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UKAS TESTING 0001

TEST REPORT

Determination of Particle Size Distribution

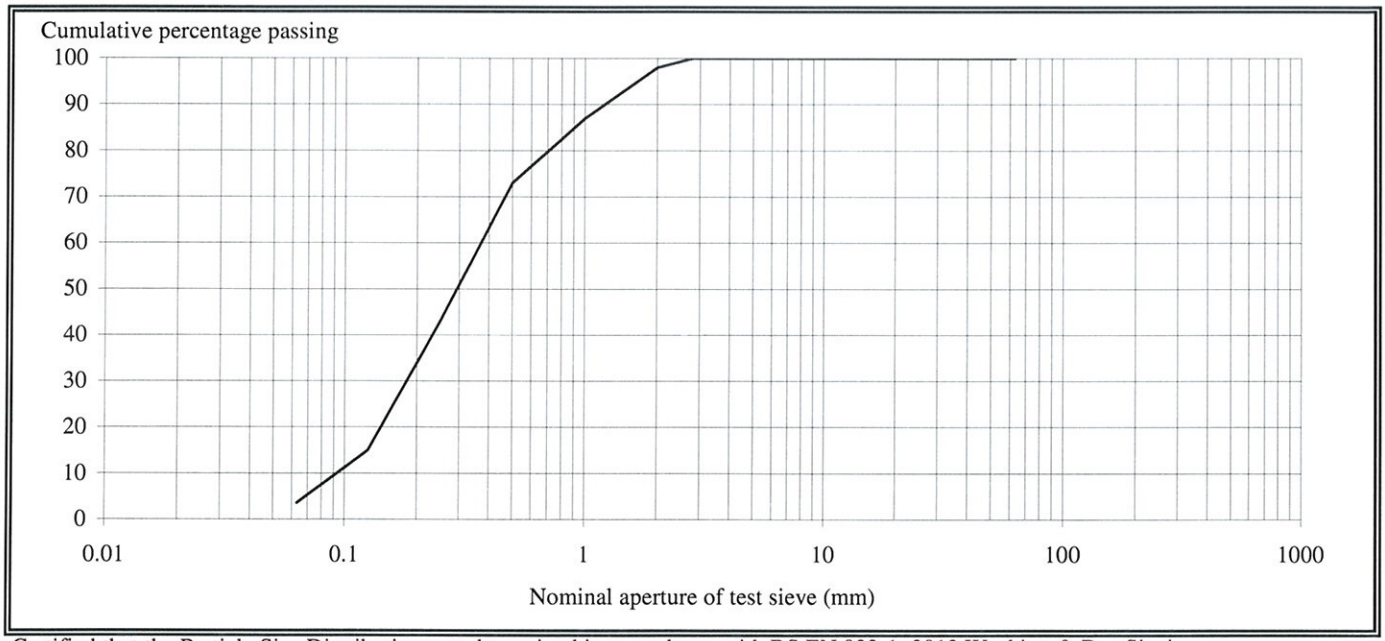
Client:	John Sheehan	Report No:	50168157/13/03
Client Address:	Knightsbridge Farm Yarnton Oxford	Batch Number: Lab Ref:	DAM0040600 45181328
Postcode:	OX5 1PH	Client Ref:	Sharp Sand
Site:	Stanton Harcourt		
		Date Sampled:	Not Advised
Sampled by:	Client	Date Received:	27.03.13
Sampled from:	Site	Date Tested:	08.04.13
Supplier:	Client	Sample Type:	Bulk
Source:	Site	Sample Mass (kg):	30.1

Description: 0/2 (FP) Fine aggregate for concrete
Sharp SAND

Specification: PD 6682-1: 2009, Table No: D.1, Category $G_f 85$
Guidence on the use of BS EN 12620:2002 + A1

Remarks: Sample complies with the grading specification

SIEVE ANALYSIS						
BS Sieve (mm)	Passing (%)		Material Specification			
63	100					
40	100					
31.5	100					
20	100					
16	100					
10	100					
8	100					
4	100			100		
2.8	100		95	-	100	
2.0	98	##	85	-	99(±5)	
1.0	87			(±20)		
0.500	73		55	-	100	
0.250	43			(±25)		
0.125	15					
0.063	3.5			(±5)		



Certified that the Particle Size Distribution was determined in accordance with BS EN 933-1: 2012 Washing & Dry Sieving
Certificate of sampling to BS EN 932-1: 1997 not received

Comments: Supplier Declared Values are not included as part of this report.

Page: 1 of 1
Date Reported: 09.04.13

Signed: D. Berr

[ ] M. Carr - Section Manager
[✓] D. Berrill - Laboratory Manager

For and on behalf of Environmental Scientifics Group

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TEST REPORT

Determination of Particle Size Distribution

Client:	John Sheehan	Report No:	50168157/13/04
Client Address:	Knightsbridge Farm Yarnton Oxford	Batch Number: Lab Ref:	DAM0040600 45181329
Postcode:	OX5 1PH	Client Ref:	Grit Sand
Site:	Stanton Harcourt		
		Date Sampled:	Not Advised
Sampled by:	Client	Date Received:	27.03.13
Sampled from:	Site	Date Tested:	08.04.13
Supplier:	Client	Sample Type:	Bulk
Source:	Site	Sample Mass (kg):	31.4

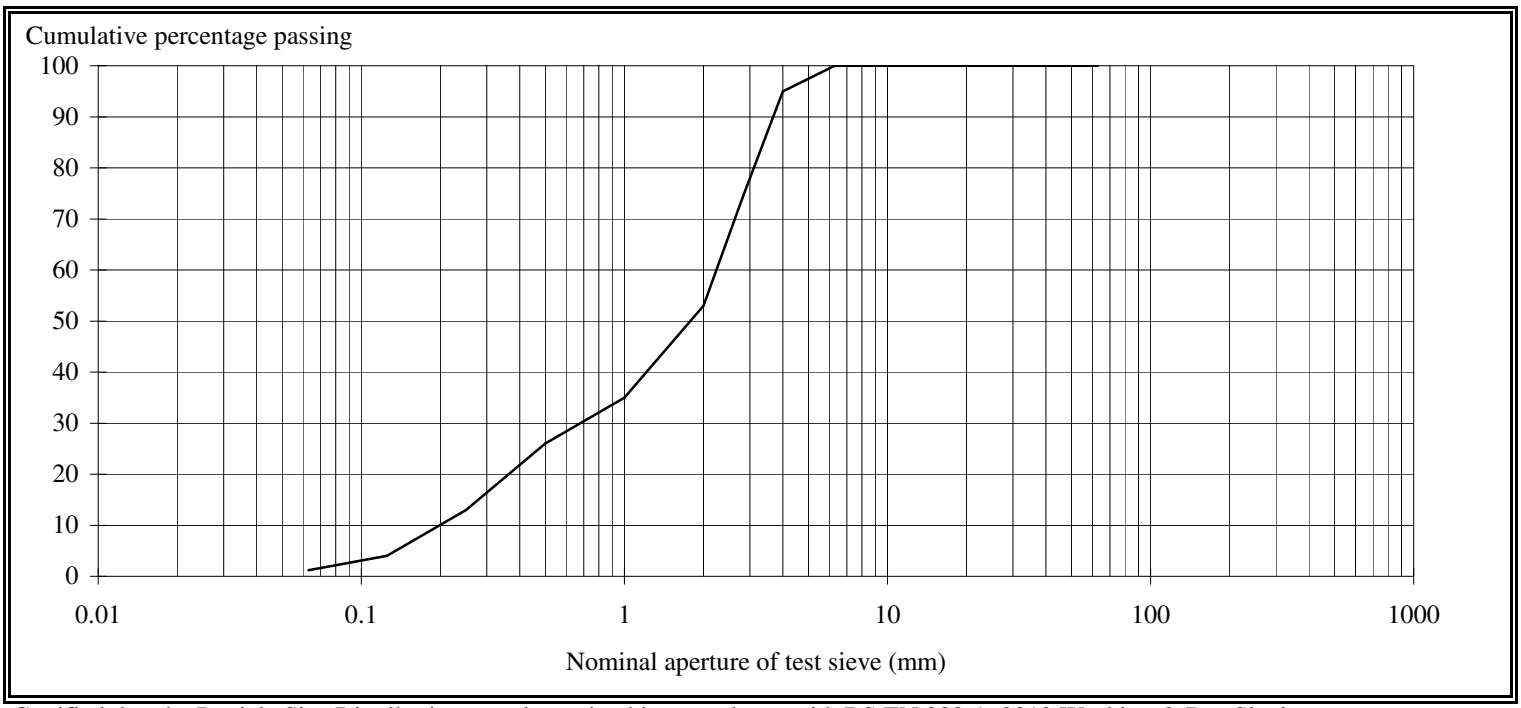
Description: 0/4 (CP) Fine aggregate for concrete
Crushed Concete, Gravel and Brick

