

Report No. 1146

Concrete Proficiency Testing Program

Round 26

July 2019

Acknowledgments

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1. FOREWORD

This report summarises the results of a proficiency testing program on the determination of Density and Compressive Strength of hardened concrete cylinders. It constitutes the twenty-sixth round of an ongoing series of programs. This program is accredited to ISO/IEC 17043:2010 “*Conformity assessment - General requirements for proficiency testing*” by International Accreditation New Zealand (IANZ).

The program was conducted in May 2019 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 Dr Emilia Cincu and the Technical Adviser was Mr M McCarthy from Soil Engineering Services, Townsville, QLD. This report was authorised by Mrs K Cividin, PTA Quality Manager.

2. FEATURES OF THE PROGRAM

- (a) Participants were provided with two concrete cylinders labelled PTA 1 and PTA 2.
- (b) A total of 73 laboratories received samples, comprising:
 - 61 Australian participants; and
 - 12 overseas participants, including:
 - Colombia (1);
 - Jordan (1);
 - Korea (1);
 - Malaysia (1);
 - Mauritius (1);
 - New Zealand (2);
 - Papua New Guinea (2);
 - Peru (1);
 - Qatar (1); and
 - Solomon Islands (1).

Of these 73 laboratories, 2 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).
- (g) A robust statistical approach, using z-scores, was utilised to assess laboratories' testing performance (see Section 4). Robust z-scores and z-score charts relevant to each test are presented in Appendix A.
- (h) The document entitled *Guide to Proficiency Testing Australia, 2016* (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 and stability 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 "§".

(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 decimal places) 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; a robust estimate of the standard deviation 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 a correction 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).

For normally distributed data, the uncertainty of the median is approximated by:

$$\sqrt{\frac{\pi}{2}} \times \frac{\text{normIQR}}{\sqrt{n}}$$

n = number of results

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.

The following table summarises the results submitted by participants for the program.

TABLE A: SUMMARY STATISTICS

Test	No. of Results	Median	Normalised IQR	Robust CV (%)
Mass/Volume PTA 1 (Nearest 1 kg/m ³)	84	2290.0	11.5	0.5%
Mass/Volume PTA 2 (Nearest 1 kg/m ³)	84	2298.0	11.9	0.5%
Compressive Strength PTA 1 (Nearest 0.5 MPa)	84	34.50	1.85	5.4%
Compressive Strength PTA 2 (Nearest 0.5 MPa)	84	62.00	4.08	6.6%

5. PTA AND TECHNICAL ADVISER'S COMMENTS

A total of 73 laboratories (61 Australian and 12 overseas) participated in this round. Two laboratories did not submit all results in time for inclusion in the final report.

Overall performance against prior expectations

In total 8 outliers were detected from the 336 results analysed, resulting in 2.38% of results classified as outliers which was lower than the previous rounds (7.9% in

round 25 and 7.2% in round 24). Overall, a very good performance was achieved in this round, with a low percentage of outliers.

All laboratories with outliers (“§”) or an absolute z-score between 2.0 and 3.0 (“?”) are encouraged to review their procedures.

Participants should take care with calculations and when recording results on the provided Results Sheet. Several laboratories did not report the results to the precision (i.e. number of decimal places) requested on the Results Sheet (Laboratory codes 7, 15A, 15B and 15C). Even if the results have not been rounded to the requested precision before being included in the statistical analysis, it is advisable that in future rounds all participants follow the instructions. Failure to do so can have a negative impact on the statistical analysis and results interpretation.

Laboratory code 94B received two PTA2 cylinders and laboratory code 94C received two PTA1 cylinders instead of one PTA1 and one PTA2. All results were statistically analysed, as 94B-1, 94B-2 and 94C-1 and 94C-2.

Laboratory code 63 reported the mass in kg instead of g (3.579 instead of 3579 and 3.600 instead 3600). Participants are recommended to read the instructions carefully before starting the analysis.

Variations between laboratories

Table B gives a comparison of the robust CVs for tests common to previous programs. The CV values for all tests and cylinders are within the limits observed in previous rounds.

Variations between test methods and procedures

The majority of participants performed the required testing using AS 1012.9 and AS 1012.12.1. Other test methods used include ASTM C39/C39M-18, BS EN 12390-3, BS EN 12504-1, NZS 3112 and INVE-410-13. It has been determined that no major differences exist between the methods, therefore the results were pooled for analysis.

Possible sources of error and suggestions for improvement

Possible sources of error that may affect the outcome of the proficiency testing program include, but are not limited to:

- the condition of the concrete specimens (damage during dispatch, late testing)
- interpretation of test methods and procedures
- calibration of laboratory instruments
- incorrect calculations
- mistakes whilst recording the results on the Results Sheet

Participants may consider the following when performing corrective action investigations:

- training of technicians
- calibration of equipment
- review of methods and procedures
- ground end inspection checked daily, randomly or 1 in 20 specimen checks
- precision in reporting and calculations

Participants could also perform internal proficiency tests under senior supervision to isolate any anomalies found.

TABLE B: COMPARISON OF PREVIOUS ROUND CVs

Test	Round 20	Round 21	Round 22	Round 23	Round 24	Round 25	Round 26
Mass/Volume PTA 1	0.5%	0.5%	0.7%	0.5%	0.5%	0.4%	0.5%
Mass/Volume PTA 2	0.7%	0.5%	0.1%	0.6%	0.3%	0.5%	0.5%
Compressive Strength PTA 1	4.2%	4.8%	5.7%	6.5%	9.8%	5.1%	5.4%
Compressive Strength PTA 2	4.4%	4.7%	6.8%	5.5%	10.9%	6.1%	6.6%

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.

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 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. Therefore, further analysis of results by Method AS 1012.9 was undertaken to provide specific information on individual method performance for Compressive Strength. Table C below presents the Median, Uncertainty of the Median and Robust CV of the results obtained by this method.

TABLE C: SUMMARY OF GROUP ANALYSIS

Test	Method	Sample	Number of Results	Median	Uncertainty of the Median	Robust CV
Compressive Strength (Nearest 0.5 MPa)	AS 1012.9	PTA 1	55	35.00	0.31	5.3%
		PTA 2	53	62.50	0.64	5.9%

6. OUTLIER RESULTS

Laboratories reporting outlier results are listed in the following table:

TABLE B: SUMMARY OF STATISTICAL OUTLIERS

Test	Laboratory Code No.
Mass/Volume PTA 1	8
Mass/Volume PTA 2	15C and 98
Compressive Strength PTA 1	59 and 67
Compressive Strength PTA 2	59, 67 and 69

7. REFERENCES

- [1] *Guide to Proficiency Testing Australia*, 2016 (This document can be found on the PTA website, www.pta.asn.au)
- [2] AS 1012.9:2014 *Methods for testing concrete. Compressive strength tests - Concrete, mortar and grout specimens*
- [3] AS 1012.12.1:1998 (R2014) *Methods of testing concrete. Determination of mass per unit volume of hardened concrete - Rapid measuring method*
- [4] ASTM C39/C39M-18 *Standard test method for compressive strength of cylindrical concrete specimens*
- [5] BS EN 12390-3:2009 *Testing hardened concrete. Compressive strength of test specimens*
- [6] BS EN 12504-1:2009 *Testing concrete in structures-Part 1: Core specimens- Taking, examining and testing in compression*
- [7] NZS 3112.2:2000 *Methods of test for concrete - Tests related to determination of strength of concrete*
- [8] INVE-410-13 *Compression test of concrete cylinders*

APPENDIX A

Results and Data Analysis

Height.....	A1
Diameter.....	A4
Weight.....	A7
Mass/Volume.....	A10
Maximum Sustained Load Unit.....	A15
Compressive Strength.....	A18
Additional Information.....	A23

