Electronic Supplementary Materials
For https://doi.org/10.1631/jzus.A2000245

Application of an interpretable artificial neural network to predict the interface strength of a near-surface mounted fiber-reinforced polymer to concrete joint

Miao SU, Hui PENG, Shao-fan LI

Table S1 Experiment database of NSM CFRP to concrete joint

Reference	No.	Input feature									Output	Data
		L_b (mm)	t_f (mm)	h_f (mm)	E_f (MPa)	f_c (MPa)	h_c (mm)	w_g (mm)	h_g (mm)	a_e (mm)	P_u (kN)	
Peng et al. (2015)	1	250	2	16	131000	11.85	150	10	30	70	59	Train
	2	250	2	16	131000	31.6	150	10	30	70	63	Train
	3	250	2	16	131000	47.4	150	10	30	70	56	Train
	4	250	4.5	16	131000	11.85	150	10	30	70	68	Train
	5	250	4.5	16	131000	31.6	150	10	30	70	74	Train
	6	250	4.5	16	131000	47.4	150	10	30	70	88	Train
	7	80	2	16	131000	31.6	150	10	30	70	31	Train
	8	120	2	16	131000	31.6	150	10	30	70	41	Test
	9	160	2	16	131000	31.6	150	10	30	70	57	Test
	10	200	2	16	131000	31.6	150	10	30	70	55	Train
	11	250	2	16	131000	31.6	150	10	30	70	63	Train
	12	320	2	16	131000	31.6	150	10	30	70	63	Train
	13	400	2	16	131000	31.6	150	10	30	70	56	Train
	14	80	4.5	16	131000	31.6	150	10	30	70	37	Train
	15	120	4.5	16	131000	31.6	150	10	30	70	54	Train
	16	160	4.5	16	131000	31.6	150	10	30	70	60	Train
	17	200	4.5	16	131000	31.6	150	10	30	70	59	Train
	18	240	4.5	16	131000	31.6	150	10	30	70	84	Train
	19	250	4.5	16	131000	31.6	150	10	30	70	76	Train
	20	320	4.5	16	131000	31.6	150	10	30	70	100	Train
	21	400	4.5	16	131000	31.6	150	10	30	70	104	Train
	22	450	4.5	16	131000	31.6	150	10	30	70	134	Train
	23	250	2	16	131000	31.6	150	10	30	20	40	Train
	24	250	2	16	131000	31.6	150	10	30	40	54	Train
	25	250	2	16	131000	31.6	150	10	30	60	62	Train
	26	250	4.5	16	131000	31.6	150	10	30	20	48	Train
	27	250	4.5	16	131000	31.6	150	10	30	40	68	Test
	28	250	4.5	16	131000	31.6	150	10	30	60	73	Train
Peng et al. (2019b)	29	300	2	16	131000	23.7	150	10	30	70	55	Train
	30	300	2	16	131000	47.4	150	10	30	70	54	Train
Peng et al. (2019a)	31	280	4	16	131000	15.8	220	15	30	92.5	64	Train
	32	280	4	16	131000	23.7	220	15	30	92.5	80	Train
	33	280	4	16	131000	31.6	220	15	30	92.5	80	Train
	34	280	4	16	131000	39.5	220	15	30	92.5	92	Test
	35	280	4	16	131000	47.4	220	15	30	92.5	88	Train
	36	280	4	16	131000	31.6	220	15	30	92.5	80	Train
	37	280	4	16	131000	31.6	220	25	30	87.5	74	Train
	38	280	4	16	131000	31.6	220	35	30	82.5	70	Test
	39	280	4	16	131000	31.6	220	15	30	30	32	Train
	40	280	4	16	131000	31.6	220	15	30	40	46	Train
	41	280	4	16	131000	31.6	220	15	30	50	68	Train
	42	280	4	16	131000	31.6	220	15	30	60	56	Train
	43	280	4	16	131000	31.6	220	15	30	70	74	Train
	44	280	4	16	131000	31.6	220	15	30	80	72	Train
	45	280	4	16	131000	31.6	220	15	30	90	88	Test
	46	280	4	16	131000	31.6	220	15	30	52.5	56	Test
	47	280	4	16	131000	31.6	220	15	30	67.5	58	Train
	48	280	4	16	131000	31.6	220	15	30	82.5	76	Train

