



**FACULTY OF ENGINEERING
CHULALONGKORN UNIVERSITY
FIRE SAFETY RESEARCH CENTER**



- TYPE OF TEST** : DETERMINATION OF THE FIRE RESISTANCE OF NON-LOADBEARING ELEMENTS OF CONSTRUCTION
- TEST SPECIMEN** : SmartBoard
- The specimen is a 3m x 3m vertical construction consisting of a double layer of 2-1200 mm x 3000 mm x 12 mm and 1-600 mm x 3000 mm x 12 mm fibre reinforced cement flat sheets (SmartBoard) in a sandwich construction with 50 mm thick fiberglass (Hi-Temp) of 38 kg/m³ density in the middle. The fibre reinforced cement sheets were installed to the 3 m x 3 m testing frame using light lip channel sections C-75 x 45 x 15 x 2.3 mm as the frame edges and as the vertical studs with 0.6 m spacing. The SmartBoards were fixed to the light lip channel frame using 45 mm long screws. The details of the specimen are shown in Appendix B. The specimen was provided and installed by the client.
- CLIENT** : The Siam Fibre-Cement Co.,Ltd.
1 Siam Cement Road, Bangsue
Bangkok 10800
Thailand
- DATE OF TEST** : November 17, 2006
- TEST MACHINE** : Large-scale vertical furnace (Fire Tester III) at the Fire Safety Research Center, Department of Civil Engineering, Chulalongkorn University (Thailand). The furnace is capable of producing a standard temperature-time relationship according to several fire resistance standards including BS476 Part 20: 1987.
- TEST METHOD** : The testing procedures follow the British Standard BS 476: Fire tests on building materials and structures
- BS 476 Part 20: 1987 : Method for determination of the fire resistance of elements of construction (general principles)
- BS 476 Part 22: 1987 : Methods for determination of the fire resistance of non-loadbearing elements of construction Section 5: Determination of the fire resistance of partitions.
- TEST RESULTS** : The non-loadbearing element of construction described above has the fire resistance of each criterion for the period stated:
(The test results are good only for the specimen tested.)

Criteria	Fire Resistance (hr:min)	Remarks
Insulation	1:29	The maximum temperature of the unexposed face of the specimen exceeded 180 °C above its initial value of 34 °C.
Integrity	1:45	The test was terminated. No visible sign of damage or leak of the specimen and no passage of flame or gases hot enough to ignite the cotton pad.

Date: October 4, 2007

Tested by : 
(Assistant Prof. Dr. Thanyawat Pothisiri)


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(Assistant Prof. Dr. Chatpan Chintanapakdee)
On Behalf of Head of Civil Engineering Department

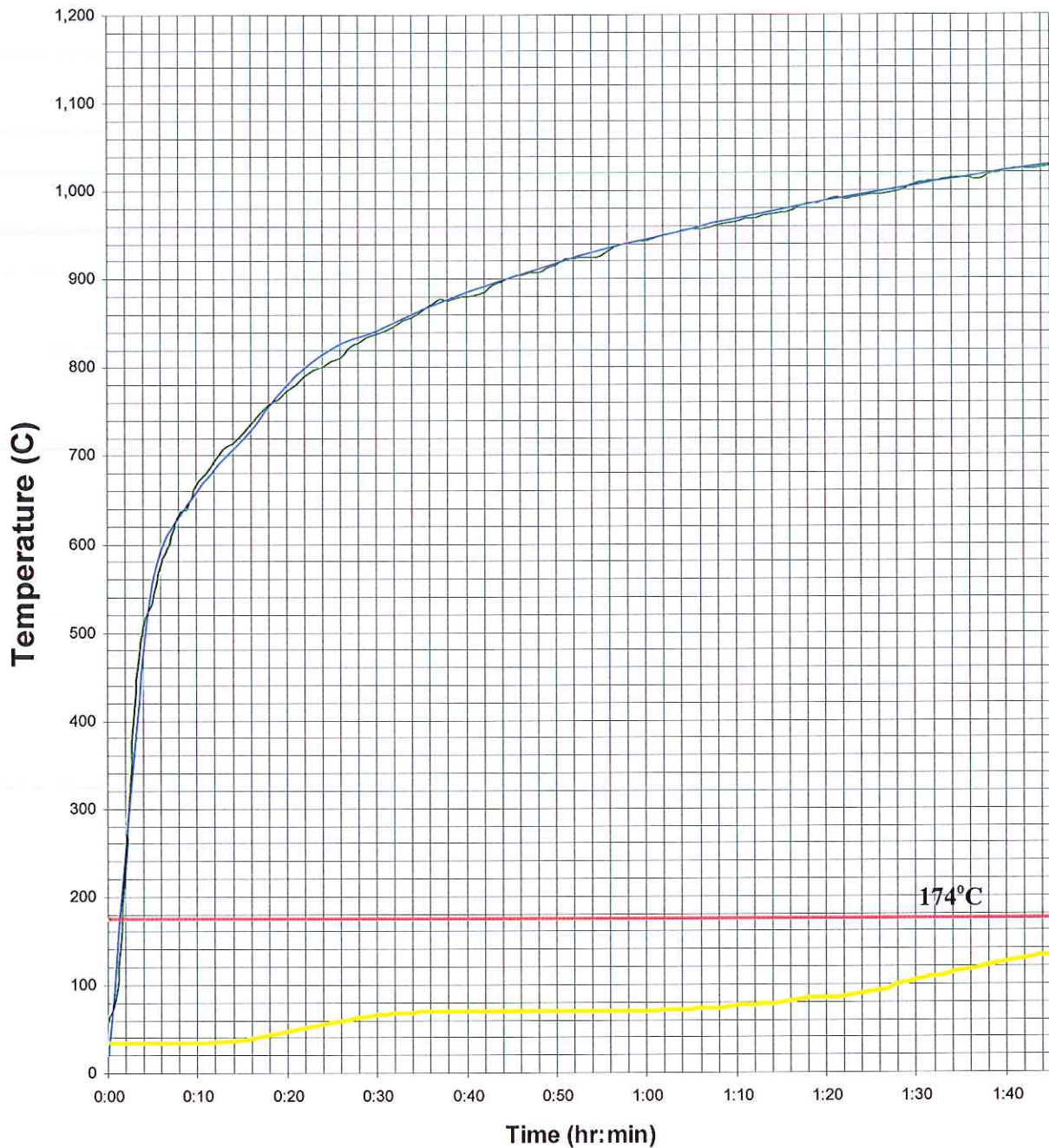

(Assistant Prof. Dr. Chadchart Sittipunt)



