


**Boral Construction Materials  
Materials Technical Services**

 Unit 4, 3-5 Gibbon Road  
 Baulkham Hills NSW 2153 Australia  
 PO Box 400, Winston Hills NSW 2153

T: +61 (02) 9624 9900

F: +61 (02) 9624 9999

www.boral.com.au

**TEST REPORT**

CLIENT: P.F. Formation

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2017

TEST METHOD: i) AS1141 – Methods for Sampling and Testing Aggregates

FILE NO: 250/17

ii) RMS – Materials Test Methods Vol. 1

REQUEST NO: 74869

iii) ASTM D7428, Standard Test Method for Resistance of Fine Aggregate to Degradation by  
Abrasion in the Micro-Deval Apparatus.SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7<sup>th</sup> November 2014

Sample Description:		Coarse Sand	
Location:		Maroota Quarry	
Date Sampled:		5.9.17	
Laboratory Sample No:		196273	
Test Method:	Test:	Spec:	Results:
AS1141.11.1*	% Passing A.S. Sieve		
	9.5mm	100*1	
	6.7mm	-	100
	4.75mm	90-100	99
	2.36mm	60-100	92
	1.18mm	30-100	77
	600 micron	15-100	49
	425 micron	-	35
	300 micron	5- 50	21
	150 micron	0- 20	3
AS1141.12	Material finer than 75 micron (%)	0- 5	1
AS1141.4	Uncompacted Bulk Density t/m <sup>3</sup>		1.57
	Compacted Bulk Density t/m <sup>3</sup>	Min. 1.2	1.68
AS1141.5	Particle Density (Dry) t/m <sup>3</sup>	Min. 2.1	2.62
	Particle Density (SSD) t/m <sup>3</sup>		2.63
	Apparent Particle Density t/m <sup>3</sup>		2.65
	Water Absorption (%)	Max. 2.0	0.4
AS1141.24	Sodium Sulphate Soundness (Total Weighted % Loss)	Max. 6	0.3
	Fraction tested :		
	-4.75mm+2.36mm (% Loss)		1.0
	-2.36mm+1.18mm (% Loss)		0.6
	-1.18mm+600 µm (% Loss)		0.1
	-600 µm +300 µm (% Loss)		0.1

\*Sample washed over 75 micron sieve as per AS1141.11.1 Clause 5.6.

\*1 As per Fine Aggregate – Recommended Gradings (Table B2), AS2758.1

Page 1 of 2



Approved Signatory

Kamal Ali

Date 19.10.17 Serial No. 161800

Accredited for compliance with ISO/IEC 17025

NATA Accredited Laboratory

Number: 547


**Boral Construction Materials  
Materials Technical Services**

 Unit 4, 3-5 Gibbon Road  
 Baulkham Hills NSW 2153 Australia  
 PO Box 400, Winston Hills NSW 2153

 T: +61 (02) 9624 9900  
 F: +61 (02) 9624 9999

[www.boral.com.au](http://www.boral.com.au)
**Page 2 of 2**
**TEST REPORT**

CLIENT: P.F. Formation

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2017

TEST METHOD: i) AS1141 – Methods for Sampling and Testing Aggregates

FILE NO: 250/17

ii) RMS – Materials Test Methods Vol. 1

REQUEST NO: 74869

iii) ASTM D7428, Standard Test Method for Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.

SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7th November 2014

Sample Description:		Coarse Sand	
Location:		Maroota Quarry	
Date Sampled:		5.9.17	
Laboratory Sample No:		196273	
<b>Test Method:</b>	<b>Test:</b>	<b>Spec:</b>	<b>Results:</b>
AS1141.34	Organic impurities other than sugar The colour assessment was made visually using coloured reference glass	Not darker than std.	Pass
AS1141.33	Silt Content (%)		5
RMS T279	Method of Determining Voids Content % Voids The Mean Flow Time (Sec.)		42.4 23.4
ASTM D7428	Micro-Deval Abrasion Test % Loss The % loss of the control aggregate tested closest to the time at which the sample was tested = 19.2		4.9
RMS T262	Moisture Content (%)		2.5
AS1141.25.3	Degradation Factor Fine Aggregate The wash water after using permitted 500ml was:		99 Clear

Sample submitted by client

J. Graham, QC File, File



**Boral Construction Materials  
Materials Technical Services**

Unit 4, 3-5 Gibbon Road  
Baulkham Hills NSW 2153 Australia  
PO Box 400, Winston Hills NSW 2153

