

STRUCTURAL CALCULATIONS

Using
MASTERSERIES POWERPAD

MIPA Paints

FOR LEOMINSTER CONSTRUCTION

STRUCTURAL ENGINEERS **R ELLIOTT ASSOCIATES LTD**

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk
Tel: (01590) 683 176 Fax: (01590) 683 533

PROJECT No: 7275

REV B

July 2019



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 1 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

INTRODUCTION

- The proposed structure is a **multi span commercial portal frame building**.
- Loadings** have been taken from the table below, unless stated otherwise.
- Codes of Practice used :-**

Concrete Design to :	BS 8110:Part 1
Steel Design to :	BS 5950:Part 1
Timber Design to :	BS 5268:Part 2
	BS 5268:Part 6
Masonry Design to:	BS 5628:Part 1
Loading to :	BS 6399:Part 1
	BS 6399:Part 2
	BS 6399:Part 3

DESIGN PHILOSOPHY

R Elliott Associates Ltd have been instructed to assess the new structure.

Wind and snow loads are applied within the analysis, based upon characteristic loads to BS6399.

Cold rolled sections by manufacturer.

It is proposed that the buildign will be onto a piled foudnation solution by others. Loadings will be provided

TYPICAL LOADS

Dead and imposed loads for all spans

Area unit loads excluding member self weight and casings

<i>Type</i>	<i>Category</i>	<i>Applied to</i>	<i>Applied on</i>	<i>kN/m²</i>
Roof cladding	Dead	Rafters	Slope	0.295
Roof imposed	Imposed	Rafters	Plan	0.600
Services	Dead	Rafters	Plan	0.100
Wall cladding	Dead	Columns	Elevation	0.295
Ceiling	Dead	Rafters	Plan	0.000
Ceiling imposed	Imposed	Rafters	Plan	0.000
Mezzanine plus partitions	Dead	Mezzanine	Plan	2.000
Mezzanine imposed	Imposed	Mezzanine	Plan	5.000



R Elliott Associates Ltd

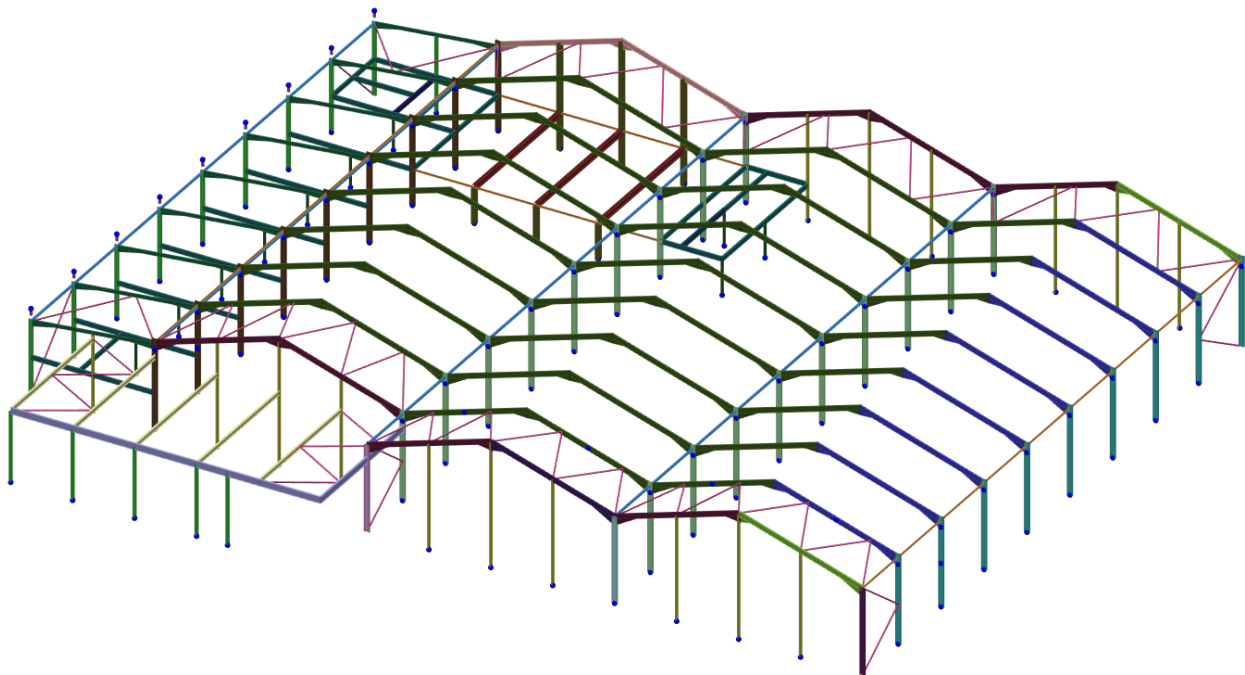
Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref	: 7275
Sheet	: Sheet Ref / 2 -
Made By	: PF
Date	: 23 Jul 2019/ Version 2015.04
Checked	:
Approved	:

FRAME



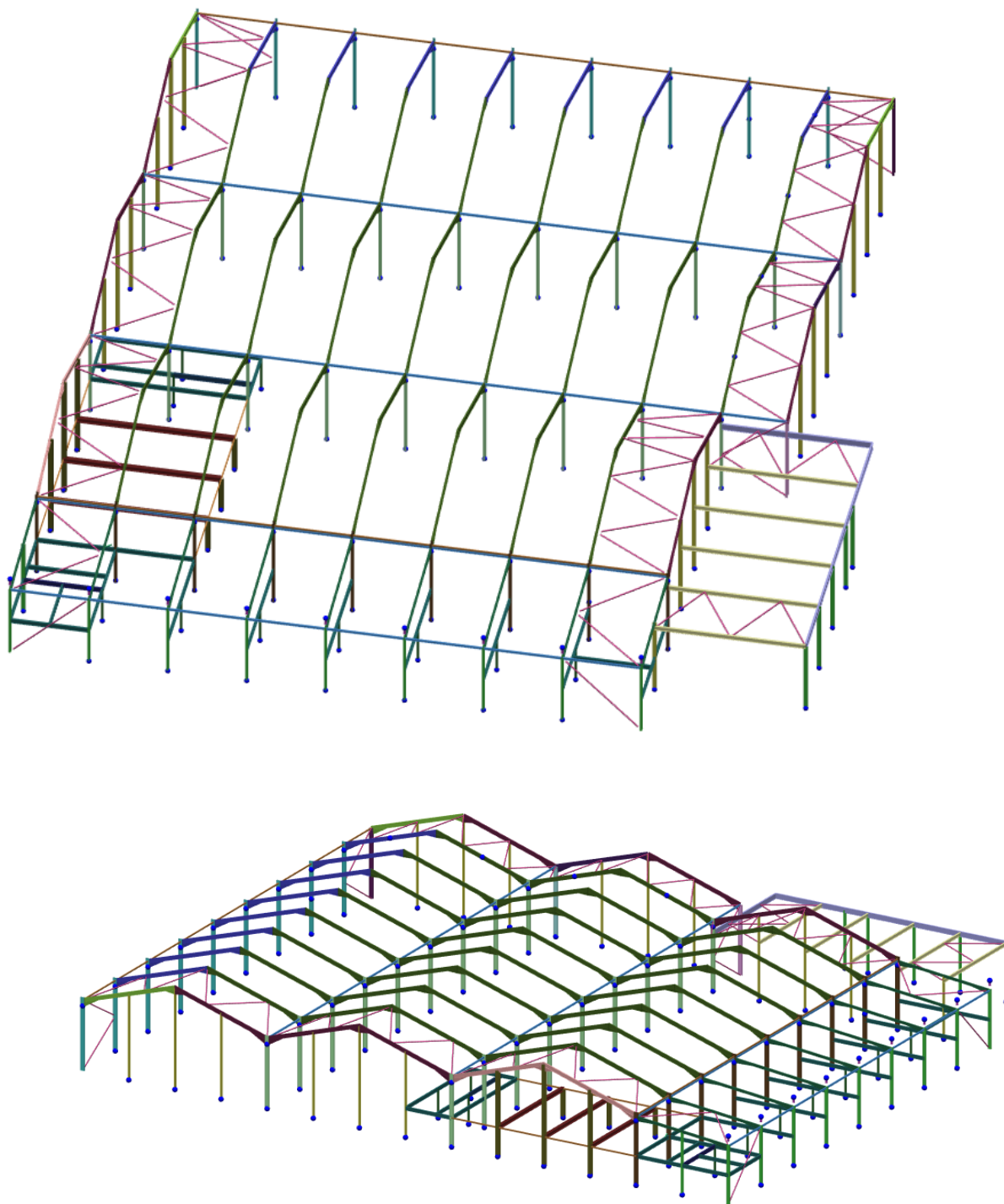
**R Elliott Associates Ltd**

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 3 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :





R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 4 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

DATA

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ BAK2.MP

MASTERPORT DATA FILE

LOADING CASES AND LOAD COMBINATION

Load Group Labels

Load Group UT	Unity Load Factor (All Cases)
Load Group D1	Dead Load
Load Group D2	Services
Load Group L0	Uniform Snow/live load
Load Group L1	Live Load
Load Group L2	Asymmetric Snow load -->
Load Group L3	Snow Drift -->
Load Group L4	Asymmetric Snow load <--
Load Group L5	Snow Drift <--
Load Group W1	Wind on Side (Top Values) --> (Fetches 214 to 304 Degrees)
Load Group W2	Wind on Side (Bottom Values) --> (Fetches 124 to 214 Degrees)
Load Group W3	Wind on Gable (Fetches 34 to 124 Degrees)
Load Group W4	Wind on Side (Top Values) <-- (Fetches 304 to 34 Degrees)
Load Group W5	Wind on Side (Bottom Values) <--

Load Case 001 : 1.4 (Dead+Services) + 1.6 Live/Snow

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L0 + 1.60 L1

Load Case 002 : Dead + Services + Live/Snow (Service)

Load Combination + 1.00 UT + 1.00 D1 + 1.00 D2 + 1.00 L0 + 1.00 L1

Load Case 003 : Live/Snow Only (Service)

Load Combination + 1.00 UT + 1.00 L0 + 1.00 L1

Load Case 004 : (Sway Stability)

Load Combination + 1.00 UT
Notional Loads Apply horizontal notional loads at 0.0 degrees from X axis equal to 0.5% of the factored vertical loads in case 1

Load Case 005 : 1.4 (Dead+Services) + 1.6 Live/Snow + Notional -->

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L0 + 1.60 L1
Notional Loads Apply horizontal notional loads at 0.0 degrees from X axis equal to 0.5% of the factored vertical loads in case 1

Load Case 006 : 1.4 (Dead+Services) + 1.6 Live/Snow + Notional <--

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L0 + 1.60 L1
Notional Loads Apply horizontal notional loads at 180.0 degrees from X axis equal to 0.5% of the factored vertical loads in case 1

Load Case 007 : 1.0 Dead + 1.4 Side Wind W1

Load Combination + 1.00 UT + 1.00 D1 + 1.40 W1

Load Case 008 : 1.4(Dead + Serv + Side Wind W1)

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.40 W1

Load Case 009 : 1.2(Dead + Serv + Live/Snow + Side Wind W1)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L0 + 1.20 L1 + 1.20 W1

Load Case 010 : 1.0 Dead + 1.4 Side Wind W2

Load Combination + 1.00 UT + 1.00 D1 + 1.40 W2

Load Case 011 : 1.4(Dead + Serv + Side Wind W2)

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.40 W2

Load Case 012 : 1.2(Dead + Serv + Live/Snow + Side Wind W2)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L0 + 1.20 L1 + 1.20 W2

Load Case 013 : 1.0 Dead + 1.4 Gable Wind W3

Load Combination + 1.00 UT + 1.00 D1 + 1.40 W3

Load Case 014 : 1.4(Dead + Serv + Gable Wind W3)

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.40 W3



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 5 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Load Case 015 : 1.2(Dead + Serv + Live/Snow + Gable Wind W3)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L0 + 1.20 L1 + 1.20 W3

Load Case 016 : 1.0 Dead + 1.4 Side Wind W4

Load Combination + 1.00 UT + 1.00 D1 + 1.40 W4

Load Case 017 : 1.4(Dead + Serv + Side Wind W4)

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.40 W4

Load Case 018 : 1.2(Dead + Serv + Live/Snow + Side Wind W4)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L0 + 1.20 L1 + 1.20 W4

Load Case 019 : 1.0 Dead + 1.4 Side Wind W5

Load Combination + 1.00 UT + 1.00 D1 + 1.40 W5

Load Case 020 : 1.4(Dead + Serv + Side Wind W5)

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.40 W5

Load Case 021 : 1.2(Dead + Serv + Live/Snow + Side Wind W5)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L0 + 1.20 L1 + 1.20 W5

Load Case 022 : 1.4 (Dead+Services) + 1.6 Live/Asym Snow L2

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.60 L2

Load Case 023 : 1.4 (Dead+Services) + 1.6 Live/Asym Snow L2 + Notional -->

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.60 L2

Notional Loads Apply horizontal notional loads at 0.0 degrees from X axis equal to 0.5% of the factored vertical loads in case 1

Load Case 024 : 1.4 (Dead+Services) + 1.6 Live/Asym Snow L2 + Notional <--

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.60 L2

Notional Loads Apply horizontal notional loads at 180.0 degrees from X axis equal to 0.5% of the factored vertical loads in case 1

Load Case 025 : 1.2(Dead + Serv + Live/Asym Snow L2 + Side Wind W1)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L1 + 1.20 L2 + 1.20 W1

Load Case 026 : 1.2(Dead + Serv + Live/Asym Snow L2 + Side Wind W2)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L1 + 1.20 L2 + 1.20 W2

Load Case 027 : 1.4 (Dead+Services) + 1.6 Live/Snow Drift L3

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.05 L3

Load Case 028 : 1.4 (Dead+Services) + 1.6 Live/Snow Drift L3 + Notional -->

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.05 L3

Notional Loads Apply horizontal notional loads at 0.0 degrees from X axis equal to 0.5% of the factored vertical loads in case 1

Load Case 029 : 1.4 (Dead+Services) + 1.6 Live/Snow Drift L3 + Notional <--

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.05 L3

Notional Loads Apply horizontal notional loads at 180.0 degrees from X axis equal to 0.5% of the factored vertical loads in case 1

Load Case 030 : 1.2(Dead + Serv + Live/Snow Drift L3 + Side Wind W1)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L1 + 1.05 L3 + 1.20 W1

Load Case 031 : 1.2(Dead + Serv + Live/Snow Drift L3 + Side Wind W2)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L1 + 1.05 L3 + 1.20 W2

Load Case 032 : 1.4 (Dead+Services) + 1.6 Live/Asym Snow L4

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.60 L4

Load Case 033 : 1.4 (Dead+Services) + 1.6 Live/Asym Snow L4 + Notional -->

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.60 L4

Notional Loads Apply horizontal notional loads at 0.0 degrees from X axis equal to 0.5% of the factored vertical loads in case 1

Load Case 034 : 1.4 (Dead+Services) + 1.6 Live/Asym Snow L4 + Notional <--

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.60 L4

Notional Loads Apply horizontal notional loads at 180.0 degrees from X axis equal to 0.5% of the factored vertical loads in case 1

Load Case 035 : 1.2(Dead + Serv + Live/Asym Snow L4 + Side Wind W4)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L1 + 1.20 L4 + 1.20 W4



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 6 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Load Case 036 : 1.2(Dead + Serv + Live/Asym Snow L4 + Side Wind W5)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L1 + 1.20 L4 + 1.20 W5

Load Case 037 : 1.4 (Dead+Services) + 1.6 Live/Snow Drift L5

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.05 L5

Load Case 038 : 1.4 (Dead+Services) + 1.6 Live/Snow Drift L5 + Notional -->

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.05 L5

Notional Loads Apply horizontal notional loads at 0.0 degrees from X axis equal to 0.5% of the factored vertical loads in case 1

Load Case 039 : 1.4 (Dead+Services) + 1.6 Live/Snow Drift L5 + Notional <--

Load Combination + 1.00 UT + 1.40 D1 + 1.40 D2 + 1.60 L1 + 1.05 L5

Notional Loads Apply horizontal notional loads at 180.0 degrees from X axis equal to 0.5% of the factored vertical loads in case 1

Load Case 040 : 1.2(Dead + Serv + Live/Snow Drift L5 + Side Wind W4)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L1 + 1.05 L5 + 1.20 W4

Load Case 041 : 1.2(Dead + Serv + Live/Snow Drift L5 + Side Wind W5)