Lab Code	Height (Nearest 1 mm)	
	PTA 1	PTA2
1	198	199
3	196.0	197.0
4	198	200
6A	196	197
6B	196	198
7	199	200
8	199	199
9	199	200
11	195.0	196.0
12	198	199
13	198	199
15A	200	200
15B	198	200
15C	200	200
16	197	197
17	198	199
18	198	199
19	195	196
20	195	197
24A	198	200
25	198	200
27	198	199
29A	199	199
29B	197	199
29C	198	199
30	198.0	198.0
32A	199	199
32B	198	199
32C	198	199
35	199	200
36	198	199
37	198	199
41	198	199
42	197	198
43	198	199
44	198	199
46	198	199
49A	195	195
49B	198	198
51	199	200
52	196	197

Lab Code	Height (Nearest 1 mm)	
	PTA 1	PTA2
53A	196	198
53B	198	198
55	197	200
56	197	198
57	195	196
58	197	199
59	200.00	200.00
60	196	198
63	197	198
65	199	200
66	199	199
67	197	199
69	198	199.6
70	200	200
71A	198	200
71B	199	200
72	198	199
73	197	200
75	196	197
77	198	199
80	198	199
81	198	199
83	197	198
85	195	196
86	198	200
87	199	200
88	197	198
90	198	199
91	197	199
93	199	198
94A	193	197
94B-1	#	199
94B-2	#	199
94C-1	196	#
94C-2	196	#
98	198	199
99	198	199
101	198	199
103	199	200
104	198	199
105	198	199
106	198	199

Lab Code	Height (Nearest 1 mm)	
	PTA 1	PTA2
107	197	199
108	199	200
110	194	196
No. of Results	84	84

Note:

"#" indicates no response was provided by the laboratory

Lab Code	Diameter PTA 1 (Nearest 0.2 mm)		
	Result 1	Result 2	Average
1	100.4	99.8	100.10
3	100.0	100.2	100.10
4	100.0	100.2	100.10
6A	99.8	99.8	99.80
6B	100.0	99.4	99.70
7	100.0	100.2	100.10
8	100.0	100.4	100.20
9	100.0	100.0	100.00
11	100.0	100.6	100.30
12	100.4	100.4	100.40
13	100.4	100.0	100.20
15A	100	100.2	100.10
15B	100.1	100.1	100.10
15C	100.3	100.2	100.25
16	100.4	99.8	100.10
17	99.8	99.6	99.70
18	100.0	100.2	100.10
19	100.0	100.0	100.00
20	100.0	100.4	100.20
24A	100.0	100.0	100.00
25	100.4	100.6	100.50
27	100.0	100.8	100.40
29A	100.0	100.4	100.20
29B	99.8	100.4	100.10
29C	99.8	100.6	100.20
30	100.2	100.2	100.20
32A	100.2	100.2	100.20
32B	100.2	100.2	100.20
32C	100.0	100.2	100.10
35	100.0	100.2	100.10
36	100.4	100.1	100.25
37	99.8	100.2	100.00
41	100.2	100.2	100.20
42	100.4	100.6	100.50
43	99.8	100.2	100.00
44	100.0	100.2	100.10
46	100.2	100.2	100.20
49A	100.2	100.2	100.20
49B	100.0	100.0	100.00
51	100.0	100.4	100.20

Lab Code	Diameter PTA 2 (Nearest 0.2 mm)		
	Result 1	Result 2	Average
1	100.0	100.4	100.20
3	100.2	100.4	100.30
4	100.2	100.2	100.20
6A	99.8	100.0	99.90
6B	100.2	100.2	100.20
7	99.6	100.2	99.90
8	100.2	100.4	100.30
9	100.0	100.2	100.10
11	100.0	100.4	100.20
12	100.4	100.2	100.30
13	100.2	100.4	100.30
15A	100.2	100.2	100.20
15B	100.4	100.3	100.35
15C	100.4	100.6	100.50
16	100.6	99.8	100.20
17	100.0	100.2	100.10
18	100.0	100.0	100.00
19	100.0	99.8	99.90
20	100.2	100.2	100.20
24A	100.4	100.2	100.30
25	100.4	100.4	100.40
27	100.8	100.0	100.40
29A	99.8	100.4	100.10
29B	99.8	100.6	100.20
29C	99.8	100.6	100.20
30	100.2	100.2	100.20
32A	100.2	100.2	100.20
32B	100.2	100.4	100.30
32C	100.0	100.4	100.20
35	100.2	100.2	100.20
36	100.3	100.1	100.20
37	99.6	100.4	100.00
41	100.0	100.4	100.20
42	100.4	100.2	100.30
43	100.2	99.8	100.00
44	100.0	100.2	100.10
46	100.0	100.0	100.00
49A	100.0	100.0	100.00
49B	100.2	99.8	100.00
51	100.2	100.2	100.20

Lab Code	Diameter PTA 1 (Nearest 0.2 mm)		
	Result 1	Result 2	Average
52	100.3	99.7	100.00
53A	99.8	100.6	100.20
53B	100.2	100.4	100.30
55	99.8	99.6	99.70
56	100.2	100.2	100.20
57	100.2	100.4	100.30
58	100.1	100.2	100.15
59	100.0	100.0	100.00
60	100	100.2	100.10
63	100.2	100.3	100.25
65	100.0	100.0	100.00
66	99.6	99.6	99.60
67	100	100	100.00
69	100.6	99.8	100.20
70	100	100	100.00
71A	100.2	100.0	100.10
71B	100.0	100.0	100.00
72	100.0	100.0	100.00
73	100.0	100.2	100.10
75	100.4	100	100.20
77	100.2	100.1	100.15
80	100.0	99.6	99.80
81	100.4	100.0	100.20
83	100.2	100.2	100.20
85	100.2	100.4	100.30
86	100.4	99.8	100.10
87	100.0	100.2	100.10
88	100.4	99.9	100.15
90	100.6	100.0	100.30
91	100.2	100.2	100.20
93	100.2	100.2	100.20
94A	100.4	100.2	100.30
94B-1	#	#	N/A
94B-2	#	#	N/A
94C-1	100.6	100.2	100.40
94C-2	100.4	100.2	100.30
98	99.8	99.6	99.70
99	100.2	100.2	100.20
101	100.2	100.4	100.30
103	100.0	100.2	100.10
104	100.0	100.4	100.20

Lab Code	Diameter PTA 2 (Nearest 0.2 mm)		
	Result 1	Result 2	Average
52	100.2	99.8	100.00
53A	99.8	100.6	100.20
53B	100.2	100.2	100.20
55	99.8	99.8	99.80
56	100.2	99.8	100.00
57	100.4	100.4	100.40
58	100.2	100.0	100.10
59	100.0	100.0	100.00
60	100.2	100	100.10
63	99.9	100.1	100.00
65	100.2	99.8	100.00
66	99.8	99.8	99.80
67	100	100	100.00
69	100.2	100.4	100.30
70	100	100	100.00
71A	100.2	100.0	100.10
71B	100.2	100.2	100.20
72	100.2	100.2	100.20
73	100.0	100.0	100.00
75	100	100.6	100.30
77	99.9	100.1	100.00
80	99.8	99.8	99.80
81	99.8	100.0	99.90
83	100.2	100.2	100.20
85	100.2	100.4	100.30
86	100.2	100.2	100.20
87	100.0	100.2	100.10
88	99.8	100.1	99.95
90	100.4	100.2	100.30
91	99.8	100.0	99.90
93	100.2	100.0	100.10
94A	100.4	100.2	100.30
94B-1	99.8	100.0	99.90
94B-2	99.8	100.4	100.10
94C-1	#	#	N/A
94C-2	#	#	N/A
98	100.0	100.0	100.00
99	100.2	100.2	100.20
101	100.4	100.6	100.50
103	100.0	100.2	100.10
104	100.2	100.4	100.30

Lab Code	Diameter PTA 1 (Nearest 0.2 mm)		
	Result 1	Result 2	Average
105	100.4	100.4	100.40
106	100.2	100.2	100.20
107	100.4	100	100.20
108	100.2	100.6	100.40
110	100.6	100	100.30

