

Civil Engineering Testing Association of New Zealand

TECHNICAL REPORT ON

FINE AGGREGATE DENSITY & ABSORPTION TEST PROFICIENCY 2015

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FINE AGGREGATE DENSITY & ABSORPTION TEST PROFICIENCY 2012

1. Introduction

In 2012, CETANZ organised and ran an inter-laboratory proficiency scheme on the Density and Absorption test for Fine aggregate, designed to achieve the following outcomes:

- 1. Provide results that should enable participants to improve their performance.
- 2. Provide information relevant for calculation of uncertainty.
- 3. Identify problems with, or between, laboratories.
- 4. Understand the differences between the two sample preparation methods.

The following Laboratories participated in the scheme:

Bitumen and Pavements Limited - Auckland Downer New Zealand Limited - Auckland Downer New Zealand Limited - Christchurch Downer New Zealand Limited - Mount Maunganui Downer New Zealand Limited - Wellington Fulton Hogan Laboratory - Auckland Fulton Hogan Laboratory - Canterbury Fulton Hogan Laboratory - Canterbury Fulton Hogan Laboratory - Dunedin Fulton Hogan Laboratory - Nelson Fulton Hogan Laboratory - Waikato Higgins - Auckland Higgins - Palmerston North OPUS International Consultants - Auckland OPUS International Consultants - Hamilton Winstone Aggregate Ltd - Auckland Laboratory

To ensure anonymity of results each laboratory was assigned a unique identifier by Keith Towl of IANZ.

2. Sample Preparation & Instruction

A bulk sample of <4.75mm Crusher Dust from the Fulton Hogan Flaxmore Quarry was sampled and split down into smaller test samples. Each Laboratory was sent two identical aggregate test samples of approximately 1.2kg each.

Each Laboratory was instructed to carry out testing using both sample preparation methods below:

- 1. As per the main body of the standard <75µm particles retained.
- 2. As per <75µm particles removed by washing (ASTM C117).

Each Laboratory was invited to have multiple competent technicians take part. Completed results were to be retuned identifying the Laboratory Number and Technician I.D. For example, Laboratory's 1 test results from Technicians A and B would be labelled ...1A <75 μ m Retained & 1B <75 μ m Retained, 1A <75 μ m Washed Away, 1B <75 μ m Washed Away.

Laboratories were advised that the samples had not been held in a continuously wet state and were not a lightweight aggregate.

Page **4** of **7** 17/11/15

3. Results

ASTM C128-12 Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate Proficiency < 0.075mm Retained (Whole Sample)																																		
Laboratory ID		1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	7A	7B	8A	8B	9A	9B	10A	10B	11A	11B	12A	12B	13A	13B	14A	14B	14C	15A	16A	16B	17A	17B
ANZ Accredited		Yes		Yes		Yes		Y	Yes		Yes		1	No		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	No		Yes	
Balance Used		0.	0.1g 0.1g		0.01g		0.	0.1g		0.1g		.1g 0.1g		0.	0.1g		0.1 & 0.01g		0.01g		0.01g		0.1g				0.1g			0.0	0.01g		3	
Water Used		Т	Тар Тар		Тар		т	Тар		Deionised		Distilled		Т	Тар		Тар		Тар		b	Distilled		Tap & Distilled		Distilled				Distilled		Distilled		
Agitator Used		На	and Mechanical			Mechanical		н	Hand		and Hand		Mechanical		Hand		Both		Hand		Hand				N	Mechanical			На	nd	Mecha	nical		
Density (OD) kg/m ³	Recorded to nearest 1kg/m ³	2650	2662	2615	2689			2573	2594	2595	2621	2585	2626	2611	2667	2673	2615	2625	2595	2598	2608	2606	2597	2638	2638	2633	2595	2583	2541		2626	2625		
Density (SSD) kg/m3	Recorded to nearest 1kg/m ³	2693	2700	2682	2721			2647	2656	2663	2677	2651	2686	2673	2709	2719	2668	2682	2659	2655	2675	2664	2661	2693	2687	2685	2660	2651	2661		2680	2676		
Apparent Density kg/m3	Recorded to nearest 1kg/m ³	2770	2768	2802	2776			2779	2765	2784	2776	2770	2795	2785	2779	2787	2764	2784	2773	2786	2796	2766	2774	2773	2773	2778	2775	2772	2769		2776	2768		
Relative Density (Specific Gravity) OD	Recorded to 3.d.p.	2.657	2.669	2.622	2.696	2.615	2.649	2.580	2.601	2.601	2.628	2.591	2.633	2.618	2.676	2.680	2.621	2.631	2.602	2.605	2.616	2.614	2.603	2.645	2.645	2.640	2.602	2.590	2.607		2.633	2.631	2.626	2.604
Relative Density (Specific Gravity) SSD	Recorded to 3.d.p.	2.700	2.707	2.689	2.727	2.678	2.704	2.654	2.663	2.669	2.684	2.658	2.693	2.680	2.715	2.720	2.675	2.688	2.666	2.672	2.683	2.672	2.667	2.693	2.694	2.692	2.667	2.658	2.668		2.687	2.683	2.679	2.665
Apparent Relative Density (Apparent Specific Gravity)	Recorded to 3.d.p.	2.777	2.775	2.809	2.783	2.791	2.803	2.786	2.772	2.791	2.783	2.777	2.802	2.792	2.786	2.794	2.771	2.791	2.780	2.793	2.804	2.774	2.781	2.780	2.780	2.785	2.782	2.779	2.776		2.783	2.775	2.775	2.773
Absorption %	Recorded to nearest 0.01%	1.63	1.44	2.54	1.16	2.41	2.08	2.87	2.37	2.61	2.12	2.80	2.29	2.39	1.48	1.52	2.06	2.17	2.47	2.58	2.57	2.21	2.46	1.85	1.85	1.97	2.48	2.62	2.33		2.04	1.96	2.04	2.33