FACULTY OF ENGINEERING
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FIRE SAFETY RESEARCH CENTER



FURNACE TEMPERATURE



— Average Furnace Temperature — BS 476
— Average Specimen Temperature — Critical Temperature

(Mr. Sorawut Yanpirat)
Authorized Testing Officer

APPENDIX A: TEMPERATURE OF THE FURNACE AND THE SPECIMEN

Time (hr:min:sec)	Furnace Temperature(°C)										Time	BS 476
	P1	P2	P3	P4	P5	P6	P7	P8	P9	Average	(hr:min:sec)	(°C)
00:00:00	56	65	48	48	54	66	56	67	56	57	00:00:00	20
00:01:00	79	112	63	66	79	137	81	121	98	93	00:05:00	556
00:02:00	191	255	163	84	196	406	211	345	288	238	00:10:00	659
00:03:00	357	424	319	282	373	616	342	500	514	414	00:15:00	718
00:04:00	512	507	394	453	518	629	453	556	552	508	00:20:00	781
00:05:00	547	525	423	497	549	643	480	571	563	533	00:25:00	821
00:06:00	593	562	482	552	600	676	526	616	589	577	00:30:00	842
00:07:00	621	592	496	588	629	683	557	638	604	601	00:35:00	865
00:08:00	654	622	526	626	664	710	593	659	643	633	00:40:00	885
00:09:00	663	627	536	634	671	721	601	665	652	641	00:45:00	902
00:10:00	684	660	568	662	698	750	622	688	667	666	00:50:00	918
00:11:00	694	661	590	681	711	751	643	706	666	678	00:55:00	932
00:12:00	710	675	603	695	722	761	655	722	704	694	01:00:00	945
00:13:00	726	697	617	709	738	779	665	719	713	707	01:05:00	957
00:14:00	737	703	616	717	751	787	670	731	722	715	01:10:00	968
00:15:00	743	711	630	726	758	793	685	749	725	724	01:15:00	979
00:16:00	755	730	631	736	770	804	695	752	747	736	01:20:00	988
00:17:00	769	738	654	751	783	819	705	765	752	748	01:25:00	997
00:18:00	774	744	669	761	790	827	723	782	749	758	01:30:00	1006
00:19:00	781	756	669	764	796	827	729	774	772	763	01:35:00	1014
00:20:00	789	762	686	773	804	841	742	794	771	773	01:40:00	1022
00:21:00	799	767	689	783	811	841	748	794	786	780	01:45:00	1029
00:22:00	807	774	704	795	821	855	758	808	793	790		
00:23:00	814	784	716	803	828	864	765	820	785	798		
00:24:00	818	793	715	806	834	860	768	814	803	801		
00:25:00	823	792	714	809	836	865	775	824	823	807		
00:26:00	829	800	728	816	843	872	778	819	816	811		
00:27:00	841	810	739	831	854	881	791	833	827	823		
00:28:00	846	814	745	835	859	884	794	838	837	828		
00:29:00	850	821	758	842	864	899	806	845	825	834		
00:30:00	855	827	757	846	868	897	805	859	832	838		
00:31:00	859	830	767	849	872	897	813	852	828	841		
00:32:00	863	835	768	854	876	903	815	860	843	846		
00:33:00	871	842	780	864	883	910	820	868	841	853		
00:34:00	873	846	780	864	885	911	826	866	856	856		
00:35:00	882	853	785	870	891	916	831	874	862	863		
00:36:00	884	854	794	874	894	935	841	894	858	870		
00:37:00	900	858	809	879	900	935	847	890	868	876		
00:38:00	899	863	803	880	902	931	851	885	864	875		
00:39:00	898	875	801	883	904	930	853	882	881	879		
00:40:00	901	868	823	886	904	933	856	893	863	881		
00:41:00	900	872	810	888	905	937	861	884	883	882		
00:42:00	899	876	818	892	909	937	864	896	874	885		
00:43:00	905	900	821	896	914	945	868	895	896	893		
00:44:00	906	899	829	903	920	951	874	899	896	897		
00:45:00	915	900	835	916	928	951	876	913	887	902		
00:46:00	918	897	837	919	930	953	879	912	893	904		
00:47:00	922	896	852	922	928	949	882	918	892	907		
00:48:00	922	899	858	922	928	951	880	915	885	907		
00:49:00	928	903	857	926	932	958	884	929	889	912		
00:50:00	931	906	859	931	936	960	891	931	898	916		
00:51:00	940	908	867	936	942	964	895	940	905	922		
00:52:00	940	909	869	936	942	963	899	938	904	922		
00:53:00	941	912	872	938	943	966	904	931	908	924		
00:54:00	940	916	874	940	945	965	905	931	904	924		
00:55:00	944	914	874	941	947	967	909	930	914	927		
00:56:00	946	921	883	947	952	976	913	940	913	932		
00:57:00	950	925	885	952	957	983	922	942	923	937		
00:58:00	953	925	890	956	959	984	926	947	918	940		
00:59:00	958	928	895	959	963	985	927	947	922	943		
01:00:00	959	930	891	959	964	984	930	942	925	943		

