

## **APPENDIX B**

### **Mix Proportion and Chemical Composition**

Table B.1 Details of the Mix Proportions of Tangtermsirikul and Nipatsat (1999)

Mix	Cement (kg/m <sup>3</sup> )	Fly Ash (kg/m <sup>3</sup> )	Water (kg/m <sup>3</sup> )	Sand (kg/m <sup>3</sup> )	Gravel (kg/m <sup>3</sup> )	w/b
gl.15c4	338.69	0	135.48	835.15	1141.12	0.40
gl.15c6	264.86	0	158.92	835.15	1141.12	0.60
gl.15r2w4	260.39	65.1	130.2	835.15	1141.12	0.40
gl.15r2w6	205.38	51.34	154.03	835.15	1141.12	0.60
gl.15r4w4	187.97	125.31	125.31	835.15	1141.12	0.40
gl.15r4w6	149.44	99.62	149.44	835.15	1141.12	0.60
gl.15r6w4	120.78	181.17	120.78	835.15	1141.12	0.40
gl.15r6w6	96.74	145.11	145.11	835.15	1141.12	0.60

Remark : This mix proportion is cured at 30, 50 and 65°C by controlling  $\gamma = 1.15$

Mix	Cement (kg/m <sup>3</sup> )	Fly Ash (kg/m <sup>3</sup> )	Water (kg/m <sup>3</sup> )	Sand (kg/m <sup>3</sup> )	Gravel (kg/m <sup>3</sup> )	w/b
gl.29c4	381.62	0	152.65	800.71	1094.07	0.40
gl.29c6	298.43	0	179.06	800.71	1094.07	0.60
gl.29r2w4	293.4	73.35	146.7	800.71	1094.07	0.40
gl.29r2w6	231.41	57.85	173.55	800.71	1094.07	0.60
gl.29r4w4	211.79	141.2	141.2	800.71	1094.07	0.40
gl.29r4w6	168.38	112.25	168.38	800.71	1094.07	0.60
gl.29r6w4	136.09	204.13	136.09	800.71	1094.07	0.40
gl.29r6w6	109	163.5	163.5	800.71	1094.07	0.60

Remark : This mix proportion is cured at 30, 50 and 65°C by controlling  $\gamma = 1.29$

Chemical Composition (%)	Tangtermsirikul and Nipatsat	
	Fly Ash	Cement
CaO	8.28	64.63
SiO <sub>2</sub>	45.88	20.99
Al <sub>2</sub> O <sub>3</sub>	26.20	5.18
Fe <sub>2</sub> O <sub>3</sub>	10.94	3.20
MgO	2.83	1.30
SO <sub>3</sub>	1.04	2.61
Na <sub>2</sub> O	0.90	0.04
K <sub>2</sub> O	2.78	0.40

Table B.2 Details of the Mix Proportions of Tangtermsirikul and Nipatsat (1998)

Mix	Cement (kg/m <sup>3</sup> )	Fly Ash (kg/m <sup>3</sup> )	Water (kg/m <sup>3</sup> )	Sand (kg/m <sup>3</sup> )	Gravel (kg/m <sup>3</sup> )	w/b	f <sub>c</sub> (7)	f <sub>c</sub> (28)	f <sub>c</sub> (91)
N1	168.12	112.08	168.12	794.69	1090.03	0.60	7.90	13.27	14.65
N2	108.29	162.44	162.44	794.69	1090.03	0.60	3.91	9.50	13.17
N3	187.09	124.73	155.91	794.69	1090.03	0.50	15.91	23.49	29.29
N4	120.05	180.07	150.06	794.69	1090.03	0.50	6.75	15.11	23.40
N5	169.85	113.23	169.85	794.69	1090.03	0.60	9.20	12.80	20.89
N6	109.91	164.87	164.87	794.69	1090.03	0.60	7.03	11.61	16.79
N7	76.96	179.56	102.61	863.05	1183.80	0.40	4.99	13.19	24.43
N8	77.87	181.69	129.78	863.05	1183.80	0.50	3.68	9.20	18.48
N9	69.48	162.12	138.96	863.05	1183.80	0.60	2.73	5.87	13.07

Chemical Composition (%)	Tangtermsirikul and Nipatsat	
	Fly Ash	Cement
CaO	12.17	65.1
SiO <sub>2</sub>	42.53	19.9
Al <sub>2</sub> O <sub>3</sub>	22.85	5.9
Fe <sub>2</sub> O <sub>3</sub>	12.51	3.1
MgO	3.54	1.00
SO <sub>3</sub>	1.75	2.80
Na <sub>2</sub> O	1.00	0.11
K <sub>2</sub> O	2.54	0.66