ASTM C128-12 Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate Proficiency < 0.075mm Washed Away																																	
Laboratory ID		1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	7A	7B	8A	8B	9A	9B	10A	10B	11A	11B	12A	12B	13A	13B	14A	14B	14C	15A	16A 16B	17A	17B
NZ Accredited		Yes		Yes		Yes		Yes		Yes		Yes	N	No		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	No	Ye	s
ance Used		0.	.1g	0.1g		0.0	0.01g		0.1g		0.1g		0.:	0.1g		0.1g		0.1 & 0.01g		0.01g		0.01g		0.1g				0.1g			0.01g	0.1	g
ter Used		Ta	ар	Tap Ta		р	Тар		Deionised		Тар	Tap Distilled		Тар		Тар		Тар		Тар		Distilled		Tap & Distilled		Distilled		t i		Distilled	Disti	lled	
Agitator Used		На	and	Mech	anical	cal		Mechanical		Hand		Hand I		nd	Mechanical		Hand		Both		Hand		Hand				Mechanical		cal		Hand	Mecha	anical
Density (OD) kg/m ³	Recorded to nearest 1kg/m ³	2684	2687	2691	2702			2675	2682	2691	2701	2688	2684	2681			2687	2693	2686	2704	2693	2686	2685	2694	2710	2687	2701	2540			2695		
Density (SSD) kg/m3	Recorded to nearest 1kg/m ³	2716	2721	2726	2736			2710	2713	2721	2727	2720	2722	2719			2711	2719	2717	2728	2725	2717	2717	2721	2736	2719	2733	2571			2722		
Apparent Density kg/m3	Recorded to nearest 1kg/m ³	2774	2781	2790	2798			2772	2768	2776	2774	2776	2789	2789			2753	2764	2772	2772	2781	2771	2774	2770	2783	2777	2790	2623			2771		
Relative Density (Specific Gravity) OD	Recorded to 3.d.p.	2.691	2.694	2.697	2.709	2.696	2.718	2.682	2.689	2.698	2.708	2.695	2.691	2.688			2.692	2.700	2.693	2.711	2.701	2.694	2.692	2.700	2.717	2.694	2.708	2.546			2.702	2.699	2.702
Relative Density (Specific Gravity) SSD	Recorded to 3.d.p.	2.723	2.728	2.733	2.743	2.730	2.743	2.717	2.720	2.728	2.734	2.727	2.729	2.726			2.718	2.726	2.724	2.735	2.733	2.725	2.724	2.728	2.743	2.726	2.740	2.578			2.729	2.728	2.728
Apparent Relative Density (Apparent Specific Gravity	Recorded to 3.d.p.	2.781	2.788	2.796	2.805	2.791	2.789	2.779	2.775	2.783	2.781	2.783	2.796	2.796			2.763	2.711	2.779	2.779	2.789	2.779	2.781	2.776	2.790	2.784	2.797	2.630			2.778	2.780	2.774
Absorption %	Recorded to nearest 0.01%	1.20	1.26	1.31	1.26	1.26	0.93	1.31	1.15	1.13	0.97	1.23	1.40	1.44			0.95	0.95	1.14	0.91	1.17	1.13	1.19	1.01	0.96	1.19	1.17	1.26			1.02	1.07	0.96

Laboratory 11 Technician B completed tests at a temperature outside the required range. i.e. at 25°C.

For the purpose of analysis, <u>all</u> results, including the possible outliers, have been tabulated. Each participant will need to undertake their own analysis on the data provide to gauge their own performance.

The graphs provided, only display result plots for Relative Density (Specific Gravity) OD, Relative Density (Specific Gravity) SSD, Apparent Relative Density (Apparent Specific Gravity) and Absorption.

Laboratories 3 and 17 did not return results for Density (OD) Density (SSD) and Apparent Density. Laboratory 15 did not return any results.

Laboratory 8 did not return and <75 Washed Away test data.

Technicians 14C and 16B did not return <75 Washed Away test data.











5. Conclusions

The results seem to indicate the possibility of a slightly smaller amount of variation between Laboratories in the '<75µm Washed Away' testing compared to the '<75µm Retained (Whole Sample)' testing. The data also seems to indicate a slight difference in Density and Absorption measurements between the two methods. More advanced analysis is required. Those using this data will need to consider the differences and relative amount of variation possible for each preparation method when designing asphalt mixes etc.

6. Further action

Advise stakeholders of proficiency data and arrange for more in-depth analysis and publication of results.

7. Referenced Documents

ASTM C128-12

8. Disclaimer

The information in this publication is to encourage high standards within the civil engineering testing industry. The information is intended as a technical report for CETANZ members only and in no way purports to be a robust statistical analysis. CETANZ cannot accept any liability of any sort for unsatisfactory site or laboratory work carried out by Companies who are

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