



Report No. 794

Concrete Proficiency Testing

Round 15

January 2013

Acknowledgments

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PO Box 7507 SILVERWATER NSW 2128, Australia

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1. FOREWORD

This report summarises the results of a proficiency testing program on the determination of the Density and Compressive Strength of hardened concrete cylinders. It constitutes the fifteenth round of an ongoing series of programs.

The program was conducted in November 2012 by Proficiency Testing Australia (PTA). The aim of the program was to assess laboratories' abilities to competently perform the prescribed analyses.

The Program Coordinator was Ms L Galbraith and the Technical Advisor was Mr G Hooper of Golder Associates Pty Ltd. This report was authorised by Mrs F Watton, PTA Quality-Business Development Manager.

2. FEATURES OF THE PROGRAM

- (a) Participants were provided with two concrete cylinders labelled PTA 1 and PTA 2.
- (b) A total of 60 laboratories received samples, comprising:
 - 52 Australian participants; and
 - 8 overseas participants, including:
 - Korea (3);
 - New Zealand (1);
 - Papua New Guinea (1);
 - Mauritius (1);
 - Cyprus (1); and
 - Dubai (1).

Of these 60 laboratories, 3 were unable to submit results by the due date.

- (c) Laboratories were provided with the *Instructions to Participants* and *Results Sheet* (see Appendix C). Laboratories were requested to perform the tests according to their routine methods and to record their results on the *Results Sheet*.
- (d) Prior to sample distribution, a number of randomly selected samples were analysed for homogeneity. Based on the results of this testing (see Appendix B), the homogeneity of the samples was established.
- (e) Each laboratory was randomly allocated a unique code number for the program to ensure confidentiality of results. Reference to each laboratory in this report is by code number only. Please note that a number of laboratories reported more than one set of results and, therefore, their code numbers (with letter) could appear several times in the same data set.

- (f) Results (as reported by participants) with corresponding summary statistics (i.e. number of results, median, uncertainty of the median, normalised interquartile range, robust coefficient of variation, minimum, maximum and range) are presented in Appendix A (for each sample and for each of the analyses performed). Other information is also presented where supplied by participants. Please note that this information is presented for information purposes only and has not been used for the formal evaluation of results.
- (g) A robust statistical approach, using z-scores, was utilised to assess laboratories' testing performance (see Section 3). Robust z-scores, z-score charts relevant to each test are presented in Appendix A.
- (h) The document entitled *Guide to Proficiency Testing Australia, 2012* (reference [1]) defines the statistical terms and details the statistical procedures referred to in this report.
- (i) A tabulated listing of laboratories (by code number) identified as having outlier results can be found on page 7.

3. FORMAT OF THE APPENDICES

- (a) Appendix A contains the analysis of results reported by laboratories for the samples. This section contains the following for each determinant, where appropriate:
 - a table of results and calculated z-scores;
 - a list of summary statistics; and
 - ordered z-score charts.
- (b) Appendix B contains details of the homogeneity testing.
- (c) Appendix C contains copies of the *Instructions to Participants and Results Sheet*.

4. STATISTICAL DESIGN OF THE PROGRAM

- (a) Outlier Results and Z-scores

In order to assess laboratories' testing performance, a robust statistical approach, using z-scores, was utilised. Z-scores give a measure of how far a result is from the consensus value (i.e. the median), and gives a "score" to each result relative to the other results in the group.

A z-score close to zero indicates that the result agrees well with those from other laboratories. Whereas, a z-score with an absolute value greater than or equal to 3.0 is considered to be an outlier and is marked by the symbol “§”.

The table on page 7 summarises the outlier results detected.

(b) Results Tables and Summary Statistics

Each of these tables contains the results returned by each laboratory, including the code number for the method used, and the robust z-score calculated for each result.

Results have been entered exactly as reported by participants. That is, laboratories which did not report results to the precision (i.e. number of significant figures) requested on the Results Sheet have **not** been rounded to the requested precision before being included in the statistical analysis.

A list of summary statistics appears at the bottom of each of the tables of results and consists of:

- the number of results for that test/sample (*No. of Results*);
- the median of these results, i.e. the middle value (*Median*);
- the uncertainty of the median;
- the normalised interquartile range of the results (*Normalised IQR*);
- the robust coefficient of variation, expressed as a percentage (*Robust CV*) - i.e. $100 \times \text{Normalised IQR} / \text{Median}$;
- the minimum and maximum laboratory results; and
- the range (*Maximum - Minimum*).

The median is a measure of the centre of the data.

The normalised IQR is a measure of the spread of the results. It is calculated by multiplying the interquartile range (IQR) by 0.7413, a factor which converts the IQR to an estimate of the standard deviation. The IQR is the difference between the upper and lower quartiles (i.e. the values above and below which a quarter of the results lie, respectively).

Please see reference [1] for further details on these robust summary statistics.

(c) Ordered Z-Score Charts

On these charts each laboratory's robust z-score is shown, in order of magnitude, and is marked with its code number. From these charts, each laboratory can readily compare its performance relative to the other laboratories.

These charts contain solid lines at +3.0 and -3.0, so that outliers are clearly identifiable as those laboratories whose "bar" extends beyond these "cut-off" lines. The y-axis of these charts has been limited, so very large z-scores appear to extend beyond the chart boundary.

TABLE A: SUMMARY STATISTICS

Test	No. of Results	Median PTA 1	Normalised IQR PTA 1	Median PTA 2	Normalised IQR PTA 2
Height (nearest 1 mm)	57	199.0	N/A	199.0	N/A
Diameter (nearest 0.2 mm)	57	100.00	N/A	100.00	N/A
Weight (nearest 1 gm)	57	3613.0	N/A	3649.0	N/A
Mass per unit Volume (nearest 1 Kg/m ³)	55	2318.0	10.4	2334.0	1.7
Maximum Sustained Load Unit (nearest 1 kN)	57	253.0	N/A	473.5	N/A
Compressive Strength (nearest 0.1 MPa)	57	32.00	1.33	60.30	1.70

5. PTA AND TECHNICAL ADVISOR'S COMMENTS

Of the 57 laboratories that submitted results for inclusion in the final report twelve laboratories received an outlier. Thus, of the 224 results returned for z-score analysis, 5.36% have been identified as outlier results. Any laboratories reporting outliers are encouraged to review their procedures.