(Mr. Sorawut Yanpirat)
Authorized Testing Officer

Time (hr:min:sec)	Furnace Temperature(°C)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	Average
01:01:00	961	934	898	961	966	986	932	945	932	946
01:02:00	964	937	904	965	968	989	935	946	931	949
01:03:00	964	941	906	966	971	992	939	957	933	952
01:04:00	965	940	909	969	973	995	940	963	931	954
01:05:00	967	946	905	970	975	996	945	960	937	956
01:06:00	967	945	906	972	976	997	948	962	940	957
01:07:00	970	944	914	975	978	997	947	960	944	959
01:08:00	972	946	915	975	979	1001	949	966	945	961
01:09:00	977	950	914	977	982	1000	952	968	949	963
01:10:00	976	951	918	980	984	1002	954	971	946	965
01:11:00	978	956	920	982	987	1007	958	971	955	968
01:12:00	977	956	922	984	988	1006	960	972	950	968
01:13:00	983	960	923	985	990	1007	962	973	958	971
01:14:00	986	959	927	988	992	1013	965	975	958	974
01:15:00	985	966	927	990	993	1013	967	977	958	975
01:16:00	988	964	929	990	994	1014	971	977	963	977
01:17:00	991	969	931	994	998	1020	975	982	968	981
01:18:00	994	973	941	1001	1003	1023	977	991	966	985
01:19:00	996	972	940	1002	1004	1020	976	992	970	986
01:20:00	1000	978	938	1002	1006	1027	981	991	971	988
01:21:00	1004	978	944	1005	1008	1029	984	998	973	991
01:22:00	1004	978	949	1004	1008	1026	983	992	971	991
01:23:00	1005	979	947	1006	1009	1027	984	993	976	992
01:24:00	1007	983	946	1007	1010	1028	985	994	976	993
01:25:00	1007	980	951	1008	1012	1030	988	998	976	994
01:26:00	1009	981	951	1010	1013	1033	989	997	981	996
01:27:00	1011	985	953	1013	1015	1033	991	1002	978	998
01:28:00	1014	981	954	1012	1016	1030	991	1000	983	998
01:29:00	1016	991	957	1017	1020	1039	996	1004	982	1002
01:30:00	1019	993	965	1023	1025	1041	998	1011	991	1007
01:31:00	1022	994	965	1025	1026	1045	999	1007	991	1008
01:32:00	1024	997	970	1027	1028	1041	998	1012	994	1010
01:33:00	1024	998	972	1027	1029	1045	998	1014	996	1011
01:34:00	1028	998	974	1029	1030	1051	1004	1015	997	1014
01:35:00	1030	1001	971	1029	1032	1049	1007	1014	997	1014
01:36:00	1030	999	975	1028	1031	1046	1004	1014	997	1014
01:37:00	1028	1000	974	1026	1030	1046	1004	1013	995	1013
01:38:00	1032	1002	979	1031	1032	1051	1007	1017	1001	1017
01:39:00	1035	1006	981	1034	1036	1052	1007	1019	1007	1020
01:40:00	1036	1008	982	1037	1039	1056	1011	1022	1008	1022
01:41:00	1041	1011	982	1038	1041	1058	1013	1024	1005	1024
01:42:00	1039	1013	983	1038	1040	1057	1014	1021	1007	1023
01:43:00	1037	1012	987	1038	1041	1055	1013	1026	1007	1024
01:44:00	1042	1018	988	1040	1043	1057	1014	1024	1008	1026
01:45:00	1042	1014	989	1040	1044	1059	1017	1024	1012	1027

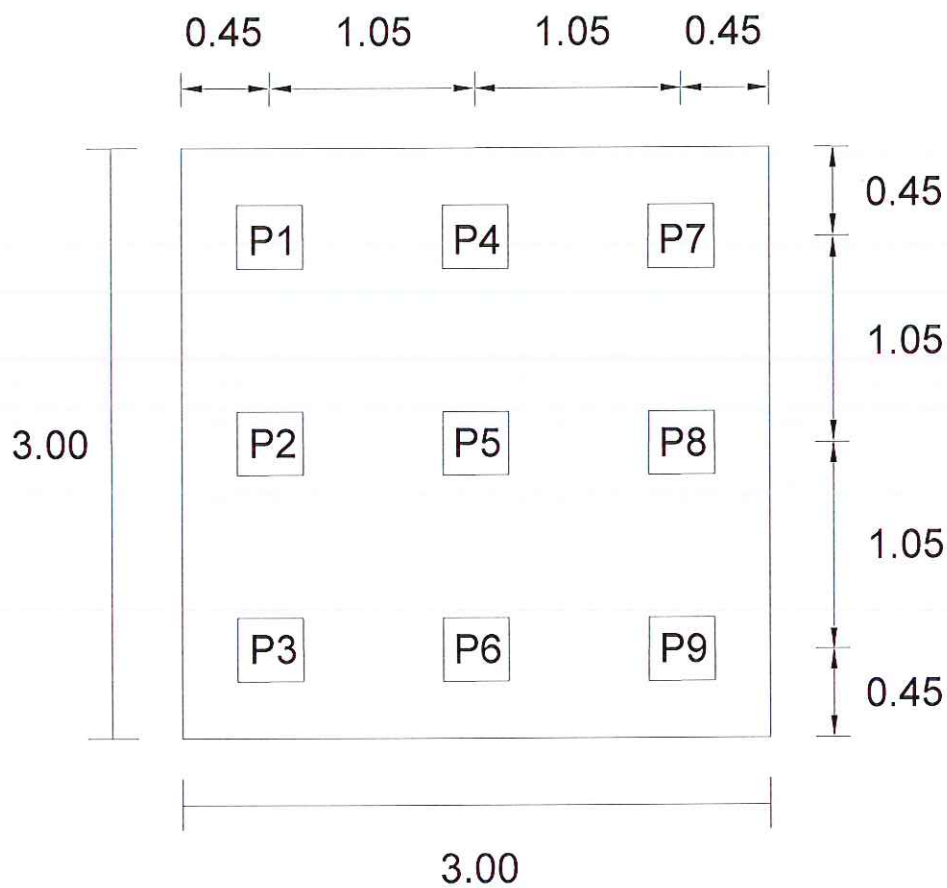
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 (Mr. Sorawut Yanpirat)
 Authorized Testing Officer