T: +61 (02) 9624 9900  
F: +61 (02) 9624 9999

www.boral.com.au

**Method for Determining Voids Content - Flow Time**

**RMS T279 - OCT. 2012**

CLIENT: P.F. Formation

FILE NO: 250/17

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2017

LAB SAMPLE NO: 196273

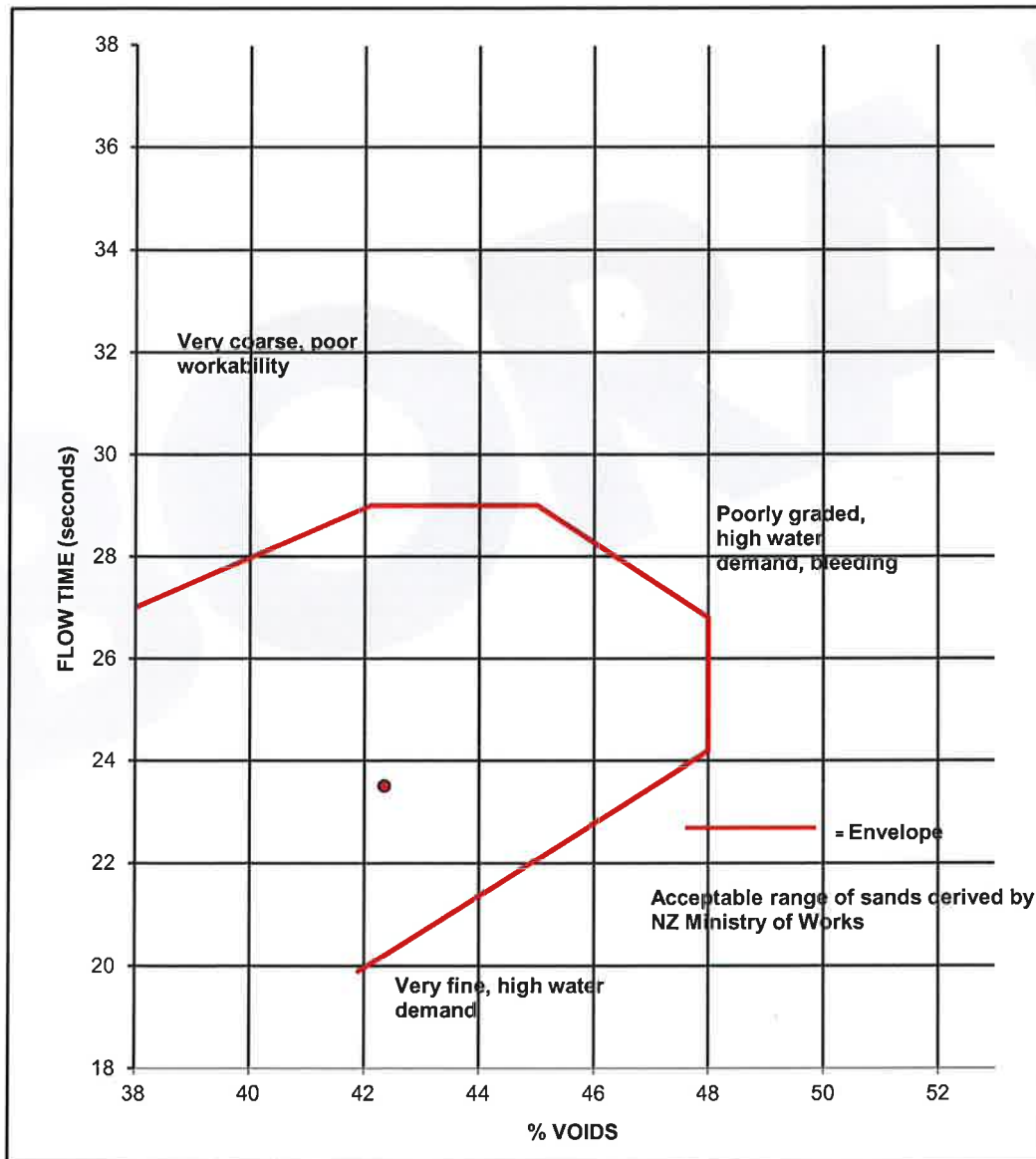
REQUEST: 74869

SAMPLE LOCATION: Maroota Quarry

DATE SAMPLED: 5.9.17

TEST METHOD: RMS – Materials Test Methods Vol. 1

SAMPLE DESCRIPTION: Coarse Sand



Sample submitted by client  
J. Graham, QC File, File

Kamal Ali

SECTION HEAD - AGGREGATES

18th October 2017



**Boral Construction Materials  
Materials Technical Services**

Unit 4, 3-5 Gibbon Road  
Baulkham Hills NSW 2153 Australia  
PO Box 400, Winston Hills NSW 2153

T: +61 (02) 9624 9900

F: +61 (02) 9624 9999

www.boral.com.au

**TEST REPORT**

CLIENT: P.F. Formation

FILE NO: 250/17

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2017

REQUEST NO: 74869

TEST PROCEDURE: Texas Highway Department – Materials and Tests Division –  
TEX.402-A, Rev. Sept. 1966

Sample Description:		Coarse Sand
Location:		Maroota Quarry
Date Sampled:		5.9.17
Laboratory Sample No:		196273
<b>Test Method:</b>	<b>Test:</b>	<b>Results:</b>
TEX-402-A	Fineness Modulus of Fine Aggregate	2.59

Sample submitted by client.