TABLE B: COMPARISON OF ROBUST CVs AND PERCENTAGE OF OUTLIERS

Program Name	Sample Number	Mass per unit Volume (nearest 1 Kg/m ³)		Compressive Strength (nearest 0.1 MPa)	
		Robust CV (%)	% outliers	Robust CV (%)	% outliers
Concrete 15	PTA 1	0.4	1.8	4.2	7.0
	PTA 2	0.4	3.6	2.8	8.8
Concrete 14	PTA 1	0.6	1.5	3.59	--
	PTA 2	0.6	1.5	3.82	--
Concrete 11	PTA 1	0.4	5.8	3.7	4.4
	PTA 2	0.5	--	3.6	4.4
Concrete 10	PTA 1	0.6	4.2	4.8	2.78
	PTA 2	0.6	2.8	4.9	5.56

There is a notable increase in the percentage of outliers for Compressive Strength. The Mass per unit Volume for laboratories 34 and 42 were omitted from the consensus to avoid erroneous conclusions. Laboratory 34 appears to not have reported results to the units indicated on the results sheet. It is imperative that participants read the instructions and result sheets carefully and check the units reported on their testing equipment to ensure results are recorded correctly.

In addition, some of the results reported are suspected to be rounded numbers that were not required according to the instructions. Rounded results can impact on z-scores and give false outliers. Again, we reinforce the need for participants to read the instructions carefully. It is important that all participants are submitting results to the accuracy level required on the instructions and result sheets, to enable the appropriate evaluation of results for proficiencies.

Metrological Traceability and Measurement Uncertainty of Assigned Values

Consensus values (median) derived from participants' results are used in this program. These values are not metrologically traceable to an external reference.

Sample preparation was undertaken according to Golder Associates Pty Ltd Standard Operating Procedures to ensure samples were fit-for-purpose and homogeneous.

As the assigned value for this program is the median of the results submitted by the participants, the uncertainty of the median has been calculated and is presented in the results tables of Appendix A.

Analysis of Results by Method Groups

In order for methods to be grouped for analysis, PTA requires at least 11 sets of results from the same method group. Analysis of grouped methods isolates laboratories using method code AS 1012 for Mass per unit Volume and Compressive Strength and method code AS1012.9 for Compressive Strength. The results are tabulated below.

TABLE C: ANALYSIS OF GROUPED METHODS

	Method	No. of Results		Median		Uncertainty of the Median	
		PTA 1	PTA 2	PTA 1	PTA 2	PTA 1	PTA 2
Mass per unit Volume (nearest 1 Kg/m ³)	AS1012	12	12	2319.0	2334.5	3.6	6.4
Compressive Strength (nearest 0.1 MPa)	AS1012 AS1012.9	50	50	32.10	60.50	0.18	0.28

No other methods were so prevalent that they could be analysed as a group.

6. OUTLIER RESULTS

Laboratories reporting outlier results are listed in the following table:

TABLE D: SUMMARY OF STATISTICAL OUTLIERS

Test	Laboratory Code No.
Mass per unit Volume (nearest 1 Kg/m ³)	25, 73A, 73B
Compressive Strength (nearest 0.1 MPa)	3, 12, 13, 66, 73B, 80A

Laboratories with an absolute z-score value between 2.0 and 3.0 (i.e. $2.0 < |z\text{-score}| < 3.0$) are strongly encouraged to review their results. In particular, Laboratories 5, 17, 28B and 42 should examine their procedures and equipment, as these laboratories reported results with absolute z-scores between 2.5 and 3.0.

7. Reference

- [1] *Guide to Proficiency Testing Australia*, 2012 (This document can be found on the PTA website, www.pta.asn.au).

APPENDIX A

Results and Data Analysis

Diameter.....	A1
Height.....	A3
Weight.....	A3
Maximum Sustained Load Unit.....	A3
Mass per unit Volume.....	A5
Compressive Strength.....	A9
Other Information.....	A13

Diameter (nearest 0.2mm)						
Laboratory code	Sample PTA 1			Sample PTA 2		
	Result 1	Result 2	Average	Result 1	Result 2	Average
1	100.0	100.2	100.1	100.2	100.4	100.3
2	100.0	99.8	99.9	100.0	100.0	100
3	100.10	100.22	100.2	99.62	99.93	99.775
5	100.0	99.8	99.9	99.6	99.4	99.5
6	99.8	100.0	99.9	99.6	99.8	99.7
7	100.0	100.0	100.0	100.4	100.2	100.3
8	100.1	100.1	100.1	99.8	100.00	99.9
9A	99.4	100.0	99.7	99.6	99.4	99.5
9B	100	99.6	99.8	99.8	99.0	99.4
9C	99.6	99.6	99.6	99.6	99.4	99.5
12	99.6	99.6	99.6	99.7	99.7	99.7
13	100.2	100.0	100.1	100.4	100.2	100.3
14	99.8	100.0	99.9	99.8	100.0	99.9
16	100.0	100.2	100.1	100.0	100.2	100.1
17	100.0	100.0	100.0	99.6	99.8	99.7
18	100.2	100.2	100.2	99.7	100.1	99.9
23	100.0	100.0	100.0	99.8	100.0	99.9
24	100.0	99.8	99.9	99.8	99.8	99.8
25	99.98	100.2	100.1	100.2	100.2	100.2
27	100.2	100.0	100.1	100.4	100.4	100.4
28A	99.8	99.8	99.8	100.0	100.0	100
28B	100.0	100.1	100.1	99.8	99.9	99.85
29	100.2	100.2	100.2	100.2	100.2	100.2
32	99.9	99.3	99.6	100.0	99.6	99.8
34	100.6	100.4	100.5	100.0	99.8	99.9
35	99.8	100.0	99.9	99.8	100.0	99.9
36	99.8	100.0	99.9	100.2	100.2	100.2
37	99.6	99.6	99.6	99.4	99.6	99.5
38	100.2	99.9	100.1	100.1	100	100.05
39A	100.0	100.0	100.0	100.0	100.0	100
39B	100	100.2	100.1	100	100	100
42	100.0	99.8	99.9	100.2	100.1	100.15
44	100.2	100.2	100.2	100.2	100.4	100.3
45	99.8	100.2	100.0	100.2	100.4	100.3
47	100.0	100.0	100.0	100.0	100.0	100
50	100.0	100.0	100.0	100.2	100.0	100.1
51A	100.0	100.2	100.1	100.2	100.0	100.1
51B	100.0	100.2	100.1	100.0	100.0	100
51C	99.8	99.8	99.8	100.0	100.0	100

