

Appendix A. Database of single-lap shear test

Table A1. Properties and results of single-lap shear tests

Table A1. Properties and results of single-lap shear tests

Specimen	f _c (MPa)	FRP	Groove					α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]	
			E _{ff} (MPa)	b _f (mm)	L _f (mm)	nu.	b _g (mm)					d _g (mm)	P _{max} (kN)	L _e (mm)	P _{max,ave} (kN)	L _{e,ave} (mm)	P _{max} (kN)
[93]-EBROG-1a	36.5	30940	48	75	2	5	10	0 (II)	normal	23	FRP	14.42	-	14.73	-	11.60	99
[93]-EBROG-1b	36.5	30940	48	75	2	5	10	0 (II)	normal	23	FRP	15.03	-	-	-	-	-
[93]-EBROG-2a	36.5	30940	48	100	2	5	10	0 (II)	normal	23	FRP	14.95	-	14.74	-	11.60	99
[93]-EBROG-2b	36.5	30940	48	100	2	5	10	0 (II)	normal	23	FRP	14.52	-	-	-	-	-
[93]-EBROG-3a	39.1	30940	48	125	2	5	10	0 (II)	normal	23	FRP	14.60	-	15.35	-	11.54	98
[93]-EBROG-3b	39.1	30940	48	125	2	5	10	0 (II)	normal	23	FRP	16.10	-	-	-	-	-
[93]-EBROG-4a	39.1	30940	48	150	2	5	10	0 (II)	normal	23	FRP	14.81	-	15.08	-	11.54	98
[93]-EBROG-4b	39.1	30940	48	150	2	5	10	0 (II)	normal	23	FRP	15.34	-	-	-	-	-
[93]-EBR-1a	36.5	30940	48	75	-	-	-	0 (II)	normal	23	DC	09.80	-	09.65	-	10.84	-
[93]-EBR-1b	36.5	30940	48	75	-	-	-	0 (II)	normal	23	DC	09.50	-	-	-	-	-
[93]-EBR-2a	36.5	30940	48	100	-	-	-	0 (II)	normal	23	DC	09.95	-	09.92	-	10.84	-
[93]-EBR-2b	36.5	30940	48	100	-	-	-	0 (II)	normal	23	DC	09.98	-	-	-	-	-
[93]-EBR-3a	39.1	30940	48	125	-	-	-	0 (II)	normal	23	DC	10.07	-	09.71	-	10.78	-
[93]-EBR-3b	39.1	30940	48	125	-	-	-	0 (II)	normal	23	DC	09.35	-	-	-	-	-
[93]-EBR-4a	39.1	30940	48	150	-	-	-	0 (II)	normal	23	DC	09.12	-	09.27	-	10.78	-
[93]-EBR-4b	39.1	30940	48	150	-	-	-	0 (II)	normal	23	DC	09.42	-	-	-	-	-
[94]-EBROG-1	45.5	30940	48	100	2	5	2	0 (II)	normal	23	FRP/DIG	11.91	80	11.91	80	11.11	74
[94]-EBROG-2	45.5	30940	48	100	2	5	5	0 (II)	normal	23	FRP/DIG	10.78	80	10.78	80	11.34	74
[94]-EBROG-3	45.5	30940	48	100	2	5	10	0 (II)	normal	23	FRP/DIG	11.70	70	11.70	70	11.40	94
[94]-EBROG-4	45.5	30940	48	100	2	5	15	0 (II)	normal	23	FRP/DIG	11.12	60	11.12	60	11.07	-
[94]-EBROG-5	46.0	30940	48	100	2	10	2	0 (II)	normal	23	FRP	10.78	25	10.78	25	11.36	74
[94]-EBROG-6	46.0	30940	48	100	2	10	5	0 (II)	normal	23	FRP/DIG	11.03	30	11.03	30	11.59	74
[94]-EBROG-7	46.0	30940	48	100	2	10	10	0 (II)	normal	23	FRP/DIG	11.26	30	11.26	30	11.65	76
[94]-EBROG-8	46.0	30940	48	100	2	10	15	0 (II)	normal	23	FRP/DIG	11.83	35	11.83	35	11.33	92
[94]-EBR-1	44.2	30940	48	100	-	-	-	0 (II)	normal	23	DC	09.32	50	09.32	50	10.67	-
[96]-EBROG-1a	33.9	39100	50	100	2	5	10	0 (II)	normal	23	FRP/ DIG	21.22	-	20.55	-	13.34	102
[96]-EBROG-1b	31.4	39100	50	100	2	5	10	0 (II)	normal	23	FRP/ DIG	19.87	-	-	-	-	-
[96]-EBROG-2a	28.4	39100	50	100	2	5	10	-2.3(I/II)	normal	23	FRP/ DIG	21.85	-	21.71	-	13.33	101
[96]-EBROG-2b	37.5	39100	50	100	2	5	10	-2.3(I/II)	normal	23	FRP/ DIG	21.56	-	-	-	-	-
[96]-EBROG-3a	37.5	39100	50	100	2	5	10	-3.3(I/II)	normal	23	FRP/DIG	22.14	-	20.46	-	13.19	98
[96]-EBROG-3b	37.5	39100	50	100	2	5	10	-3.3(I/II)	normal	23	FRP/DIG/CFS	18.77	-	-	-	-	-

Table A1. (Continued)

Specimen	f_c (MPa)	FRP		Groove			α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]		
		E_{fr} (MPa)	b_f (mm)	L_f (mm)	nu.	b_g (mm)					d_g (mm)	P_{max} (kN)	L_c (mm)	$P_{max,ave}$ (kN)	$L_{c,ave}$ (mm)	P_{max} (kN)	L_c (mm)
[96]-EBROG-4a	32.8	39100	50	100	2	5	10	-4.5 (II)	normal	23	FRP/DIG	20.27	-	19.85	-	13.33	102
[96]-EBROG-4b	32.8	39100	50	100	2	5	10	-4.5 (II)	normal	23	FRP/DIG	19.43	-				
[96]-EBROG-5a	33.0	39100	50	100	2	5	10	-6.0 (I/II)	normal	23	FRP/DIG	19.42	-	19.71	-	13.35	102
[96]-EBROG-5b	31.4	39100	50	100	2	5	10	-6.0 (I/II)	normal	23	FRP/DIG	19.99	-				
[96]-EBROG-6a	39.0	39100	50	100	2	5	10	+2.4(I/II)	normal	23	FRP/DIG	13.74	-	13.80	-	13.13	97
[96]-EBROG-6b	40.4	39100	50	100	2	5	10	+2.4(I/II)	normal	23	DIG	13.85	-				
[96]-EBROG-7a	27.3	39100	50	100	2	5	10	+3.6 (II)	normal	23	DIG	10.84	-	10.75	-	13.53	106
[96]-EBROG-7b	27.3	39100	50	100	2	5	10	+3.6 (II)	normal	23	DIG	10.66	-				
[96]-EBROG-8a	33.6	39100	50	100	2	5	10	+4.7(I/II)	normal	23	DIG	11.44	-	10.93	-	13.30	101
[96]-EBROG-8b	33.6	39100	50	100	2	5	10	+4.7(I/II)	normal	23	DIG	10.42	-				
[96]-EBROG-9a	28.4	39100	50	150	2	5	10	0 (II)	normal	23	FRP/DIG	20.41	-	20.18	-	13.28	100
[96]-EBROG-9b	40.4	39100	50	150	2	5	10	0 (II)	normal	23	FRP/DIG	19.95	-				
[96]-EBROG-10a	38.5	39100	50	150	2	5	10	-2.3(I/II)	normal	23	FRP/DIG/CSF	20.97	-	21.10	-	13.31	101
[96]-EBROG-10b	28.4	39100	50	150	2	5	10	-2.3(I/II)	normal	23	FRP/DIG	21.23	-				
[96]-EBROG-11a	37.5	39100	50	150	2	5	10	-3.3(I/II)	normal	23	FRP/DIG	19.69	-	20.47	-	13.19	98
[96]-EBROG-11b	37.5	39100	50	150	2	5	10	-3.3(I/II)	normal	23	FRP/DIG	21.24	-				
[96]-EBROG-12a	32.8	39100	50	150	2	5	10	-4.5 (II)	normal	23	FRP/DIG	19.21	-	19.21	-	13.33	102
[96]-EBROG-12b	-	39100	50	150	2	5	10	-4.5 (II)	normal	23	-	-	-				
[96]-EBROG-13a	35.8	39100	50	150	2	5	10	-6.0 (I/II)	normal	23	FRP/DIG	19.60	-	19.92	-	13.24	99
[96]-EBROG-13b	35.8	39100	50	150	2	5	10	-6.0 (I/II)	normal	23	FRP/DIG/CSF	20.23	-				
[96]-EBROG-14a	37.4	39100	50	150	2	5	10	+2.4(I/II)	normal	23	FRP/DIG	14.71	-	14.53	-	13.19	98
[96]-EBROG-14b	37.4	39100	50	150	2	5	10	+2.4(I/II)	normal	23	FRP	14.34	-				
[96]-EBROG-15a	28.6	39100	50	150	2	5	10	+3.6 (II)	normal	23	DIG	13.04	-	12.39	-	13.48	105
[96]-EBROG-15b	28.6	39100	50	150	2	5	10	+3.6 (II)	normal	23	FRP/DIG	11.74	-				
[96]-EBROG-16a	33.6	39100	50	150	2	5	10	+4.7(I/II)	normal	23	DIG	11.83	-	12.42	-	13.39	103
[96]-EBROG-16b	28.6	39100	50	150	2	5	10	+4.7(I/II)	normal	23	DIG	13.00	-				
[96]-EBR-1a	32.0	39100	50	100	-	-	-	0 (II)	normal	23	DC	12.39	-	11.38	-	12.23	-
[96]-EBR-1b	37.4	39100	50	100	-	-	-	0 (II)	normal	23	DC	10.36	-				
[96]-EBR-2a	33.6	39100	50	100	-	-	-	-2.3(I/II)	normal	23	DC	12.48	-	12.51	-	12.26	-
[96]-EBR-2b	33.6	39100	50	100	-	-	-	-2.3(I/II)	normal	23	DC	12.54	-				
[96]-EBR-3a	38.5	39100	50	100	-	-	-	-3.3(I/II)	normal	23	DC	12.72	-	12.23	-	12.13	-
[96]-EBR-3b	38.5	39100	50	100	-	-	-	-3.3(I/II)	normal	23	DC	11.74	-				