No. of Results	84
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Lab Code	Diameter PTA 2 (Nearest 0.2 mm)		
	Result 1	Result 2	Average
105	100.2	100.2	100.20
106	100.2	100.4	100.30
107	100	100.6	100.30
108	100.0	100.2	100.10
110	100	100.6	100.30

No. of Results	84
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Note:

"#" indicates no response was provided by the laboratory

Lab Code	Weight (Nearest 1 g)	
	PTA 1	PTA 2
1	3573	3604
3	3540	3590
4	3569	3589
6A	3515	3553
6B	3547	3593
7	3572	3599
8	3565	3610
9	3576	3603
11	3521	3555
12	3589	3601
13	3558	3607
15A	3573.2	3604
15B	3570	3597
15C	3576	3594
16	3537	3566
17	3570	3600
18	3569	3593
19	3527	3552
20	3527	3582
24A	3576	3610
25	3565	3611
27	3570	3608
29A	3579	3603
29B	3558	3602
29C	3575	3602
30	3583	3603
32A	3574	3599
32B	3579	3583
32C	3566	3611
35	3587	3611
36	3570	3602
37	3561	3611
41	3579	3599
42	3533	3560
43	3559	3597
44	3563	3608
46	3559	3589
49A	3512	3532
49B	3577	3598
51	3588	3605

Lab Code	Weight (Nearest 1 g)	
	PTA 1	PTA 2
52	3536	3572
53A	3568	3608
53B	3572	3607
55	3562	3604
56	3560	3589
57	3516	3559
58	3557	3615
59	3598	3566
60	3526	3570
63	3.579	3.600
65	3573	3602
66	3572	3611
67	3560	3592
69	3568	3604
70	3563	3595
71A	3567	3594
71B	3567	3621
72	3572	3605
73	3545	3612
75	3548	3559
77	3582	3579
80	3539	3568
81	3583	3594
83	3576	3598
85	3539	3561
86	3573	3602
87	3575	3599
88	3579	3595
90	3577	3603
91	3558.4	3598
93	3577	3573
94A	3477	3579
94B-1	#	3589
94B-2	#	3593
94C-1	3553	#
94C-2	3542	#
98	3561	3731
99	3566	3601
101	3572	3613
103	3568	3610
104	3570	3624
105	3578	3597

Lab Code	Weight (Nearest 1 g)	
	PTA 1	PTA 2
106	3571	3612
107	3569	3608
108	3575	3612
110	3508	3561
No. of Results	84	84

Note:

"#" indicates no response was provided by the laboratory

Lab Code	Mass/Volume (Nearest 1 kg/m ³)				
	PTA 1	Z-Score		PTA 2	Z-Score
1	2290	0.00		2294	-0.34
3	2295	0.44		2307	0.76
4	2293	0.26		2281	-1.43
6A	2293	0.26		2296	-0.17
6B	2318	2.44	?	2301	0.25
7	2280	-0.87		2300	0.17
8	2172	-10.27	§	2296	-0.17
9	2287	-0.26		2286	-1.01
11	2285	-0.44		2300	0.17
12	2290	0.00		2290	-0.67
13	2300	0.87		2310	1.01
15A	2273	-1.48		2285	-1.10
15B	2268	-1.91		2272	-2.19
15C	2263	-2.35	?	2260	-3.20
16	2281	-0.78		2296	-0.17
17	2310	1.74		2299	0.08
18	2287	-0.26		2300	0.17
19	2300	0.87		2320	1.85
20	2294	0.35		2306	0.67
24A	2301	0.96		2281	-1.43
25	2302	1.04		2312	1.18
27	2280	-0.87		2300	0.17
29A	2282	-0.70		2292	-0.51
29B	2284	-0.52		2290	-0.67
29C	2288	-0.17		2296	-0.17
30	2300	0.87		2305	0.59
32A	2278	-1.04		2317	1.60
32B	2292	0.17		2279	-1.60
32C	2280	-0.87		2300	0.17
35	2290	0.00		2289	-0.76
36	2287	-0.26		2292	-0.51
37	2290	0.00		2310	1.01
41	2292	0.17		2294	-0.34
42	2263	-2.35	?	2278	-1.69
43	2296	0.52		2306	0.67
44	2289	-0.09		2306	0.67
46	2279	-0.96		2296	-0.17
49A	2284	-0.52		2306	0.67
49B	2300	0.87		2314	1.35
51	2287	-0.26		2286	-1.01
52	2300	0.87		2310	1.01

Lab Code	Mass/Volume (Nearest 1 kg/m ³)			Mass/Volume (Nearest 1 kg/m ³)		
	PTA 1	Z-Score		PTA 2	Z-Score	
53A	2309	1.65		2311	1.10	
53B	2284	-0.52		2311	1.10	
55	2316	2.26	?	2304	0.51	
56	2291	0.09		2308	0.84	
57	2287	-0.26		2295	-0.25	
58	2292	0.17		2308	0.84	
59	2290	0.00		2270	-2.36	?
60	2291	0.09		2286	-1.01	
63	2302	1.04		2315	1.43	
65	2286	-0.35		2293	-0.42	
66	2304	1.22		2320	1.85	
67	2302	1.04		2299	0.08	
69	2300	0.87		2280	-1.52	
70	2269	-1.83		2290	-0.67	
71A	2289	-0.09		2283	-1.26	
71B	2282	-0.70		2296	-0.17	
72	2300	0.87		2309	0.93	
73	2282	-0.70		2299	0.08	
75	2295	0.44		2286	-1.01	
77	2299	0.78		2290	-0.67	
80	2285	-0.44		2292	-0.51	
81	2290	0.00		2300	0.17	
83	2302	1.04		2304	0.51	
85	2297	0.61		2300	0.17	
86	2293	0.26		2284	-1.18	
87	2280	-0.87		2280	-1.52	
88	2300	0.87		2320	1.85	
90	2305	1.31		2313	1.26	
91	2290	0.00		2307	0.76	
93	2280	-0.87		2290	-0.67	
94A	2281	-0.78		2302	0.34	
94B-1	#	N/A		2301	0.25	
94B-2	#	N/A		2294	-0.34	
94C-1	2290	0.00		#	N/A	
94C-2	2287	-0.26		#	N/A	
98	2304	1.22		2387	7.50	§
99	2280	-0.87		2300	0.17	
101	2290	0.00		2280	-1.52	
103	2278	-1.04		2294	-0.34	
104	2290	0.00		2300	0.17	
105	2280	-0.87		2290	-0.67	
106	2287	-0.26		2297	-0.08	

Lab Code	Mass/Volume (Nearest 1 kg/m ³)			Mass/Volume (Nearest 1 kg/m ³)		
	PTA 1	Z-Score		PTA 2	Z-Score	
107	2297	0.61		2295	-0.25	
108	2269	-1.83		2295	-0.25	
110	2288	-0.17		2299	0.08	

No. of Results	84
Median	2290.0
Normalised IQR	11.5
Uncertainty of the Median	1.6
Robust CV	0.5%
Minimum	2172
Maximum	2318
Range	146