Diameter (nearest 0.2mm)						
Laboratory code	PTA 1			PTA 2		
	Result 1	Result 2	Average	Result 1	Result 2	Average
53	99.8	100.0	99.9	100.0	100.0	100
54	100.2	100.4	100.3	100.2	100.2	100.2
59	99.8	100.0	99.9	100.2	100.4	100.3
60	100.0	100.0	100.0	100.0	100.0	100
61	100.5	100.8	100.7	100.3	100.6	100.45
62	100.4	100.4	100.4	100.0	100.0	100
65	100.0	99.8	99.9	99.4	99.6	99.5
66	99.8	100.0	99.9	100.0	100.2	100.1
67	100.1	100.0	100.1	99.9	99.5	99.7
68	99.4	99.8	99.6	99.8	100.2	100
70	100.0	100.0	100.0	100.0	99.8	99.9
73A	100.0	100.2	100.1	100.0	100.0	100
73B	100.0	100.0	100.0	100.0	100.2	100.1
74	100.2	100.2	100.2	100.0	100.0	100
77	99.8	100	99.9	100	100	100
78	99.8	99.8	99.8	100.0	100.0	100
80A	100.0	100.2	100.1	100.0	100.0	100
80B	99.8	99.8	99.8	99.8	99.8	99.8

No of Results:	57	No of Results:	57
Median:	100.00	Median:	100.00
Minimum:	99.6	Minimum:	99.4
Maximum:	100.7	Maximum:	100.45
Range:	1.1	Range:	1.05

Laboratory Code	Height (nearest 1 mm)		Weight (nearest 1 gm)		Max. Sustained Load Unit (nearest 1 kN)	
	PTA 1	PTA 2	PTA 1	PTA 2	PTA 1	PTA 2
1	195	196	3545	3600	260.0	469
2	198	199	3605	3650	259	489
3	196.74	198.27	3602.8	3616.3	243.3	430.4
5	199	198	3614	3634	230	463
6	198	199	3587	3635	256.0	474.0
7	199	200	3627	3683	253	495
8	199	199	3633	3642	243.0	457.0
9A	199	200	3601	3653	243	471
9B	199	200	3615	3652	248	458
9C	199	199	3614	3644	258	445
12	199	200	3592	3634	169	458
13	198	199	3589	3656	262	520
14	199	200	3600	3643	238	481
16	198	199	3618	3655	250	500
17	198	197	3603	3646	259	505
18	199	199	3620	3627	250	458
23	197	200	3615	3650	259.5	473.5
24	199	200	3602	3633	254	449
25	197	198	3560.8	3594.7	262.0	479.0
27	198	199	3619	3659	257	474
28A	198	199	3599	3652	244	479
28B	199	200	3607	3642	221	465
29	198	199	3619	3655	253	466
32	198	199	3613	3634	247	482
34	198	199	3650	3647	254	474
35	198	200	3607	3652	252.2	466.2
36	198	198	3613	3658	244	466
37	200	200	3608	3647	252	477
38	195.0	196.1	3570	3590	258.5	475
39A	199	199	3621	3656	276	476
39B	199	200	3619	3639	268	472
42	199	199	3622	3661	272.1	436.8
44	200	199	3617	3671	254.3	492.6
45	197	197	3586	3624	254	486
47	200	200	3626	3671	274	475
50	199	200	3602	3644	263	462
51A	197	197	3589	3608	242	473
51B	197	198	3584	3640	240	467
51C	197	198	3568	3624	249	471

Laboratory Code	Height (nearest 1 mm)		Weight (nearest 1 gm)		Max. Sustained Load Unit (nearest 1 kN)	
	PTA 1	PTA 2	PTA 1	PTA 2	PTA 1	PTA 2
53	197	198	3572	3631	247	481
54	198	199	3616	3649	252	473
59	199	199	3619	3667	256	476
60	199	200	3624	3669	255	486
61	199	199	3644	3667	240	479
62	198.0	200.0	3618	3657	254	502
65	198	199	3628	3642	254	489
66	199	199	3611	3664	210	380
67	199	199	3628	3628	264.4	461.5
68	199	199	3607	3650	251.4	487.4
70	199	199	3596	3637	252	493
73A	199	199	3631	3650	264	498
73B	198	200	3603	3656	482	253
74	198	199	3616	3667	253	461
77	200	200	3598	3632	247	463
78	199	200	3631	3656	247	482
80A	199	199	3616	3658	218	418
80B	199	200	3608	3649	241	472

No of Results:	57	57	57	57	57	57
Median:	199.0	199.0	3613.0	3649.0	253.0	473.5
Minimum:	195	196	3545	3590	169	253
Maximum:	200	200	3650	3683	482	520
Range:	5	4	105	93	313	267

