ARC
Asphalt Research Consortium

Subtask E2b-1.a:

Impact of current extraction techniques on properties of extracted RAP aggregates

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ARC Work Element E2b:

Subtask E2b-1.a: Develop a System to Evaluate the Properties of RAP Aggregates

- Evaluate impact of current extraction techniques on properties of extracted RAP aggregates.

- Extract aggregates from Lab-produce RAP mixes using:
  - Centrifuge (Trichloroethylene)
  - Reflux (Trichloroethylene)
  - Ignition oven

ARC Work Element E2b:

Subtask E2b-1.a: Develop a System to Evaluate the Properties of RAP Aggregates

- **Aggregate Sources:**
  - Nevada: Andesite (UNR)
  - California: Granite (UNR)
  - Alabama: Hard Limestone (NCAT)
  - Florida: Soft Limestone (NCAT)

ARC Work Element E2b:

Subtask E2b-1.a: Develop a System to Evaluate the Properties of RAP Aggregates

- SP mix design (intermediate gradation, 6 millions ESALs for a top lift).
- Subject ***loose*** samples to STOA (4 hrs at 275°F) followed by LTOA (5 days at 185°F).
- Extract aggregates from aged loose specimens.
- Measure extracted aggregates physical properties.

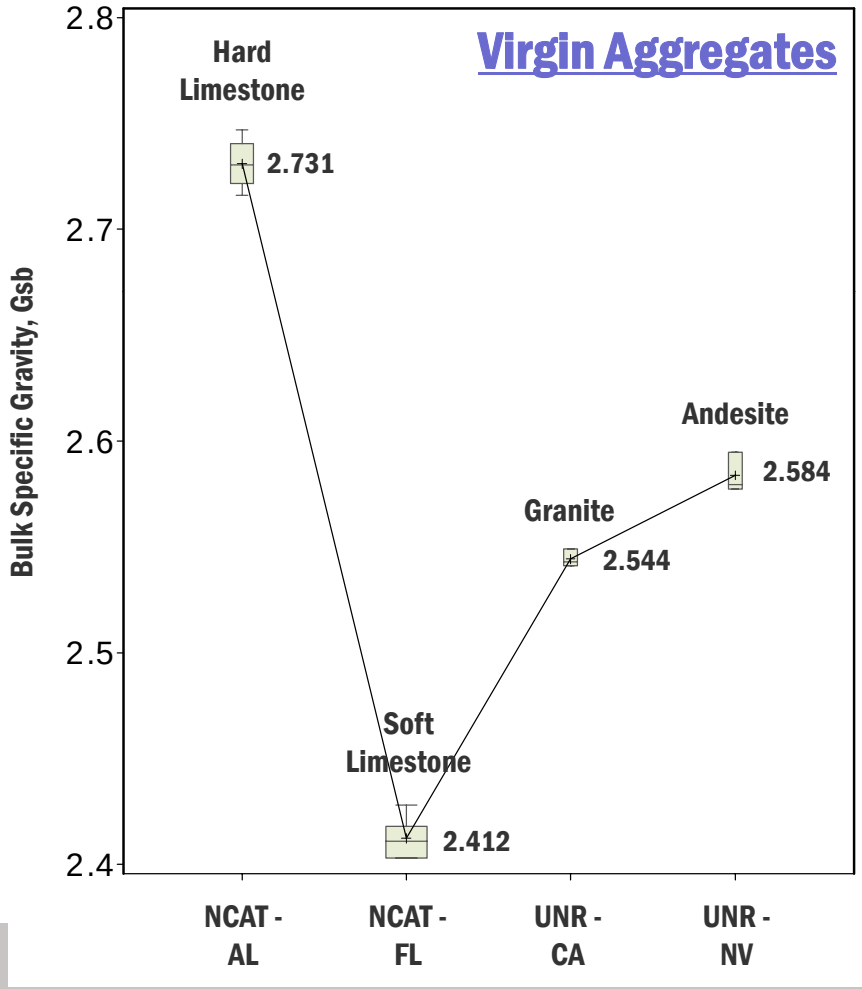
ARC Work Element E2b:

Subtask E2b-1.a: Develop a System to Evaluate the Properties of RAP Aggregates

- **Measured properties:**
  - Gradation: AASHTO T27, T30
  - Specific gravities: AASHTO T84, T85
  - Absorption: AASHTO T84, T85
  - FAA: AASHTO T304
  - CAA: ASTM D5821
  - SE: AASHTO T176
  - LAA: AASHTO T96
  - Soundness: AASHTO T104
  - Durability Index: AASHTO T210
  - Cleanness Value: CT 227
  - AIMS

ARC Work Element E2b:

Coarse Aggregate – Bulk Specific Gravities (Gsb)

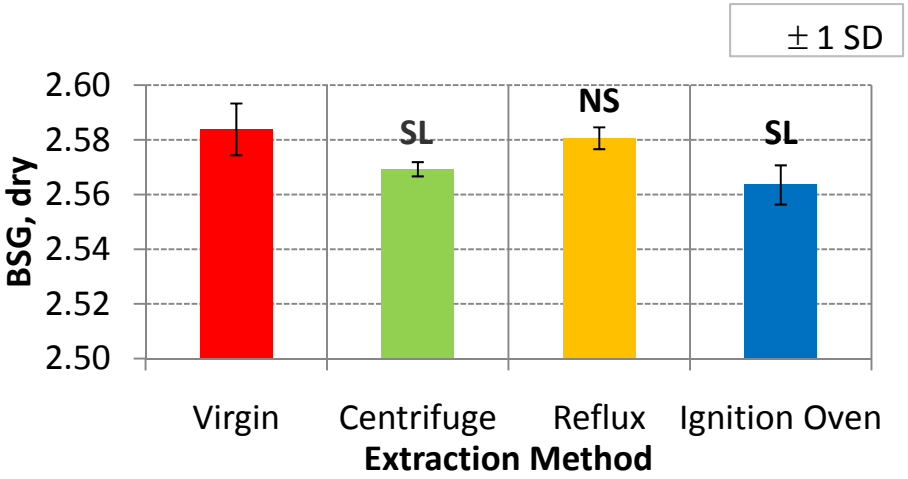


ARC Work Element E2b:

Coarse Aggregate – Bulk Specific Gravities

NV – Andesite

Extraction Method	Replicates	Average Gsb	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	3	2.584	0.008	2.577	2.595	0.017	0.009	✔	0.0297	✔
Centrifuge	3	2.569	0.003	2.567	2.572	0.005	0.009	✔	0.0297	✔
Reflux	3	2.581	0.004	2.577	2.585	0.008	0.009	✔	0.0297	✔
Ignition Oven	3	2.564	0.007	2.556	2.571	0.014	0.009	✔	0.0297	✔



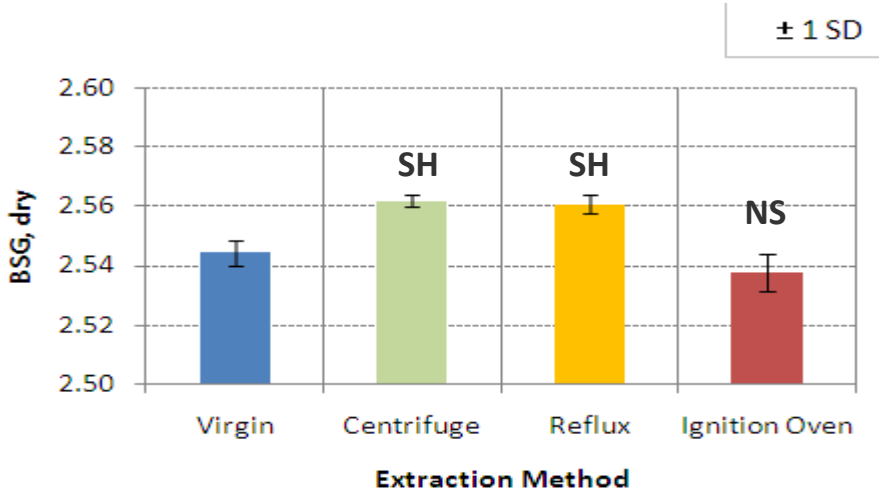
Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			SH		NS		SH	
	Single Operator Precision	< 1s = 0.009	< d2s = 0.025	✘	✔	✔	✔	✘	✔
	Multi-lab precision	< 1s = 0.013	< d2s = 0.038	✔	✔	✔	✔	✘	✔