Specification: PD 6682-1: 2009, Table No: D.1, Category G_f 85
Guidence on the use of BS EN 12620:2002 + A1

Remarks: Sample complies with the grading specification

SIEVE ANALYSIS

BS Sieve (mm)	Passing (%)		Material Specification		
63	100				
40	100				
31.5	100				
20	100				
16	100				
10	100				
8	100			100	
6.3	100		95	-	100
4	95	##	85	-	99(±5)
2.8	74				
2.0	53				
1.0	35			(±20)	
0.500	26		5	-	45
0.250	13			(±20)	
0.125	4				
0.063	1.2			(±3)	



Certified that the Particle Size Distribution was determined in accordance with BS EN 933-1: 2012 Washing & Dry Sieving
Certificate of sampling to BS EN 932-1: 1997 not received

Comments: Supplier Declared Values are not included as part of this report.

Page: 1 of 1
Date Reported: 09.04.13

Signed: D. Berrill

[ ] M. Carr - Section Manager
[✓] D. Berrill - Laboratory Manager

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TEST REPORT

Determination of Particle Size Distribution

Client:	Sheehan Group	Report No:	50164751/12/03
Client Address:	Knightsbridge Farm Yarnton Oxford	Batch Number: Lab Ref:	DAM0036539 45159693
Postcode:	OX5 1PH	Client Ref: Location:	Sharp Sand Stockpile
Site:	Oxford, OX29 5UX		
		Date Sampled:	09.05.12
Sampled by:	Client	Date Received:	09.05.12
Sampled from:	Site	Date Tested:	17.05.12
Supplier:	Client	Sample Type:	Bulk
Source:	Site	Sample Mass (kg):	20

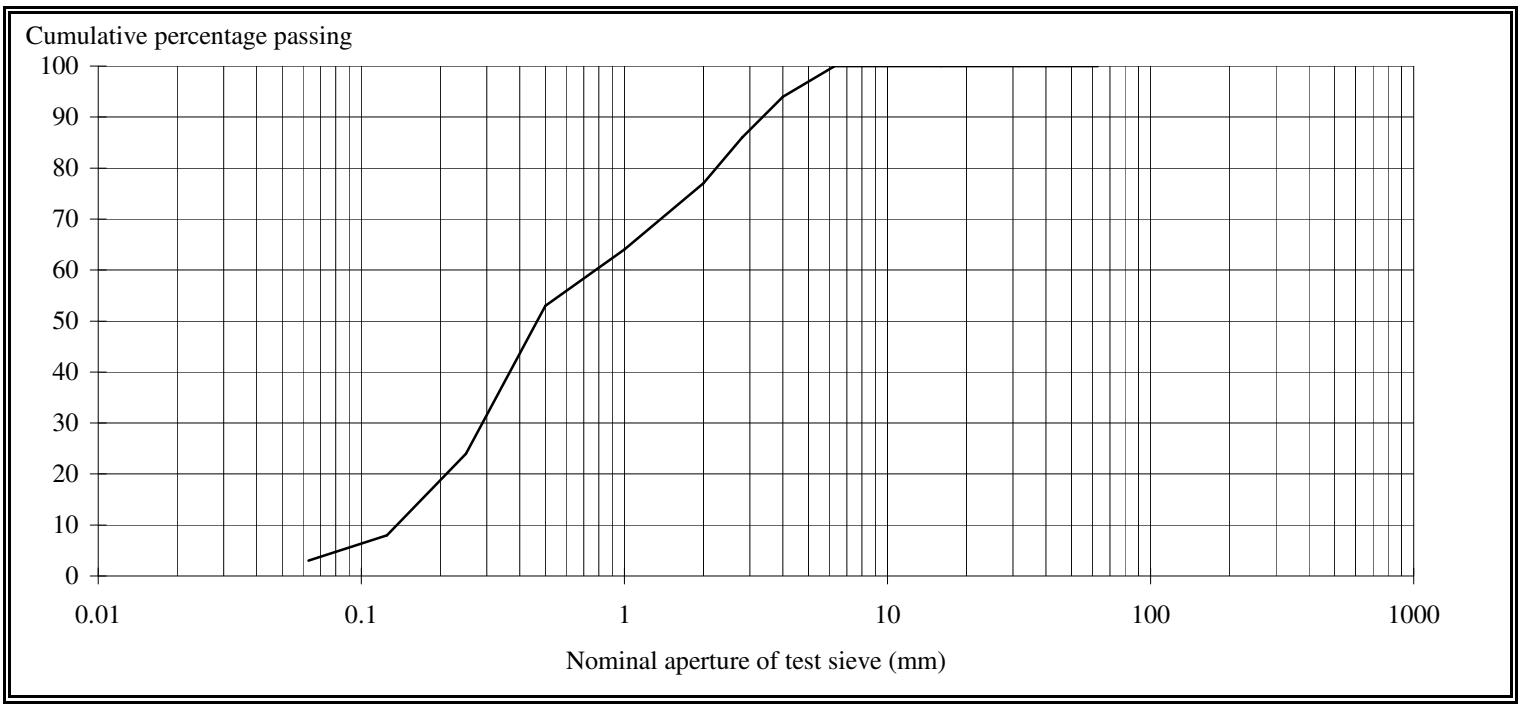
Description: 0/4 (MP) Fine aggregate for concrete
Brown SAND with occasional Crushed Concrete and Brick

Specification: PD 6682-1: 2009, Table No: D.1, Category G_f 85
Guidence on the use of BS EN 12620:2002 + A1