Table A1. (Continued)

Specimen	f _c (MPa)	FRP		Groove				α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]	
		E _f f _r (MPa)	b _f (mm)	L _f (mm)	nu.	b _g (mm)	d _g (mm)					P _{max} (kN)	L _e (mm)	P _{max,ave} (kN)	L _{e,ave} (mm)	P _{max} (kN)	L _e (mm)
[96]-EBR-4a	35.8	39100	50	100	-	-	-	-4.5 (II)	normal	23	DC	14.02	-	13.79	-	12.20	-
[96]-EBR-4b	35.8	39100	50	100	-	-	-	-4.5 (II)	normal	23	DC	13.56	-	-	-	-	-
[96]-EBR-5a	33.1	39100	50	100	-	-	-	-6.0 (I/II)	normal	23	DC	14.70	-	15.04	-	12.28	-
[96]-EBR-5b	33.1	39100	50	100	-	-	-	-6.0 (I/II)	normal	23	DC	15.35	-	-	-	-	-
[96]-EBR-6a	37.4	39100	50	100	-	-	-	+2.4(I/II)	normal	23	DC	09.94	-	09.95	-	12.21	-
[96]-EBR-6b	33.6	39100	50	100	-	-	-	+2.4(I/II)	normal	23	DC	09.97	-	-	-	-	-
[96]-EBR-7a	32.8	39100	50	100	-	-	-	+3.6 (II)	normal	23	DC	09.27	-	09.61	-	12.35	-
[96]-EBR-7b	28.9	39100	50	100	-	-	-	+3.6 (II)	normal	23	DC	09.96	-	-	-	-	-
[96]-EBR-8a	32.8	39100	50	100	-	-	-	+4.7(I/II)	normal	23	DC/FAIF	08.36	-	08.37	-	12.29	-
[96]-EBR-8b	32.8	39100	50	100	-	-	-	+4.7(I/II)	normal	23	DC/FAIF	08.38	-	-	-	-	-
[96]-EBR-9a	33.9	39100	50	150	-	-	-	0 (II)	normal	23	DC	11.06	-	11.37	-	12.26	-
[96]-EBR-9b	33.5	39100	50	150	-	-	-	0 (II)	normal	23	DC	11.69	-	-	-	-	-
[96]-EBR-10a	33.6	39100	50	150	-	-	-	-2.3(I/II)	normal	23	DC	13.91	-	12.84	-	12.20	-
[96]-EBR-10b	38.5	39100	50	150	-	-	-	-2.3(I/II)	normal	23	DC	11.76	-	-	-	-	-
[96]-EBR-11a	38.5	39100	50	150	-	-	-	-3.3(I/II)	normal	23	DC	13.33	-	12.21	-	12.13	-
[96]-EBR-11b	38.5	39100	50	150	-	-	-	-3.3(I/II)	normal	23	DC	11.10	-	-	-	-	-
[96]-EBR-12a	35.8	39100	50	150	-	-	-	-4.5 (II)	normal	23	DC	14.50	-	14.50	-	12.20	-
[96]-EBR-12b	35.8	39100	50	150	-	-	-	-4.5 (II)	normal	23	DC	-	-	-	-	-	-
[96]-EBR-13a	33.1	39100	50	150	-	-	-	-6.0 (I/II)	normal	23	DC	16.91	-	15.75	-	12.28	-
[96]-EBR-13b	33.1	39100	50	150	-	-	-	-6.0 (I/II)	normal	23	FRP/DC	14.60	-	-	-	-	-
[96]-EBR-14a	33.6	39100	50	150	-	-	-	+2.4(I/II)	normal	23	DC	10.86	-	10.94	-	12.19	-
[96]-EBR-14b	39.0	39100	50	150	-	-	-	+2.4(I/II)	normal	23	DC	11.02	-	-	-	-	-
[96]-EBR-15a	32.8	39100	50	150	-	-	-	+3.6 (II)	normal	23	DC	09.79	-	10.55	-	12.35	-
[96]-EBR-15b	28.9	39100	50	150	-	-	-	+3.6 (II)	normal	23	DC/FAIF	11.31	-	-	-	-	-
[96]-EBR-16a	32.8	39100	50	150	-	-	-	+4.7(I/II)	normal	23	DC/FAIF	10.27	-	09.91	-	12.29	-
[96]-EBR-16b	32.8	39100	50	150	-	-	-	+4.7(I/II)	normal	23	DC	09.56	-	-	-	-	-
[97]-EBROG-1a	34.6	30940	48	200	2	8	10	0 (II)	normal	23	FRP/DIG	19.46	-	18.70	-	11.81	83
[97]-EBROG-1b	35.2	30940	48	200	2	8	10	0 (II)	normal	23	FRP/DIG	18.91	-	-	-	-	-
[97]-EBROG-1c	34.3	30940	48	200	2	8	10	0 (II)	normal	23	FRP/DIG	17.74	-	-	-	-	-
[97]-EBROG-2a	34.6	30940	48	200	2	8	10	0 (II)	Alkaline-3000	23	FRP/DIG	18.59	-	17.80	-	11.81	83
[97]-EBROG-2b	35.2	30940	48	200	2	8	10	0 (II)	Alkaline-3000	23	FRP	18.60	-	-	-	-	-
[97]-EBROG-2c	34.3	30940	48	200	2	8	10	0 (II)	Alkaline-3000	23	FRP/DIG	16.23	-	-	-	-	-

Table A1. (Continued)

