

# COMPFIRE

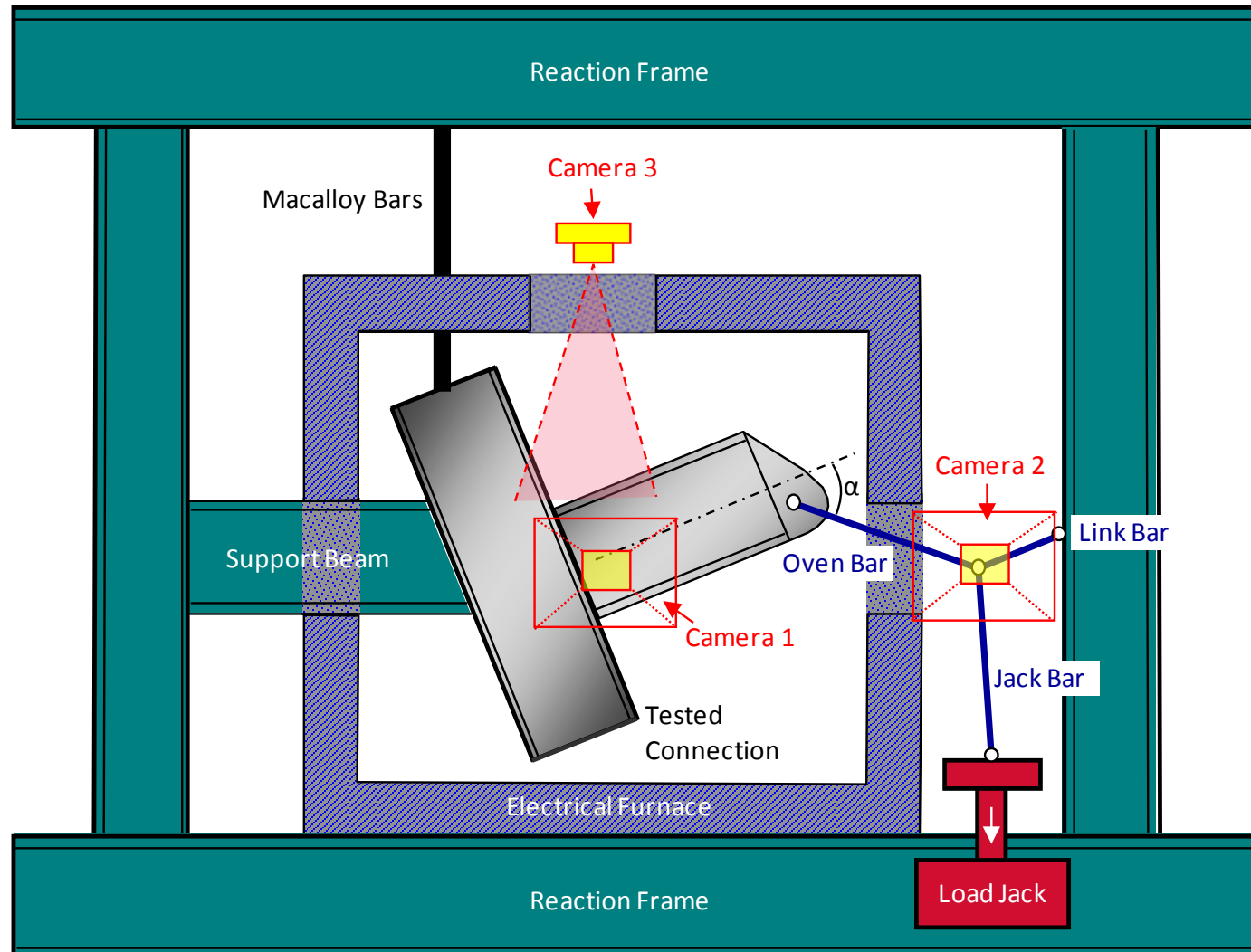
CCFT-FP\_20\_55\_17-11-2010

17 November 2010 Fin Plate Connection to Circular Concrete-Filled Tube Test Result

RFSR-CT-2009-0021