Table B.3 Details of the Mix Proportions of Sujjavanich (1998)

Mix	Cement (kg/m <sup>3</sup> )	Fly Ash (kg/m <sup>3</sup> )	Water (kg/m <sup>3</sup> )	Sand (kg/m <sup>3</sup> )	Gravel (kg/m <sup>3</sup> )	Temp (°C)	w/b	γ
g1.54w0.4T30	480	0	192	713.7	948.6	30	0.40	1.54
g1.65w0.45T30	480	0	216	652.8	948.6	30	0.45	1.65
g1.75w0.5T30	480	0	240	591.8	948.6	30	0.50	1.75
g1.54w0.4T40	480	0	192	713.7	948.6	40	0.40	1.54
g1.65w0.45T40	480	0	216	652.8	948.6	40	0.45	1.65
g1.75w0.5T40	480	0	240	591.8	948.6	40	0.50	1.75
g1.54w0.4T60	480	0	192	713.7	948.6	60	0.40	1.54
g1.65w0.45T60	480	0	216	652.8	948.6	60	0.45	1.65
g1.75w0.5T60	480	0	240	591.8	948.6	60	0.50	1.75

Chemical Composition (%)	Cement
CaO	65.10
SiO <sub>2</sub>	19.90
Al <sub>2</sub> O <sub>3</sub>	5.90
Fe <sub>2</sub> O <sub>3</sub>	3.10
MgO	1.00
SO <sub>3</sub>	2.80
Na <sub>2</sub> O	0.11
K <sub>2</sub> O	0.66

Table B.4 Details of the Mix Proportions of Tahir (1998)

Mix	Cement (kg/m <sup>3</sup> )	Fly Ash (kg/m <sup>3</sup> )	Water (kg/m <sup>3</sup> )	Sand (kg/m <sup>3</sup> )	Gravel (kg/m <sup>3</sup> )	w/b	$\gamma$
ta28w40	280	0	112	770	1260	0.4	0.91
ta28w50	280	0	140	720	1240	0.5	1.01
ta28w60	280	0	170	700	1200	0.6	1.1
ta35w40	350	0	140	700	1200	0.4	1.1
ta35w50	350	0	175	675	1160	0.5	1.19
ta35w60	350	0	210	630	1110	0.6	1.33
ta40w40	400	0	160	670	1170	0.4	1.19
ta40w50	400	0	20	640	1120	0.5	1.3
ta40w60	400	0	240	610	1050	0.6	1.45
ta45w40	450	0	180	635	1100	0.4	1.34
ta45w50	450	0	225	600	1040	0.5	1.48
ta45w60	450	0	270	530	1010	0.6	1.63

Chemical Composition (%)	Cement
CaO	65.10
SiO <sub>2</sub>	19.90
Al <sub>2</sub> O <sub>3</sub>	5.90
Fe <sub>2</sub> O <sub>3</sub>	3.10
MgO	1.00
SO <sub>3</sub>	2.80
Na <sub>2</sub> O	0.11
K <sub>2</sub> O	0.66

Table B.5 Details of the Mix Proportions of Deatpan (1999)

Mix	Cement (kg/m <sup>3</sup> )	Fly Ash (kg/m <sup>3</sup> )	Water (kg/m <sup>3</sup> )	Sand (kg/m <sup>3</sup> )	Gravel (kg/m <sup>3</sup> )	w/b	$\gamma$
g1.1w/c0.4	299.75	0	119.9	863.05	1225.34	0.4	1.1
g1.1w/c0.6	234.41	0	140.65	863.05	1225.34	0.6	1.1
g1.3w/c0.35	383.51	0	134.23	817.48	1160.63	0.35	1.3
g1.3w/c0.5	313.14	0	156.57	817.48	1160.63	0.5	1.3
g1.3w/c0.65	264.61	0	172	817.48	1160.63	0.65	1.3
g1.5w/c0.4	413.82	0	165.53	771.91	1095.93	0.4	1.5
g1.5w/c0.6	323.61	0	194.17	771.91	1095.93	0.6	1.5

