ONLINE SUPPLEMENT

Table S1: Low-cycle fatigue experimental data – 10mm diameter bars

10 mm diameter bars				
1% Strain Amplitude				
L/D	**Total Time**	**Frequency**	**Number of Half Cycles**	**Total Normalised**
5	3877	0.125	969	3171
8	962	0.125	240	1165
10	710	0.125	178	825
12	454	0.125	114	415
15	646	0.125	162	397
2% Strain Amplitude				
5	1000	0.063	125	1681
8	549	0.063	69	730
10	407	0.063	51	429
12	471	0.063	59	375
15	455	0.063	57	277
3% Strain Amplitude				
5	586	0.042	49	1082
8	320	0.042	27	457
10	297	0.042	25	342
12	297	0.042	25	277
15	681	0.042	57	368
4% Strain Amplitude				
5	445	0.031	28	912
8	260	0.031	16	348
10	361	0.031	23	370
12	300	0.031	19	268
15	520	0.031	33	287
5% Strain Amplitude				
5	452	0.025	23	935
8	249	0.025	12	350
10	282	0.025	14	278
12	252	0.025	13	233
15	368	0.025	18	221
6% Strain Amplitude				
5	300	0.021	12	726
8	195	0.021	8	279
10	253	0.021	11	284
12	410	0.021	17	238
15	348	0.021	15	217

Table S2: Low-cycle fatigue experimental data – 12mm diameter bars

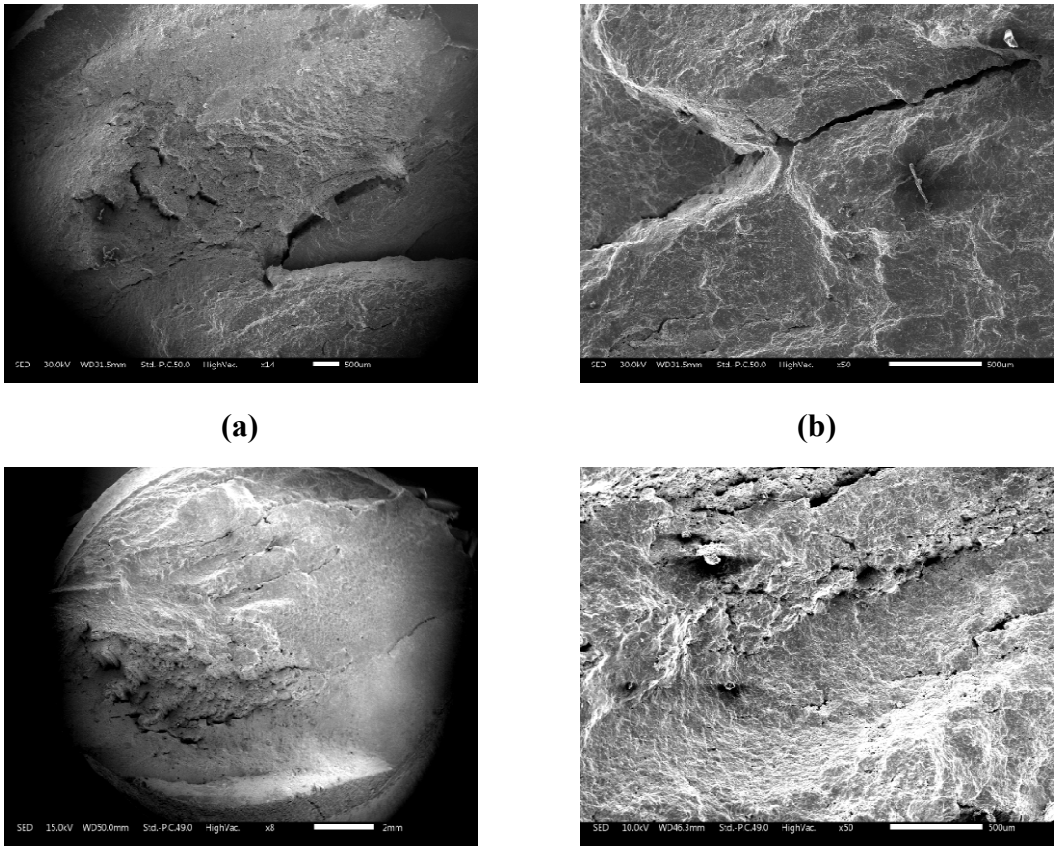
12 mm diameter bars				
1% Strain Amplitude				
L/D	**Total Time (s)**	**Frequency (Hz)**	**Number of Half Cycles to Failure ($2N_f$)**	**Total Normalised Dissipated Energy (E_t/E_y)**
5	4146	0.125	1036	2904
8	1735	0.125	434	1952
10	1041	0.125	260	1131
12	550	0.125	137	505
15	641	0.125	160	419
2% Strain Amplitude				
5	1334	0.063	167	2213
8	409	0.063	51	590
10	390	0.063	49	378
12	358	0.063	45	320
15	422	0.063	53	280
3% Strain Amplitude				
5	823	0.042	69	1572
8	392	0.042	33	489
10	318	0.042	26	332
12	340	0.042	28	285
15	370	0.042	31	263
4% Strain Amplitude				
5	458	0.031	29	922
8	263	0.031	16	357
10	388	0.031	24	367
12	325	0.031	20	277
15	423	0.031	26	266
5% Strain Amplitude				
5	369	0.025	18	878
8	207	0.025	10	303
10	253	0.025	13	269
12	248	0.025	12	216
15	408	0.025	20	257
6% Strain Amplitude				
5	394	0.021	16	937
8	242	0.021	10	335
10	251	0.021	10	268
12	311	0.021	13	266
15	253	0.021	11	200

