


**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

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**TEST REPORT**

CLIENT: P.F. Formation

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2020

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

FILE NO: 250/20

ii) TfNSW – Materials Test Methods Vol. 1

REQUEST NO: 91273

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

DATE TESTED: 14.9.20 to 16.10.20

SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7<sup>th</sup> November 2014

Sample Description:		Coarse Sand	
Location:		Maroota Quarry	
Date Sampled:		8.9.20	
Date Received:		11.9.20	
Laboratory Sample No:		244539	
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	87
	1.18mm	30-100	68
	600 micron	15-100	47
	425 micron	-	35
	300 micron	5- 50	20
	150 micron	0- 20	4
AS1141.12	Material finer than 75 micron (%)	0- 5	1
AS1141.4	Uncompacted Bulk Density t/m <sup>3</sup>		1.64
	Compacted Bulk Density t/m <sup>3</sup>	Min. 1.2	1.73
RMS T262	Moisture Content (%)		4.5
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	0.5
	Fraction tested :		
	-4.75mm+2.36mm (% Loss)		1.1
	-2.36mm+1.18mm (% Loss)		0.6
	-1.18mm+600 µm (% Loss)		0.4
	-600 µm +300 µm (% Loss)		0.2

\*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 16.10.20 Serial No. AGG91273.KA.1

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Number: 547


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**Page 2 of 2****TEST REPORT**

CLIENT: P.F. Formation

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2020

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

FILE NO: 250/20

ii) TfNSW – Materials Test Methods Vol. 1

REQUEST NO: 91273

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

DATE TESTED: 14.9.20 to 16.10.20

SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7<sup>th</sup> November 2014

Sample Description:			Coarse Sand
Location:			Maroota Quarry
Date Sampled:			8.9.20
Date Received:			11.9.20
Laboratory Sample No:			226227
Test Method:	Test:	Spec:	Results:
AS1141.25.3*	Degradation Factor Fine Aggregate The wash water after using permitted 500ml was:		99 Clear
AS1141.33	Silt Content (%)		3
AS1141.34	Organic impurities other than sugar The colour assessment was made visually using coloured reference glass	Not darker than std.	Lighter than Std
RMS T279	Method of Determining Voids Content % Voids The Mean Flow Time (Sec.)		41.1 22.6
ASTM D7428	Micro-Deval Abrasion Test % Loss The % loss of the control aggregate tested closest to the time at which the sample was tested = 19.5		5.3

\*At the end of 20 min. reading the height ( $H$ ) of the upper surface of the flocculate column was not possible. Reading was performed after 40 min.