Remarks: Sample complies with the grading specification

SIEVE ANALYSIS

BS Sieve (mm)	Passing (%)	Material Specification		
63	100			
40	100			
31.5	100			
20	100			
16	100			
10	100			
8	100		100	
6.3	100	95	-	100
4	94	85	-	99(±5)
2.8	86			
2.0	77			
1.0	64		(±20)	
0.500	53	30	-	70
0.250	24		(±20)	
0.125	8			
0.063	3		(±3)	



Certified that the Particle Size Distribution was determined in accordance with BS EN 933-1: 1997
Certificate of sampling to BS EN 932-1: 1997 received

Date Reported: 22.05.12

Signed: M. Carr

[✓] M. Carr - Section Manager
[ ] D. Berrill - Laboratory Manager

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TEST REPORT

Determination of Particle Size Distribution

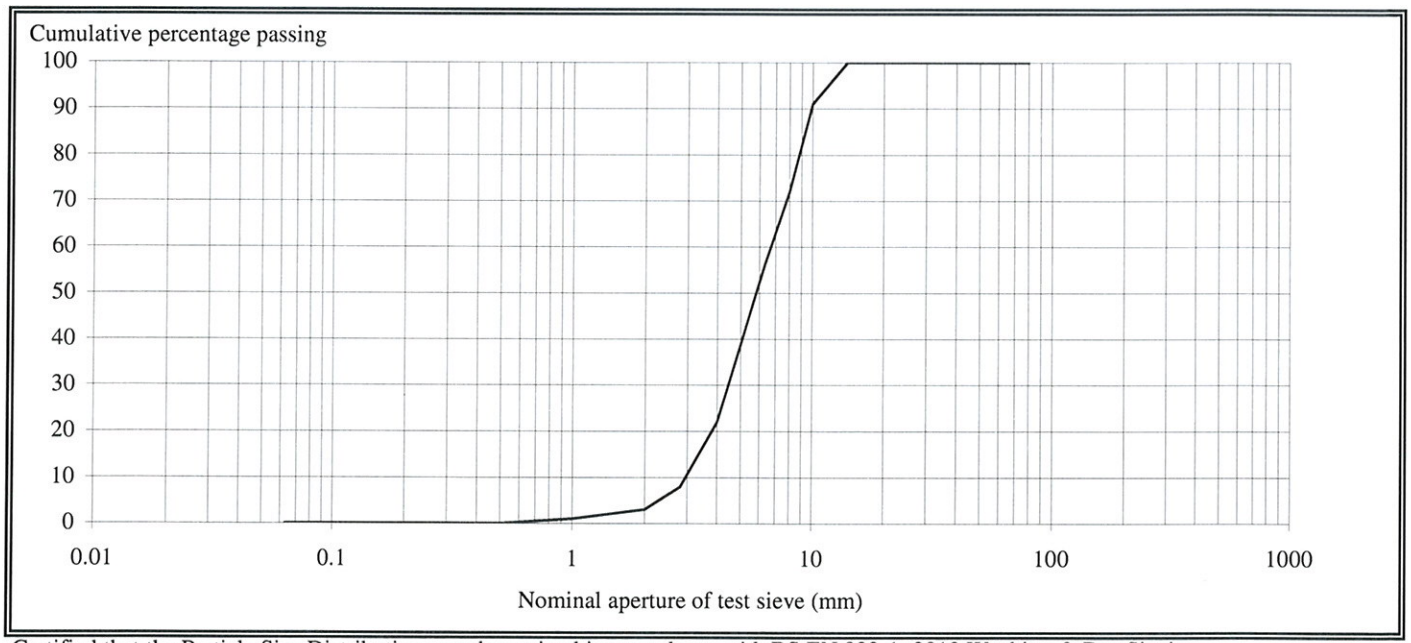
Client:	John Sheehan	Report No:	50168157/13/02
Client Address:	Knightsbridge Farm Yarnton Oxford	Batch Number:	DAM0040600
		Lab Ref:	45181327
Postcode:	OX5 1PH	Client Ref:	10mm
Site:	Stanton Harcourt		
		Date Sampled:	Not Advised
Sampled by:	Client	Date Received:	27.03.13
Sampled from:	Site	Date Tested:	08.04.13
Supplier:	Client	Sample Type:	Bulk
Source:	Site	Sample Mass (kg):	29.2

Description: 0/10 All-in aggregate for civil engineering
10mm Recycled Aggregate

Specification: PD 6682-6: 2009, Table 5, Category $G_A 90 (GT_A 20)$
Guidence on the use of BS EN 13242:2002 + A1

Remarks: Sample complies with the grading specification

SIEVE ANALYSIS					
BS Sieve (mm)	Passing (%)		Material Specification		
80	100				
63	100				
40	100				
31.5	100				
20	100		100		
16	100				
14	100		98	-	100
10	91	##	80	-	99(±5)
8	72				
6.3	56				
4	22		(±20)		
2.8	8				
2.0	3				
1.0	1				
0.500	0				
0.250	0				
0.125	0				
0.063	0		(±4)		



Certified that the Particle Size Distribution was determined in accordance with BS EN 933-1: 2012 Washing & Dry Sieving
Certificate of sampling to BS EN 932-1: 1997 not received

Comments: Supplier Declared Values are not included as part of this report.

Page: 1 of 1
Date Reported: 09.04.13

Signed: D. Berr

[ ] M. Carr - Section Manager
[ ] D. Berrill - Laboratory Manager

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TEST REPORT

Determination of Particle Size Distribution

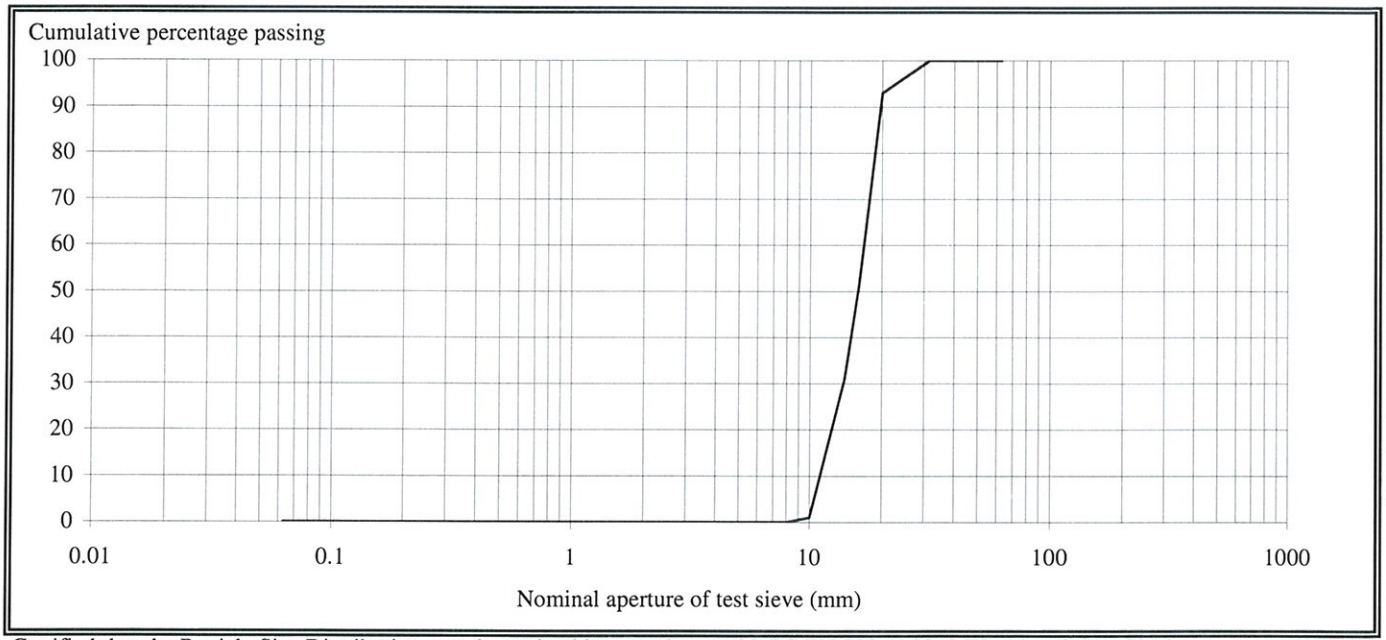
Client:	John Sheehan	Report No:	50168157/13/01
Client Address:	Knightsbridge Farm Yarnton Oxford	Batch Number:	DAM0040600
		Lab Ref:	45181326
Postcode:	OX5 1PH	Client Ref:	20mm
Site:	Stanton Harcourt		
		Date Sampled:	Not Advised
Sampled by:	Client	Date Received:	27.03.13
Sampled from:	Site	Date Tested:	08.04.13
Supplier:	Client	Sample Type:	Bulk
Source:	Site	Sample Mass (kg):	35