84
2298.0
11.9
1.6
0.5%
2260
2387
127

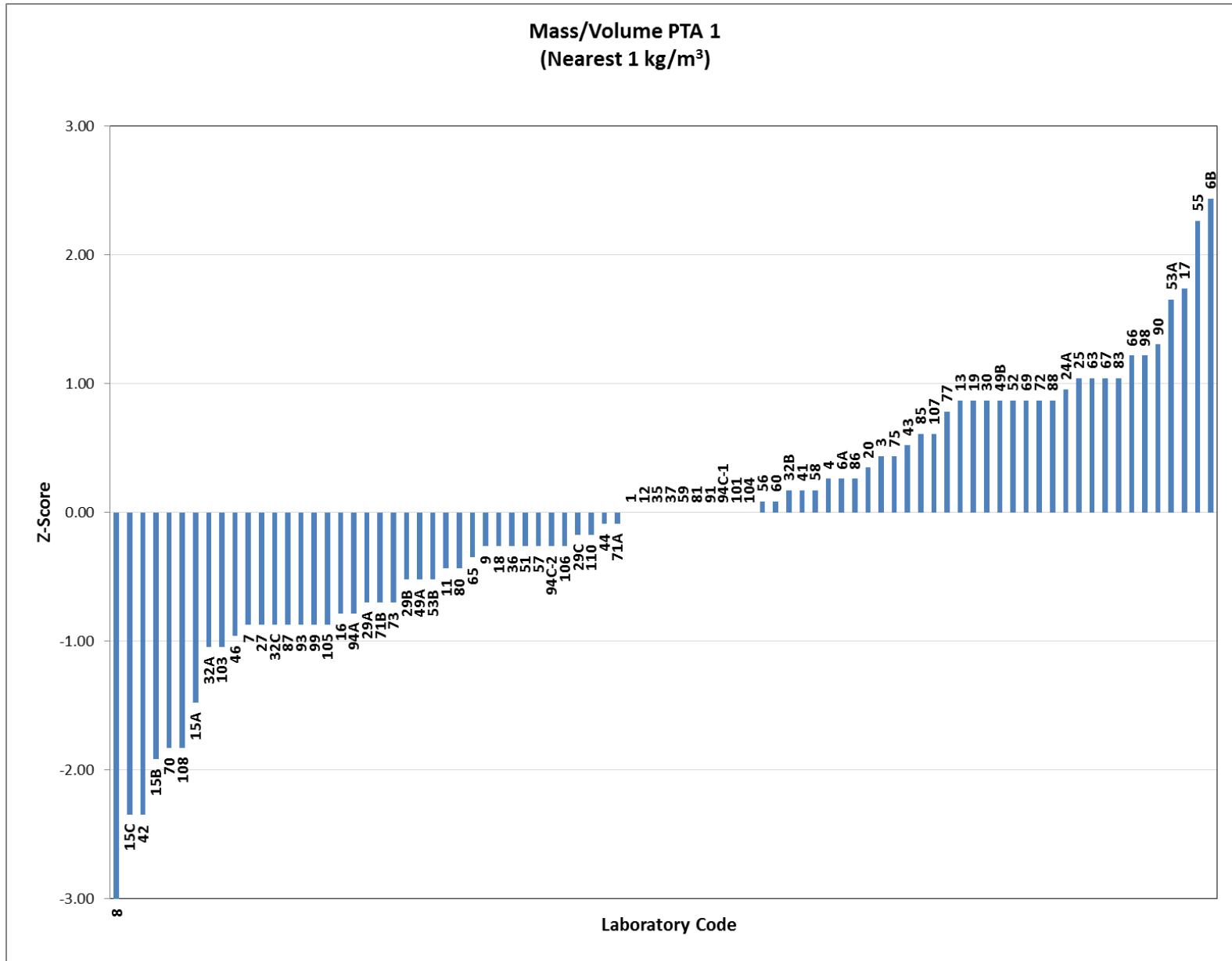
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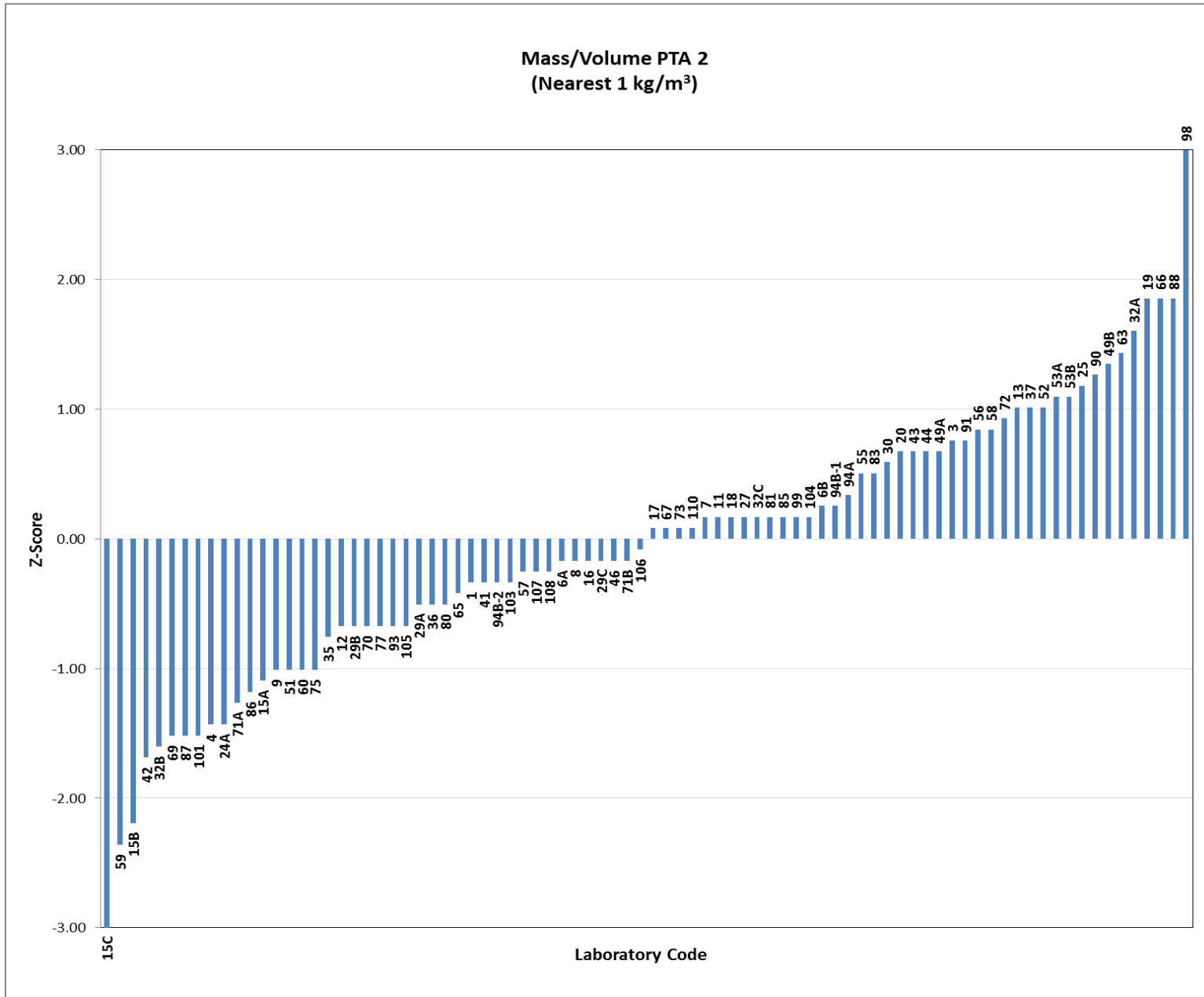
"?" indicates an absolute z-score greater than 2.0 but less than 3,
i.e. $2.0 < |z\text{-score}| < 3.0$

"§" indicates an outlier, i.e. $|z\text{-score}| \geq 3.0$

"#" indicates no response was provided by the laboratory

N/A indicates not applicable





Lab Code	Maximum Sustained Load Unit (Nearest 1 kN)	
	PTA 1	PTA 2
1	274	469
3	245	425
4	277	491
6A	256	454
6B	276	508
7	235.6	442.0
8	267	525
9	284	504
11	281	475
12	270	442
13	280	520
15A	301	538
15B	290	529
15C	297	536
16	266.0	505.5
17	266	463
18	276	473
19	278	441
20	277	498
24A	277	454
25	272	513
27	286	503
29A	279.8	493.5
29B	268.2	532.1
29C	286.8	532.9
30	261.3	475.6
32A	268	508
32B	276	459
32C	287	450
35	260	527
36	274	265
37	264	497
41	284	484
42	271	480
43	240	461
44	263	491
46	284	461
49A	261	490
49B	265	485
51	254	494
52	280.0	479.9