Specimen	f _c (MPa)	FRP			Groove			α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]	
		E _{frf} (MPa)	b _f (mm)	L _f (mm)	nu.	b _g (mm)	d _g (mm)					P _{max} (kN)	L _e (mm)	P _{max,ave} (kN)	L _{e,ave} (mm)	P _{max} (kN)	L _e (mm)
[97]-EBROG-3a	34.6	30940	48	200	2	8	10	0 (II)	Alkaline-3000	40	FRP	20.18	-	18.71	-	11.81	83
[97]-EBROG-3b	35.2	30940	48	200	2	8	10	0 (II)	Alkaline-3000	40	FRP	18.69	-				
[97]-EBROG-3c	34.3	30940	48	200	2	8	10	0 (II)	Alkaline-3000	40	FRP	17.26	-				
[97]-EBROG-4a	34.6	30940	48	200	2	8	10	0 (II)	Alkaline-3000	60	FRP	16.87	-	17.81	-	11.81	83
[97]-EBROG-4b	35.2	30940	48	200	2	8	10	0 (II)	Alkaline-3000	60	FRP	18.45	-				
[97]-EBROG-4c	34.3	30940	48	200	2	8	10	0 (II)	Alkaline-3000	60	FRP	18.12	-				
[98]-EBROG-5a	34.6	30940	48	200	2	8	10	0 (II)	Alkaline-6000	23	FRP/DIG	20.45	-	18.49	-	11.81	83
[98]-EBROG-5b	35.2	30940	48	200	2	8	10	0 (II)	Alkaline-6000	23	FRP/DIG	18.34	-				
[98]-EBROG-5c	34.3	30940	48	200	2	8	10	0 (II)	Alkaline-6000	23	FRP	16.69	-				
[98]-EBROG-6a	34.6	30940	48	200	2	8	10	0 (II)	Alkaline-6000	40	FRP/DIG	18.63	-	18.86	-	11.81	83
[98]-EBROG-6b	35.2	30940	48	200	2	8	10	0 (II)	Alkaline-6000	40	FRP	20.41	-				
[98]-EBROG-6c	34.3	30940	48	200	2	8	10	0 (II)	Alkaline-6000	40	FRP/DIG	17.55	-				
[98]-EBROG-7a	34.6	30940	48	200	2	8	10	0 (II)	Alkaline-6000	60	FRP/DIG	16.48	-	18.39	-	11.81	83
[98]-EBROG-7b	35.2	30940	48	200	2	8	10	0 (II)	Alkaline-6000	60	FRP/DIG	18.51	-				
[98]-EBROG-7c	34.3	30940	48	200	2	8	10	0 (II)	Alkaline-6000	60	FRP/DIG	20.19	-				
[108]-EBROG-8a	34.6	30940	48	200	2	8	10	0 (II)	Freeze-thaw200	23	FRP	20.54	-	19.99	-	11.81	83
[108]-EBROG-8b	35.2	30940	48	200	2	8	10	0 (II)	Freeze-thaw200	23	FRP	20.29	-				
[108]-EBROG-8c	34.3	30940	48	200	2	8	10	0 (II)	Freeze-thaw200	23	FRP	19.16	-				
[108]-EBROG-9a	34.6	30940	48	200	2	8	10	0 (II)	Freeze-thaw500	23	FRP	22.57	-	22.33	-	11.81	83
[108]-EBROG-9b	35.2	30940	48	200	2	8	10	0 (II)	Freeze-thaw500	23	FRP	22.48	-				
[108]-EBROG-9c	34.3	30940	48	200	2	8	10	0 (II)	Freeze-thaw500	23	FRP	21.96	-				
[97]-EBR-1a	34.6	30940	48	200	-	-	-	0 (II)	normal	23	DC	10.70	-	10.34	-	10.88	-
[97]-EBR-1b	35.2	30940	48	200	-	-	-	0 (II)	normal	23	DC	10.43	-				
[97]-EBR-1c	34.3	30940	48	200	-	-	-	0 (II)	normal	23	DC	09.87	-				
[97]-EBR-2a	34.6	30940	48	200	-	-	-	0 (II)	Alkaline-3000	23	DC	07.50	-	07.86	-	10.88	-
[97]-EBR-2b	35.2	30940	48	200	-	-	-	0 (II)	Alkaline-3000	23	DC	08.89	-				
[97]-EBR-2c	34.3	30940	48	200	-	-	-	0 (II)	Alkaline-3000	23	DC	07.20	-				
[97]-EBR-3a	34.6	30940	48	200	-	-	-	0 (II)	Alkaline-3000	40	DC	07.50	-	08.21	-	10.88	-
[97]-EBR-3b	35.2	30940	48	200	-	-	-	0 (II)	Alkaline-3000	40	DC	08.93	-				
[97]-EBR-3c	34.3	30940	48	200	-	-	-	0 (II)	Alkaline-3000	40	DC	08.20	-				

Table A1. (Continued)

Specimen	f _c (MPa)	FRP		Groove				α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]	
		E _{rf} (MPa)	b _f (mm)	L _f (mm)	nu.	b _g (mm)	d _g (mm)					P _{max} (kN)	L _e (mm)	P _{max,ave} (kN)	L _{e,ave} (mm)	P _{max} (kN)	L _e (mm)
[97]-EBR-4a	34.6	30940	48	200	-	-	-	0 (II)	Alkaline-3000	60	DC	07.83	-	08.14	-	10.88	-
[97]-EBR-4b	35.2	30940	48	200	-	-	-	0 (II)	Alkaline-3000	60	DI	08.46	-	-	-	-	-
[97]-EBR-4c	34.3	30940	48	200	-	-	-	0 (II)	Alkaline-3000	60	DI	-	-	-	-	-	-
[98]-EBR-5a	34.6	30940	48	200	-	-	-	0 (II)	Alkaline-6000	23	DC	08.02	-	08.14	-	10.88	-
[98]-EBR-5b	35.2	30940	48	200	-	-	-	0 (II)	Alkaline-6000	23	DC	08.27	-	-	-	-	-
[98]-EBR-5c	34.3	30940	48	200	-	-	-	0 (II)	Alkaline-6000	23	-	-	-	-	-	-	-
[98]-EBR-6a	34.6	30940	48	200	-	-	-	0 (II)	Alkaline-6000	40	DI	09.14	-	8.23	-	10.88	-
[98]-EBR-6b	35.2	30940	48	200	-	-	-	0 (II)	Alkaline-6000	40	DI	09.19	-	-	-	-	-
[98]-EBR-6c	34.3	30940	48	200	-	-	-	0 (II)	Alkaline-6000	40	DI	08.15	-	-	-	-	-
[98]-EBR-7a	34.6	30940	48	200	-	-	-	0 (II)	Alkaline-6000	60	DI	08.36	-	8.60	-	10.88	-
[98]-EBR-7b	35.2	30940	48	200	-	-	-	0 (II)	Alkaline-6000	60	DI	08.84	-	-	-	-	-
[98]-EBR-7c	34.3	30940	48	200	-	-	-	0 (II)	Alkaline-6000	60	DI	-	-	-	-	-	-
[108]-EBR-8a	34.6	30940	48	200	-	-	-	0 (II)	Freeze-thaw200	23	DC	10.39	-	9.99	-	10.88	-
[108]-EBR-8b	35.2	30940	48	200	-	-	-	0 (II)	Freeze-thaw200	23	DC	09.87	-	-	-	-	-
[108]-EBR-8c	34.3	30940	48	200	-	-	-	0 (II)	Freeze-thaw200	23	DC	09.71	-	-	-	-	-
[108]-EBR-9a	34.6	30940	48	200	-	-	-	0 (II)	Freeze-thaw500	23	DC	10.27	-	09.34	-	10.88	-
[108]-EBR-9b	35.2	30940	48	200	-	-	-	0 (II)	Freeze-thaw500	23	DC	09.23	-	-	-	-	-
[108]-EBR-9c	34.3	30940	48	200	-	-	-	0 (II)	Freeze-thaw500	23	DC	08.54	-	-	-	-	-
[99]-EBROG-1a	20.0	30940	48	150	2	5	2	0 (II)	normal	23	DC	10.60	-	10.75	-	11.86	91
[99]-EBROG-1b	20.0	30940	48	150	2	5	2	0 (II)	normal	23	DC	10.90	-	-	-	-	-
[99]-EBROG-2a	20.0	39100	48	150	2	5	2	0 (II)	normal	23	DC	11.71	-	11.38	-	13.09	93
[99]-EBROG-2b	20.0	39100	48	150	2	5	2	0 (II)	normal	23	DC	11.04	-	-	-	-	-
[99]-EBROG-3a	20.0	61880	48	150	2	5	2	0 (II)	normal	23	DC	16.19	-	15.56	-	15.87	97
[99]-EBROG-3b	20.0	61880	48	150	2	5	2	0 (II)	normal	23	DC	14.91	-	-	-	-	-
[99]-EBROG-4a	32.0	30940	48	150	2	5	2	0 (II)	normal	23	DC	12.78	-	12.52	-	11.42	80
[99]-EBROG-4b	32.0	30940	48	150	2	5	2	0 (II)	normal	23	DC	12.26	-	-	-	-	-
[99]-EBROG-5a	32.0	39100	48	150	2	5	2	0 (II)	normal	23	DC	14.74	-	14.33	-	12.60	82
[99]-EBROG-5b	32.0	39100	48	150	2	5	2	0 (II)	normal	23	DC	13.92	-	-	-	-	-
[99]-EBROG-6a	32.0	61880	48	150	2	5	2	0 (II)	normal	23	DC	17.63	-	16.99	-	15.29	86
[99]-EBROG-6b	32.0	61880	48	150	2	5	2	0 (II)	normal	23	DC	16.34	-	-	-	-	-

Table A1. (Continued)