ARC Work Element E2b:

Coarse Aggregate – Bulk Specific Gravities

CA – Granite

Extraction Method	Replicates	Average Gsb	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	3	2.544	0.004	2.541	2.549	0.008	0.009	✔	0.0297	✔
Centrifuge	3	2.562	0.007	2.214	2.228	0.014	0.009	✔	0.0297	✔
Reflux	3	2.561	0.003	2.557	2.563	0.006	0.009	✔	0.0297	✔
Ignition Oven	3	2.538	0.006	2.531	2.543	0.012	0.009	✔	0.0297	✔



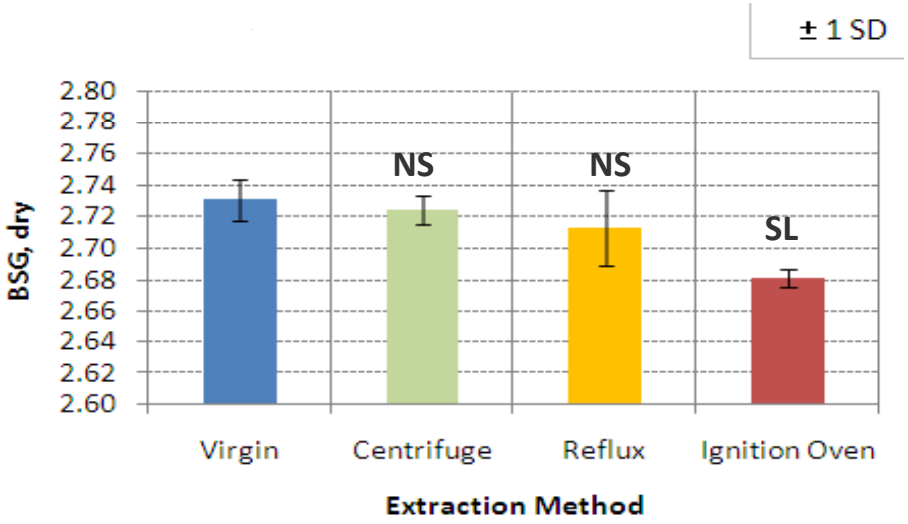
Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			SL		SL		NS	
	Single Operator Precision	< 1s = 0.009	< d2s = 0.025	✘	✔	✘	✔	✔	✔
	Multi-lab precision	< 1s = 0.013	< d2s = 0.038	✔	✔	✔	✔	✔	✔

ARC Work Element E2b:

Coarse Aggregate – Bulk Specific Gravities

AL – Hard Limestone

Extraction Method	Replicates	Average Gsb	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	4	2.731	0.013	2.716	2.747	0.031	0.009	✘	0.0324	✔
Centrifuge	4	2.725	0.009	2.715	2.733	0.018	0.009	✔	0.0324	✔
Reflux	4	2.714	0.024	2.678	2.727	0.049	0.009	✘	0.0324	✘
Ignition Oven	4	2.681	0.006	2.674	2.686	0.012	0.009	✔	0.0324	✔



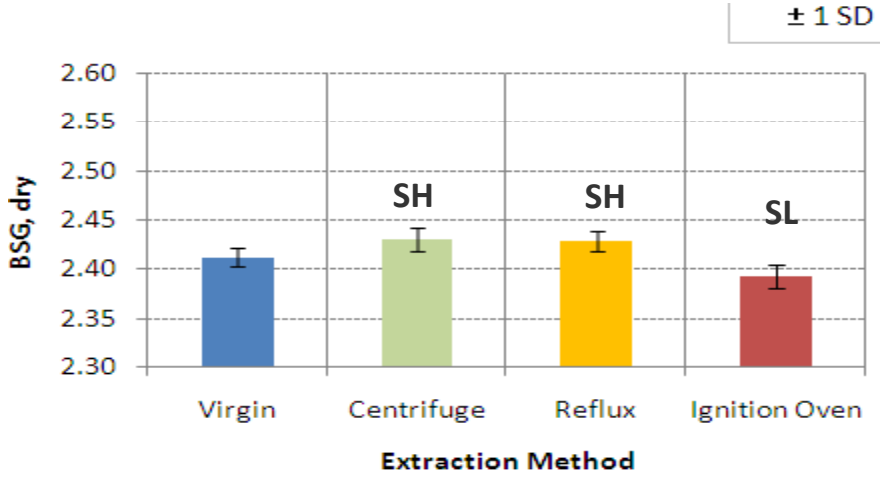
Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			NS		NS		SH	
	Single Operator Precision	< 1s = 0.009	< d2s = 0.025	✔	✔	✘	✔	✘	✘
	Multi-lab precision	< 1s = 0.013	< d2s = 0.038	✔	✔	✔	✔	✘	✘

ARC Work Element E2b:

Coarse Aggregate – Bulk Specific Gravities

FL – Soft Limestone

Extraction Method	Replicates	Average Gsb	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	4	2.412	0.010	2.403	2.428	0.025	0.009	✘	0.0324	✔
Centrifuge	4	2.431	0.011	2.417	2.443	0.026	0.009	✘	0.0324	✔
Reflux	4	2.429	0.010	2.416	2.437	0.021	0.009	✘	0.0324	✔
Ignition Oven	4	2.393	0.012	2.378	2.407	0.029	0.009	✘	0.0324	✔



Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			SL		SL		SH	
	Single Operator Precision	< 1s = 0.009	< d2s = 0.025	✘	✔	✘	✔	✘	✔
	Multi-lab precision	< 1s = 0.013	< d2s = 0.038	✔	✔	✔	✔	✔	✔

ARC Work Element E2b:

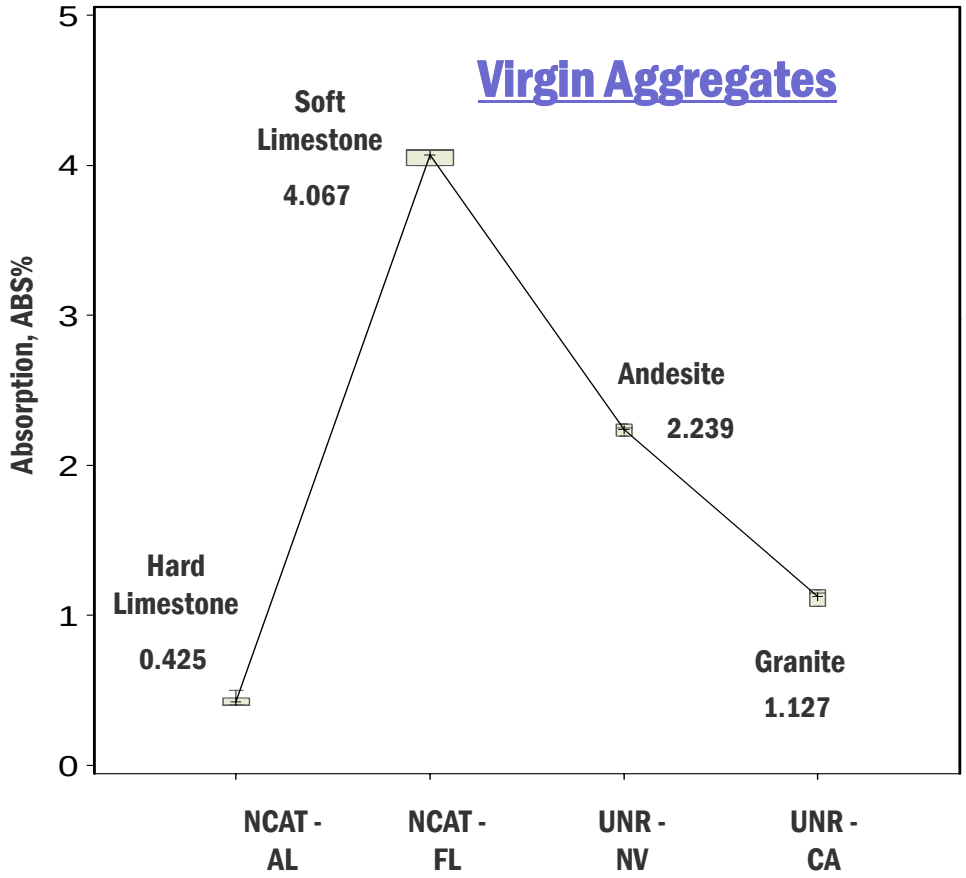
Coarse Aggregate – Bulk Specific Gravities