Design of joints to composite columns for improved fire robustness

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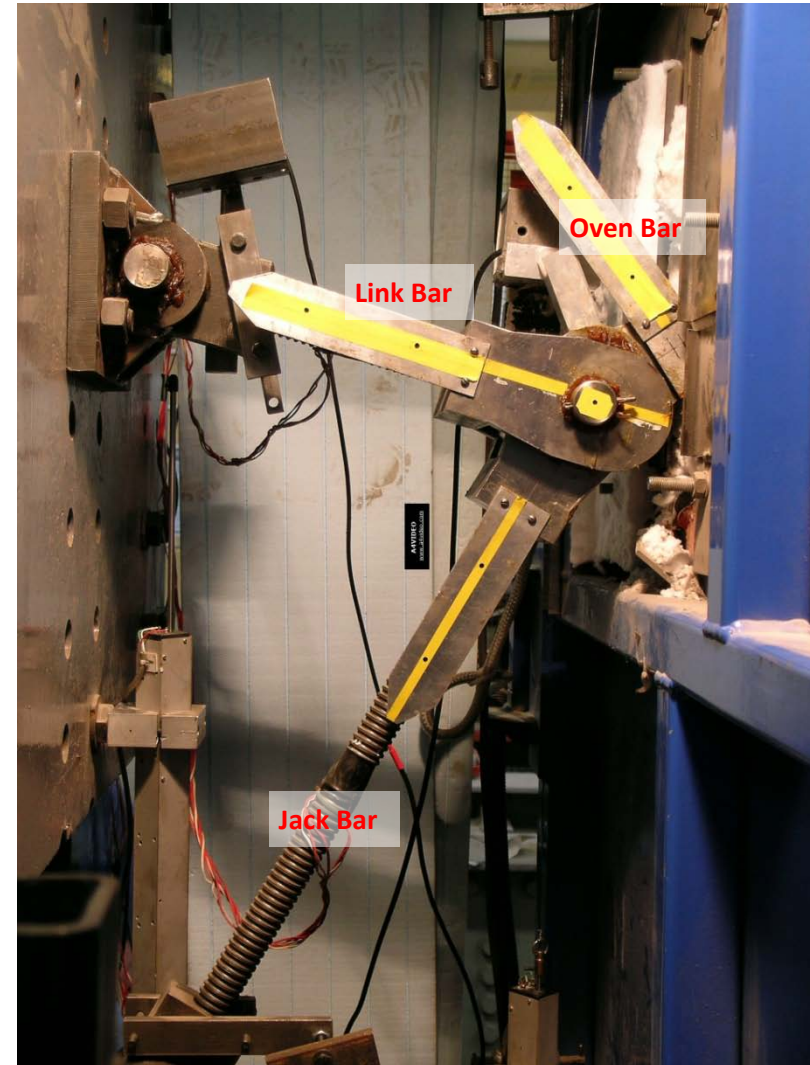
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View of Camera 1