Description: 10/20 Single size aggregate for concrete
20mm Recycled Aggregate

Specification: PD 6682-1: 2009, Table No: C.1, Category G_c 85/20
Guidence on the use of BS EN 12620:2002 + A1

Remarks: Sample complies with the grading specification

SIEVE ANALYSIS				
BS Sieve (mm)	Passing (%)	Material Specification		
63	100			
40	100		100	
31.5	100	98	-	100
20	93	85	-	99
16	51			
14	31			
10	1	0	-	20
8	0			
6.3	0			
4	0	0	-	5
2.8	0			
2.0	0			
1.0	0			
0.500	0			
0.250	0			
0.125	0			
0.063	0			



Certified that the Particle Size Distribution was determined in accordance with BS EN 933-1: 2012 Washing & Dry Sieving
Certificate of sampling to BS EN 932-1: 1997 not received

Comments: Supplier Declared Values are not included as part of this report.

Page: 1 of 1
Date Reported: 09.04.13

Signed: D. Berrill

[ ] M. Carr - Section Manager
[✓] D. Berrill - Laboratory Manager

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TEST REPORT

Determination of Particle Size Distribution

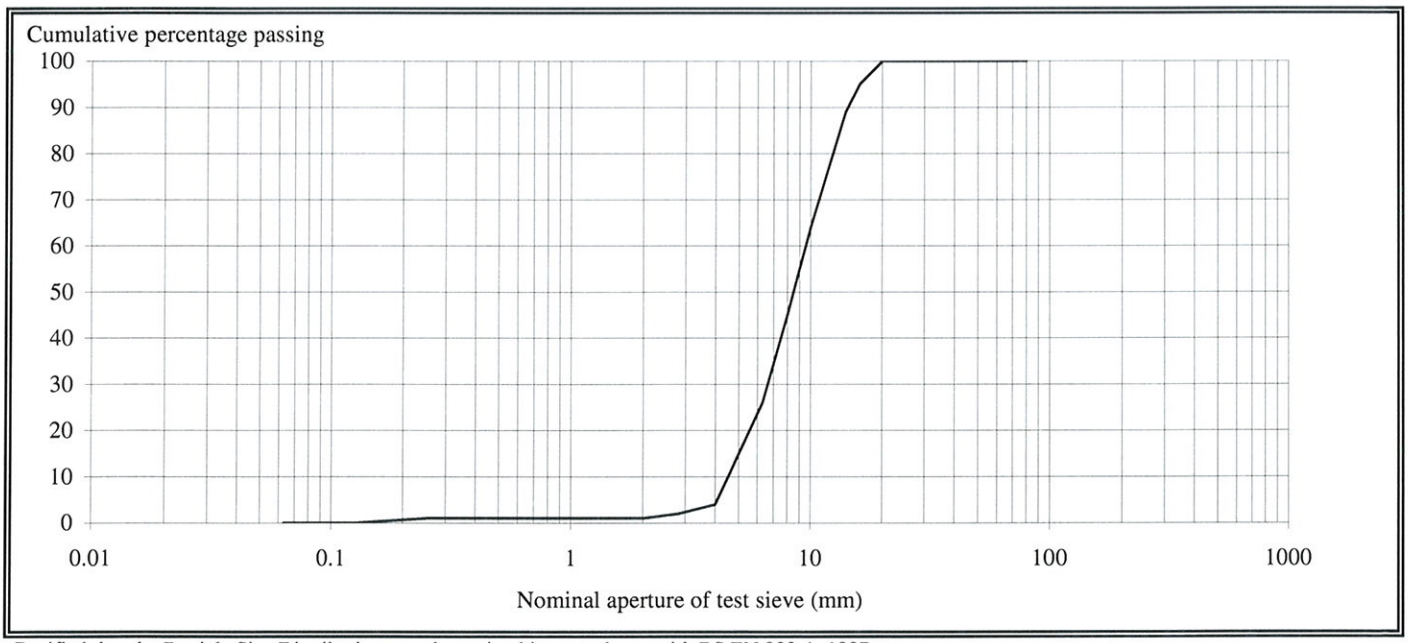
Client:	Sheehan Group	Report No:	50164751/12/11
Client Address:	Knightsbridge Farm Yarnton Oxford	Batch Number:	DAM0036964
		Lab Ref:	45162282
Postcode:	OX5 1PH		
		Location:	Stockpile
Site:	Oxford, OX29 5UX		
		Date Sampled:	11.06.12
Sampled by:	ESG Daventry	Date Received:	11.06.12
Sampled from:	Site	Date Tested:	21.06.12
Supplier:	Client	Sample Type:	Bulk
Source:	Site	Sample Mass (kg):	100

Description: 2/14 Graded coarse aggregate for civil engineering
4-20mm Crushed Concrete and Brick

Specification: PD 6682-6: 2009, Table 3, Category G_c 85/15
Guidence on the use of BS EN 13242:2002 + A1

Remarks: Sample complies with the grading specification

SIEVE ANALYSIS				
BS Sieve (mm)	Passing (%)	Material Specification		
80	100			
63	100			
40	100			
31.5	100		100	
20	100	98	-	100
16	95			
14	89	85	-	99
10	64			
8	45			
6.3	26	20	-	70(±17.5)
4	4			
2.8	2			
2.0	1	0	-	15
1.0	1	0	-	5
0.500	1			
0.250	1			
0.125	0			
0.063	0			



Certified that the Particle Size Distribution was determined in accordance with BS EN 933-1: 1997
Certificate of sampling to BS EN 932-1: 1997 received