Mass per unit Volume (nearest 1 Kg/m³)				
Laboratory Code	PTA 1	PTA 2	Z-score PTA 1	Z-score PTA 2
1	2310	2325	-0.77	-0.90
2	2326	2335	0.77	0.10
3	2325	2328	0.67	-0.60
5	2327	2360	0.87	2.60
6	2319	2345	0.10	1.10
7	2321	2331	0.29	-0.30
8	2320	2335	0.19	0.10
9A	2318	2349	0.00	1.50
9B	2322	2353	0.39	1.90
9C	2331	2350	1.25	1.60
12	2318	2322	0.00	-1.20
13	2302	2324	-1.54	-1.00
14	2308	2324	-0.96	-1.00
16	2322	2335	0.39	0.10
17	2322	2345	0.39	1.10
18	2306	2325	-1.16	-0.90
23	2340	2330	2.12	-0.40
24	2309	2322	-0.87	-1.20
25	2297	2302	-2.02	-3.20
27	2322	2322	0.39	-1.20
28A	2324	2337	0.58	0.30
28B	2306	2326	-1.16	-0.80
29	2318	2329	0.00	-0.50
32	2342	2334	2.31	0.00
34	2.324	2.338	na	na
35	2333	2346	1.45	1.20
36	2320	2340	0.19	0.60
37	2315	2342	-0.29	0.80
38	2329	2329	1.06	-0.50
39A	2333	2351	1.45	1.70
39B	2330	2348	1.16	1.40
42	4	4	na	na
44	2293	2335	-2.41	0.10
45	2318	2328	0.00	-0.60
47	2300	2340	-1.73	0.60
50	2307	2315	-1.06	-1.90
51A	2315	2327	-0.29	-0.70
51B	2312	2341	-0.58	0.70
51C	2315	2330	-0.29	-0.40