Time (hr:min:sec)	Specimen Temperature(°C)										Max. (A-I)	Average (A-E)
	A	B	C	D	E	F	G	H	I			
00:00:00	35	34	34	34	34	34	35	36	35	36	34	
00:05:00	35	34	34	34	34	34	35	36	35	36	34	
00:10:00	35	34	34	34	35	34	36	36	36	36	34	
00:15:00	38	35	40	38	38	35	98	47	43	98	38	
00:20:00	48	42	49	50	46	39	98	71	56	98	47	
00:25:00	56	52	57	60	65	45	96	81	66	96	58	
00:30:00	64	59	65	67	73	47	94	82	70	94	65	
00:31:00	64	59	65	67	73	47	94	82	70	94	65	
00:32:00	65	61	67	68	75	49	94	82	71	94	67	
00:33:00	67	62	68	69	75	49	93	82	71	93	68	
00:34:00	67	62	68	70	75	49	92	82	71	92	68	
00:35:00	68	63	69	70	75	49	92	82	71	92	69	
00:36:00	68	64	69	70	75	49	89	83	71	89	69	
00:37:00	68	64	69	71	75	50	85	83	72	85	70	
00:38:00	69	65	70	71	76	50	83	83	72	83	70	
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00:40:00	69	65	69	71	75	51	79	84	73	84	70	
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00:45:00	70	63	68	72	73	49	74	87	74	87	69	
00:46:00	70	63	68	72	73	48	73	87	74	87	69	
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00:54:00	71	62	68	72	71	46	71	92	78	92	69	
00:55:00	71	62	68	72	71	45	71	93	78	93	69	
00:56:00	72	62	68	72	71	45	71	94	79	94	69	
00:57:00	72	62	68	72	71	45	72	95	79	95	69	
00:58:00	73	62	69	72	72	45	72	96	80	96	69	
00:59:00	73	62	69	72	72	44	72	97	80	97	69	
01:00:00	73	62	68	73	71	44	71	98	80	98	69	

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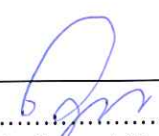
Time (hr:min:sec)	Specimen Temperature(°C)										Max. (A-I)	Average (A-E)
	A	B	C	D	E	F	G	H	I			
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01:02:00	74	63	69	73	72	44	72	100	81	100	70	
01:03:00	75	63	69	74	73	43	72	101	82	101	71	
01:04:00	75	63	69	74	73	43	73	103	82	103	71	
01:05:00	76	63	70	75	74	43	73	104	82	104	71	
01:06:00	76	64	70	76	74	43	73	106	83	106	72	
01:07:00	77	64	71	76	74	42	73	107	83	107	73	
01:08:00	78	65	73	77	75	42	73	109	84	109	73	
01:09:00	79	65	74	78	75	42	73	112	85	112	74	
01:10:00	80	66	76	78	76	42	73	114	85	114	75	
01:11:00	83	67	77	80	76	67	73	117	86	117	76	
01:12:00	83	67	78	81	76	74	73	119	86	119	77	
01:13:00	84	68	79	82	77	54	73	121	87	121	78	
01:14:00	84	68	80	84	77	48	73	124	87	124	79	
01:15:00	85	69	82	85	77	46	73	128	88	128	80	
01:16:00	85	70	87	86	78	45	74	131	89	131	81	
01:17:00	85	70	98	87	78	45	74	135	89	135	83	
01:18:00	85	71	101	87	78	45	74	140	91	140	85	
01:19:00	86	70	101	87	78	-	74	142	92	142	85	
01:20:00	86	71	102	88	78	-	75	146	92	146	85	
01:21:00	86	71	104	88	78	67	75	151	93	151	85	
01:22:00	86	71	108	88	79	55	76	155	94	155	86	
01:23:00	86	71	114	88	79	52	77	161	95	161	87	
01:24:00	86	72	121	88	79	50	78	167	96	167	89	
01:25:00	86	72	132	88	79	49	78	174	97	174	91	
01:26:00	86	72	141	88	79	49	79	181	98	181	93	
01:27:00	86	71	153	88	79	49	80	188	99	188	96	
01:28:00	86	72	170	88	80	49	80	196	101	196	99	
01:29:00	86	71	180	88	81	49	80	205	-	205	101	
01:30:00	87	71	198	89	81	49	81	217	-	217	105	
01:31:00	87	71	203	89	81	49	81	222	-	222	106	
01:32:00	87	72	213	89	81	49	81	232	-	232	108	
01:33:00	87	72	223	89	81	49	81	241	-	241	110	
01:34:00	88	72	237	89	81	50	81	253	-	253	113	
01:35:00	88	72	242	89	81	50	81	257	-	257	115	
01:36:00	89	72	251	90	81	50	82	266	-	266	117	
01:37:00	89	73	259	91	82	50	82	274	-	274	119	
01:38:00	90	74	274	92	82	50	82	286	-	286	123	
01:39:00	91	74	278	93	83	51	82	291	-	291	124	
01:40:00	91	75	285	95	83	52	82	299	-	299	126	
01:41:00	93	76	286	98	84	53	82	304	-	304	127	
01:42:00	94	77	285	101	85	54	83	307	-	307	128	
01:43:00	95	79	287	104	87	55	83	313	-	313	130	
01:44:00	96	81	289	105	88	56	83	317	-	317	132	
01:45:00	98	82	281	105	89	57	83	320	-	320	131	