Table S3: Low-cycle fatigue experimental data – 16mm diameter bars

16 mm diameter bars				
1% Strain Amplitude				
L/D	**Total Time (s)**	**Frequency (Hz)**	**Number of Half Cycles to Failure ($2N_f$)**	**Total Normalised Dissipated Energy (E_t/E_y)**
5	4560	0.125	1140	2935
8	1472	0.125	368	1491
10	961	0.125	240	1048
12	796	0.125	199	495
15	431	0.125	108	304
2% Strain Amplitude				
5	886	0.063	111	1400
8	358	0.063	45	492
10	426	0.063	53	416
12	327	0.063	41	290
15	326	0.063	41	224
3% Strain Amplitude				
5	395	0.042	33	802
8	342	0.042	29	438
10	222	0.042	19	254
12	270	0.042	22	240
15	224	0.042	19	176
4% Strain Amplitude				
5	300	0.031	19	667
8	234	0.031	15	344
10	202	0.031	13	234
12	294	0.031	18	230
15	211	0.031	13	158
5% Strain Amplitude				
5	246	0.025	12	580
8	160	0.025	8	250
10	172	0.025	9	212
12	211	0.025	11	191
15	415	0.025	21	160
6% Strain Amplitude				
5	158	0.021	7	423
8	199	0.021	8	287
10	206	0.021	9	232
12	301	0.021	13	244
15	204	0.021	8	168

Table S4: Low-cycle fatigue experimental data – 20mm diameter bars

20 mm diameter bars				
1% Strain Amplitude				
L/D	**Total Time (s)**	**Frequency (Hz)**	**Number of Half Cycles to Failure ($2N_f$)**	**Total Normalised Dissipated Energy (E_t/E_v)**
5	6302	0.125	1180	3201
8	2262	0.125	566	2143
10	752	0.125	188	778
12	591	0.125	148	521
15	416	0.125	104	290
2% Strain Amplitude				
5	1144	0.063	143	1673
8	574	0.063	72	576
10	344	0.063	43	365
12	296	0.063	37	251
15	442	0.063	55	277
3% Strain Amplitude				
5	533	0.042	44	1021
8	320	0.042	27	427
10	275	0.042	23	307
12	322	0.042	27	267
15	324	0.042	27	225
4% Strain Amplitude				
5	391	0.031	24	797
8	233	0.031	15	337
10	232	0.031	14	259
12	208	0.031	13	188
15	331	0.031	21	225
5% Strain Amplitude				
5	285	0.025	14	633
8	170	0.025	9	257
10	372	0.025	19	334
12	377	0.025	19	214
15	266	0.025	13	176
6% Strain Amplitude				
5	249	0.021	10	565
8	204	0.021	8	295
10	210	0.021	9	240
12	207	0.021	9	195
15	340	0.021	14	222