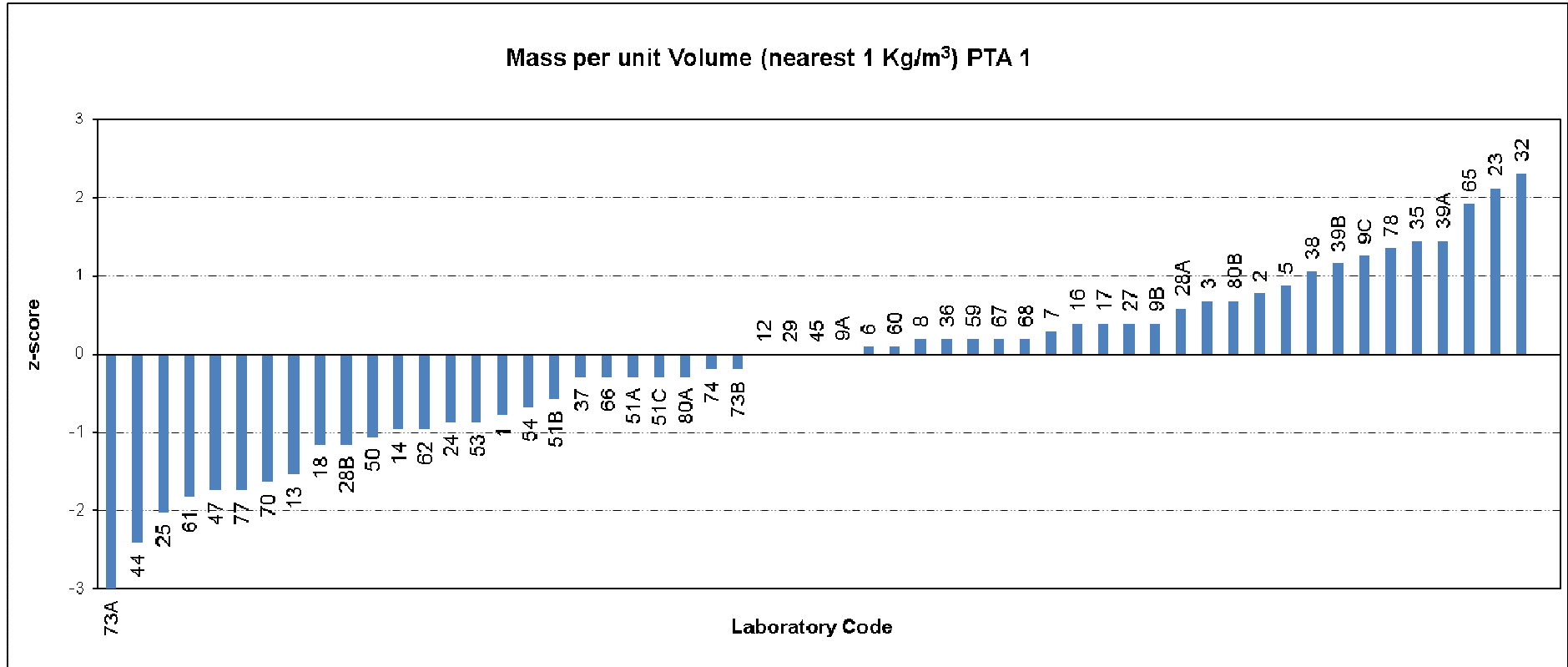
§

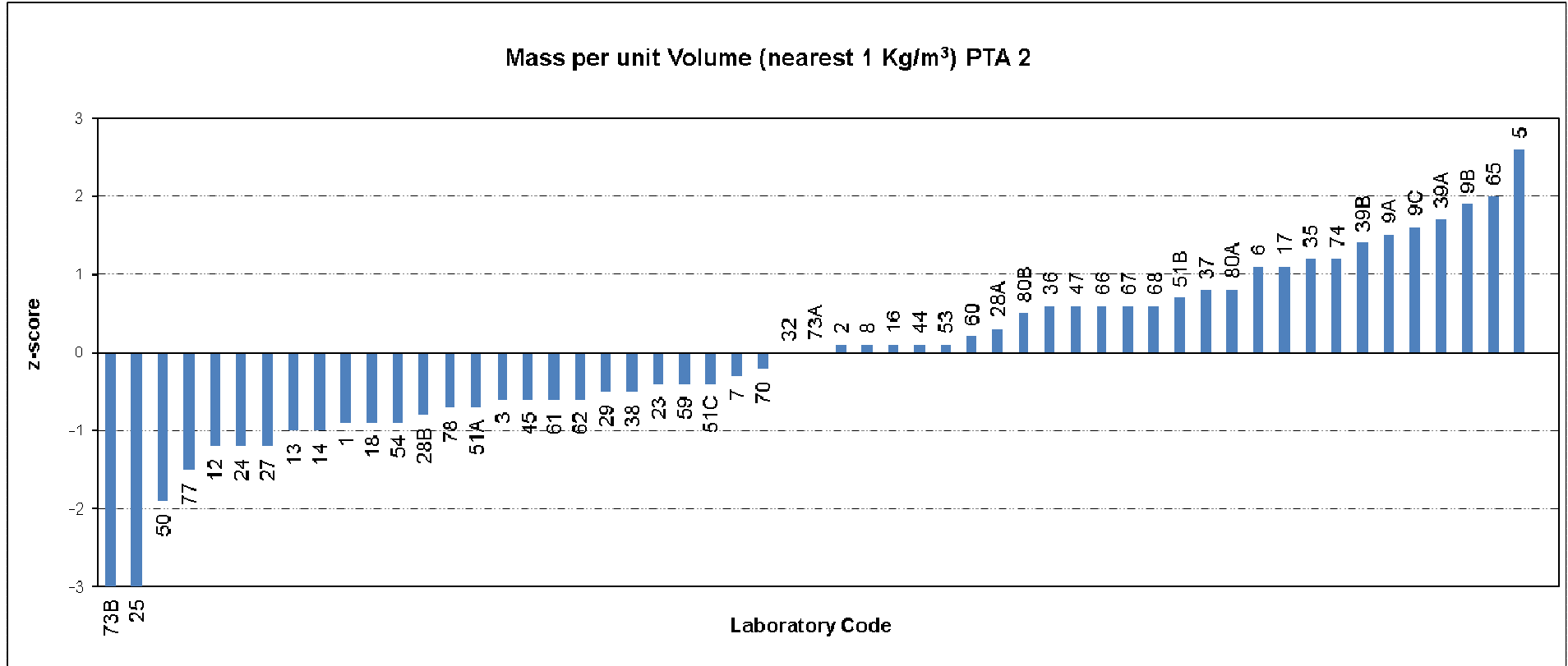
Mass per unit Volume (nearest 1 Kg/m ³)				
Laboratory Code	PTA 1	PTA 2	Z-score PTA 1	Z-score PTA 2
53	2309	2335	-0.87	0.10
54	2311	2325	-0.67	-0.90
59	2320	2330	0.19	-0.40
60	2319	2336	0.10	0.20
61	2299	2328	-1.83	-0.60
62	2308	2328	-0.96	-0.60
65	2338	2354	1.93	2.00
66	2315	2340	-0.29	0.60
67	2320	2340	0.19	0.60
68	2320	2340	0.19	0.60
70	2301	2332	-1.64	-0.20
73A	2276	2334	-4.05 §	0.00
73B	2316	2280	-0.19	-5.40 §
74	2316	2346	-0.19	1.20
77	2300	2319	-1.73	-1.50
78	2332	2327	1.35	-0.70
80A	2315	2342	-0.29	0.80
80B	2325	2339	0.67	0.50

No of Results:	55	55
Median:	2318.0	2334.0
Uncertainty (median):	1.8	1.7
Normalised IQR:	10.4	10.0
Robust CV:	0.4%	0.4%
Minimum:	2276	2280
Maximum:	2342	2360

Note: A “§” indicates an outlier i.e. $|z\text{-score}| \geq 3.0$

Note: Laboratories 34 and 42 results were extreme and therefore could not be included to avoid erroneous conclusions drawn from the data set.