Page: 1 of 1
Date Reported: 25.06.12

Signed: M. Carr

[✓] M. Carr - Section Manager
[ ] D. Berrill - Laboratory Manager

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TEST REPORT

Determination of Particle Size Distribution

Client:	Sheehan Group	Report No:	50164751/12/06
Client Address:	Knightsbridge Farm Yarnton Oxford	Batch Number: Lab Ref:	DAM0036539 45159696
Postcode:	OX5 1PH	Client Ref: Location:	40mm Agg Stockpile
Site:	Oxford, OX29 5UX		
		Date Sampled:	09.05.12
Sampled by:	Client	Date Received:	09.05.12
Sampled from:	Site	Date Tested:	17.05.12
Supplier:	Client	Sample Type:	Bulk
Source:	Site	Sample Mass (kg):	20

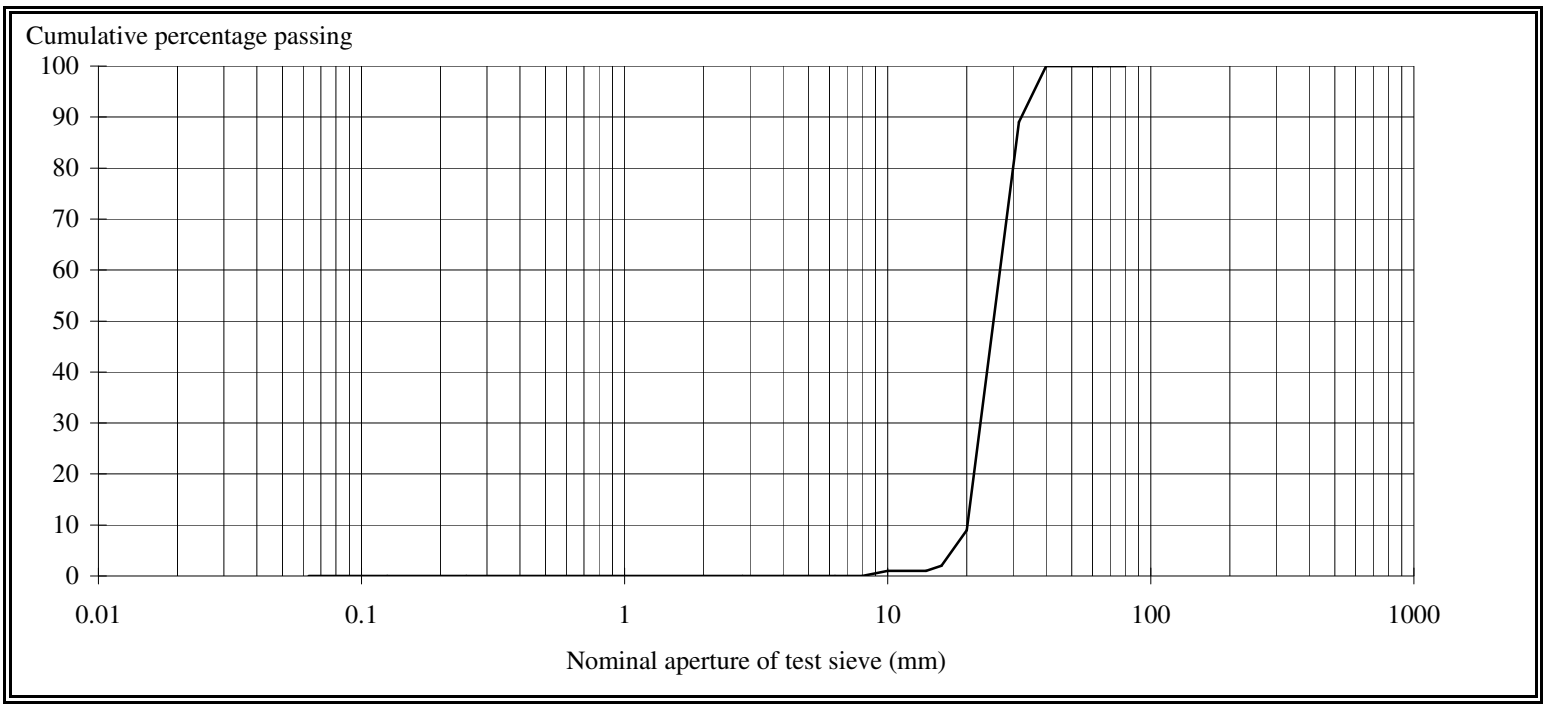
Description: 0/40 All-in aggregate for civil engineering
Crushed Concrete, Brick and Asphalt

Specification: PD 6682-6: 2009, Table 5, Category G_A 90 (GT_A20)
Guidence on the use of BS EN 13242:2002 + A1

Remarks: Sample complies with the grading specification

SIEVE ANALYSIS

BS Sieve (mm)	Passing (%)	Material Specification
80	100	100
63	100	98 - 100
40	100	80 - 99(±5)
31.5	89	
20	9	(±20)
16	2	
14	1	
10	1	
8	0	
6.3	0	
4	0	
2.8	0	
2.0	0	
1.0	0	
0.500	0	
0.250	0	
0.125	0	
0.063	0	(±4)



Certified that the Particle Size Distribution was determined in accordance with BS EN 933-1: 1997
Certificate of sampling to BS EN 932-1: 1997 received

Page: 1 of 1
Date Reported: 22.05.12

Signed: M. Carr

[✓] M. Carr - Section Manager
[ ] D. Berrill - Laboratory Manager

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TEST REPORT

Determination of Particle Size Distribution

Client:	Sheehan Group	Report No:	50164751/13/01
Client Address:	Knightsbridge Farm	Batch Number:	DAM0039527
	Yarnton	Lab Ref:	45176037
	Oxford		
Postcode:	OX5 1PH	Client Ref:	75mm
Site:	Station Lane, Witney		
		Date Sampled:	03.01.13
Sampled by:	ESG Daventry	Date Received:	03.01.13
Sampled from:	Site	Date Tested:	08.01.13
Supplier:	Client	Sample Type:	Bulk
Source:	Site	Sample Mass (kg):	120