(a) **(b)**

(c) **(d)**

Figure S1: SEM fractographs of fractured bars without the effect of buckling with *L/D* = 5: (a) and (b) 12 mm diameter at 4% strain amplitude, (c) and (d) 16 mm diameter at 4% strain amplitude

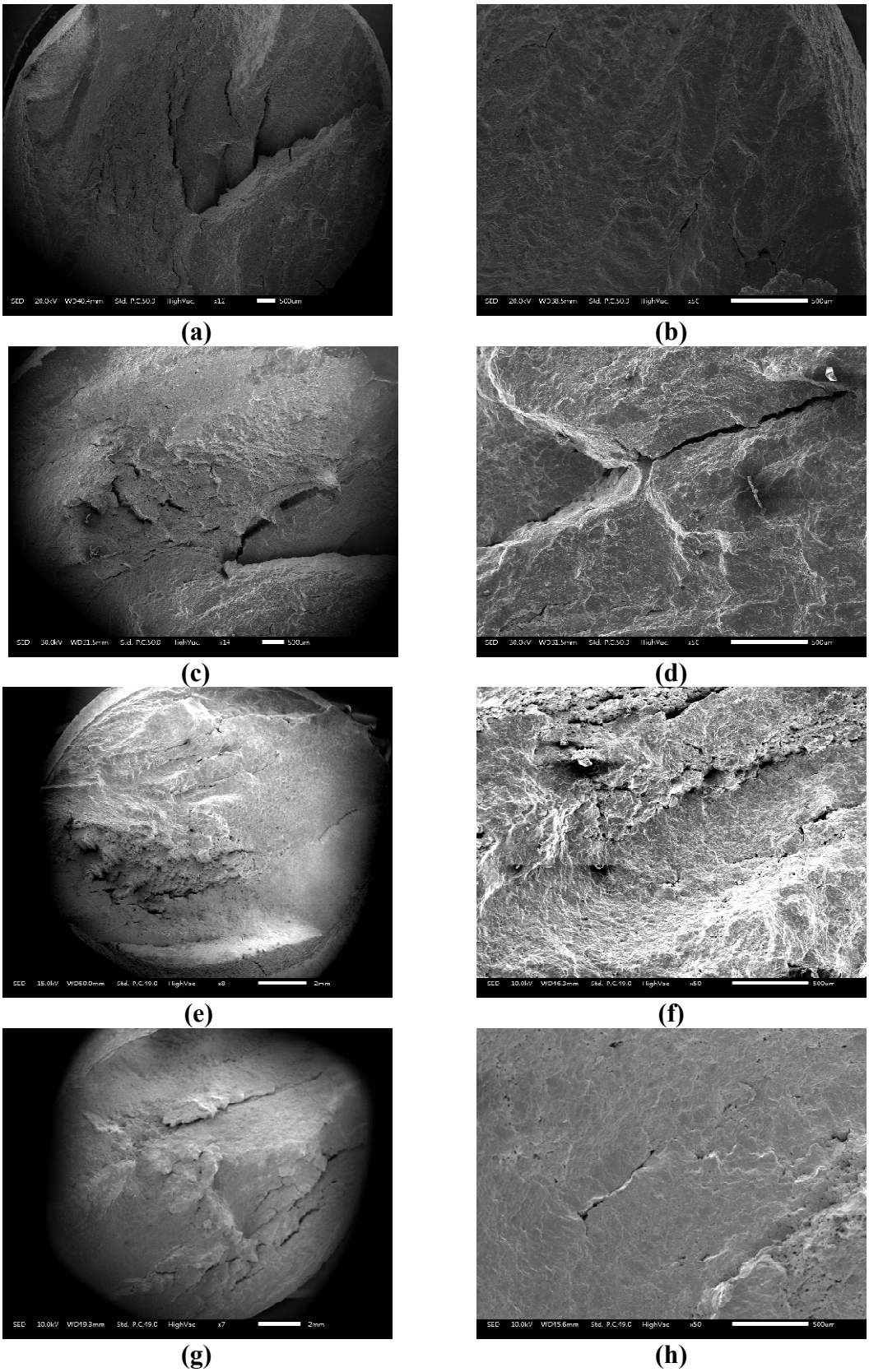


Figure S2: SEM fractographs of fractured bars with the effect of buckling with L/D = 15: (a) and (b) 10 mm diameter at 4% strain amplitude, (c) and (d) 12 mm diameter at 4% strain amplitude, (e) and (f) 16 mm diameter at 4% strain amplitude, and (g) and (h) 20 mm diameter at 4% strain amplitude