To be continued

Continued

	49	280	4	16	131000	31.6	220	15	30	92.5	80	Train
Peng et al. (2019a)	50	280	4	16	131000	31.6	220	15	30	92.5	62	Train
	51	280	4	16	131000	31.6	220	15	30	92.5	80	Train
	52	280	4	16	131000	31.6	220	15	30	92.5	74	Test
Chen (2012)	53	250	2	16	131000	15.8	150	10	30	70	59	Train
	54	250	4.5	16	131000	15.8	150	10	30	70	58	Train
	55	250	2	16	131000	31.6	150	10	30	70	63	Test
	56	250	4.5	16	131000	31.6	150	10	30	70	74	Test
	57	250	2	16	131000	47.4	150	10	30	70	56	Train
	58	250	4.5	16	131000	47.4	150	10	30	70	88	Train
	59	250	2	16	131000	31.6	150	10	30	70	63	Train
	60	250	2	16	131000	31.6	150	20	30	70	56	Train
	61	250	2	16	131000	31.6	150	30	30	70	57	Train
	62	250	4.5	16	131000	31.6	150	10	30	70	72	Train
	63	250	4.5	16	131000	31.6	150	20	30	70	90	Test
	64	250	4.5	16	131000	31.6	150	30	30	70	78	Test
	65	250	2	16	131000	31.6	150	10	30	20	40	Train
	66	250	2	16	131000	31.6	150	10	30	40	54	Train
	67	250	2	16	131000	31.6	150	10	30	60	59	Train
	68	250	4.5	16	131000	31.6	150	10	30	20	48	Train
	69	250	4.5	16	131000	31.6	150	10	30	40	68	Train
	70	250	4.5	16	131000	31.6	150	10	30	60	73	Train
	71	80	2	16	131000	31.6	150	15	30	67.5	31	Train
	72	120	2	16	131000	31.6	150	15	30	67.5	41	Train
	73	160	2	16	131000	31.6	150	15	30	67.5	57	Train
	74	200	2	16	131000	31.6	150	15	30	67.5	55	Test
	75	250	2	16	131000	31.6	150	15	30	67.5	56	Train
	76	320	2	16	131000	31.6	150	15	30	67.5	63	Train
	77	400	2	16	131000	31.6	150	15	30	67.5	56	Train
	78	80	4.5	16	131000	31.6	150	15	30	67.5	37	Train
	79	120	4.5	16	131000	31.6	150	15	30	67.5	54	Train
	80	160	4.5	16	131000	31.6	150	15	30	67.5	60	Train
	81	200	4.5	16	131000	31.6	150	15	30	67.5	59	Test
	82	240	4.5	16	131000	31.6	150	15	30	67.5	84	Train
	83	250	4.5	16	131000	31.6	150	15	30	67.5	76	Train
	84	320	4.5	16	131000	31.6	150	15	30	67.5	100	Train
Sun (2017)	85	280	4	16	131000	15.8	220	15	30	92.5	84	Train
	86	280	4	16	131000	23.7	220	15	30	92.5	80	Train
	87	280	4	16	131000	31.6	220	15	30	92.5	80	Train
	88	280	4	16	131000	39.5	220	15	30	92.5	92	Train
	89	280	4	16	131000	47.4	220	15	30	92.5	88	Train
	90	280	4	16	131000	31.6	220	15	30	92.5	74	Test
	91	280	4	16	131000	31.6	220	25	30	87.5	74	Test
	92	280	4	16	131000	31.6	220	35	30	82.5	70	Train
	93	280	4	16	131000	31.6	220	15	30	30	32	Test
	94	280	4	16	131000	31.6	220	15	30	40	46	Test
	95	280	4	16	131000	31.6	220	15	30	50	68	Test
	96	280	4	16	131000	31.6	220	15	30	60	54	Train
	97	280	4	16	131000	31.6	220	15	30	70	74	Train
	98	280	4	16	131000	31.6	220	15	30	80	74	Train
	99	280	4	16	131000	31.6	220	15	30	90	72	Train
Mo (2016)	100	240	2	16	131000	15.8	220	10	30	70	50	Train
	101	240	2	16	131000	23.7	220	10	30	70	48	Test
	102	240	2	16	131000	31.6	220	10	30	70	54	Test