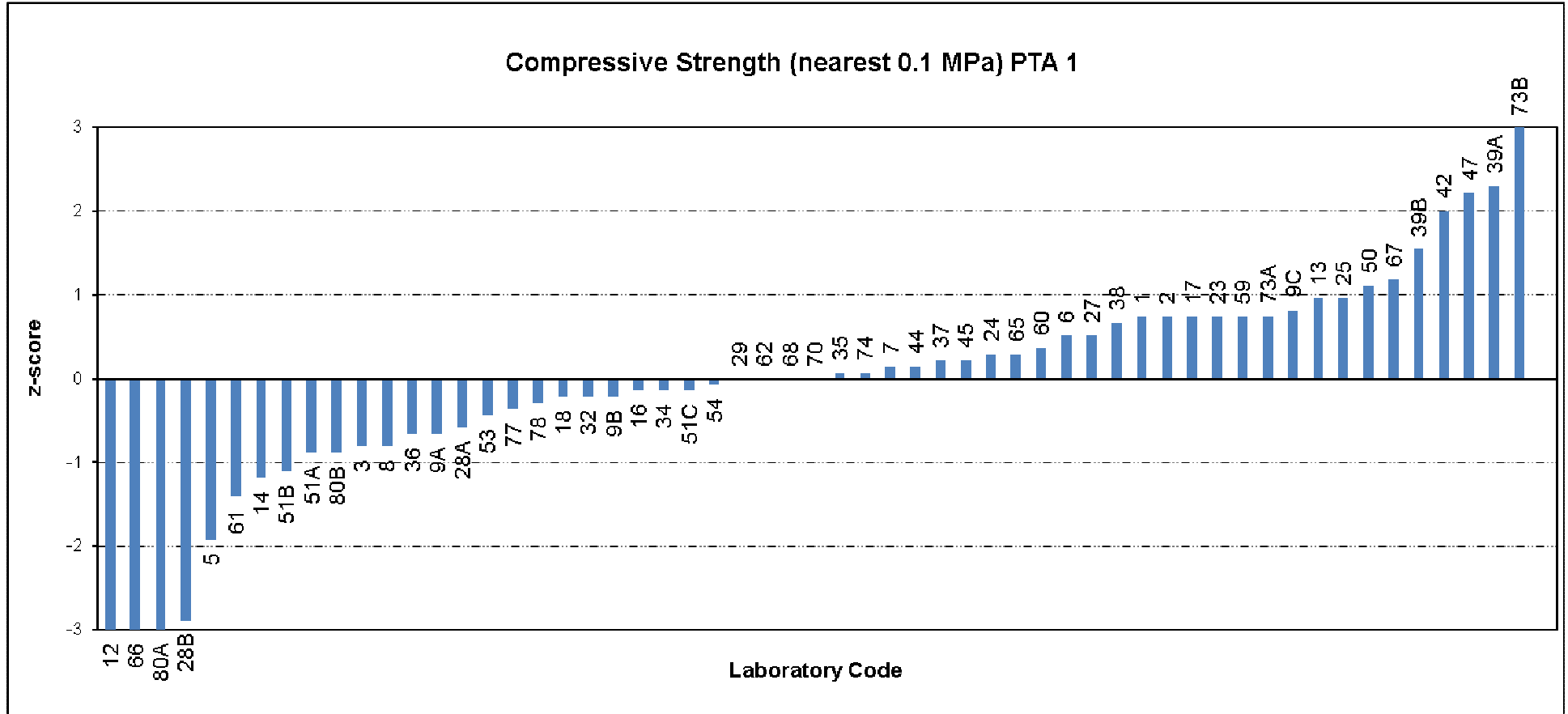


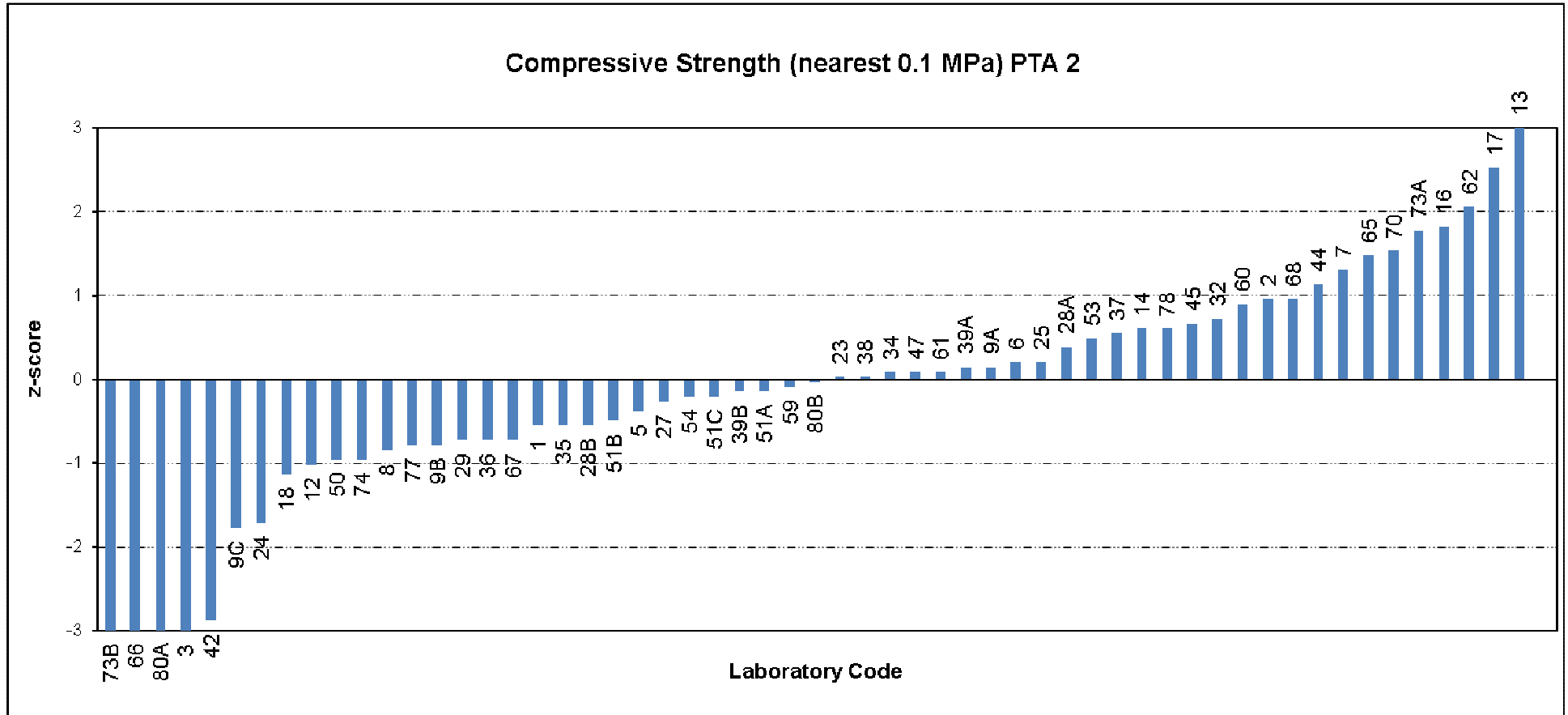
Compressive Strength (nearest 0.1 MPa)				
Laboratory Code	PTA 1	PTA 2	Z-score PTA 1	Z-score PTA 2
1	33	59.4	0.75	-0.53
2	33	62	0.75	1.00
3	30.9	55.1	-0.82	-3.05 §
5	29.4	59.7	-1.95	-0.35
6	32.7	60.7	0.52	0.23
7	32.2	62.6	0.15	1.35
8	30.9	58.89	-0.82	-0.83
9A	31.1	60.6	-0.67	0.18
9B	31.7	59	-0.22	-0.76
9C	33.1	57.3	0.82	-1.76
12	21.7	58.6	-7.72 §	-1.00
13	33.3	65.8	0.97	3.23 §
14	30.4	61.4	-1.20	0.65
16	31.8	63.5	-0.15	1.88
17	33	64.7	0.75	2.58
18	31.7	58.4	-0.22	-1.11
23	33	60.4	0.75	0.06
24	32.4	57.4	0.30	-1.70
25	33.3	60.7	0.97	0.23
27	32.7	59.9	0.52	-0.23
28A	31.2	61	-0.60	0.41
28B	28.1	59.4	-2.92	-0.53
29	32	59.1	0.00	-0.70
32	31.7	61.6	-0.22	0.76
34	31.8	60.5	-0.15	0.12
35	32.1	59.4	0.07	-0.53
36	31.1	59.1	-0.67	-0.70
37	32.3	61.3	0.22	0.59
38	32.9	60.4	0.67	0.06
39A	35.1	60.6	2.32	0.18
39B	34.1	60.1	1.57	-0.12
42	34.71	55.39	2.03	-2.88
44	32.2	62.3	0.15	1.17
45	32.3	61.5	0.22	0.70
47	35	60.5	2.25	0.12
50	33.5	58.7	1.12	-0.94
51A	30.8	60.1	-0.90	-0.12
51B	30.5	59.5	-1.12	-0.47
51C	31.8	60	-0.15	-0.18