- **SUMMARY:**

Extraction Method	Aggregate Source											
	NV-Andesite			CA-Granite			AL-Hard Limestone			FL-Soft Limestone		
	STAT.	SOP		STAT.	SOP		STAT.	SOP		STAT.	SOP	
		1s	d2s		1s	d2s		1s	d2s		1s	d2s
Centrifuge	SL	✘	✔	SH	✘	✔	NS	✔	✔	SH	✘	✔
Reflux	NS	✔	✔	SH	✘	✔	NS	✘	✔	SH	✘	✔
Ignition	SL	✘	✔	NS	✔	✔	SL	✘	✘	SL	✘	✔

ARC Work Element E2b:

Coarse Aggregate – Absorption

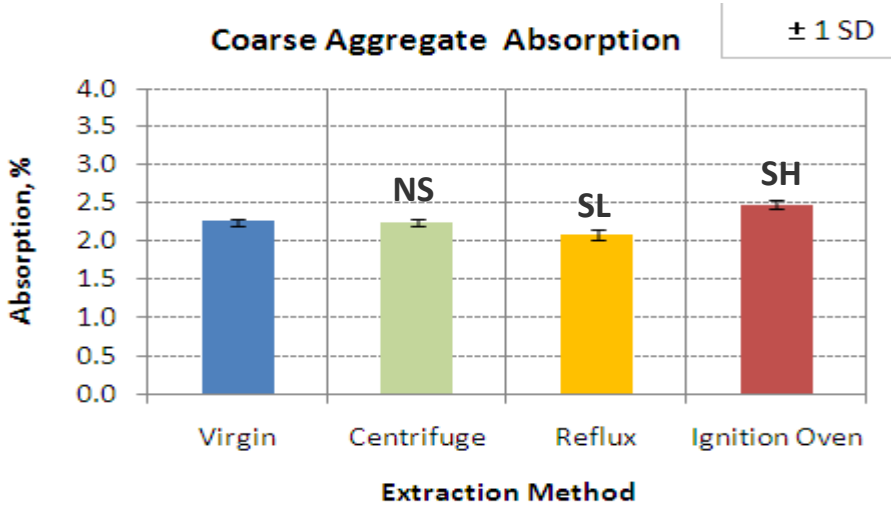


ARC Work Element E2b:

Coarse Aggregate – Absorption

NV – Andesite

Extraction Method	Replicates	Average Abs%	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	3	2.239	0.041	2.193	2.274	0.081	0.088	✔	0.2904	✔
Centrifuge	3	2.246	0.046	2.203	2.295	0.092	0.088	✔	0.2904	✔
Reflux	3	2.083	0.066	2.015	2.145	0.131	0.088	✔	0.2904	✔
Ignition Oven	3	2.468	0.052	2.415	2.519	0.104	0.088	✔	0.2904	✔



Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			NS		SH		SL	
	Single Operator Precision	< 1s = 0.088	< d2s = 0.25	✔	✔	✘	✔	✘	✔
	Multi-lab precision	< 1s = 0.145	< d2s = 0.41	✔	✔	✔	✔	✘	✔

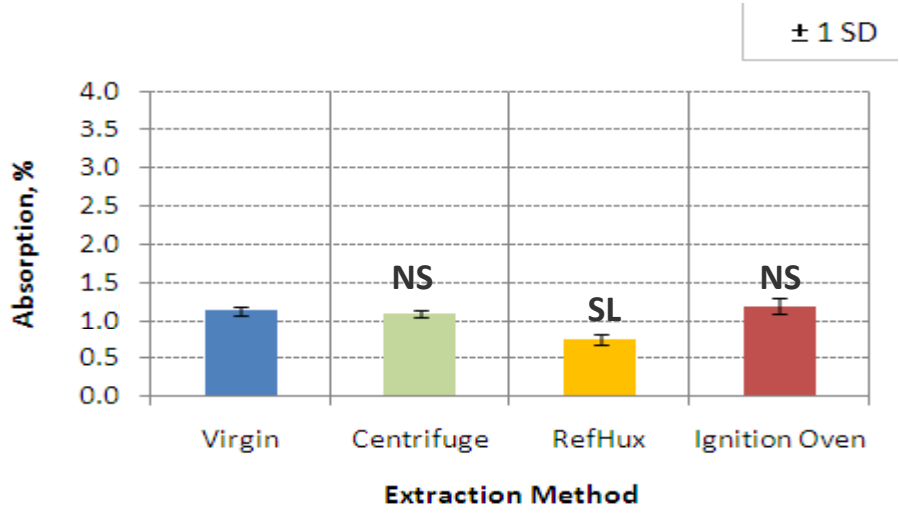
Based on aggregates with ABS < 2%

ARC Work Element E2b:

Coarse Aggregate – Absorption

CA – Granite

Extraction Method	Replicates	Average Abs%	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	3	1.127	0.059	1.060	1.170	0.110	0.088	✔	0.2904	✔
Centrifuge	3	1.107	0.050	1.060	1.160	0.100	0.088	✔	0.2904	✔
Reflux	3	0.733	0.068	0.680	0.810	0.130	0.088	✔	0.2904	✔
Ignition Oven	3	1.200	0.081	1.110	1.300	0.190	0.088	✔	0.2904	✔



Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			NS		SH		NS	
	Single Operator Precision*	< 1s = 0.088	< d2s = 0.25	✔	✔	✘	✘	✔	✔
	Multi-lab precision*	< 1s = 0.145	< d2s = 0.41	✔	✔	✘	✔	✔	✔

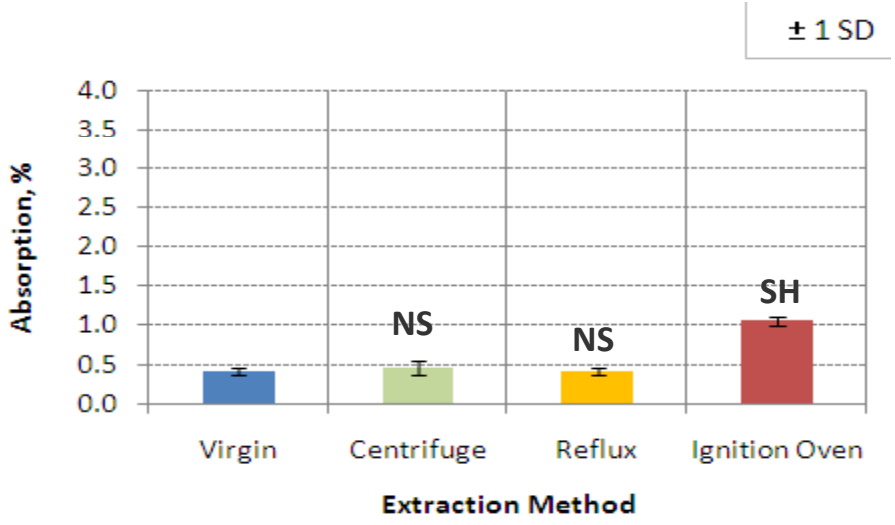
Based on aggregates with ABS < 2%

ARC Work Element E2b:

Coarse Aggregate – Absorption

AL – Hard Limestone

Extraction Method	Replicates	Average Abs%	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	4	0.425	0.050	0.4	0.5	0.1	0.088	✔	0.3168	✔
Centrifuge	4	0.475	0.096	0.4	0.6	0.2	0.088	✘	0.3168	✔
Reflux	4	0.425	0.050	0.4	0.5	0.1	0.088	✔	0.3168	✔
Ignition Oven	4	1.050	0.058	1.0	1.1	0.1	0.088	✔	0.3168	✔



Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			NS		NS		SL	
	Single Operator Precision	< 1s = 0.088	< d2s = 0.25	✔	✔	✔	✔	✘	✘
	Multi-lab precision	< 1s = 0.145	< d2s = 0.41	✔	✔	✔	✔	✘	✘

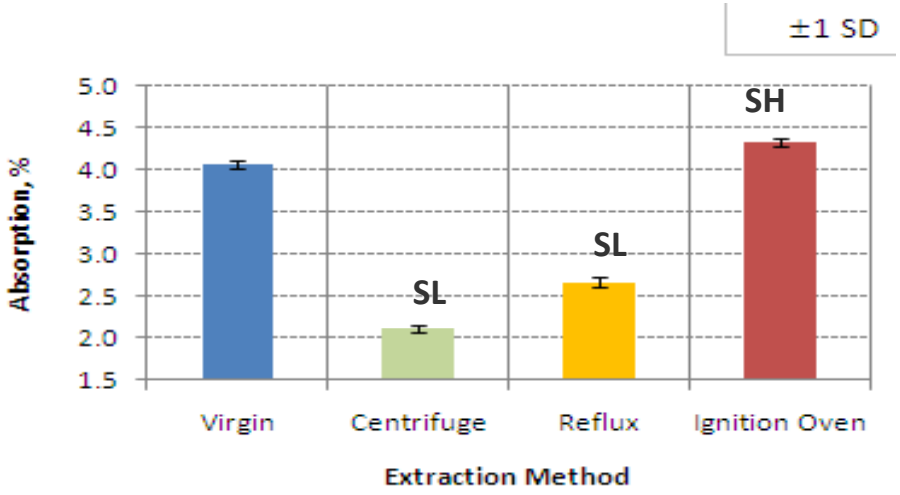
Based on aggregates with ABS < 2%

ARC Work Element E2b:

Coarse Aggregate – Absorption

FL – Soft Limestone

Extraction Method	Replicates	Average Abs%	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	6	4.067	0.052	4.0	4.1	0.1	0.088	✔	0.3520	✔
Centrifuge	4	2.125	0.050	2.1	2.2	0.1	0.088	✔	0.3168	✔
Reflux	4	2.675	0.050	2.6	2.7	0.1	0.088	✔	0.3168	✔
Ignition Oven	4	4.325	0.050	4.3	4.4	0.1	0.088	✔	0.3168	✔



Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			SH		SH		SL	
	Single Operator Precision	< 1s = 0.088	< d2s = 0.25	✘	✘	✘	✘	✘	✘
	Multi-lab precision	< 1s = 0.145	< d2s = 0.41	✘	✘	✘	✘	✘	✔

Based on aggregates with ABS < 2%

ARC Work Element E2b:

Coarse Aggregate – Absorption

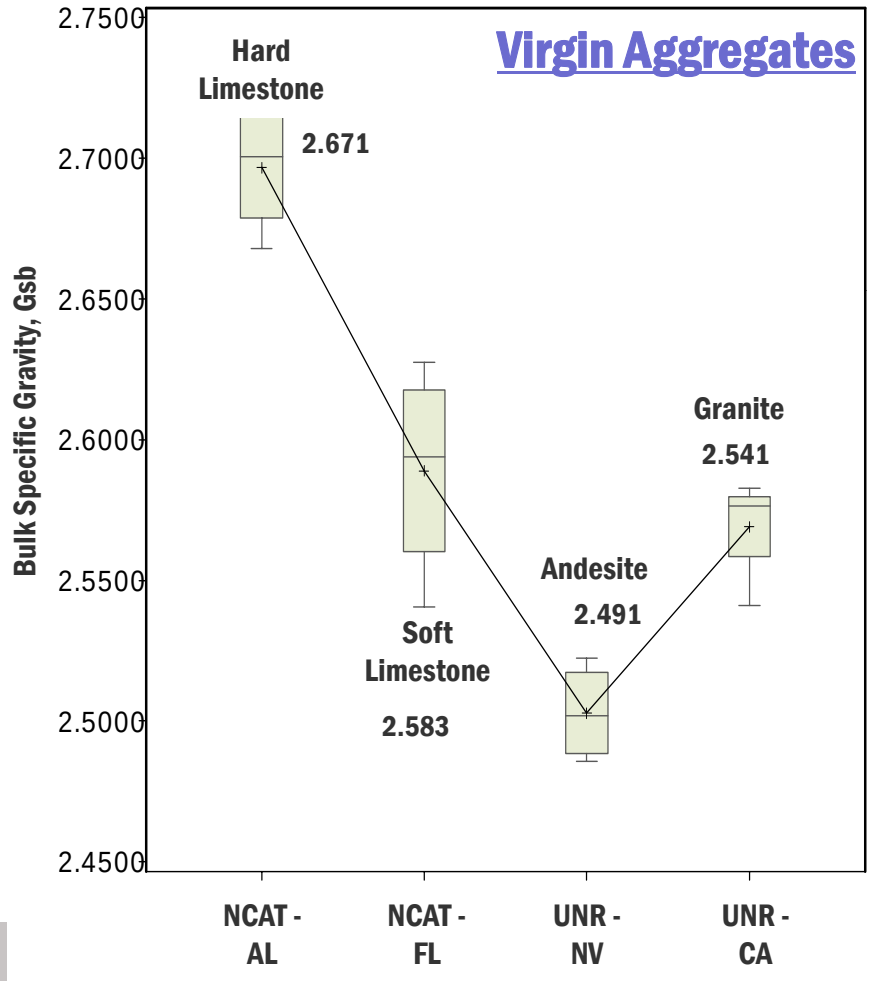
- **SUMMARY:**

Extraction Method	Aggregate Source											
	NV-Andesite			CA-Granite			AL-Hard Limestone			FL-Soft Limestone		
	STAT.	SOP		STAT.	SOP		STAT.	SOP		STAT.	SOP	
		1s	d2s		1s	d2s		1s	d2s		1s	d2s
Centrifuge	NS	✔	✔	NS	✔	✔	NS	✔	✔	SL	✘	✘
Reflux	SL	✘	✔	SL	✘	✘	NS	✔	✔	SL	✘	✘
Ignition	SH	✘	✔	NS	✔	✔	SH	✘	✘	SH	✘	✘

Precision estimates are based on aggregates with ABS < 2%

ARC Work Element E2b:

Fine Aggregate – Bulk Specific Gravities

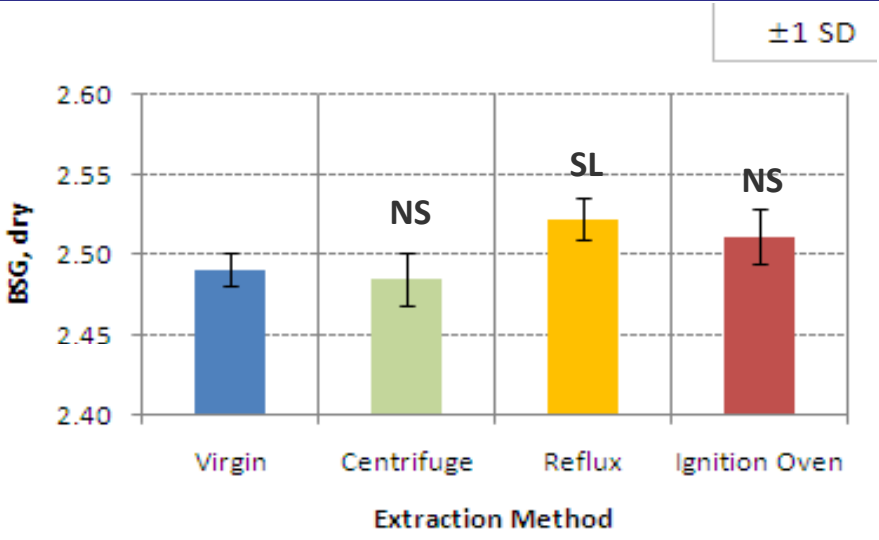


ARC Work Element E2b:

Fine Aggregate – Bulk Specific Gravities

NV – Andesite

Extraction Method	Replicates	Average Gsb	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	3	2.491	0.010	2.484	2.503	0.019	0.011	✔	0.0363	✔
Centrifuge	3	2.486	0.010	2.472	2.503	0.032	0.011	✔	0.0363	✔
Reflux	3	2.523	0.010	2.510	2.535	0.025	0.011	✔	0.0363	✔
Ignition Oven	3	2.512	0.010	2.492	2.524	0.032	0.011	✔	0.0363	✔



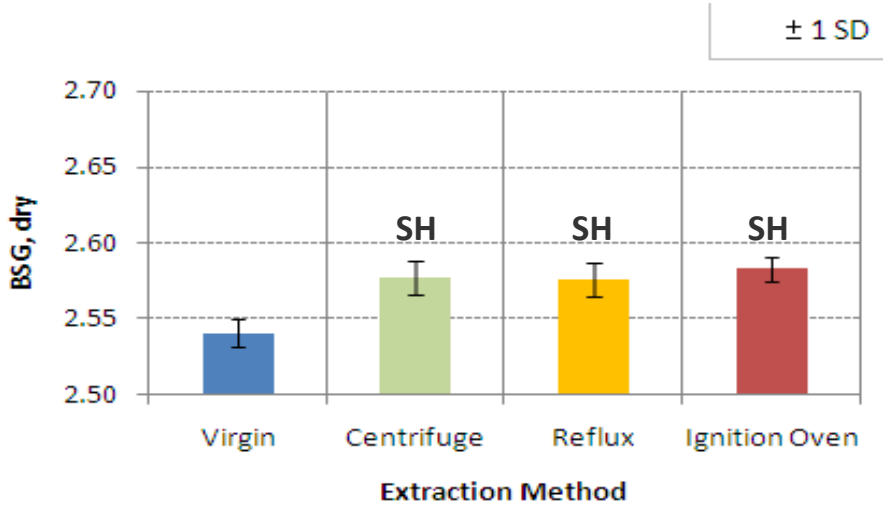
Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			NS		SH		NS	
	Single Operator Precision	< 1s = 0.011	< d2s = 0.032	✔	✔	✘	✘	✘	✔
	Multi-lab precision	< 1s = 0.023	< d2s = 0.066	✔	✔	✔	✔	✔	✔

ARC Work Element E2b:

Fine Aggregate – Bulk Specific Gravities

CA – Granite

Extraction Method	Replicates	Average Gsb	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	3	2.541	0.009	2.531	2.548	0.017	0.011	✔	0.0363	✔
Centrifuge	3	2.577	0.010	2.564	2.585	0.021	0.011	✔	0.0363	✔
Reflux	3	2.576	0.010	2.567	2.588	0.021	0.011	✔	0.0363	✔
Ignition Oven	3	2.583	0.008	2.575	2.590	0.015	0.011	✔	0.0363	✔



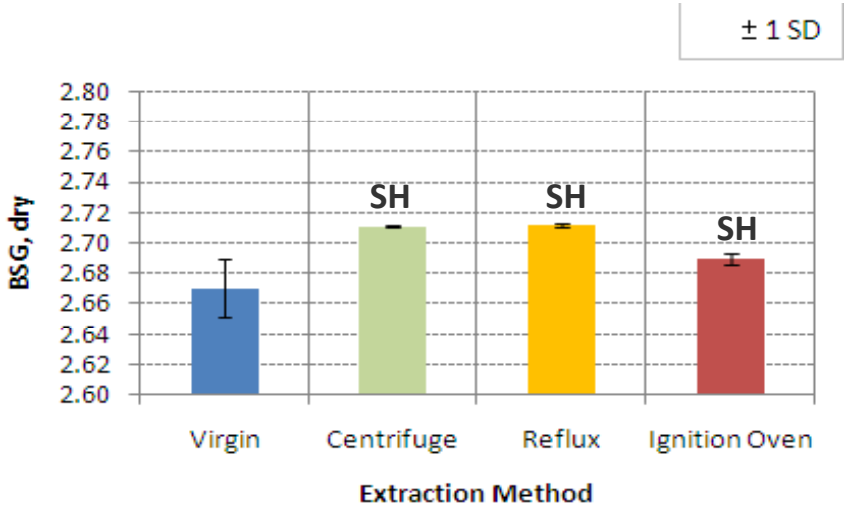
Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			SL		SL		SL	
	Single Operator Precision	< 1s = 0.011	< d2s = 0.032	✘	✘	✘	✘	✘	✘
	Multi-lab precision	< 1s = 0.023	< d2s = 0.066	✘	✔	✘	✔	✘	✔

ARC Work Element E2b:

Fine Aggregate – Bulk Specific Gravities

AL – Hard Limestone

Extraction Method	Replicates	Average Gsb	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	4	2.671	0.019	2.657	2.698	0.041	0.011	✘	0.0396	✘
Centrifuge	3	2.711	0.001	2.71	2.712	0.002	0.011	✔	0.0363	✔
Reflux	3	2.712	0.001	2.711	2.713	0.002	0.011	✔	0.0363	✔
Ignition Oven	3	2.690	0.004	2.7	2.692	0.007	0.011	✔	0.0363	✔



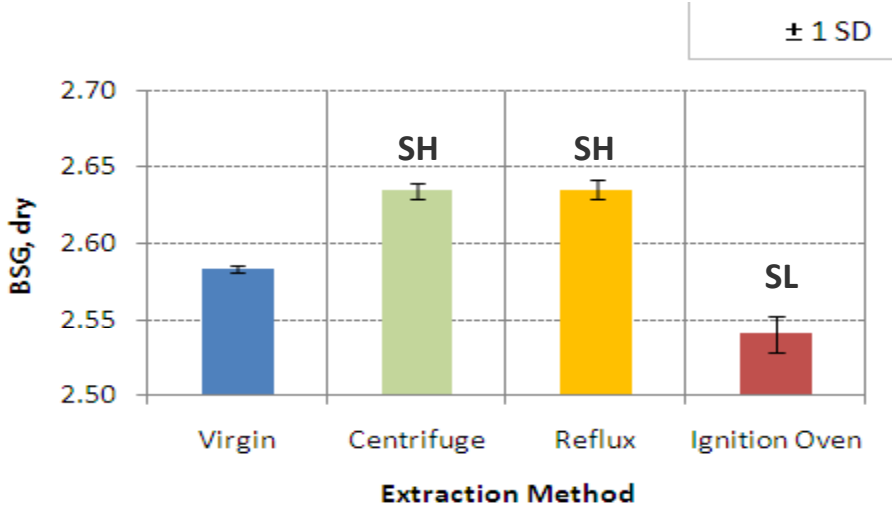
Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			SL		SL		SL	
	Single Operator Precision	< 1s = 0.011	< d2s = 0.032	✘	✘	✘	✘	✘	✔
	Multi-lab precision	< 1s = 0.023	< d2s = 0.066	✘	✔	✘	✔	✔	✔

ARC Work Element E2b:

Fine Aggregate – Bulk Specific Gravities

FL – Soft Limestone

Extraction Method	Replicates	Average Gsb	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	6	2.583	0.002	2.581	2.585	0.004	0.011	✔	0.0440	✔
Centrifuge	6	2.634	0.005	2.63	2.641	0.011	0.011	✔	0.0440	✔
Reflux	6	2.635	0.006	2.626	2.64	0.014	0.011	✔	0.0440	✔
Ignition Oven	4	2.541	0.012	2.525	2.551	0.026	0.011	✘	0.0396	✔



Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			SL		SL		SH	
	Single Operator Precision	< 1s = 0.011	< d2s = 0.032	✘	✘	✘	✘	✘	✘
	Multi-lab precision	< 1s = 0.023	< d2s = 0.066	✘	✔	✘	✔	✘	✔

ARC Work Element E2b:

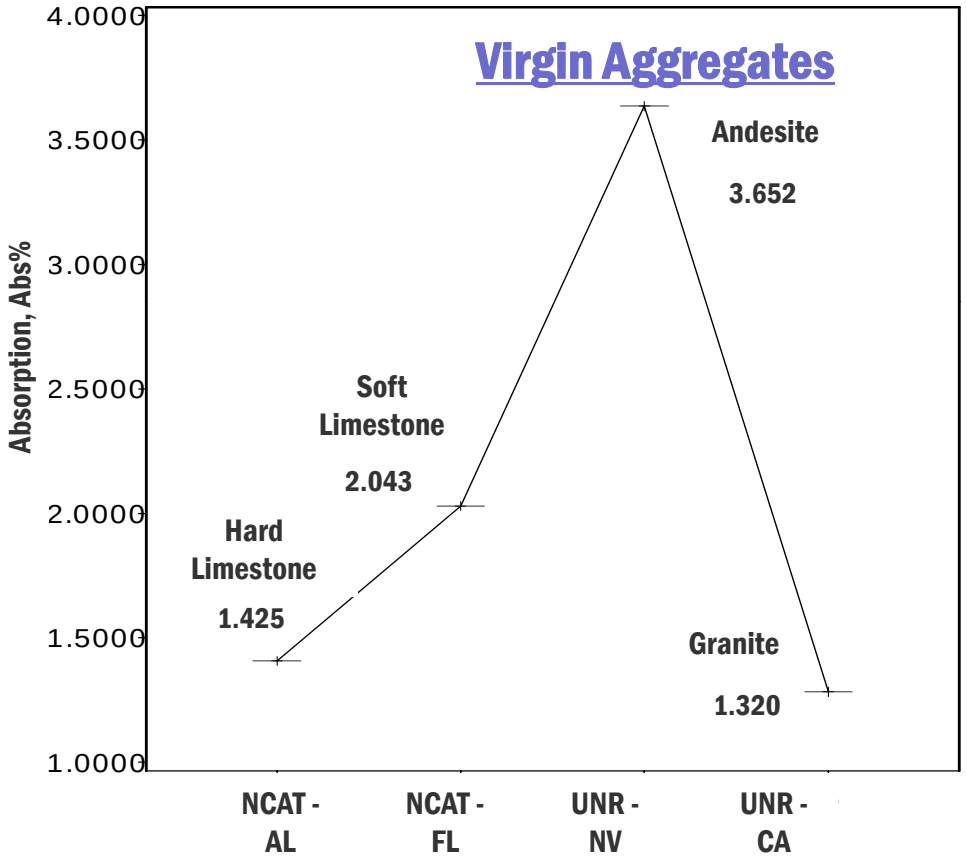
Fine Aggregate – Bulk Specific Gravities (Gsb)

- **SUMMARY:**

Extraction Method	Aggregate Source											
	NV-Andesite			CA-Granite			AL-Hard Limestone			FL-Soft Limestone		
	STAT.	SOP		STAT.	SOP		STAT.	SOP		STAT.	SOP	
		1s	d2s		1s	d2s		1s	d2s		1s	d2s
Centrifuge	NS	✔	✔	SH	✘	✘	SH	✘	✘	SH	✘	✘
Reflux	SL	✘	✘	SH	✘	✘	SH	✘	✘	SH	✘	✘
Ignition	NS	✘	✔	SH	✘	✘	SH	✘	✔	SL	✘	✘

ARC Work Element E2b:

Fine Aggregate – Absorption

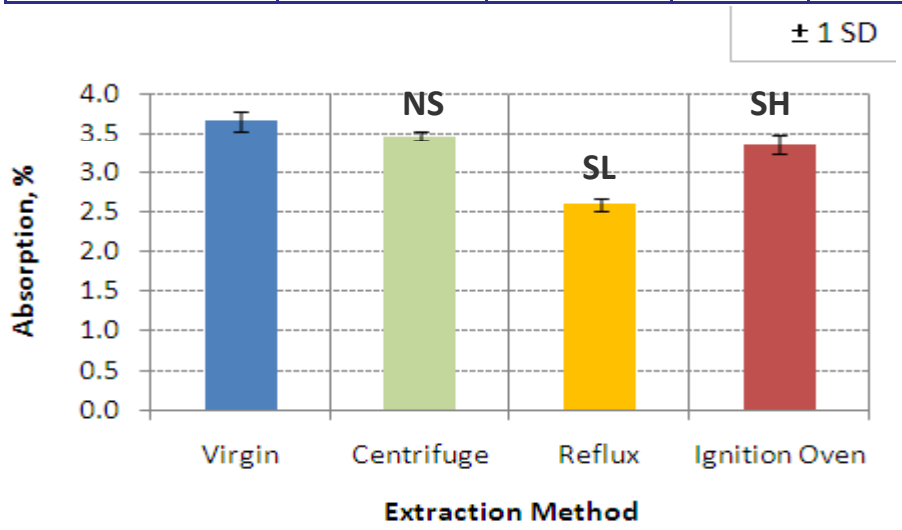


ARC Work Element E2b:

Fine Aggregate – Absorption

NV – Andesite

Extraction Method	Replicates	Average Abs%	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	3	3.652	0.010	3.546	3.794	0.249	0.11	✔	0.3630	✔
Centrifuge	3	3.471	0.061	3.419	3.539	0.120	0.11	✔	0.3630	✔
Reflux	3	2.594	0.084	2.500	2.661	0.161	0.11	✔	0.3630	✔
Ignition Oven	3	3.356	0.010	3.275	3.500	0.225	0.11	✔	0.3630	✔



Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			NS		SH		SL	
	Single Operator Precision	< 1s = 0.11	< d2s = 0.31	✘	✔	✘	✘	✘	✔
	Multi-lab precision	< 1s = 0.23	< d2s = 0.66	✔	✔	✘	✘	✔	✔

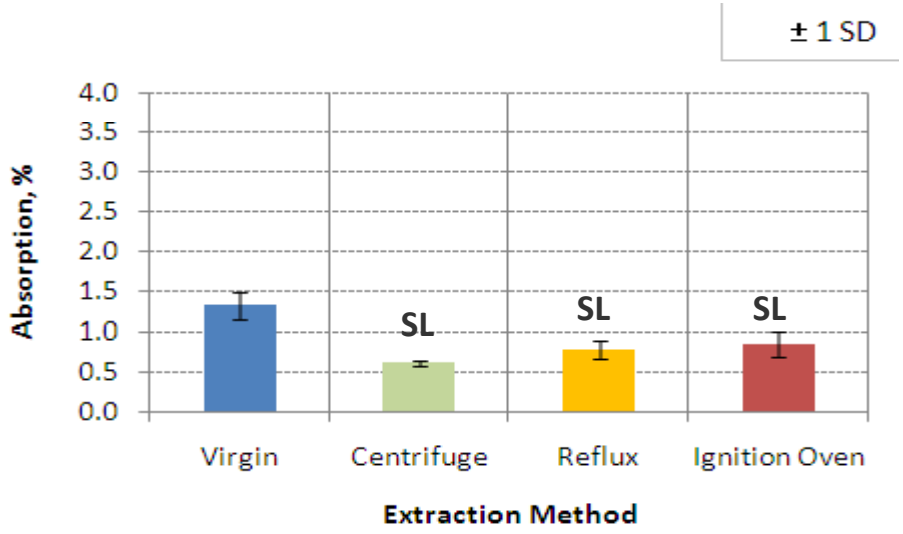
Based on aggregates with ABS < 1%

ARC Work Element E2b:

Fine Aggregate – Absorption

CA – Granite

Extraction Method	Replicates	Average Abs%	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	3	1.320	0.090	1.210	1.510	0.300	0.11	✔	0.3630	✔
Centrifuge	3	0.613	0.040	0.590	0.660	0.070	0.11	✔	0.3630	✔
Reflux	3	0.790	0.090	0.670	0.900	0.230	0.11	✔	0.3630	✔
Ignition Oven	3	0.850	0.090	0.730	1.030	0.300	0.11	✔	0.3630	✔



Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			SH		SH		SH	
	Single Operator Precision	< 1s = 0.11	< d2s = 0.31	✘	✘	✘	✘	✘	✘
	Multi-lab precision	< 1s = 0.23	< d2s = 0.66	✘	✘	✘	✔	✘	✔

