Marrangaroo Quarry
Product Technical Guide - 2022

PRODUCTS *Other Products May be Available Upon Request	***PERFORMANCE INFORMATION*** **The information provided below is to be used as a basic guide only. For current test data or information relating to specific construction specifications, please contact Marrangaroo Quarry on (02) 63 514209*	
20mm Roadbase	• Densely Graded 20mm Minus • Mis-shapen Particles ≤ 35% • Aggregate Wet Strength ≥ 100kN • Wet / Dry Variation ≤ 35%	• Maximum Dry Compressive Strength ≥ 1.7 MPa • Plasticity Index ≤ 6 • California Bearing Ratio ≥ 80
20mm Subbase	• Densely Graded 20mm Minus • Mis-shapen Particles ≤ 35% • Aggregate Wet Strength ≥ 70kN • Wet / Dry Variation ≤ 35%	• Maximum Dry Compressive Strength ≥ 1.0 MPa • Plasticity Index ≤ 10 • California Bearing Ratio ≥ 30
40mm Subbase	• Densely Graded 40mm Minus • Mis-shapen Particles ≤ 35% • Aggregate Wet Strength ≥ 70kN • Wet / Dry Variation ≤ 35%	• Maximum Dry Compressive Strength ≥ 1.0 MPa • Plasticity Index ≤ 10 • California Bearing Ratio ≥ 30
Select Fill	• Densely Graded 40mm Minus • California Bearing Ratio ≥ 33 (100% Standard Compaction)	• Maximum Dry Compressive Strength ≥ 2.0 MPa • Plasticity Index ≤ 15
General Fill	• Graded Fill • California Bearing Ratio ≥ 8 (100% Standard Compaction)	• Plasticity Index ≤ 25
Concrete Aggregates (mm) (20 Graded) (20/14) (10) (7) (5mm Minus Manufactured Sand)	• As per AS2758.1 Guidelines • Suitable for Exposure Categories A1, A2, B1, B2 and C.	• Test Reports Can be Provided Upon Request
Rail Ballast	• Graded - 100% Passing the 63mm Sieve • < 2% Passing the 13.2mm Sieve. • Mis-shapen Particles ≤ 30% • Flakiness Index ≤ 30%	• Aggregate Crushing Value ≤ 25% • Wet Attrition Value ≤ 6% • LA Value ≤ 25 • Particle Density ≥ 2.5t/m³
Gabion / Hammered Rock	• Gabion = 200mm - 75mm • Hammered Rock = 500mm - 300mm • Wet Strength ≥ 100kN • Wet / Dry Variation ≤ 35%	

Marrangaroo Quarry is a Quartzite based source. Petrographic information provided in the report below.

Petrographic Report 2021

Our Ref M31508 P21-2019

Contact Trudie Bradbury

19 February 2021

Macquarie Geotech
3 Watt Drive
Bathurst, NSW 2795

Attention: Mark Dawson

Dear Mark,

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PETROGRAPHIC ANALYSIS OF COARSE AGGREGATE – METROMIX QUARRIES MARRANGAROO.

SAMPLE IDENTIFICATION

CLIENT	Metromix
SAMPLE DESCRIPTION	20mm Graded
PROJECT NAME	Material Assessment- 12 monthly
SOURCE	Metromix Quarries Marrangeroo
SAMPLE REFERENCE	B65433
DATE SAMPLED	20/1/21
SAMPLED BY	J Ward

SUMMARY

One sample was submitted for petrographic analysis to determine suitability for use as concrete aggregate, and to petrographically assess the potential for alkali-silica reactivity.

The sample was assessed with reference to (NATA accredited):

- AS 1141.65-2008: Alkali aggregate reactivity – Qualitative petrological screening for potential alkali-silica reaction;
- ASTM C295: Standard Guide for Petrographic Examination of Aggregates for Concrete;

The following standards and guidelines are also referenced (non-NATA accredited)

- AS1726: Geotechnical Site Investigation;
- HB79-2015: Alkali Aggregate Reaction – Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia; and
- Test method T276: Foreign materials content of recycled crushed concrete.

The mineralogy present in the thin section and the hand specimen indicates that the sample should be classed as a **QUARTZITE** with reference to the *Recommendations of the International Union of Geological Sciences Subcommission on the Systematics of Metamorphic Rocks*: A rock very high in quartz derived from metamorphism of a protolith. The source rock has a mineralogy which may be representative of a sedimentary origin and the rock may also be referred to as para-quartzite.

APPROVED SIGNATORY

Trudie Bradbury - Analyst
NATA Accreditation Number
910 Mackay Laboratory

Based on the guidance given by the referenced documentation and the assessment undertaken by a qualified and experienced petrographer, the sample is considered to be:

- Innocuous in relation to alkali-silica reactivity;
- Free from asbestiform minerals;
- Fresh with reference to AS1726;
- Durable;
- Petrographically suitable for use as a concrete aggregate.