Specimen	f _c (MPa)	FRP		Groove			α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]		
		E _{frf} (MPa)	b _f (mm)	L _f (mm)	nu.	b _g (mm)					d _g (mm)	P _{max} (kN)	L _e (mm)	P _{max,ave} (kN)	L _{e,ave} (mm)	P _{max} (kN)	L _e (mm)
[99]-EBROG-7a	43.0	30940	48	150	2	5	2	0 (II)	normal	23	DC	15.88	-	15.47	-	11.16	75
[99]-EBROG-7b	43.0	30940	48	150	2	5	2	0 (II)	normal	23	DC	15.05	-	-	-	-	-
[99]-EBROG-8a	43.0	39100	48	150	2	5	2	0 (II)	normal	23	DC	16.96	-	16.32	-	12.31	77
[99]-EBROG-8b	43.0	39100	48	150	2	5	2	0 (II)	normal	23	DC	15.68	-	-	-	-	-
[99]-EBROG-9a	43.0	61880	48	150	2	5	2	0 (II)	normal	23	DC	18.26	-	18.40	-	14.93	80
[99]-EBROG-9b	43.0	61880	48	150	2	5	2	0 (II)	normal	23	DC	18.54	-	-	-	-	-
[99]-EBROG-10a	20.0	30940	48	150	2	5	5	0 (II)	normal	23	DC	14.80	-	14.52	-	12.11	91
[99]-EBROG-10b	20.0	30940	48	150	2	5	5	0 (II)	normal	23	DC	14.23	-	-	-	-	-
[99]-EBROG-11a	20.0	39100	48	150	2	5	5	0 (II)	normal	23	DC	16.29	-	16.16	-	13.36	93
[99]-EBROG-11b	20.0	39100	48	150	2	5	5	0 (II)	normal	23	DC	16.02	-	-	-	-	-
[99]-EBROG-12a	20.0	61880	48	150	2	5	5	0 (II)	normal	23	FRP	20.12	-	19.91	-	16.20	98
[99]-EBROG-12b	20.0	61880	48	150	2	5	5	0 (II)	normal	23	FRP	19.70	-	-	-	-	-
[99]-EBROG-13a	32.0	30940	48	150	2	5	5	0 (II)	normal	23	DC	15.57	-	15.37	-	11.66	81
[99]-EBROG-13b	32.0	30940	48	150	2	5	5	0 (II)	normal	23	DC	15.15	-	-	-	-	-
[99]-EBROG-14a	32.0	39100	48	150	2	5	5	0 (II)	normal	23	FRP	18.43	-	18.84	-	12.86	83
[99]-EBROG-14b	32.0	39100	48	150	2	5	5	0 (II)	normal	23	FRP	19.26	-	-	-	-	-
[99]-EBROG-15a	32.0	61880	48	150	2	5	5	0 (II)	normal	23	FRP	21.75	-	21.53	-	15.60	87
[99]-EBROG-15b	32.0	61880	48	150	2	5	5	0 (II)	normal	23	FRP	21.32	-	-	-	-	-
[99]-EBROG-16a	43.0	30940	48	150	2	5	5	0 (II)	normal	23	DC	16.57	-	16.33	-	11.39	75
[99]-EBROG-16b	43.0	30940	48	150	2	5	5	0 (II)	normal	23	DC	16.09	-	-	-	-	-
[99]-EBROG-17a	43.0	39100	48	150	2	5	5	0 (II)	normal	23	FRP	18.36	-	18.77	-	12.56	77
[99]-EBROG-17b	43.0	39100	48	150	2	5	5	0 (II)	normal	23	FRP	19.18	-	-	-	-	-
[99]-EBROG-18a	43.0	61880	48	150	2	5	5	0 (II)	normal	23	FRP	22.22	-	21.91	-	15.23	81
[99]-EBROG-18b	43.0	61880	48	150	2	5	5	0 (II)	normal	23	FRP	21.60	-	-	-	-	-
[99]-EBROG-19a	20.0	30940	48	150	2	5	10	0 (II)	normal	23	FRP	17.26	-	17.56	-	12.18	115
[99]-EBROG-19b	20.0	30940	48	150	2	5	10	0 (II)	normal	23	FRP	17.85	-	-	-	-	-
[99]-EBROG-20a	20.0	39100	48	150	2	5	10	0 (II)	normal	23	FRP	18.53	-	18.46	-	13.43	118
[99]-EBROG-20b	20.0	39100	48	150	2	5	10	0 (II)	normal	23	FRP	18.39	-	-	-	-	-
[99]-EBROG-21a	20.0	61880	48	150	2	5	10	0 (II)	normal	23	FRP	23.20	-	23.52	-	16.29	124
[99]-EBROG-21b	20.0	61880	48	150	2	5	10	0 (II)	normal	23	FRP	23.84	-	-	-	-	-
[99]-EBROG-22a	32.0	30940	48	150	2	5	10	0 (II)	normal	23	FRP	16.72	-	17.33	-	11.73	103
[99]-EBROG-22b	32.0	30940	48	150	2	5	10	0 (II)	normal	23	FRP	17.93	-	-	-	-	-

Table A1. (Continued)

Specimen	f_c (MPa)	FRP		Groove			α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]		
		E_{fr} (MPa)	b_f (mm)	L_f (mm)	nu.	b_g (mm)					d_g (mm)	P_{max} (kN)	L_e (mm)	$P_{max,ave}$ (kN)	$L_{e,ave}$ (mm)	P_{max} (kN)	L_e (mm)
[99]-EBROG-23a	32.0	39100	48	150	2	5	10	0 (II)	normal	23	FRP	18.31	-	18.53	-	12.94	105
[99]-EBROG-23b	32.0	39100	48	150	2	5	10	0 (II)	normal	23	FRP	18.75	-	-	-	-	-
[99]-EBROG-24a	32.0	61880	48	150	2	5	10	0 (II)	normal	23	FRP	23.89	-	23.51	-	15.69	110
[99]-EBROG-24b	32.0	61880	48	150	2	5	10	0 (II)	normal	23	FRP	23.13	-	-	-	-	-
[99]-EBROG-25a	43.0	30940	48	150	2	5	10	0 (II)	normal	23	FRP	17.77	-	17.86	-	11.45	95
[99]-EBROG-25b	43.0	30940	48	150	2	5	10	0 (II)	normal	23	FRP	17.95	-	-	-	-	-
[99]-EBROG-26a	43.0	39100	48	150	2	5	10	0 (II)	normal	23	FRP	18.19	-	18.72	-	12.64	98
[99]-EBROG-26b	43.0	39100	48	150	2	5	10	0 (II)	normal	23	FRP	19.24	-	-	-	-	-
[99]-EBROG-27a	43.0	61880	48	150	2	5	10	0 (II)	normal	23	FRP	23.40	-	24.12	-	15.32	102
[99]-EBROG-27b	43.0	61880	48	150	2	5	10	0 (II)	normal	23	FRP	24.83	-	-	-	-	-
[99]-EBROG-28a	20.0	30940	48	150	2	5	15	0 (II)	normal	23	FRP	16.18	-	16.78	-	11.83	-
[99]-EBROG-28b	20.0	30940	48	150	2	5	15	0 (II)	normal	23	FRP	17.37	-	-	-	-	-
[99]-EBROG-29a	20.0	39100	48	150	2	5	15	0 (II)	normal	23	FRP	18.44	-	17.76	-	13.05	-
[99]-EBROG-29b	20.0	39100	48	150	2	5	15	0 (II)	normal	23	FRP	17.08	-	-	-	-	-
[99]-EBROG-30a	20.0	61880	48	150	2	5	15	0 (II)	normal	23	FRP	21.60	-	21.70	-	15.82	-
[99]-EBROG-30b	20.0	61880	48	150	2	5	15	0 (II)	normal	23	FRP	21.80	-	-	-	-	-
[99]-EBROG-31a	32.0	30940	48	150	2	5	15	0 (II)	normal	23	FRP	16.03	-	15.95	-	11.39	-
[99]-EBROG-31b	32.0	30940	48	150	2	5	15	0 (II)	normal	23	FRP	15.87	-	-	-	-	-
[99]-EBROG-32a	32.0	39100	48	150	2	5	15	0 (II)	normal	23	FRP	18.22	-	17.46	-	12.57	-
[99]-EBROG-32b	32.0	39100	48	150	2	5	15	0 (II)	normal	23	FRP	16.69	-	-	-	-	-
[99]-EBROG-33a	32.0	61880	48	150	2	5	15	0 (II)	normal	23	FRP	21.67	-	21.44	-	15.24	-
[99]-EBROG-33b	32.0	61880	48	150	2	5	15	0 (II)	normal	23	FRP	21.21	-	-	-	-	-
[99]-EBR-1a	20.0	30940	48	150	-	-	-	0 (II)	normal	23	DC	10.82	-	10.27	-	11.34	-
[99]-EBR-1b	20.0	30940	48	150	-	-	-	0 (II)	normal	23	DC	09.71	-	-	-	-	-
[99]-EBR-2a	20.0	39100	48	150	-	-	-	0 (II)	normal	23	DC	11.60	-	11.35	-	12.51	-
[99]-EBR-2b	20.0	39100	48	150	-	-	-	0 (II)	normal	23	DC	11.10	-	-	-	-	-
[99]-EBR-3a	20.0	61880	48	150	-	-	-	0 (II)	normal	23	DC	13.97	-	14.00	-	15.17	-
[99]-EBR-3b	20.0	61880	48	150	-	-	-	0 (II)	normal	23	DC	14.03	-	-	-	-	-
[99]-EBR-4a	32.0	30940	48	150	-	-	-	0 (II)	normal	23	DC	10.82	-	11.06	-	10.92	-
[99]-EBR-4b	32.0	30940	48	150	-	-	-	0 (II)	normal	23	DC	11.29	-	-	-	-	-
[99]-EBR-5a	32.0	39100	48	150	-	-	-	0 (II)	normal	23	DC	11.13	-	11.90	-	12.05	-
[99]-EBR-5b	32.0	39100	48	150	-	-	-	0 (II)	normal	23	DC	12.67	-	-	-	-	-