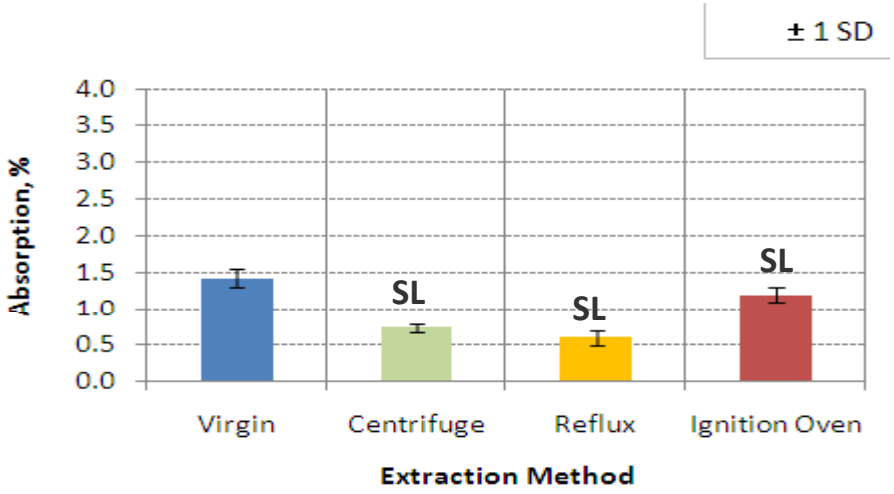
Based on aggregates with ABS < 1%

ARC Work Element E2b:

Fine Aggregate – Absorption

AL – Hard Limestone

Extraction Method	Replicates	Average Abs%	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	4	1.425	0.126	1.3	1.6	0.3	0.11	✘	0.3960	✔
Centrifuge	3	0.733	0.058	0.7	0.8	0.1	0.11	✔	0.3630	✔
Reflux	3	0.600	0.100	0.5	0.7	0.2	0.11	✔	0.3630	✔
Ignition Oven	3	1.200	0.100	1.1	1.3	0.2	0.11	✔	0.3630	✔



Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			SH		SH		SH	
	Single Operator Precision	< 1s = 0.11	< d2s = 0.31	✘	✘	✘	✘	✘	✔
	Multi-lab precision	< 1s = 0.23	< d2s = 0.66	✘	✘	✘	✘	✔	✔

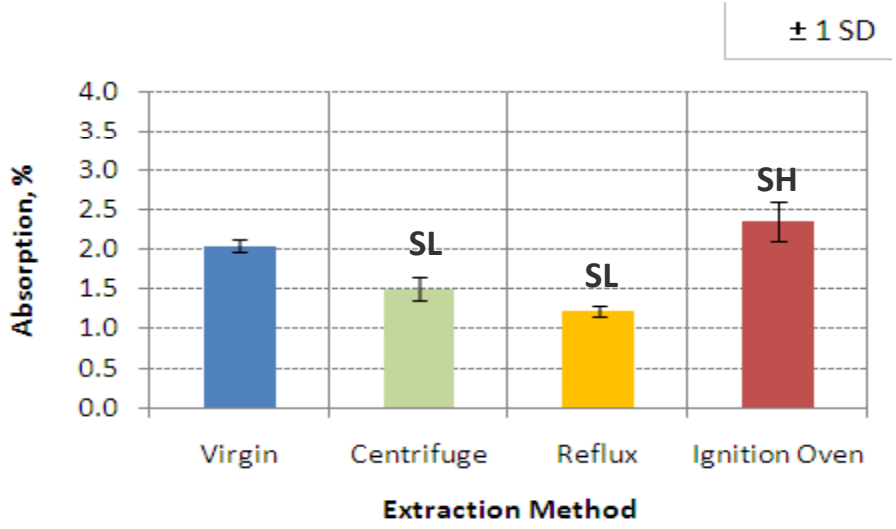
Based on aggregates with ABS < 1%

ARC Work Element E2b:

Fine Aggregate – Absorption

FL – Soft Limestone

Extraction Method	Replicates	Average Abs%	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin	7	2.043	0.079	2	2.2	0.2	0.11	✔	0.4620	✔
Centrifuge	6	1.500	0.141	1.3	1.7	0.4	0.11	✘	0.4400	✔
Reflux	6	1.217	0.075	1.1	1.3	0.2	0.11	✔	0.4400	✔
Ignition Oven	4	2.350	0.252	2.1	2.7	0.6	0.11	✘	0.3960	✘



Test method				Centrifuge		Reflux		Ignition Oven	
Virgin	Mean Comparison (α = 0.05)			SH		SH		SL	
	Single Operator Precision	< 1s = 0.11	< d2s = 0.31	✘	✘	✘	✘	✘	✔
	Multi-lab precision	< 1s = 0.23	< d2s = 0.66	✘	✔	✘	✘	✔	✔

Based on aggregates with ABS < 1%

ARC Work Element E2b:

Fine Aggregate – Absorption

- **SUMMARY:**

Extraction Method	Aggregate Source											
	NV-Andesite			CA-Granite			AL-Hard Limestone			FL-Soft Limestone		
	STAT.	SOP		STAT.	SOP		STAT.	SOP		STAT.	SOP	
		1s	d2s		1s	d2s		1s	d2s		1s	d2s
Centrifuge	NS	✘	✔	SL	✘	✘	SL	✘	✘	SL	✘	✘
Reflux	SL	✘	✘	SL	✘	✘	SL	✘	✘	SL	✘	✘
Ignition	SH	✘	✔	SL	✘	✘	SL	✘	✔	SH	✘	✔

Precision estimates are based on aggregates with ABS < 1%

ARC Work Element E2b:

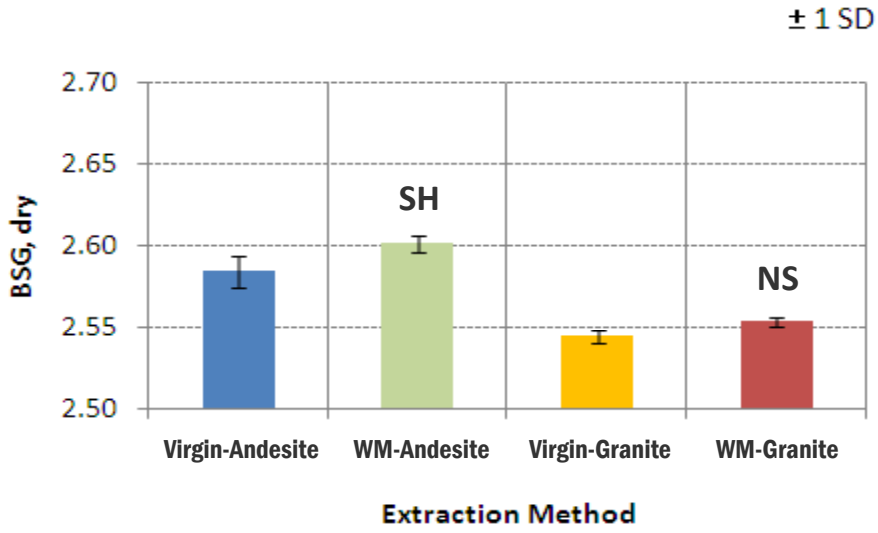
Subtask E2b-1.a: Develop a System to Evaluate the Properties of RAP Aggregates

- Last RAP ETG meeting (Phoenix, AZ):
  - Impact of mixing on aggregates properties.
  - This will be achieved by mixing virgin aggregate with water (no asphalt) in the mixer and re-evaluate their properties.

