AGGREGATES ROUND 3
VIC & TAS

PROFICIENCY TESTING PROGRAM

MARCH 2006

REPORT NO. 504

ACKNOWLEDGEMENTS

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CONTENTS

1. FOREWORD

This report summarises the results for round three of a series of proficiency testing programs on the analysis of aggregate.

NATA's Proficiency Testing Group conducted the exercise in November 2005 as part of it's laboratory accreditation activities. Note that from 1 January 2006 the delivery of proficiency testing services was transferred from NATA to a new, wholly owned subsidiary called Proficiency Testing Australia (PTA).

The aim of the program was to assess laboratories' ability to competently perform the tests examined.

2. FEATURES OF THE PROGRAM

a) A total of 111 laboratories from Victoria and Tasmania were sent samples for the program. 98 of the 111 laboratories returned results in time for inclusion in the final report.

b) Participating laboratories were supplied one bucket of 20 mm graded blend of aggregate.

c) The following tests were performed on each sample:

- Material finer than 75 µm (nearest 0.1%)
- Particle size distribution (nearest whole number)
- Particle shape by proportional calliper (nearest 1%) by 2:1 and 3:1 ratio
- Particle density on a saturated-surface-dry basis (nearest 0.01t/m^3)
- Apparent particle density (nearest 0.01t/m^3)
- Particle density on a dry basis (nearest 0.01t/m^3)
- Water absorption (nearest 0.1%)

Not all laboratories reported results for each analyte.

d) Prior to distribution the samples were analysed for homogeneity. Based on the results of this preliminary testing it was concluded that the samples were sufficiently homogeneous. Therefore, any results later identified as outliers could not be attributed to any significant sample variability. (Appendix B)

e) Laboratories were requested to perform the tests according to their accredited methods and the "Instructions to Participants", and to record their results on the accompanying "Results Sheet", both of which were distributed to participants with the sample. (Appendix C)

f) Each laboratory was randomly allocated a unique code number for the program to enable confidentiality of results. Reference to each laboratory in this report is made by its code number.

3. FORMAT OF APPENDICES

APPENDIX A

Appendix A lists all the results reported by the participating laboratories for each test.

Calculated robust z-scores, z-score charts and a table of robust statistics - number of results, median, normalised IQR, robust CV, minimum, maximum and range, are presented for the following tests:

- Material finer than 75 µm
- Particle density on a saturated-surface-dry basis
- Apparent particle density
- Particle density on a dry basis
- Water absorption

Number of results, median and normalised IQR are presented for the following tests:

- Particle size distribution
- Particle shape by proportional calliper

No z-scores were calculated for these tests. Upper and lower limits were determined by multiplying the normalised IQR by 3. Any results reported outside of these limits is classed as an outlier result. Scatter plots display the distribution of results reported.

APPENDIX B

Appendix B contains details of sample preparation and homogeneity testing data.

APPENDIX C

Appendix C contains a copy of the “Instructions to Participants” and the “Results Sheet” supplied to participants.

4. STATISTICAL DESIGN OF THE PROGRAM

Robust statistical procedures were used to generate the z-scores and summary statistics for the sample.

- number of results
- median
- normalised interquartile range
- minimum
- maximum
- range

Robust z-scores were calculated for each laboratory based on the results submitted for each test. Robust z-scores were not calculated for Particle Size Distribution or Particle Shape by Proportional Calliper. Outliers were determined by setting upper and lower limits.

5. OUTLIER RESULTS

In order to achieve the program's aim of assessing laboratories' testing performance, a robust statistical approach, which uses z-scores to assess participants performance has been utilised. The z-score is a measure of how far the result(s) is from the consensus value - a normalised value which gives a "score" to each result relative to the other results in the group. Therefore a z-score close to zero means that the result agrees well with those from other laboratories. An outlier will be any result(s) which has an absolute z-score value greater than three. For Particle Size Distribution and Particle Shape by Proportional Calliper, any results reported that are outside the upper and lower limits are deemed outliers.

Laboratories who reported outliers are listed in Table B. Any laboratories reporting outliers who are accredited for the specific test will be requested to investigate the cause/s of the outlier.

TABLE A: Summary Statistics

Test	No. of Results	Median	Normalised IQR
Material finer than 75 µm (nearest 0.1%)	72	0.70	0.22
Particle size distribution (nearest whole number) 26.5mm	86	100.0	0.0
19.0mm	96	99.0	0.7
13.2mm	96	23.0	3.7
9.5mm	96	3.0	0.8
6.7mm	95	2.0	0.7
4.75mm	95	2.0	0.7
2.36mm	93	1.0	0.7
Particle shape by proportional calliper (nearest 1%) 2:1	38	10.0	2.8
3:1	38	1.0	1.4
Particle density on a saturated-surface-dry basis (nearest 0.01t/m^3)	31	2.670	0.011
Apparent particle density (nearest 0.01t/m^3)	30	2.690	0.015
Particle density on a dry basis (nearest 0.01t/m^3)	31	2.660	0.011
Water absorption (nearest 0.1%)	31	0.500	0.074

TABLE B: Outlier Results

Test	Lab Code
Material finer than 75 µm	29, 31, 61
Particle size distribution (nearest whole number)	2, 7, 14, 24, 26, 27, 31, 50, 54, 75, 79, 83, 89
Particle shape by proportional calliper (nearest 1%)	46
Particle density on a saturated-surface-dry basis	26, 104
Apparent particle density	104
Particle density on a dry basis	104, 106
Water absorption	27

6. TECHNICAL COMMENTS

General Comments
Overall, the laboratories performed the required tests very well. For the seven tests, the 98 participant laboratories reported a total of 928 results. In total, 37 outlier results were reported by 17 laboratories. This means 3.99% of the total results reported for this program were outlier results. Also any laboratories reporting results with an absolute z-score between 2 and 3 are also encouraged to review procedures. For all tests the relevant section of AS1141 was reported by the majority of participants.

Material finer than 75 µm (nearest 0.1%)
Three outliers were reported by lab codes 29, 31 and 61. The majority of labs reported using AS1141.12. Three labs (codes 5, 18 & 46) reported using 1141.11, one lab (code 83) used KS1238 Part 4.2, and one lab (code 8) used an in-house method.

Particle Size Distribution (nearest whole number)
Upper and lower limits were set for each sieve size, with any results outside these limits considered outliers. Scatter plots (see Appendix A) highlight the upper and lower limits and display the spread of results. For sieve size 26.5, all laboratories reported 100% passing, so no limits were set.
For sieve size 19.00mm, limits were set at 100 and 96.8 and no outliers were reported.
For sieve size 13.2, the upper limit was 34.2 and the lower limit 11.8. One outlier was reported by lab code 31.
For sieve size 9.5, the upper limit was 5.5 and the lower limit 0.5. Outliers were reported by lab codes 7, 14, 24, 26, 27, 31, 50, 54, 75, 79 & 89.
For sieve size 6.7, the upper limit was 4.5 and the lower limit 0. Outliers were reported by lab codes 2, 7, 26, 27, 31, 54, 75 & 89.
For sieve size 4.75, the upper limit was 4.2 and the lower limit 0. Outliers were reported by lab codes 26, 31 & 75.
For sieve size 2.36, the upper limit was 3.2 and the lower limit 0. Outliers were reported by lab codes 2, 26 & 31.

Particle shape by proportional calliper (nearest 1%) by 2:1 and 3:1 ratio
For 2:1 ratio, the upper limit was set at 18.3 and the lower limit at 1.7. For 3:1 ratio, the upper limit was 5.3 and the lower limit was 0. Lab code 46 reported outliers for both 2:1 and 3:1 ratio. All laboratories reported using AS1141.14.

Particle density on a saturated-surface-dry basis (nearest 0.01t/m^3)
Two outliers were reported by lab codes 26 and 104. The majority of labs reported using AS1141.6. Lab code 70 reported using AS1289 5.4.1 part 3(c).

Apparent particle density (nearest 0.01t/m^3)
Only one outlier was reported by lab code 104. All laboratories reported using AS1141.6.

Particle density on a dry basis (nearest 0.01t/m^3)
Two outliers were reported by lab codes 104 and 106. Lab code 70 reported using AS1289 5.4.1 part 3(c), while all other labs reported using AS1141.6.

Water Absorption (nearest 0.1%)
Lab code 27 reported the only outlier for this test. The majority of labs reported using AS1141.6, while lab code 70 reported using AS1289 5.4.1 part 3(c).

7. REFERENCE

[1] Guide to Proficiency Testing Australia – January 2006.

APPENDIX A

Summary of Results

and

Robust Z-Score Charts

Material finer than 75 µm (nearest 0.1%)

Lab Code	Result	Robust Z-Score	Method
1	0.9	0.90	AS1141.12
5	0.8	0.45	1141.11
6	0.4	-1.35	AS1141.12
7	0.7	0.00	AS1141.12
8	1.1	1.80	T203
9	0.5	-0.90	1141.12
10	0.2	-2.25	AS1141.12-1996
11	0.7	0.00	AS1141.12
13	0.5	-0.90	AS1141.12
15	0.4	-1.35	AS1141.12
16	0.8	0.45	AS1141.12
18	0.6	-0.45	AS1141.11
19	0.4	-1.35	AS1141.12
23	1.0	1.35	AS1141.12
25	0.8	0.45	AS1141.12
26	1.1	1.80	AS1141.12
27	0.8	0.45	AS1141.12
28	0.9	0.90	AS1141.12
29	17.2	74.19 §	AS1141.12
30	0.5	-0.90	AS1141.12
31	1.6	4.05 §	AS1141.12
33	0.4	-1.35	AS1141.12
36	0.4	-1.35	1141.12
37	0.6	-0.45	AS1141.12
39	0.6	-0.45	AS1141.12
40	0.8	0.45	1141.12
41	0.5	-0.90	AS1141.12
42	0.7	0.00	
43	0.4	-1.35	AS1141.12
45	0.7	0.00	AS1141.12
46	0.6	-0.45	AS1141.11
48	1	1.35	AS1141.12
50	0.7	0.00	AS1141.12
52	0.7	0.00	AS1141.12
53	0.7	0.00	AS1141.12
55	0.5	-0.90	AS1141.12
57	0.6	-0.45	AS1141.12
58	1	1.35	AS1141.12
61	4.5	17.09 §	AS1141.12
63	0.7	0.00	1141.12
64	0.5	-0.90	AS1141.12