(Mr. Sorawut Yanpirat)
Authorized Testing Officer



Unit in meters

Figure A-1: Details of the furnace


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Authorized Testing Officer

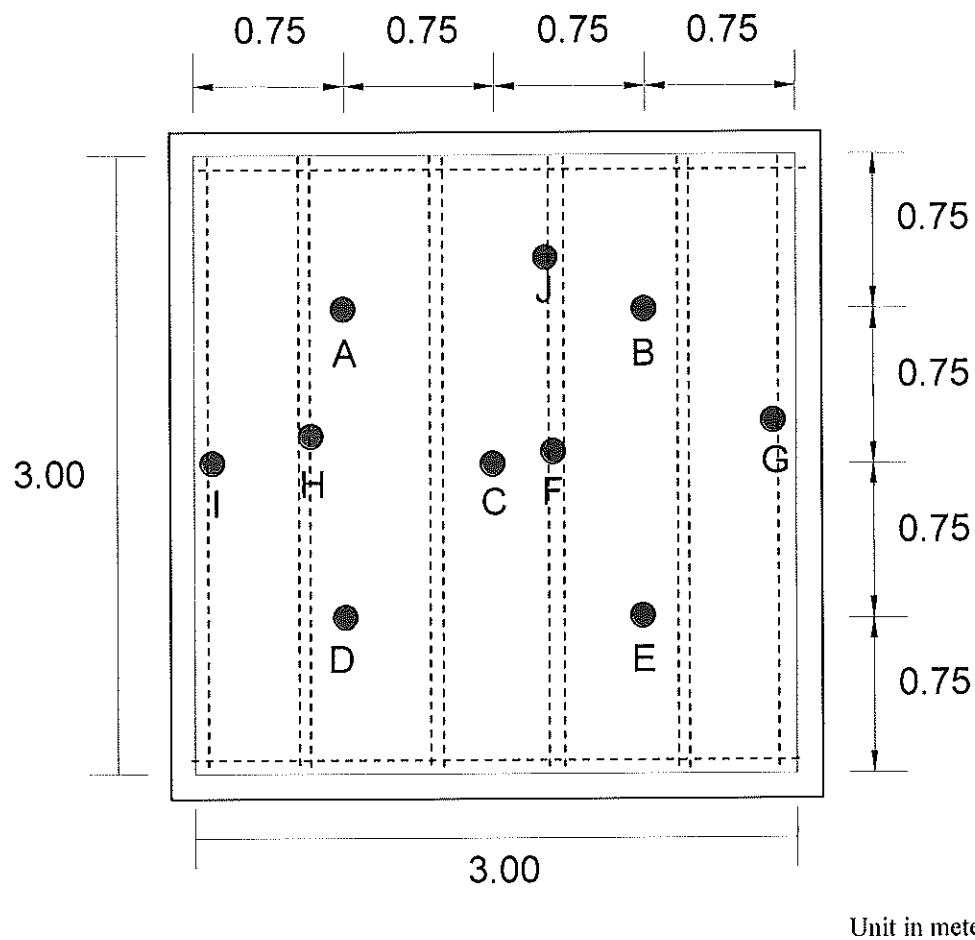


Figure A-2: Location of thermocouples on the specimen

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APPENDIX B: DETAILS OF THE SPECIMEN

SmartBoard
Fire Testing

Scale 1:25

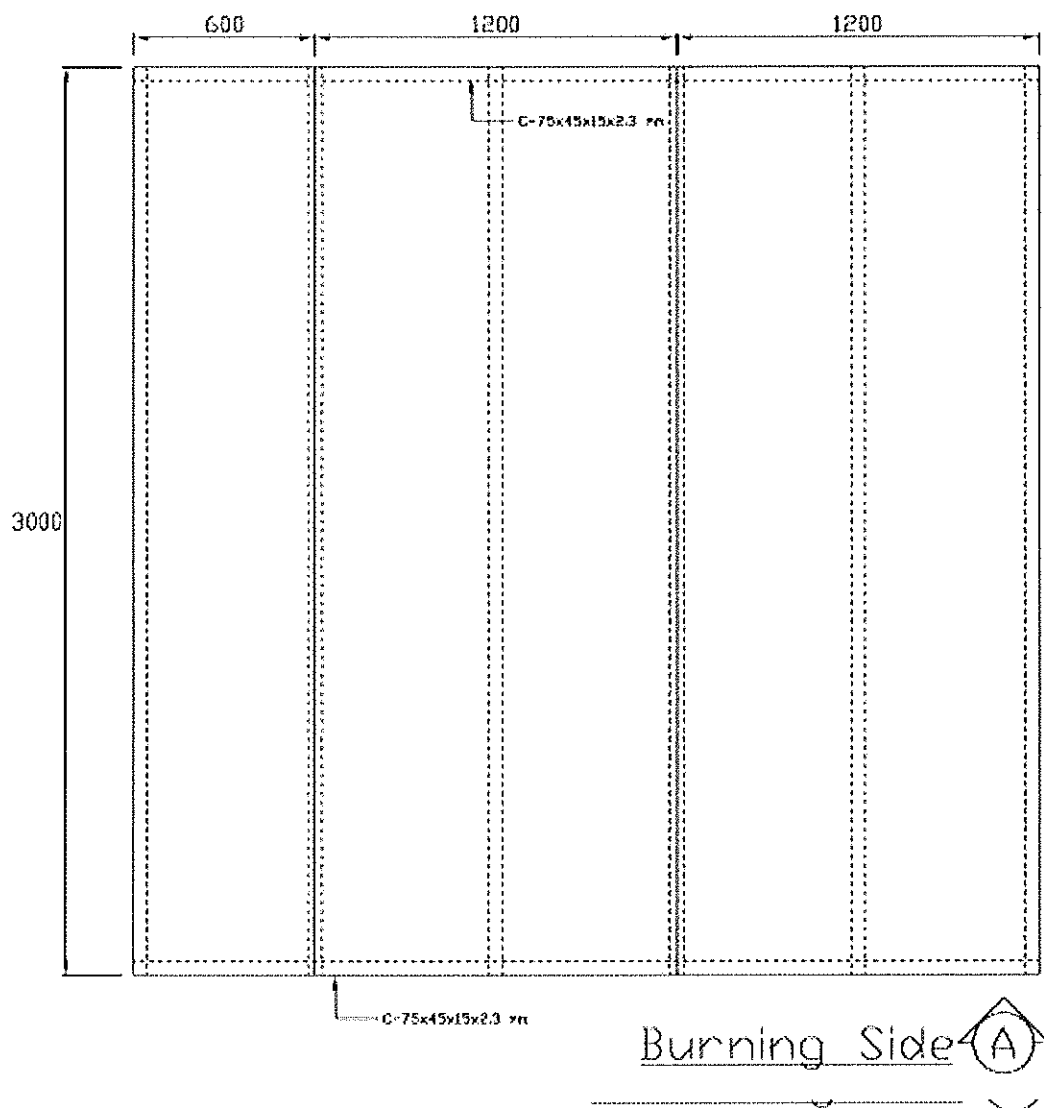


Figure B-1: Details of the specimen (as provided by the client)