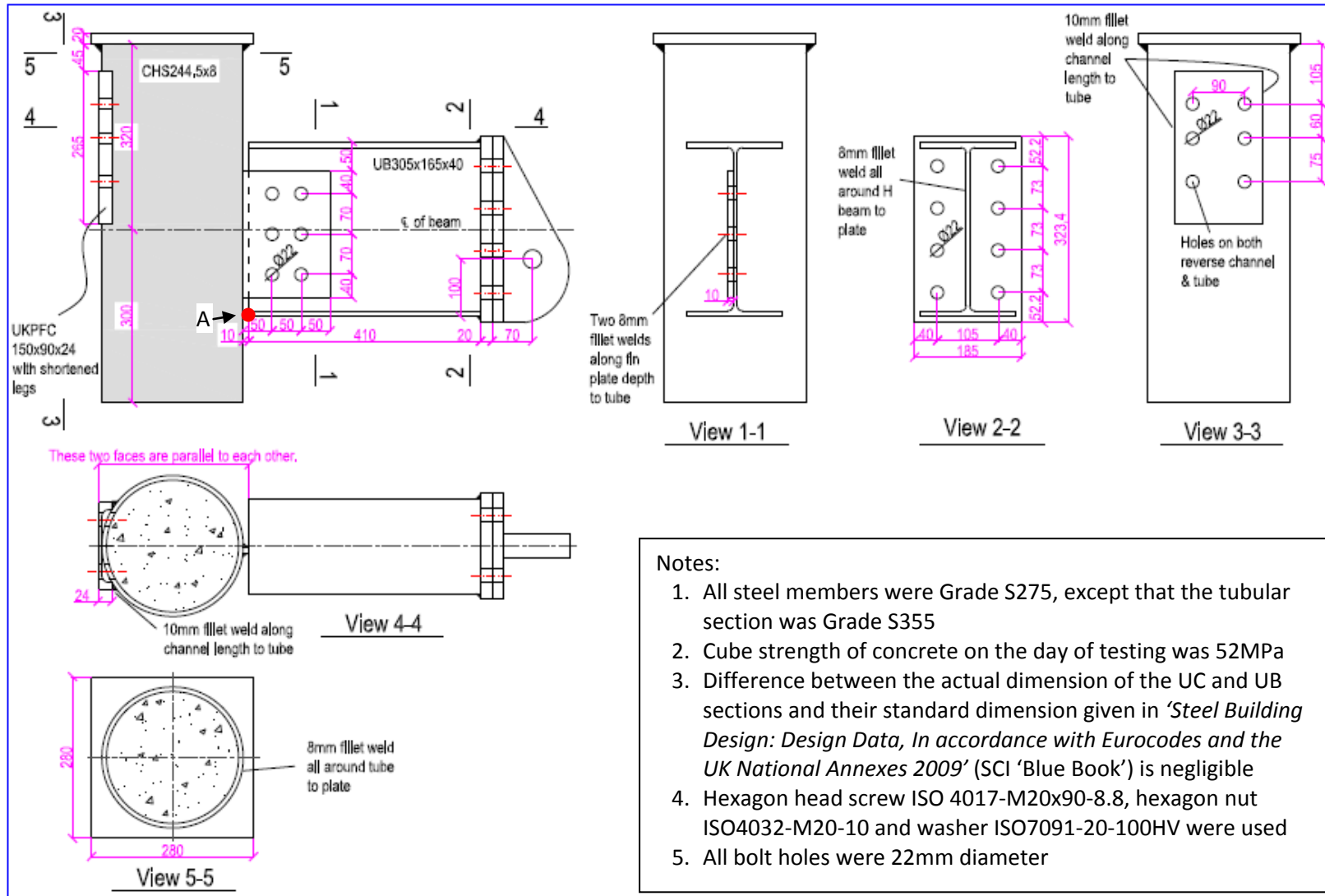
View of Camera 2

\*Camera 3 was not necessary in this test.

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Nominal Temperature: 20°C

Time	Oven Temperature	Jack Displacement	Load Angle	Beam Rotation	Column Rotation	Connection Rotation	Oven Bar Force	Tension	Shear	Moment*
(minute)	(°C)	(mm)	$\alpha$ (°)	(°)	(°)	(°)	(kN)	(kN)	(kN)	(kNm)
0	20.50	-0.24	55.50	0.00	0.00	0.00	0.66	0.37	0.54	0.31
1	20.60	0.54	55.48	0.02	0.03	-0.01	1.68	0.95	1.39	0.79
2	20.52	1.63	55.42	0.08	0.04	0.04	3.67	2.08	3.02	1.72
3	20.57	3.12	55.26	0.24	0.04	0.20	4.32	2.46	3.55	2.02
4	20.56	4.62	55.12	0.38	0.04	0.33	4.79	2.74	3.93	2.24
5	20.76	6.18	54.97	0.52	0.05	0.47	5.23	3.00	4.28	2.44
6	20.81	7.59	54.81	0.68	0.06	0.63	5.90	3.40	4.82	2.75
7	20.85	9.06	54.69	0.81	0.06	0.74	7.09	4.10	5.79	3.30
8	20.92	10.57	54.57	0.93	0.07	0.85	8.61	4.99	7.02	4.01
9	20.92	12.03	54.46	1.03	0.08	0.95	10.12	5.88	8.24	4.71
10	20.97	13.70	54.40	1.10	0.09	1.01	11.16	6.50	9.07	5.19
11	20.83	15.22	54.31	1.18	0.09	1.09	12.57	7.33	10.21	5.84
12	20.75	17.56	54.22	1.27	0.11	1.17	14.04	8.21	11.39	6.52
13	20.96	19.31	54.09	1.40	0.12	1.28	16.21	9.51	13.12	7.51
14	21.08	20.94	53.96	1.53	0.13	1.40	18.46	10.86	14.93	8.55
15	20.91	22.55	53.83	1.65	0.15	1.51	20.82	12.29	16.81	9.63
16	20.89	24.01	53.73	1.76	0.16	1.60	23.29	13.78	18.78	10.77
17	20.87	25.43	53.62	1.87	0.17	1.70	25.69	15.24	20.68	11.86
18	20.84	26.91	53.52	1.97	0.19	1.79	28.21	16.78	22.68	13.02
19	20.89	28.34	53.39	2.10	0.20	1.90	30.86	18.40	24.77	14.22
20	20.98	29.97	53.29	2.20	0.22	1.99	33.70	20.15	27.02	15.52
21	21.02	31.50	53.17	2.32	0.23	2.09	36.43	21.84	29.15	16.76



