APPENDIX C: Exposure Block Results

Appendix C of *NCHRP Research Report 1083: Alkali-Silica Reactivity Potential and Mitigation: Test Methods and State of Practice* (NCHRP Project 10-103).

Table 1: Block expansion of CA1 (PA)

Aggregate	Mixture Design	Austin, TX.		Corvallis, OR		Fredericton, Canada	
		Age (Years)	Expansion (%)	Age (Years)	Expansion (%)	Age (Years)	Expansion (%)
CA1	2.8- Control	1.1	0.00	0.4	0.00	2	0.00
	2.8 - 35% FA3	1.1	0.00	0.4	0.00	0.9	0.00
	2.8 - 35% SC1	1.1	0.00	0.4	0.00	1.9	0.00
	2.8 - 35% FA3 + 5% SF	1.1	0.00	0.4	0.00	0.7	-0.04
	2.8 - 15% FA1 + 75% Li	1.1	0.00	0.4	0.00	0.7	0.00
	2.8 – XX MK	1.1	0.00	0.4	0.00	0.7	0.06
	3.5 - Control	1.1	0.00	-	-	1.9	0.00
	3.5 - 35% FA3	1.1	0.00	-	-	0.9	0.00
	3.5 - 35% SC1	1.1	0.00	-	-	1.9	0.00
	3.5 - 35% FA3 + 5% SF	1.1	0.00	-	-	0.9	0.00
	3.5 - 15% FA1 + 75% Li	1.1	0.00	-	-	0.7	0.03
	3.5 – XX MK	1.1	0.00	-	-	0.7	0.01
	6.4 - Control	1.7	0.00	1.6	0.00	1.9	0.00
	6.4 - 35% FA3	1.7	0.00	1.6	0.00	1.7	0.00
	6.4 - 25% SC1	1.7	0.00	1.5	0.00	1.9	0.00
	6.4 - 35% SC1	1.7	0.00	0.4	0.00	-	-
	6.4 - 35% FA3 + 5% SF	0.7	0.00	-	-	1.7	0.00
	6.4 - 15% FA1 + 75% Li	1.7	0.00	0.4	0.00	0.7	0.00
	6.4 – XX MK	1.4	0.00	0.4	0.00	0.7	0.02
	8.0 - Control	0.4	0.00	1.7	0.00	1.9	0.00
	8.0 - 35% FA3	0.7	0.00	1.7	0.00	1.7	0.02
	8.0 - 35% SC1	0.7	-0.01	1.7	0.00	1.7	0.00
	8.0 - 35% FA3 + 5% SF	1.7	0.00	-	-	1.7	0.00
	8.0 – XX MK	0.7	0.00	-	-	0.6	0.00
	8.0 - 15% FA1 + 75% Li	0.7	0.00	-	-	0.6	-0.04

Table 2: Block expansion for CA2 (WY)

Aggregate	Mixture design	Austin, TX		Corvallis, OR		Fredericton, Canada	
		Age (Years)	Expansion (%)	Age (Years)	Expansion (%)	Age (Years)	Expansion (%)
CA2	3.5 - Control	2	0	1.8	0	1.9	0
	3.5 - 20% FA1	2	0	1.8	0.001	1.8	0.053
	3.5 - 25% FA1	2	-0.001	1.8	0	1.8	0.031
	3.5 - 15% FA2	2	0.002	1.8	0	1.8	0
	3.5 - 25% SC1	2	0.002	1.8	0	1.8	0
	3.5 - 15% NP1	2	0	1.5	0	1.6	0
	3.5 - 25% BA1	2	0	1.8	0	1.8	0
	3.5 - 35% BA2	2	0	1.6	0.001	1.6	0
	3.5 - FA + Li	0.7	0.002	0.4	-0.001	1.5	0
	6.4 - Control	2	0.001	1.8	-0.001	1.9	0
	6.4 - 20% FA1	2	0	2	0	1.9	0
	6.4 - 25% FA1	2	-0.003	1.8	0.001	1.9	0
	6.4 - 15% FA2	2	0.003	1.8	-0.001	1.9	0
	6.4 - 25% SC1	2	-0.001	1.8	-0.001	1.9	0
	6.4 - 15% NP1	2	-0.002	1.6	-0.001	1.7	0
	6.4- 25% BA1	2	-0.001	1.7	-0.001	1.8	-0.003
	6.4 - 35% BA2	2	0	1.6	0	1.7	0
	6.4 - FA + Li	0.7	-0.001	0.4	0	1.5	0