Table A1. (Continued)

Specimen	f _c (MPa)	FRP			Groove			α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]	
		E _{frf} (MPa)	b _f (mm)	L _f (mm)	nu.	b _g (mm)	d _g (mm)					P _{max} (kN)	L _e (mm)	P _{max,ave} (kN)	L _{e,ave} (mm)	P _{max} (kN)	L _e (mm)
[99]-EBR-6a	32.0	61880	48	150	-	-	-	0 (II)	normal	23	DC	14.42	-	14.44	-	14.61	-
[99]-EBR-6b	32.0	61880	48	150	-	-	-	0 (II)	normal	23	DC	14.45	-	-	-	-	-
[99]-EBR-7a	43.0	30940	48	150	-	-	-	0 (II)	normal	23	DC	10.98	-	11.24	-	10.66	-
[99]-EBR-7b	43.0	30940	48	150	-	-	-	0 (II)	normal	23	DC	11.49	-	-	-	-	-
[99]-EBR-8a	43.0	39100	48	150	-	-	-	0 (II)	normal	23	DC	13.18	-	13.53	-	11.76	-
[99]-EBR-8b	43.0	39100	48	150	-	-	-	0 (II)	normal	23	DC	13.87	-	-	-	-	-
[99]-EBR-9a	43.0	61880	48	150	-	-	-	0 (II)	normal	23	DC	14.50	-	15.07	-	14.27	-
[99]-EBR-9b	43.0	61880	48	150	-	-	-	0 (II)	normal	23	DC	15.63	-	-	-	-	-
[100]-EBROG-1a	34.5	232500	51	381	5	3	4.9	0 (II)	normal	23	DC	29.74	-	32.97	-	25.11	-
[100]-EBROG-1b	34.5	232500	51	381	5	3	5.0	0 (II)	normal	23	DC	31.50	-	-	-	-	-
[100]-EBROG-1c	34.5	232500	51	381	5	3	5.0	0 (II)	normal	23	DC	37.69	-	-	-	-	-
[100]-EBROG-2a	34.5	232500	51	381	5	3	4.8	0 (II)	normal	23	DC	65.02	-	62.30	-	25.05	-
[100]-EBROG-2b	34.5	232500	51	381	5	3	4.9	0 (II)	normal	23	DC	64.87	-	-	-	-	-
[100]-EBROG-2c	34.5	232500	51	381	5	3	5.0	0 (II)	normal	23	DC	57.02	-	-	-	-	-
[101]-EBROG-1a	38.2	231000	50	240	2	5	5	0 (II)	normal	23	CF	47.14	145	47.14	145	27.61	95
[101]-EBROG-1b	38.2	231000	50	240	2	5	5	0 (II)	normal	23	CF	32.41	-	-	-	-	-
[101]-EBROG-2a	38.2	231000	50	240	2	5	10	0 (II)	normal	23	CF	52.66	160	52.03	160	27.77	117
[101]-EBROG-2b	38.2	231000	50	240	2	5	10	0 (II)	normal	23	CF	51.40	160	-	-	-	-
[101]-EBROG-3a	38.2	231000	50	240	2	10	5	0 (II)	normal	23	CF	44.98	150	44.78	155	28.25	94
[101]-EBROG-3b	38.2	231000	50	240	2	10	5	0 (II)	normal	23	CF	44.59	160	-	-	-	-
[101]-EBROG-4a	38.2	231000	50	240	2	10	10	0 (II)	normal	23	CF	66.69	215	72.21	217	28.41	96
[101]-EBROG-4b	38.2	231000	50	240	2	10	10	0 (II)	normal	23	CF	77.73	220	-	-	-	-
[106]-EBROG-1a	38.2	1020000	50	240	2	10	10	0 (II)	normal	23	DI	84.73	-	83.44	-	42.41	112
[106]-EBROG-1b	38.2	1020000	50	240	2	10	10	0 (II)	normal	23	DC	90.72	-	-	-	-	-
[106]-EBROG-2a	38.2	1020000	50	240	2	10	10	0 (II)	normal	23	DI	74.89	-	-	-	-	-
[101]-EBR-1a	38.2	231000	50	240	-	-	-	0 (II)	normal	23	DC	25.29	-	24.49	90	25.85	-
[101]-EBR-1b	38.2	231000	50	240	-	-	-	0 (II)	normal	23	DC	23.70	90	-	-	-	-
[106]-EBR-1a	38.2	1020000	50	240	-	-	-	0 (II)	normal	23	DC	70.14	-	69.55	-	38.60	-
[106]-EBR-1b	38.2	1020000	50	240	-	-	-	0 (II)	normal	23	DC	68.97	-	-	-	-	-
[102]-EBROG-1a	56.0	30940	48	200	1	5	5	0 (II)	normal	23	DC	09.94	39	10.40	39	11.15	70
[102]-EBROG-1b	56.0	30940	48	200	1	5	5	0 (II)	normal	23	DC	10.87	39	-	-	-	-

Table A1. (Continued)

Specimen	f _c (MPa)	FRP	Groove					α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]	
			E _{fr} (MPa)	b _f (mm)	L _f (mm)	nu.	b _g (mm)					d _g (mm)	P _{max} (kN)	L _e (mm)	P _{max,ave} (kN)	L _{e,ave} (mm)	P _{max} (kN)
[102]-EBROG-2a	56.0	30940	48	200	1	5	10	0 (II)	normal	23	DC	12.66	35	12.25	35	11.21	89
[102]-EBROG-2b	56.0	30940	48	200	1	5	10	0 (II)	normal	23	DC/DFG	11.84	35				
[102]-EBROG-3a	56.0	30940	48	200	1	5	15	0 (II)	normal	23	DC/DFG	10.86	28	11.09	28	10.89	-
[102]-EBROG-3b	56.0	30940	48	200	1	5	15	0 (II)	normal	23	DC/DFG	11.31	28				
[102]-EBROG-4a	56.0	30940	48	200	1	5	20	0 (II)	normal	23	DC	11.33	19	11.71	19	10.18	-
[102]-EBROG-4b	56.0	30940	48	200	1	5	20	0 (II)	normal	23	DC/DFG	12.09	19				
[102]-EBROG-5a	56.0	30940	48	200	1	10	5	0 (II)	normal	23	DC	10.53	24	11.05	24	11.41	70
[102]-EBROG-5b	56.0	30940	48	200	1	10	5	0 (II)	normal	23	DC	11.57	24				
[102]-EBROG-6a	56.0	30940	48	200	1	10	10	0 (II)	normal	23	DC	10.88	28	11.77	28	11.47	72
[102]-EBROG-6b	56.0	30940	48	200	1	10	10	0 (II)	normal	23	DC	12.66	28				
[102]-EBROG-7a	56.0	30940	48	200	1	10	15	0 (II)	normal	23	DC	11.70	17	11.15	17	11.15	88
[102]-EBROG-7b	56.0	30940	48	200	1	10	15	0 (II)	normal	23	DC	10.59	17				
[102]-EBROG-8a	56.0	30940	48	200	1	10	20	0 (II)	normal	23	DC	10.73	17	11.22	17	10.44	-
[102]-EBROG-8b	56.0	30940	48	200	1	10	20	0 (II)	normal	23	DC	11.70	17				
[102]-EBR-1a	56.0	30940	48	200	-	-	-	0 (II)	normal	23	DC	07.17	51	07.31	51	10.47	-
[102]-EBR-1b	56.0	30940	48	200	-	-	-	0 (II)	normal	23	DC	07.46	51				
[103]-EBROG-1a	26.7	12920	30	200	1	5	5	0 (II)	normal	23	DIG	04.86	-	04.81	-	05.56	79
[103]-EBROG-1b	26.7	12920	30	200	1	5	5	0 (II)	normal	23	DIG	04.75	-				
[103]-EBROG-2a	37.9	12920	40	200	1	5	5	0 (II)	normal	23	DIG	07.70	95	06.91	75	06.89	72
[103]-EBROG-2b	37.9	12920	40	200	1	5	5	0 (II)	normal	23	DIG	06.13	55				
[103]-EBROG-3a	27.1	12920	50	200	1	5	5	0 (II)	normal	23	DIG	06.68	75	07.87	81	08.45	77
[103]-EBROG-3b	27.1	12920	50	200	1	5	5	0 (II)	normal	23	DIG	09.05	86				
[103]-EBROG-4a	32.7	12920	60	200	1	5	5	0 (II)	normal	23	DIG	10.43	78	10.15	74	09.55	74
[103]-EBROG-4b	32.7	12920	60	200	1	5	5	0 (II)	normal	23	DIG	09.87	69				
[103]-EBROG-5a	39.1	25300	30	200	1	5	5	0 (II)	normal	23	DIG	07.91	86	07.15	74	07.15	77
[103]-EBROG-5b	39.1	25300	30	200	1	5	5	0 (II)	normal	23	DIG	06.39	61				
[103]-EBROG-6a	22.7	25300	40	200	1	5	5	0 (II)	normal	23	DIG	09.56	92	09.40	93	09.52	87
[103]-EBROG-6b	22.7	25300	40	200	1	5	5	0 (II)	normal	23	DIG	09.24	94				
[103]-EBROG-7a	28.1	25300	60	200	1	5	5	0 (II)	normal	23	DIG	11.64	68	11.85	70	12.82	82
[103]-EBROG-7b	28.1	25300	60	200	1	5	5	0 (II)	normal	23	DIG	12.05	71				
[103]-EBROG-8a	26.7	39100	30	200	1	5	5	0 (II)	normal	23	DIG	09.39	107	08.56	107	08.86	89
[103]-EBROG-8b	26.7	39100	30	200	1	5	5	0 (II)	normal	23	DIG	07.74	107				