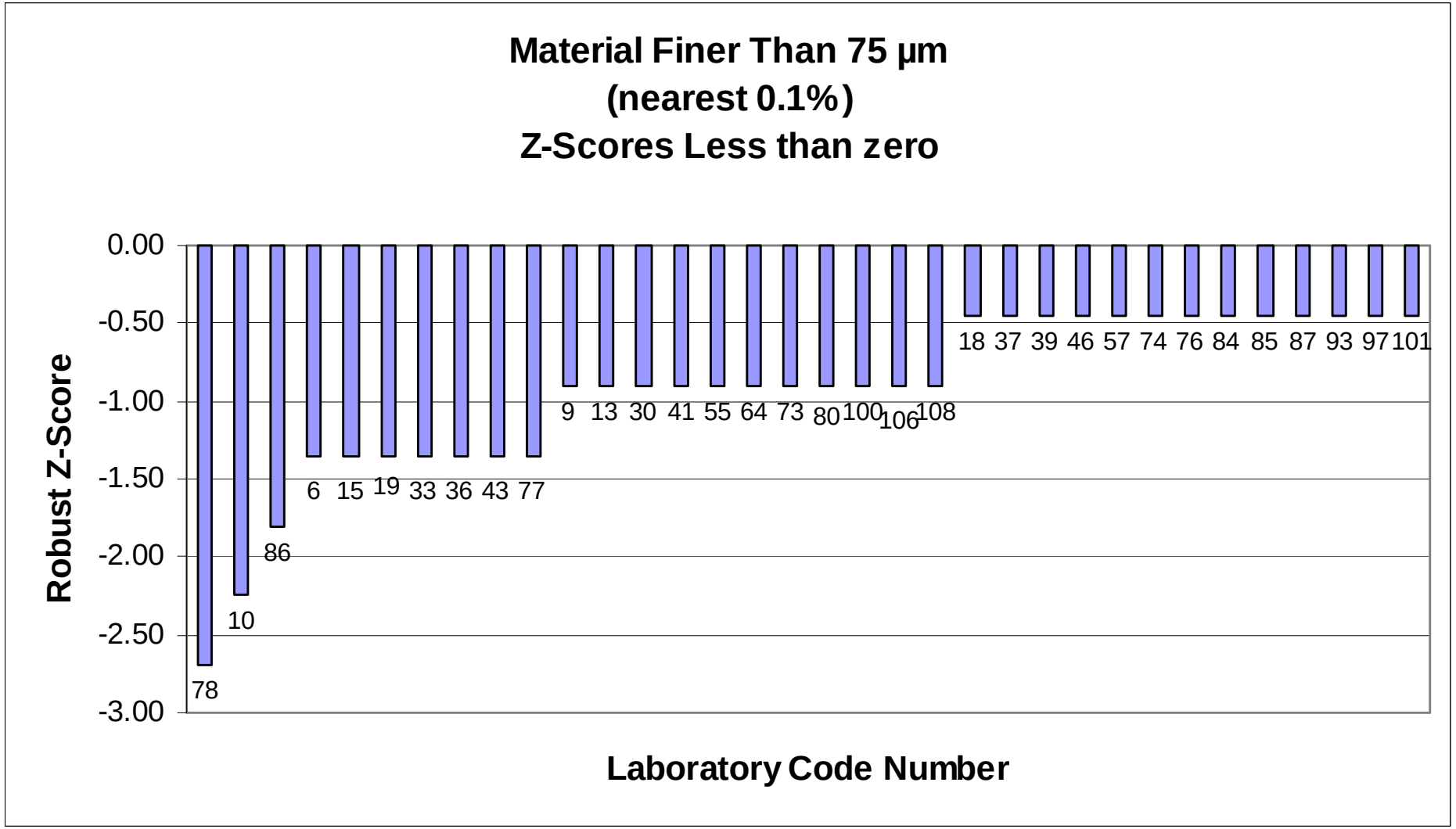
Note:
§ Denotes an outlier

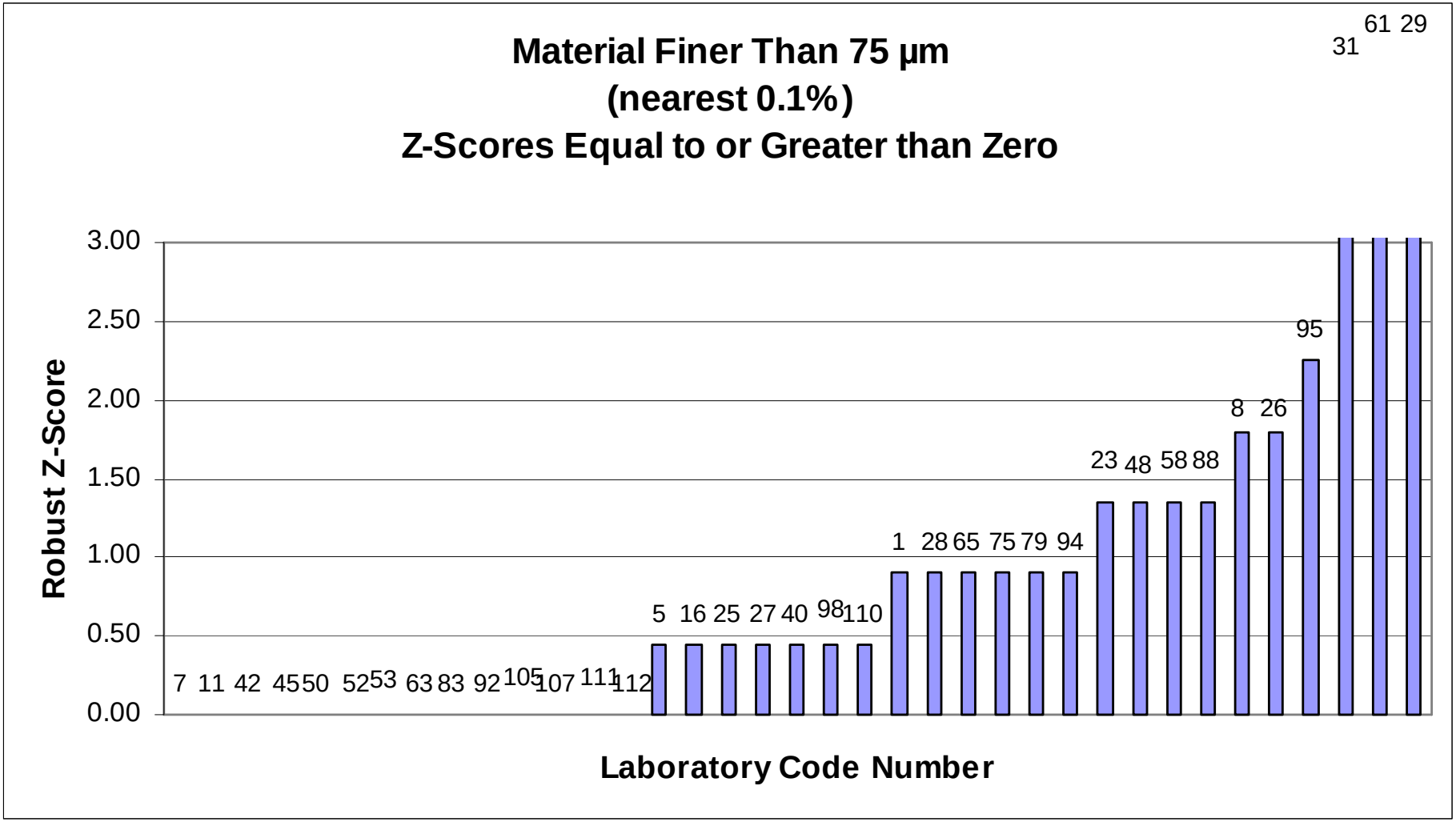
Material finer than 75 µm (nearest 0.1%)

Lab Code	Result	Robust Z-Score	Method
65	0.9	0.90	AS1141.12
73	0.5	-0.90	AS1141.12
74	0.6	-0.45	AS1141.12
75	0.9	0.90	AS1141.12
76	0.6	-0.45	AS1141.12
77	0.4	-1.35	AS1141.12
78	0.1	-2.70	
79	0.9	0.90	AS1141.12
80	0.5	-0.90	AS1141.12
83	0.7	0.00	KS1238 Part 4.2
84	0.6	-0.45	AS1141.12
85	0.6	-0.45	AS1141.12
86	0.3	-1.80	AS1141.12
87	0.6	-0.45	AS1141.12
88	1.0	1.35	AS1141.12-1996
92	0.7	0.00	1141.12
93	0.6	-0.45	AS1141.12-1996
94	0.9	0.90	AS1141.12
95	1.2	2.25	AS1141.12-1996
97	0.6	-0.45	AS1141.12
98	0.8	0.45	AS1141.12
100	0.5	-0.90	AS1141.12
101	0.6	-0.45	AS1141.12
104	0.6	-0.45	AS1141.12
105	0.7	0.00	AS1141.12
106	0.5	-0.90	
107	0.7	0.00	1141.12
108	0.5	-0.90	AS1141.12
110	0.8	0.45	AS1141.12
111	0.7	0.00	AS1141.12
112	0.7	0.00	AS1141.12

No. Results	72
Median	0.70
Normalised IQR	0.22
Robust CV	31.8%
Minimum	0.1
Maximum	17.2
Range	17.1

Note:
§ Denotes an outlier


Material Finer Than 75 µm
(nearest 0.1%)
Z-Scores Less than zero
Robust Z-Score
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00
78
10
86
6 15 19 33 36 43 77
9 13 30 41 55 64 73 80 100 106 108
18 37 39 46 57 74 76 84 85 87 93 97 101
Laboratory Code Number


Material Finer Than 75 µm
(nearest 0.1%)
Z-Scores Equal to or Greater than Zero
Robust Z-Score
3.00
2.50
2.00
1.50
1.00
0.50
0.00
7 11 42 45 50 52 53 63 83 92 105 107 111 112 5 16 25 27 40 98 110 1 28 65 75 79 94 23 48 58 88 8 26 95 31 61 29
Laboratory Code Number

Particle Size Distribution (nearest whole number)