Sample submitted by client

J. Graham, QC File, File



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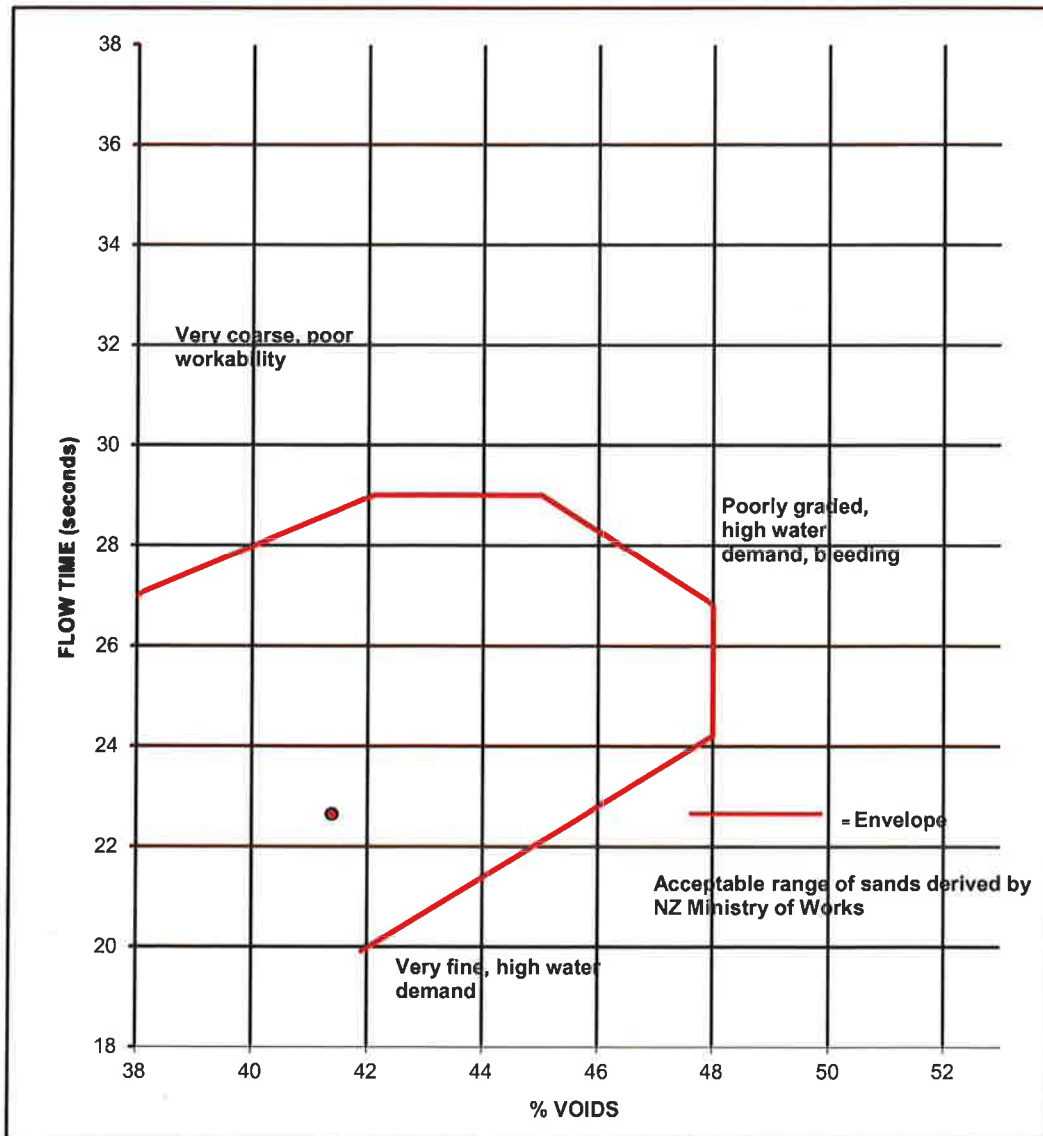
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**Method for Determining Voids Content - Flow Time**  
**RMS T279**


CLIENT: P.F. Formation  
PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2020  
LAB SAMPLE NO: 244539  
SAMPLE LOCATION: Maroota Quarry  
TEST METHOD: TfNSW – Materials Test Methods Vol. 1  
SAMPLE DESCRIPTION: Coarse Sand

FILE NO: 250/20  
REQUEST: 91273  
DATE SAMPLED: 8.9.20  
DATE TESTED: 15.10.20

T: +61 (02) 9624 9900  
F: +61 (02) 9624 9999  
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Sample submitted by client  
J. Graham, QC File, File

Kamal Ali   
**SECTION HEAD - AGGREGATES**  
16th October 2020



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Baulkham Hills NSW 2153 Australia  
PO Box 400, Winston Hills NSW 2153

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F: +61 (02) 9624 9999

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**TEST REPORT**

CLIENT: P.F. Formation

FILE NO: 250/20


PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2020

REQUEST NO: 91273

TEST PROCEDURE: TEST PROCEDURE: Texas Highway Department – Materials and Tests Division –  
TEX.402-A, Rev. Sept. 1999

Sample Description:		Coarse Sand
Location:		Maroota Quarry
Date Sampled:		8.9.20
Date Received:		11.9.20
Laboratory Sample No:		244539
<b>Test Method:</b>	<b>Test:</b>	<b>Results:</b>
TEX-402-A	Fineness Modulus of Fine Aggregate	2.75

Sample submitted by client.