Load Combination + 1.00 UT + 1.20 D1 + 1.20 D2 + 1.20 L1 + 1.05 L5 + 1.20 W5

THE NODAL CO-ORDINATES

Node	X (m)	Y (m)	Z (m)	Node	X (m)	Y (m)	Z (m)
1	30.000	0.000	0.000	2	35.000	0.000	0.000
3	40.000	0.000	0.000	4	45.000	0.000	0.000
5	50.000	0.000	0.000	6	55.000	0.000	0.000
7	60.000	0.000	0.000	8	65.000	0.000	0.000
9	70.000	0.000	0.000	10	0.000	0.000	5.000
11	5.000	0.000	5.000	12	10.000	0.000	5.000
13	15.000	0.000	5.000	14	20.000	0.000	5.000
15	25.000	0.000	5.000	16	30.000	0.000	5.000
17	50.000	0.000	5.000	18	70.000	0.000	5.000
19	0.000	0.000	11.000	20	5.000	0.000	11.000
21	10.000	0.000	11.000	22	30.000	0.000	11.000
23	50.000	0.000	11.000	24	70.000	0.000	11.000
25	0.000	0.000	17.000	26	5.000	0.000	17.000
27	10.000	0.000	17.000	28	30.000	0.000	17.000
29	50.000	0.000	17.000	30	70.000	0.000	17.000
31	0.000	0.000	23.000	32	5.000	0.000	23.000
33	10.000	0.000	23.000	34	30.000	0.000	23.000
35	50.000	0.000	23.000	36	70.000	0.000	23.000
37	0.000	0.000	29.000	38	5.000	0.000	29.000
39	10.000	0.000	29.000	40	30.000	0.000	29.000
41	50.000	0.000	29.000	42	70.000	0.000	29.000
43	0.000	0.000	35.000	44	5.000	0.000	35.000
45	10.000	0.000	35.000	46	30.000	0.000	35.000
47	50.000	0.000	35.000	48	70.000	0.000	35.000
49	0.000	0.000	41.000	50	5.000	0.000	41.000
51	10.000	0.000	41.000	52	15.000	0.000	41.000
53	20.000	0.000	41.000	54	25.000	0.000	41.000
55	30.000	0.000	41.000	56	35.000	0.000	41.000
57	50.000	0.000	41.000	58	70.000	0.000	41.000
59	0.000	0.000	47.000	60	5.000	0.000	47.000
61	10.000	0.000	47.000	62	30.000	0.000	47.000
63	31.700	0.000	47.000	64	35.000	0.000	47.000
65	50.000	0.000	47.000	66	70.000	0.000	47.000
67	0.000	0.000	53.000	68	5.000	0.000	53.000
69	10.000	0.000	53.000	70	15.000	0.000	53.000
71	20.000	0.000	53.000	72	25.000	0.000	53.000
73	30.000	0.000	53.000	74	35.000	0.000	53.000
75	40.000	0.000	53.000	76	45.000	0.000	53.000
77	50.000	0.000	53.000	78	55.000	0.000	53.000
79	60.000	0.000	53.000	80	30.000	3.167	5.000
81	65.000	0.000	53.000	82	70.000	0.000	53.000
83	0.000	2.900	5.000	84	3.900	2.900	5.000



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 7 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

85	5.000	2.900	5.000	86	10.000	2.900	5.000
87	0.000	2.900	11.000	88	3.900	2.900	11.000
89	5.000	2.900	11.000	90	10.000	2.900	11.000
91	0.000	2.900	17.000	92	5.000	2.900	17.000
93	10.000	2.900	17.000	94	0.000	2.900	23.000
95	5.000	2.900	23.000	96	10.000	2.900	23.000
97	0.000	2.900	29.000	98	70.000	3.213	5.000
99	5.000	2.900	29.000	100	10.000	2.900	29.000
101	0.000	2.900	35.000	102	5.000	2.900	35.000
103	10.000	2.900	35.000	104	0.000	2.900	41.000
105	5.000	2.900	41.000	106	10.000	2.900	41.000
107	15.000	2.900	41.000	108	20.000	2.900	41.000
109	25.000	2.900	41.000	110	30.000	2.900	41.000
111	31.700	2.900	41.000	112	35.000	2.900	41.000
113	0.000	2.900	47.000	114	5.000	2.900	47.000
115	6.667	2.900	47.000	116	10.000	2.900	47.000
117	30.000	2.900	47.000	118	31.700	2.900	47.000
119	35.000	2.900	47.000	120	10.000	2.900	48.029
121	0.000	2.900	50.000	122	5.000	2.900	50.000
123	0.000	2.900	53.000	124	5.000	2.900	53.000
125	6.667	2.900	53.000	126	10.000	2.900	53.000
127	15.000	2.900	53.000	128	20.000	2.900	53.000
129	25.000	2.900	53.000	130	30.000	2.900	53.000
131	31.700	2.900	53.000	132	35.000	2.900	53.000
133	10.000	3.500	11.000	134	70.000	3.500	11.000
135	10.000	3.500	47.000	136	70.000	3.500	47.000
137	0.000	5.800	5.000	138	0.000	5.800	11.000
139	0.000	5.800	17.000	140	0.000	5.800	23.000
141	0.000	5.800	29.000	142	0.000	5.800	35.000
143	0.000	5.800	41.000	144	0.000	5.800	47.000
145	0.000	5.800	53.000	146	5.000	6.300	5.000
147	5.000	6.300	11.000	148	5.000	6.300	47.000
149	5.000	6.300	53.000	150	30.000	6.433	5.000
151	50.000	6.433	5.000	152	30.000	6.433	11.000
153	50.000	6.432	11.000	154	30.000	6.433	17.000
155	50.000	6.433	17.000	156	30.000	6.433	23.000
157	50.000	6.433	23.000	158	30.000	6.433	29.000
159	50.000	6.433	29.000	160	30.000	6.433	35.000
161	50.000	6.433	35.000	162	30.000	6.433	41.000
163	50.000	6.433	41.000	164	30.000	6.433	47.000
165	50.000	6.433	47.000	166	30.000	6.433	53.000
167	50.000	6.433	53.000	168	10.000	6.422	5.000
169	10.000	6.422	11.000	170	10.000	6.422	17.000
171	10.000	6.422	29.000	172	10.000	6.422	35.000
173	10.000	6.422	41.000	174	10.000	6.422	47.000
175	10.000	6.422	53.000	176	10.000	6.424	23.000
177	70.000	6.425	5.000	178	70.000	6.425	11.000
179	70.000	6.425	17.000	180	70.000	6.425	23.000
181	70.000	6.425	29.000	182	70.000	6.425	35.000
183	70.000	6.425	41.000	184	70.000	6.425	47.000
185	70.000	6.425	53.000	186	0.000	6.800	5.000
187	10.000	6.800	5.000	188	0.000	6.800	11.000
189	10.000	6.800	11.000	190	0.000	6.800	17.000
191	10.000	6.800	17.000	192	0.000	6.800	23.000
193	10.000	6.800	23.000	194	0.000	6.800	29.000
195	10.000	6.800	29.000	196	0.000	6.800	35.000
197	10.000	6.800	35.000	198	0.000	6.800	41.000
199	10.000	6.800	41.000	200	0.000	6.800	47.000
201	10.000	6.800	47.000	202	0.000	6.800	53.000
203	10.000	6.800	53.000	204	30.000	7.000	0.000
205	50.000	7.000	0.000	206	70.000	7.000	0.000
207	10.000	7.000	5.000	208	30.000	7.000	5.000
209	50.000	7.000	5.000	210	70.000	7.000	5.000
211	10.000	7.000	11.000	212	30.000	7.000	11.000
213	50.000	7.000	11.000	214	70.000	7.000	11.000
215	10.000	7.000	17.000	216	30.000	7.000	17.000



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 8 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

217	50.000	7.000	17.000	218	70.000	7.000	17.000
219	10.000	7.000	23.000	220	30.000	7.000	23.000
221	50.000	7.000	23.000	222	70.000	7.000	23.000
223	10.000	7.000	29.000	224	30.000	7.000	29.000
225	50.000	7.000	29.000	226	70.000	7.000	29.000
227	32.475	7.780	5.000	228	47.778	7.701	5.000
229	52.761	7.871	5.000	230	10.000	7.000	35.000
231	67.778	7.701	5.000	232	12.856	7.901	11.000
233	30.000	7.000	35.000	234	50.000	7.000	35.000
235	70.000	7.000	35.000	236	10.000	7.000	41.000
237	30.000	7.000	41.000	238	50.000	7.000	41.000
239	70.000	7.000	41.000	240	10.000	7.000	47.000
241	30.000	7.000	47.000	242	50.000	7.000	47.000
243	70.000	7.000	47.000	244	10.000	7.000	53.000
245	30.000	7.000	53.000	246	50.000	7.000	53.000
247	70.000	7.000	53.000	248	13.333	8.051	5.000
249	26.667	8.051	5.000	250	33.333	8.051	5.000
251	46.667	8.051	5.000	252	53.333	8.051	5.000
253	66.667	8.051	5.000	254	13.333	8.051	11.000
255	26.667	8.051	11.000	256	33.333	8.051	11.000
257	46.667	8.051	11.000	258	53.333	8.051	11.000
259	66.667	8.051	11.000	260	13.333	8.051	17.000
261	26.667	8.051	17.000	262	33.333	8.051	17.000
263	46.667	8.051	17.000	264	53.333	8.051	17.000
265	66.667	8.051	17.000	266	13.333	8.051	23.000
267	26.667	8.051	23.000	268	33.333	8.051	23.000
269	46.667	8.051	23.000	270	53.333	8.051	23.000
271	66.667	8.051	23.000	272	13.333	8.051	29.000
273	26.667	8.051	29.000	274	33.333	8.051	29.000
275	46.667	8.051	29.000	276	53.333	8.051	29.000
277	66.667	8.051	29.000	278	13.333	8.051	35.000
279	26.667	8.051	35.000	280	33.333	8.051	35.000
281	46.667	8.051	35.000	282	53.333	8.051	35.000
283	66.667	8.051	35.000	284	13.333	8.051	41.000
285	26.667	8.051	41.000	286	33.333	8.051	41.000
287	46.667	8.051	41.000	288	53.333	8.051	41.000
289	66.667	8.051	41.000	290	13.333	8.051	47.000
291	26.667	8.051	47.000	292	33.333	8.051	47.000
293	46.667	8.051	47.000	294	53.333	8.051	47.000
295	66.667	8.051	47.000	296	13.333	8.051	53.000
297	26.667	8.051	53.000	298	33.333	8.051	53.000
299	46.667	8.051	53.000	300	53.333	8.051	53.000
301	66.667	8.051	53.000	302	35.000	8.577	0.000
303	45.000	8.577	0.000	304	55.000	8.577	0.000
305	65.000	8.577	0.000	306	15.000	8.577	5.000
307	25.000	8.577	5.000	308	35.000	8.577	5.000
309	45.000	8.577	5.000	310	55.000	8.577	5.000
311	65.000	8.577	5.000	312	15.000	8.577	53.000
313	25.000	8.577	53.000	314	35.000	8.577	53.000
315	45.000	8.577	53.000	316	55.000	8.577	53.000
317	65.000	8.577	53.000	318	16.667	9.102	5.000
319	23.333	9.102	5.000	320	36.667	9.102	5.000
321	43.333	9.102	5.000	322	56.667	9.102	5.000
323	63.333	9.102	5.000	324	16.667	9.102	11.000
325	23.333	9.102	11.000	326	36.667	9.102	11.000
327	43.333	9.102	11.000	328	56.667	9.102	11.000
329	63.333	9.102	11.000	330	16.667	9.102	17.000
331	23.333	9.102	17.000	332	36.667	9.102	17.000
333	43.333	9.102	17.000	334	56.667	9.102	17.000
335	63.333	9.102	17.000	336	16.667	9.102	23.000
337	23.333	9.102	23.000	338	36.667	9.102	23.000
339	43.333	9.102	23.000	340	56.667	9.102	23.000
341	63.333	9.102	23.000	342	16.667	9.102	29.000
343	23.333	9.102	29.000	344	36.667	9.102	29.000
345	43.333	9.102	29.000	346	56.667	9.102	29.000
347	63.333	9.102	29.000	348	37.144	9.253	5.000



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 9 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

349	42.856	9.253	5.000	350	57.239	9.282	5.000
351	62.761	9.282	5.000	352	16.667	9.102	35.000
353	17.778	9.452	11.000	354	22.761	9.282	11.000
355	23.333	9.102	35.000	356	36.667	9.102	35.000
357	43.333	9.102	35.000	358	56.667	9.102	35.000
359	63.333	9.102	35.000	360	16.667	9.102	41.000
361	23.333	9.102	41.000	362	36.667	9.102	41.000
363	43.333	9.102	41.000	364	56.667	9.102	41.000
365	63.333	9.102	41.000	366	16.667	9.102	47.000
367	23.333	9.102	47.000	368	36.667	9.102	47.000
369	43.333	9.102	47.000	370	56.667	9.102	47.000
371	63.333	9.102	47.000	372	16.667	9.102	53.000
373	23.333	9.102	53.000	374	36.667	9.102	53.000
375	43.333	9.102	53.000	376	56.667	9.102	53.000
377	63.333	9.102	53.000	378	40.000	10.153	0.000
379	60.000	10.153	0.000	380	20.000	10.153	5.000
381	40.000	10.153	5.000	382	60.000	10.153	5.000
383	20.000	10.153	11.000	384	40.000	10.153	11.000
385	60.000	10.153	11.000	386	20.000	10.153	17.000
387	40.000	10.153	17.000	388	60.000	10.153	17.000
389	20.000	10.153	23.000	390	40.000	10.153	23.000
391	60.000	10.153	23.000	392	20.000	10.153	29.000
393	40.000	10.153	29.000	394	60.000	10.153	29.000
395	20.000	10.153	35.000	396	40.000	10.153	35.000
397	60.000	10.153	35.000	398	20.000	10.153	41.000
399	40.000	10.153	41.000	400	60.000	10.153	41.000
401	20.000	10.153	47.000	402	40.000	10.153	47.000
403	60.000	10.153	47.000	404	20.000	10.153	53.000
405	40.000	10.153	53.000	406	60.000	10.153	53.000

MEMBER PROPERTIES

Members 1-16, 21-29, 34-35, 49-50, 54-57 & 59-65

M 356x171 UB 51 [S 275]
A 64.9E-4 Ix 14139E-8 Iy 971.2E-8 J 23.81E-8
E 205.0E6 G 78.85E6

Members 17-20, 30-33, 87, 90-91, 94-95, 98-99, 102-103, 106-107, 110-111, 114-115, 118 & 636

M 150x75 PFC 17.9 [S 275]
A 22.8E-4 Ix 861.0E-8 Iy 131.0E-8 J 6.1E-8
E 205.0E6 G 78.85E6

Members 36-38 & 40-48 (1.997m Haunch End1 (503.1), 2.023m Haunch End2 (513.4))

MD 254x146 UB 31 [S 355]
A 39.67E-4 Ix 4414E-8 Iy 448.4E-8 J 8.55E-8
E 205.0E6 G 78.85E6

Member 39 (1.997m Haunch End1 (503.1), 2.023m Haunch End2 (509.8))

MD 254x146 UB 31 [S 355]
A 39.67E-4 Ix 4414E-8 Iy 448.4E-8 J 8.55E-8
E 205.0E6 G 78.85E6

Members 51-53

M 356x368 UC 177 [S 275]
A 225.5E-4 Ix 57132E-8 Iy 20544E-8 J 381.5E-8
E 205.0E6 G 78.85E6

Members 58 & 66

M 356x171 UB 67 [S 275]
A 85.48E-4 Ix 19466E-8 Iy 1365E-8 J 55.68E-8
E 205.0E6 G 78.85E6



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 10 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Members 67, 69-75, 79-86, 88-89, 92-93, 96-97, 100-101, 104-105, 108-109,
112-113, 116-117 & 634-635

M 152x152 UC 23 [S 275]
A 29.24E-4 Ix 1251E-8 Iy 400.8E-8 J 4.63E-8
E 205.0E6 G 78.85E6

Members 68, 76-78, 239, 241 & 245

M 139.7x3.6 CHS 12.1 [S 275]
A 15.39E-4 Ix 356.6E-8 Iy 356.6E-8 J 713.3E-8
E 205.0E6 G 78.85E6

Members 119-238

M 406x178 UB 60 [S 275]
A 76.51E-4 Ix 21599E-8 Iy 1206E-8 J 33.32E-8
E 205.0E6 G 78.85E6

Members 240, 242-244 & 246-248

M 114.3x4 CHS 10.9 [S 275]
A 13.86E-4 Ix 211.1E-8 Iy 211.1E-8 J 422.1E-8
E 205.0E6 G 78.85E6

Members 249, 251, 313, 317, 378, 380, 382, 384, 394, 396, 459 & 463 (1.825m Haunch End1 (827.8), 1.111m Haunch End2 (925.4))

MD 406x140 UB 39 [S 235]
A 49.65E-4 Ix 12511E-8 Iy 412.7E-8 J 10.7E-8
E 205.0E6 G 78.85E6

Members 250 & 383 (1.816m Haunch End1 (828.2), 1.120m Haunch End2 (923.0))

MD 406x140 UB 39 [S 275]
A 49.65E-4 Ix 12511E-8 Iy 412.7E-8 J 10.7E-8
E 205.0E6 G 78.85E6

Members 252-253, 309, 319-320, 376, 381, 385-386, 392, 397-398, 455 & 465
1.825m Haunch End1 (819.9), 1.111m Haunch End2 (925.4)

MD 406x140 UB 39 [S 355]
A 49.65E-4 Ix 12511E-8 Iy 412.7E-8 J 10.7E-8
E 205.0E6 G 78.85E6

Members 254, 258, 308, 310-311, 314-315, 318, 326, 328, 365, 367, 369, 371, 373,
375, 399, 401, 454, 456, 458, 460, 462, 464 & 637-658

M 114.3x5 CHS 13.5 [S 275]
A 17.17E-4 Ix 256.9E-8 Iy 256.9E-8 J 513.8E-8
E 205.0E6 G 78.85E6

Members 255, 312, 316, 321, 377, 379, 387, 393, 395, 400, 457 & 461 (1.825m Haunch End1 (827.8), 1.111m Haunch End2 (925.4))

MD 406x140 UB 39 [S 355]
A 49.65E-4 Ix 12511E-8 Iy 412.7E-8 J 10.7E-8
E 205.0E6 G 78.85E6

Members 256-257, 261-262, 268, 270, 274, 276, 280, 282, 286, 288, 292, 294, 298,
300, 304, 306, 322, 324, 330, 332, 336, 338, 342, 344, 348, 350, 354, 356,
360, 362, 368, 372, 388, 390, 402-403, 406-407, 414, 416, 420, 422, 426, 428,
432, 434, 438, 440, 444, 446, 450 & 452 (1.825m Haunch End1 (827.8), 1.111m Haunch End2 (796.0))