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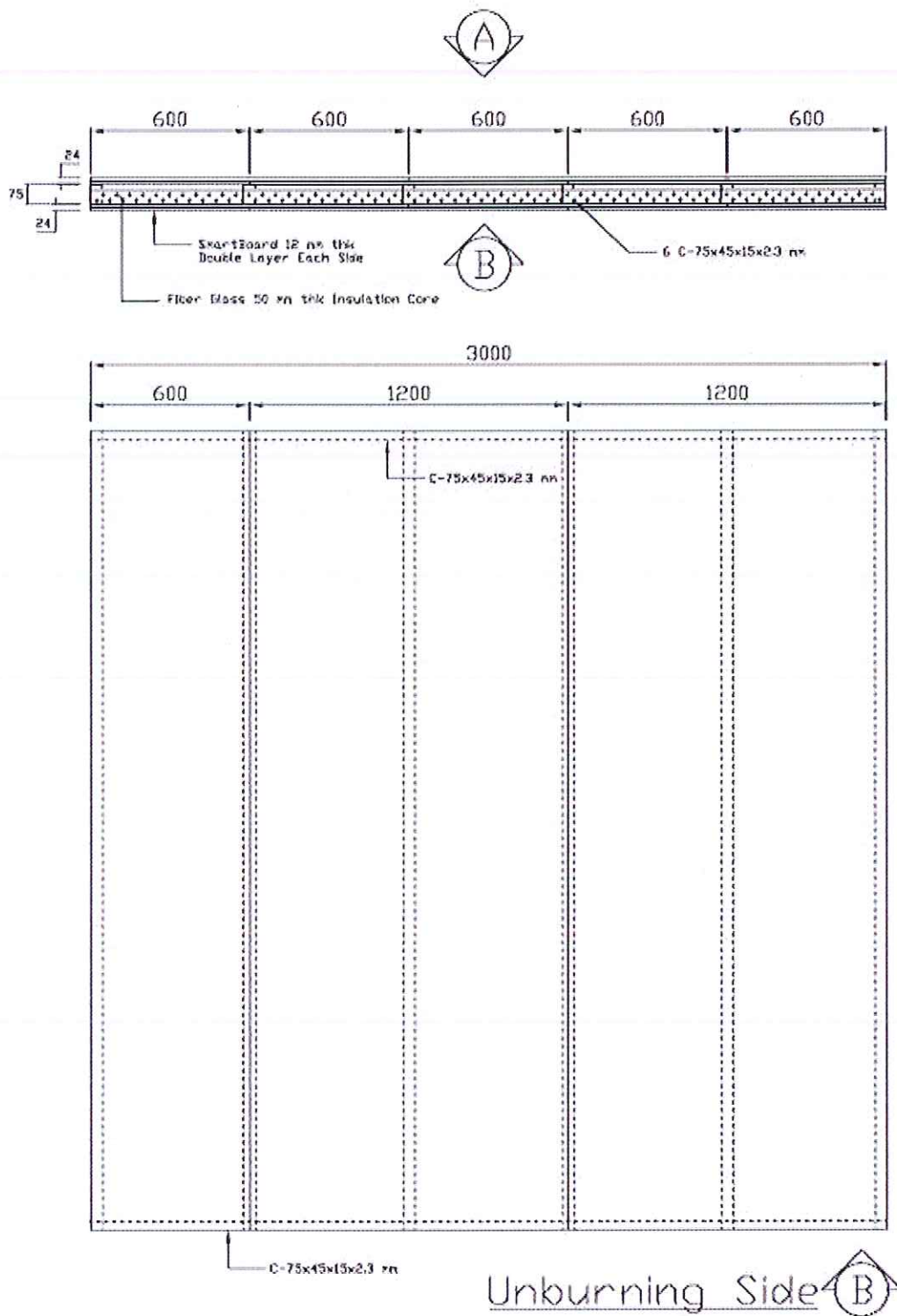
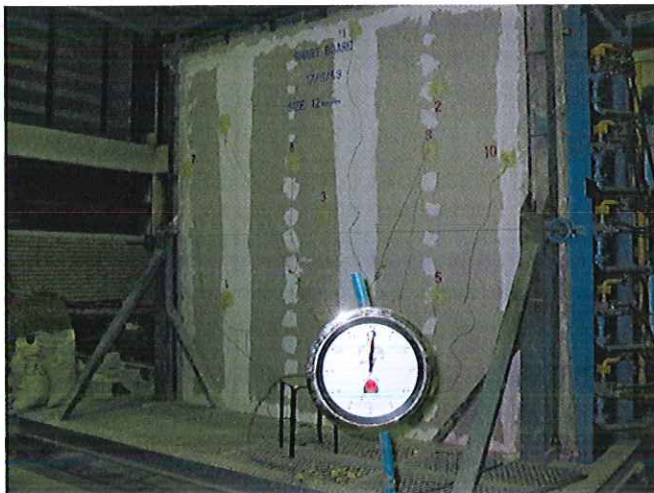


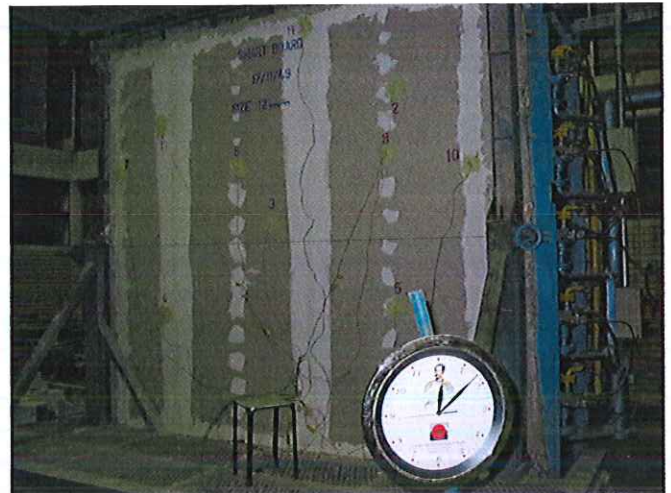
Figure B-1 (continued): Details of the specimen (as provided by the client)

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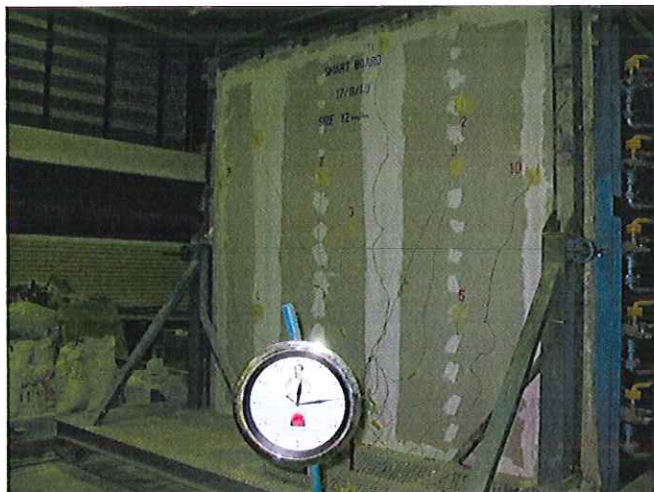
APPENDIX C: PHOTOGRAPHS