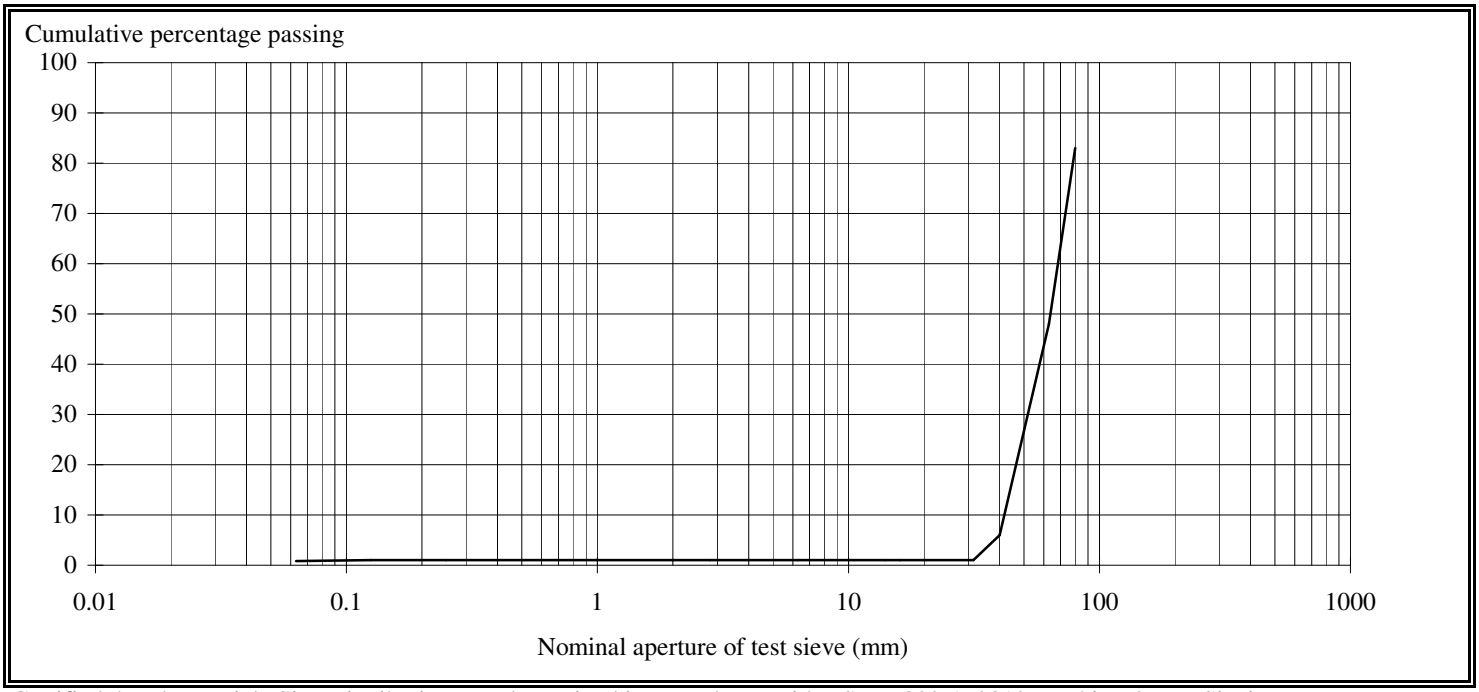
Description: 40/80 Single size aggregate for civil engineering
Crushed Concrete, Rock and Brick

Specification: Guidance on the use of BS EN 13242:2002 + A1:2007
Table 2, Category G_c 80/20

Remarks: Sample complies with the grading specification

SIEVE ANALYSIS

BS Sieve (mm)	Passing (%)	Material Specification		
125	100	98	-	100
80	83	80	-	99
63	48	20	-	70(±15)
40	6	0	-	20
31.5	1			
20	1	0	-	5
16	1			
14	1			
10	1			
8	1			
6.3	1			
4	1			
2.8	1			
2.0	1			
1.0	1			
0.500	1			
0.250	1			
0.125	1			
0.063	0.8			



Certified that the Particle Size Distribution was determined in accordance with BS EN 933-1: 2012 Washing & Dry Sieving
Certificate of sampling to BS EN 932-1: 1997 received

Comments: Supplier Declared Values are not included as part of this report.

Page: 1 of 1
Date Reported: 17.01.13

Signed: M. Carr

[✓] M. Carr - Section Manager
[ ] D. Berrill - Laboratory Manager

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TEST REPORT

Determination of Constituent Parts

Client: Sheehan Group
Knightsbridge Farm
Yarnton
Oxford
OX5 1PH

Report No: 50164751/12/12
Batch Number: DAM0036964

Contact:

Site: Oxford, OX29 5UX

Sample Details:

Laboratory Ref:	45162282
Client Ref:	Not Advised
Location:	Stockpile
Date Received:	11.06.12
Date Tested:	18.06.12
Date Sampled:	11.06.12
Sampled By:	ESG Daventry
Sample Certificate:	Received
Source:	Site
Supplier:	Client
Sample Type:	Bulk
Description:	Crushed Concrete and Brick

Test Results:

Constituents	Class	As Found (%)
Mass of Initial Test Portion (g):	-	**8760.3**
Mass of Test Portion (g):	-	**8461**
Mass Retained 63mm Sieve (g):	-	**0.0**
Mass Passing 4mm Sieve (g):	-	**299.3**
Mass of Reduced non Floating (g):	-	**2086.7**
Drying Temperature (°C):	-	**110**
Floating Constituents	(Class FL)	0.0
Other Particles	(Class X)	0.0
Concrete, Mortar & Products	(Class Rc)	21.2
Aggregate and Stone	(Class Ru)	65.2
Brick/Masonry/Clay (<1000 kg/m^3)	(Class Rb)	1.9
Asphaltic Materials	(Class RA)	11.3
Glass	(Class Rg)	0.2

Comments: Test undertaken on material retained 4mm sieve

Test Method: Specification for Highway Works 2009: Clause 710 and BS EN 933-11:2009

Page: 1 of 1
Date: 25.06.12

Signed: M. Carr

[✓] M. Carr - Section Manager
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TEST REPORT

Determination of Los Angeles Coefficient

Client: Sheehan Group
Knightsbridge Farm
Yarnton
Oxford
OX5 1PH

Report No: 50164751/12/09
Batch Number: DAM0036539

Contact:

Site: Oxford, OX29 5UX

Sample Details:

Client Ref:	20mm Agg
Location:	Stockpile
Date Received:	09.05.12
Date Tested:	15.05.12
Supplier:	Client
Date Sampled:	09.05.12
Sampled By:	ESG Daventry
Sample Certificate:	Received
Sample Type:	Bulk
Description:	20mm Agg
Size Fraction used in Test:	14/10mm

Test Results:

Laboratory Reference	Source	Material Class	Los Angeles Coefficient
45159697	Site	20mm	34

Test Method: BS EN 1097-2: 2010

Date: 22.05.12

Signed: M. Carr

[✓] M. Carr - Section Manager
[ ] D. Berrill - Laboratory Manager

For and on behalf of Environmental Scientifics Group

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

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TEST REPORT

Determination of 10% Fines Value

Client: Sheehan Group
Knightsbridge Farm
Yarnton
Oxford
OX5 1PH

Report No: 50164751/13/02
Batch Number: DAM0039527

Contact:

Site: Station Lane, Witney

Sample Details:

Laboratory Ref:	45176037
Client Ref:	75mm
Source:	Site
Location:	Not Advised
Date Received:	03.01.13
Date Tested:	16.01.13
Date Sampled:	03.01.13
Sampled By:	ESG Daventry
Sampling Certificate:	Received
Description:	Crushed Concrete, Rock and Brick

Test Results:

Supplier	Material Class	10% Fines Value (kN)
Client	75mm	85

Comments: Material tested in its soaked condition

Test Method: BS 812-111: 1990

Page: 1 of 1
Date: 17.01.13

Signed: 

[ ] M. Carr - Section Manager
[✓] D. Berrill - Laboratory Manager

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TEST REPORT

Determination of Permeability in Triaxial Cell

Client:	Sheehan Group Knightsbridge Farm Yarnton Oxford OX5 1PH	Report No: Batch Number:	50164751/12/10 DAM0036539
Contact:			
Site:	Oxford, OX29 5UX		

Sample Details:

Laboratory Ref:	45159699	Date Sampled:	09.05.12
Client Ref:	Silt	Sampled By:	ESG Daventry
Location:	Stockpile	Sampling Certificate:	Received
Type of Sample:	Bulk	Date Received:	09.05.12
Description:	Brown CLAY	Tested From:	11.05.12-17.05.12

	Initial Conditions	Final Conditions
Height (mm)	80.1	74.7
Diameter (mm)	105.8	105.5
Bulk Density (Mg/m³)	1.72	1.59
Moisture Content (%)	49	37
Dry Density (Mg/m³)	1.15	1.16
Hydraulic Gradient	159.2	
Mean Effective Stress (kPa)	187.5	
Permeability (m/s)	1.45 x 10-10	

Comments: Saturation achieved by circulation of water with a minimum back pressure of 300kPa.
Permeability measured when equal linear flow of water through the sample was achieved.
"data from calibration checks and volume change measurements available on request."