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22	20.98	33.02	53.05	2.44	0.25	2.19	39.15	23.53	31.28	17.99
23	21.03	34.47	52.94	2.55	0.26	2.29	41.86	25.23	33.40	19.22
24	21.02	36.04	52.81	2.68	0.27	2.40	44.52	26.91	35.47	20.42
25	21.03	37.49	52.69	2.79	0.29	2.50	47.40	28.73	37.70	21.73
26	21.02	38.89	52.57	2.91	0.31	2.61	50.37	30.61	40.00	23.06
27	21.06	40.54	52.45	3.04	0.32	2.71	53.39	32.54	42.33	24.42
28	21.09	42.14	52.30	3.18	0.34	2.84	56.51	34.56	44.71	25.81
29	21.08	43.74	52.18	3.30	0.36	2.95	59.91	36.74	47.32	27.33
30	21.07	45.35	52.04	3.44	0.37	3.06	63.33	38.96	49.93	28.86
31	21.14	47.02	51.91	3.57	0.40	3.17	66.93	41.29	52.67	30.47
32	21.19	48.53	51.78	3.70	0.41	3.29	70.35	43.52	55.27	31.99
33	21.14	49.98	51.65	3.83	0.44	3.40	73.63	45.69	57.74	33.44
34	21.04	51.50	51.51	3.97	0.46	3.51	77.17	48.02	60.40	35.00
35	20.94	53.07	51.39	4.09	0.47	3.62	80.54	50.26	62.94	36.49
36	20.97	54.67	51.26	4.22	0.49	3.73	83.99	52.56	65.51	38.01
37	20.99	56.22	51.14	4.34	0.51	3.83	87.04	54.61	67.77	39.35
38	20.90	57.74	51.00	4.48	0.52	3.95	89.70	56.45	69.71	40.50
39	20.96	59.39	50.87	4.61	0.54	4.07	92.44	58.34	71.71	41.69
40	21.06	60.88	50.72	4.76	0.56	4.20	95.24	60.30	73.72	42.89
41	20.92	62.51	50.57	4.91	0.58	4.33	97.61	61.99	75.39	43.89
42	21.03	64.10	50.44	5.04	0.59	4.46	99.96	63.67	77.06	44.90
43	20.94	65.48	50.29	5.19	0.60	4.59	102.31	65.37	78.71	45.89
44	20.86	67.22	50.14	5.34	0.61	4.73	104.53	67.00	80.24	46.82
45	20.81	68.83	50.00	5.48	0.63	4.85	106.73	68.60	81.76	47.74
46	20.55	70.39	49.86	5.62	0.64	4.99	109.00	70.27	83.32	48.69
47	20.59	71.83	49.72	5.76	0.67	5.09	112.88	72.97	86.12	50.36
48	20.77	73.34	49.59	5.89	0.68	5.21	116.66	75.63	88.82	51.97