The sample as inspected is therefore deemed petrographically suitable for the uses listed above providing the durability and other inherent properties are assessed by mechanical and / or chemical testing

SPECIMEN DESCRIPTION

The sample comprises approximately 2.5kg of grey, orange and brown rock of mainly fine grain size and tending to be opaque. The clasts appear to be mainly tabular to platy, with a small amount being elongate. The clasts are highly resistant to crushing under finger pressure, even clasts of high aspect ratio cannot be broken, and the edges cannot be abraded when ground against each other. Clasts cannot be scratched with a steel point.

Under magnification with a 10x loupe the majority of the clasts comprise almost entirely of quartz. The clasts show several textures, with the majority being rough and opaque; while other clasts have a smoother, though not glassy appearance; there does not appear to be a tendency for conchoidal fracture to be developed. Minor iron oxides can be seen which tend to influence the colour of the specimen.

There is no suggestion of a laminar fabric in the clasts nor any obvious orientation of the minerals, though the elongation of many of the clasts may be related to pressure-orientation during lithification.

In hand specimen, the sample appears to contain minimal open voids.

Overall the sample appears clean with little fine material present, which is likely a by-product of the crushing process.

Representative sample of aggregate as delivered

Weathering was present only in the form of orange discolouration along some of the faces. Overall the sample does not appear to be deleteriously weathered though there are variations in colour due to presence of iron oxides.

PETROLOGICAL DESCRIPTION

A thin section was prepared of a representative sample of aggregate for examination in transmitted light through a polarizing microscope. 100 random points were examined.

The sample comprises largely of quartz, though there is some variation in the amount of other minerals throughout the sample. Grain size is fairly consistent and tends to be fine to medium – though not cryptocrystalline or glassy - there is little indication of fining cycles or similar structures inherited from the protolith.

The sample shows recrystallisation and formation of a welded metamorphic framework, apparently derived from a fine grained, quartz-rich source rock, likely sandstone. Grains are generally intergrown with welded boundaries, occasionally showing triple junctions but mainly uneven sutured edges which occasionally show pressure nucleation, and occasionally secondary quartz overgrowth in optical continuity with the grains.

Few minerals other than quartz are present: between the grains is commonly found remnant lithic fragments which are often heavily replaced with sericite. The lithics are otherwise too fine grained to determine their composition under optical examination. Iron oxide is sometimes present as distinct crystals, and occasional zircons are also seen. These minerals, however, comprise a very small portion of the sample and are in minor amounts overall.

Small vapour bubbles and occasional pores are also contained in the quartz but these are neither of the size nor abundance to have any detrimental effect on the strength of the sample.

The rock does not appear to have been subjected to particularly strong regional pressures, and there is no readily identifiable pressure structures or alignment of the component minerals..

Overall there is little indication of weathering – no staining or degradation of the component minerals is present in the sample observed, though the fine minerals give a slight colour cast to some of the clasts.

Straining is minimal. Occasional crystals show a degree of stringing but these appear to have been affected before the rock was lithified. Generally the component parts of the rock are unstrained.

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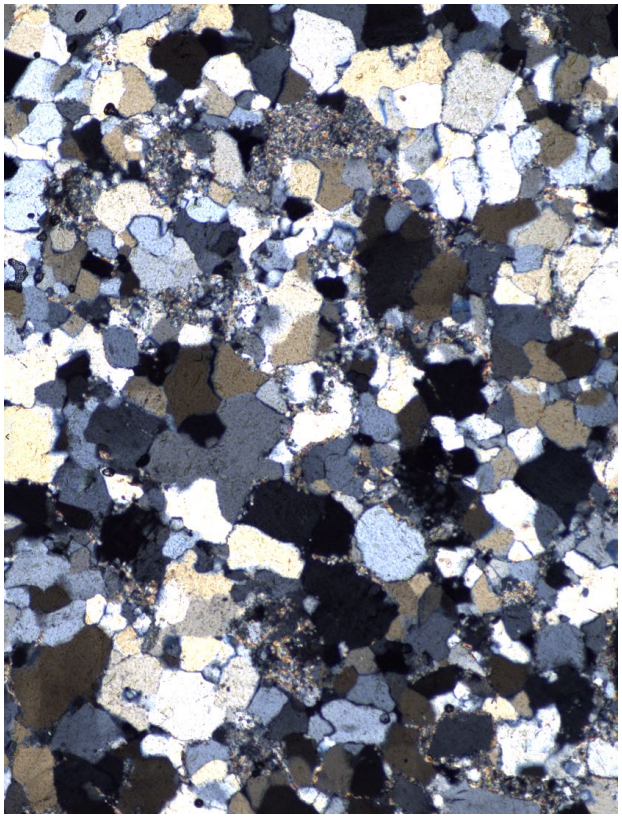
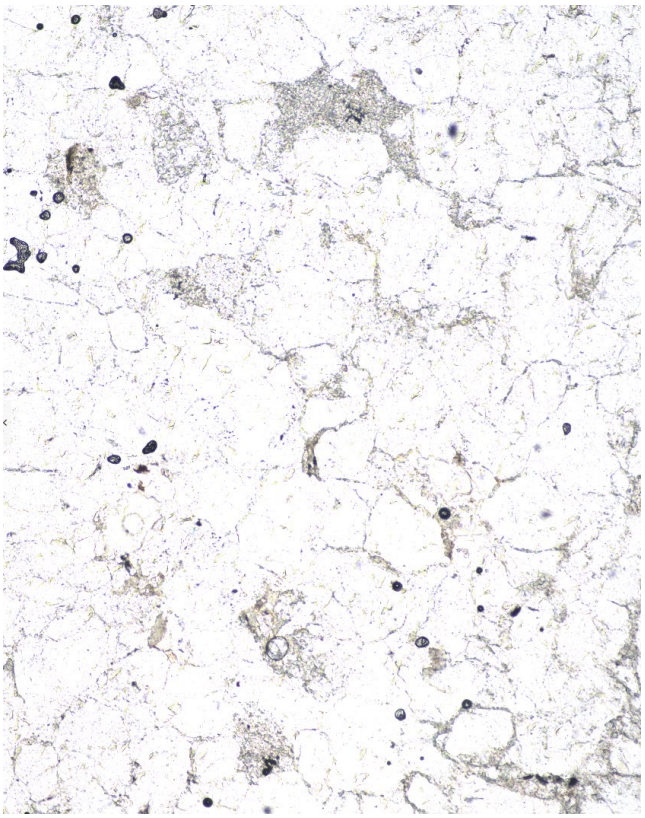