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

16<sup>th</sup> October 2020

J. Graham, QC File, File



Ref: 2020 244539 Coarse Sand Maroota Q. AS Sand Equivalent PI - AFT

Page 1 of 1

Report Template Rev 0 Jan 09 Authorised by A. Mendoza

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**TEST REPORT**

CLIENT: P. F. FORMATION  
PROJECT: Quality Control - Annual Full Test - 2020  
MATERIAL: Coarse Sand from Maroota Quarry

FILE No: 250/20  
REQUEST No: 91273  
DATE RECEIVED: 11.9.20  
DATE SAMPLED: 8.9.20  
DATE TESTED: 14.9.20 to 16.10.20

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. 244539
Sand Equivalent	89
Temperature of test solution (°C)	24

AS1289 - Soil Classification Tests	Results
Determination of the Liquid Limit, Plastic Limit and Plasticity Index	Field Sample No. 1 Laboratory Sample No. 244539
AS1289.3.1.1 - Liquid Limit (%)	N/A*
AS1289.3.2.1 - Plastic Limit (%)	N/A**
AS1289.3.3.1 - Plasticity Index (%)	NP
Sample history	OD
Preparation method	WS
Method used for moisture content determination	N/App

N/A\* - Test is not applicable due to continual slippage in bowl. Liquid Limit could not be obtained. NP - Non-plastic.

N/A\*\* - Unable to roll, plastic limit could not be obtained. N/App. - 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

Note: Sample provided by client.

JOSHUA GRAHAM, Q. C. FILE, FILE.



Approved Signatory Aroon Singh Aroon Singh

Date 16.10.20 Serial No. SOIL91273.AS.1

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Baulkham Hills NSW 2153 Australia  
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**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 2020.

FILE No: 250 / 20  
REQUEST No: 91273

**TEST PROCEDURE:**

- AS 1141.12 – Percent Passing 75 micron
- 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.:	244539
Date Sampled:	8.09.20
Date Received:	11.09.20
Date Tested:	15 <sup>th</sup> to the 18 <sup>th</sup> September 2020
Sample Description:	Coarse Sand
Field No.:	1

**TEST RESULTS:**


Percent Passing 75micron (µm) (%)	1
Material Finer than 2 micron (µm) (%)	Not Applicable
Light Particles (%)	0
Sugar	Not Detected
Sulfur as S (%)	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)	7.1
pH (RMS)	7.1
Soluble Salts (%)	< 0.3 (Free from Soluble Salts)

Sample submitted by the Client.

Note: Test results in this test report relate only to the samples tested.

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



Approved Signatory   
Date 25-9-2020 Serial No. CHEM91273.FG.1

KAMAL ALI  
FRANK GRIMA



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**TEST REPORT**

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

FILE No: 250 / 20

PROJECT: Quality Control Annual Full test of Coarse Sand ex. Maroota for  
2020.

REQUEST No: 91273

**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.:	244539
Date Sampled:	08.09.20
Date Received:	11.09.20
Date Tested:	18.09.20
Sample Description:	Coarse Sand Maroota Quarry

Field No.: 1

**TEST RESULTS:**

Sulfate as SO <sub>3</sub> (%)	0.04
Chloride as Cl <sup>-</sup> (Acid) (%)	0.006
Chloride as Cl <sup>-</sup> (Water) (%)	0.001

Sample submitted by the Client.  
Joshua Graham, Mat .File, File.