MD 406x140 UB 39 [S 235]
A 49.65E-4 Ix 12511E-8 Iy 412.7E-8 J 10.7E-8
E 205.0E6 G 78.85E6

Members 259-260, 267, 273, 275, 279, 281, 285, 287, 291, 293, 297, 299, 303,
305, 323, 329, 335, 337, 341, 343, 347, 349, 353, 355, 359, 361, 366, 370,
389, 404-405, 412-413, 419, 421, 425, 427, 431, 433, 437, 439, 443, 445, 449 &
451 (1.825m Haunch End1 (827.8), 1.111m Haunch End2 (796.0))

MD 406x140 UB 39 [S 355]
A 49.65E-4 Ix 12511E-8 Iy 412.7E-8 J 10.7E-8
E 205.0E6 G 78.85E6



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 11 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Members 263-266, 271-272, 283-284, 289-290, 295-296, 301-302, 307, 325, 327,
333-334, 345-346, 351-352, 357-358, 363-364, 374, 391, 408-411, 417-418,
429-430, 435-436, 441-442, 447-448 & 453 (1.825m Haunch End1 (819.9), 1.111m Haunch End2 (796.0))

MD 406x140 UB 39 [S 355]
A 49.65E-4 Ix 12511E-8 Iy 412.7E-8 J 10.7E-8
E 205.0E6 G 78.85E6

Members 269, 331 & 415 (1.816m Haunch End1 (828.2), 1.120m Haunch End2 (796.0))

MD 406x140 UB 39 [S 275]
A 49.65E-4 Ix 12511E-8 Iy 412.7E-8 J 10.7E-8
E 205.0E6 G 78.85E6

Members 277, 339 & 423 (1.825m Haunch End1 (819.9), 1.111m Haunch End2 (796.0))

MD 406x140 UB 39 [S 275]
A 49.65E-4 Ix 12511E-8 Iy 412.7E-8 J 10.7E-8
E 205.0E6 G 78.85E6

Members 278, 340 & 424 (1.825m Haunch End1 (813.5), 1.111m Haunch End2 (796.0))

MD 406x140 UB 39 [S 355]
A 49.65E-4 Ix 12511E-8 Iy 412.7E-8 J 10.7E-8
E 205.0E6 G 78.85E6

Members 466 & 470 (Tapering Member from 457.0mm to 914.0mm)

MH 457x191 UB 74 [S 275]
A 94.62E-4 Ix 33322E-8 Iy 1674E-8 J 51.8E-8
E 205.0E6 G 78.85E6

Members 467-469, 471-473, 478-480, 541-543, 545-547 & 575

M 305x102 UB 25 [S 275]
A 31.6E-4 Ix 4456E-8 Iy 123.8E-8 J 4.77E-8
E 205.0E6 G 78.85E6

Member 474 (Tapering Member from 402.6mm to 805.2mm)

MH 406x178 UB 54 [S 355]
A 68.95E-4 Ix 18725E-8 Iy 1024E-8 J 23.12E-8
E 205.0E6 G 78.85E6

Members 475, 486, 492, 498, 504, 510, 516, 526, 534, 549, 552, 554, 556, 558,
560, 562, 565 & 568

M 305x165 UB 40 [S 355]
A 51.31E-4 Ix 8504E-8 Iy 766.0E-8 J 14.73E-8
E 205.0E6 G 78.85E6

Members 476, 523, 535, 550 & 569

M 203x203 UC 46 [S 275]
A 58.73E-4 Ix 4571E-8 Iy 1551E-8 J 22.15E-8
E 205.0E6 G 78.85E6

Members 477, 488, 494, 506, 512, 518, 528, 536, 551, 553, 555, 559, 561, 563,
566, 570, 576, 578, 607-614, 625-627 & 629-633 (0.200m Haunch at End 2, Depth 402.6mm to 805.2mm)

MH 406x178 UB 54 [S 355]
A 68.95E-4 Ix 18725E-8 Iy 1024E-8 J 23.12E-8
E 205.0E6 G 78.85E6

Members 481-483, 489, 495-496, 501-502, 507-508, 513-514, 522, 524, 529, 532,
540, 544, 564, 567, 574, 589-591 & 593-606 (0.567m Haunch at End 2, Depth 457.0mm to 914.0mm)

MH 457x191 UB 74 [S 275]
A 94.62E-4 Ix 33322E-8 Iy 1674E-8 J 51.8E-8
E 205.0E6 G 78.85E6

Members 484-485, 491, 497, 503, 509, 515, 525, 533, 548, 577, 579 & 616-624
0.575m Haunch at End 2, Depth 402.6mm to 805.2mm

MH 406x178 UB 54 [S 355]
A 68.95E-4 Ix 18725E-8 Iy 1024E-8 J 23.12E-8
E 205.0E6 G 78.85E6



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 12 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Members 487, 493, 499, 505, 511, 517, 527 & 530-531
M 152x152 UC 30 [S 275]
A 38.26E-4 Ix 1749E-8 Iy 561.4E-8 J 10.52E-8
E 205.0E6 G 78.85E6

Members 490 & 592 (0.568m Haunch at End 2, Depth 457.0mm to 914.0mm)
MH 457x191 UB 74 [S 275]
A 94.62E-4 Ix 33322E-8 Iy 1674E-8 J 51.8E-8
E 205.0E6 G 78.85E6

Members 500, 557, 615 & 628 (0.200m Haunch at End 2, Depth 355.0mm to 710.0mm)
MH 356x171 UB 51 [S 275]
A 64.9E-4 Ix 14139E-8 Iy 971.2E-8 J 23.81E-8
E 205.0E6 G 78.85E6

Members 519-521, 537-539 & 571-573
M 254x254 UC 107 [S 275]
A 136.4E-4 Ix 17517E-8 Iy 5935E-8 J 172.4E-8
E 205.0E6 G 78.85E6

Members 580-588
M 152x152 UC 23 [S 355]
A 29.24E-4 Ix 1251E-8 Iy 400.8E-8 J 4.63E-8
E 205.0E6 G 78.85E6

MEMBER LOADING

Note: Partial Fixity - Use 0% in Ultimate, 10% in Sway Stability and 20% in Serviceability Loading Cases
Member Self Weight Density Load Included in Load Group D1, defined by Modulus of Elasticity

E kN/mm ²	Density kN/m ³
>= 200.00	77.01
>= 20.00	24.00
>= 2.00	10.00

Members 1-16, 23-29, 51-53, 60 & 64

UT Spacing 05.000 [Multiply AllLoads]
D1 UDLY -005.000 [kN/m]
L1 UDLY -005.000 [kN/m]

Members 36 & 45
UT Spacing 03.000 [Multiply AllLoads]
Lean-To Beam 1
D1 UDLY -000.350 [kN/m]
D2 UDLY -000.100 [kN/m]
L0 UDLY -000.600 [kN/m]
L3 PTRY -000.000 9.000 10.00 -000.400 [kN/m,m,m,kN/m]
L4 UDLY -000.433 [kN/m]
L5 PTRY -002.000 0.000 5.000 -000.000 [kN/m,m,m,kN/m]
W1 PTRN +001.348 0.000 2.041 +001.348 [kN/m,m,m,kN/m]
W1 PTRN +000.452 2.041 10.05 +000.452 [kN/m,m,m,kN/m]
W2 PTRN -000.011 0.000 2.041 -000.011 [kN/m,m,m,kN/m]
W2 PTRN -000.011 2.041 10.05 -000.011 [kN/m,m,m,kN/m]
W3 PTRN +000.754 0.000 5.101 +000.754 [kN/m,m,m,kN/m]
W3 UDLN +000.179 [kN/m]
W3 PTRN +000.431 5.101 10.05 +000.431 [kN/m,m,m,kN/m]
W4 PTRN +000.172 0.000 8.009 +000.172 [kN/m,m,m,kN/m]
W4 PTRN +000.392 8.009 10.05 +000.392 [kN/m,m,m,kN/m]
W5 PTRN +000.172 0.000 8.009 +000.172 [kN/m,m,m,kN/m]
W5 PTRN +000.392 8.009 10.05 +000.392 [kN/m,m,m,kN/m]

Members 37 & 46
UT Spacing 06.000 [Multiply AllLoads]
Lean-To Beam 1
D1 UDLY -000.350 [kN/m]
D2 UDLY -000.100 [kN/m]
L0 UDLY -000.600 [kN/m]
L3 PTRY -000.000 9.000 10.00 -000.400 [kN/m,m,m,kN/m]
L4 UDLY -000.433 [kN/m]
L5 PTRY -002.000 0.000 5.000 -000.000 [kN/m,m,m,kN/m]
W1 PTRN +001.328 0.000 2.041 +001.328 [kN/m,m,m,kN/m]
W1 PTRN +000.452 2.041 10.05 +000.452 [kN/m,m,m,kN/m]
W2 PTRN -000.011 0.000 2.041 -000.011 [kN/m,m,m,kN/m]
W2 PTRN -000.011 2.041 10.05 -000.011 [kN/m,m,m,kN/m]
W3 PTRN +000.077 0.000 5.101 +000.077 [kN/m,m,m,kN/m]
W3 UDLN +000.382 [kN/m]
W3 PTRN +000.044 5.101 10.05 +000.044 [kN/m,m,m,kN/m]
W4 PTRN +000.172 0.000 8.009 +000.172 [kN/m,m,m,kN/m]
W4 PTRN +000.380 8.009 10.05 +000.380 [kN/m,m,m,kN/m]
W5 PTRN +000.172 0.000 8.009 +000.172 [kN/m,m,m,kN/m]
W5 PTRN +000.380 8.009 10.05 +000.380 [kN/m,m,m,kN/m]

Member 38
UT Spacing 06.000 [Multiply AllLoads]
Lean-To Beam 1
D1 UDLY -000.350 [kN/m]
D2 UDLY -000.100 [kN/m]
L0 UDLY -000.600 [kN/m]
L3 PTRY -000.000 9.000 10.00 -000.400 [kN/m,m,m,kN/m]
L4 UDLY -000.433 [kN/m]
L5 PTRY -002.000 0.000 5.000 -000.000 [kN/m,m,m,kN/m]
W1 PTRN +001.009 0.000 2.041 +001.009 [kN/m,m,m,kN/m]
W1 PTRN +000.452 2.041 10.05 +000.452 [kN/m,m,m,kN/m]
W2 PTRN -000.011 0.000 2.041 -000.011 [kN/m,m,m,kN/m]
W2 PTRN -000.011 2.041 10.05 -000.011 [kN/m,m,m,kN/m]
W3 UDLN +000.353 [kN/m]
W4 PTRN +000.172 0.000 8.009 +000.172 [kN/m,m,m,kN/m]
W4 PTRN +000.204 8.009 10.05 +000.204 [kN/m,m,m,kN/m]
W5 PTRN +000.172 0.000 8.009 +000.172 [kN/m,m,m,kN/m]
W5 PTRN +000.204 8.009 10.05 +000.204 [kN/m,m,m,kN/m]

Members 39-41
UT Spacing 06.000 [Multiply AllLoads]
Lean-To Beam 1
D1 UDLY -000.350 [kN/m]
D2 UDLY -000.100 [kN/m]
L0 UDLY -000.600 [kN/m]
L3 PTRY -000.000 9.000 10.00 -000.400 [kN/m,m,m,kN/m]
L4 UDLY -000.433 [kN/m]
L5 PTRY -002.000 0.000 5.000 -000.000 [kN/m,m,m,kN/m]
W1 PTRN +000.903 0.000 2.041 +000.903 [kN/m,m,m,kN/m]
W1 PTRN +000.452 2.041 10.05 +000.452 [kN/m,m,m,kN/m]
W2 PTRN -000.011 0.000 2.041 -000.011 [kN/m,m,m,kN/m]
W2 PTRN -000.011 2.041 10.05 -000.011 [kN/m,m,m,kN/m]
W3 UDLN +000.335 [kN/m]
W4 PTRN +000.172 0.000 8.009 +000.172 [kN/m,m,m,kN/m]
W4 PTRN +000.145 8.009 10.05 +000.145 [kN/m,m,m,kN/m]
W5 PTRN +000.172 0.000 8.009 +000.172 [kN/m,m,m,kN/m]
W5 PTRN +000.145 8.009 10.05 +000.145 [kN/m,m,m,kN/m]

Member 42
UT Spacing 06.000 [Multiply AllLoads]



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway

Lymington, Hampshire SO41 6EB

E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
 Sheet : Sheet Ref / 13 -
 Made By : PF
 Date : 23 Jul 2019/ Version 2015.04
 Checked :
 Approved :

Lean-To Beam 1			
D1 UDLY -000.350	[kN/m]	D1 UDLY -000.350	[kN/m]
D2 UDLY -000.100	[kN/m]	D2 UDLY -000.100	[kN/m]
L0 UDLY -000.600	[kN/m]	L0 UDLY -000.600	[kN/m]
L2 UDLY -000.433	[kN/m]	L2 UDLY -000.433	[kN/m]
L3 PTRY -000.000 9.000 10.00 -000.400	[kN/m,m,m,kN/m]	L3 PTRY -001.500 0.000 10.00 -000.000	[kN/m,m,m,kN/m]
L4 UDLY -000.433	[kN/m]	L5 PTRY -001.500 0.000 10.00 -000.000	[kN/m,m,m,kN/m]
L5 PTRY -002.000 0.000 5.000 -000.000	[kN/m,m,m,kN/m]	W1 PTRN +000.942 8.356 10.48 +000.942	[kN/m,m,m,kN/m]
W1 PTRN +001.009 0.000 2.041 +001.009	[kN/m,m,m,kN/m]	W1 PTRN +000.382 0.000 8.356 +000.382	[kN/m,m,m,kN/m]
W1 PTRN +000.452 2.041 10.05 +000.452	[kN/m,m,m,kN/m]	W2 PTRN +000.942 8.356 10.48 +000.942	[kN/m,m,m,kN/m]
W2 PTRN -000.011 0.000 2.041 -000.011	[kN/m,m,m,kN/m]	W2 PTRN +000.382 0.000 8.356 +000.382	[kN/m,m,m,kN/m]
W2 PTRN -000.011 2.041 10.05 -000.011	[kN/m,m,m,kN/m]	W3 UDLN +000.720	[kN/m]
W3 UDLN +000.335	[kN/m]	W4 PTRN +000.223 2.130 10.48 +000.223	[kN/m,m,m,kN/m]
W4 PTRN +000.172 0.000 8.009 +000.172	[kN/m,m,m,kN/m]	W4 PTRN +000.300 0.000 2.130 +000.300	[kN/m,m,m,kN/m]
W4 PTRN +000.204 8.009 10.05 +000.204	[kN/m,m,m,kN/m]	W5 PTRN +000.223 2.130 10.48 +000.223	[kN/m,m,m,kN/m]
W5 PTRN +000.172 0.000 8.009 +000.172	[kN/m,m,m,kN/m]	W5 PTRN +000.300 0.000 2.130 +000.300	[kN/m,m,m,kN/m]
W5 PTRN +000.204 8.009 10.05 +000.204	[kN/m,m,m,kN/m]		

Members 43 & 47			
UT Spacing 06.000 [Multiply AllLoads]			
Lean-To Beam 1			
D1 UDLY -000.350	[kN/m]	D1 UDLY -000.350	[kN/m]
D2 UDLY -000.100	[kN/m]	D2 UDLY -000.100	[kN/m]
L0 UDLY -000.600	[kN/m]	L0 UDLY -000.600	[kN/m]
L2 UDLY -000.433	[kN/m]	L2 UDLY -000.433	[kN/m]
L3 PTRY -000.000 9.000 10.00 -000.400	[kN/m,m,m,kN/m]	L3 PTRY -001.500 0.000 10.00 -000.000	[kN/m,m,m,kN/m]
L4 UDLY -000.433	[kN/m]	L5 PTRY -001.500 0.000 10.00 -000.000	[kN/m,m,m,kN/m]
L5 PTRY -002.000 0.000 5.000 -000.000	[kN/m,m,m,kN/m]	W1 PTRN +000.548 0.000 2.130 +000.548	[kN/m,m,m,kN/m]
W1 PTRN +001.328 0.000 2.041 +001.328	[kN/m,m,m,kN/m]	W1 PTRN +000.407 2.130 10.48 +000.407	[kN/m,m,m,kN/m]
W1 PTRN +000.452 2.041 10.05 +000.452	[kN/m,m,m,kN/m]	W2 PTRN +000.548 0.000 2.130 +000.548	[kN/m,m,m,kN/m]
W2 PTRN -000.011 0.000 2.041 -000.011	[kN/m,m,m,kN/m]	W2 PTRN +000.407 2.130 10.48 +000.407	[kN/m,m,m,kN/m]
W2 PTRN -000.011 2.041 10.05 -000.011	[kN/m,m,m,kN/m]	W3 UDLN +000.720	[kN/m]
W3 UDLN +000.335	[kN/m]	W4 PTRN +000.209 0.000 8.356 +000.209	[kN/m,m,m,kN/m]
W4 PTRN +000.172 0.000 8.009 +000.172	[kN/m,m,m,kN/m]	W4 PTRN +000.516 8.356 10.48 +000.516	[kN/m,m,m,kN/m]
W4 PTRN +000.380 8.009 10.05 +000.380	[kN/m,m,m,kN/m]	W5 PTRN +000.209 0.000 8.356 +000.209	[kN/m,m,m,kN/m]
W5 PTRN +000.172 0.000 8.009 +000.172	[kN/m,m,m,kN/m]	W5 PTRN +000.516 8.356 10.48 +000.516	[kN/m,m,m,kN/m]
W5 PTRN +000.380 8.009 10.05 +000.380	[kN/m,m,m,kN/m]		