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49	20.74	74.73	49.46	6.02	0.71	5.31	120.70	78.45	91.73	53.71
50	20.75	76.30	49.33	6.16	0.73	5.42	124.55	81.17	94.46	55.35
51	20.75	77.66	49.21	6.28	0.77	5.51	128.16	83.73	97.02	56.89
52	20.73	79.19	49.08	6.41	0.79	5.62	131.98	86.46	99.72	58.51
53	20.85	80.74	48.95	6.53	0.81	5.73	131.19	86.15	98.94	58.08
54	20.90	82.12	48.84	6.64	0.83	5.81	136.75	90.00	102.96	60.48
55	20.85	83.56	48.71	6.77	0.85	5.92	139.99	92.38	105.19	61.83
56	20.81	85.00	48.60	6.89	0.87	6.02	143.18	94.69	107.40	63.17
57	20.93	86.50	48.46	7.02	0.89	6.13	146.28	97.00	109.50	64.45
58	20.89	88.00	48.33	7.15	0.91	6.24	149.35	99.28	111.57	65.71
59	20.85	89.54	48.21	7.27	0.94	6.34	152.60	101.68	113.78	67.06
60	20.91	91.10	48.08	7.40	0.95	6.46	155.70	104.03	115.85	68.33
61	20.85	92.72	47.93	7.55	0.97	6.58	158.54	106.22	117.70	69.47
62	20.78	94.05	47.81	7.67	0.99	6.69	161.42	108.41	119.60	70.64
63**	20.80	95.46	47.68	7.80	1.02	6.79	164.06	110.45	121.31	71.70
64^	21.74	96.55	45.41	8.88	1.81	7.06	46.23	32.46	32.92	19.71
65	21.80	97.86	45.34	8.95	1.86	7.10	56.35	39.61	40.08	24.00
66	21.81	99.14	45.26	9.03	1.90	7.13	66.28	46.65	47.08	28.20
67	21.75	100.44	45.17	9.12	1.94	7.18	76.06	53.62	53.94	32.33
68	21.82	101.70	45.09	9.20	1.98	7.21	85.84	60.60	60.79	36.46
69	21.89	102.98	45.02	9.27	2.02	7.25	96.17	67.97	68.02	40.81
70	21.85	104.30	44.94	9.35	2.07	7.28	106.32	75.26	75.10	45.08
71	21.89	105.44	44.86	9.43	2.12	7.32	116.42	82.53	82.12	49.31
72	21.87	106.33	44.78	9.52	2.16	7.36	126.75	89.97	89.27	53.63
73	21.94	107.44	44.69	9.61	2.20	7.40	136.38	96.96	95.91	57.65
74	21.99	108.49	44.61	9.69	2.25	7.44	146.43	104.25	102.83	61.84
75	21.95	109.59	44.52	9.78	2.29	7.49	156.01	111.24	109.39	65.82



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76	22.04	110.69	44.43	9.87	2.35	7.52	165.03	117.85	115.52	69.54
77	22.02	112.06	44.32	9.98	2.38	7.60	170.31	121.84	118.99	71.68
78	22.09	113.54	44.20	10.10	2.40	7.70	174.44	125.07	121.61	73.31
79	22.01	114.89	44.06	10.24	2.43	7.81	177.59	127.63	123.50	74.51
80	22.11	116.26	43.92	10.38	2.44	7.94	181.04	130.41	125.58	75.83
81	22.04	117.78	43.79	10.51	2.47	8.05	184.26	133.02	127.50	77.05
82	22.19	119.33	43.63	10.67	2.47	8.20	186.71	135.14	128.83	77.93
83	22.24	120.77	43.48	10.82	2.48	8.34	188.87	137.05	129.96	78.69
84	22.15	122.26	43.32	10.98	2.49	8.49	189.53	137.89	130.03	78.80
85	22.15	123.90	43.11	11.19	2.49	8.70	187.89	137.16	128.40	77.92
86	22.09	126.56	42.29	12.02	2.23	9.79	104.48	77.29	70.30	42.88
87	22.09	128.38	41.91	12.40	2.14	10.26	83.02	61.79	55.45	33.90
88	22.04	129.95	41.66	12.64	2.12	10.53	77.20	57.67	51.32	31.43

\* Moment about Point A on the specimen drawing

\*\* Weld between the column and supporting bars (circled on the image on Page 9) failed.

^ Test continued after repair work.