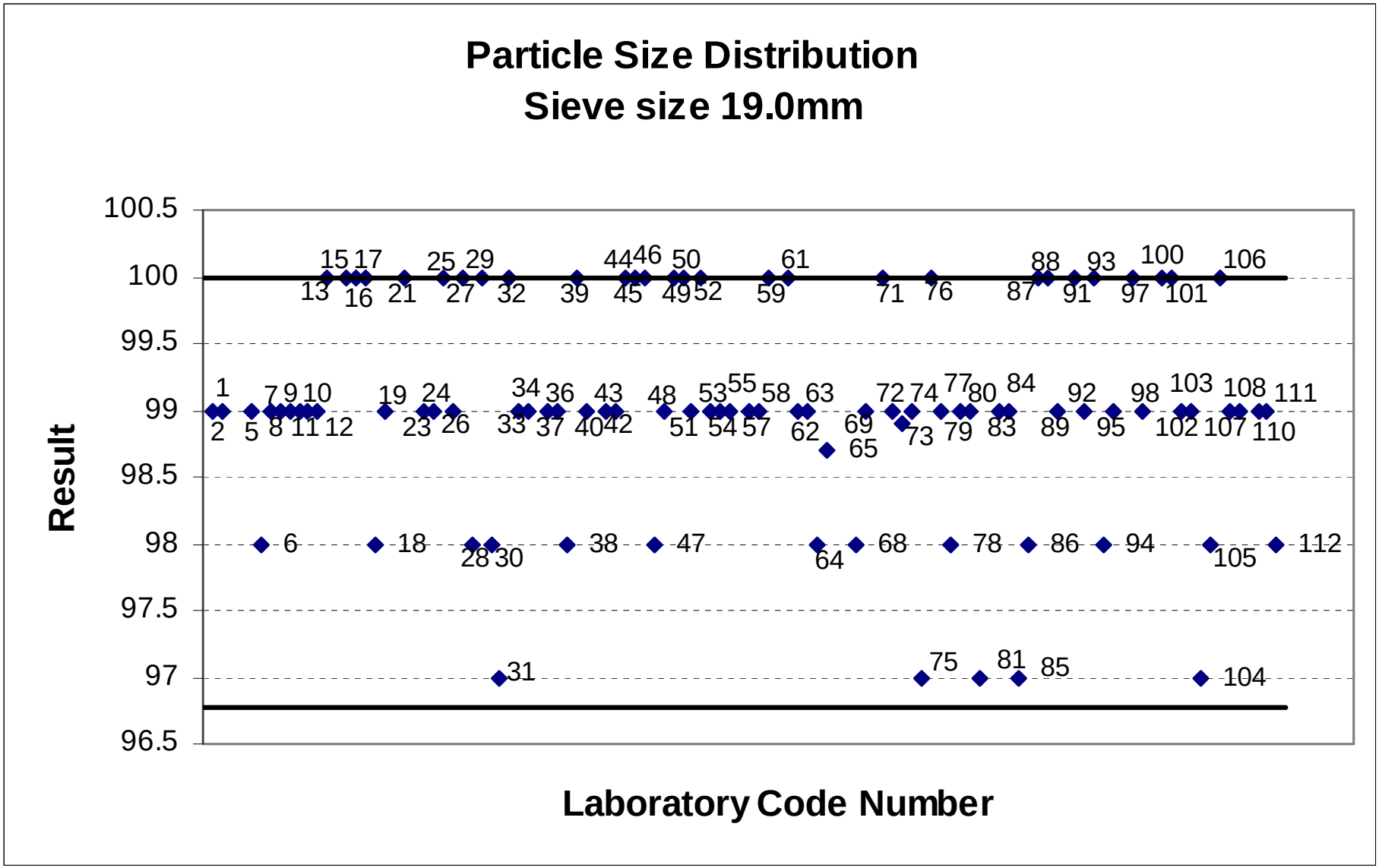
Lab Code	26.5mm	19.0mm	13.2mm	9.5mm	6.7mm	4.75mm	2.36mm	Method
1	100	99	26	5	3	3	2	AS1141.11
2	100	99	23	5	5 §	4	4 §	AS1141.11
5	100	99	14	2	1	1	1	AS1141.11
6	100	98	21	2	1	1	1	AS1141.11
7	100	99	27	6 §	5 §	4	2	AS1141.11
8	100	99	23	4	3	3	2	AS1141.11
9	100	99	23	3	2	1	1	1141.11
10	100	99	22	2	1	1	1	AS1141.11-1996
11	100	99	18	3	2	2	2	AS1141.11
12	100	99	17	3	3	2	2	AS1141.11
13	100	100	23	3	2	2	2	AS1141.11
14	0	0	29	6 §	4	4	3	AS1141.11
15	100	100	21	2.2	1.4	1.3	1.2	AS1141.11
16		100	25	4	3	2	2	AS1141.11
17	100	100	15	2	1	1	0	AS1141.11
18	100	98	28	3	3	2	2	AS1141.11
19	100	99	20	1	0	0	0	AS1141.11
21	100	100	16	2	2	1	1	AS1141.11
23	100	99	17	3	2	2	1	AS1141.11
24	100	99	20	6 §	4	3	2	AS1141.11
25	100	100	20	3	3	2	2	AS1141.11
26	100	99	31	8 §	7 §	6 §	4 §	AS1141.11
27	100	100	27	6 §	5 §	4	2	AS1141.11
28	100	98	24	3	2	2	2	AS1141.11
29	100	100	25	3	2	2	1	AS1141.11
30	100	98	28	3	2	1	1	AS1141.11
31	0	97	39 §	25 §	24 §	24 §	16 §	AS1141.11
32	100	100	26	3	2	1	1	AS1141.11
33	100	99	21	4	3	2	2	AS1141.11
34	100.0	99.0	21.0	3.0	2.0	2.0	1.0	AS1141.11
36	100	99	22	3	2	1	1	1141.11
37	100	99	22	4	3	2	2	AS1141.11
38	100	98	20	2	2	1	1	1141.11
39	100	100	24	3				AS1141.11
40	100	99	23	3	2	2	2	1141.11
41								
42	100	99	25	5	3	2	1	AS1141.11
43	100	99	19	2	1	1	1	AS1141.11
44	100	100	27	3	2	1	1	AS1141.11
45	100	100	26	5	2	2	1	AS1141.11
46	100	100	21	2	1	1	1	
47		98	21	3	2	1	1	1141.11

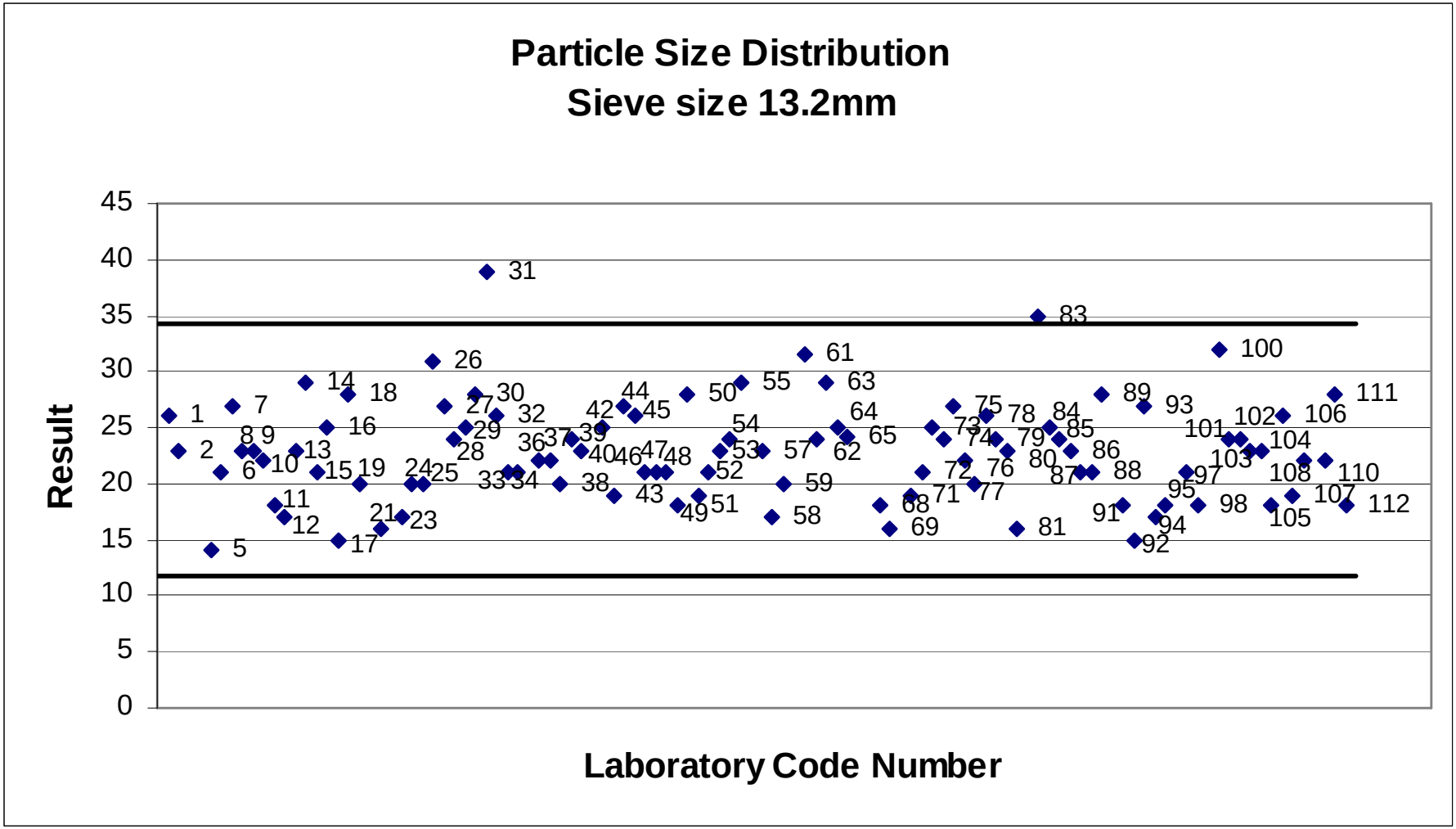
Particle Size Distribution (nearest whole number)