Lab Code	Maximum Sustained Load Unit (Nearest 1 kN)	
	PTA 1	PTA 2
53A	278	497
53B	265.5	487.5
55	294	517
56	239	481
57	288	517
58	296	553.0
59	334	251
60	267	421
63	299.2	468.5
65	295	481
66	242	410
67	211	312
69	245	384
70	273	507
71A	281	484
71B	263	523
72	268	545
73	248	416
75	290	493
77	262.3	462.9
80	284	532
81	250	447
83	266	492
85	276	469
86	251	488
87	261	479
88	261.6	486.0
90	273	513
91	260	497
93	245	490
94A	283	485
94B-1	#	514
94B-2	#	511
94C-1	283	#
94C-2	280	#
98	255	454
99	265	519
101	258	482
103	259	442
104	286	484
105	281	490

Lab Code	Maximum Sustained Load Unit (Nearest 1 kN)	
	PTA 1	PTA 2
106	263	508.0
107	255	482
108	277	490
110	286	495
No. of Results	84	84

Note:

"#" indicates no response was provided by the laboratory

Lab Code	Compressive Strength (Nearest 0.5 MPa)				
	PTA 1	Z-Score		PTA 2	Z-Score
1	35.0	0.27		59.5	-0.61
3	31.5	-1.62		54.5	-1.84
4	35.0	0.27		62.5	0.12
6A	33.0	-0.81		58.0	-0.98
6B	35.5	0.54		64.5	0.61
7	29.999	-2.43	?	56.282	-1.40
8	34.0	-0.27		66.5	1.10
9	36.0	0.81		64.0	0.49
11	35.5	0.54		60.5	-0.37
12	34.0	-0.27		56.0	-1.47
13	35.5	0.54		66.0	0.98
15A	38.28	2.04	?	68.23	1.53
15B	36.48	1.07		66.82	1.18
15C	37.60	1.67		67.44	1.33
16	34.0	-0.27		64.0	0.49
17	34.0	-0.27		59.0	-0.74
18	35.0	0.27		60.0	-0.49
19	35.5	0.54		56.5	-1.35
20	35.0	0.27		63.0	0.25
24A	35.5	0.54		57.5	-1.10
25	34.5	0.00		65.0	0.74
27	36.0	0.81		63.5	0.37
29A	35.5	0.54		62.5	0.12
29B	34.0	-0.27		67.5	1.35
29C	36.5	1.08		67.5	1.35
30	33.0	-0.81		60.5	-0.37
32A	34.0	-0.27		64.5	0.61
32B	35.0	0.27		58.0	-0.98
32C	36.5	1.08		57.0	-1.23
35	33.0	-0.81		67.0	1.23
36	34.5	0.00		59.0	-0.74
37	33.5	-0.54		63.5	0.37
41	36.0	0.81		61.5	-0.12
42	34.0	-0.27		61.0	-0.25
43	30.5	-2.16	?	58.5	-0.86
44	33.5	-0.54		62.5	0.12
46	36.0	0.81		58.5	-0.86
49A	33.0	-0.81		62.5	0.12
49B	33.5	-0.54		61.5	-0.12
51	32.0	-1.35		62.5	0.12
52	35.5	0.54		61.0	-0.25
53A	35.5	0.54		63.0	0.25

Lab Code	Compressive Strength (Nearest 0.5 MPa)			Compressive Strength (Nearest 0.5 MPa)		
	PTA 1	Z-Score		PTA 2	Z-Score	
53B	33.5	-0.54		62.0	0.00	
55	37.5	1.62		66.0	0.98	
56	30.5	-2.16	?	61	-0.25	
57	36.5	1.08		65.5	0.86	
58	37.5	1.62		70.0	1.96	
59	42.5	4.32	§	32.0	-7.36	§
60	34	-0.27		53.5	-2.08	?
63	38.0	1.89		59.5	-0.61	
65	37.5	1.62		61.5	-0.12	
66	31.0	-1.89		52.5	-2.33	?
67	27	-4.05	§	40	-5.40	§
69	31	-1.89		49	-3.19	§
70	35.0	0.27		64.5	0.61	
71A	35.5	0.54		61.5	-0.12	
71B	33.5	-0.54		66.5	1.10	
72	34.0	-0.27		69.0	1.72	
73	31.5	-1.62		53.0	-2.21	?
75	37	1.35		62.5	0.12	
77	33.5	-0.54		59.0	-0.74	
80	36.0	0.81		67.5	1.35	
81	31.5	-1.62		57.0	-1.23	
83	33.5	-0.54		62.5	0.12	
85	35.0	0.27		59.5	-0.61	
86	32.0	-1.35		62.0	0.00	
87	33.0	-0.81		61.0	-0.25	
88	33.0	-0.81		62.0	0.00	
90	34.5	0.00		65.0	0.74	
91	33.0	-0.81		63.5	0.37	
93	35.0	0.27		62.0	0.00	
94A	36.0	0.81		61.5	-0.12	
94B-1	#	N/A		65.5	0.86	
94B-2	#	N/A		65.0	0.74	
94C-1	35.5	0.54		#	N/A	
94C-2	35.5	0.54		#	N/A	
98	32.5	-1.08		57.5	-1.10	
99	34	-0.27		66	0.98	
101	32.5	-1.08		61.0	-0.25	
103	33.0	-0.81		56.0	-1.47	
104	36.5	1.08		61.5	-0.12	
105	35.5	0.54		62.0	0.00	
106	33.5	-0.54		64.5	0.61	
107	32	-1.35		61	-0.25	

Lab Code	Compressive Strength (Nearest 0.5 MPa)			Compressive Strength (Nearest 0.5 MPa)		
	PTA 1	Z-Score		PTA 2	Z-Score	
108	35.5	0.54		62.5	0.12	
110	36	0.81		63	0.25	

No. of Results	84
Median	34.50
Normalised IQR	1.85
Uncertainty of the Median	0.25
Robust CV	5.4%
Minimum	27.0
Maximum	42.5
Range	15.5