Chemical Composition (%)	Cement
CaO	65.10
SiO <sub>2</sub>	19.90
Al <sub>2</sub> O <sub>3</sub>	5.90
Fe <sub>2</sub> O <sub>3</sub>	3.10
MgO	1.00
SO <sub>3</sub>	2.80
Na <sub>2</sub> O	0.11
K <sub>2</sub> O	0.66

Table B.6 Details of the Mix Proportions of RCC of Sribua-Iaum (1996)

Mix	Cement (kg/m <sup>3</sup> )	Fly Ash (kg/m <sup>3</sup> )	Water (kg/m <sup>3</sup> )	Sand (kg/m <sup>3</sup> )	Gravel (kg/m <sup>3</sup> )	w/b	f(91) (Mpa)
A308a	52.24	209	78.36	807.4	1095	0.30	27.5
A308b	58.05	232.2	87.07	807.4	1095	0.30	33.9
A308c	59.21	236.8	88.81	807.4	1095	0.30	40.5
A308d	60.95	243.8	91.42	807.4	1095	0.30	40.6
A308e	63.85	255.4	95.78	807.4	1095	0.30	39.1
A368a	48.53	194.1	87.35	807.4	1095	0.36	22.3
A368b	53.92	215.7	97.06	807.4	1095	0.36	28.3
A368c	55	220	99	807.4	1095	0.36	29.7
A368d	56.62	226.5	101.9	807.4	1095	0.36	27.2
A368e	59.31	237.3	106.8	807.4	1095	0.36	26
A365a	131.05	131.1	94.35	807.4	1095	0.36	59
A365b	145.61	145.6	104.8	807.4	1095	0.36	63.1
A365c	148.52	148.5	106.9	807.4	1095	0.36	69.6
A365d	152.89	152.9	110.1	807.4	1095	0.36	68.1
A365e	160.17	160.2	115.3	807.4	1095	0.36	63.9
B355	157	157	109	807.4	1095	0.35	50.9
CC	400	0	180	760	1140	0.45	43.7
C300	376	0	112.8	807.4	1095	0.30	75.4
C302	281.85	70.46	105.7	807.4	1095	0.30	69.7
C304	198.79	132.5	99.4	807.4	1095	0.30	70.1
C306	125.07	187.6	93.81	807.4	1095	0.30	54.3
C308	59.21	236.8	88.81	807.4	1095	0.30	40.1
C320	364.34	0	116.6	807.4	1095	0.32	65.2
C322	273.55	68.39	109.4	807.4	1095	0.32	68.4
C324	193.28	128.9	103.1	807.4	1095	0.32	62
C326	121.79	182.7	97.44	807.4	1095	0.32	48.9
C328	57.74	230.9	92.38	807.4	1095	0.32	36.7
C360	342.83	0	123.4	807.4	1095	0.36	68.5
C362	258.34	64.58	116.3	807.4	1095	0.36	64.4
C364	183.12	122.1	109.9	807.4	1095	0.36	55.4
C366	115.73	173.6	104.2	807.4	1095	0.36	45.7
C368	55	220	99	807.4	1095	0.36	29.7
C400	323.72	0	129.5	807.4	1095	0.40	56.4
C402	244.73	61.18	122.4	807.4	1095	0.40	57
C404	173.97	116	116	807.4	1095	0.40	54.7
C406	110.23	165.4	110.2	807.4	1095	0.40	40.2
C408	52.51	210.1	105	807.4	1095	0.40	15.2

Chemical Composition (%)	Sribua-Iaum	
	Fly Ash	Cement
CaO	9.82	67.33
SiO <sub>2</sub>	42.45	21.45
Al <sub>2</sub> O <sub>3</sub>	22.51	5.35
Fe <sub>2</sub> O <sub>3</sub>	9.02	3.01
MgO	3.05	1.52
SO <sub>3</sub>	1.51	2.31
Na <sub>2</sub> O	0.18	0.11
K <sub>2</sub> O	2.53	0.33



Table B.7 Details of the Mix Proportions of SCC of Singhatiraj (1995)

Mix	Cement (kg/m <sup>3</sup> )	Fly Ash (kg/m <sup>3</sup> )	Water (kg/m <sup>3</sup> )	Sand (kg/m <sup>3</sup> )	Gravel (kg/m <sup>3</sup> )	w/b	f <sub>c</sub> (Mpa)
Sing1	219	219	148.92	1161	538.8	0.34	37.4
Sing2	279.5	279.5	150.93	889.6	695.3	0.27	66.1
Sing3	301.3	301.3	156.676	742	801	0.26	73.8
Sing4	218	218	174.4	1117	517.6	0.4	30.2
Sing5	312	312	168.48	717	775	0.27	77.2
Sing6	286.7	286.7	177.754	846.2	663.6	0.31	47