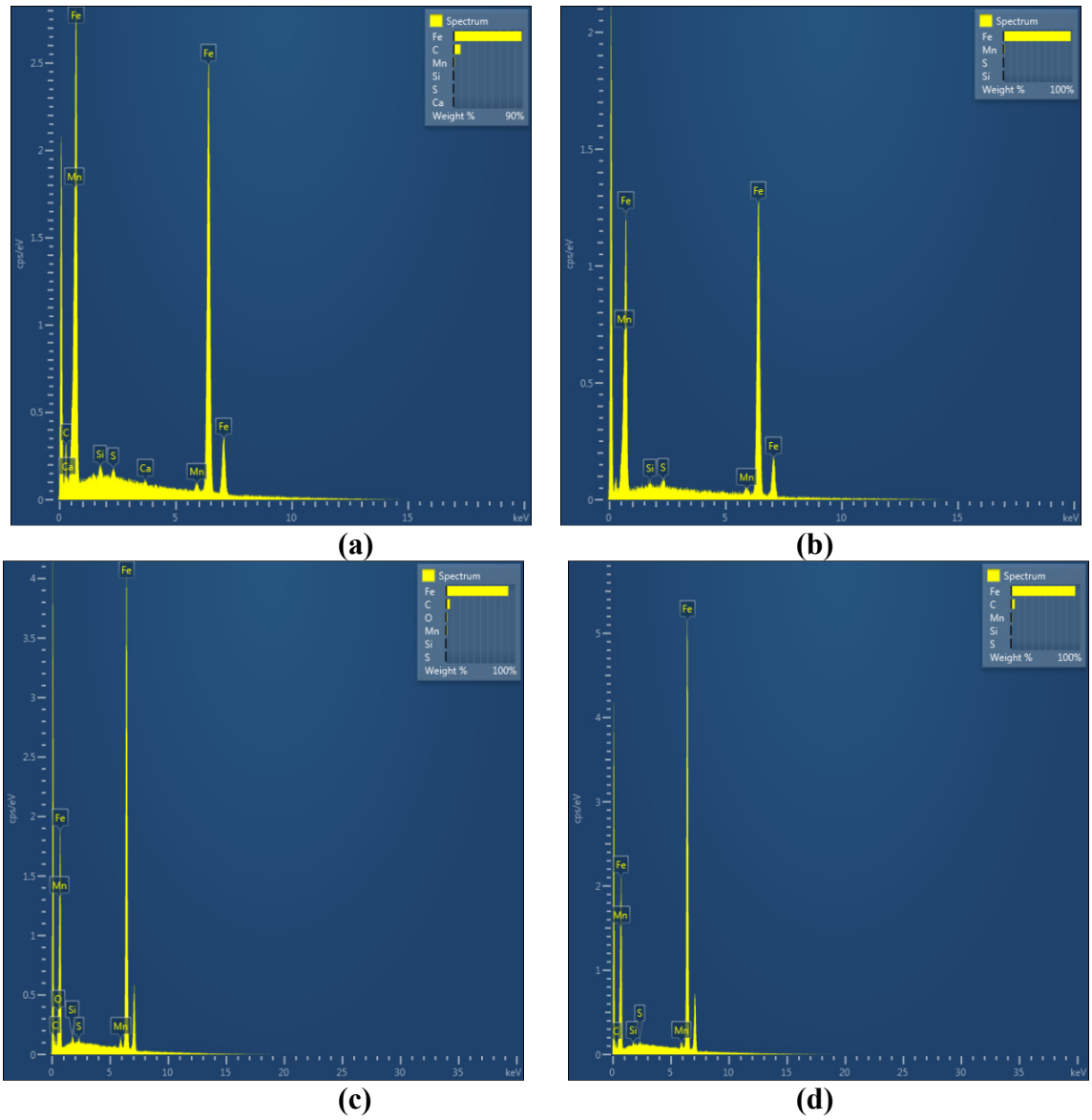


Figure S3: EDX spectra of the test specimens: (a) 10 mm diameter; (b) 12 mm diameter; (c) 16 mm diameter; (d) 20 mm diameter