Certified that the Permeability was measured under constant head condition in a triaxial cell in accordance with Environment Agency R & D Technical Report P1 – 398/TR/2: January 2003

Page: 1 of 1
Date: 22.05.12

Signed: M. Carr

[✓] M. Carr - Section Manager
[ ] D. Berrill - Laboratory Manager

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TEST REPORT

Determination of Particle Density and Water Absorption

Client: Sheehan Group
Knightsbridge Farm
Yarnton
Oxford
OX5 1PH

Report No: 50164751/12/13
Batch Number: DAM0036964

Contact:

Site: Oxford, OX29 5UX

Sample Details:

Client Ref:	Not Advised
Date Received:	11.06.12
Date Tested:	19.06.12
Source:	Site
Supplier:	Client
Location:	Stockpile
Date Sampled:	11.06.12
Sampled By:	ESG Daventry
Sample Certificate:	Received
Sample Type:	Bulk
Description:	Crushed Concrete and Brick

Test Results:

Laboratory Reference	Mass of Dry Sample Tested	Size Fraction	Particle Density (Mg/m³)			Water Absorption (%)
			Oven Dried	Saturated Surface Dry	Apparent	
45162282	1937.5	4-31.5mm	2.47	2.55	2.7	3.5

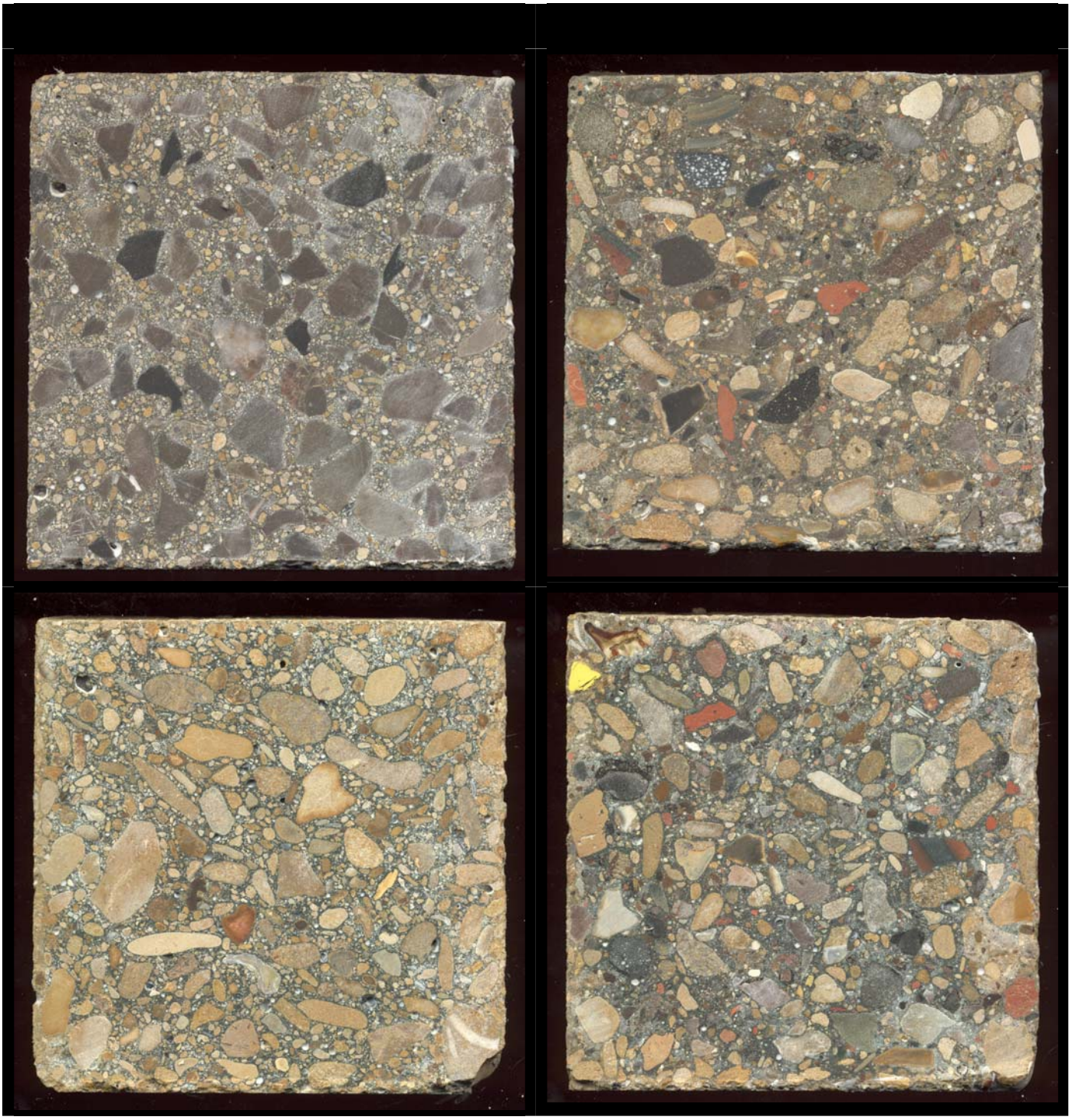
Test Method: BS EN 1097-6: 2000

Page: 1 of 1
Date: 25.06.12

Signed: M. Carr

[✓] M. Carr - Section Manager
[ ] D. Berrill - Laboratory Manager

For and on behalf of Environmental Scientifics Group



Dix Pit Washing Plant, Stanton Harcourt

Assessment of recycled fine aggregate

JULY 2013

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TABLES

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Cover image – Images of polished slices of 100 mm cube. Top left: Primary aggregate (coarse and fine), pfa, CEM I. Top right: Sheehan aggregates (coarse and fine), pfa, CEM I. Bottom left: Primary aggregates (coarse and fine), ggbs, CEM I. Bottom right: Sheehan aggregates (coarse and fine), ggbs, CEM I.

RSK DOCUMENT CONTROL

Report No.: 285231-02 (01)

Title: Dix Pit Washing Plant, Stanton Harcourt – Assessment of recycled fine aggregate

Client: Sheehan Group
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Date: 12 July 2013

Office: Hemel Hempstead

Status: FINAL

Author	Paul Bennett Hughes Associate Director	**Technical reviewer**	Dr Ian Sims Director
Signature		Signature	
Date:	12 July 2013	Date:	12 July 2013

This report is an abridged version of the full RSK report 284831-01 (01). None of the tests carried out have been omitted.