**Kamal Ali**   
**Section Head – Aggregates**

18<sup>th</sup> October 2017

J. Graham, QC File, File



**Boral Construction Materials  
Materials Technical Services**

Unit 4, 3-5 Gibbon Road  
Baulkham Hills NSW 2153 Australia  
PO Box 400, Winston Hills NSW 2153

T: +61 (02) 9624 9900

F: +61 (02) 9624 9999

www.boral.com.au

**TEST REPORT**

CLIENT: P. F. FORMATION  
PROJECT: Quality Control - Annual Full Test - 2017  
MATERIAL: Coarse Sand from Maroota Quarry

FILE No: 250/17  
REQUEST No: 74869  
DATE SAMPLED: 5.9.17  
DATE TESTED: 8.9.17 to 12.9.17


Test Method AS1289.3.7.1	Results
Determination of the Sand Equivalent of a soil using a power-operated shaker	Field Sample No. 1 Laboratory Sample No. 196273
<b>Sand Equivalent</b>	<b>92</b>
Temperature of test solution (°C)	21

Test Methods RMS T108 and T109	Results
Determination of the Liquid Limit (refers to AS1289.3.1.1), Plastic Limit (refers to AS1289.2.1), and Plasticity Index of Road Materials.	Field Sample No. 1 Laboratory Sample No. 196273
Test: RMS T108 - Liquid Limit (%) RMS T109 - Plastic Limit (%) and Plasticity Index (%)	N/A* N/A** NP
Sample history Preparation method Method used for moisture content determination	OD DS N/App
<p><b>N/A*</b> - Test is not applicable due to continual slippage in bowl. Liquid Limit could not be obtained. <b>NP</b> - Non-plastic.  <b>N/A**</b> - Unable to roll, plastic limit could not be obtained. <b>N/App.</b> - Not Applicable.                      Sample history:- NS = Natural state, AD = Air dried, OD = Oven dried at 50°C, UN = Unknown, AR = As received                      Preparation method:- WS = Wet sieved, DS = Dry sieved, AR = As received</p>	

Note: Sample provided by client.

JOSHUA GRAHAM, Q. C. FILE, FILE.



Approved Signatory   
Date 12.9.17 Serial No. 161801

**Artemio Mendoza**


**Boral Construction Materials  
Materials Technical Services**

 Unit 4, 3-5 Gibbon Road  
 Baulkham Hills NSW 2153 Australia  
 PO Box 400, Winston Hills NSW 2153

T: +61 (02) 9624 9900

F: +61 (02) 9624 9999

www.boral.com.au

FILE No: 250 / 17

**TEST REPORT**

CLIENT: P.F. Formation

1774 Wisemans Ferry Road Maroota NSW 2756

PROJECT: Quality Control Annual Full Test of Coarse Sand ex. Maroota for 2017 to  
AS 2758.1 Specification

REQUEST No: 74869

**TEST PROCEDURE:**

AS 1012.20.1 – Determination of Chloride and Sulfate in Hardened Concrete and Aggregates – Nitric Acid Digestion Method

AS 1141.13 – Material Finer than 2 micron

AS 1141.31 – Determination of Light Particles

AS 1141.35 – Detection of Sugar

AS 1141.36 – Sulfur in Metallurgical Slag, Crushed Rock or Other Pavement Materials

RMS T659 – Methylene Blue Adsorption value of Road Construction Material

AS 1289.4.1.1 – Organic Matter content

AS 1289.4.3.1 – Determination of the pH value of a Soil

RMS T123 – Determination of the pH value of a Soil

RMS T264 – Soluble Salts in Sand

Laboratory Sample No.:

196273

Date Sampled:

5.9.17

Sample Description:

Coarse Sand

Field No.:

1

**TEST RESULTS:**Chloride as Cl<sup>-</sup> (%)

0.003

Sulfate as SO<sub>3</sub> (%)

0.03

Material Finer than 2 micron (µm) (%)

Not Applicable

Light Particles (%)

Nil

Sugar

Not Detected

Sulfur as S (%)

&lt; 0.02

Methylene Blue Adsorption value (mg/g)

1

Methylene Blue Adsorption value for a Duplicate (mg/g)

1

Average Methylene Blue Adsorption value (mg/g)

1

Organic Matter (%)

0.1

pH (AS)

10.1

pH (RMS)

10.1

Soluble Salts (%)

&lt; 0.3 (Free from Soluble Salts)

Sample submitted by the Client.