Table 3: Block expansion for CA3 (NC)

Aggregate	Mixture design	Austin, TX		Corvallis, OR		Fredericton, Canada	
		Age (Years)	Expansion (%)	Age (Years)	Expansion (%)	Age (Years)	Expansion (%)
CA3	2.8 - Control	2	0	2	-0.001	2.5	0
	2.8 - 25% FA1	2	0.002	1.8	0	2.2	-0.001
	2.8 - 25% FA2	2	0	2	0	2.5	-0.002
	2.8 - 35% SC2	2	-0.005	1.8	0.001	1.5	0
	2.8 - 35% FA3 + 5% SF	2	-0.002	2	0	2.4	0
	2.8 – XX MK	1.3	-0.001	1.3	-0.002	1.3	0
	3.5 - Control	2	-0.002	1.8	0	2.5	0
	3.5 - 25% FA1	2	0.002	1.8	0	2	-0.001
	3.5 - 25% FA2	2	0	1.8	0	2.4	0
	3.5 - 35% SC2	2	0.001	1.8	-0.002	2.4	0
	3.5 - 35% FA3 + 5% SF	2	0.001	1.8	-0.001	2.4	0
	3.5 – XX MK	1.2	-0.002	1.3	0	1.1	0
	6.4 - Control	2.4	-0.001	-	-	2.4	0
	6.4- 25% FA1	2	0.002	0.4	0	2.2	0
	6.4 - 25% FA2	2.3	0	0.4	0.001	2.4	0.052
	6.4 - 35% SC2	2.3	0	0.4	0.001	2.4	0
	6.4 - 35% FA3 + 5% SF	2	-0.003	0.4	0.001	2.4	0
	6.4 – XX MK	1	-0.001	1.3	0	1	0
	8.0 - Control	2.3	0	-	-	1.8	0
	8.0- 25% FA1	2	0.002	-	-	1.8	0
	8.0 - 25% FA2	2.3	0.001	-	-	0.7	-0.063
	8.0 - 35% SC2	2.3	0	-	-	0.6	0
	8.0 - 35% FA3 + 5% SF	2	0.002	-	-	-	-
	8.0 – XX MK	1	0	-	-	0.6	0

Table 4: Block expansion for CA4 (RH)

Aggregate	Mixture design	Austin, TX		Corvallis, OR		Fredericton, Canada	
		Age (Years)	Expansion (%)	Age (Years)	Expansion (%)	Age (Years)	Expansion (%)
CA4	2.8 - Control	2	0.003	1.3	-0.001	2.1	0
	2.8 - 25% FA1	2	0.001	1.3	0.001	2.1	0
	2.8 - 35% FA3	2	0.001	1.3	0	2.1	-0.001
	2.8 - 15% NP1	2	0.001	1.3	0.001	2.1	0
	2.8 - 15% NP2	2	0	1.3	0.001	2.1	-0.001
	2.8 - 20% BA1	2	0.001	1.3	0	2.1	0
	2.8 - 20% BA2	2	0.002	2	0	2.1	0
	6.4 - Control	2	-0.001	0.5	-0.001	2	0
	6.4 - 25% FA1	2	0.005	0.4	0	2	0
	6.4 - 35% FA3	2	0	0.5	0	2	0
	6.4 - 15% NP1	1.7	0.003	1.3	0	2	0
	6.4 - 15% NP2	1.7	0	0.4	-0.001	2	0
	6.4 - 20% BA1	1.7	-0.002	-	-	2	0
	6.4 - 20% BA2	1.7	-0.003	1.3	0	2	0

Table 5: Block expansion of RAT1

Aggregate	Mixture design	Austin, TX	
		Age (Years)	Expansion (%)
RAT1	2.8 - Control	1.7	-0.002
	2.8 - 25% FA1	1.7	-0.003
	2.8 - 35% FA1	1.7	-0.003
	2.8 - 35% FA2	1.7	-0.005
	2.8 - 7.5% Meta	1.7	-0.003
	3.5 - Control	1.7	-0.003
	3.5 - Control Duplicate	1.6	-0.002
	3.5 - 25% FA1	1.6	0.001
	3.5 - 35% FA1	1.6	0.002
	3.5 - 35% FA2	1.6	-0.003
	3.5 - 7.5% Meta	1.6	0
	6.4 - Control	1.6	-0.001
	6.4 - 25% FA1	1.6	-0.004
	6.4 - 35% FA1	1.6	-0.001
	6.4 - 35% FA2	1.6	0.001
	6.4 - 7.5% Meta	1.6	-0.005