Approved Signatory  
22.09.2020

Otilia Costache  
CHEM91273.OC.1

Date \_\_\_\_\_ Serial No. \_\_\_\_\_

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F: +61 (02) 9624 9999

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**TEST REPORT**

CLIENT: P.F. FORMATION  
1774 Wisemans Ferry Road Maroota, N.S.W. 2756

FILE No: 250 / 19

PROJECT: Quality Control annual Full Test of Coarse Sand from Maroota for 2020. REQUEST No: 91273

**TEST PROCEDURE: Boral In house Method 34 – Determination of metal oxides by XRF Flux (66:34) Fusion Bead and analysed using XRF**

Laboratory Sample No.: 224539  
Date Sampled: 08.09.20  
Date Received: 11.09.20  
Date Tested: 18.09.20  
Sample Description: Coarse Sand from  
Maroota Quarry  
Field No.: 1

**TEST RESULTS**

Silicon as SiO<sub>2</sub> (%) 97.7

Notes: Test results in this test report relate only to the samples tested.

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Sample submitted by the Client.

Otilia Costache  
21.09.2020  
J.Graham, Mat. File, File.





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

T: +61 (02) 9624 9900

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**TEST REPORT**

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

FILE No.: 250 / 20

PROJECT: Quality Control Annual Full Test of Coarse Sand ex. Maroota for 2020  
to AS 2758.1 Specification

REQUEST No.: 91273

**TEST METHOD:**

AS 2350.2 Clause 5.5 - Loss on Ignition (Modified)  
Tex- 612 - J - Acid Insoluble Residue for Fine Aggregate

Laboratory Sample No.:	244539
Date Sampled:	8.9.2020
Date Received:	11.9.2020
Date Tested:	17.9.2020
Sample Description:	Coarse Sand
Field No.:	1

**TEST RESULTS:**

CO <sub>2</sub> by Loss on Ignition (%)	0.03
Calcium Carbonate as CaCO <sub>3</sub> (%)	0.07
Acid Insoluble Residue (%)	99

**Notes:**

- Sample submitted by the Client.
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S.Krishnamoorthy  
17<sup>th</sup> September 2020

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



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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

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**Test Report**

**Client:** P.F. FORMATION  
**Address:** 1774 Wisemans Ferry Road Maroota, NSW 2756  
**Date Received:** September 2020  
**Project:** Quality Control Annual Full Test of Coarse Sand ex Maroota for 2020.  
**Test Method:** Accelerated Mortar Bar Test for AAR Assessment - RMS T363

**File No:** 250/20  
**Req. No:** 91273  
**Date Sampled:** 08/09/2020

Lab Sample No	Sample Description	Location
244539	Coarse Sand	Maroota Quarry.
N/A	Boral GP / SL Cement	Berrima

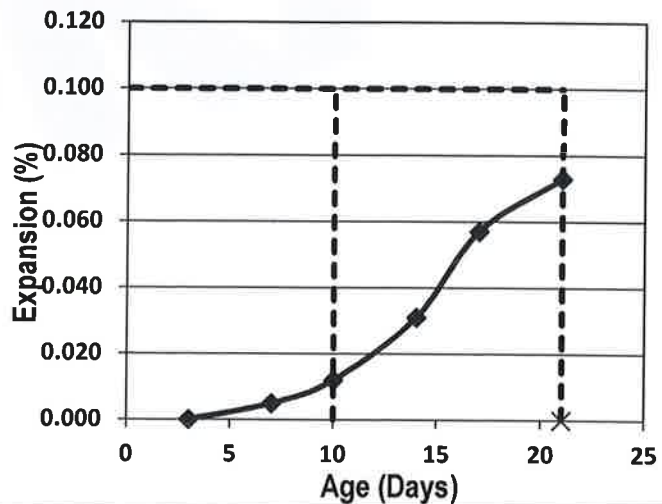
**Results:**

Flow (%): 14

W/C Ratio: 0.37

Mixing Date: 15/09/2020

Age (Days)	Expansion (%) Avg. of 3 specimens
3	0.000
7	0.005
10	0.012
14	0.031
17	0.057
21	0.073



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:**

- Sample submitted by the Client.