Joshua Graham, Q.C.File, Mat.File, File.

FRANK GRIMA



Approved Signatory

Date

3-10-17

Serial No.

16 18 0 2



**Boral Construction Materials  
Materials Technical Services**

Unit 4, 3-5 Gibbon Road  
Baulkham Hills NSW 2153 Australia  
PO Box 400, Winston Hills NSW 2153

T: +61 (02) 9624 9900

F: +61 (02) 9624 9999

www.boral.com.au

**TEST REPORT**

CLIENT: P.F.FORMATION  
1774 Wisemans Ferry Road,  
Maroota, NSW 2756

FILE No: 250 / 17

PROJECT: Quality Control Annual Full test of Coarse Sand ex. Maroota for  
2017.

REQUEST No: 74869

**TEST PROCEDURE:**

AS 1012.20.1 – Determination of Chloride and Sulfate in Hardened Concrete and Aggregates – Nitric Acid  
Extraction Method

AS1012.20.2 – Determination of Water-Soluble Chloride in Hardened Concrete and Concrete Aggregates

Laboratory Sample No.:	196273
Date Sampled:	05.09.17
Date Received:	07.09.17
Sample Description:	Coarse Sand Maroota Quarry

Field No.: 1


**TEST RESULTS:**

Chloride as Cl <sup>-</sup> (Acid) (%)	0.003
Chloride as Cl <sup>-</sup> (Water) (%) *	0.001

\* Note: The Test method not covered by the laboratory's current scope of accreditation.

Sample submitted by the Client.

Joshua Graham, Mat .File, File.

Approved Signatory  Otilia Costache  
 Date 03.10.2017 Serial No. 161803





**Boral Construction Materials  
Materials Technical Services**

Unit 4, 3-5 Gibbon Road  
Baulkham Hills NSW 2153 Australia  
PO Box 400, Winston Hills NSW 2153

T: +61 (02) 9624 9900

F: +61 (02) 9624 9999

[www.boral.com.au](http://www.boral.com.au)

**TEST REPORT**

CLIENT: P.F. Formation  
1774 Wisemans Ferry Road Maroota NSW 2756

FILE No: 250 / 17

PROJECT: Quality Control Annual Full Test of Coarse Sand ex. Maroota for 2017 to  
AS 2758.1 Specification

REQUEST No: 74869

**TEST METHOD:**

AS 2350.2 Clause 5.5 - Loss on Ignition (Modified)

Tex- 612 - J - Acid Insoluble Residue For Fine Aggregate

Laboratory Sample No.: 196273  
Date Sampled: 5.9.17  
Sample Description: Coarse Sand  
Field No.: 1

**TEST RESULTS:**

CO<sub>2</sub> by Loss on Ignition (%) < 0.1  
Calcium Carbonate as CaCO<sub>3</sub> (%) 0.1  
Acid Insoluble Residue (%) 99

Sample submitted by the Client.

S. Krishnamoorthy  
Analytical Chemist  
14<sup>th</sup> September 2017

J.Graham, Q.C.File, Mat.File, File.





**Boral Construction Materials  
Materials Technical Services**

Unit 4, 3-5 Gibbon Road  
Baulkham Hills NSW 2153 Australia  
PO Box 400, Winston Hills NSW 2153

T: +61 (02) 9624 9900

F: +61 (02) 9624 9999

www.boral.com.au

**TEST REPORT**

CLIENT: P.F.FORMATION  
1774 Wisemans Ferry Road, Maroota, NSW 2756.

FILE No.: 250/17

PROJECT: Quality Control Annual Full test of Coarse Sand ex Maroota for 2017.

REQUEST No.: 74869

**TEST PROCEDURE: Boral Chemical Method 2 – Determination of metal oxides by Lithium Meta Borate Fusion and analysed using ICP**

Laboratory Sample No.: 196273  
Date Sampled: 05/09/17.  
Date Received: 07/09/17  
Sample Description: Coarse Sand.  
Field No.: 1

**TEST RESULTS**

Silicon as SiO<sub>2</sub> (%) 97.1

Sample submitted by the Client.

Nanthini S  
Analytical Chemist  
25<sup>th</sup> September 2016.  
J.Graham, Q.C.File, Mat. File, File.