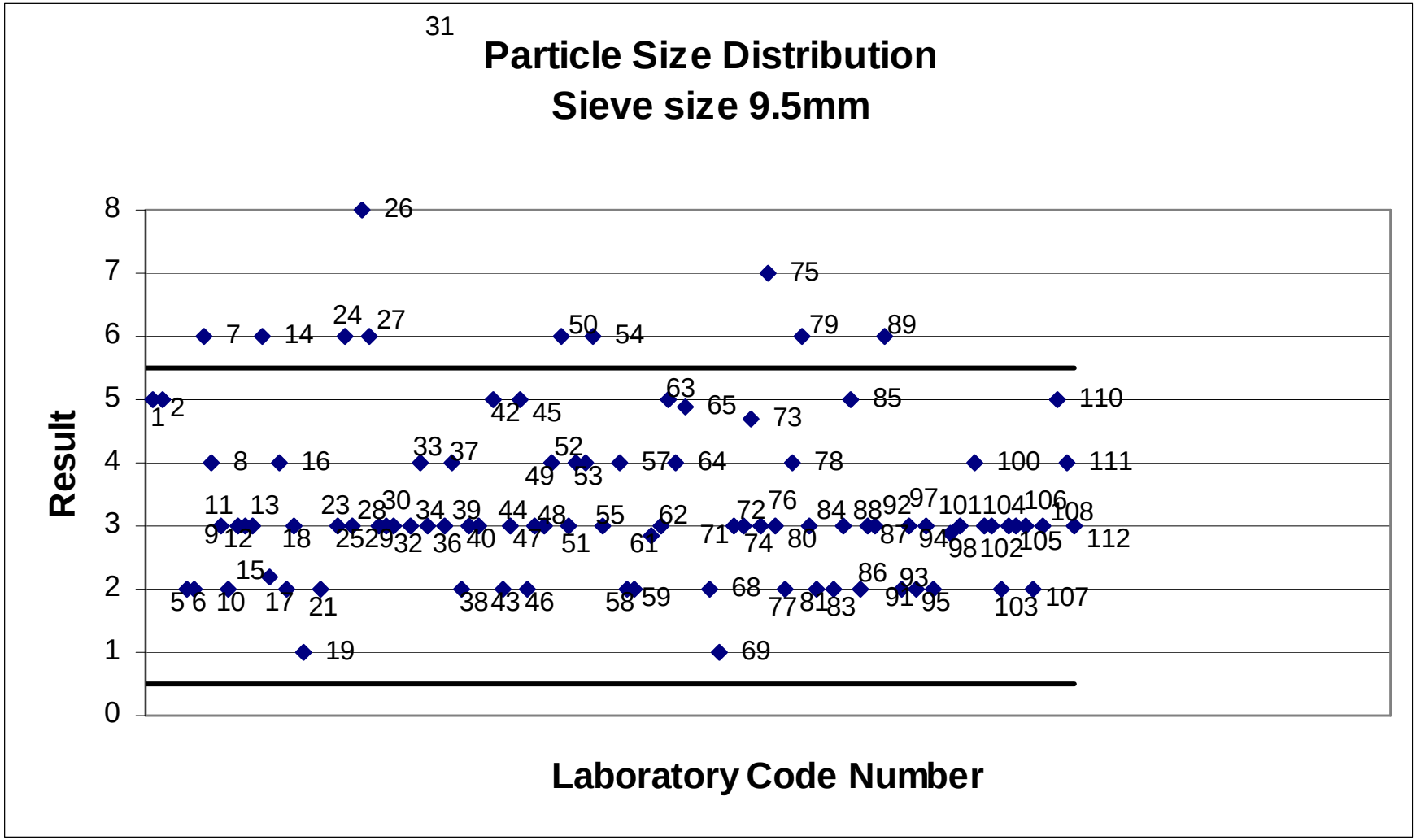
Lab Code	26.5mm	19.0mm	13.2mm	9.5mm	6.7mm	4.75mm	2.36mm	Method
48	100	99	21	3	2	2	1	AS1141.11
49	100	100	18	4	2	2	2	AS1141.11
50	100	100	28	6 §	4	4	2	AS1141.11
51	100	99	19	3	2	2	1	AS1141.11
52		100	21	4	3	2	1	AS1141.11
53	100	99	23	4	3	2	2	AS1141.11
54	100	99	24	6 §	5 §	4	2	
55	100	99	29	3	2	1	1	AS1141.11
57	100	99	23	4	2	2	1	AS1141.11
58	100	99	17	2	2	1	1	AS1141.11
59		100	20	2	2	1	1	AS1141.11
61		100.00	31.62	2.83	1.97	1.86		AS1141.11
62	100	99	24	3	2	2	2	1141.11 1289.216
63	100	99	29	5	3	2	2	1141.11
64	100	98	25	4	3	2	2	AS1141.11
65	100	98.7	24.1	4.9	3.1	2.5	2.0	AS1141.11
68	100	98	18	2	2	2	1	AS1141.11
69		99	16	1	0	0	0	AS1141.11
71		100	19	3	2	2	1	AS1141.11
72	100	99	21	3	2	2	2	AS1141.11
73	100	98.9	25.1	4.7	2.4	1.8	1.3	AS1141.11
74	100	99	24	3	2	2	2	AS1141.11
75	100	97	27	7 §	6 §	5 §	3	AS1141.11
76	100	100	22	3	2	2	1	AS1141.11
77	100	99	20	2	2	1	1	AS1141.11
78	100	98	26	4	2	2	2	
79	100	99	24	6 §	4	3	2	AS1141.11
80	100	99	23	3	2	2	2	
81	100	97	16	2	2	2	1	AS1141.11
83	100	99	35	2	0	0		KS 1238 Part 4.1
84	100	99	25	3	2	2	1	AS1141.11
85	100	97	24	5	4	3	2	AS1141.11
86	100	98	23	2	2	1	1	AS1141.11
87	100	100	21	3	2	2	1	AS1141.11
88	100	100	21	3	2	2	2	AS1141.11-1996
89	100	99	28	6 §	5 §	4	2	AS1141.11
91	100	100	18	2	2	1	1	
92	100	99	15	3	2	2	2	1141.11
93	100	100	27	2	1	1	1	AS1141.11-1996
94	100	98	17	3	2	2	1	AS1141.11
95	100	99	18	2	2	1	1	AS1141.11-1996
97	100	100	21	2.9	2.3	2.0	1.5	AS1141.11

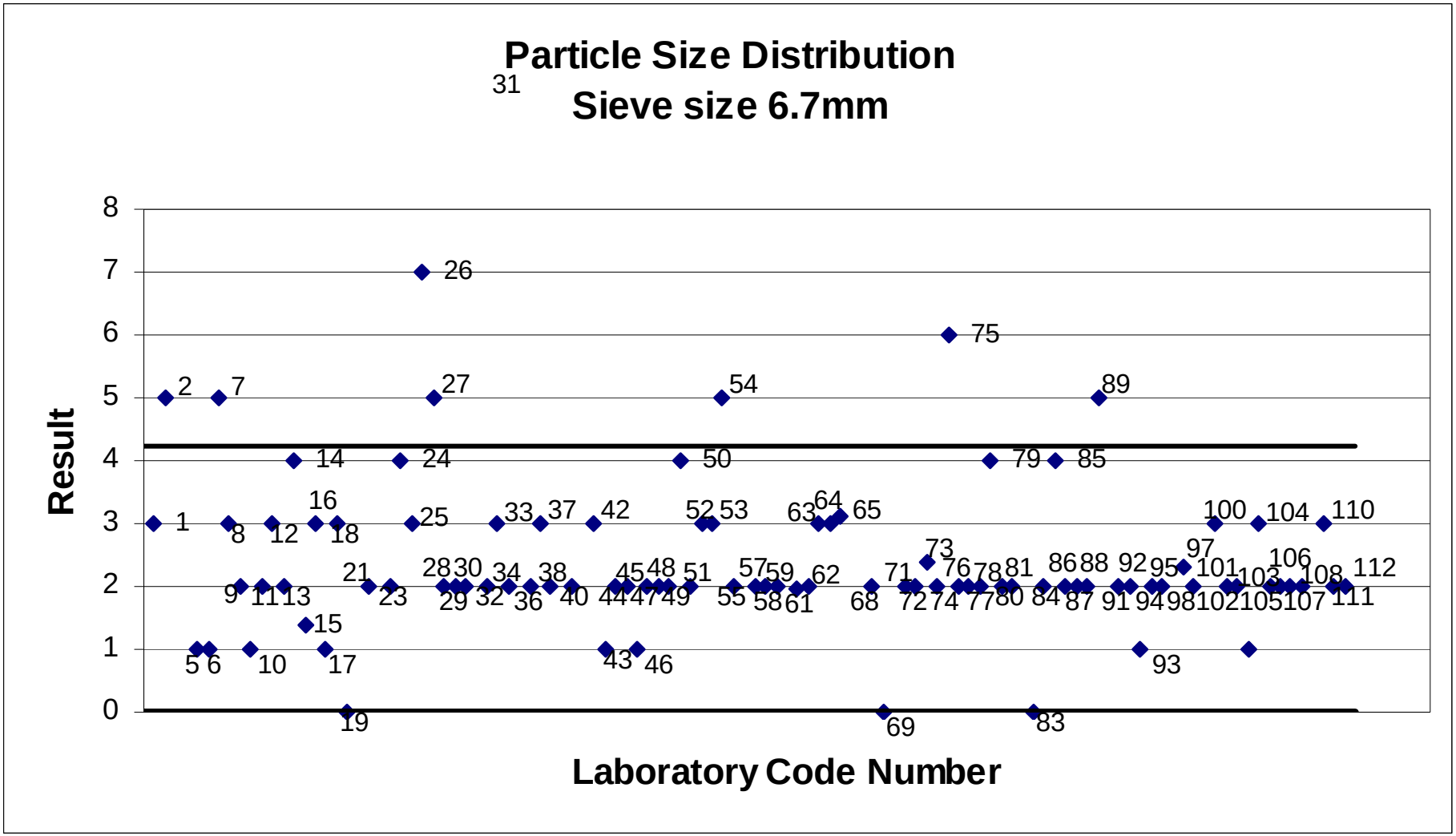
Particle Size Distribution (nearest whole number)

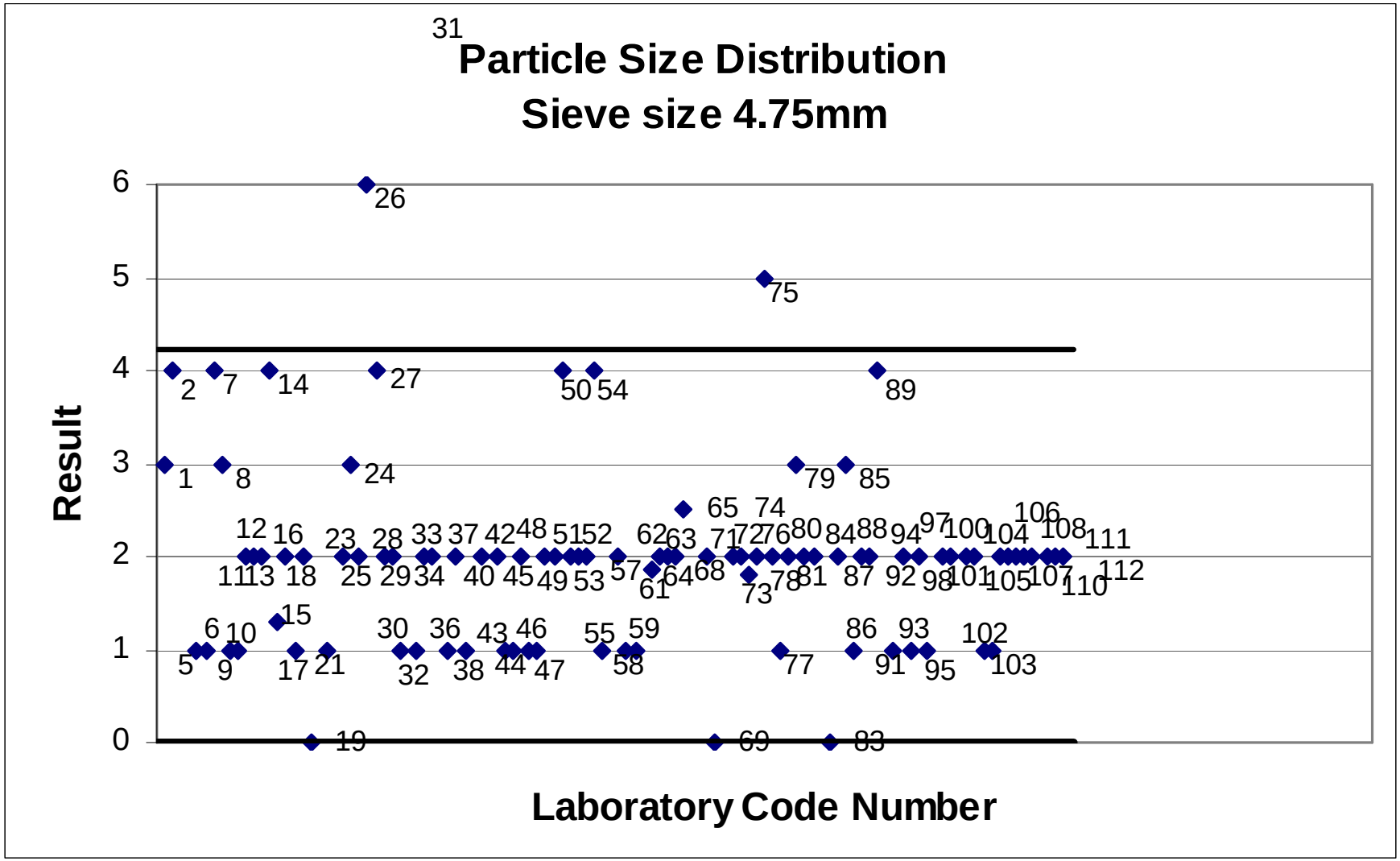
Lab Code	26.5mm	19.0mm	13.2mm	9.5mm	6.7mm	4.75mm	2.36mm	Method
98	100	99	18	3	2	2	2	AS1289.2.1
100	100	100	32	4	3	2	1	AS1141.11
101	100	100	24	3	2	2	1	AS1141.11
102	100	99	24	3	2	1	1	AS1141.11
103		99	23	2	1	1	1	AS1141.11
104	100	97	23	3	3	2	2	AS1141.11
105		98	18	3	2	2	1	AS1141.11
106		100	26	3	2	2	1	AS1141.11
107	100	99	19	2	2	2	1	1141.11
108	100	99	22	3	2	2	1	AS1141.11
110	100	99	22	5	3	2	1	AS1141.11
111	100	99	28	4	2	2	1	AS1141.11
112	100	98	18	3	2	2	2	AS1141.11
No. Results	86	96	96	96	95	95	93	
Median	100.0	99.0	23.0	3.0	2.0	2.0	1.0	
Normalised IQR	0.0	0.7	3.7	0.8	0.7	0.7	0.7	
Normalised IQR x 3	0.00	2.22	11.18	2.49	2.22	2.22	2.22	
Upper Limit	100.0	100.0	34.2	5.5	4.2	4.2	3.2	
Lower Limit	100.0	96.8	11.8	0.5	0.0	0.0	0.0	