Table A1. (Continued)

Specimen	f_c (MPa)	FRP			Groove			α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]	
		E_{ff} (MPa)	b_f (mm)	L_f (mm)	nu.	b_g (mm)	d_g (mm)					P_{max} (kN)	L_e (mm)	$P_{max,ave}$ (kN)	$L_{e,ave}$ (mm)	P_{max} (kN)	L_e (mm)
[103]-EBROG-9a	32.7	39100	50	200	1	5	5	0 (II)	normal	23	DIG	14.70	80	14.75	86	13.26	82
[103]-EBROG-9b	32.7	39100	50	200	1	5	5	0 (II)	normal	23	DIG	14.80	91				
[103]-EBROG-10a	39.1	78200	30	200	1	5	5	0 (II)	normal	23	DIG	13.01	64	11.44	79	11.49	86
[103]-EBROG-10b	39.1	78200	30	200	1	5	5	0 (II)	normal	23	DIG	09.87	93				
[103]-EBROG-11a	48.1	78200	30	200	1	5	5	0 (II)	normal	23	DIG	13.66	-	12.69	-	11.30	82
[103]-EBROG-11b	48.1	78200	30	200	1	5	5	0 (II)	normal	23	DIG	11.72	-				
[103]-EBROG-12a	22.7	78200	40	200	1	5	5	0 (II)	normal	23	DIG	17.20	104	16.10	102	15.29	97
[103]-EBROG-12b	22.7	78200	40	200	1	5	5	0 (II)	normal	23	DIG	15.00	100				
[103]-EBROG-13a	28.1	78200	60	200	1	5	5	0 (II)	normal	23	DIG	20.85	-	20.16	-	20.60	91
[103]-EBROG-13b	28.1	78200	60	200	1	5	5	0 (II)	normal	23	DIG	19.47	-				
[103]-EBROG-14a	36.5	78200	60	200	1	5	5	0 (II)	normal	23	DIG	25.49	-	24.99	-	20.17	86
[103]-EBROG-14b	36.5	78200	60	200	1	5	5	0 (II)	normal	23	DIG	25.50	-				
[103]-EBROG-15a	22.7	12920	40	200	1	5	10	0 (II)	normal	23	DIG	07.72	69	07.37	72	07.22	122
[103]-EBROG-15b	22.7	12920	40	200	1	5	10	0 (II)	normal	23	DIG	07.02	75				
[103]-EBROG-16a	26.7	12920	60	200	1	5	10	0 (II)	normal	23	DIG	09.35	78	09.51	78	09.77	87
[103]-EBROG-16b	26.7	12920	60	200	1	5	10	0 (II)	normal	23	DIG	09.68	77				
[103]-EBROG-17a	32.7	12920	60	200	1	5	10	0 (II)	normal	23	DIG	10.78	-	10.41	-	09.61	83
[103]-EBROG-17b	32.7	12920	60	200	1	5	10	0 (II)	normal	23	DIG	10.04	-				
[103]-EBROG-18a	26.7	25300	30	200	1	5	10	0 (II)	normal	23	DIG	08.19	79	07.20	78	07.42	224
[103]-EBROG-18b	26.7	25300	30	200	1	5	10	0 (II)	normal	23	DIG	06.21	76				
[103]-EBROG-19a	48.1	25300	30	200	1	5	10	0 (II)	normal	23	DIG	08.56	76	07.59	74	07.08	193
[103]-EBROG-19b	48.1	25300	30	200	1	5	10	0 (II)	normal	23	DIG	06.61	72				
[103]-EBROG-20a	36.5	25300	50	200	1	5	10	0 (II)	normal	23	DIG	11.10	-	10.95	-	11.01	95
[103]-EBROG-20b	36.5	25300	50	200	1	5	10	0 (II)	normal	23	DIG	10.81	-				
[103]-EBROG-21a	45.3	25300	60	200	1	5	10	0 (II)	normal	23	DIG	10.71	-	10.98	-	12.41	82
[103]-EBROG-21b	45.3	25300	60	200	1	5	10	0 (II)	normal	23	DIG	11.25	-				
[103]-EBROG-22a	39.1	39100	30	200	1	5	10	0 (II)	normal	23	DIG	10.53	114	09.32	101	08.64	213
[103]-EBROG-22b	39.1	39100	30	200	1	5	10	0 (II)	normal	23	DIG	08.12	87				
[103]-EBROG-23a	22.7	39100	40	200	1	5	10	0 (II)	normal	23	DIG	10.41	61	10.95	79	11.49	137
[103]-EBROG-23b	22.7	39100	40	200	1	5	10	0 (II)	normal	23	DIG	11.48	97				
[103]-EBROG-24a	26.7	39100	60	200	1	5	10	0 (II)	normal	23	DIG	13.98	-	14.76	-	15.55	98
[103]-EBROG-24b	26.7	39100	60	200	1	5	10	0 (II)	normal	23	DIG	15.54	-				

Table A1. (Continued)