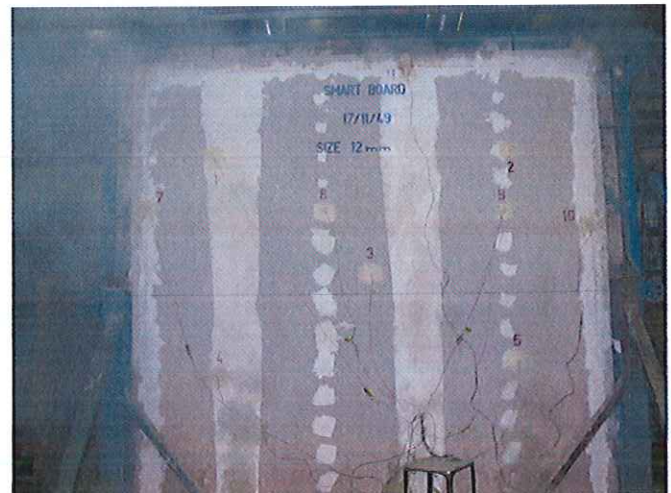
(a) 0:00 hr



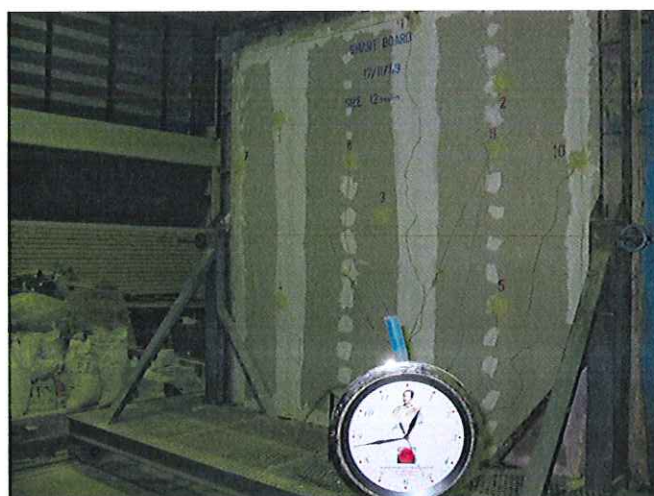
(b) 0:08 hr



(c) 0:14 hr



(d) 0:34 hr



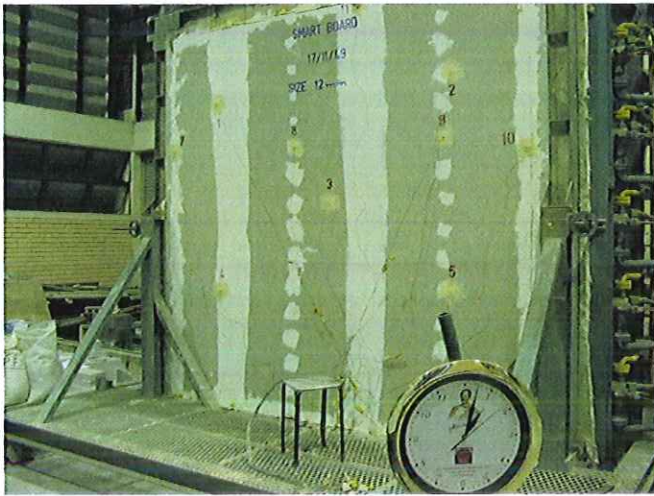
(e) 0:43 hr



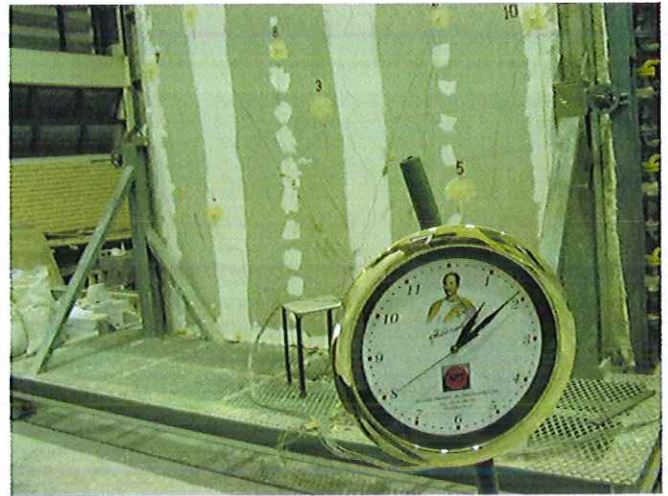
(f) 0:43 hr

Figure C-1: The specimen during testing

.....
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Authorized Testing Officer