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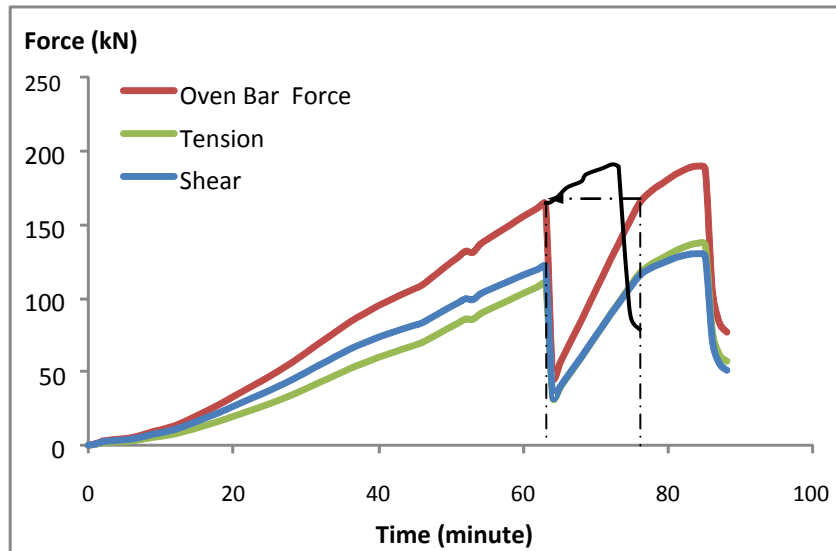
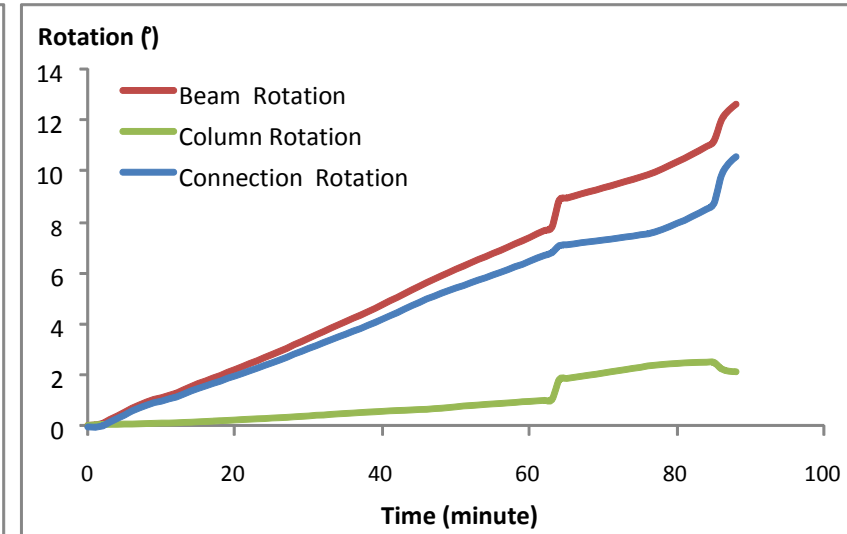
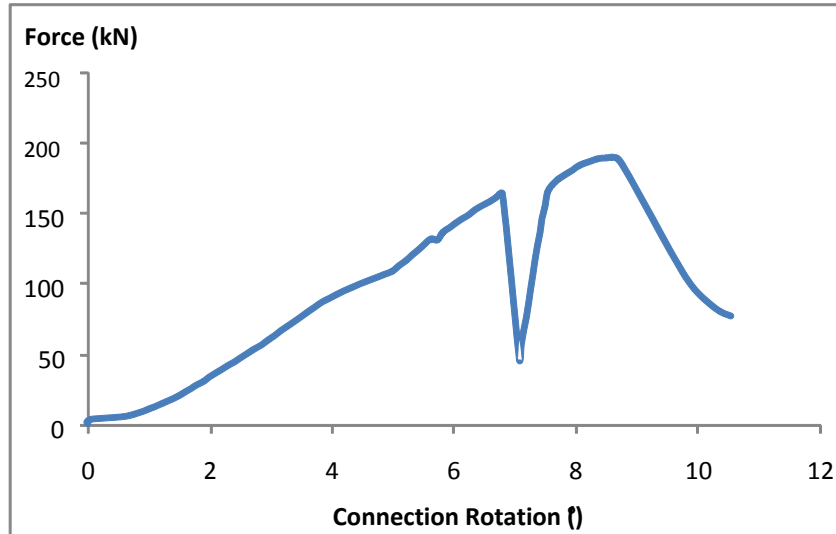
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## NOTE:

The weld connecting a support bar fractured at 64 minutes into the initial test. Since there was no visible sign of failure of the connection, this weld was reinstated and the connection was reloaded. The first data point in the repeat test is given at 64 minutes in this data sheet.

It can be seen that, after reaching the previous peak load, the loading curve essentially continues.

It may be appropriate to reduce the times of results beyond 75 minutes by 12 minutes, giving almost continuous loading. This is illustrated for the oven bar force – time plot. Clearly this will not give continuity in the raw rotations of the column and beam because of the resetting which occurred after repair.



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## Photographs after Test



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