Members 44 & 48			
UT Spacing 03.000 [Multiply AllLoads]			
Lean-To Beam 1			
D1 UDLY -000.350	[kN/m]	D1 UDLY -000.350	[kN/m]
D2 UDLY -000.100	[kN/m]	D2 UDLY -000.100	[kN/m]
L0 UDLY -000.600	[kN/m]	L0 UDLY -000.600	[kN/m]
L2 UDLY -000.433	[kN/m]	L2 UDLY -000.433	[kN/m]
L3 PTRY -000.000 9.000 10.00 -000.400	[kN/m,m,m,kN/m]	L3 PTRY -001.500 0.000 10.00 -000.000	[kN/m,m,m,kN/m]
L4 UDLY -000.433	[kN/m]	L5 PTRY -001.500 0.000 10.00 -000.000	[kN/m,m,m,kN/m]
L5 PTRY -002.000 0.000 5.000 -000.000	[kN/m,m,m,kN/m]	W1 PTRN +000.942 8.356 10.48 +000.942	[kN/m,m,m,kN/m]
W1 PTRN +001.348 0.000 2.041 +001.348	[kN/m,m,m,kN/m]	W1 PTRN +000.382 0.000 8.356 +000.382	[kN/m,m,m,kN/m]
W1 PTRN +000.452 2.041 10.05 +000.452	[kN/m,m,m,kN/m]	W2 PTRN +000.942 8.356 10.48 +000.942	[kN/m,m,m,kN/m]
W2 PTRN -000.011 0.000 2.041 -000.011	[kN/m,m,m,kN/m]	W2 PTRN +000.382 0.000 8.356 +000.382	[kN/m,m,m,kN/m]
W2 PTRN -000.011 2.041 10.05 -000.011	[kN/m,m,m,kN/m]	W3 UDLN +000.720	[kN/m]
W3 UDLN +000.335	[kN/m]	W4 PTRN +000.223 2.130 10.48 +000.223	[kN/m,m,m,kN/m]
W4 PTRN +000.172 0.000 8.009 +000.172	[kN/m,m,m,kN/m]	W4 PTRN +000.300 0.000 2.130 +000.300	[kN/m,m,m,kN/m]
W4 PTRN +000.392 8.009 10.05 +000.392	[kN/m,m,m,kN/m]	W5 PTRN +000.223 2.130 10.48 +000.223	[kN/m,m,m,kN/m]
W5 PTRN +000.172 0.000 8.009 +000.172	[kN/m,m,m,kN/m]	W5 PTRN +000.300 0.000 2.130 +000.300	[kN/m,m,m,kN/m]
W5 PTRN +000.392 8.009 10.05 +000.392	[kN/m,m,m,kN/m]		

Members 50, 54 & 61			
UT Spacing 02.500 [Multiply AllLoads]			
D1 UDLY -005.000	[kN/m]	D1 UDLY -000.350	[kN/m]
L1 UDLY -005.000	[kN/m]	D2 UDLY -000.100	[kN/m]
		L0 UDLY -000.600	[kN/m]
		L2 UDLY -000.433	[kN/m]
		L4 UDLY -000.433	[kN/m]
		L3 PTRY -001.500 0.000 10.00 -000.000	[kN/m,m,m,kN/m]
		L5 PTRY -001.500 0.000 10.00 -000.000	[kN/m,m,m,kN/m]
		W1 PTRN +000.548 0.000 2.130 +000.548	[kN/m,m,m,kN/m]
		W1 PTRN +000.407 2.130 10.48 +000.407	[kN/m,m,m,kN/m]
		W2 PTRN +000.548 0.000 2.130 +000.548	[kN/m,m,m,kN/m]
		W2 PTRN +000.407 2.130 10.48 +000.407	[kN/m,m,m,kN/m]
		W3 UDLN +000.720	[kN/m]
		W4 PTRN +000.209 0.000 8.356 +000.209	[kN/m,m,m,kN/m]
		W4 PTRN +000.516 8.356 10.48 +000.516	[kN/m,m,m,kN/m]
		W5 PTRN +000.209 0.000 8.356 +000.209	[kN/m,m,m,kN/m]
		W5 PTRN +000.516 8.356 10.48 +000.516	[kN/m,m,m,kN/m]

Members 67, 69-75, 79-118 & 239-248			
Wall Bracing			
Members 68, 76-78, 254, 258, 308, 310-311, 314-315, 318, 326, 328, 365, 367,			
369, 371, 373, 375, 399,			
401, 454, 456, 458, 460, 462, 464, 637-638 & 640-656			
Roof Bracing			
Members 119-238			
Dummy Transfer Member			
Members 253, 320, 386 & 398			
UT Spacing 03.000 [Multiply AllLoads]			
Rafter 1 of Bay 1			
D1 UDLY -000.350	[kN/m]	D1 UDLY -000.350	[kN/m]
D2 UDLY -000.100	[kN/m]	D2 UDLY -000.100	[kN/m]
L0 UDLY -000.600	[kN/m]	L0 UDLY -000.600	[kN/m]
L2 UDLY -000.433	[kN/m]	L2 UDLY -000.433	[kN/m]
L3 PTRN +000.764 0.000 2.130 +000.764	[kN/m,m,m,kN/m]	W1 PTRN +000.942 8.356 10.48 +000.942	[kN/m,m,m,kN/m]
W1 PTRN +000.280 2.130 10.48 +000.280	[kN/m,m,m,kN/m]	W1 PTRN +000.382 0.000 8.356 +000.382	[kN/m,m,m,kN/m]
W2 PTRN -000.229 0.000 2.130 -000.229	[kN/m,m,m,kN/m]	W2 PTRN +000.942 8.356 10.48 +000.942	[kN/m,m,m,kN/m]
W2 PTRN -000.178 2.130 10.48 -000.178	[kN/m,m,m,kN/m]	W2 PTRN +000.382 0.000 8.356 +000.382	[kN/m,m,m,kN/m]
W3 PTRN +000.581 0.000 5.322 +000.581	[kN/m,m,m,kN/m]	W3 PTRN +000.543 5.322 10.48 +000.543	[kN/m,m,m,kN/m]
W3 UDLN +000.177	[kN/m]	W3 UDLN +000.177	[kN/m]
W3 PTRN +000.543 5.322 10.48 +000.543	[kN/m,m,m,kN/m]	W3 PTRN +000.581 0.000 5.322 +000.581	[kN/m,m,m,kN/m]
W4 PTRN +000.209 0.000 8.356 +000.209	[kN/m,m,m,kN/m]	W4 PTRN +000.153 2.130 10.48 +000.153	[kN/m,m,m,kN/m]
W4 PTRN +000.516 8.356 10.48 +000.516	[kN/m,m,m,kN/m]	W4 PTRN +000.418 0.000 2.130 +000.418	[kN/m,m,m,kN/m]
W5 PTRN +000.209 0.000 8.356 +000.209	[kN/m,m,m,kN/m]	W5 PTRN -000.097 2.130 10.48 -000.097	[kN/m,m,m,kN/m]
W5 PTRN +000.516 8.356 10.48 +000.516	[kN/m,m,m,kN/m]	W5 PTRN -000.125 0.000 2.130 -000.125	[kN/m,m,m,kN/m]

Members 255, 321, 387 & 400			
UT Spacing 03.000 [Multiply AllLoads]			
Rafter 2 of Bay 1			
D1 UDLY -000.350	[kN/m]	D1 UDLY -000.350	[kN/m]
D2 UDLY -000.100	[kN/m]	D2 UDLY -000.100	[kN/m]
L0 UDLY -000.600	[kN/m]	L0 UDLY -000.600	[kN/m]
L2 UDLY -000.433	[kN/m]	L2 UDLY -000.433	[kN/m]
W1 PTRN +000.754 0.000 2.130 +000.754	[kN/m,m,m,kN/m]		



R Elliott Associates Ltd

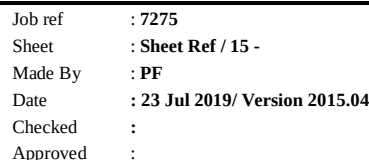
Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 14 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

W1 PTRN +000.280 2.130 10.48 +000.280 [kN/m,m,m,kN/m]	W3 PTRN +000.059 0.000 5.322 +000.059 [kN/m,m,m,kN/m]
W2 PTRN -000.228 0.000 2.130 -000.228 [kN/m,m,m,kN/m]	W4 PTRN +000.153 2.130 10.48 +000.153 [kN/m,m,m,kN/m]
W2 PTRN -000.178 2.130 10.48 -000.178 [kN/m,m,m,kN/m]	W4 PTRN +000.413 0.000 2.130 +000.413 [kN/m,m,m,kN/m]
W3 PTRN +000.059 0.000 5.322 +000.059 [kN/m,m,m,kN/m]	W5 PTRN -000.097 2.130 10.48 -000.097 [kN/m,m,m,kN/m]
W3 UDLN +000.376 [kN/m]	W5 PTRN -000.125 0.000 2.130 -000.125 [kN/m,m,m,kN/m]
W3 PTRN +000.055 5.322 10.48 +000.055 [kN/m,m,m,kN/m]	
W4 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]	Members 272, 334 & 418
W4 PTRN +000.508 8.356 10.48 +000.508 [kN/m,m,m,kN/m]	UT Spacing 06.000 [Multiply AllLoads]
W5 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]	Rafter 1 of Bay 1
W5 PTRN +000.508 8.356 10.48 +000.508 [kN/m,m,m,kN/m]	D1 UDLY -000.350 [kN/m]
	D2 UDLY -000.100 [kN/m]
	L0 UDLY -000.600 [kN/m]
	L4 UDLY -000.433 [kN/m]
Members 267, 329 & 412-413	W1 PTRN +000.619 0.000 2.130 +000.619 [kN/m,m,m,kN/m]
UT Spacing 06.000 [Multiply AllLoads]	W1 PTRN +000.280 2.130 10.48 +000.280 [kN/m,m,m,kN/m]
Rafter 2 of Bay 1	W2 PTRN -000.200 0.000 2.130 -000.200 [kN/m,m,m,kN/m]
D1 UDLY -000.350 [kN/m]	W2 PTRN -000.178 2.130 10.48 -000.178 [kN/m,m,m,kN/m]
D2 UDLY -000.100 [kN/m]	W3 UDLN +000.311 [kN/m]
L0 UDLY -000.600 [kN/m]	W4 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]
L2 UDLY -000.433 [kN/m]	W4 PTRN +000.388 8.356 10.48 +000.388 [kN/m,m,m,kN/m]
L3 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]	W5 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]
L5 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]	W5 PTRN +000.388 8.356 10.48 +000.388 [kN/m,m,m,kN/m]
W1 PTRN +000.927 8.356 10.48 +000.927 [kN/m,m,m,kN/m]	
W1 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]	Members 273, 335 & 419
W2 PTRN +000.927 8.356 10.48 +000.927 [kN/m,m,m,kN/m]	UT Spacing 06.000 [Multiply AllLoads]
W2 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]	Rafter 2 of Bay 1
W3 UDLN +000.431 [kN/m]	D1 UDLY -000.350 [kN/m]
W4 PTRN +000.223 2.130 10.48 +000.223 [kN/m,m,m,kN/m]	D2 UDLY -000.100 [kN/m]
W4 PTRN +000.296 0.000 2.130 +000.296 [kN/m,m,m,kN/m]	L0 UDLY -000.600 [kN/m]
W5 PTRN +000.223 2.130 10.48 +000.223 [kN/m,m,m,kN/m]	L2 UDLY -000.433 [kN/m]
W5 PTRN +000.296 0.000 2.130 +000.296 [kN/m,m,m,kN/m]	L3 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
	L5 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
	W1 PTRN +000.709 8.356 10.48 +000.709 [kN/m,m,m,kN/m]
Members 268, 330 & 414	W1 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]
UT Spacing 06.000 [Multiply AllLoads]	W2 PTRN +000.709 8.356 10.48 +000.709 [kN/m,m,m,kN/m]
Rafter 1 of Bay 2	W2 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]
D1 UDLY -000.350 [kN/m]	W3 UDLN +000.311 [kN/m]
D2 UDLY -000.100 [kN/m]	W4 PTRN +000.223 2.130 10.48 +000.223 [kN/m,m,m,kN/m]
L0 UDLY -000.600 [kN/m]	W4 PTRN +000.241 0.000 2.130 +000.241 [kN/m,m,m,kN/m]
L2 UDLY -000.433 [kN/m]	W5 PTRN +000.223 2.130 10.48 +000.223 [kN/m,m,m,kN/m]
L3 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]	W5 PTRN +000.241 0.000 2.130 +000.241 [kN/m,m,m,kN/m]
L5 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]	
W1 PTRN +000.541 0.000 2.130 +000.541 [kN/m,m,m,kN/m]	Members 274, 336 & 420
W1 PTRN +000.407 2.130 10.48 +000.407 [kN/m,m,m,kN/m]	UT Spacing 06.000 [Multiply AllLoads]
W2 PTRN +000.541 0.000 2.130 +000.541 [kN/m,m,m,kN/m]	Rafter 1 of Bay 2
W2 PTRN +000.407 2.130 10.48 +000.407 [kN/m,m,m,kN/m]	D1 UDLY -000.350 [kN/m]
W3 UDLN +000.431 [kN/m]	D2 UDLY -000.100 [kN/m]
W4 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]	L0 UDLY -000.600 [kN/m]
W4 PTRN +000.508 8.356 10.48 +000.508 [kN/m,m,m,kN/m]	L2 UDLY -000.433 [kN/m]
W5 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]	L3 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
W5 PTRN +000.508 8.356 10.48 +000.508 [kN/m,m,m,kN/m]	L5 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
	W1 PTRN +000.441 0.000 2.130 +000.441 [kN/m,m,m,kN/m]
Members 269, 331 & 415	W1 PTRN +000.407 2.130 10.48 +000.407 [kN/m,m,m,kN/m]
UT Spacing 06.000 [Multiply AllLoads]	W2 PTRN +000.441 0.000 2.130 +000.441 [kN/m,m,m,kN/m]
Rafter 2 of Bay 2	W2 PTRN +000.407 2.130 10.48 +000.407 [kN/m,m,m,kN/m]
D1 UDLY -000.350 [kN/m]	W3 UDLN +000.311 [kN/m]
D2 UDLY -000.100 [kN/m]	W4 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]
L0 UDLY -000.600 [kN/m]	W4 PTRN +000.388 8.356 10.48 +000.388 [kN/m,m,m,kN/m]
L2 UDLY -000.433 [kN/m]	W5 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]
L3 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]	W5 PTRN +000.388 8.356 10.48 +000.388 [kN/m,m,m,kN/m]
L5 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]	
W1 PTRN +000.927 8.356 10.48 +000.927 [kN/m,m,m,kN/m]	Members 275, 337 & 421
W1 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]	UT Spacing 06.000 [Multiply AllLoads]
W2 PTRN +000.927 8.356 10.48 +000.927 [kN/m,m,m,kN/m]	Rafter 2 of Bay 2
W2 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]	D1 UDLY -000.350 [kN/m]
W3 UDLN +000.431 [kN/m]	D2 UDLY -000.100 [kN/m]
W4 PTRN +000.223 2.130 10.48 +000.223 [kN/m,m,m,kN/m]	L0 UDLY -000.600 [kN/m]
W4 PTRN +000.296 0.000 2.130 +000.296 [kN/m,m,m,kN/m]	L2 UDLY -000.433 [kN/m]
W5 PTRN +000.223 2.130 10.48 +000.223 [kN/m,m,m,kN/m]	L3 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
W5 PTRN +000.296 0.000 2.130 +000.296 [kN/m,m,m,kN/m]	L5 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
	W1 PTRN +000.709 8.356 10.48 +000.709 [kN/m,m,m,kN/m]
Members 270, 332 & 416	W1 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]
UT Spacing 06.000 [Multiply AllLoads]	W2 PTRN +000.709 8.356 10.48 +000.709 [kN/m,m,m,kN/m]
Rafter 1 of Bay 3	W2 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]
D1 UDLY -000.350 [kN/m]	W3 UDLN +000.311 [kN/m]
D2 UDLY -000.100 [kN/m]	W4 PTRN +000.223 2.130 10.48 +000.223 [kN/m,m,m,kN/m]
L0 UDLY -000.600 [kN/m]	W4 PTRN +000.241 0.000 2.130 +000.241 [kN/m,m,m,kN/m]
L2 UDLY -000.433 [kN/m]	W5 PTRN +000.223 2.130 10.48 +000.223 [kN/m,m,m,kN/m]
L3 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]	W5 PTRN +000.241 0.000 2.130 +000.241 [kN/m,m,m,kN/m]
L5 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]	
W1 PTRN +000.541 0.000 2.130 +000.541 [kN/m,m,m,kN/m]	Members 276, 338 & 422
W1 PTRN +000.407 2.130 10.48 +000.407 [kN/m,m,m,kN/m]	UT Spacing 06.000 [Multiply AllLoads]
W2 PTRN +000.541 0.000 2.130 +000.541 [kN/m,m,m,kN/m]	Rafter 1 of Bay 3
W2 PTRN +000.407 2.130 10.48 +000.407 [kN/m,m,m,kN/m]	D1 UDLY -000.350 [kN/m]
W3 UDLN +000.431 [kN/m]	D2 UDLY -000.100 [kN/m]
W4 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]	L0 UDLY -000.600 [kN/m]
W4 PTRN +000.508 8.356 10.48 +000.508 [kN/m,m,m,kN/m]	L2 UDLY -000.433 [kN/m]
W5 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]	L3 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
W5 PTRN +000.508 8.356 10.48 +000.508 [kN/m,m,m,kN/m]	L5 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
	W1 PTRN +000.441 0.000 2.130 +000.441 [kN/m,m,m,kN/m]
Members 271, 333 & 417	W1 PTRN +000.407 2.130 10.48 +000.407 [kN/m,m,m,kN/m]
UT Spacing 06.000 [Multiply AllLoads]	W2 PTRN +000.441 0.000 2.130 +000.441 [kN/m,m,m,kN/m]
Rafter 2 of Bay 3	W2 PTRN +000.407 2.130 10.48 +000.407 [kN/m,m,m,kN/m]
D1 UDLY -000.350 [kN/m]	W3 UDLN +000.311 [kN/m]
D2 UDLY -000.100 [kN/m]	W4 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]
L0 UDLY -000.600 [kN/m]	W4 PTRN +000.388 8.356 10.48 +000.388 [kN/m,m,m,kN/m]
L2 UDLY -000.433 [kN/m]	W5 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]
L3 PTRY -001.500 0.000 10.48 +000.927 [kN/m,m,m,kN/m]	W5 PTRN +000.388 8.356 10.48 +000.388 [kN/m,m,m,kN/m]
L5 PTRY -001.500 0.000 10.48 +000.382 [kN/m,m,m,kN/m]	
W1 PTRN +000.927 8.356 10.48 +000.927 [kN/m,m,m,kN/m]	Members 277, 339 & 423
W1 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]	
W2 PTRN +000.927 8.356 10.48 +000.927 [kN/m,m,m,kN/m]	
W2 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]	
W3 PTRN +000.055 5.322 10.48 +000.055 [kN/m,m,m,kN/m]	
W3 UDLN +000.376 [kN/m]	