ARC Work Element E2b:

Coarse Aggregate – Bulk Specific Gravities

Material	Replicates	Average Gsb	SD	Min	Max	Max Difference	Single Operator Precision			
							1s		ds	
Virgin-Andesite	3	2.584	0.008	2.577	2.595	0.017	0.009	✔	0.0297	✔
WM-Andesite	3	2.601	0.005	2.598	2.607	0.009	0.009	✔	0.0297	✔
Virgin-Granite	3	2.544	0.004	2.541	2.549	0.008	0.009	✔	0.0297	✔
WM-Granite	3	2.553	0.003	2.551	2.556	0.005	0.009	✔	0.0297	✔

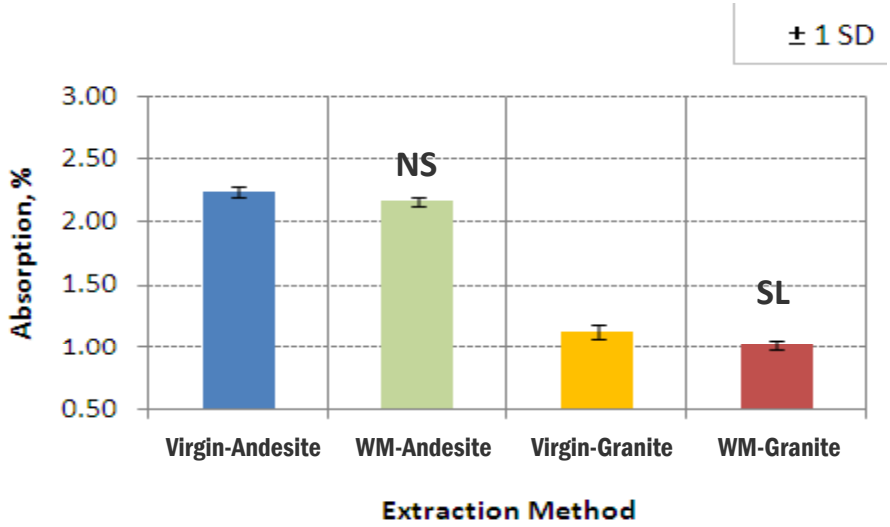


Test method				WM-Andesite		WM-Granite	
Virgin	Mean Comparison (α = 0.05)			SL		NS	
	SOP	< 1s = 0.009	< d2s = 0.025	✘	✔	✔	✔
	MLP	< 1s = 0.013	< d2s = 0.038	✔	✔	✔	✔

ARC Work Element E2b:

Coarse Aggregate – Absorption

Material	Replicates	Average Abs%	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin-Andesite	3	2.24	0.04	2.19	2.27	0.08	0.088	✔	0.2904	✔
WM-Andesite	3	2.16	0.03	2.14	2.20	0.11	0.088	✔	0.2904	✔
Virgin-Granite	3	1.13	0.06	1.06	1.17	0.06	0.088	✔	0.2904	✔
WM-Granite	3	1.02	0.04	0.97	1.05	0.08	0.088	✔	0.2904	✔



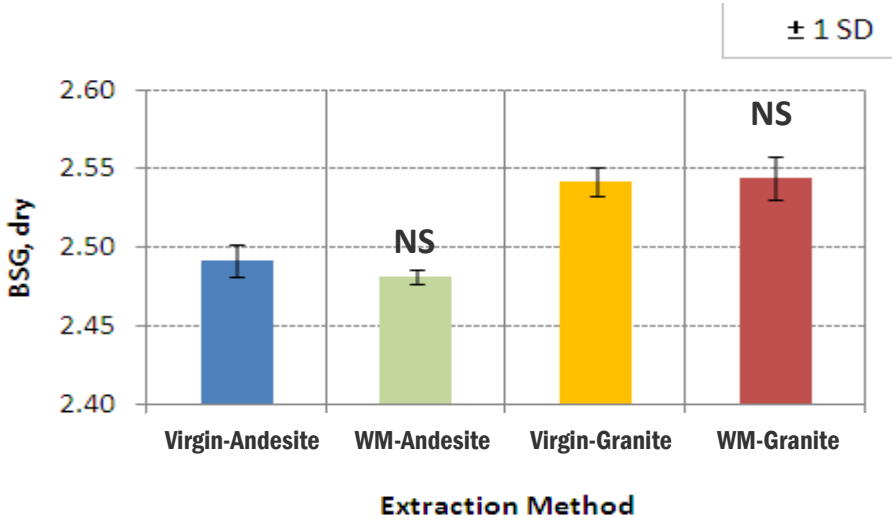
Test method				WM-Andesite		WM-Granite	
Virgin	Mean Comparison (α = 0.05)			NS		SH	
	SOP	< 1s = 0.088	< d2s = 0.25	✔	✔	✔	✔
	MLP	< 1s = 0.145	< d2s = 0.41	✔	✔	✔	✔

Based on aggregates with ABS < 2%

ARC Work Element E2b:

Fine Aggregate – Bulk Specific Gravities

Material	Replicates	Average Gsb	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin-Andesite	3	2.491	0.010	2.484	2.503	0.019	0.011	✔	0.0363	✔
WM-Andesite	3	2.481	0.004	2.478	2.486	0.017	0.011	✔	0.0363	✔
Virgin-Granite	3	2.541	0.009	2.531	2.548	0.008	0.011	✔	0.0363	✔
WM-Granite	3	2.544	0.009	2.530	2.557	0.027	0.011	✔	0.0363	✔

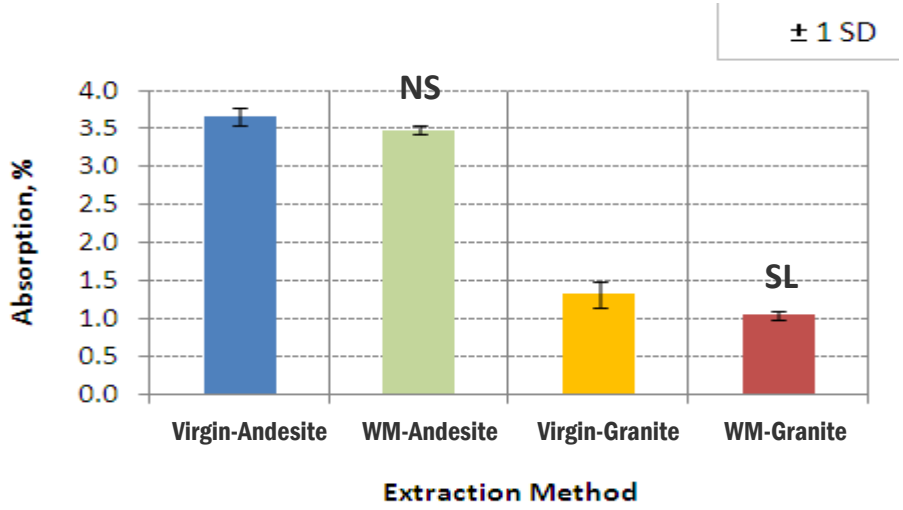


Test method				WM-Andesite		WM-Granite	
Virgin	Mean Comparison (α = 0.05)			NS		NS	
	SOP	< 1s = 0.011	< d2s = 0.032	✔	✔	✔	✔
	MLP	< 1s = 0.023	< d2s = 0.066	✔	✔	✔	✔

ARC Work Element E2b:

Fine Aggregate – Absorption

Material	Replicates	Average Abs%	SD	Min	Max	Max Difference	Single Operator precision			
							1s		ds	
Virgin-Andesite	3	3.652	0.100	3.54	3.79	0.2	0.11	✔	0.3630	✔
WM-Andesite	3	3.467	0.059	3.4	3.51	0.3	0.11	✔	0.3630	✔
Virgin-Granite	3	1.320	0.090	1.21	1.51	0.11	0.11	✔	0.3630	✔
WM-Granite	3	1.050	0.052	1.0	1.11	0.09	0.11	✔	0.3630	✔



Test method				WM-Andesite		WM-Granite	
Virgin	Mean Comparison (α = 0.05)			NS		SH	
	SOP	< 1s = 0.11	< d2s = 0.31	✘	✔	✘	✔
	MLP	< 1s = 0.23	< d2s = 0.66	✔	✔	✔	✔

Based on aggregates with ABS < 1%

ARC Work Element E2b:

Water Mixing Experiment

- **SUMMARY:**

Property	Aggregate Source					
	NV-Andesite			CA-Granite		
	STAT.	SOP		STAT.	SOP	
		1s	d2s		1s	d2s
Coarse – Gsb	SH	✘	✔	NS	✔	✔
Coarse – Abs	NS	✔	✔	SL	✔	✔
Fine – Gsb	NS	✔	✔	NS	✔	✔
Fine – Abs	NS	✘	✔	SL	✘	✔

Precision estimates are based on aggregates with ABS < 2% for Coarse fraction and less than 1% for Fine fraction