Compressive Strength (nearest 0.1 MPa)				
Laboratory Code	PTA 1	PTA 2	Z-score PTA 1	Z-score PTA 2
53	31.4	61.2	-0.45	0.53
54	31.9	60	-0.07	-0.18
59	33	60.2	0.75	-0.06
60	32.5	61.9	0.37	0.94
61	30.1	60.5	-1.42	0.12
62	32	63.9	0.00	2.11
65	32.4	62.9	0.30	1.52
66	26.8	48.3	-3.90 §	-7.04 §
67	33.6	59.1	1.20	-0.70
68	32	62	0.00	1.00
70	32	63	0.00	1.58
73A	33	63.4	0.75	1.82
73B	61.4	32.2	22.03 §	-16.48 §
74	32.1	58.7	0.07	-0.94
77	31.5	59	-0.37	-0.76
78	31.6	61.4	-0.30	0.65
80A	27.6	53.2	-3.30 §	-4.16 §
80B	30.8	60.3	-0.90	0.00

No of Results:	57	57
Median:	32.00	60.30
Uncertainty (median):	0.22	0.28
Normalised IQR:	1.33	1.70
Robust CV:	4.2%	2.8%
Minimum:	21.7	32.2
Maximum:	61.4	65.8

Note: A “§” indicates an outlier i.e. $|z\text{-score}| \geq 3.0$





Laboratory Code	Failure Mode		Moisture condition on receipt (SSD or dry)	Daily temperature of the curing tank (°C)	Details of end treatment	Method
	PTA 1	PTA 2				
1	Normal	Normal	SSD	27	grinding	1012.3.1
2	Normal	Normal	SSD	26.9	ground	AS1012.9
3	Type 2	Type 3	SSD	20	End grinding	KS F 2405:2010
5	#	#	SSD	#	rubber capped	AS1012.9
6	Shear	Conical	SSD	23	Rubber capping	AS1012.12.2 (density) AS1012.9 (strength)
7	Normal	Normal	SSD	26	rubber	AS1012.9, AS1012.12
8	Cone (A)	Cone (A)	SSD	23	rubber cap	AS1012
9A	Top crumble	Normal	SSD	27.1	R Rubber cap	AS1012
9B	Top crumble	Normal	SSD	27.1	R Rubber cap	AS1012
9C	Top crumble	Normal	SSD	27.1	R Rubber cap	AS1012
12	satisfactory	satisfactory	SSD	20	sulphur capping	BS EN 12390-3
13	N	N	SSD	27	rubber cap	AS1012.9
14	S	N	Moist	23	sulphur capping	AS1012.9
16	N	N	SSD	22	Rubber	AS1012.9
17	Conical	Sheer	SSD	23	#	AS1012
18	Normal	Normal	SSD	27	sulphur capping	AS1012
23	N	N	SSD	27	SSD	AS1012.9
24	Normal	Normal	SSD	27	sulphur capped	AS1012
25	cone	cone	SSD	22.5	end grinding	AS1012.9
27	Normal Shear	Normal Shear	SSD	19	sulphur capping	AS1012
28A	Cone	Shear	SSD	21.3	Rubber caps	AS1012
28B	Horizontal Vertical Cracking	#	SSD	23.3	Rubber capped	AS1012.9
29	Normal	Normal	SSD	23.5	rubber capped	AS1012.9 and 12.1
32	N	N	SSD	23	sulphur cap	AS1012.9
34	N	N	SSD	23.5	sulphur capping	1012.9 and 6.2.4
35	Normal	Normal	SSD	22.4	rubber cap	AS1012.9 and 12.2

Laboratory Code	Failure Mode		Moisture condition on receipt (SSD or dry)	Daily temperature of the curing tank (°C)	Details of end treatment	Method
	PTA 1	PTA 1				
36	N	N	SSD	22.5	sulph capping	AS1012.6
37	Normal	Normal	SSD	24	rubber capping	AS1012.9
38	Normal	Normal	SSD	22	ground	AS1012.9
39A	Conical	Conical	SSD	23.5	Rubber capped	AS1012.9, 12.1, 12.2
39B	Cone and split	Cone and split	SSD	23.5	rubber cap	AS1012.9 and AS1012.12.2
42	#	#	SSD	27	#	AS1012
44	Normal	Cone split	SSD	27.5	wet	AS1012.9, AS.1012.12.1
45	Normal	Normal	SSD	23.5	grinding	AS1012.9
47	loaded to failure	loaded to failure	Moist	27	sulphur capped	AS1012.9-1999/AS1012.1-1998
50	Conical	Conical	SSD		rubber	AS1012
51A	vertical splitting	vertical splitting	SSD	23	ground	AS1012.9
51B	vertical splitting	vertical splitting	SSD	23	ground	AS1012.9
51C	#	#	SSD	23	ground	AS1012.9
53	Normal	Normal	SSD	22.5	ground	AS1012.9 - AS1012.12.1
54	Normal	Normal	SSD	23.5	sulphur	AS1012.9
59	N	N	SSD	23	sulphur capped	1012.9, clause 6.2.2a
60	Shear	Normal	SSD	23.3	one end ground	AS1012.9
61	Shear	Shear	SSD		rubber capped	AS1012.9
62	Shear	Shear	SSD	27	rubber capping	AS1012.9
65	Normal	Sheer	SSD	27	rubber cap	AS1012.9
66	Satisfactory 3	Satisfactory 4	SSD	20	other	EN12390-3
67	N	S	SSD	27	rubber cap	#
68	#	#	SSD	26.5	rubber capping	AS1012.9

Laboratory Code	Failure Mode		Moisture condition on receipt (SSD or dry)	Daily temperature of the curing tank (°C)	Details of end treatment	Method
	PTA 1	PTA 1				
70	Normal	Normal	SSD	26	rubber capped	AS1012.9, 12.1
73A	Normal	Normal	SSD	23.6	ground	AS1012
73B	Normal	Normal	SSD	23.6	rubber cap	AS1012
74	Shear	Conical	SSD	23	#	AS1012.9
77	#	#	SSD	23	rubber cap	NZS 3112
78	cone and shear	shear	SSD	27.9	rubber	AS1012.9
80A	#	#	SSD	23	end grinding	AS1012-12.2-1998, AS1012.9-1999
80B	#	#	SSD	23	End grinding	AS1012-12.2-1998, AS1012.9-1999