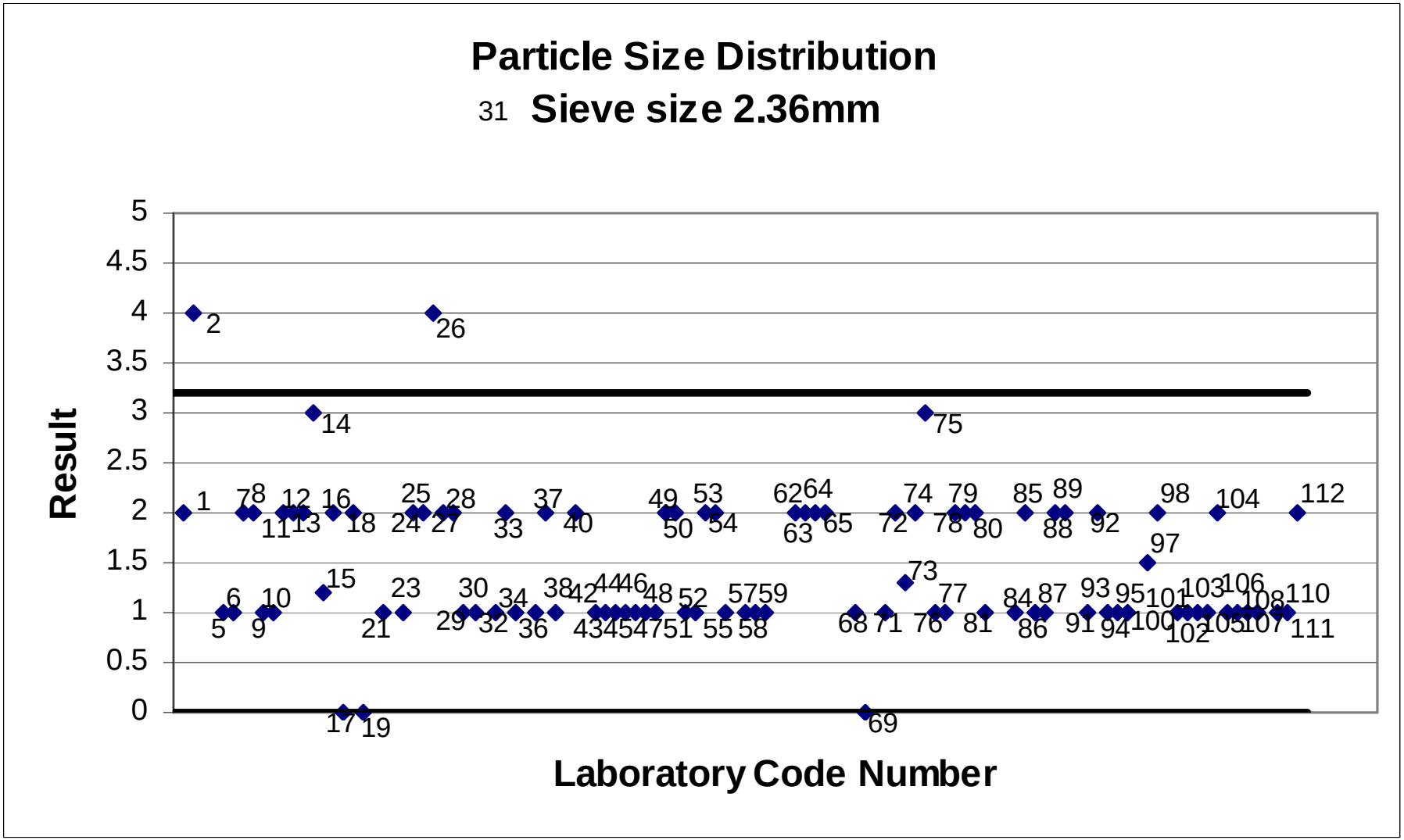

Particle Size Distribution
Sieve size 19.0mm
Result
Laboratory Code Number
100.5
100
99.5
99
98.5
98
97.5
97
96.5


Particle Size Distribution
Sieve size 13.2mm
Result
Laboratory Code Number
0
5
10
15
20
25
30
35
40
45


Particle Size Distribution
Sieve size 9.5mm
Result
Laboratory Code Number
0
1
2
3
4
5
6
7
8


Particle Size Distribution
Sieve size 6.7mm
Result
Laboratory Code Number
0
1
2
3
4
5
6
7
8


Particle Size Distribution
Sieve size 4.75mm
Result
Laboratory Code Number
0
1
2
3
4
5
6
31

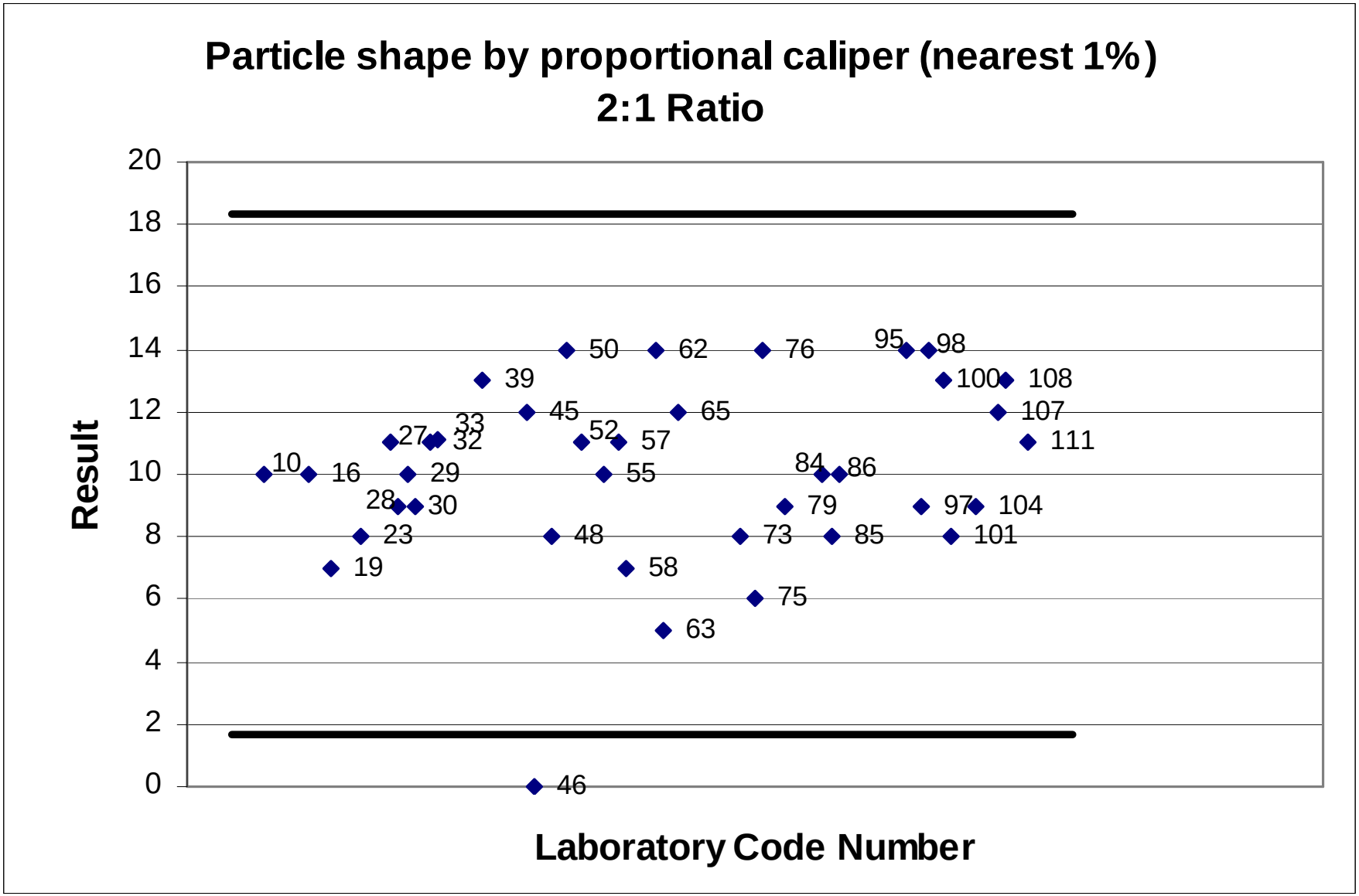

Particle Size Distribution
31 Sieve size 2.36mm
Result
Laboratory Code Number
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