© Civil and Structural Computer Services Limited, 1 Circular Road, Newtownabbey, Co. Antrim BT37 0RA. Tel : 028 9036 5950 Fax : 028 9036 5102



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 16 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Members 300, 362 & 446				W1 PTRN +000.927 8.356 10.48 +000.927	[kN/m, m, m, kN/m]
UT Spacing 06.000 [Multiply AllLoads]				W1 PTRN +000.382 0.000 8.356 +000.382	[kN/m, m, m, kN/m]
Rafter 1 of Bay 3				W2 PTRN +000.927 8.356 10.48 +000.927	[kN/m, m, m, kN/m]
D1 UDLY -000.350	[kN/m]			W2 PTRN +000.382 0.000 8.356 +000.382	[kN/m, m, m, kN/m]
D2 UDLY -000.100	[kN/m]			W3 UDLN +000.281	[kN/m]
L0 UDLY -000.600	[kN/m]			W4 PTRN +000.223 2.130 10.48 +000.223	[kN/m, m, m, kN/m]
L4 UDLY -000.433	[kN/m]			W4 PTRN +000.296 0.000 2.130 +000.296	[kN/m, m, m, kN/m]
L3 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]			W5 PTRN +000.223 2.130 10.48 +000.223	[kN/m, m, m, kN/m]
L5 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]			W5 PTRN +000.296 0.000 2.130 +000.296	[kN/m, m, m, kN/m]
W1 PTRN +000.441 0.000 2.130 +000.441	[kN/m, m, m, kN/m]				
W1 PTRN +000.407 2.130 10.48 +000.407	[kN/m, m, m, kN/m]			Members 306, 372 & 452	
W2 PTRN +000.441 0.000 2.130 +000.441	[kN/m, m, m, kN/m]			UT Spacing 06.000 [Multiply AllLoads]	
W2 PTRN +000.407 2.130 10.48 +000.407	[kN/m, m, m, kN/m]			Rafter 1 of Bay 3	
W3 UDLN +000.281	[kN/m]			D1 UDLY -000.350	[kN/m]
W4 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]			D2 UDLY -000.100	[kN/m]
W4 PTRN +000.388 8.356 10.48 +000.388	[kN/m, m, m, kN/m]			L0 UDLY -000.600	[kN/m]
W5 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]			L4 UDLY -000.433	[kN/m]
W5 PTRN +000.388 8.356 10.48 +000.388	[kN/m, m, m, kN/m]			L3 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]
				L5 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]
Members 301, 363 & 447				W1 PTRN +000.541 0.000 2.130 +000.541	[kN/m, m, m, kN/m]
UT Spacing 06.000 [Multiply AllLoads]				W1 PTRN +000.407 2.130 10.48 +000.407	[kN/m, m, m, kN/m]
Rafter 2 of Bay 3				W2 PTRN +000.541 0.000 2.130 +000.541	[kN/m, m, m, kN/m]
D1 UDLY -000.350	[kN/m]			W2 PTRN +000.407 2.130 10.48 +000.407	[kN/m, m, m, kN/m]
D2 UDLY -000.100	[kN/m]			W3 UDLN +000.281	[kN/m]
L0 UDLY -000.600	[kN/m]			W4 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]
L2 UDLY -000.433	[kN/m]			W4 PTRN +000.508 8.356 10.48 +000.508	[kN/m, m, m, kN/m]
W1 PTRN +000.709 8.356 10.48 +000.709	[kN/m, m, m, kN/m]			W5 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]
W1 PTRN +000.382 0.000 8.356 +000.382	[kN/m, m, m, kN/m]			W5 PTRN +000.508 8.356 10.48 +000.508	[kN/m, m, m, kN/m]
W2 PTRN +000.709 8.356 10.48 +000.709	[kN/m, m, m, kN/m]				
W2 PTRN +000.382 0.000 8.356 +000.382	[kN/m, m, m, kN/m]			Members 307, 374 & 453	
W3 UDLN +000.281	[kN/m]			UT Spacing 06.000 [Multiply AllLoads]	
W4 PTRN +000.153 2.130 10.48 +000.153	[kN/m, m, m, kN/m]			Rafter 2 of Bay 3	
W4 PTRN +000.339 0.000 2.130 +000.339	[kN/m, m, m, kN/m]			D1 UDLY -000.350	[kN/m]
W5 PTRN -000.097 2.130 10.48 -000.097	[kN/m, m, m, kN/m]			D2 UDLY -000.100	[kN/m]
W5 PTRN -000.110 0.000 2.130 -000.110	[kN/m, m, m, kN/m]			L0 UDLY -000.600	[kN/m]
				L2 UDLY -000.433	[kN/m]
Members 302, 364 & 448				W1 PTRN +000.927 8.356 10.48 +000.927	[kN/m, m, m, kN/m]
UT Spacing 06.000 [Multiply AllLoads]				W1 PTRN +000.382 0.000 8.356 +000.382	[kN/m, m, m, kN/m]
Rafter 1 of Bay 1				W2 PTRN +000.927 8.356 10.48 +000.927	[kN/m, m, m, kN/m]
D1 UDLY -000.350	[kN/m]			W2 PTRN +000.382 0.000 8.356 +000.382	[kN/m, m, m, kN/m]
D2 UDLY -000.100	[kN/m]			W3 UDLN +000.281	[kN/m]
L0 UDLY -000.600	[kN/m]			W4 PTRN +000.153 2.130 10.48 +000.153	[kN/m, m, m, kN/m]
L4 UDLY -000.433	[kN/m]			W4 PTRN +000.413 0.000 2.130 +000.413	[kN/m, m, m, kN/m]
W1 PTRN +000.754 0.000 2.130 +000.754	[kN/m, m, m, kN/m]			W5 PTRN -000.097 2.130 10.48 -000.097	[kN/m, m, m, kN/m]
W1 PTRN +000.280 2.130 10.48 +000.280	[kN/m, m, m, kN/m]			W5 PTRN -000.125 0.000 2.130 -000.125	[kN/m, m, m, kN/m]
W2 PTRN -000.228 0.000 2.130 -000.228	[kN/m, m, m, kN/m]				
W2 PTRN -000.178 2.130 10.48 -000.178	[kN/m, m, m, kN/m]			Members 309, 376, 392 & 455	
W3 UDLN +000.281	[kN/m]			UT Spacing 03.000 [Multiply AllLoads]	
W4 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]			Rafter 1 of Bay 1	
W4 PTRN +000.508 8.356 10.48 +000.508	[kN/m, m, m, kN/m]			D1 UDLY -000.350	[kN/m]
W5 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]			D2 UDLY -000.100	[kN/m]
W5 PTRN +000.508 8.356 10.48 +000.508	[kN/m, m, m, kN/m]			L0 UDLY -000.600	[kN/m]
				L4 UDLY -000.433	[kN/m]
Members 303, 366 & 449				W1 PTRN +000.764 0.000 2.130 +000.764	[kN/m, m, m, kN/m]
UT Spacing 06.000 [Multiply AllLoads]				W1 PTRN +000.280 2.130 10.48 +000.280	[kN/m, m, m, kN/m]
Rafter 2 of Bay 1				W2 PTRN -000.229 0.000 2.130 -000.229	[kN/m, m, m, kN/m]
D1 UDLY -000.350	[kN/m]			W2 PTRN -000.178 2.130 10.48 -000.178	[kN/m, m, m, kN/m]
D2 UDLY -000.100	[kN/m]			W3 UDLN +000.281	[kN/m]
L0 UDLY -000.600	[kN/m]			W4 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]
L2 UDLY -000.433	[kN/m]			W4 PTRN +000.516 8.356 10.48 +000.516	[kN/m, m, m, kN/m]
L3 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]			W5 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]
L5 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]			W5 PTRN +000.516 8.356 10.48 +000.516	[kN/m, m, m, kN/m]
W1 PTRN +000.927 8.356 10.48 +000.927	[kN/m, m, m, kN/m]				
W1 PTRN +000.382 0.000 8.356 +000.382	[kN/m, m, m, kN/m]			Members 312, 377, 393 & 457	
W2 PTRN +000.927 8.356 10.48 +000.927	[kN/m, m, m, kN/m]			UT Spacing 03.000 [Multiply AllLoads]	
W2 PTRN +000.382 0.000 8.356 +000.382	[kN/m, m, m, kN/m]			Rafter 2 of Bay 1	
W3 UDLN +000.281	[kN/m]			D1 UDLY -000.350	[kN/m]
W4 PTRN +000.223 2.130 10.48 +000.223	[kN/m, m, m, kN/m]			D2 UDLY -000.100	[kN/m]
W4 PTRN +000.296 0.000 2.130 +000.296	[kN/m, m, m, kN/m]			L0 UDLY -000.600	[kN/m]
W5 PTRN +000.223 2.130 10.48 +000.223	[kN/m, m, m, kN/m]			L2 UDLY -000.433	[kN/m]
W5 PTRN +000.296 0.000 2.130 +000.296	[kN/m, m, m, kN/m]			L3 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]
				L5 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]
Members 304, 368 & 450				W1 PTRN +000.942 8.356 10.48 +000.942	[kN/m, m, m, kN/m]
UT Spacing 06.000 [Multiply AllLoads]				W1 PTRN +000.382 0.000 8.356 +000.382	[kN/m, m, m, kN/m]
Rafter 1 of Bay 2				W2 PTRN +000.942 8.356 10.48 +000.942	[kN/m, m, m, kN/m]
D1 UDLY -000.350	[kN/m]			W2 PTRN +000.382 0.000 8.356 +000.382	[kN/m, m, m, kN/m]
D2 UDLY -000.100	[kN/m]			W3 UDLN +000.281	[kN/m]
L0 UDLY -000.600	[kN/m]			W4 PTRN +000.223 2.130 10.48 +000.223	[kN/m, m, m, kN/m]
L4 UDLY -000.433	[kN/m]			W4 PTRN +000.300 0.000 2.130 +000.300	[kN/m, m, m, kN/m]
L3 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]			W5 PTRN +000.223 2.130 10.48 +000.223	[kN/m, m, m, kN/m]
L5 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]			W5 PTRN +000.300 0.000 2.130 +000.300	[kN/m, m, m, kN/m]
W1 PTRN +000.541 0.000 2.130 +000.541	[kN/m, m, m, kN/m]				
W1 PTRN +000.407 2.130 10.48 +000.407	[kN/m, m, m, kN/m]			Members 313, 378, 394 & 459	
W2 PTRN +000.541 0.000 2.130 +000.541	[kN/m, m, m, kN/m]			UT Spacing 03.000 [Multiply AllLoads]	
W2 PTRN +000.407 2.130 10.48 +000.407	[kN/m, m, m, kN/m]			Rafter 1 of Bay 2	
W3 UDLN +000.281	[kN/m]			D1 UDLY -000.350	[kN/m]
W4 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]			D2 UDLY -000.100	[kN/m]
W4 PTRN +000.508 8.356 10.48 +000.508	[kN/m, m, m, kN/m]			L0 UDLY -000.600	[kN/m]
W5 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]			L4 UDLY -000.433	[kN/m]
W5 PTRN +000.508 8.356 10.48 +000.508	[kN/m, m, m, kN/m]			L3 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]
				L5 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]
Members 305, 370 & 451				W1 PTRN +000.548 0.000 2.130 +000.548	[kN/m, m, m, kN/m]
UT Spacing 06.000 [Multiply AllLoads]				W1 PTRN +000.407 2.130 10.48 +000.407	[kN/m, m, m, kN/m]
Rafter 2 of Bay 2				W2 PTRN +000.548 0.000 2.130 +000.548	[kN/m, m, m, kN/m]
D1 UDLY -000.350	[kN/m]			W2 PTRN +000.407 2.130 10.48 +000.407	[kN/m, m, m, kN/m]
D2 UDLY -000.100	[kN/m]			W3 UDLN +000.281	[kN/m]
L0 UDLY -000.600	[kN/m]			W4 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]
L2 UDLY -000.433	[kN/m]			W4 PTRN +000.516 8.356 10.48 +000.516	[kN/m, m, m, kN/m]
L3 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]			W5 PTRN +000.209 0.000 8.356 +000.209	[kN/m, m, m, kN/m]
L5 PTRY -001.500 0.000 10.00 -000.000	[kN/m, m, m, kN/m]			W5 PTRN +000.516 8.356 10.48 +000.516	[kN/m, m, m, kN/m]

**R Elliott Associates Ltd**

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 17 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Members 316, 379, 395 & 461
UT Spacing 03.000 [Multiply AllLoads]
Rafter 2 of Bay 2
D1 UDLY -000.350 [kN/m]
D2 UDLY -000.100 [kN/m]
L0 UDLY -000.600 [kN/m]
L2 UDLY -000.433 [kN/m]
L3 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
L5 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
W1 PTRN +000.942 8.356 10.48 +000.942 [kN/m,m,m,kN/m]
W1 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]
W2 PTRN +000.942 8.356 10.48 +000.942 [kN/m,m,m,kN/m]
W2 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]
W3 UDLN +000.281 [kN/m]
W4 PTRN +000.223 2.130 10.48 +000.223 [kN/m,m,m,kN/m]
W4 PTRN +000.300 0.000 2.130 +000.300 [kN/m,m,m,kN/m]
W5 PTRN +000.223 2.130 10.48 +000.223 [kN/m,m,m,kN/m]
W5 PTRN +000.300 0.000 2.130 +000.300 [kN/m,m,m,kN/m]

Members 317, 380, 396 & 463
UT Spacing 03.000 [Multiply AllLoads]
Rafter 1 of Bay 3
D1 UDLY -000.350 [kN/m]
D2 UDLY -000.100 [kN/m]
L0 UDLY -000.600 [kN/m]
L4 UDLY -000.433 [kN/m]
L3 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
L5 PTRY -001.500 0.000 10.00 -000.000 [kN/m,m,m,kN/m]
W1 PTRN +000.548 0.000 2.130 +000.548 [kN/m,m,m,kN/m]
W1 PTRN +000.407 2.130 10.48 +000.407 [kN/m,m,m,kN/m]
W2 PTRN +000.548 0.000 2.130 +000.548 [kN/m,m,m,kN/m]
W2 PTRN +000.407 2.130 10.48 +000.407 [kN/m,m,m,kN/m]
W3 UDLN +000.281 [kN/m]
W4 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]
W4 PTRN +000.516 8.356 10.48 +000.516 [kN/m,m,m,kN/m]
W5 PTRN +000.209 0.000 8.356 +000.209 [kN/m,m,m,kN/m]
W5 PTRN +000.516 8.356 10.48 +000.516 [kN/m,m,m,kN/m]

Members 319, 381, 397 & 465
UT Spacing 03.000 [Multiply AllLoads]
Rafter 2 of Bay 3
D1 UDLY -000.350 [kN/m]
D2 UDLY -000.100 [kN/m]
L0 UDLY -000.600 [kN/m]
L2 UDLY -000.433 [kN/m]
W1 PTRN +000.942 8.356 10.48 +000.942 [kN/m,m,m,kN/m]
W1 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]
W2 PTRN +000.942 8.356 10.48 +000.942 [kN/m,m,m,kN/m]
W2 PTRN +000.382 0.000 8.356 +000.382 [kN/m,m,m,kN/m]
W3 UDLN +000.281 [kN/m]
W4 PTRN +000.153 2.130 10.48 +000.153 [kN/m,m,m,kN/m]
W4 PTRN +000.418 0.000 2.130 +000.418 [kN/m,m,m,kN/m]
W5 PTRN -000.097 2.130 10.48 -000.097 [kN/m,m,m,kN/m]
W5 PTRN -000.125 0.000 2.130 -000.125 [kN/m,m,m,kN/m]

Members 468-469, 471-473 & 480
Gable Column
W1 UDLY -001.705 (kN/m)
W2 UDLY -001.705 (kN/m)
W3 UDLY +001.804 (kN/m)
W4 UDLY -000.932 (kN/m)
W5 UDLY -000.932 (kN/m)

Members 475 & 549
UT Spacing 03.000 [Multiply AllLoads]
Lean-To Column 1
UT PartFix 20.00 +++ --- (0/10/20)
W1 UDLX +000.409 [kN/m]
W2 UDLX +000.409 [kN/m]
W3 UDLX -000.750 [kN/m]
W4 UDLX -000.186 [kN/m]
W5 UDLX -000.186 [kN/m]
W1 UDLY -001.339 [kN/m]
W2 UDLY -001.339 [kN/m]
W3 UDLY +000.636 [kN/m]
W4 UDLY -000.329 [kN/m]
W5 UDLY -000.329 [kN/m]