Note: A '#' indicates no response provided

APPENDIX B

Homogeneity Testing

Homogeneity Testing

Concrete Round 15 - Proficiency Testing Homogeneity Results										
							Date Compiled: 16/11/2012			
		PTA 1							PTA 2	
Date Sampled	Date Tested	MPUV (Kg/m ³)	Compressive Strength (MPa)	Sample Number	Date Sampled	Date Tested	MPUV(Kg/m ³)	Compressive Strength (MPa)		
21/09/2012	16/11/2012	2323	32.6	C1230943	25/09/2012	16/11/2012	2342	61.3		
		2328	33.0	C1230944			2327	61.3		
		2325	31.9	C1230945			2333	60.4		
		2325	32.7	C1230946			2330	61.6		
		2328	33.2	C1230947			2338	60.8		
		2324	32.2	C1230948			2339	60.9		
		2327	32.1	C1230949			2335	58.6		
		2330	32.2	C1230950			2338	61.4		
		2319	32	C1230951			2334	58.4		
		2326	32.8	C1230952			2335	58.6		
Mean		2325	32.5	Mean			2335	60.3		
Standard Deviation		3.14	0.45	Standard Deviation			4.27	1.29		
Coefficient of Variation (%)		0.13	1.39	Coefficient of Variation (%)			0.18	2.13		
Lowest Value		2319	31.9	Lowest Value			2327	58.4		
Highest Value		2330	33.2	Highest Value			2342	61.6		

APPENDIX C

Documentation

Instructions to Participants	C1
Results Sheet	C3



PROFICIENCY TESTING AUSTRALIA
Proficiency Testing Program
Concrete Round 15

INSTRUCTIONS TO PARTICIPANTS

Please read instructions carefully **BEFORE** commencing testing.

To ensure that the results of this program can be analysed properly, participants are asked to carefully note the following:

1. Two concrete cylinders (nominally 100 mm diameter x 200 mm length) have been supplied to each laboratory. The cylinders are marked PTA 1 and PTA 2.
2. Please treat the samples as normal samples received into the laboratory.
3. The following determinations are to be performed on each sample:

Height - to nearest 1 mm

Diameter - to nearest 0.2 mm

Weight - to **nearest 1 gm**

Mass per unit Volume - to the nearest 1 kg/m³

Maximum Sustained Load Unit - to nearest 1 kN

Compressive Strength - to the nearest 0.1 MPa

Type of Fracture

The results for all determinations are to be recorded on the results sheet to the accuracy and reporting basis indicated where possible.

4. The tests are based on AS1012; however other methods may be used. Note a higher level of accuracy is requested for specific tests to allow for statistical comparison.
5. Remove the newspaper and plastic bag, and record the moisture condition on the results sheet. Also record if there has been any damage caused to the cylinders.
6. Place the cylinders in the curing tank within 30 minutes of unwrapping. Ensure that the cylinders remain totally immersed in water until compression tested. Each day record on the results sheet the temperature (°C) of the curing tank water until tested.
7. Remove and test the cylinders marked PTA 1 and PTA 2 on **16 November 2012**.
8. Wipe all the excess water and any loose accumulation of grit and lime, such that the cylinders have a clean but damp surface only.
9. Immediately weigh the cylinder on a balance to the nearest 1 gram.

10. Measure the height of the cylinders to the nearest 1 mm. Measure the diameter in the middle of the cylinder to the nearest 0.2 mm (Record as Result 1). Repeat the process measuring from a 90° rotation (Record as Result 2). Do not measure on the mould joint as marked on the cylinder.
11. Treat the ends of each test cylinder by either sulphur capping, rubber capping or end grinding.
12. After end treatment allow the sulphur caps to cure for 1 hour prior to testing. Moulded rubber capped and ground cylinders may be tested immediately. Test the cylinders for compressive strength to AS1012 or other methods.

The following steps shall be observed:

- 12.1 Wipe clean the upper and lower platten of the testing machine with a hand broom/a cloth.
 - 12.2 Wipe both ends of the cylinder capping to remove excess water.
 - 12.3 Place the cylinder in the testing machine.
 - 12.4 Set the load pacing control unit at 20 MPa ± 2 MPa (157 kN/minute).
 - 12.5 Start the compression machine and increase the load at the rate described in AS1012 until the cylinder fails. Record the maximum load on the results sheet.
 - 12.6 Record the type of failure.
 - 12.7 Record the type of end treatment.
13. Calculate the Mass per unit Volume to the nearest 1 kg/m³.
 14. Calculate the Compressive Strength to the nearest 0.1 MPa.
 15. For this program your laboratory has been allocated the code number shown on the results sheet. All reference to your laboratory in reports associated with this program will be with this code number, thus ensuring confidentiality of results.
 16. All laboratories must return the results sheet no later than **21 November 2012** to:

Laura Galbratih
Proficiency Testing Australia
Fax: 02 9743 6664
Email: laura.galbraith@pta.asn.au

PROFICIENCY TESTING AUSTRALIA
Concrete 15 - Proficiency Testing Program
Results Sheet

Lab Code:

NOTE: When entering results, please ensure that the measurement recorded corresponds to the cylinder PTA 1 or PTA 2.

TEST (report to)	PTA 1		PTA 2	
Height (nearest 1 mm)				
Diameter (nearest 0.2 mm)	Result 1	Result 2	Result 1	Result 2
Weight (nearest 1 gm)				
Mass/Volume (nearest 1 kg/m ³)				
Maximum Sustained Load Unit (nearest 1 kN)				
Compressive Strength (nearest 0.1 MPa)				
Failure Mode				

Date of receipt _____

Moisture condition on receipt (SSD or dry): _____

Daily temperature of the curing tank: _____

Details of end treatment _____

Method: _____

Date of tests - PTA 1 & PTA 2: _____

Signature: _____

Return no later than **21 November 2012** to:**Laura Galbraith****Proficiency Testing Australia****Phone: 02 9736 8397****Fax: 02 9743 6664****Email: laura.galbraith@pta.asn.au**

- *End of Report* -