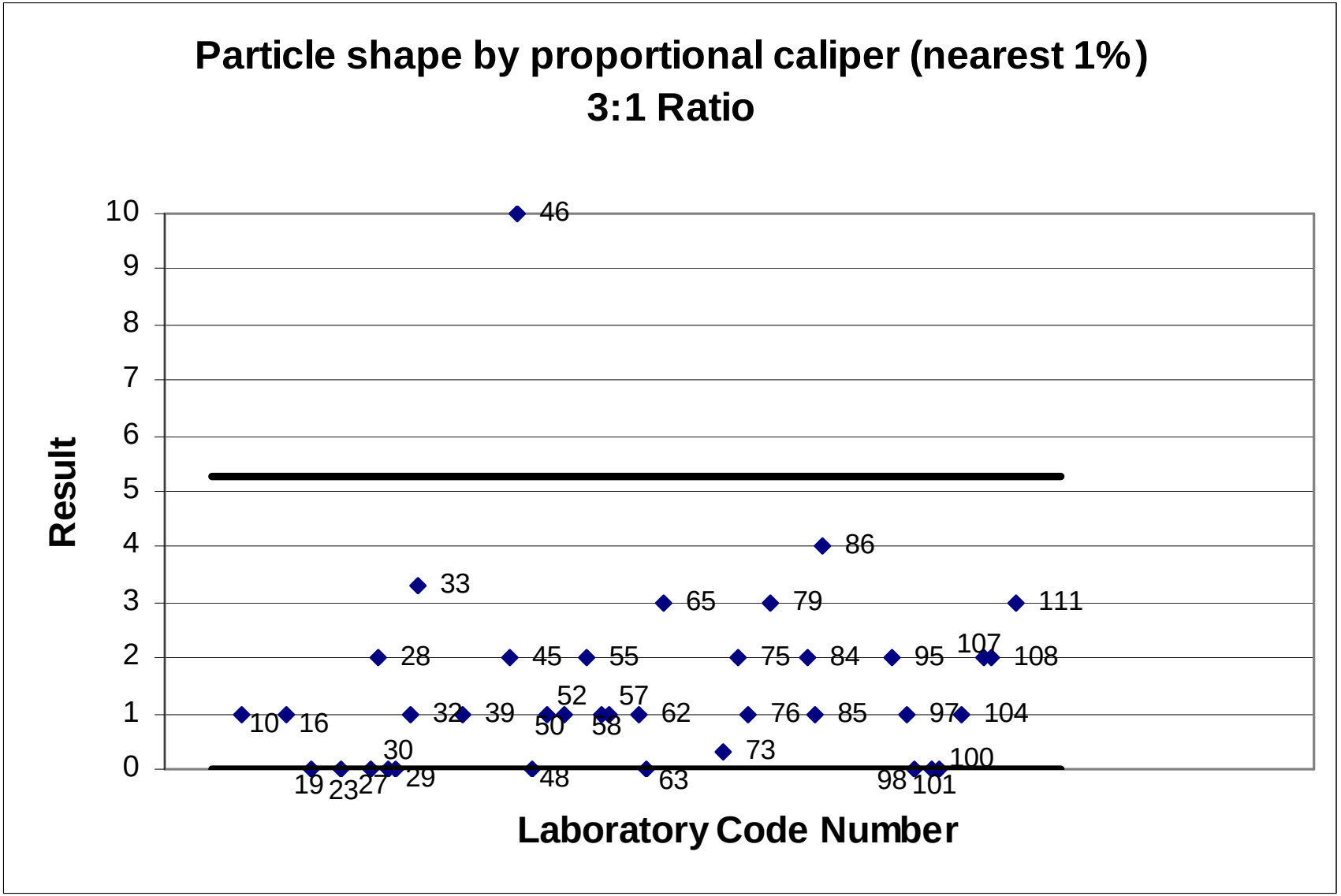
Particle shape by proportional calliper (nearest 1%)

Lab Code	2:1 ratio	3:1 ratio	Method
10	10	1	AS1141.14-1995
16	10	1	AS1141.14
19	7	0	AS1141.14
23	8	0	AS1141.14
27	11	0	AS1141.14
28	9	2	AS1141.14
29	10	0	AS1141.14
30	9	0	AS1141.14
32	11	1	AS1141.14
33	11.1	3.3	AS1141.14
39	13	1	AS1141.14
45	12	2	AS1141.14
46	0 **§**	10 **§**	
48	8	0	AS1141.14
50	14	1	AS1141.14
52	11	1	AS1141.14
55	10	2	AS1141.14
57	11	1	AS1141.14
58	7	1	AS1141.14
62	14	1	1141.14
63	5	0	1141.14
65	12	3	AS1141.14
73	8.0	0.3	AS1141.14
75	6	2	AS1141.14
76	14.0	1.0	AS1141.14
79	9	3	AS1141.14
84	10	2	AS1141.14
85	8	1	AS1141.14

Particle shape by proportional calliper (nearest 1%)

Lab Code	2:1 ratio	3:1 ratio	Method
86	10	4	AS1141.14
95	14	2	AS1141.14-1995
97	9	1	AS1141.14
98	14	0	AS1141.14
100	13	0	AS1141.14
101	8	0	AS1141.14
104	9	1	AS1141.14
107	12	2	AS1141.14
108	13	2	AS1141.14
111	11	3	AS1141.14
No. Results	38	38	
Median	10.0	1.0	
Normalised IQR	2.8	1.4	
Normalised IQR x 3	8.34	4.28	
Upper Limit	18.3	5.3	
Lower Limit	1.7	0.0	


Particle shape by proportional caliper (nearest 1%)
2:1 Ratio
Result
Laboratory Code Number
20
18
16
14
12
10
8
6
4
2
0
10
16
19
23
27
28
29
30
32
33
39
45
46
48
50
52
55
57
58
62
63
65
73
75
76
79
84
85
86
95
97
98
100
101
104
107
108
111

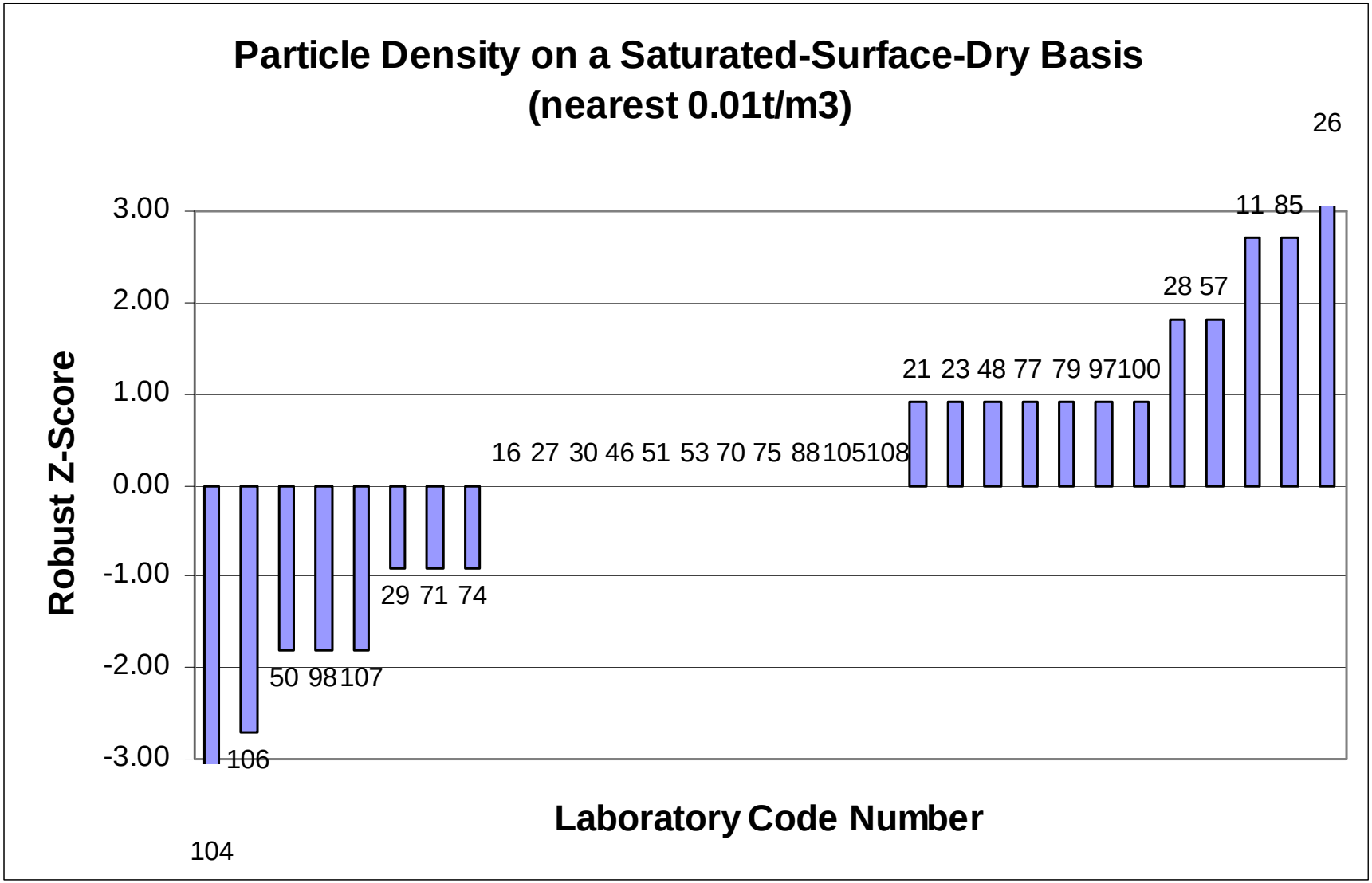

Particle shape by proportional caliper (nearest 1%)
3:1 Ratio
Result
Laboratory Code Number
10
9
8
7
6
5
4
3
2
1
0
46
86
33
65
79
111
28
45
55
75
84
95
107
108
10
16
32
39
52
57
62
76
85
97
104
50
58
30
73
100
19
23
27
29
48
63
98
101

Particle density on a saturated-surface-dry basis (nearest 0.01t/m^3)

Lab Code	Result	Robust Z-Score	Method
11	2.7	2.70	AS1141.6.1
16	2.67	0.00	AS1141.6.1
21	2.68	0.90	AS1141.6.1
23	2.68	0.90	AS1141.6.1
26	2.71	3.60 **§**	AS1141.6.1
27	2.67	0.00	AS1141.6.1
28	2.69	1.80	AS1141.6.1
29	2.66	-0.90	AS1141.6.1
30	2.67	0.00	AS1141.6.1
46	2.67	0.00	AS1141.6.1
48	2.68	0.90	AS1141.6.1
50	2.65	-1.80	AS1141.6.1
51	2.67	0.00	AS1141.6
53	2.67	0.00	AS1141.6.1
57	2.69	1.80	AS1141.6.1
70	2.67	0.00	AS1289 5.4.1 part 3(c)
71	2.66	-0.90	AS1141.6.1
74	2.66	-0.90	AS1141.6.1
75	2.67	0.00	AS1141.6.1
77	2.68	0.90	AS1141.6.1
79	2.68	0.90	AS1141.6.1
85	2.70	2.70	AS1141.6.1
88	2.67	0.00	AS1141.6.1-2000
97	2.68	0.90	AS1141.6.1
98	2.65	-1.80	AS1141.6.1
100	2.68	0.90	AS1141.6.1
104	2.58	-8.09 **§**	AS1141.6.1
105	2.67	0.00	AS1141.6.1
106	2.64	-2.70	AS1141.6.1
107	2.65	-1.80	1141.6.1
108	2.67	0.00	AS1141.6.1

No. Results	31
Median	2.670
Normalised IQR	0.011
Robust CV	0.42%
Minimum	2.58
Maximum	2.71
Range	0.13