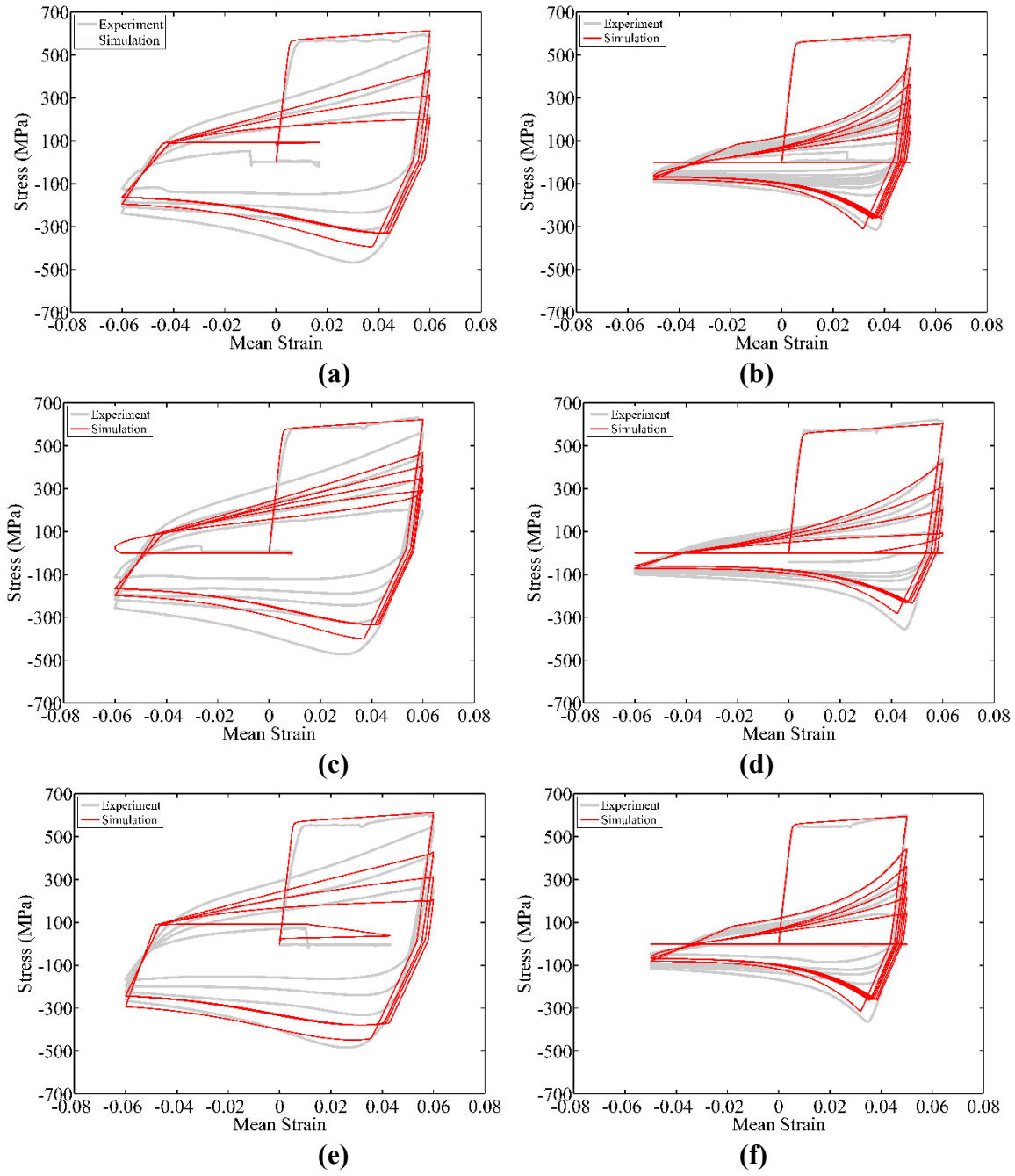


Figure S4: Comparison of simulation results using the phenomenological model proposed in (Kashani et al. 2015b) and observed experimental results: (a) and (b) 10 mm diameter with L/D = 8 and 15 respectively, (c) and (d) 12 mm diameter with L/D = 8 and 15 respectively, (e) and (f) 16 mm diameter with L/D = 8 and 15 respectively