Chemical Composition (%)	Singhatiraj	
	Fly Ash	Cement
CaO	9.18	66.22
SiO <sub>2</sub>	41.14	21.16
Al <sub>2</sub> O <sub>3</sub>	23.35	5.09
Fe <sub>2</sub> O <sub>3</sub>	11.05	3.01
MgO	2.55	1.27
SO <sub>3</sub>	1.21	2.42
Na <sub>2</sub> O	0.53	0.04
K <sub>2</sub> O	2.71	0.25

Table B.8 Details of the Mix Proportions of SCC of Bui Khanh Van (1994)

Mix	Cement (kg/m <sup>3</sup> )	Fly Ash (kg/m <sup>3</sup> )	Water (kg/m <sup>3</sup> )	Sand (kg/m <sup>3</sup> )	Gravel (kg/m <sup>3</sup> )	w/b	f <sub>c</sub> (Mpa)
Van1	281	281	166.4	932	622	0.3	54.6
Van2	281	281	165.8	903	653	0.3	47.2
Van3	393	169	181.5	903	653	0.32	57.8
Van4	169	393	154	903	653	0.28	43.4
Van5	274	274	172	903	653	0.31	58.1
Van6	257	257	180	869	711	0.35	33.1

Chemical Composition (%)	Bui Khanh Van	
	Fly Ash	Cement
CaO	9.41	65.93
SiO <sub>2</sub>	39.12	21.14
Al <sub>2</sub> O <sub>3</sub>	22.33	5.52
Fe <sub>2</sub> O <sub>3</sub>	12.95	3.25
MgO	2.45	1.41
SO <sub>3</sub>	1.52	2.48
Na <sub>2</sub> O	0.68	0.1
K <sub>2</sub> O	2.57	0.37

Table B.9 Details of the Mix Proportions of SCC of Kim (1997)

Mix	Cement (kg/m <sup>3</sup> )	Fly Ash (kg/m <sup>3</sup> )	Water (kg/m <sup>3</sup> )	Sand (kg/m <sup>3</sup> )	Gravel (kg/m <sup>3</sup> )	w/b	f <sub>c</sub> (Mpa)
Kim1	390	167	195	814	733	0.35	47
Kim2	370	159	185	782	820	0.35	47
Kim3	350	150	175	739	917	0.35	46
Kim4	330	141	165	678	1032	0.35	37
Kim5	300	200	190	778	819	0.38	34
Kim6	350	0	185	775	1035	0.53	24
Kim7	400	0	175	760	1035	0.44	42
Kim8	500	0	175	677	1032	0.35	61

Chemical Composition (%)	Kim	
	Fly Ash	Cement
CaO	4.08	65.93
SiO <sub>2</sub>	57.19	21.14
Al <sub>2</sub> O <sub>3</sub>	23.07	5.52
Fe <sub>2</sub> O <sub>3</sub>	5.04	3.25
MgO	1.19	1.41
SO <sub>3</sub>	0.24	2.48
Na <sub>2</sub> O	0.73	0.1
K <sub>2</sub> O	0.89	0.37

Table B.10 Details of the Mix Proportions of Jin Choon Kim (1999)

Mix	Cement (kg/m <sup>3</sup> )	Fly Ash (kg/m <sup>3</sup> )	Water (kg/m <sup>3</sup> )	Sand (kg/m <sup>3</sup> )	Gravel (kg/m <sup>3</sup> )	SP	AEA mL/m <sup>3</sup>
K1	157	217	119	753	1127	5.0	392
K1R	154	214	118	740	1107	4.2	397
K2	154	213	118	737	1104	6.0	481
K2R	155	216	118	744	1115	4.5	401

Chemical Composition (%)	Jin Choon Kim		
	Cement	Fly Ash (F)	Fly Ash (C)
CaO	62.8	2.8	28.2
SiO <sub>2</sub>	20.6	40.7	33.9
Al <sub>2</sub> O <sub>3</sub>	4.0	17.9	19.4
Fe <sub>2</sub> O <sub>3</sub>	3.1	29.9	6.1
MgO	2.6	1.1	4.8
SO <sub>3</sub>	3.1	1.3	3.0
Na <sub>2</sub> O	-	0.7	1.9
K <sub>2</sub> O	-	1.6	0.4