Table 6: Block expansion of RAT2

Aggregate	Mixture design	Austin, TX	
		Age (Years)	Expansion (%)
RAT2	3.5 - Control	1.4	-0.003
	3.5 - 20% FA1	2	0.001
	3.5 - 35% FA1	2	0.001
	3.5 - 35% FA3	2.4	0.002
	3.5 - 35% SC1	1.5	0.002
	3.5 - 50% SC1	1.5	0
	3.5 - 35% SC2	1.5	0.001
	3.5 - 7.5% SF	1.4	-0.001
	3.5 - 10% MK	1.6	-0.001
	3.5 - 15% NP1	1.6	0
	3.5 - 15% NP2	1.6	0
	6.4 - Control	1.5	0.003
	6.4 - 20% FA1	2.7	0
	6.4 - 35% FA1	2	-0.004
	6.4 - 35% FA3	2.4	-0.002
	6.4 - 35% SC1	1.4	0.001
	6.4 - 50% SC1	1.4	0
	6.4 - 35% SC2	2.4	0
	6.4 - 7.5% SF	1.4	0
	6.4 - 10% MK	1.5	0.001
	6.4 - 15% NP1	1.5	-0.001
	6.4 - 15% NP2	1.5	0

Table 7: Block expansion of RAO1

Aggregate	Mixture design	Corvallis, OR	
		Age (Years)	Expansion (%)
RAO1	2.8 - Control	1.7	0
	2.8 - 25% FA1	1.7	0
	2.8 - 35% FA1	1.7	0
	2.8 - 35% FA2	1.7	0
	2.8 - 7.5% MK	1.3	-0.001
	3.5 – Control	1.7	0
	3.5 - Control Duplicate	-	-
	3.5 - 25% FA1	1.5	0
	3.5 - 35% FA1	-	-
	3.5 - 35% FA2	1.7	0
	3.5 - 7.5% MK	-	-
	6.4 – Control	1.7	0
	6.4 - 25% FA1	1.7	0
	6.4 - 35% FA1	1.7	0
	6.4 - 35% FA2	1.5	0
	6.4 - 7.5% MK	0.4	-0.001

Table 8: Block expansion of RAO2

Aggregate	Mixture design	Corvallis, OR	
		Age (Years)	Expansion (%)
RAO2	3.5 - Control	1.5	0.001
	3.5 - 20% FA1	1.5	0
	3.5 - 35% FA1	1.5	0
	3.5 - 35% FA3	-	-
	3.5 - 35% SC1	-	-
	3.5 - 50% SC1	-	-
	3.5 - 35% SC2	-	-
	3.5 - 7.5% SF	-	-
	3.5 - 10% MK	-	-
	3.5 - 15% NP1	-	-
	3.5 - 15% NP2	-	-
	6.4 - Control	1.5	-0.001
	6.4 - 20% FA1	1.5	0
	6.4 - 35% FA1	1.5	0
	6.4 - 35% FA3	1.5	-0.001
	6.4 - 35% SC1	1.6	0
	6.4 - 50% SC1	1.6	0
	6.4 - 35% SC2	1.6	0
	6.4 - 7.5% SF	1.6	0
	6.4 - 10% MK	1.5	0
	6.4 - 15% NP1	1.5	0
	6.4 - 15% NP2	-	-

Table 9: Block expansion for RAC1

Aggregate	Mixture design	Fredericton, Canada	
		Age (Years)	Expansion (%)
RAC1	2.8 - Control	1.7	0
	2.8 - 25% FA1	2.2	0.074
	2.8 - 35% FA1	2.1	-0.02
	2.8 - 35% FA2	2.3	-0.057
	2.8 - 7.5% MK	1.6	-0.065
	3.5 – Control	2.3	0.056
	3.5 - Control Duplicate	-	-
	3.5 - 25% FA1	2.1	-0.035
	3.5 - 35% FA1	2.1	-0.001
	3.5 - 35% FA2	2.3	0.023
	3.5 - 7.5% MK	1.6	0.005
	6.4 – Control	2.3	-0.095
	6.4 - 25% FA1	2.1	-0.002
	6.4 - 35% FA1	2.1	-0.05
	6.4 - 35% FA2	2.3	0.015
	6.4 - 7.5% MK	1.6	0.037