Specimen	f_c (MPa)	FRP		Groove			α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]		
		E_{ftf} (MPa)	b_f (mm)	L_f (mm)	nu.	b_g (mm)					d_g (mm)	P_{max} (kN)	L_c (mm)	$P_{max,ave}$ (kN)	$L_{c,ave}$ (mm)	P_{max} (kN)	L_c (mm)
[103]-EBROG-25a	32.7	39100	60	200	1	5	10	0 (II)	normal	23	DIG	18.18	110	16.64	91	15.30	93
[103]-EBROG-25b	32.7	39100	60	200	1	5	10	0 (II)	normal	23	DIG	15.10	72				
[103]-EBROG-26a	26.7	78200	30	200	1	5	10	0 (II)	normal	23	DIG	10.61	-	10.93	-	11.92	251
[103]-EBROG-26b	26.7	78200	30	200	1	5	10	0 (II)	normal	23	DIG	11.25	-				
[103]-EBROG-27a	26.7	78200	50	200	1	5	10	0 (II)	normal	23	DIG	22.66	-	20.58	-	18.13	115
[103]-EBROG-27b	26.7	78200	50	200	1	5	10	0 (II)	normal	23	DIG	18.49	-				
[103]-EBROG-28a	48.2	78200	60	200	1	5	10	0 (II)	normal	23	DIG	19.09	-	19.24	-	19.84	90
[103]-EBROG-28b	48.2	78200	60	200	1	5	10	0 (II)	normal	23	DIG	19.40	-				
[103]-EBROG-29a	48.1	12920	30	200	1	10	10	0 (II)	normal	23	DIG	05.95	-	05.41	-	05.46	75
[103]-EBROG-29b	48.1	12920	30	200	1	10	10	0 (II)	normal	23	DIG	04.87	-				
[103]-EBROG-30a	22.7	12920	40	200	1	10	10	0 (II)	normal	23	DIG	07.68	61	07.68	68	07.38	84
[103]-EBROG-30b	22.7	12920	40	200	1	10	10	0 (II)	normal	23	DIG	07.67	75				
[103]-EBROG-31a	48.2	12920	50	200	1	10	10	0 (II)	normal	23	DIG	09.50	69	08.51	60	08.30	68
[103]-EBROG-31b	48.2	12920	50	200	1	10	10	0 (II)	normal	23	DIG	07.53	51				
[103]-EBROG-32a	32.7	12920	60	200	1	10	10	0 (II)	normal	23	DIG	10.10	-	10.51	-	09.83	74
[103]-EBROG-32b	32.7	12920	60	200	1	10	10	0 (II)	normal	23	DIG	10.92	-				
[103]-EBROG-33a	45.3	12920	60	200	1	10	10	0 (II)	normal	23	DIG	08.72	82	09.10	72	09.58	69
[103]-EBROG-33b	45.3	12920	60	200	1	10	10	0 (II)	normal	23	DIG	09.47	62				
[103]-EBROG-34a	37.9	25300	40	200	1	10	10	0 (II)	normal	23	DIG	09.87	65	09.58	59	09.40	79
[103]-EBROG-34b	37.9	25300	40	200	1	10	10	0 (II)	normal	23	DIG	09.35	53				
[103]-EBROG-34c	37.9	25300	40	200	1	10	10	0 (II)	normal	23	DIG	09.51	-				
[103]-EBROG-35a	26.7	25300	50	200	1	10	10	0 (II)	normal	23	DIG	12.06	-	12.68	-	11.55	85
[103]-EBROG-35b	26.7	25300	50	200	1	10	10	0 (II)	normal	23	DIG	13.30	-				
[103]-EBROG-36a	28.1	25300	50	200	1	10	10	0 (II)	normal	23	DIG	11.81	-	11.57	-	11.50	84
[103]-EBROG-36b	28.1	25300	50	200	1	10	10	0 (II)	normal	23	DIG	11.34	-				
[103]-EBROG-37a	47.9	25300	60	200	1	10	10	0 (II)	normal	23	DIG	13.91	84	12.67	78	12.64	72
[103]-EBROG-37b	47.9	25300	60	200	1	10	10	0 (II)	normal	23	DIG	11.43	72				
[103]-EBROG-38a	39.1	39100	30	200	1	10	10	0 (II)	normal	23	DIG	09.72	54	08.72	59	08.84	88
[103]-EBROG-38b	39.1	39100	30	200	1	10	10	0 (II)	normal	23	DIG	07.72	63				
[103]-EBROG-39a	22.7	39100	40	200	1	10	10	0 (II)	normal	23	DIG	10.74	120	10.96	99	11.76	94
[103]-EBROG-39b	22.7	39100	40	200	1	10	10	0 (II)	normal	23	DIG	11.18	78				
[103]-EBROG-40a	47.9	39100	40	200	1	10	10	0 (II)	normal	23	DIG	09.63	75	10.42	72	11.07	78
[103]-EBROG-40b	47.9	39100	40	200	1	10	10	0 (II)	normal	23	DIG	11.20	68				

Specimen	f_c (MPa)	FRP			Groove			α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]	
		E_{fr} (MPa)	b_f (mm)	L_f (mm)	nu.	b_g (mm)	d_g (mm)					P_{max} (kN)	L_c (mm)	$P_{max,ave}$ (kN)	$L_{c,ave}$ (mm)	P_{max} (kN)	L_c (mm)
[103]-EBROG-41a	30.8	39100	50	200	1	10	10	0 (II)	normal	23	DIG	13.16	-	13.21	-	13.71	85
[103]-EBROG-41b	30.8	39100	50	200	1	10	10	0 (II)	normal	23	DIG	13.27	-	-	-	-	-
[103]-EBROG-42a	36.5	39100	50	200	1	10	10	0 (II)	normal	23	DIG	14.07	86	14.45	79	13.52	82
[103]-EBROG-42b	36.5	39100	50	200	1	10	10	0 (II)	normal	23	DIG	14.84	72	-	-	-	-
[103]-EBROG-43a	26.7	39100	60	200	1	10	10	0 (II)	normal	23	DIG	16.47	82	15.31	85	15.91	87
[103]-EBROG-43b	26.7	39100	60	200	1	10	10	0 (II)	normal	23	DIG	14.14	88	-	-	-	-
[103]-EBROG-44a	26.7	78200	30	200	1	10	10	0 (II)	normal	23	DIG	14.21	103	12.93	88	12.19	104
[103]-EBROG-44b	26.7	78200	30	200	1	10	10	0 (II)	normal	23	DIG	11.64	72	-	-	-	-
[103]-EBROG-45a	48.1	78200	30	200	1	10	10	0 (II)	normal	23	DIG	12.77	102	11.49	89	11.63	90
[103]-EBROG-45b	48.1	78200	30	200	1	10	10	0 (II)	normal	23	DIG	10.20	75	-	-	-	-
[103]-EBROG-46a	37.9	78200	40	200	1	10	10	0 (II)	normal	23	DIG	15.55	-	16.06	-	15.10	89
[103]-EBROG-46b	37.9	78200	40	200	1	10	10	0 (II)	normal	23	DIG	16.56	-	-	-	-	-
[103]-EBROG-47a	26.7	78200	50	200	1	10	10	0 (II)	normal	23	DIG	20.03	-	20.15	-	18.55	95
[103]-EBROG-47b	26.7	78200	50	200	1	10	10	0 (II)	normal	23	DIG	20.27	-	-	-	-	-
[103]-EBROG-48a	47.9	78200	50	200	1	10	10	0 (II)	normal	23	DIG	16.34	89	16.71	80	17.70	82
[103]-EBROG-48b	47.9	78200	50	200	1	10	10	0 (II)	normal	23	DIG	17.08	71	-	-	-	-
[103]-EBROG-49a	48.2	78200	60	200	1	10	10	0 (II)	normal	23	DIG	20.09	89	19.05	71	20.30	81
[103]-EBROG-49b	48.2	78200	60	200	1	10	10	0 (II)	normal	23	DIG	18.01	52	-	-	-	-
[103]-EBROG-50a	27.0	12920	30	200	1	10	15	0 (II)	normal	23	DIG	05.46	-	05.77	-	05.56	194
[103]-EBROG-50b	27.0	12920	30	200	1	10	15	0 (II)	normal	23	DIG	06.07	-	-	-	-	-
[103]-EBROG-51a	37.9	12920	40	200	1	10	15	0 (II)	normal	23	DIG	06.67	97	07.43	88	06.89	104
[103]-EBROG-51b	37.9	12920	40	200	1	10	15	0 (II)	normal	23	DIG	08.19	79	-	-	-	-
[103]-EBROG-52a	27.1	12920	60	200	1	10	15	0 (II)	normal	23	DIG	11.11	-	10.56	-	09.70	86
[103]-EBROG-52b	27.1	12920	60	200	1	10	15	0 (II)	normal	23	DIG	10.02	-	-	-	-	-
[103]-EBROG-53a	36.9	12920	60	200	1	10	15	0 (II)	normal	23	DIG	10.21	103	10.12	94	09.46	80
[103]-EBROG-53b	36.9	12920	60	200	1	10	15	0 (II)	normal	23	DIG	10.03	85	-	-	-	-
[103]-EBROG-54a	45.3	12920	60	200	1	10	15	0 (II)	normal	23	DIG	09.25	60	09.12	53	09.31	76
[103]-EBROG-54b	45.3	12920	60	200	1	10	15	0 (II)	normal	23	DIG	08.98	46	-	-	-	-
[103]-EBROG-55a	39.1	25300	30	200	1	10	15	0 (II)	normal	23	DIG	07.16	-	07.26	-	07.15	189
[103]-EBROG-55b	39.1	25300	30	200	1	10	15	0 (II)	normal	23	DIG	07.35	-	-	-	-	-
[103]-EBROG-56a	27.1	25300	50	200	1	10	15	0 (II)	normal	23	DIG	11.60	87	11.02	96	11.21	100
[103]-EBROG-56b	27.1	25300	50	200	1	10	15	0 (II)	normal	23	DIG	10.68	104	-	-	-	-

Table A1. (Continued)