Note:
§ Denotes an outlier

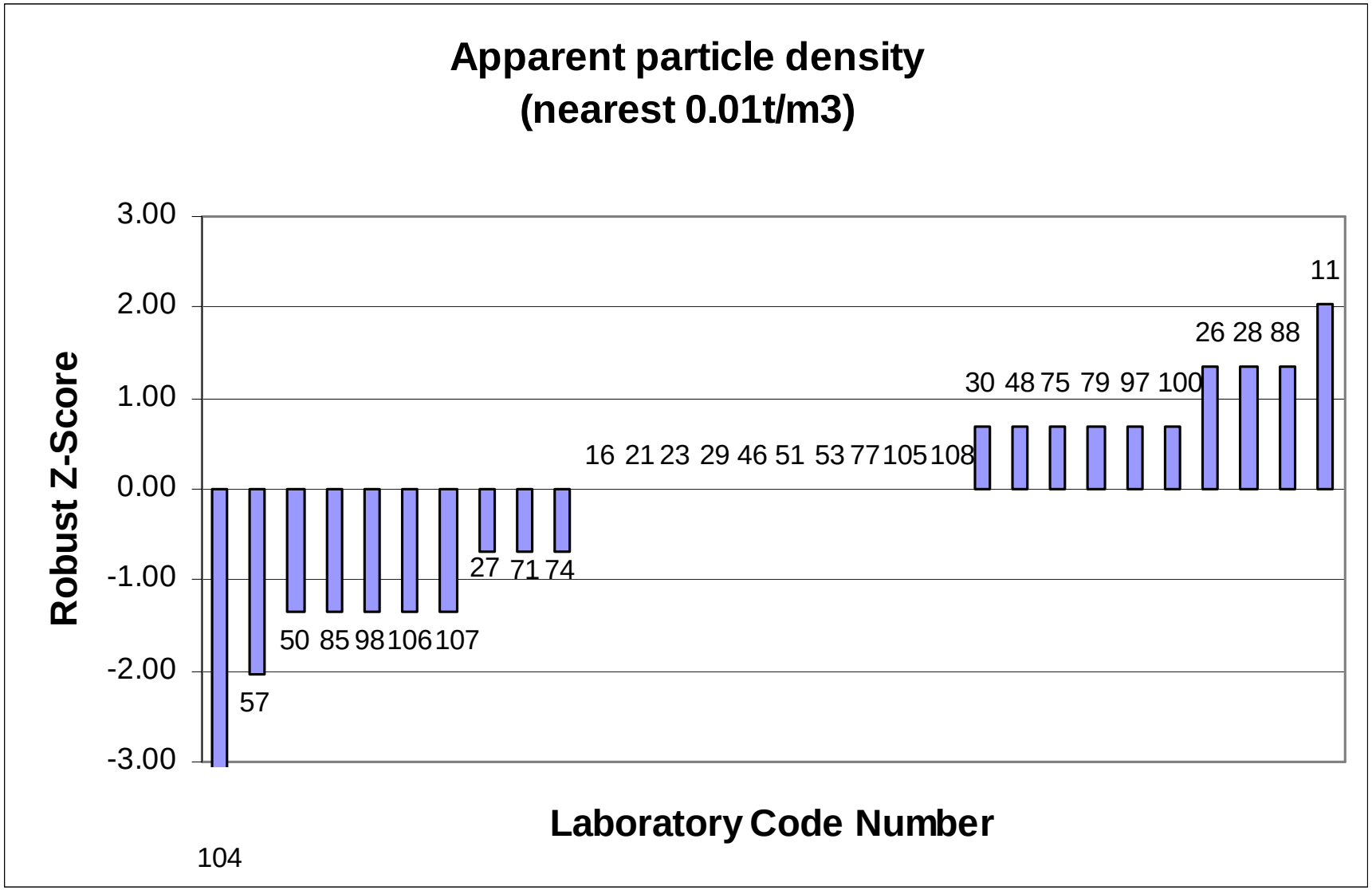

Particle Density on a Saturated-Surface-Dry Basis
(nearest 0.01t/m3)
Robust Z-Score
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
104
106
50 98 107
29 71 74
16 27 30 46 51 53 70 75 88 105 108
21 23 48 77 79 97 100
28 57
11 85
26
Laboratory Code Number

Apparent particle density (nearest 0.01t/m^3)

Lab Code	Result	Robust Z-Score	Method
11	2.72	2.02	AS1141.6.1
16	2.69	0.00	AS1141.6.1
21	2.69	0.00	AS1141.6.1
23	2.69	0.00	AS1141.6.1
26	2.71	1.35	AS1141.6.1
27	2.68	-0.67	AS1141.6.1
28	2.71	1.35	AS1141.6.1
29	2.69	0.00	AS1141.6.1
30	2.70	0.67	AS1141.6.1
46	2.69	0.00	AS1141.6.1
48	2.70	0.67	AS1141.6.1
50	2.67	-1.35	AS1141.6.1
51	2.69	0.00	AS1141.6
53	2.69	0.00	AS1141.6.1
57	2.66	-2.02	AS1141.6.1
71	2.68	-0.67	AS1141.6.1
74	2.68	-0.67	AS1141.6.1
75	2.70	0.67	AS1141.6.1
77	2.69	0.00	AS1141.6.1
79	2.70	0.67	AS1141.6.1
85	2.67	-1.35	AS1141.6.1
88	2.71	1.35	AS1141.6.1-2000
97	2.70	0.67	AS1141.6.1
98	2.67	-1.35	AS1141.6.1
100	2.70	0.67	AS1141.6.1
104	2.60	-6.07 **§**	AS1141.6.1
105	2.69	0.00	AS1141.6.1
106	2.67	-1.35	AS1141.6.1
107	2.67	-1.35	1141.6.1
108	2.69	0.00	AS1141.6.1

No. Results	30
Median	2.690
Normalised IQR	0.015
Robust CV	0.55%
Minimum	2.60
Maximum	2.72
Range	0.12

Note:
§ Denotes an outlier

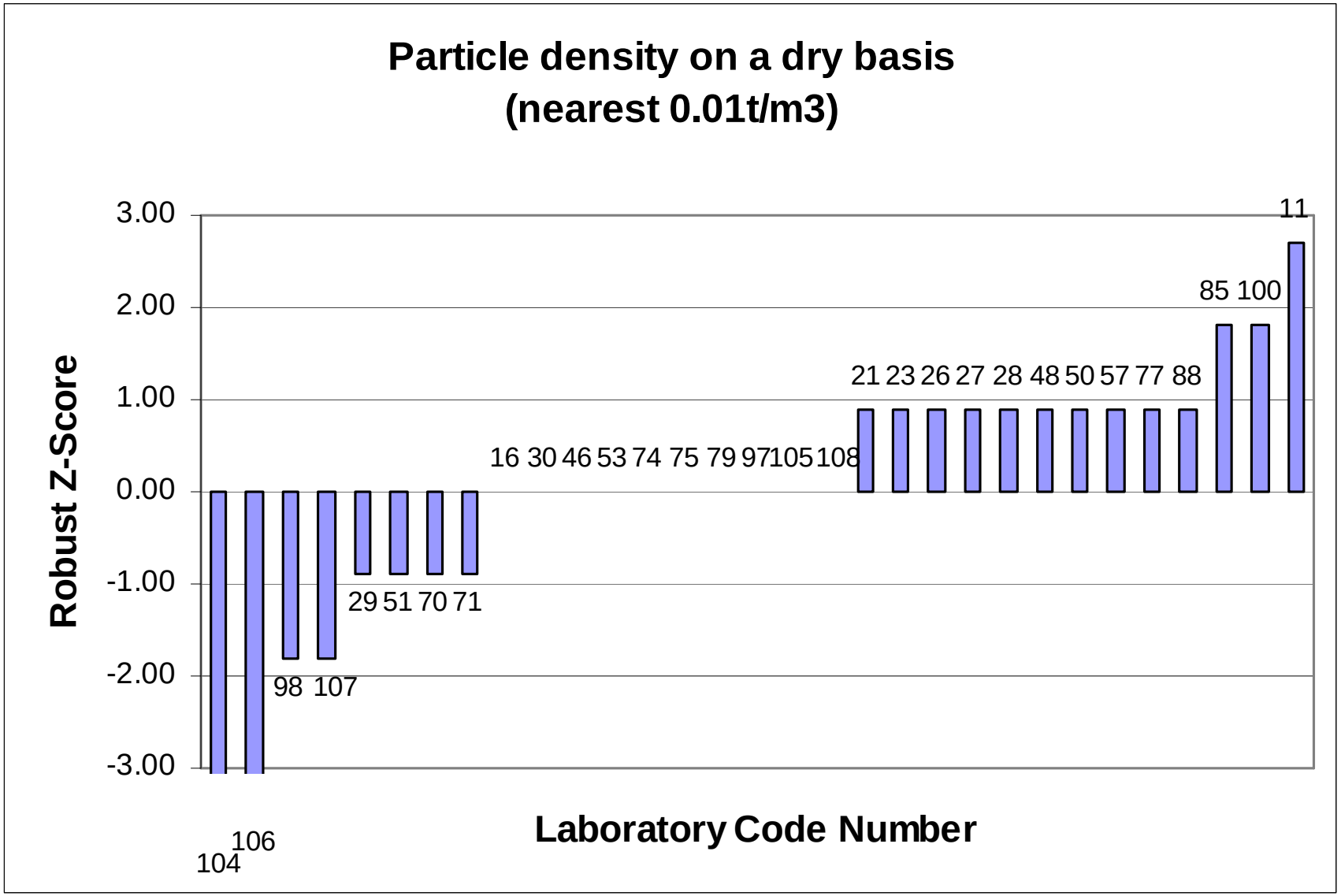

Apparent particle density
(nearest 0.01t/m3)
Robust Z-Score
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
104
57
50 85 98 106 107
27 71 74
16 21 23 29 46 51 53 77 105 108
30 48 75 79 97 100
26 28 88
11
Laboratory Code Number

Particle density on a dry basis (nearest 0.01t/m3)

Lab Code	Result	Robust Z-Score	Method
11	2.69	2.70	AS1141.6.1
16	2.66	0.00	AS1141.6.1
21	2.67	0.90	AS1141.6.1
23	2.67	0.90	AS1141.6.1
26	2.67	0.90	AS1141.6.1
27	2.67	0.90	AS1141.6.1
28	2.67	0.90	AS1141.6.1
29	2.65	-0.90	AS1141.6.1
30	2.66	0.00	AS1141.6.1
46	2.66	0.00	AS1141.6.1
48	2.67	0.90	AS1141.6.1
50	2.67	0.90	AS1141.6.1
51	2.65	-0.90	AS1141.6
53	2.66	0.00	AS1141.6.1
57	2.67	0.90	AS1141.6.1
70	2.65	-0.90	AS1289 5.4.1 part 3(c)
71	2.65	-0.90	AS1141.6.1
74	2.66	0.00	AS1141.6.1
75	2.66	0.00	AS1141.6.1
77	2.67	0.90	AS1141.6.1
79	2.66	0.00	AS1141.6.1
85	2.68	1.80	AS1141.6.1
88	2.67	0.90	AS1141.6.1-2000
97	2.66	0.00	AS1141.6.1
98	2.64	-1.80	AS1141.6.1
100	2.68	1.80	AS1141.6.1
104	2.57	-8.09 **§**	AS1141.6.1
105	2.66	0.00	AS1141.6.1
106	2.62	-3.60 **§**	AS1141.6.1
107	2.64	-1.80	1141.6.1
108	2.66	0.00	AS1141.6.1