(g) 1:02 hrs



(h) 1:09 hrs



(i) 1:26 hrs

Figure C-1 (continued): The specimen during testing


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Authorized Testing Officer

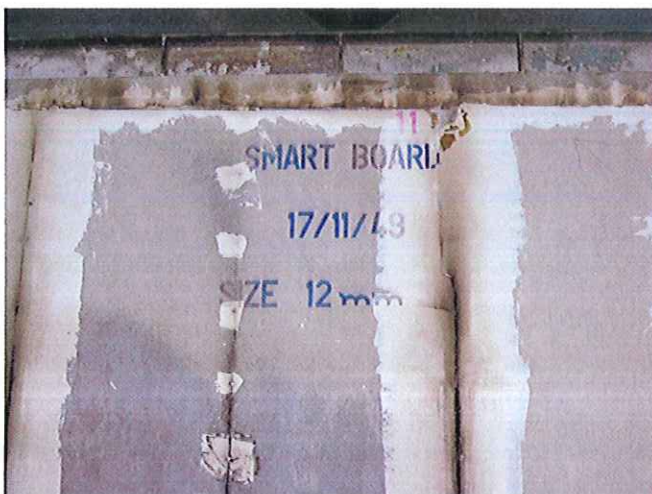
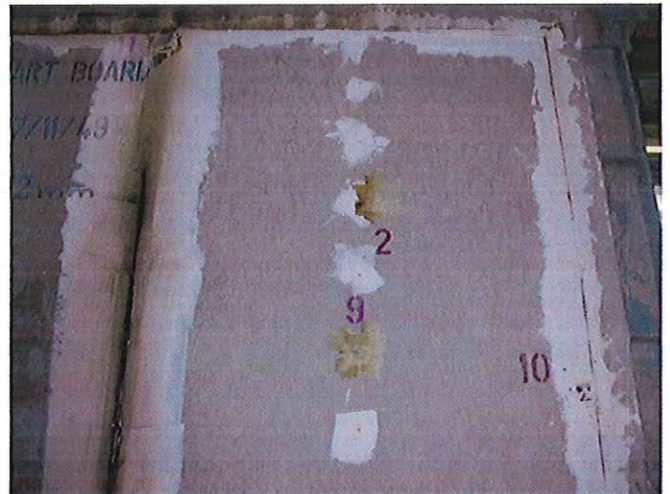
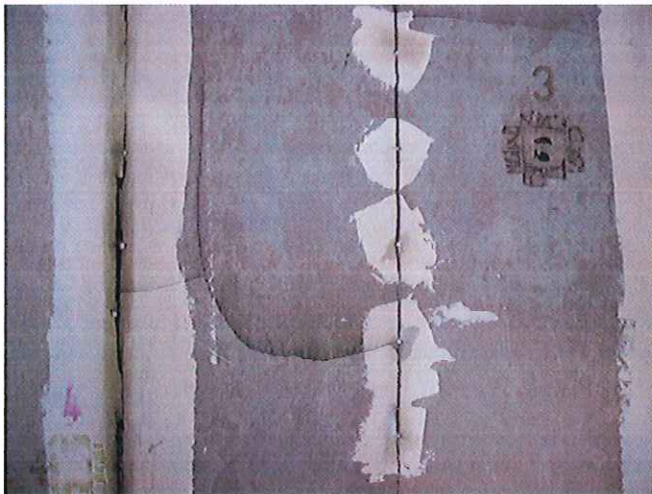
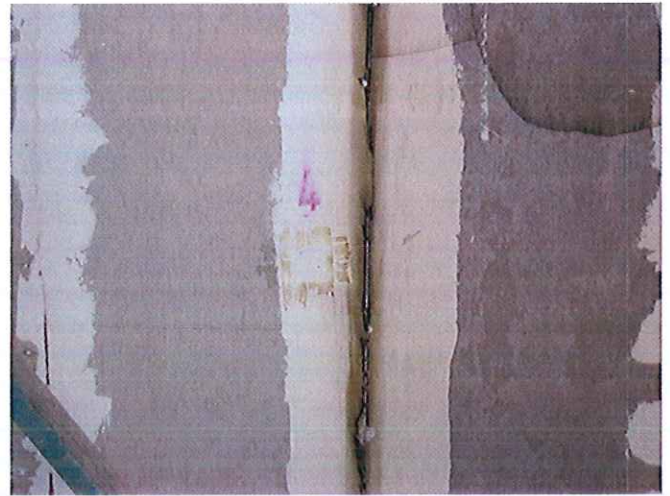
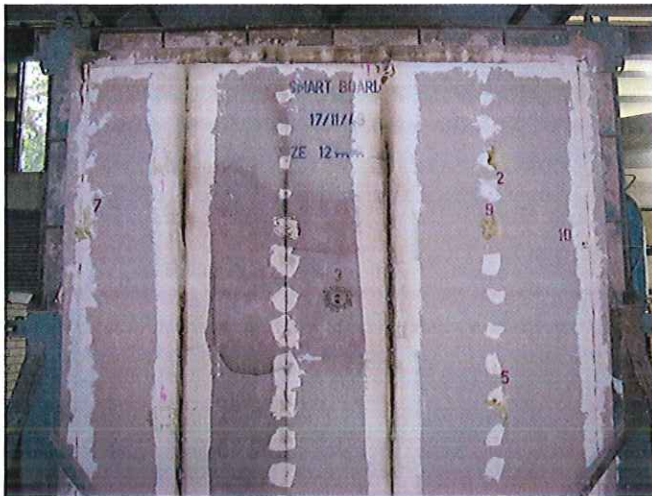
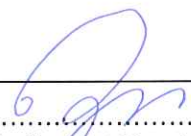


Figure C-2: The specimen after testing


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(Mr. Sorawut Yanpirat)
Authorized Testing Officer

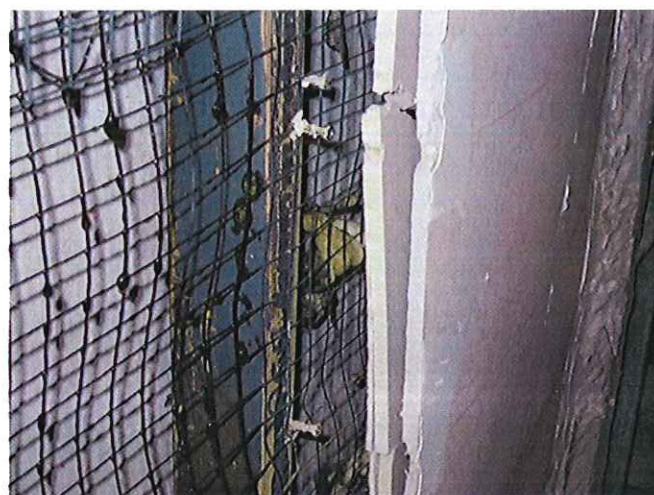
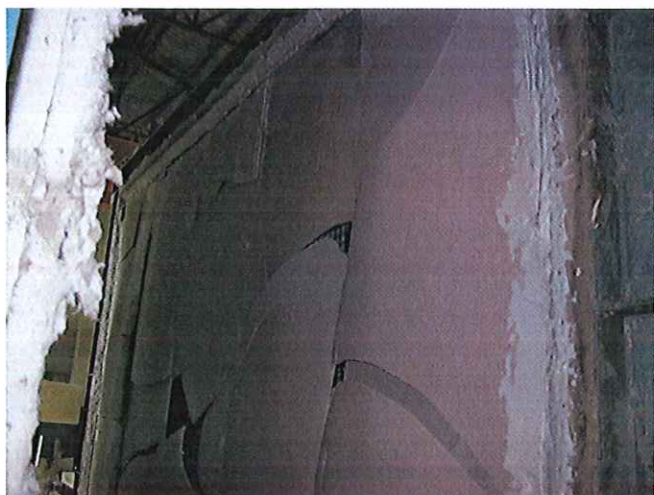


Figure C-2 (continued): The specimen after testing


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(Mr. Sorawut Yanpirat)
Authorized Testing Officer