**Boral Construction Materials  
Materials Technical Services**

Unit 4, 3-5 Gibbon Road  
Baulkham Hills NSW 2153 Australia  
PO Box 400, Winston Hills NSW 2153

T: +61 (02) 9624 9900  
F: +61 (02) 9624 9999

www.boral.com.au

**Test Report**

<b>Client:</b>	P.F. FORMATION	<b>File No:</b>	250/17
<b>Address:</b>	1774 Wisemans Ferry Road Maroota, NSW 2756	<b>Req. No:</b>	74869
<b>Date Received:</b>	September 2017	<b>Date Sampled:</b>	05/09/2017
<b>Project:</b>	Quality Control Annual Full Test of Coarse Sand ex Maroota for 2017.		
<b>Test Method:</b>	Accelerated Mortar Bar Test for AAR Assessment - RMS T363		

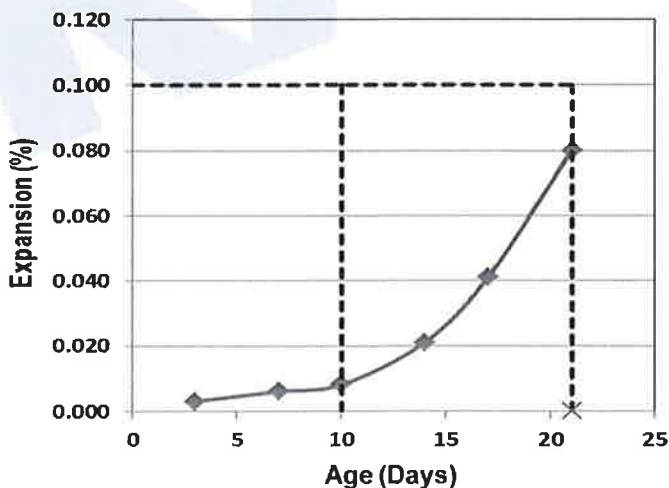
Lab Sample No	Sample Description	Location
196273	Coarse Sand	Maroota Quarry
N/A	Boral GP / SL Cement	Berrima

**Results:**

Flow (%): 14

W/C Ratio: 0.36

Age (Days)	Expansion (%) Avg. of 3 specimens
3	0.003
7	0.006
10	0.008
14	0.021
17	0.041
21	0.080



Mortar Bar Expansion (E) % Duration of Specimens In 1mol/L NaOH at 80°C		RMS T363 Aggregate Reactivity Classification
10 Days	21 Days	
< 0.1*	< 0.1*	Non-Reactive
< 0.1*	≥ 0.1*	Slowly Reactive
≥ 0.1*	≥ 0.1*	Reactive

\* 0.15% for naturally occurring fine aggregates

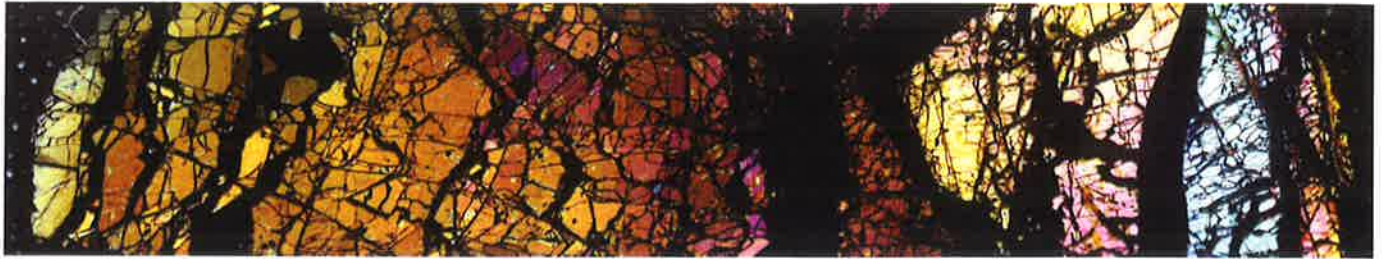
**Notes:** N/A

Joshua Graham, Q. C. File, Mat. File, File



Approved Signatory Safwan Fawal  
Date 17/10/2017 Serial No. 161804

NATA Accredited Laboratory



# Geochempet Services

ABN 980 6945 3445

PETROLOGICAL and GEOCHEMICAL CONSULTANTS

Principals: K.E. Spring B.Sc. (Hons), MAppSc and H.M. Spring B.Sc.