84
62.00
4.08
0.56
6.6%
32.0
70.0
38.0

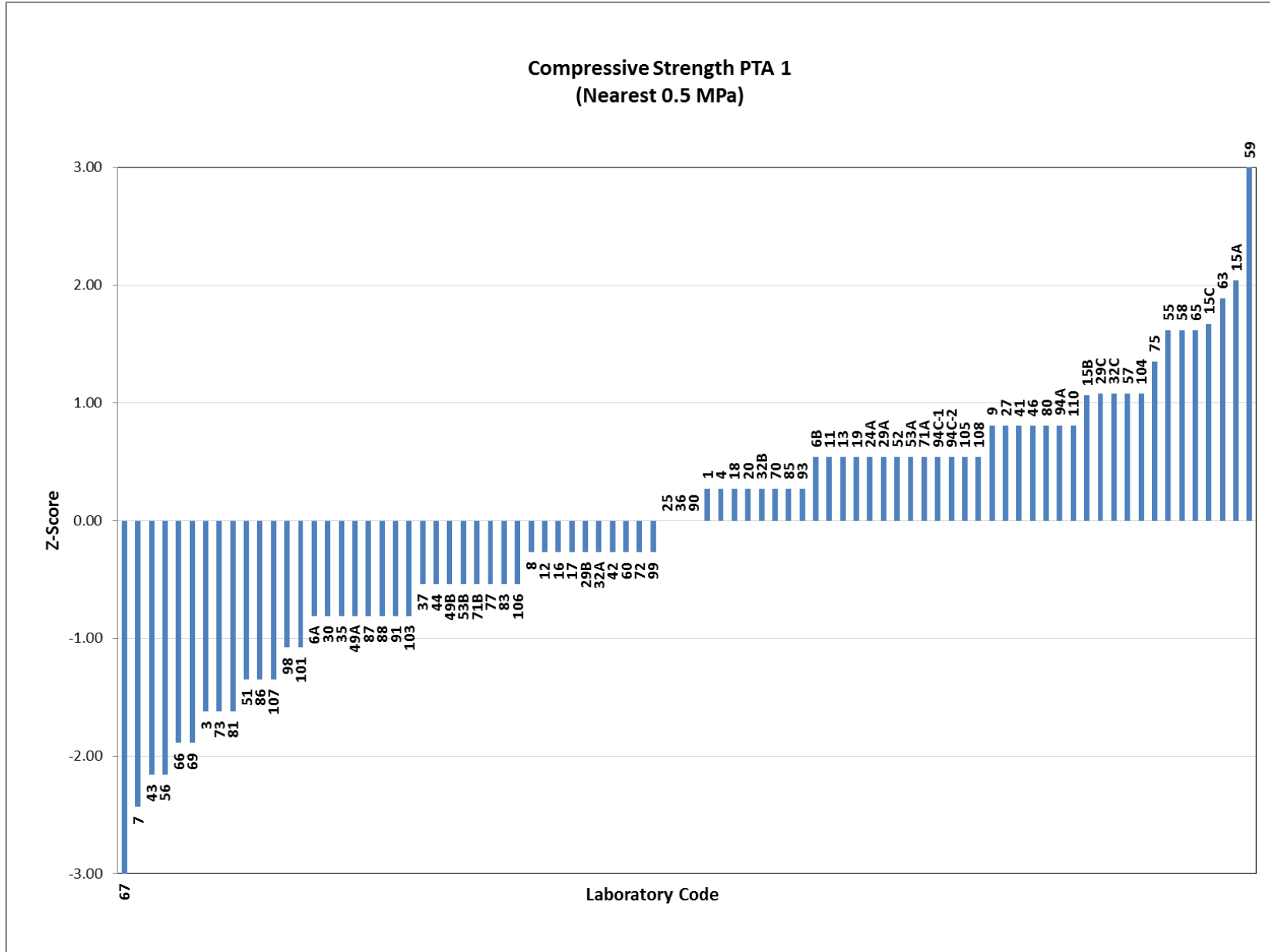
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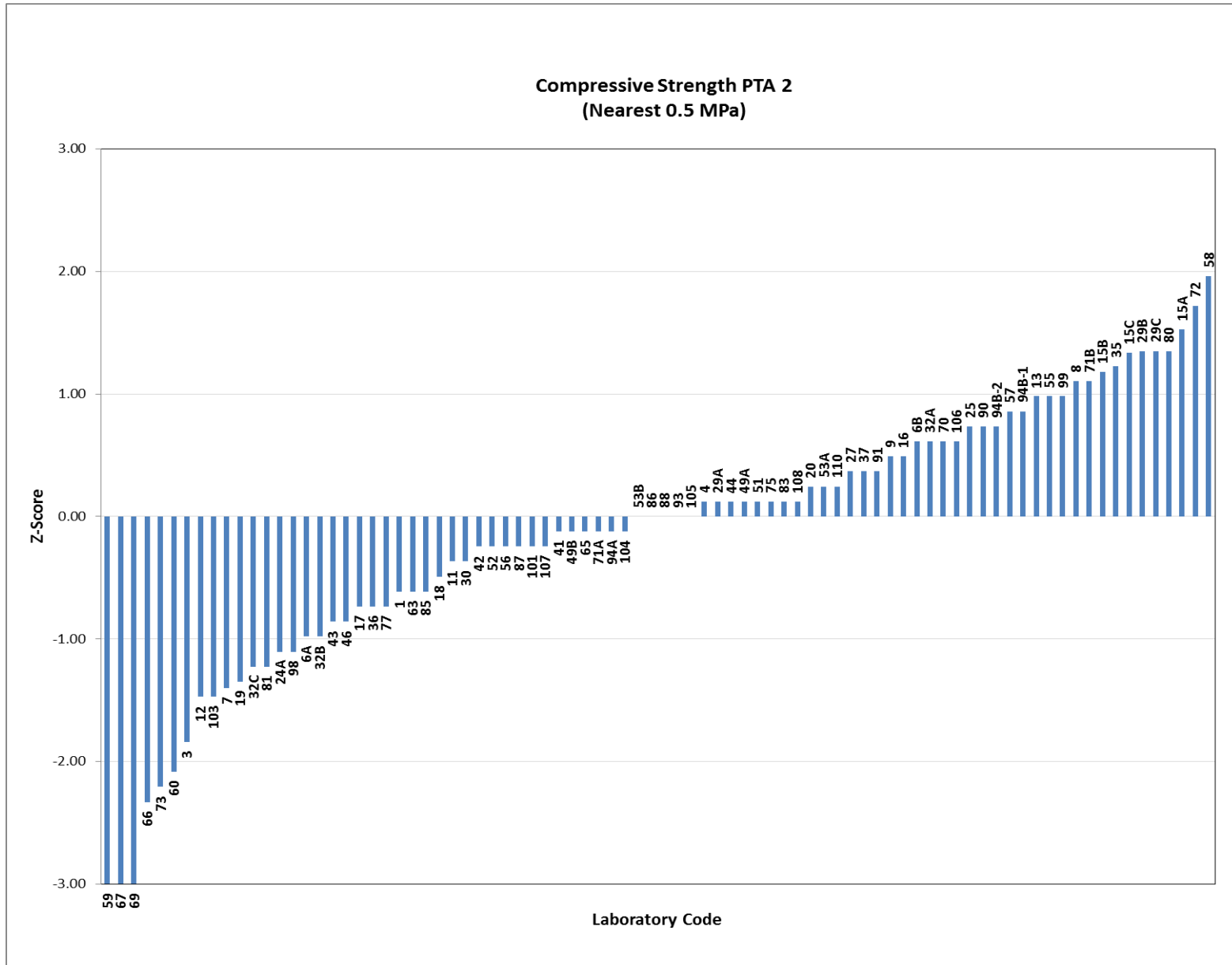
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"#" indicates no response was provided by the laboratory

N/A indicates not applicable





Lab Code	Failure Mode		Date of Receipt	Date of Tests
	PTA 1	PTA 2		
1	Normal	Normal	3/05/2019	15/05/2019
3	N	N	8/05/2019	15/05/2019
4	Cone and Shear	Cone	9/05/2019	15/05/2019
6A	Normal	Conical	8/05/2019	15/05/2019
6B	Normal	Conical	8/05/2019	15/05/2019
7	N	N	13/05/2019	15/05/2019
8	D - Shear	A- Cone	8/05/2019	15/05/2019
9	Normal	Normal	2/05/2019	15/05/2019
11	Normal	Normal	9/05/2019	15/05/2019
12	Shear	Cone and Shear	7/05/2019	15/05/2019
13	Mixed	Single Shear	6/05/2019	15/05/2019
15A	Shear	Cone & Split	21/05/2019	21/05/2019
15B	Cone & Split	Shear Cone	21/05/2019	21/05/2019
15C	Shear	Columnar	21/05/2019	21/05/2019
16	Normal	Normal	6/05/2019	15/05/2019
17	Normal	#	6/05/2019	15/05/2019
18	Normal	Shear	8/05/2019	15/05/2019
19	Normal	Normal	8/05/2019	15/05/2019
20	N	N	6/05/2019	15/05/2019
24A	Normal	Normal	7/05/2019	15/05/2019
25	Crumbled	Shear	6/05/2019	15/05/2019
27	Shear	Cone	15/05/2019	15/05/2019
29A	Fractures	Normal Cone	6/05/2019	15/05/2019
29B	Fractures	Normal Cone	6/05/2019	15/05/2019
29C	Fractures	Shear	6/05/2019	15/05/2019
30	Conical	Conical	3/05/2019	15/05/2019