Members 477, 551, 607 & 625
UT Spacing 03.000 [Multiply AllLoads]
Column 1
UT PartFix 20.00 +++ --- (0/10/20)
W1 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]
W2 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]
W3 PTRX -000.750 6.800 7.000 -000.750 [kN/m,m,m,kN/m]
W4 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]
W5 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]
W1 UDLY -000.488 [kN/m]
W1 PTRZ -000.947 0.000 6.800 -000.947 [kN/m,m,m,kN/m]
W2 UDLY -000.488 [kN/m]
W2 PTRZ -000.947 0.000 6.800 -000.947 [kN/m,m,m,kN/m]
W3 UDLY +000.323 [kN/m]
W3 PTRZ +000.572 0.000 6.800 +000.572 [kN/m,m,m,kN/m]
W4 UDLY -000.167 [kN/m]
W4 PTRZ -000.296 0.000 6.800 -000.296 [kN/m,m,m,kN/m]
W5 UDLY -000.167 [kN/m]
W5 PTRZ -000.296 0.000 6.800 -000.296 [kN/m,m,m,kN/m]

Member 478

Gable Column
W1 UDLY -002.724 (kN/m)
W2 UDLY -002.724 (kN/m)
W3 UDLY +001.804 (kN/m)
W4 UDLY -000.932 (kN/m)
W5 UDLY -000.932 (kN/m)

Member 479
Gable Column
W1 UDLY -002.159 (kN/m)
W2 UDLY -002.159 (kN/m)
W3 UDLY +001.711 (kN/m)
W4 UDLY -000.884 (kN/m)
W5 UDLY -000.884 (kN/m)

Members 481-482 & 589
UT Spacing 03.000 [Multiply AllLoads]
Column 2
UT PartFix 20.00 +++ --- (0/10/20)
W1 UDLY -000.610 [kN/m]
W2 UDLY -000.610 [kN/m]
W3 UDLY +000.646 [kN/m]
W4 UDLY -000.334 [kN/m]
W5 UDLY -000.334 [kN/m]

Members 483 & 590
UT Spacing 03.000 [Multiply AllLoads]
Column 3
UT PartFix 20.00 +++ --- (0/10/20)
W1 UDLY -000.610 [kN/m]
W2 UDLY -000.610 [kN/m]
W3 UDLY +000.646 [kN/m]
W4 UDLY -000.445 [kN/m]
W5 UDLY -000.445 [kN/m]

Members 484-485 & 616
UT Spacing 03.000 [Multiply AllLoads]
Column 4
UT PartFix 20.00 +++ --- (0/10/20)
W1 UDLX +000.341 [kN/m]
W2 UDLX +000.341 [kN/m]
W3 UDLX +000.750 [kN/m]
W4 UDLX -000.224 [kN/m]
W5 UDLX -000.224 [kN/m]
W1 UDLY -000.305 [kN/m]
W2 UDLY -000.305 [kN/m]
W3 UDLY +000.323 [kN/m]
W4 UDLY -000.428 [kN/m]
W5 UDLY -000.428 [kN/m]

Members 486 & 552
UT Spacing 06.000 [Multiply AllLoads]
Lean-To Column 1
UT PartFix 20.00 +++ --- (0/10/20)
W1 UDLX +000.409 [kN/m]
W2 UDLX +000.409 [kN/m]
W3 UDLX -000.550 [kN/m]
W4 UDLX -000.186 [kN/m]
W5 UDLX -000.186 [kN/m]

Members 488, 553, 576, 608 & 626
UT Spacing 06.000 [Multiply AllLoads]
Column 1
UT PartFix 20.00 +++ --- (0/10/20)
W1 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]
W2 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]
W3 PTRX -000.550 6.800 7.000 -000.550 [kN/m,m,m,kN/m]
W4 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]
W5 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]

Members 489, 495, 501, 507, 513, 522, 529, 564, 567, 591, 593, 595, 597, 599,

601 & 603

UT Spacing 06.000 [Multiply AllLoads]
Column 2
UT PartFix 20.00 +++ --- (0/10/20)

Members 490, 496, 502, 508, 514, 524, 532, 592, 594, 596, 598, 600, 602 & 604

UT Spacing 06.000 [Multiply AllLoads]
Column 3
UT PartFix 20.00 +++ --- (0/10/20)

Members 491, 577 & 617
UT Spacing 06.000 [Multiply AllLoads]
Column 4
UT PartFix 20.00 +++ --- (0/10/20)
W1 UDLX +000.341 [kN/m]
W2 UDLX +000.341 [kN/m]
W3 UDLX +000.550 [kN/m]
W4 UDLX -000.224 [kN/m]
W5 UDLX -000.224 [kN/m]

Members 492 & 554
UT Spacing 06.000 [Multiply AllLoads]
Lean-To Column 1
UT PartFix 20.00 +++ --- (0/10/20)
W1 UDLX +000.409 [kN/m]



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 18 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

W2 UDLX +000.409 [kN/m]	W2 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]
W3 UDLX -000.481 [kN/m]	W3 PTRX -000.301 6.800 7.000 -000.301 [kN/m,m,m,kN/m]
W4 UDLX -000.186 [kN/m]	W4 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]
W5 UDLX -000.186 [kN/m]	W5 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]
Members 494, 555, 609 & 627	Members 515, 525, 533, 579 & 621-623
UT Spacing 06.000 [Multiply AllLoads]	UT Spacing 06.000 [Multiply AllLoads]
Column 1	Column 4
UT PartFix 20.00 +++ --- (0/10/20)	UT PartFix 20.00 +++ --- (0/10/20)
W1 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]	W1 UDLX +000.341 [kN/m]
W2 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]	W2 UDLX +000.341 [kN/m]
W3 PTRX -000.481 6.800 7.000 -000.481 [kN/m,m,m,kN/m]	W3 UDLX +000.301 [kN/m]
W4 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]	W4 UDLX -000.224 [kN/m]
W5 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]	W5 UDLX -000.224 [kN/m]
Members 497 & 618	Members 534 & 568
UT Spacing 06.000 [Multiply AllLoads]	UT Spacing 03.000 [Multiply AllLoads]
Column 4	Lean-To Column 1
UT PartFix 20.00 +++ --- (0/10/20)	UT PartFix 20.00 +++ --- (0/10/20)
W1 UDLX +000.341 [kN/m]	W1 UDLX +000.409 [kN/m]
W2 UDLX +000.341 [kN/m]	W2 UDLX +000.409 [kN/m]
W3 UDLX +000.481 [kN/m]	W3 UDLX -000.301 [kN/m]
W4 UDLX -000.224 [kN/m]	W4 UDLX -000.186 [kN/m]
W5 UDLX -000.224 [kN/m]	W5 UDLX -000.186 [kN/m]
Members 498 & 556	W1 UDLZ +001.339 [kN/m]
UT Spacing 06.000 [Multiply AllLoads]	W2 UDLZ +001.339 [kN/m]
Lean-To Column 1	W3 UDLZ +000.530 [kN/m]
UT PartFix 20.00 +++ --- (0/10/20)	W4 UDLZ +000.329 [kN/m]
W1 UDLX +000.409 [kN/m]	W5 UDLZ +000.329 [kN/m]
W2 UDLX +000.409 [kN/m]	
W3 UDLX -000.447 [kN/m]	Members 536, 570, 614 & 633
W4 UDLX -000.186 [kN/m]	UT Spacing 03.000 [Multiply AllLoads]
W5 UDLX -000.186 [kN/m]	Column 1
Members 500, 557, 615 & 628	UT PartFix 20.00 +++ --- (0/10/20)
UT Spacing 06.000 [Multiply AllLoads]	W1 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]
Column 1	W2 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]
UT PartFix 20.00 +++ --- (0/10/20)	W3 PTRX -000.301 6.800 7.000 -000.301 [kN/m,m,m,kN/m]
W1 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]	W4 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]
W2 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]	W5 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]
W3 PTRX -000.447 6.800 7.000 -000.447 [kN/m,m,m,kN/m]	W1 UDLZ +000.488 [kN/m]
W4 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]	W1 PTRZ +000.947 0.000 6.800 +000.947 [kN/m,m,m,kN/m]
W5 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]	W2 UDLZ +000.488 [kN/m]
Members 503 & 619	W2 PTRZ +000.947 0.000 6.800 +000.947 [kN/m,m,m,kN/m]
UT Spacing 06.000 [Multiply AllLoads]	W3 UDLZ +000.269 [kN/m]
Column 4	W3 PTRZ +000.477 0.000 6.800 +000.477 [kN/m,m,m,kN/m]
UT PartFix 20.00 +++ --- (0/10/20)	W4 UDLZ +000.167 [kN/m]
W1 UDLX +000.341 [kN/m]	W4 PTRZ +000.296 0.000 6.800 +000.296 [kN/m,m,m,kN/m]
W2 UDLX +000.341 [kN/m]	W5 UDLZ +000.167 [kN/m]
W3 UDLX +000.447 [kN/m]	W5 PTRZ +000.296 0.000 6.800 +000.296 [kN/m,m,m,kN/m]
W4 UDLX -000.224 [kN/m]	
W5 UDLX -000.224 [kN/m]	Members 537 & 571
Members 504 & 558	Gable Column
UT Spacing 06.000 [Multiply AllLoads]	W1 UDLZ +002.724 (kN/m)
Lean-To Column 1	W2 UDLZ +002.724 (kN/m)
UT PartFix 20.00 +++ --- (0/10/20)	W3 UDLZ +001.503 (kN/m)
W1 UDLX +000.409 [kN/m]	W4 UDLZ +000.932 (kN/m)
W2 UDLX +000.409 [kN/m]	W5 UDLZ +000.932 (kN/m)
W3 UDLX -000.314 [kN/m]	
W4 UDLX -000.186 [kN/m]	Members 538 & 572
W5 UDLX -000.186 [kN/m]	Gable Column
Members 506, 559, 610 & 629	W1 UDLZ +002.159 (kN/m)
UT Spacing 06.000 [Multiply AllLoads]	W2 UDLZ +002.159 (kN/m)
Column 1	W3 UDLZ +001.425 (kN/m)
UT PartFix 20.00 +++ --- (0/10/20)	W4 UDLZ +000.884 (kN/m)
W1 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]	W5 UDLZ +000.884 (kN/m)
W2 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]	
W3 PTRX -000.314 6.800 7.000 -000.314 [kN/m,m,m,kN/m]	Members 539 & 573
W4 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]	Gable Column
W5 PTRX -000.186 6.800 7.000 -000.186 [kN/m,m,m,kN/m]	W1 UDLZ +001.705 (kN/m)
Members 509 & 620	W2 UDLZ +001.705 (kN/m)
UT Spacing 06.000 [Multiply AllLoads]	W3 UDLZ +001.503 (kN/m)
Column 4	W4 UDLZ +000.932 (kN/m)
UT PartFix 20.00 +++ --- (0/10/20)	W5 UDLZ +000.932 (kN/m)
W1 UDLX +000.341 [kN/m]	
W2 UDLX +000.341 [kN/m]	Members 540, 574 & 605
W3 UDLX +000.314 [kN/m]	UT Spacing 03.000 [Multiply AllLoads]
W4 UDLX -000.224 [kN/m]	Column 2
W5 UDLX -000.224 [kN/m]	UT PartFix 20.00 +++ --- (0/10/20)
Members 510, 516, 526, 560, 562 & 565	W1 UDLZ +000.610 [kN/m]
UT Spacing 06.000 [Multiply AllLoads]	W2 UDLZ +000.610 [kN/m]
Lean-To Column 1	W3 UDLZ +000.539 [kN/m]
UT PartFix 20.00 +++ --- (0/10/20)	W4 UDLZ +000.334 [kN/m]
W1 UDLX +000.409 [kN/m]	W5 UDLZ +000.334 [kN/m]
W2 UDLX +000.409 [kN/m]	
W3 UDLX -000.301 [kN/m]	Members 541 & 575
W4 UDLX -000.186 [kN/m]	Gable Column
W5 UDLX -000.186 [kN/m]	W1 UDLZ +001.703 (kN/m)
Members 512, 518, 528, 561, 563, 566, 578, 611-613 & 630-632	W2 UDLZ +001.703 (kN/m)
UT Spacing 06.000 [Multiply AllLoads]	W3 UDLZ +001.503 (kN/m)
Column 1	W4 UDLZ +000.932 (kN/m)
UT PartFix 20.00 +++ --- (0/10/20)	W5 UDLZ +000.932 (kN/m)
W1 PTRX +000.409 6.800 7.000 +000.409 [kN/m,m,m,kN/m]	
	Member 542
	Gable Column
	W1 UDLZ +001.614 (kN/m)
	W2 UDLZ +001.614 (kN/m)
	W3 UDLZ +001.425 (kN/m)
	W4 UDLZ +000.884 (kN/m)
	W5 UDLZ +000.884 (kN/m)



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 19 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Member 543 Gable Column	W5 UDLZ +001.773 (kN/m)	Members 548 & 624 UT Spacing 03.000 [Multiply AllLoads] Column 4 UT PartFix 20.00 +++ --- (0/10/20)
W1 UDLZ +001.703 (kN/m)	W1 UDLX +000.341 [kN/m]	W1 UDLX +000.341 [kN/m]
W2 UDLZ +001.703 (kN/m)	W2 UDLX +000.341 [kN/m]	W2 UDLX +000.341 [kN/m]
W3 UDLZ +001.503 (kN/m)	W3 UDLX +000.301 [kN/m]	W3 UDLX +000.301 [kN/m]
W4 UDLZ +000.933 (kN/m)	W4 UDLX -000.224 [kN/m]	W4 UDLX -000.224 [kN/m]
W5 UDLZ +000.933 (kN/m)	W5 UDLX -000.224 [kN/m]	W5 UDLX -000.224 [kN/m]
Members 544 & 606 UT Spacing 03.000 [Multiply AllLoads] Column 3 UT PartFix 20.00 +++ --- (0/10/20)	W1 UDLZ +000.305 [kN/m]	W1 UDLZ +000.305 [kN/m]
W1 UDLZ +000.610 [kN/m]	W2 UDLZ +000.305 [kN/m]	W2 UDLZ +000.305 [kN/m]
W2 UDLZ +000.610 [kN/m]	W3 UDLZ +000.269 [kN/m]	W3 UDLZ +000.269 [kN/m]
W3 UDLZ +000.539 [kN/m]	W4 UDLZ +000.428 [kN/m]	W4 UDLZ +000.428 [kN/m]
W4 UDLZ +000.445 [kN/m]	W5 UDLZ +000.428 [kN/m]	W5 UDLZ +000.428 [kN/m]
W5 UDLZ +000.445 [kN/m]	Members 580 & 588 UT Spacing 03.000 [Multiply AllLoads] Lean-To Parapet 1	W1 UDLX +000.964 [kN/m]
Member 545 Gable Column	W2 UDLX +000.964 [kN/m]	W2 UDLX +000.964 [kN/m]
W1 UDLZ +001.703 (kN/m)	W4 UDLX -000.528 [kN/m]	W4 UDLX -000.528 [kN/m]
W2 UDLZ +001.703 (kN/m)	W5 UDLX -000.528 [kN/m]	W5 UDLX -000.528 [kN/m]
W3 UDLZ +001.503 (kN/m)	Members 581 & 587 UT Spacing 06.000 [Multiply AllLoads] Lean-To Parapet 1	W1 UDLX +000.840 [kN/m]
W4 UDLZ +001.492 (kN/m)	W2 UDLX +000.840 [kN/m]	W2 UDLX +000.840 [kN/m]
W5 UDLZ +001.492 (kN/m)	W4 UDLX -000.460 [kN/m]	W4 UDLX -000.460 [kN/m]
Member 546 Gable Column	W5 UDLX -000.460 [kN/m]	Members 582-586 UT Spacing 06.000 [Multiply AllLoads] Lean-To Parapet 1
W1 UDLZ +001.614 (kN/m)	W1 UDLX +000.817 [kN/m]	W1 UDLX +000.817 [kN/m]
W2 UDLZ +001.614 (kN/m)		
W3 UDLZ +001.425 (kN/m)		
W4 UDLZ +001.415 (kN/m)		
W5 UDLZ +001.415 (kN/m)		
Member 547 Gable Column		
W1 UDLZ +001.703 (kN/m)		
W2 UDLZ +001.703 (kN/m)		
W3 UDLZ +001.503 (kN/m)		
W4 UDLZ +001.773 (kN/m)		
W2 UDLX +000.817 [kN/m]		
W4 UDLX -000.448 [kN/m]		
W5 UDLX -000.448 [kN/m]		

MEMBER ORIENTATION

Members 250, 252, 255, 259-260, 263-264, 267, 269, 271, 273, 275, 277, 279, 281,
283, 285, 287, 289, 291, 293, 295, 297, 299, 301, 303, 305, 307, 312, 316,
319, 321, 323, 325, 329, 331, 333, 335, 337, 339, 341, 343, 345, 347, 349,
351, 353, 355, 357, 359, 361, 363, 366, 370, 374, 377, 379, 381, 383, 385,
387, 389, 391, 393, 395, 397, 400, 404-405, 408-409, 412-413, 415, 417, 419,
421, 423, 425, 427, 429, 431, 433, 435, 437, 439, 441, 443, 445, 447, 449,
451, 453, 457, 461, 465, 474, 483-485, 490-491, 496-497, 502-503, 508-509,
514-515, 524-525, 527, 532-533, 544, 548, 577, 579, 590, 592, 594, 596, 598,
600, 602, 604, 606 & 616-624 B +180.00

Members 467-469, 471-473, 476, 478-480, 519-521, 535, 537-539, 541-543, 545-547,
550, 569, 571-573 & 575 B +090.00