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



Approved Signatory

Muans Abdulnebe

Date 13-10-2020 Serial No.

CEM91273.MA.1

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# GEOCHEMPET SERVICES

ABN 25 065 630 506

PETROGRAPHIC, GEOLOGICAL & GEOCHEMICAL CONSULTANTS

28 Cameron Street  
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 (244539) FROM MAROOTA QUARRY

prepared for

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

Purchase Order: 6278113  
Invoice Number: G2110518  
Client Ref: Kamal Ali

Issued by

*H.M. Spring*  
H.M. Spring BSc.  
9 October 2020

October, 2020

Bo201002

Page 1 of 6

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# GEOCHEMPET SERVICES, BRISBANE

**Sample Number:** 244539 **Date Sampled:** 08/09/2020  
**Product Type:** Coarse Sand **Date Supplied:** 11/09/2020  
**Sample Source:** Maroota Quarry **Date Received:** 18/09/2020  
**Client:** P. F. Formation  
**Work Requested** Petrographic analysis in relation to suitability for use as concrete sand

**Methods** Account taken of ASTM C 295 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** medium to coarse quartz sand

## **Description**

The sample consisted of about 0.5 kg of free flowing, reddish 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 244539

# GEOCHEMPET SERVICES, BRISBANE

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

Sieve Size	Wt % of sample
Coarse (>1.18mm)	32.9%
Medium (>0.3mm)	48.7%
Fine (>0.075mm)	17.8%
Silt (<0.075mm)	0.6%

The 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 occurs as minor grain coatings and within surficial indents.

When a subsample was swirled in water, a very reddish turbidity was noted with some argillized scum, which cleared rapidly suggesting minor silt and clay within 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:

- 67% quartz as single, free, unstrained to mildly strained grains (55%) or as simple composite crystalline aggregates of quartz grains (12%)
- 25% quartz as moderately strained single or more commonly crystalline composite grains
- 4% quartzite (3% moderately strained)
- <1% vein quartz (heavily strained)
  
- 1% feldspar grains (orthoclase)
- 1% heavy mineral grains (including epidote, zircon, haematite/goethite (1%), hornblende and opaque oxide)
  
- 2% lithic clasts of acid volcanics (<1% microcrystalline quartz)
- <1% lithic clasts of intermediate volcanics

The free silica content (or total quartz plus chert content) of the sand is 96% comprised of 92% free quartz grains or simple crystalline composite grains, and 4% quartz locked within lithic fragments of quartzite, 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 55% quartz as single, free, unstrained to mildly strained grains, 12% quartz as simple composite crystalline aggregates of quartz grains, and 24% quartz as moderately strained single or crystalline composite grains. The grains carry minor iron trapped in surface indents, but the amount is very small (<1%). Siliceous fragments of quartzite amounts to about 4% and <1% vein quartz.

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

Lithic clasts amount to 2% of the sample and consist of 2% acid volcanic/tuffaceous fragments (<1% finely crystalline quartz in groundmass), and <1% intermediate volcanics.

## Comments and Interpretations

The supplied coarse sand sample (labelled 244539) from the Maroota Quarry is considered to be fairly clean quartz sand which may be described broadly for engineering purposes as medium to coarse sand however there is significant fine fraction.

The **free silica content** of the sand is **about 96%** comprised of 92% free quartz grains or simple crystalline composite grains, and 4% quartz locked within lithic fragments of quartzite, and <1% 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 28% of moderately stained quartz (as free grains or simple composite grains, and in quartzite), and <1% heavily strained quartz within vein material and a further <1% microcrystalline quartz in lithic clasts of acid volcanic/tuffaceous rock.

Guidance can be obtained from the 2015 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 96%.



## GEOCHEMPET SERVICES, BRISBANE



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