No. Results	31
Median	2.660
Normalised IQR	0.011
Robust CV	0.42%
Minimum	2.57
Maximum	2.69
Range	0.12

Note:
§ Denotes an outlier

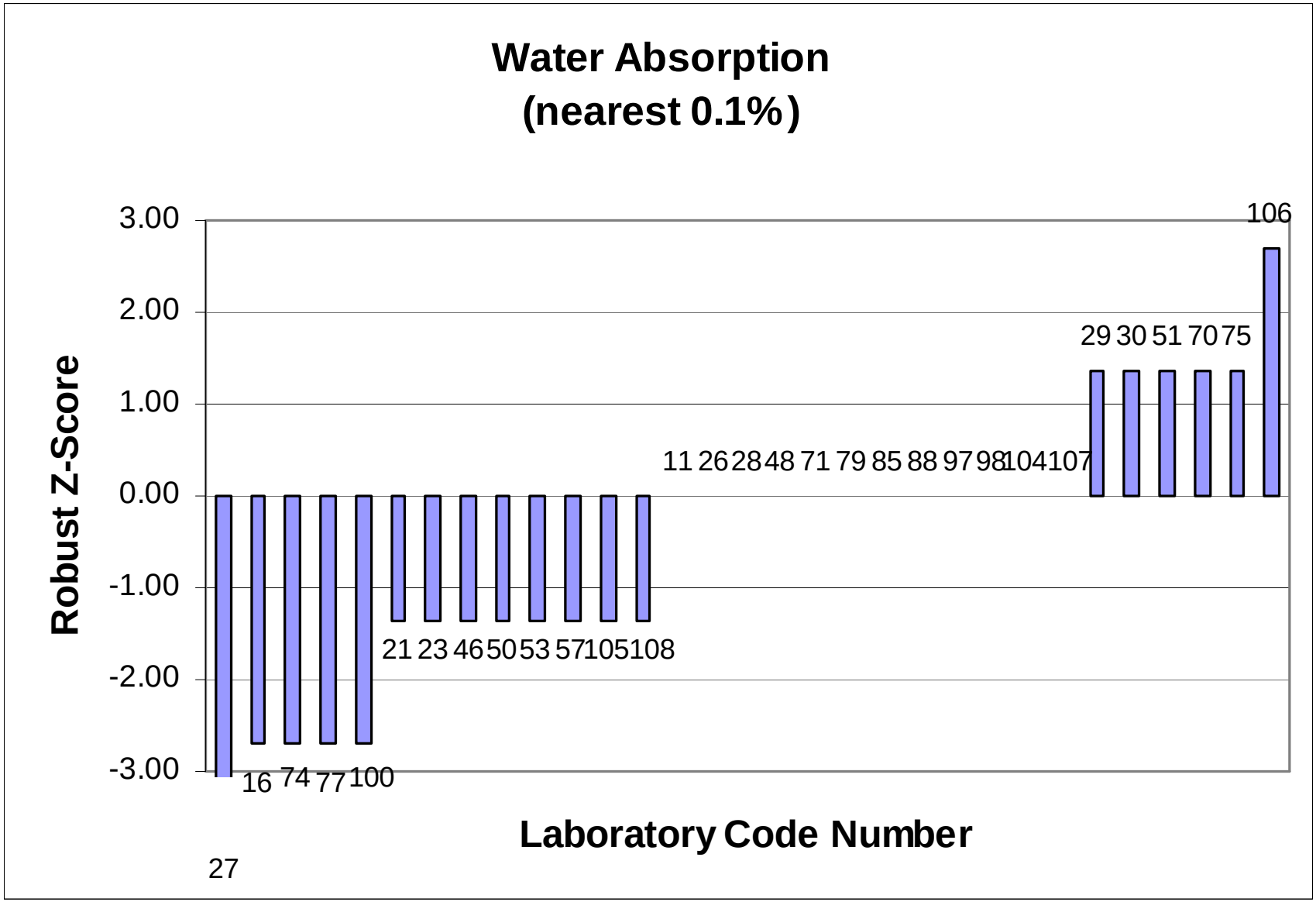

Particle density on a dry basis
(nearest 0.01t/m3)
Robust Z-Score
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
104
106
98
107
29
51
70
71
16
30
46
53
74
75
79
97
105
108
21
23
26
27
28
48
50
57
77
88
85
100
11
Laboratory Code Number

Water Absorption (nearest 0.1%)

Lab Code	Result	Robust Z-Score	Method
11	0.5	0.00	AS1141.6.1
16	0.3	-2.70	AS1141.6.1
21	0.4	-1.35	AS1141.6.1
23	0.4	-1.35	AS1141.6.1
26	0.5	0.00	AS1141.6.1
27	0.2	-4.05 §	AS1141.6.1
28	0.5	0.00	AS1141.6.1
29	0.6	1.35	AS1141.6.1
30	0.6	1.35	AS1141.6.1
46	0.4	-1.35	AS1141.6.1
48	0.5	0.00	AS1141.6.1
50	0.4	-1.35	AS1141.6.1
51	0.6	1.35	AS1141.6
53	0.4	-1.35	AS1141.6.1
57	0.4	-1.35	AS1141.6.1
70	0.6	1.35	AS1289 5.4.1 part 3(c)
71	0.5	0.00	AS1141.6.1
74	0.3	-2.70	AS1141.6.1
75	0.6	1.35	AS1141.6.1
77	0.3	-2.70	AS1141.6.1
79	0.5	0.00	AS1141.6.1
85	0.5	0.00	AS1141.6.1
88	0.5	0.00	AS1141.6.1-2000
97	0.50	0.00	AS1141.6.1
98	0.5	0.00	AS1141.6.1
100	0.3	-2.70	AS1141.6.1
104	0.5	0.00	AS1141.6.1
105	0.4	-1.35	AS1141.6.1
106	0.7	2.70	AS1141.6.1
107	0.5	0.00	1141.6.1
108	0.4	-1.35	AS1141.6.1

No. Results	31
Median	0.50
Normalised IQR	0.07
Robust CV	14.8%
Minimum	0.2
Maximum	0.7
Range	0.5

Note:
§ Denotes an outlier


Water Absorption
(nearest 0.1%)
Robust Z-Score
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
27
16 74 77 100
21 23 46 50 53 57 105 108
11 26 28 48 71 79 85 88 97 98 104 107
29 30 51 70 75
106
Laboratory Code Number

APPENDIX B

Sample Preparation

and

Homogeneity Testing

SAMPLE PREPARATION

A 20mm concrete aggregate was sourced form Boral Montrose Quarry, Victoria. The samples were packaged in 10 Litre plastic buckets with handles and tamper proof lids. The sample buckets were numbered sequentially from 1 to 170 in order of preparation. These numbers were independent of the laboratory code numbers.

HOMOGENEITY TESTING

10 numbers were randomly generated and the samples labelled with these numbers were tested for homogeneity. Sieve analysis was conducted according to AS1141.11 and 75 micron by washing was conducted according to AS1141.12.

Statistical analysis of the results indicated that no significant sample variability existed. Therefore, it was concluded that any outlier results subsequently identified could not be attributed to sample variability.

No.	7	23	26	31	60	75	92	97	105	107
AS1141.11 Sieve Analysis % Passing										
26.5 mm	100	100	100	100	100	100	100	100	100	100
19.0 mm	99	99	99	100	100	99	99	99	99	99
13.2 mm	22	24	23	25	23	28	18	16	23	18
9.5 mm	3	4	4	4	5	4	2	3	3	4
6.7 mm	2	2	3	3	4	3	2	2	2	2
4.75 mm	1	2	2	2	3	2	1	2	2	2
2.36 mm	1	2	2	1	2	2	1	2	1	2
1.18 mm	1	1	2	1	1	1	1	1	1	1
AS1141.12 75 micron by washing										
% Pass	0.5	0.7	0.7	0.5	0.6	0.6	0.6	0.8	0.6	0.8

APPENDIX C

Instructions to Participants

and

Results Sheet

NATIONAL ASSOCIATION OF TESTING AUTHORITIES, AUSTRALIA

AGGREGATES PROFICIENCY TESTING PROGRAM (ROUND 3 – VIC & TAS)

INSTRUCTIONS TO PARTICIPANTS

To ensure that results from this program can be analysed properly, participants are asked to adhere carefully to the following instructions.

1. One sample of a 20/14 mm graded blend of aggregate has been supplied to each laboratory.

2. Before any testing, mix the sample and then cone and quarter or riffle thoroughly using the whole sample.

3. The following determinations are to be performed on the sample:

   Material finer than 75 μm (AS 1141.12)
   Particle size distribution (AS 1141.11)
   Particle shape by proportional caliper (AS 1141.14) by 2:1 and 3:1 ratio
   Particle density on a saturated-surface-dry basis (AS 1141.6.1)
   Apparent particle density (AS 1141.6.1)
   Particle density on a dry basis (AS 1141.6.1)
   Water absorption (AS 1141.6.1)

4. These tests are to be conducted in accordance to AS 1141. However laboratories NATA accredited for performing these tests solely to other methods are required to follow their accredited method and note this on the results sheet. Participants are welcome to report results for any tests for which NATA accreditation is not held.

5. The results for all determinations are to be recorded on the results sheet to the accuracy and reporting basis indicated. The method used is also to be recorded.

6. Testing may commence as soon as the sample is received. All laboratories must return the results sheet no later than **Friday 25 November 2005** to:

Ms Kate Wiggins
National Association of Testing Authorities, Australia
7 Leeds Street
RHODES NSW 2138

Phone: 02 9736 8222
Fax: 02 9743 6664 or 02 9743 5311

NATIONAL ASSOCIATION OF TESTING AUTHORITIES, AUSTRALIA
AGGREGATES PROFICIENCY TESTING PROGRAM
(ROUND 3 – VIC & TAS)

RESULTS SHEET

Lab Code
«Code»

TEST (report to)	Result		Method
Material finer than 75 μm (nearest 0.1%)			
Particle size distribution (nearest whole number) 26.5mm			
19.0mm			
13.2mm			
9.5mm			
6.7mm			
4.75mm			
2.36mm			
Particle shape by proportional caliper (nearest 1%)	2:1 Ratio	3:1 Ratio	
Particle density on a saturated-surface-dry basis (nearest 0.01t/m^3)			
Apparent particle density (nearest 0.01t/m^3)			
Particle density on a dry basis (nearest 0.01t/m^3)			
Water absorption (nearest 0.1%)			

Date of tests: _____ Signature: _____