1 INTRODUCTION

1.1 Instructions

RSK were instructed to characterise the composition and properties of the processed recycled fine aggregate from stockpiles at Dix Pit Washing Plant, Stanton Harcourt, Oxfordshire. The purpose of assessing the various stockpiles, representing approximately 6 months of production, of the fine recycled arisings (say 'FRA') was to gain an initial assessment of the consistency of the product over a period of production time and also to assess whether it was potentially suitable for use within concrete. The tests included within this investigation were selected to give a preliminary indication of the fitness for purpose of the material.

1.2 Fine aggregate derived from arisings

The source of the material for the recycling plant is primarily construction arisings, rather than those sources stated for RA and RCA. There is a lack of published documents relating to the use of fine recycled arisings (say 'FRA') within concrete, so the properties of the material must be assessed on a 'first principles' basis. However, given that the FRA is a recycled product for use within concrete, it is possible to use some of the current BS and EN standards as guides to assess the potential use of the material within concrete. The use of fine RCA and RA should be taken on a case-by-case basis, which also seems applicable to FRA given the potential range of sources of material to be recycled.

1.3 Sampling

Samples were taken in accordance with BS EN 932-1[1].

[1] BS En 932-1: 1997, Tests for general properties of aggregates, Part 1: Methods of sampling, British Standards Institution, London, UK.

2 SUMMARY OF MATERIAL CHARACTERISTICS

A summary of the results of the testing undertaken by RSK on behalf of Sheehan Recycled Aggregates is shown in **Table 2.1**. All testing was conducted between January 2013 and April 2013.

Table 2.1 Summary of fine aggregate material properties

Test	EN 12620[2] Notes for aggregate	
	Class/Mean	Unit
Particle size distribution	***MP***	-
Acid soluble sulfate content	***$AS_{0.8}$***	as SO_3 (% by mass of dry aggregate)
Water soluble sulfate content	***$SS_{0.2}$***	as SO_3 (% by mass of dry aggregate)
Acid soluble chloride content	***0.014***	% chloride by mass of sample
Acid soluble chloride content	***0.004***	% chloride by mass of sample
Total sulfur	***Pass***	% S by mass of sample
Alkali content	***0.070***	% total alkalis as Na_2Oeq
Methylene blue	***0.93***	g of dye per kg
Apparent particle density	***3.04***	Mg/m^3
Particle water absorption	***3.2***	% of dry mass
Influence on initial setting time	***A_{40}***	delay in minutes (20 min in test)
Loose bulk density	***1.403***	kg/L

A more detailed schedule of test results is presented in **Appendix A**.

A summary of the mean petrographic composition of the aggregate is shown in **Table 2.2**.

Table 2.2 Summary of petrographic composition

Constituent	%
Quartz	38
Limestone	35
Ironstone	6
Sandstone	5
Shell	5
Brick	4
Slag	4
Quartzite	3
Chert	3
Calcite	1
Dolomite	1
Dolerite	<1
Glauconite	<1
Plant material	<1
Paint	<1

[2] BS EN 12620: 2008, Aggregates for concrete, British Standards Institution, London, UK

3 ASSESSMENT

- This assessment of suitability is based upon the sampling and testing described in this report.
- The recycled fine aggregate samples were well graded and could be classified as fitting the *MP* grading envelope. The mean fines (<63 µm) content was 3%, which is the threshold value between non-harmful and harmful fines in accordance with EN 12620. X-ray diffraction (XRD) analysis of the fines determined that the <2 µm sized material did not contain any clay materials.
- The mean methylene blue value of the recycled aggregate (0.93 g/kg) was relatively low and consistent with an aggregate dominated by quartz and limestone. There is no UK threshold value for methylene blue values, however the determined value would just satisfy the French maximum value of 1g/kg for aggregates for use in concrete.
- The constituents within the <63 µm sized material were similar to the >63 µm sized material (ie dominated by quartz and limestone).
- There was some variability in the results for the acid and water-soluble sulfate contents, with individual determinations, which, if taken on their own, would put the material into a higher category than the mean value. In accordance with EN 12620 the mean values for the material would classify the material as $AS_{0.2}$ and $SS_{0.2}$.
- The determined acid and water-soluble chloride contents for the fine recycled aggregate varied, but were consistently low. The chloride contents, along with the alkali content, particle density and water absorption value could be taken into account when specifying a concrete mix. The acid and water soluble chloride content of the recycled fine aggregate within a standard concrete mix, would suggest values of 0.09% and 0.05% by mass of cement for acid and water soluble chloride contents of concrete, respectively. These values of chlorides within a concrete would enable it to be used for plain concrete and concrete containing steel reinforcement, however, it would not be suitable for concrete containing prestressing steel.
- The alkali content of the recycled fine aggregate if used in a 2:1 ratio with a typical natural flint coarse aggregate would contribute approximately 0.9 kg $Na_2Oeq./m^3$ of concrete.
- The mean total sulfur content of the recycled aggregate did not exceed the threshold value in EN 12620 for natural aggregates (mean value 0.10% sulfur by mass of sample against a threshold value of 1%).
- The initial setting time of cement was increased by use of the fine recycled aggregate; increasing the mean setting time by 20 minutes.
- The loose bulk density of the aggregate appears fairly consistent, with a mean of 1.40 kg/L, which is comparable with fine aggregates used for normal weight concrete. The particle density appears slightly higher than expected.

- Overall, the findings of the testing appear positive and indicate that the fine aggregate material can be used within concrete for a wide range of applications.
- Further sampling and monitoring of the fine aggregate will take place as production continues and consequently this report will be updated from time to time.

APPENDIX A - SUMMARY OF TESTING

Test	EN 12620[3] Notes for aggregate			
	Class/Mean	Unit	Sieve size, mm	Percentage passing (range)
Particle size distribution*	***MP***	-		
			63.0	100
			31.5	100
			16.0	100
			8.0	100
			3.35	100
			2.0	98 to 99
			1.0	80 to 87
			0.5	61 to 69
			0.25	29 to 33
			0.125	10 to 12
			0.063	2.5 to 3.2
Test	**Class/Mean**	**Unit**	**Range**	**Mean value**
Acid soluble sulfate content	***$AS_{0.8}$***	as SO_3 (% by mass of dry aggregate)	0.1 to 0.3	0.2
Water soluble sulfate content	***$SS_{0.2}$***	as SO_3 (% by mass of dry aggregate)	0.01 – 0.26	0.13
Acid soluble chloride content	***0.014***	% chloride by mass of sample	0.012 – 0.016	0.014
Water soluble chloride content	***0.004***	% chloride by mass of sample	0.002 – 0.005	0.004
Total sulfur	***Pass***	% S by mass of sample	0.05 – 0.16	0.10
Alkali content	***0.070***	% total alkalis as Na_2Oeq	0.066 – 0.073	0.070
Methylene blue	***0.93***	g of dye per kg	0.7 – 1.1	0.93
Apparent particle density	***3.04***	Mg/m^3	3.02 – 3.08	3.04
Particle water absorption	***3.2***	% of dry mass	2.9 – 3.7	3.2
Influence on initial setting time	***A_{40}***	delay in minutes (20 min in test)	*-4 - 32*	*20*
Loose bulk density	***1.403***	kg/L	1.364 – 1.430	1.403

**<63µm material shown by XRD predominantly to exhibit a similar composition as the >63µm material and not include any clay mineral material.*

[3] BS EN 12620: 2008, Aggregates for concrete, British Standards Institution, London, UK