Table 10: Block expansion for RAC2

Aggregate	Mixture design	Fredericton, Canada	
		Age (Years)	Expansion (%)
RAC2	3.5 - Control	2.6	0
	3.5 - 20% FA1	2	-0.001
	3.5 - 35% FA1	1.9	0.001
	3.5 - 35% FA3	2.4	0
	3.5 - 35% SC1	2.6	0
	3.5 - 50% SC1	2.6	0
	3.5 - 35% SC2	2.6	-0.001
	3.5 - 7.5% SF	2.5	-0.001
	3.5 - 10% MK	1.6	0
	3.5 - 15% NP1	2.5	-0.001
	3.5 - 15% NP2	2.5	0
	6.4 - Control	2.6	0
	6.4 - 20% FA1	2.1	0.072
	6.4 - 35% FA1	2	0
	6.4 - 35% FA3	1.4	0
	6.4 - 35% SC1	2.6	-0.002
	6.4 - 50% SC1	2.6	0
	6.4 - 35% SC2	2.6	0
	6.4 - 7.5% SF	2.5	-0.001
	6.4 - 10% MK	1.6	0
	6.4 - 15% NP1	2.5	0
	6.4 - 15% NP2	2.5	0

Table 11: Block expansion for marine blocks with RAT2

Aggregate	Mixture design	Port Aransas, TX	
		Age (Years)	Expansion (%)
RAT-2	M1	1.6	0.2
	M2	1.6	-0.001
	M3	1.6	-0.001
	M4	1.6	-0.003
	M5	1.6	0
	M6	1.6	0
	M7	1.6	0
	M8	1.6	0
	M9	1.6	0
	M10	1.6	0
	M11	1.6	0
	M12	1.6	0

Table 12: Block expansion for marine blocks with RAO1

Aggregate	Mixture design	New Port, OR	
		Age (Years)	Expansion (%)
RAO1	M1	1.6	-
	M2	1.6	-
	M3	1.6	-
	M4	1.6	0
	M5	1.6	0
	M6	1.6	-
	M7	1.6	-
	M8	1.6	-
	M9	1.6	-
	M10	1.6	-
	M11	1.6	-
	M12	1.6	-

Table 13: Block expansion for marine blocks with RAC1

Aggregate	Mixture design	Treat Island, ME	
		Age (Years)	Expansion (%)
RAC1	2.8 – Control	1.6	0
	2.8 – 35% FA1	1.6	0
	2.8 – 40% FA2	1.6	0
	2.8 – 45% FA3	1.6	0
	2.8 – 12.5% MK	1.6	0
	2.8 – 65% SC1	1.6	0
	3.5 – Control	1.9	0
	3.5 – 35% FA1	1.9	0
	3.5 – 40% FA2	1.9	0
	3.5 – 45% FA3	1.8	0
	3.5 – 12.5% MK	1.8	0
	3.5 – 65% SC1	1.8	0

Table 14: Expansion of marine blocks with CA1

Aggregate	Mixture design	Port Aransas, TX		New Port, OR		Treat Island, ME	
		Age (Years)	Expansion (%)	Age (Years)	Expansion (%)	Age (Years)	Expansion (%)
CA1	2.8 – Control	0.6	0			1.6	0
	2.8 – 35% SC1	0.6	0			1.6	0
	2.8 – 35% FA3	0.6	0			1.6	0
	2.8 – 7.5% MK	0.6	0			1.6	0
	2.8 – 20% FA3 5% SF	0.6	0			1.6	0
	2.8 – 75% Li 20% FA1	0.6	0			1.6	0
	6.4 – Control	0.6	0			1.9	0
	6.4 – 35% SC1	0.6	0			1.9	0
	6.4 – 35% FA3	0.6	0			1.9	0
	6.4 – 7.5% MK	0.6	0			1.8	0
	6.4 – 20% FA3 5% SF	0.6	0			1.8	0
	6.4 – 75% Li 20% FA1	0.6	0			1.8	0