5/14 Redcliffe Gardens Drive  
Clontarf, QLD 4019

Telephone: (07) 3284 0020

Email: [info@geochempet.com](mailto:info@geochempet.com)  
[www.geochempet.com](http://www.geochempet.com)

## PETROGRAPHIC REPORT ON A COARSE SAND SAMPLE (196273) FROM MAROOTA QUARRY

prepared for

**BORAL RESOURCES (NSW) PTY LTD  
MATERIALS TECHNICAL SERVICES**

Purchase Order: 5800848  
Invoice Number: 00007865  
Client Ref: George Calvar

Issued by

  
T. F. D. Spring BAppSc MAppSc  
8 October 2017

October, 2017

Bo171004

Page 1 of 6

*The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services*

# GEOCHEMPET SERVICES, BRISBANE

**Sample Number:** 196273 **Date Sampled:** 05/09/2017

**Product Type:** Coarse Sand **Date Supplied:** 07/09/2017

**Sample Source:** Ex. Maroota Quarry **Date Received:** 15/09/2017

**Location:** P.F. Formation

**Work Requested** Petrographic analysis in relation to suitability for use as concrete sand; 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*, of the content of the 2015 joint publication of the Cement and Concrete Association of Australia and Standards Australia, (HB 79-2015) entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*

**Identification** Coarse to medium quartz sand

## **Description**

The sample consisted of about 0.5 kg of pinkish-orange, clean sand, composed of water-worn, sub-rounded and sub-angular quartz grains and minor lithic fragments.



**Figure 1:** Digital image of sub-sample from supplied sample 196273.

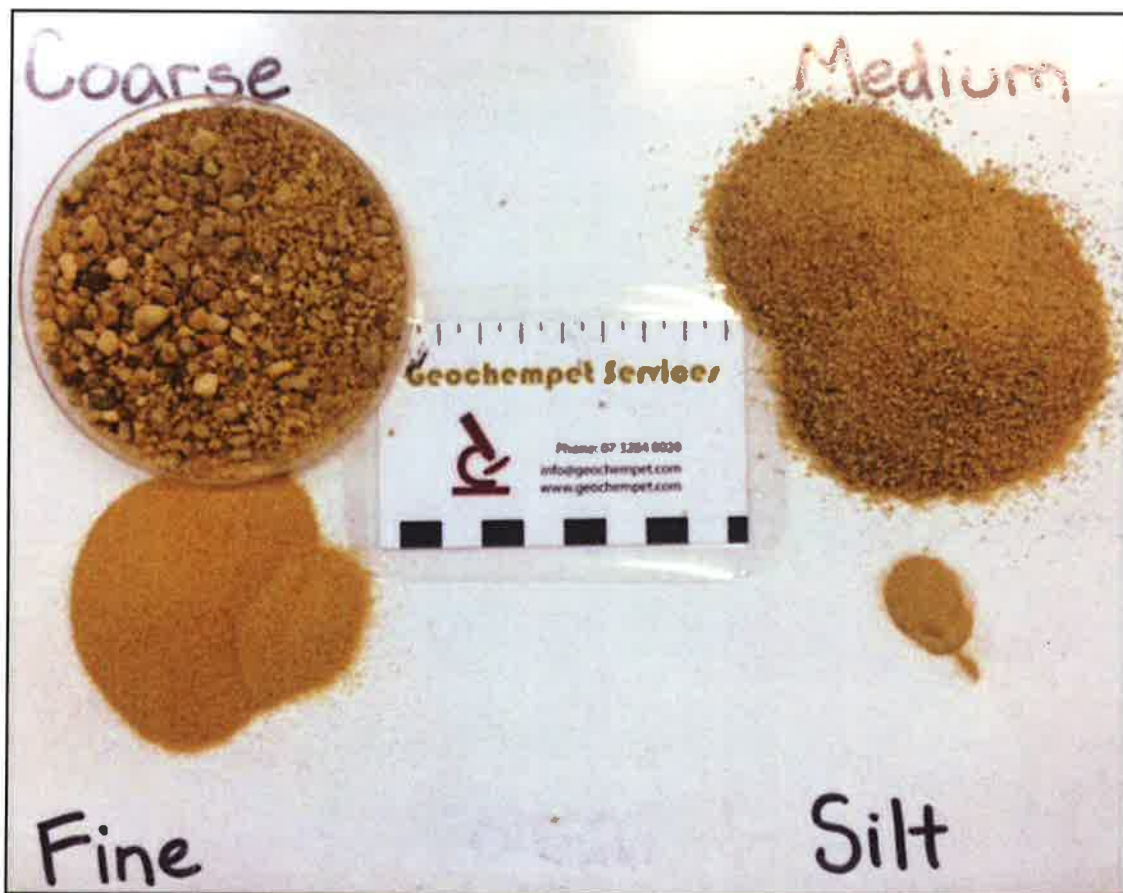
# GEOCHEMPET SERVICES, BRISBANE

In a crude, dry sieving test of small subsample these results were tabulated:

Sieve Size	Wt % of sample
Coarse (>1.18mm)	28.0%
Medium (>0.3mm)	54.6%
Fine (>0.075mm)	17.1%
Silt (<0.075mm)	0.3%

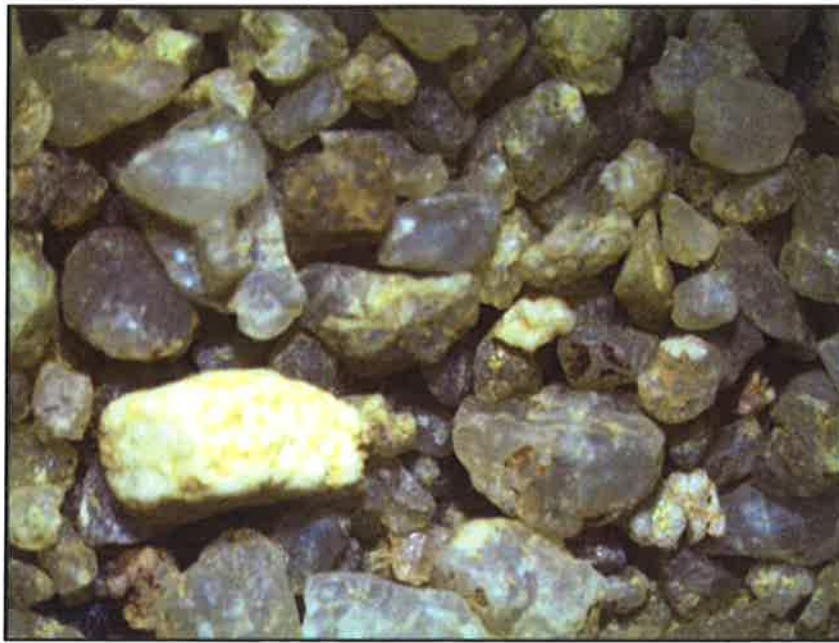
The minor coarse fraction consists of quartz grains and minor lithic fragments of variably ferruginized sandstone clasts which are difficult to break by hand. There are no apparent deleterious grain coatings; benign secondary iron oxide does occur as occasional coatings on a few sand grains.

When a subsample was swirled in water, a very light grey persistent turbidity was noted, suggesting the presence of minor silt and clay in the sample.



**Figure 2:** Digital image of sieve fractions as recorded above.

## GEOCHEMPET SERVICES, BRISBANE



**Figure 3:** Digital image of coarse sieve fraction as recorded above. Note the secondary iron oxide in indents.

A thin section was prepared for microscopic examination in transmitted polarized light. A count of 100 widely spaced points falling within sectioned clasts gave the following composition:

- 75% quartz as single, free, unstrained to mildly strained grains (67%) or as simple composite crystalline aggregates of quartz grains (8%)
- 19% quartz as moderately strained single or more commonly crystalline composite grains
- 2% quartzite (moderately strained)
- 1% feldspar grains (orthoclase)
- <1% heavy mineral grains (including epidote, zircon, haematite/goethite, hornblende and opaque oxide)
- <1% free mica flakes
- <1% lithic clasts of acid volcanics (<1% microcrystalline quartz)
- 2% lithic clasts of quartz sandstone (2% quartz)
- <1% lithic clasts of intermediate volcanics
- <1% ferruginous fragments
- <1% sericitized fragments
- 1% secondary iron coating on free quartz grains

The free silica content (or total quartz plus chert content) of the sand is 98% comprised of 94% free quartz grains or simple crystalline composite grains, and 4% quartz locked within lithic fragments of quartzite, iron-cemented clasts and arenite and <1% microcrystalline quartz locked within acid volcanic/tuffaceous clasts.

# GEOCHEMPET SERVICES, BRISBANE

In thin section, the sand is seen to consist very largely of quartz, comprising 67% quartz as single, free, unstrained to mildly strained grains, 8% quartz as simple composite crystalline aggregates of quartz grains, and 19% quartz as moderately strained single or crystalline composite grains. The grains are confirmed to carry some iron trapped in surface indents, but the amount is very small (apparently 1%).

Variable weathered sericitized and kaolinized feldspar grains amount to about 1%. Small heavy mineral grains are conspicuous and amount to less than 1%, comprising epidote, zircon, haematite/goethite, hornblende and opaque oxide.

Lithic clasts amount to 2% of the sample and consist of <1% acid volcanic/tuffaceous fragments (<1% finely crystalline quartz in groundmass), 2% quartz sandstone (consisting of quartz and subordinate feldspars suspended in a ferruginous matrix) and <1% intermediate volcanics.