To be continued

Continued

Mo (2016)	103	240	2	16	131000	39.5	220	10	30	70	58	Train
	104	240	2	16	131000	47.4	220	10	30	70	60	Train
	105	240	2	16	131000	31.6	220	10	30	70	54	Train
	106	240	2	16	131000	31.6	220	20	30	65	60	Train
	107	240	2	16	131000	31.6	220	30	30	60	62	Train
	108	240	2	16	131000	31.6	220	10	30	30	56	Train
	109	240	2	16	131000	31.6	220	10	30	40	59	Train
	110	240	2	16	131000	31.6	220	10	30	50	62	Train
	111	240	2	16	131000	31.6	220	10	30	60	62	Train
	112	240	2	16	131000	31.6	220	10	30	70	64	Train
Li et al. (2005)	113	30	4	16	131000	23.2	150	8	20	71	14.8	Train
	114	100	4	16	131000	23.2	150	8	20	71	36.3	Train
	115	150	4	16	131000	23.2	150	8	20	71	46.1	Train
Shield et al. (2005)	116	152	2	16	131000	64.5	152	6.4	19	98	73.4	Train
	117	305	2	16	131000	60	152	6.4	19	226	60.5	Train
	118	305	2	16	131000	60	152	6.4	19	226	62.5	Train
	119	305	2	16	131000	60	162	6.4	19	226	60.5	Train
Seracino et al. (2007a)	120	100	1.2	10	161800	30	180	3.2	11	148	22.6	Test
	121	100	1.22	10	161800	30	180	3.2	11	148	20.4	Train
	122	150	1.23	10.3	161800	30	180	3.2	11.3	148	23.2	Train
	123	200	1.22	10.5	161800	30	180	3.2	11.5	148	27.9	Train
	124	250	1.22	10.3	161800	30	180	3.2	11.3	148	26.6	Train
	125	300	1.22	10.4	161800	30	180	3.2	11.4	148	26	Test
	126	350	1.22	10.4	161800	30	180	3.2	11.4	148	23	Test
	127	200	1.27	10.3	161800	41.8	180	3.3	11.3	148	30.6	Train
	128	100	1.2	20	162300	30	180	3.2	21	148	51.4	Train
	129	200	1.2	20	162300	30	180	3.2	21	148	57.8	Train
	130	300	1.2	20	162300	30	180	3.2	21	148	66.7	Train
	131	200	2.88	10.1	144600	64.8	180	4.9	11.1	148	45	Train
	132	200	2.97	19.8	162300	64.8	180	5	20.8	148	108.8	Test
	133	200	1.24	10.2	161800	52.8	180	3.2	11.2	148	31.9	Train
	134	200	1.3	10.4	161800	53	180	3.3	11.4	148	34	Train
	135	100	1.25	20.2	162300	53	180	3.3	21.2	148	63.8	Train
	136	200	1.26	15.7	162050	33.4	180	3.3	16.7	148	47.5	Train
	137	300	1.26	15.3	162050	33.4	180	3.3	16.3	148	51.6	Test
	138	200	2.9	10	144600	64.8	180	4.9	11	148	45.1	Train
	139	200	1.2	20	162300	33.4	180	3.2	21	148	60.7	Test
Seracino et al. (2007b)	140	350	2.76	12.4	146348	36.7	180	4.8	13.4	148	59.2	Train
	141	350	4.24	12.5	134467	36.7	180	6.2	13.5	147	54.1	Train
	142	350	5.73	12.4	130489	36.7	180	7.7	13.4	146	47.6	Train
	143	350	4.33	24.1	141434	36.7	180	6.3	25.1	147	130	Test
	144	350	12	12	131566	36.7	180	14	13	143	85.9	Train
	145	350	7.3	30.6	134562	36.7	180	9.3	31.6	145	165.3	Train
	146	350	20.6	25.3	129837	36.7	180	22.6	26.3	139	199.4	Train
Rashid et al. (2008)	147	350	1.4	20	161000	35.5	180	3	20.8	60	59.2	Test
	148	350	1.4	20	161000	35.5	180	3	20.8	85	75.7	Train
	149	350	1.4	20	161000	35.5	180	3	20.8	150	63	Train
	150	350	2.4	40	173000	35.5	180	3	40.8	150	205.1	Test
	151	350	1.4	20	161000	35.5	180	3	20.8	147	61.2	Test
	152	350	1.4	20	161000	35.5	180	3	20.8	147	64.8	Train
Oehlers et al. (2008)	153	350	3.6	10	150000	38.8	180	5.6	11	147	40	Train
	154	350	3.6	10	160000	38.8	180	5.6	11	147	39.2	Train
	155	350	3.6	10	165000	38.8	180	5.6	21	147	61.8	Test
	156	350	6	10	166000	38.8	180	8	11	146	54.8	Train