Lab Code	Failure Mode		Date of Receipt	Date of Tests
	PTA 1	PTA 2		
32A	Normal	Normal	14/05/2019	15/05/2019
32B	N	N	14/05/2019	15/05/2019
32C	Normal	Normal	14/05/2019	20/05/2019
35	Normal	Normal	8/05/2019	15/05/2019
36	Type 5	Type 5	6/05/2019	15/05/2019
37	Cap	Cone & Shear	8/05/2019	15/05/2019
41	End cap	Shear - Conic	10/05/2019	15/05/2019
42	N	N	6/05/2019	15/05/2019
43	Type 2: well-formed cone on one end, vertical cracks running through caps, no well-defined cone at the other end (ASTM C39/C39M-09, Fig 2)	Type 5: side fracture (ASTM C39/C39M-09, Fig 2)	3/05/2019	15/05/2019
44	Normal	Normal	3/05/2019	15/05/2019
46	Shear	Shear	7/05/2019	15/05/2019
49A	Vertical splitting	Vertical splitting	2/05/2019	15/05/2019
49B	Normal	Normal	2/05/2019	15/05/2019
51	Satisfactory	Satisfactory	3/05/2019	15/05/2019
52	N	N	10/05/2019	15/05/2019
53A	Shear	Shear	7/05/2019	15/05/2019
53B	N	S	7/05/2019	15/05/2019
55	N	N	10/05/2019	15/05/2019
56	End fail	End fail	9/05/2019	15/05/2019
57	Normal	Normal	3/05/2019	15/05/2019
58	Columnar	Cone	9/05/2019	15/05/2019
59	N	C	9/05/2019	15/05/2019
60	N	N	7/05/2019	15/05/2019

Lab Code	Failure Mode		Date of Receipt	Date of Tests
	PTA 1	PTA 2		
63	N	N	9/05/2019	15/05/2019
65	Satisfactory	Satisfactory	6/05/2019	15/05/2019
66	Well formed cone on one end. Vertical cracks running. No well defined cone on other end.	Side fracture of top	4/05/2019	15/05/2019
67	#	#	3/05/2019	15/05/2019
69	Shear	Shear	13/05/2019	15/05/2019
70	Compressional failure	Shear	12/05/2019	15/05/2019
71A	N	N	10/05/2019	15/05/2019
71B	N	N	10/05/2019	15/05/2019
72	C	N	#	15/05/2019
73	Satisfactory	Satisfactory	5/05/2019	15/05/2019
75	Shear	Shear	8/05/2019	15/05/2019
77	Normal	Shear	13/05/2019	15/05/2019
80	S	N	10/05/2019	15/05/2019
81	Local failure at the top possibly due to pass casting of specimens.	Local failure at the top possibly due to pass casting of specimens.	10/05/2019	15/05/2019
83	N	N	10/05/2019	15/05/2019
85	Shear	Cone (Normal)	13/05/2019	15/05/2019
86	Type 2	Type 3	6/05/2019	15/05/2019
87	Shear	Shear	10/05/2019	15/05/2019
88	C	C	15/05/2019	15/05/2019
90	Normal	Normal	9/05/2019	15/05/2019
91	Side fracture top type 5	Columnar vertical cracking type 3	7/05/2019	15/05/2019
93	N	N	10/05/2019	15/05/2019

Lab Code	Failure Mode		Date of Receipt	Date of Tests
	PTA 1	PTA 2		
94A	Normal	Normal-Vertical splitting	1/05/2019	15/05/2019
94B-1	#	N	8/05/2019	15/05/2019
94B-2	#	N	8/05/2019	15/05/2019
94C-1	Shear	#	1/05/2019	15/05/2019
94C-2	Shear	#	1/05/2019	15/05/2019
98	Cone	Cone & Shear	3/05/2019	15/05/2019
99	Cone and Shear	Cone and Shear	3/05/2019	15/05/2019
101	Top Shear	Top Shear	6/05/2019	15/05/2019
103	Shear	Shear	6/05/2019	15/05/2019
104	N	N	8/05/2019	15/05/2019
105	Normal	Normal	3/05/2019	15/05/2019
106	Cap	Normal	3/05/2019	15/05/2019
107	Cone & Split(B)	Cone & Split(B)	2/05/2019	15/05/2019
108	Cone & Split	Cone & Split	2/05/2019	15/05/2019
110	Shear	Shear	10/05/2019	15/05/2019

Lab Code	Moisture Condition	End Treatment	Method
1	SSD	Rubber	AS 1012.9, AS 1012.12
3	SSD	End Grinding	AS 1012
4	SSD	Rubber cap	AS 1012.9
6A	SSD	Ground	AS 1012.12.1
6B	SSD	Ground	AS 1012.12.1
7	SSD	Rubber capped	AS 1012.9, 12.1
8	SSD	Rubber capping	AS 1012.9
9	SSD	Rubber cap	AS 1012.9
11	SSD	End Ground	AS 1012.12.1, AS 1012.9
12	SSD	Rubber cap	AS 1012
13	SSD	Rubber cap	AS 1012.9
15A	SSD	#	AS 1012.9.2014
15B	SSD	#	AS 1012.9.2014
15C	SSD	#	AS 1012.9.2014
16	SSD	End ground	AS 1012.9, 12.1
17	SSD	Sulphur	AS 1012.9, 12.1
18	SSD	Rubber	AS 1012
19	SSD	Grind	AS 1012.9, AS 1012.12.1
20	SSD	Ground plane	AS 1012.9 Part 5a (ii)
24A	SSD	Rubber capping	AS 1012.9, AS 1012.12.1
25	SSD	Rubber cap	AS 1012
27	SSD	Rubber cap	AS 1012.9
29A	SSD	Sulphur capping	AS 1012.9
29B	SSD	Sulphur capping	AS 1012.9
29C	SSD	Sulphur capping	AS 1012.9

Lab Code	Moisture Condition	End Treatment	Method
30	SSD	Rubber cap	NZS 3112
32A	SSD	Grind	AS 1012.9 Annex A
32B	SSD	Grinding	AS 1012
32C	SSD	Grind	AS 1012
35	SSD	Rubber capping	AS 1012
36	SSD	Rubber	INVE-410-13
37	SSD	RNR	AS 1012.12, AS 1012.9
41	SSD	Rubber cap	AS 1012.9, 12.1
42	SSD	Double ends Ground	AS 1012.9, AS 1012.12.1
43	SSD	Rubber cap	NZS 3112 part 2
44	SSD	Rubber capping	AS 1012
46	SSD	Rubber cap	AS 1012.12.1, AS 1012.9
49A	SSD	Ground	AS 1012.9
49B	SSD	Unground (Rubber cap)	AS 1012.9
51	SSD	Densite capping	BS EN 12390-3:2009 except loading speed
52	SSD	Grinding	AS 1012.9, AS 1012.12.1
53A	SSD	Ground	AS 1012
53B	SSD	End grinding	AS 1012
55	SSD	Rubber cap	AS 1012.9
56	SSD	Rubber cap	Compression
57	SSD	Grinding	AS 1012
58	SSD	Rubber capped	AS 1012.9
59	SSD	Rubber capped	AS 1012.9
60	SSD	Grind	Grinder
63	SSD	Grind	AS 1012.9