Both ferruginous fragments and sericitized clasts amounted to less than 1%.

## Comments and Interpretations

The supplied coarse sand sample (labelled 196273) from the Maroota Quarry is considered to be fairly clean quartz sand which may be described broadly for engineering purposes as coarse to medium quartz sand.

The **free silica content** (or **total quartz content** as defined in the Queensland Department of Main Roads Test Method **Q188**) of the sand is **about 98%**, comprised of 94% free quartz grains or simple crystalline composite grains, and 4% quartz locked within lithic fragments of quartzite, clay cemented quartz grains and arenite and <1% of microcrystalline quartz locked within acid volcanic/tuffaceous clasts.

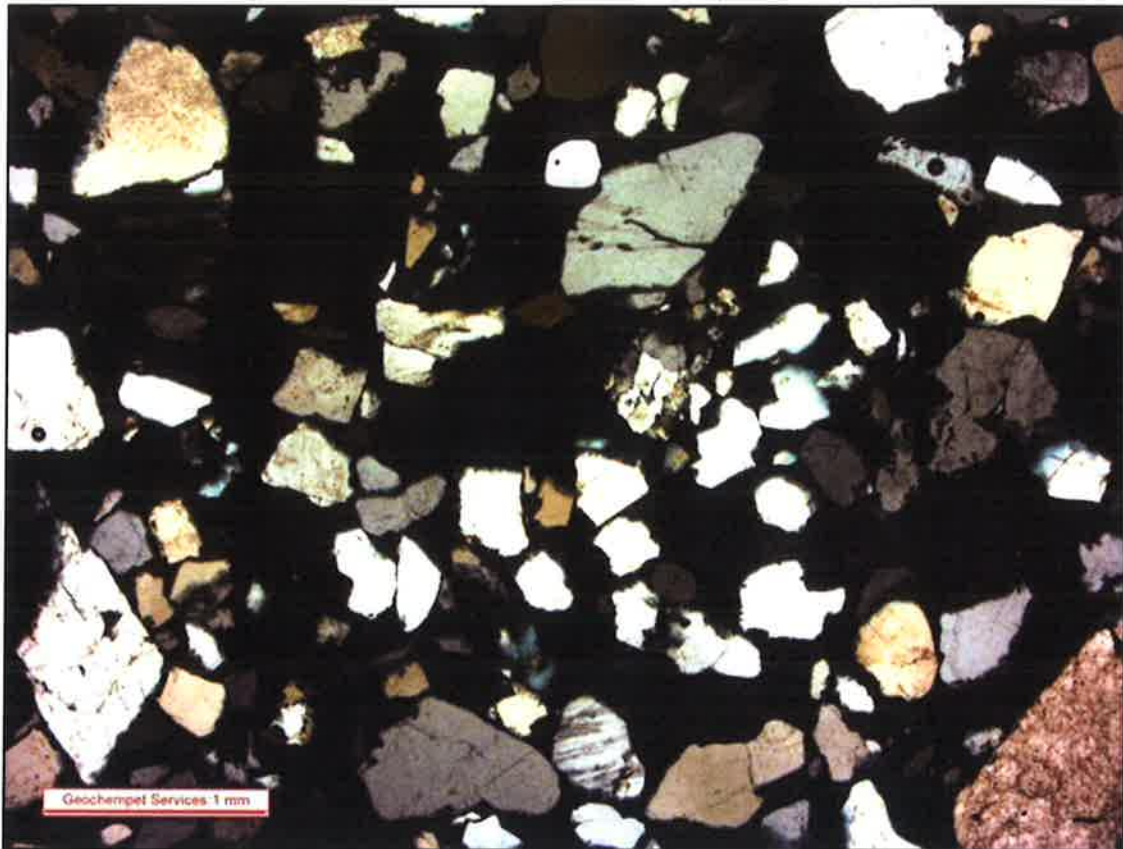
Being composed largely of sub-rounded and sub-angular grains of quartz, the sand is interpreted to be **physically suitable for use as concrete sand**.

The sand as a whole is predicted to have **potential for mild or slow deleterious alkali-silica reactivity in concrete**. It carries about 21% of moderately stained quartz (as free grains or simple composite grains, and in quartzite), and <1% microcrystalline quartz in lithic clasts of acid volcanic/tuffaceous rock.

Guidance 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

The free silica content is about 98%.



**Figure 4:** Micrograph of supplied sand sample 196273, taken at low magnification under transmitted cross polarised light. Image shows a typical view of the sample, dominated by sub-rounded quartz showing a range of straining extinctions.