MEMBER END RELEASES

Symbols	End 1 torsion-minor-major	End 2 torsion-minor-major	O Released	® Fixed
1 @OO @OO	2 @OO @OO	3 @OO @OO	4 @OO @OO	
6 @OO @OO	7 @OO @OO	8 @OO @OO	9 @OO @OO	
10 @OO @OO	11 @OO @OO	12 @OO @OO	13 @OO @OO	
14 @OO @OO	15 @OO @OO	16 @OO @OO	17 @OO @OO	
18 @OO @OO	19 @OO @OO	20 @OO @OO	21 @OO @OO	
22 @OO @OO	23 @OO @OO	25 @OO @OO	26 @OO @OO	
27 @OO @OO	28 @OO @OO	29 @OO @OO	30 @OO @OO	
34 @OO @OO	35 @OO @OO	49 @OO @OO	50 @OO @OO	
54 @OO @OO	55 @OO @OO	56 @OO @OO	57 @OO @OO	
58 @OO @OO	59 @OO @OO	60 @OO @OO	61 @OO @OO	
62 @OO @OO	63 @OO @OO	64 @OO @OO	65 @OO @OO	
66 @OO @OO	67 @OO @OO	68 @OO @OO	69 @OO @OO	
70 @OO @OO	71 @OO @OO	72 @OO @OO	73 @OO @OO	
74 @OO @OO	75 @OO @OO	76 @OO @OO	77 @OO @OO	
78 @OO @OO	79 @OO @OO	80 @OO @OO	81 @OO @OO	
82 @OO @OO	83 @OO @OO	84 @OO @OO	85 @OO @OO	
86 @OO @OO	87 @OO @OO	88 @OO @OO	89 @OO @OO	
90 @OO @OO	91 @OO @OO	92 @OO @OO	93 @OO @OO	
94 @OO @OO	95 @OO @OO	96 @OO @OO	97 @OO @OO	
98 @OO @OO	99 @OO @OO	100 @OO @OO	101 @OO @OO	
102 @OO @OO	103 @OO @OO	104 @OO @OO	105 @OO @OO	
106 @OO @OO	107 @OO @OO	108 @OO @OO	109 @OO @OO	
110 @OO @OO	111 @OO @OO	112 @OO @OO	113 @OO @OO	
114 @OO @OO	115 @OO @OO	116 @OO @OO	117 @OO @OO	



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 20 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

118 @00 @00	119 @00 @00	120 @00 @00	121 @00 @00
122 @00 @00	123 @00 @00	124 @00 @00	125 @00 @00
126 @00 @00	127 @00 @00	128 @00 @00	129 @00 @00
130 @00 @00	131 @00 @00	132 @00 @00	133 @00 @00
134 @00 @00	135 @00 @00	136 @00 @00	137 @00 @00
138 @00 @00	139 @00 @00	140 @00 @00	141 @00 @00
142 @00 @00	143 @00 @00	144 @00 @00	145 @00 @00
146 @00 @00	147 @00 @00	148 @00 @00	149 @00 @00
150 @00 @00	151 @00 @00	152 @00 @00	153 @00 @00
154 @00 @00	155 @00 @00	156 @00 @00	157 @00 @00
158 @00 @00	159 @00 @00	160 @00 @00	161 @00 @00
162 @00 @00	163 @00 @00	164 @00 @00	165 @00 @00
166 @00 @00	167 @00 @00	168 @00 @00	169 @00 @00
170 @00 @00	171 @00 @00	172 @00 @00	173 @00 @00
174 @00 @00	175 @00 @00	176 @00 @00	177 @00 @00
178 @00 @00	179 @00 @00	180 @00 @00	181 @00 @00
182 @00 @00	183 @00 @00	184 @00 @00	185 @00 @00
186 @00 @00	187 @00 @00	188 @00 @00	189 @00 @00
190 @00 @00	191 @00 @00	192 @00 @00	193 @00 @00
194 @00 @00	195 @00 @00	196 @00 @00	197 @00 @00
198 @00 @00	199 @00 @00	200 @00 @00	201 @00 @00
202 @00 @00	203 @00 @00	204 @00 @00	205 @00 @00
206 @00 @00	207 @00 @00	208 @00 @00	209 @00 @00
210 @00 @00	211 @00 @00	212 @00 @00	213 @00 @00
214 @00 @00	215 @00 @00	216 @00 @00	217 @00 @00
218 @00 @00	219 @00 @00	220 @00 @00	221 @00 @00
222 @00 @00	223 @00 @00	224 @00 @00	225 @00 @00
226 @00 @00	227 @00 @00	228 @00 @00	229 @00 @00
230 @00 @00	231 @00 @00	232 @00 @00	233 @00 @00
234 @00 @00	235 @00 @00	236 @00 @00	237 @00 @00
238 @00 @00	239 @00 @00	240 @00 @00	241 @00 @00
242 @00 @00	243 @00 @00	244 @00 @00	245 @00 @00
246 @00 @00	247 @00 @00	248 @00 @00	254 @00 @00
258 @00 @00	308 @00 @00	310 @00 @00	311 @00 @00
314 @00 @00	315 @00 @00	318 @00 @00	326 @00 @00
328 @00 @00	365 @00 @00	367 @00 @00	369 @00 @00
371 @00 @00	373 @00 @00	375 @00 @00	399 @00 @00
401 @00 @00	454 @00 @00	456 @00 @00	458 @00 @00
460 @00 @00	462 @00 @00	464 @00 @00	467 @00 @00
468 @00 @00	469 @00 @00	470 @00 @00	472 @00 @00
478 @00 @00	479 @00 @00	480 @00 @00	487 @00 @00
493 @00 @00	499 @00 @00	505 @00 @00	511 @00 @00
517 @00 @00	523 @00 @00	527 @00 @00	531 @00 @00
542 @00 @00	543 @00 @00	545 @00 @00	546 @00 @00
547 @00 @00	550 @00 @00	569 @00 @00	571 @00 @00
572 @00 @00	573 @00 @00	575 @00 @00	616 @00 @00
634 @00 @00	635 @00 @00	636 @00 @00	637 @00 @00
638 @00 @00	639 @00 @00	640 @00 @00	641 @00 @00
642 @00 @00	643 @00 @00	644 @00 @00	645 @00 @00
646 @00 @00	647 @00 @00	648 @00 @00	649 @00 @00
650 @00 @00	651 @00 @00	652 @00 @00	653 @00 @00
654 @00 @00	655 @00 @00	656 @00 @00	657 @00 @00
658 @00 @00			

NODAL LOADING AND SUPPORT CONDITIONS

NODES 1, 5, 9-10, 12, 16-19, 21-25, 27-31, 33-37, 39-43, 45-49, 51, 55, 57-59,
61-62, 65-67, 69, 73, 77 & 82

UT Rs 1 1 1 1 1 1 (20.00% Fixity)

NODES 2-4, 6-8, 11, 13-15, 20, 26, 32, 38, 44, 50, 52-54, 56, 60, 63-64, 68,
70-72, 74-76, 78-79 & 81

UT Rs 1 1 1 0 1 0 (Pinned Support)



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 21 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

ANALYSIS

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275.MP

AXIAL WITH MOMENTS (MEMBER)

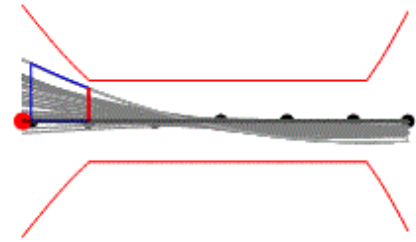
Rafter 1 of Bay 3 : Members 142-144 (E\10-12)

Between 0.240 and 1.800 m, in Load Case 6

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.4 D2 + 1.6 L0 + 1.6 L1

UT Spacing 06.000 [Multiply AllLoads]
D1 UDLY -000.350 [kN/m]
D2 UDLY -000.100 [kN/m]
L0 UDLY -000.600 [kN/m]



Member Forces in Load Case 6 and Maximum Deflection from Load Case 2										
Mem ber No.	Node End1 End2	Axial Force (kN)	Torque Moment (kN.m)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)		Maximum Deflection (mm @ m)
				x-x	y-y	x-x	y-y	x-x	y-y	
	151	68.58C	0.00	86.46	0.00	-302.50	0.00	102.97	0.00	9.19
	303	37.81C	0.00	-10.09	0.00	97.45	0.00	@ 9.402	@ 0.000	@ 7.620

Classification and Properties (BS 5950: 2000)

Section (38.98 kg/m) 406x140 UB 39 [S 275]
Class = $F_n(b/T, d/t, p_y, F, M_x, M_y)$ 8.24, 56.31, 275, 68.58, 302.5, 0 (Axial: Non-Slender) Plastic
Sec. Depth = $F_n(X)$ Moment Capacity X = 1.8 m 401.8 mm
Sec. Depth = $F_n(X)$ Lateral Buckling X = 1.8 m 401.8 mm
Auto Design Load Cases 1 & 5-41

Local Capacity Check @ 1.8 m

F_{vx}/P_{vx} 69.801 / 424.291 = 0.165 Low Shear
 $M_{cx} = p_y.S_{xx} \leq 1.2 p_y.Z_{xx}$ 275 x 733.1 $\leq$ 1.2 x 275 x 636.37 = 201.603 kN.m
 $P_z = A_g.p_y$ 49.89 x 275 = 1371.975 kN
 $n = F/P_z$ 68.583 / 1371.975 = 0.050 OK
 $S_{rx} = F_n(S_{xx}, n)$ 733.1, 0.05 730.67 cm³
 $M_{rx} = S_{rx}.p_y$ 730.67 x 275 200.934 kN.m
 $(M_x/M_{rx})^{2.1} + (M_y/M_{ry})^{2.2}$ (161.867/200.934)^{2.1} + (0)^{2.2} = 0.649 OK

Compression Resistance Pc

$\lambda_x = L_{ex}/r_{xx}$ 100x1x10.485/16.01 = 65.5 OK
 $P_{cx} = A_{area}.p_{cx}$ 49.89x231.159/10 = 1153.252 kN Table 24 a
 $\lambda_y = L_{ey}/r_{yy}$ 100x1x1.56/2.87 = 54.4 OK
 $P_{cy} = A_{area}.p_{cy}$ 49.89x229.81/10 = 1146.525 kN Table 24 b

Equivalent Uniform Moment Factors m_{LT} , m_x , m_y and m_{yx}

$m_{LT} = 0.2 + (.15M_2 + .5M_3 + .15M_4)/M_{max}$ 0.2 + (.15x250 + .5x219 + .15x190)/282 = 0.44 1 Table 18
 $m_y = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ 0.2 + (.1x0 + .6x0 + .1x0)/0 = .8x0/0 1 Table 26
 $m_x = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ 0.2 + (.1x-108 + .6x24 + .1x92)/302 = .8x108/302 0.285 Table 26
 $m_{yx} = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ 0.2 + (.1x0 + .6x0 + .1x0)/0 = .8x0/0 1 Table 26

Lateral Buckling Check M_b @ 1.8 m

$L_e = 1.00 L$ 1 x 1.56 = 1.56 m
 $\lambda = L_e/r_{yy}$ 1.56 / 2.87 54.43 OK
 $v = F_n(x, L_e, r_{yy}, \lambda)$ 47.91, 1.56, 2.87, 54.43 0.984 Table 19
 $\lambda_{LT} = u.v.\lambda.\sqrt{\beta_w}$ 0.858 x 0.984 x 54.43 $\sqrt{1}$ 45.98
 $p_b = F_n(p_y, \lambda_{LT})$ 275, 45.98 247.69 N/mm² Table 16



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 22 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

$$M_b = S_{xx}.p_b \leq M_c \quad 733.1 \times 247.69 \leq 201.603 = \quad 181.582 \text{ kN.m}$$

Combined Axial Compression and Bending to Annex I @ 1.8 m

$r_b = M_{LT}/M_b$	$1 \times 161.9/181.6$	0.891	
$r_c = F_c/P_{cy}$	$68.6/1146.5$	0.060	
$\lambda_r = (r_b \lambda_{LT} + r_c \lambda_y)/(r_b + r_c)$	$(0.891 \times 46 + 0.06 \times 54.4)/(0.891 + 0.06)$	46.515	
$\lambda_{ro} = 17.15 \varepsilon (2r_b + r_c)/(r_b + r_c)$	$17.15 \times 1(2 \times 0.891 + 0.06)/(0.891 + 0.06)$	33.222	
$M_{ob} = M_b(1 - F_c/P_{cy})$	$181.582(1 - 68.6/1146.5)$	170.720	
$M_{xy} = M_{ox}(1 - F_c/P_{cy})^{1/2}$	$201.603(1 - 68.6/1146.5)^{1/2}$	195.480	
$M_{ox} = M_{ox}(1 - F_c/P_{cy})/(1 + 0.5F_c/P_{cy})$	$201.603(1 - 68.6/1153.3)/(1 + 0.5 \times 68.6/1153.3)$	184.138	
$M_{oy} = M_{oy}(1 - F_c/P_{cy})/(1 + k_y(F_c/P_{cy}))$	$19.074(1 - 68.6/1146.5)/(1 + 1.0(68.6/1146.5))$	16.921	
$M_{ab} = \text{fn}(\lambda_r, \lambda_{ro}, \varepsilon, M_{xy}, M_{ob})$	46.515, 33.222, 1.000, 195.480, 170.720	193.295	
$M_{ax} = \text{fn}(\lambda_x, \varepsilon, M_{rx}, M_{ox})$	65.501, 1.000, 200.934, 184.138	189.105	
$M_{ay} = \text{fn}(\lambda_y, \varepsilon, M_{ry}, M_{oy})$	54.431, 1.000, 19.074, 16.921	17.905	
$m_x M_x/M_{ax}$	$0.285 \times 161.9/189.1$	0.244	OK
$m_{LT} M_{LT}/M_{ab}$	$1 \times 161.9/193.3$	0.837	OK
$m_x M_x/M_{ax}$	$0.285 \times 161.9/189.1$	0.244	OK
Compare with Simplified to 4.8.3.3	0.323, 0.951, 0.951	0.951	
Compare with MoreExact to 4.8.3.3	0.295, 0.951, 0.879	0.951	

Deflection Check - Load Case 2

In-span $\delta \leq \text{Span}/360$	$9.19 \leq 10485 / 360$	9.19 mm	OK
---------------------------------------	-------------------------	---------	----

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275.MP

AXIAL WITH MOMENTS (MEMBER)

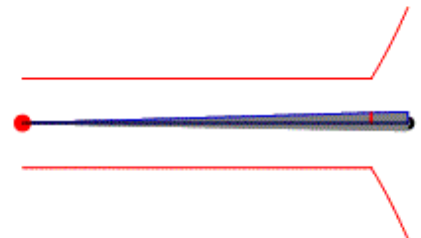
Column 3 : Members 151 & 156 (E\10) in Load Case 31

Member Loading and Member Forces

Loading Combination : 1 UT + 1.2 D1 + 1.2 D2 + 1.2 L1 + 1.05 L3

+ 1.2 W2

UT Spacing 06.000 [Multiply AllLoads]
UT PartFix 20.00 +++ --- (Mt My Mz)



Member Forces in Load Case 31 and Maximum Deflection from Load Case 2										
Member No.	Node End1 End2	Axial Force (kN)	Torque Moment (kN.m)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)		Maximum Deflection (mm @ m)
				x-x	y-y	x-x	y-y	x-x	y-y	
	33	121.34C	0.00	-16.58	0.00	0.00	0.00		0.00	0.37
	151	115.10C	0.00	-16.58	0.00	-116.05	0.00	@ 0.000	@ 0.000	@ 4.624

Classification and Properties (BS 5950: 2000)

Section (74.28 kg/m) 457x191 UB 74 [S 275]
Class = $F_n(b/T, d/t, p_y, F, M_x, M_y)$ 6.57, 45.29, 275, 121.34, 116.05, 0 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1 & 5-41

Local Capacity Check

F_vx/P_vx	$16.579 / 678.645 =$	0.024	Low Shear
$M_{cx} = p_y.S_{xx} \leq 1.2 p_y.Z_{xx}$	$275 \times 1652.7 \leq 1.2 \times 275 \times 1458.18 =$	454.493 kN.m	
$P_z = A_g.p_y$	$94.62 \times 275 =$	2602.05 kN	
$n = F/P_z$	$121.338 / 2602.05 =$	0.047	OK
$S_{rx} = F_n(S_{xx}, n)$	$1652.7, 0.047$	1647.29 cm ³	
$M_{rx} = S_{rx}.p_y$	1647.29×275	453.005 kN.m	
$(M_x/M_{rx})^{21} + (M_y/M_{ry})^{22}$	$(105.008/453.005)^{21} + (0)^{22} =$	0.054	OK

Compression Resistance P_c

$\lambda_x = L_{ex}/r_{xx}$	$100 \times 17/18.77 =$	37.3	OK
$P_{cx} = A_{area}.p_{cx}$	$94.62 \times 262.115/10 =$	2480.134 kN	Table 24 a



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 23 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

$\lambda_y = L_{ey}/r_{yy} = 100 \times 17 / 4.2 = 166.6$ OK
 $P_{cy} = A_{area} \cdot p_{cy} = 94.62 \times 61.86 / 10 = 585.296 \text{ kN}$ Table 24 b

Equivalent Uniform Moment Factors m_{LT} , m_x , m_y and m_{yx}

$m_{LT} = 0.2 + (.15M_2 + .5M_3 + .15M_4) / M_{max} = 0.2 + (.15 \times 29 + .5 \times 58 + .15 \times 87) / 116 = 0.44$ 1 Table 18
 $m_y = 0.2 + (.1M_2 + .6M_3 + .1M_4) / M_{max} = 0.2 + (.1 \times 0 + .6 \times 0 + .1 \times 0) / 0 = .8 \times 0 / 0$ 1 Table 26
 $m_x = 0.2 + (.1M_2 + .6M_3 + .1M_4) / M_{max} = 0.2 + (.1 \times -29 + .6 \times -58 + .1 \times -87) / 116 = .8 \times 87 / 116$ 0.6 Table 26
 $m_{yx} = 0.2 + (.1M_2 + .6M_3 + .1M_4) / M_{max} = 0.2 + (.1 \times 0 + .6 \times 0 + .1 \times 0) / 0 = .8 \times 0 / 0$ 1 Table 26