Lab Code	Moisture Condition	End Treatment	Method
65	SSD	End Grinding	BS EN 12390-3:2009
66	SSD	Capping (ASTM C617/C617m:2015)	ASTM C39/C39M:2018
67	#	#	#
69	SSD	Rubber cap	AS 1012
70	SSD	NA	AS 1012
71A	SSD	Ground	AS 1012.9
71B	SSD	Ground	AS 1012.9
72	SSD	Rubber cap	AS 1012
73	SSD	Sulphur cap	BS EN 12504-1:2009
75	SSD	End grinding machine and rubber cap	AS 1012 Method 9
77	SSD	#	1012.9, 12.1
80	SSD	Grinding	AS 1012.9:2014, AS 1012.12.1:1998
81	SSD	Rubber capping	AS 1012.9
83	SSD	Sulphur capping	AS 1012.9, AS 1012.12.1
85	SSD	End grinding	AS 1012.9 (App. A)
86	SSD	Sulphur capping	ASTM C39/C39M-18
87	SSD	Rubber capping	AS 1012.9
88	SSD	Rubber cap	AS 1012.9
90	SSD	Rubber cap	AS 1012.9, AS 1012.12.2
91	SSD	PTA1-Rubber cap/PTA2-end grid and rubber cap	AS102.9
93	SSD	Rubber cap	AS 1012
94A	SSD	Ground -Nil capping, N.B. specimen PTA1 ground both ends	AS1012.9, AS 1012.12.1
94B-1	SSD	As received	Rubber capping
94B-2	SSD	As received	Rubber capping
94C-1	SSD	End ground	AS 1012.9, AS 1012.12.1

Lab Code	Moisture Condition	End Treatment	Method
94C-2	SSD	End ground	AS 1012.9, AS 1012.12.1
98	SSD	Rubber cap	AS 1012.9, 12
99	SSD	Rubber cap	AS 1012.9
101	SSD	Rubber cap	AS 1012.9
103	SSD	Rubber capped	AS 1012.9
104	Moist	Rubber cap	AS 1012.9
105	SSD	Rubber cap	AS 1012
106	SSD	Rubber cap	AS 1012.8.1
107	SSD	Rubber capping	AS 1012
108	SSD	End grinding	AS 1012.9
110	SSD	End grinding machining & rubber cap	AS 1012 Method 9

APPENDIX B

Homogeneity and Stability Testing

Homogeneity Testing

The samples utilised in this program were supplied by Soil Engineering Services Pty Ltd, Townsville Laboratory. Samples PTA 1 and PTA 2 were cast on two separate days. Ten random samples from each day were selected and tested for homogeneity after three weeks. Statistical analysis showed that the samples were sufficiently homogeneous so that any results identified as outliers could not be attributed to sample variability. The results of the homogeneity testing, along with summary statistics are provided in the tables below.

Concrete Round 26 Homogeneity Results										
PTA 1										
Sample Number	Date Sampled	Date Tested	Height (mm)	Average Diameter (mm)	Mass (g)	Mass per Unit Volume (kg/m ³)	Compressive Strength (MPa)	Age of Specimen (Days)	Capping Method	Condition of Specimen
6	02/04/2019	23/04/2019	198	100.1	3554	2281	29.35	21	Rubber	SSD
7	02/04/2019	23/04/2019	198	100.3	3556	2273	29.62	21	Rubber	SSD
11	02/04/2019	23/04/2019	197	100.1	3562	2298	31.64	21	Rubber	SSD
27	02/04/2019	23/04/2019	198	100.3	3562	2277	29.49	21	Rubber	SSD
42	02/04/2019	23/04/2019	198	100.3	3569	2281	29.74	21	Rubber	SSD
59	02/04/2019	23/04/2019	199	100.3	3552	2259	30.12	21	Rubber	SSD
71	02/04/2019	23/04/2019	198	100.3	3559	2275	29.36	21	Rubber	SSD
99	02/04/2019	23/04/2019	196	99.9	3553	2313	29.47	21	Rubber	SSD
103	02/04/2019	23/04/2019	198	100.3	3558	2274	28.1	21	Rubber	SSD
104	02/04/2019	23/04/2019	199	100.1	3571	2280	30.12	21	Rubber	SSD
Mean						2281.1	29.70			
Standard Deviation						14.77	0.88			
Coefficient of Variation						0.65%	2.97%			
Lowest Value						2259	28.1			
Highest Value						2313	31.64			

Concrete Round 26 Homogeneity Results										
PTA 2										
Sample Number	Date Sampled	Date Tested	Height (mm)	Average Diameter (mm)	Mass (g)	Mass per Unit Volume (kg/m ³)	Compressive Strength (MPa)	Age of Specimen (Days)	Capping Method	Condition of Specimen
6	04/04/2019	24/04/2019	199	100.1	3596	2296	55.78	20	Rubber	SSD
7	04/04/2019	24/04/2019	199	100.3	3601	2290	56.07	20	Rubber	SSD
11	04/04/2019	24/04/2019	199	100.1	3611	2306	52.86	20	Rubber	SSD
27	04/04/2019	24/04/2019	198	100.3	3598	2300	54.93	20	Rubber	SSD
42	04/04/2019	24/04/2019	199	100.1	3587	2290	51.72	20	Rubber	SSD
59	04/04/2019	24/04/2019	199	100.1	3602	2300	54.39	20	Rubber	SSD
71	04/04/2019	24/04/2019	198	100.1	3598	2309	57.94	20	Rubber	SSD
99	04/04/2019	24/04/2019	198	100.1	3587	2302	55.4	20	Rubber	SSD
103	04/04/2019	24/04/2019	199	100.3	3592	2285	54.42	20	Rubber	SSD
104	04/04/2019	24/04/2019	199	100.1	3619	2311	54.51	20	Rubber	SSD
Mean						2298.9	54.80			
Standard Deviation						8.63	1.71			
Coefficient of Variation						0.38%	3.13%			
Lowest Value						2285	51.72			
Highest Value						2311	57.94			

Stability Testing

Due to the nature of the samples, stability testing was not considered necessary.

APPENDIX C

Documentation

Instructions to Participants	C1
Results Sheet	C3

PROFICIENCY TESTING AUSTRALIA
Proficiency Testing Program

Concrete Round 26

INSTRUCTIONS TO PARTICIPANTS

PLEASE NOTE CYLINDERS ARE TO BE TESTED ON THE 15 MAY 2019.

If you receive your cylinders before this date keep them sealed in the plastic bucket (do not place them in the curing tank).

If you receive your cylinders after this date test them as soon as possible.

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. Participants are to treat the proficiency testing samples as they would a routine sample tested in 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 1g

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

Maximum Sustained Load Unit - to nearest 1 kN

Compressive Strength - to the nearest 0.5 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. **Please ensure you check your rounding details.**

4. The tests are based on AS1012; however other equivalent 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. Remove and test the cylinders marked PTA 1 and PTA 2 on **15 May 2019**.
7. Wipe all the excess water and any loose accumulation of grit and lime, such that the cylinders have a clean but damp surface only.
8. Immediately weigh the cylinder on a balance to the nearest 1 gram

9. 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 90⁰ rotation (Record as Result 2). Do not measure on the mould joint as marked on the cylinder.
10. Treat the ends of each test cylinder by sulphur capping, rubber capping or end grinding.
11. 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.
12. Calculate the Mass per unit Volume to the nearest 1 kg/m³.
 13. Calculate the Compressive Strength to the nearest 0.5 MPa.
 14. 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.
 15. All laboratories must return the results sheet no later than **24 May 2019** to:

Emilia Cincu
Proficiency Testing Australia
Fax: 02 9743 6664
Email: emilia.cincu@pta.asn.au

PROFICIENCY TESTING AUSTRALIA
Concrete 26 - Proficiency Testing Program
Results Sheet

TEST DATE: 15 May 2019

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)				
Weight (nearest 1g)				
Mass/Volume (nearest 1 kg/m ³)				
Maximum Sustained Load Unit (nearest 1 kN)				
Compressive Strength (nearest 0.5 MPa)				
Failure Mode				

Please ensure to check rounding details.

Date of receipt: _____

Moisture condition on receipt (SSD or dry): _____

Details of end treatment: _____

Method: _____

Date of testing: _____

Signature: _____

Return no later than **24 May 2019** to:

Emilia Cincu
Proficiency Testing Australia
Phone: 02 9736 8397 Fax: 02 9743 6664 Email: emilia.cincu@pta.asn.au

- End of Report -