To be continued

Continued

Oehlers et al. (2008)	157	350	6	10	165000	38.8	180	8	21	146	86.1	Train
	158	350	6	10	169000	38.8	180	8	31	146	136	Train
	159	350	6	10	160000	38.8	180	8	26	146	89.8	Train
	160	350	6	10	161000	38.8	180	8	36	146	117	Train
	161	350	6	10	160000	38.8	180	8	41	146	129.9	Test
	162	350	6	10	154000	38.8	180	8	51	146	130.6	Train
Perera et al. (2009)	163	230	2	16	151000	71.1	220	6	20	52	50.8	Train

Note: L_b is the bond length, t_f is the thickness of CFRP strip, h_f is the height of CFRP strip, E_f is the elastic modulus of CFRP strip, f_c is the cylinder compressive strength of concrete, h_c is the height of concrete, w_g is the width of groove, h_g is the height of groove, a_e is edge distance of concrete block, and P_u is the tested bond capacity of the joint.

References

Chen JM, 2012. Study of the Bond Performance Between CFRP Strips and Concrete in NSM Reinforcement. MS Thesis, Changsha University of Science & Technology, Changsha, China (in Chinese).

Li R, Teng JG, Yue QR, 2005. Experimental study on bond behavior of NSM CFRP strips-concrete interface. *Industrial Construction*, 35(8):31-34 (in Chinese). https://doi.org/10.3321/j.issn:1000-8993.2005.08.007

Mo YX, 2016. The Test Research of NSM CFRP and Concrete Interface Bond-slip Model. MS Thesis, Changsha University of Science & Technology, Changsha, China (in Chinese).

Oehlers DJ, Haskett M, Wu CQ, et al., 2008. Embedding NSM FRP plates for improved IC debonding resistance. *Journal of Composites for Construction*, 12(6):635-642. https://doi.org/10.1061/(asce)1090-0268(2008)12:6(635)

Peng H, Hao HX, Zhang JR, et al., 2015. Experimental investigation of the bond behavior of the interface between near-surface-mounted CFRP strips and concrete. *Construction and Building Materials*, 96:11-19. https://doi.org/10.1016/j.conbuildmat.2015.07.156

Peng H, Chou JX, Sun Y, et al., 2019a. Bond behavior of near-surface-mounted CFRP to concrete structure. *China Journal of Highway and Transport*, 32(12):156-166 (in Chinese). https://doi.org/10.19721/j.cnki.1001-7372.2019.12.016

Peng H, Liu Y, Cai CS, et al., 2019b. Experimental investigation of bond between near-surface-mounted CFRP strips and concrete under freeze-thawing cycling. *Journal of Aerospace Engineering*, 32(1):04018125. https://doi.org/10.1061/(asce)as.1943-5525.0000937

Perera K, Ibell T, Darby A, 2019. Bond behaviour and effectiveness of various shapes of NSM CFRP bars. Proceedings of the 9th International Symposium on Fiber-reinforced Polymers Reinforcement for Concrete Structures.

Rashid R, Oehlers DJ, Seracino R, 2008. IC debonding of FRP NSM and EB retrofitted concrete: plate and cover interaction tests. *Journal of Composites for Construction*, 12(2):160-167. https://doi.org/10.1061/(asce)1090-0268(2008)12:2(160)

Seracino R, Jones NM, Ali SM, et al., 2007a. Bond strength of near-surface mounted FRP strip-to-concrete joints. *Journal of Composites for Construction*, 11(4):401-409. https://doi.org/10.1061/(asce)1090-0268(2007)11:4(401)

Seracino R, Saifulnaz MRR, Oehlers DJ, 2007b. Generic debonding resistance of EB and NSM plate-to-concrete joints. *Journal of Composites for Construction*, 11(1):62-70. https://doi.org/10.1061/(asce)1090-0268(2007)11:1(62)

Shield C, French C, Milde E, 2005. The effect of adhesive type on the bond of NSM tape to concrete. Proceedings of the 7th International Symposium on Fiber-Reinforced Polymer (FRP) Reinforcment for Concrete Structures, p.355-372.

Sun Y, 2017. Theoretical Analysis on Interface Characteristics of NSM CFRP Strips to Concrete. MS Thesis, Changsha University of Science & Technology, Changsha, China (in Chinese).