Specimen	f _c (MPa)	FRP			Groove			α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]	
		E _{ftf} (MPa)	b _f (mm)	L _f (mm)	nu.	b _g (mm)	d _g (mm)					P _{max} (kN)	L _e (mm)	P _{max,ave} (kN)	L _{e,ave} (mm)	P _{max} (kN)	L _e (mm)
[103]-EBROG-56c	27.1	25300	50	200	1	10	15	0 (II)	normal	23	DIG	10.74	98				
[103]-EBROG-56d	27.1	25300	50	200	1	10	15	0 (II)	normal	23	DIG	11.04	-				
[103]-EBROG-57a	28.1	25300	60	200	1	10	15	0 (II)	normal	23	DIG	14.34	-	13.69	-	12.82	91
[103]-EBROG-57b	28.1	25300	60	200	1	10	15	0 (II)	normal	23	DIG	13.03	-				
[103]-EBROG-58a	26.7	39100	30	200	1	10	15	0 (II)	normal	23	DIG	08.39	-	08.82	-	08.86	217
[103]-EBROG-58b	26.7	39100	30	200	1	10	15	0 (II)	normal	23	DIG	09.24	-				
[103]-EBROG-59a	22.7	39100	40	200	1	10	15	0 (II)	normal	23	DIG	09.61	-	10.98	-	11.43	133
[103]-EBROG-59b	22.7	39100	40	200	1	10	15	0 (II)	normal	23	DIG	12.35	-				
[103]-EBROG-60a	27.1	39100	50	200	1	10	15	0 (II)	normal	23	DIG	12.09	109	13.01	103	13.46	105
[103]-EBROG-60b	27.1	39100	50	200	1	10	15	0 (II)	normal	23	DIG	13.72	97				
[103]-EBROG-60c	27.1	39100	50	200	1	10	15	0 (II)	normal	23	DIG	13.23	-				
[103]-EBROG-61a	45.3	39100	60	200	1	10	15	0 (II)	normal	23	DIG	14.93	65	14.94	83	14.82	85
[103]-EBROG-61b	45.3	39100	60	200	1	10	15	0 (II)	normal	23	DIG	14.95	101				
[103]-EBROG-62a	26.7	78200	30	200	1	10	15	0 (II)	normal	23	DIG	11.25	-	11.00	-	11.85	233
[103]-EBROG-62b	26.7	78200	30	200	1	10	15	0 (II)	normal	23	DIG	10.74	-				
[103]-EBROG-63a	27.1	78200	40	200	1	10	15	0 (II)	normal	23	DIG	14.77	-	15.83	-	15.07	136
[103]-EBROG-63b	27.1	78200	40	200	1	10	15	0 (II)	normal	23	DIG	16.88	-				
[103]-EBROG-64a	37.9	78200	40	200	1	10	15	0 (II)	normal	23	DIG	15.77	92	16.71	101	14.67	125
[103]-EBROG-64b	37.9	78200	40	200	1	10	15	0 (II)	normal	23	DIG	17.65	110				
[103]-EBROG-65a	28.1	78200	60	200	1	10	15	0 (II)	normal	23	DIG	19.26	76	20.01	84	20.60	102
[103]-EBROG-65b	28.1	78200	60	200	1	10	15	0 (II)	normal	23	DIG	20.76	92				
[103]-EBROG-66a	36.5	78200	60	200	1	10	15	0 (II)	normal	23	DIG	18.99	-	20.39	-	20.17	96
[103]-EBROG-66b	36.5	78200	60	200	1	10	15	0 (II)	normal	23	DIG	21.79	-				
[103]-EBR-1a	27.1	12920	30	200	-	-	-	0 (II)	normal	23	DIG	03.90	42	04.04	43	05.20	-
[103]-EBR-1b	27.1	12920	30	200	-	-	-	0 (II)	normal	23	DIG	04.18	44				
[103]-EBR-2a	27.1	78200	30	200	-	-	-	0 (II)	normal	23	DIG	09.39	-	08.58	-	11.08	-
[103]-EBR-2b	27.1	78200	30	200	-	-	-	0 (II)	normal	23	DIG	07.78	-				
[103]-EBR-3a	26.7	39100	40	200	-	-	-	0 (II)	normal	23	DIG	08.46	90	08.17	91	10.56	-
[103]-EBR-3b	26.7	39100	40	200	-	-	-	0 (II)	normal	23	DIG	07.88	92				
[103]-EBR-4a	27.1	12920	60	200	-	-	-	0 (II)	normal	23	DIG	07.41	48	07.67	55	09.08	-
[103]-EBR-4b	27.1	12920	60	200	-	-	-	0 (II)	normal	23	DIG	07.92	62				

Table A1. (Continued)

Specimen	f _c (MPa)	FRP		Groove				α (deg.)	Condition	Tem. (°C)	Failure mode	Experimental results				models [103,105]	
		E _{fr} (MPa)	b _f (mm)	L _f (mm)	nu.	b _g (mm)	d _g (mm)					P _{max} (kN)	L _e (mm)	P _{max,ave} (kN)	L _{e,ave} (mm)	P _{max} (kN)	L _e (mm)
[103]-EBR-5a	26.7	78200	60	200	-	-	-	0 (II)	normal	23	DIG	14.66	98	14.63	98	19.37	-
[103]-EBR-5b	26.7	78200	60	200	-	-	-	0 (II)	normal	23	DIG	14.59	-	-	-	-	-
[103]-EBR-6a	36.9	39100	30	200	-	-	-	0 (II)	normal	23	DIG	06.09	69	06.48	76	08.08	-
[103]-EBR-6b	36.9	39100	30	200	-	-	-	0 (II)	normal	23	DIG	06.86	82	-	-	-	-
[103]-EBR-7a	36.9	25300	40	200	-	-	-	0 (II)	normal	23	DIG	08.11	70	07.18	67	08.57	-
[103]-EBR-7b	36.9	25300	40	200	-	-	-	0 (II)	normal	23	DIG	06.26	64	-	-	-	-
[103]-EBR-8a	36.9	39100	60	200	-	-	-	0 (II)	normal	23	DIG	13.43	52	14.74	50	14.11	-
[103]-EBR-8b	36.9	39100	60	200	-	-	-	0 (II)	normal	23	DIG	16.04	48	-	-	-	-
[103]-EBR-9a	47.9	25300	60	200	-	-	-	0 (II)	normal	23	DIG	09.48	74	09.31	73	11.51	-
[103]-EBR-9b	47.9	25300	60	200	-	-	-	0 (II)	normal	23	DIG	09.13	71	-	-	-	-
[107]-EBROG-1a	41.80	241500	50	300	2	10	10	Prestressing force (kN)= 100.0			DFG	79.10	-	81.10	-	-	-
[107]-EBROG-1b	41.80	241500	50	300	2	10	10	Prestressing force (kN)= 101.9			DFG	83.10	-	-	-	-	-
[107]-EBR-1a	41.80	241500	50	300	-	-	-	Prestressing force (kN)= 051.8			DC	39.20	-	34.40	-	-	-
[107]-EBR-b	41.80	241500	50	300	-	-	-	Prestressing force (kN)= 048.8			DC	29.60	-	-	-	-	-
[95]-EBROG-1a	masonry	31178	48	100	2	5	10	0 (II)	normal	23	DIG	14.23	-	14.45	-	-	-
[95]-EBROG-1b	masonry	31178	48	100	2	5	10	0 (II)	normal	23	DIG	14.66	-	-	-	-	-
[95]-EBROG-2a	masonry	31178	48	200	2	5	10	0 (II)	normal	23	DIG	14.71	-	15.23	-	-	-
[95]-EBROG-2b	masonry	31178	48	200	2	5	10	0 (II)	normal	23	DIG	15.84	-	-	-	-	-
[95]-EBROG-3a	masonry	31178	48	100	2	10	10	0 (II)	normal	23	DIG	13.72	-	14.31	-	-	-
[95]-EBROG-3b	masonry	31178	48	100	2	10	10	0 (II)	normal	23	DIG	14.89	-	-	-	-	-
[95]-EBR-1a	masonry	31178	48	100	-	-	-	0 (II)	normal	23	DIG	08.48	-	09.14	-	-	-
[95]-EBR-1b	masonry	31178	48	100	-	-	-	0 (II)	normal	23	DIG	09.80	-	-	-	-	-
[95]-EBR-2a	masonry	31178	48	200	-	-	-	0 (II)	normal	23	DIG	10.66	-	11.18	-	-	-
[95]-EBR-2b	masonry	31178	48	200	-	-	-	0 (II)	normal	23	DIG	11.69	-	-	-	-	-

Note: nu= number of grooves; FRP= FRP rupture; DC=debonding in concrete; DIG= debonding in at FRP-adhesive interface over groove; CSF=concrete shear fracture; DI=debonding at FRP-adhesive interface; DFG= deep failure in groove; CF=cohesion failure