Picture shows mainly quartz; here the material is largely small and intergrown, and not particularly strained. Fine lithics with sericite also present. Cross polarised light, 100x magnification



Under plane polarised light the discolouration of the lithics can be clearly seen. Plane polarised light, 100x magnification

POINT COUNT

A point count of 100 points was undertaken with reference to AS 1141.26-2008. Methods for sampling and testing aggregates. Metamorphic minerals are considered primary in this context. The results of the point count are tabulated below:

Primary Minerals	Count number, %
Quartz, unstrained	87
Quartz, strained	4
Fine lithics	3
Other (zircon, iron oxide)	2
Mineral Count	**96**

Secondary Minerals	Count number, %
Sericite	2
Mineral Count	**2**

Voids (not including those infilled with secondary minerals). Based on point count results.

Voids	Count number, %
Pores	2
Void Count	**2**

An assessment on the percentage of minerals likely to be non-durable is given (based on the point count results).

Soft, Weak or Non-Durable Minerals	Count number, %
Sericite	2
Mineral Count	**2**

ASBESTOS MINERALS

Asbestos can be defined on the basis of two critera, both of which must be met simultaneously: that is, a defined asbestos mineral and the presence of that mineral in an asbestiform habit. Based on the observable minerals in the thin section, the sample is considered **FREE FROM ASBESTOS MINERALS**.

ALKALI-SILICA / ALKALI CARBONATE REACTIVITY POTENTIAL (ASR / ACR)

The sample contains almost entirely quartz, though there is only a minor amount of strained quartz (defined by AS1141.65 as less than 5%). Therefore the specimen is assessed as being **INNOCUOUS IN RELATION TO ALKALI SILICA REACTIVITY**. There may be some variation in the source and other areas may show higher levels.

No carbonates were observed in the sample. It is therefore assessed as being **INNOCUOUS IN RELATION TO ALKALI CARBONATE REACTIVITY.**

FREE SILICA CONTENT

The free silica content (total free quartz in vein and groundmass) is estimated at around 91%. This may be variable depending on local variations in the rock.

WEATHERING

There does not appear to be any particular degree of weathering in the rock. A very small amount of iron staining is observed and discolouration on some of the faces, and few weak secondary minerals are observed. With reference to AS1726 -2017, table 20, overall the rock shows virtually no signs of decomposition in hand specimen, and only some mineral replacement in thin section and can therefore be considered **FRESH.**

DURABILITY AND SUITABILITY

The sample does not appear to have any layering or inter-connected weak minerals that would deleteriously affect the durability of the rock. There were not any deleterious minerals observed, and the small amount of vapour-filled bubbles and pores are surrounded by an interlocked mineralogical framework and are only very minor in occurrence.

The specimen, as presented is assessed petrologically as having the durability for concrete aggregate, subject to adequate performance in the physical durability tests.

The high quartz content and sometimes smooth and near-glassy appearance of the sample may mean there is a higher risk of bitumen stripping. Testing is recommended if this a proposed use.

LIMITATIONS

The analysis is based on a single sample and thin section taken from that sample, it may not be representative of the sample mass as a whole and inspection of the source should be undertaken to further qualify the suitability of the aggregate for the intended use. Comments are general and may be superseded by material specification. If a specification exists further advice may be sought from a mineralogist to ensure compatibility.

Yours faithfully

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