grains along with epidote and amoeboidal grains of opaque oxides (probably chromite). The hornblendites are composed of prisms of green hornblende along with epidotized and sericitized plagioclase grains. These pebbles are considered to be in a hard and strong condition.

Comments and Interpretations

The supplied river gravel shingle aggregate (labelled #2) from Motueka River is interpreted to represent river shingle containing water-worn pebbles of meta-greywacke, related metamorphosed quartz sandstone and quartz-mica schist along with minor other rock types of ultramafic and ultrabasic composition.

For engineering purposes, the supplied sample may be summarised as consisting of:

- water-worn pebbles
- **47% of which are meta-greywacke pebbles** in an essentially hard, strong and durable condition
- **16% of which are quartz meta-sandstone**, in a hard, strong and durable condition
- **10% of which are quartz-mica schist** in an essentially hard, strong, durable condition
- **16% of which are altered peridotite** in a hard, strong, durable condition
- **11% of which are altered basaltic rock** in an essentially hard, strong and durable condition

Overall, the pebbles are predicted to be **durable**.

The pebbles are predicted to have **potential for mild or slow deleterious alkali-silica reactivity in concrete** because it contains about 3% finely microcrystalline quartz and 12% of moderately strained quartz (in pebbles of meta-greywacke).

Thus, aggregate of the type represented by the supplied sample is predicted to be **suitable for use in concrete** provided that appropriate precautions are taken in mix and engineering design to take account of a perceived potential for deleterious alkali-silica reactivity.

Guidance on appropriate precautions can be obtained from the 1996 joint publication of the *Cement and Concrete Association of Australia* and *Standards Australia*, entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia.*

Free Silica Content

About 35%.

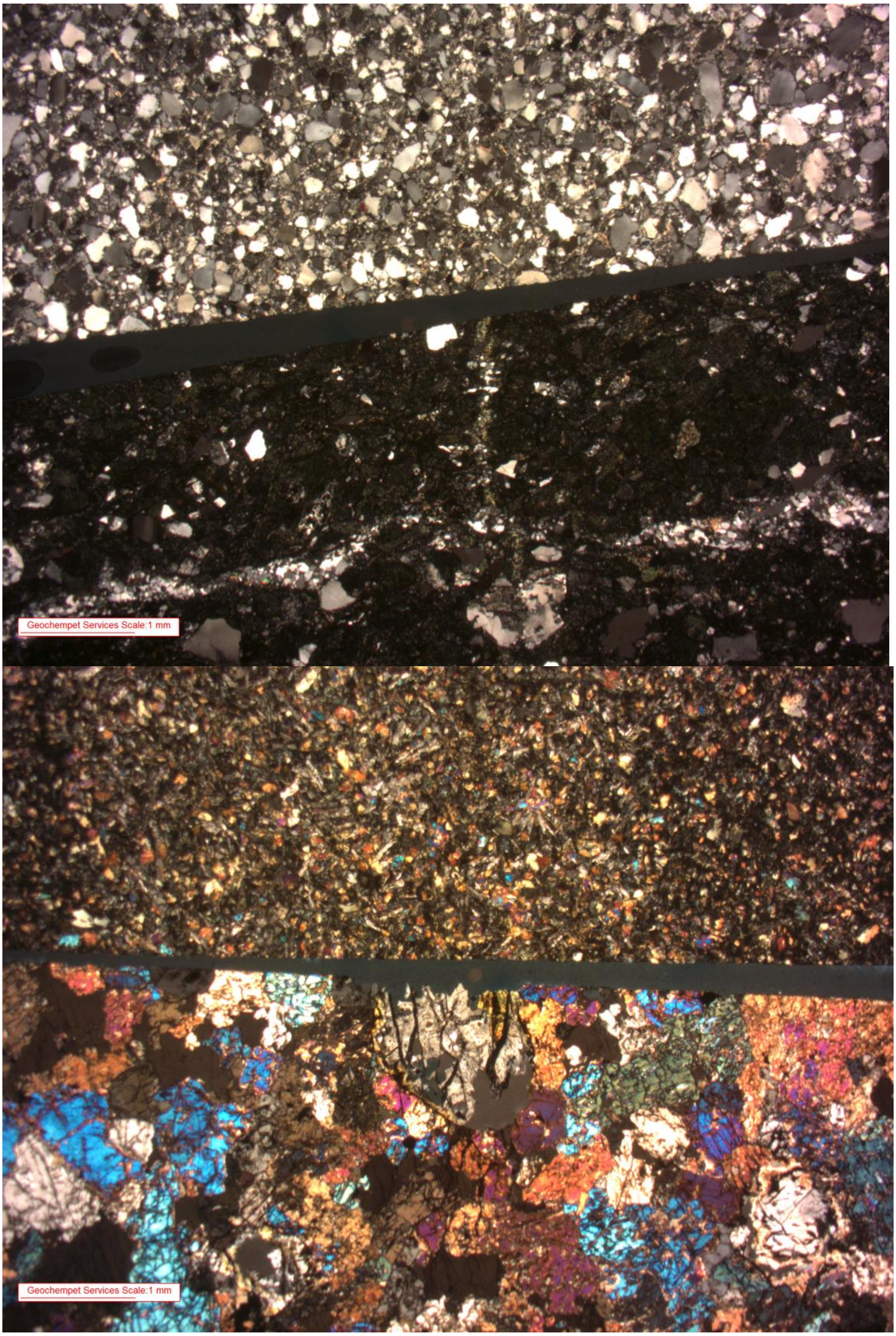

Plate 2. Low magnification, cross polarised transmitted light view of 4 slices of different rock types in the supplied river gravel sample. From top to bottom, the rock types are quartz meta-sandstone, meta-greywacke, basalt and pyroxenite.