Lateral Buckling Check M_b

$L_e = 1.00 L = 1 \times 7 = 7 \text{ m}$
 $\lambda = L_e / r_{yy} = 7 / 4.2 = 166.57$ OK
 $v = F_n(x, L_e, r_{yy}, \lambda) = 33.818, 7, 4.2, 166.57$ 0.82 Table 19
 $\lambda_{LT} = u \cdot v \cdot \lambda \cdot \sqrt{\beta_w} = 0.878 \times 0.82 \times 166.57 \sqrt{1} = 119.84$
 $p_b = F_n(p_y, \lambda_{LT}) = 275, 119.84$ 95.79 N/mm² Table 16
 $M_b = S_{xx} \cdot p_b \leq M_c = 1652.7 \times 95.79 \leq 454.493 = 158.308 \text{ kN.m}$

Combined Axial Compression and Bending to Annex I

$r_b = m_{LT} \cdot M_{LT} / M_b = 1 \times -105 / 158.3 = 0.663$
 $r_c = F_c / P_{cy} = 121.3 / 585.3 = 0.207$
 $\lambda_r = (r_b \lambda_{LT} + r_c \lambda_y) / (r_b + r_c) = (0.663 \cdot 119.8 + 0.207 \cdot 166.6) / (0.663 + 0.207) = 130.970$
 $\lambda_{ro} = 17.15 \varepsilon (2r_b + r_c) / (r_b + r_c) = 17.15 \cdot 1 (2 \cdot 0.663 + 0.207) / (0.663 + 0.207) = 30.216$
 $M_{ob} = M_b (1 - F_c / P_{cy}) = 158.308 (1 - 121.3 / 585.3) = 125.489$
 $M_{xy} = M_{cx} (1 - F_c / P_{cy})^{1/2} = 454.493 (1 - 121.3 / 585.3)^{1/2} = 404.649$
 $M_{ox} = M_{cx} (1 - F_c / P_{cy}) / (1 + 0.5 F_c / P_{cy}) = 454.493 (1 - 121.3 / 2480.1) / (1 + 0.5 \cdot 121.3 / 2480.1) = 421.936$
 $M_{oy} = M_{cy} (1 - F_c / P_{cy}) / (1 + k_y (F_c / P_{cy})) = 57.927 (1 - 121.3 / 585.3) / (1 + 1.0 (121.3 / 585.3)) = 38.033$
 $M_{ab} = \text{fn}(\lambda_r, \lambda_{ro}, \varepsilon, M_{xy}, M_{ob}) = 130.970, 30.216, 1.000, 404.649, 125.489 = 125.489$
 $M_{ax} = \text{fn}(\lambda_x, \varepsilon, M_{rx}, M_{ox}) = 37.303, 1.000, 453.005, 421.936 = 443.885$
 $M_{ay} = \text{fn}(\lambda_y, \varepsilon, M_{ry}, M_{oy}) = 166.567, 1.000, 57.927, 38.033 = 38.033$
 $m_x \cdot M_x / M_{ax} = 0.6 \times 105 / 443.9 = 0.142$ OK
 $m_{LT} \cdot M_{LT} / M_{ab} = 1 \times -105 / 125.5 = 0.837$ OK
 $m_x \cdot M_x / M_{ax} = 0.6 \times 105 / 443.9 = 0.142$ OK
Compare with Simplified to 4.8.3.3 0.364, 0.871, 0.871 0.871
Compare with MoreExact to 4.8.3.3 0.191, 0.871, 0.249 0.871

Deflection Check - Load Case 2

In-span $\delta \leq \text{Span} / 360 = 0.37 \leq 7000 / 360 = 0.37 \text{ mm}$ OK

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275.MP

AXIAL WITH MOMENTS (MEMBER)

Gable Column : Member 305 (A\12)

Between 0.000 and 2.100 m, in Load Case 14

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.4 D2 + 1.4 W3

W3 UDLZ +001.711 (kN/m)



Member Forces in Load Case 14										
Mem ber No.	Node End1 End2	Axial Force (kN)	Torque Moment (kN.m)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)		Maximum Deflection (mm @ m)
				x-x	y-y	x-x	y-y	x-x	y-y	
305	12	4.66T	0.00	-12.16	0.00	0.00	0.00	-30.87	0.00	0.00
	291	8.11T	0.00	12.16	0.00	0.00	0.00	@ 5.077	@ 0.000	@ 4.624



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 24 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Classification and Properties (BS 5950: 2000)

Section (24.81 kg/m) 305x102 UB 25 [S 275]
Class = $F_n(b/T, d/t, p_y, F, M_x, M_y)$ 7.26, 47.57, 275, 0, 30.86, 0 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1 & 5-41

Local Capacity Check

F_{vx}/P_{vx} 7.129 / 291.981 = 0.024 Low Shear
 $M_{cx} = p_y.S_{xx} \leq 1.2 p_y.Z_{xx}$ 275 x 342 $\leq$ 1.2 x 275 x 292.12 = 94.05 kN.m
 $A_e = F_n(A_g, A_{net}, p_y, U_s)$ 31.6, 31.6, 275, 410 31.6 cm²
 $P_z = A_e.p_y$ 31.6 x 275 869 kN
 $n = F/P_z$ -8.115 / 869 = 0.009 OK
 $S_{rx} = F_n(S_{xx}, n)$ 342, 0.009 341.96 cm³
 $M_{rx} = S_{rx}.p_y$ 341.96 x 275 94.04 kN.m
 $(M_x/M_{rx})^{2.1} + (M_y/M_{ry})^{2.2}$ $(20.25/94.04)^{2.1} + (0)^{2.2} =$ 0.046 OK

Equivalent Uniform Moment Factors m_{LT} , m_x , m_y and m_{yx}

$m_{LT} = 0.2 + (.15M_2 + .5M_3 + .15M_4)/M_{max}$ $0.2 + (.15 \times 6 + .5 \times 11 + .15 \times 16)/20 = 0.44$ 0.647 Table 18
 $m_y = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1 \times 0 + .6 \times 0 + .1 \times 0)/0 = .8 \times 0/0$ 1 Table 26
 $m_x = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1 \times -23 + .6 \times -31 + .1 \times -23)/31 = .8 \times 31/31$ 0.95 Table 26
 $m_{yx} = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1 \times 0 + .6 \times 0 + .1 \times 0)/0 = .8 \times 0/0$ 1 Table 26

Lateral Buckling Check M_b

$L_e = 1.00 L$ 1 x 2.1 = 2.1 m
 $\lambda = L_e/r_{yy}$ 2.1 / 1.98 106.06 OK
 $v = F_n(x, L_e, r_{yy}, \lambda)$ 42.474, 2.1, 1.98, 106.06 0.934 Table 19
 $\lambda_{LT} = u.v.\lambda.\sqrt{\beta_w}$ 0.849 x 0.934 x 106.06 $\sqrt{1}$ 84.1
 $p_b = F_n(p_y, \lambda_{LT})$ 275, 84.1 155.78 N/mm² Table 16
 $M_b = S_{xx}.p_b \leq M_c$ 342 x 155.78 $\leq$ 94.05 = 53.276 kN.m

Simplified Approach

$p_y.Z_x$ 275 x 292.12 80.333 kN.m
 $F/P_c + m_x.M_x/p_y.Z_x$ 0 + 0.95 x 30.9/80.3 0.365 OK
 $F/P_{cy} + m_{LT}.M_{LT}/M_b$ 0 + 0.647 x -20.3/53.3 0.246 OK

More Exact Approach

$M_{ax} = M_{cx}/(1 + .5F/P_{cx})$ 94.1/(1 + .5 x 0/603.5) 94.05 kN.m
 $F/P_{cx} + m_x.M_x/M_{ax}$ 0/603.5 + 0.95 x 30.9/94.1 0.312 OK
 $F/P_{cy} + m_{LT}.M_{LT}/M_b$ 0/410.2 + 0.647 x -20.3/53.3 0.246 OK

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275.MP

STRUT AND TIE (MEMBER)

Roof Bracing : Member 394 (13\B-A)

Classification and Properties (BS 5950: 2000)

Section (13.5 kg/m) 114.3x5 CHS 13.5 [S 275]
Class = $F_n(D/t, p_y)$ 22.86, 275 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1 & 5-41

Strut by One Row of Bolts or Equivalent Weld (Case 13)

$\lambda = F_n(L_x, L_y, r_x, r_y)$ 6.944, 6.944, 3.87, 3.87 179.42 OK
 $P_c = A_{ea}.p_c$ 17.17 x 57.46/10 = 98.663 kN Table 24 a
 $F(\text{Strut})/P_c$ 36.04 / 98.663 0.365 OK

Axially Loaded Member in Tension : 3.4.3 (Case 5)

$A_e = F_n(A_g, A_{net}, p_y, U_s)$ 17.17, 17.17, 275, 410 17.17 cm²
 $T_c = A_e.p_y$ 17.17 x 275/10 = 472.175 kN
 $F(\text{Tie})/T_c$ 107.402 / 472.175 0.227 OK

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275.MP



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 25 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

STRUT AND TIE (MEMBER)

Applied Major and Minor Axes Bending Moments have been ignored Wall Bracing : Member 333 (10\C-D)

Classification and Properties (BS 5950: 2000)

Section (22.95 kg/m) 152x152 UC 23 [S 275]
Class = $F_n(b/T, d/t, p_y, F, M_x, M_y)$ 11.19, 21.31, 275, -12.59, 1.85, 0 (Axial: Non-Slender) SemiComp
Effective Properties Area=29.24 cm², Sxx=176.29(182) cm³, Syy=71.41(80.2) cm³
Auto Design Load Cases 1 & 5-41

Strut by One Row of Bolts or Equivalent Weld (Case 13)

$\lambda = F_n(L_x, L_y, r_x, r_y)$ 6,6,6.54,3.7 162.16 OK
Pc = Area.pc 29.24x59.87/10 = 175.046 kN Table 24 c
F (Strut)/Pc 3.981 / 175.046 0.023 OK

Axially Loaded Member in Tension : 3.4.3 (Case 1)

Ae = $F_n(A_g, A_{net}, p_y, U_s)$ 29.24, 29.24, 275, 410 29.24 cm²
Tc = Ae.py 29.24x275/10 = 804.1 kN
F (Tie)/Tc 12.586 / 804.1 0.016 OK

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ BAK2.MP

AXIAL WITH MOMENTS (MEMBER)

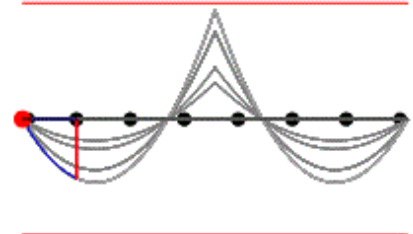
Members 15-16 (G\1-2)

Between 0.152 and 1.400 m, in Load Case 6

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.4 D2 + 1.6 L0 + 1.6 L1

UT Spacing 05.000 [Multiply AllLoads]
D1 UDL -005.000 [kN/m]
L1 UDL -005.000 [kN/m]



Member Forces in Load Case 6 and Maximum Deflection from Load Case 2										
Mem ber No.	Node End1 End2	Axial Force (kN)	Torque Moment (kN.m)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)		Maximum Deflection (mm @ m)
				x-x	y-y	x-x	y-y	x-x	y-y	
	104	57.24T	0.00	142.66	0.00	0.00	0.00	-232.93	0.00	6.31
	106	59.61T	0.00	-142.66	0.00	0.00	0.00	@ 5.000	@ 0.000	@ 2.150

Classification and Properties (BS 5950: 2000)

Section (50.95 kg/m) 356x171 UB 51 [S 275]
Class = $F_n(b/T, d/t, p_y, F, M_x, M_y)$ 7.46, 42.11, 275, 0, 232.95, 0 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1 & 5-41

Local Capacity Check

Fvx/Pvx 36.688 / 433.455 = 0.085 Low Shear
Mcx = $p_y \cdot S_{xx} \leq 1.2 \cdot p_y \cdot Z_{xx}$ 275 x 896 ≤ 1.2 x 275 x 796.55 = 246.4 kN.m
Ae = $F_n(A_g, A_{net}, p_y, U_s)$ 64.9, 64.9, 275, 410 64.9 cm²
Pz = Ae.py 64.9x275 1784.75 kN
n = F/Pz -59.609 / 1784.75 = 0.033 OK
Srx = $F_n(S_{xx}, n)$ 896, 0.033 894.41 cm³
Mrx = Srx.py 894.41 x 275 245.964 kN.m
(Mx/Mrx)² + (My/Mry)² (125.532/245.964)² + (0)² = 0.26 OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 26 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Equivalent Uniform Moment Factors m_{LT} , m_x , m_y and m_{yx}

$m_{LT} = 0.2 + (.15M_2 + .5M_3 + .15M_4) / M_{max}$	$0.2 + (.15 \times 58 + .5 \times 88 + .15 \times 110) / 125 = 0.44$	0.752	Table 18
$m_y = 0.2 + (.1M_2 + .6M_3 + .1M_4) / M_{max}$	$0.2 + (.1 \times 0 + .6 \times 0 + .1 \times 0) / 0 = .8 \times 0 / 0$	1	Table 26
$m_x = 0.2 + (.1M_2 + .6M_3 + .1M_4) / M_{max}$	$0.2 + (.1 \times 120 + .6 \times 233 + .1 \times 120) / 233 = .8 \times 233 / 233$	0.8	Table 26
$m_{yx} = 0.2 + (.1M_2 + .6M_3 + .1M_4) / M_{max}$	$0.2 + (.1 \times 0 + .6 \times 0 + .1 \times 0) / 0 = .8 \times 0 / 0$	0.8	Table 26

Lateral Buckling Check M_b

$L_e = 1.00 L$	$1 \times 1.248 =$	1.248 m	
$\lambda = L_e / r_{yy}$	$1.248 / 3.87$	32.25	OK
$v = F_n(x, L_e, r_{yy}, \lambda)$	32.073, 1.248, 3.87, 32.25	0.988	Table 19
$\lambda_{LT} = u.v.\lambda.\sqrt{\beta_w}$	$0.882 \times 0.988 \times 32.25 \sqrt{1}$	28.09	
$p_b = F_n(p_y, \lambda_{LT})$	275, 28.09	275 N/mm ²	Table 16
$M_b = S_{xx}.p_b \leq M_c$	$896 \times 275 \leq 246.4 =$	246.400 kN.m	

Simplified Approach

$p_y.Z_x$	275 x 796.55	219.051 kN.m	
$F/P_c + m_x.M_x / p_y.Z_x$	$0 + 0.8 \times 232.9 / 219.1$	0.851	OK
$F/P_{cy} + m_{LT}.M_{LT} / M_b$	$0 + 0.752 \times 125.5 / 246.4$	0.383	OK

More Exact Approach

$M_{ax} = M_{cx} / (1 + .5F/P_{cx})$	$246.4 / (1 + .5 \times 0 / 1476.1)$	246.4 kN.m	
$F/P_{cx} + m_x.M_x / M_{ax}$	$0 / 1476.1 + 0.8 \times 232.9 / 246.4$	0.756	OK
$F/P_{cy} + m_{LT}.M_{LT} / M_b$	$0 / 1682.2 + 0.752 \times 125.5 / 246.4$	0.383	OK

Deflection Check - Load Case 2

In-span $\delta \leq \text{Span} / 360$	$6.31 \leq 10000 / 360$	6.31 mm	OK
---	-------------------------	---------	----

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ BAK2.MP

AXIAL WITH MOMENTS (MEMBER)

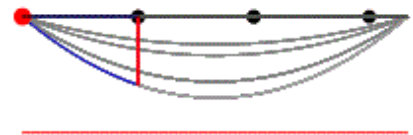
Member 50 (2\G-H)

Between 0.000 and 1.800 m, in Load Case 33

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.4 D2 + 1.6 L1 + 1.6 L4

UT Spacing 02.500 [Multiply AllLoads]
D1 UDLY -005.000 [kN/m]
L1 UDLY -005.000 [kN/m]



Member Forces in Load Case 33 and Maximum Deflection from Load Case 2										
Mem ber No.	Node End1 End2	Axial Force (kN)	Torque Moment (kN.m)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)		Maximum Deflection (mm @ m)
				x-x	y-y	x-x	y-y	x-x	y-y	
50	106	13.60C	0.00	114.60	0.00	0.00	0.00	171.90	0.00	14.84
	116	13.60C	0.00	-114.60	0.00	0.00	0.00	@ 3.000	@ 0.000	@ 3.000

Classification and Properties (BS 5950: 2000)

Section (50.95 kg/m) 356x171 UB 51 [S 275]
Class = $F_n(b/T, d/t, p_y, F, M_x, M_y)$ 7.46, 42.11, 275, 13.6, 171.9, 0 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1 & 5-41

Local Capacity Check

F_{vx} / P_{vx}	$45.843 / 433.455 =$	0.106	Low Shear
$M_{cx} = p_y.S_{xx} \leq 1.2 p_y.Z_{xx}$	$275 \times 896 \leq 1.2 \times 275 \times 796.55 =$	246.4 kN.m	
$P_z = A_g.p_y$	$64.9 \times 275 =$	1784.75 kN	
$n = F / P_z$	$13.601 / 1784.75 =$	0.008	OK
$S_{rx} = F_n(S_{xx}, n)$	$896, 0.008$	895.92 cm ³	



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 27 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Mrx = Srx.py	895.92 x 275	246.377 kN.m	
$(M_x/M_{rx})^{21} + (M_y/M_{ry})^{22}$	$(144.391/246.377)^2 + (0)^1 =$	0.343	OK

Compression Resistance Pc

$\lambda_x = L_{ex}/r_{xx}$	$100 \times 16 / 14.76 =$	40.7	OK
$P_{cx} = A_{area} \cdot p_{cx}$	$64.9 \times 259.525 / 10 =$	1684.314 kN	Table 24 a
$\lambda_y = L_{ey}/r_{yy}$	$100 \times 16 / 3.87 =$	46.5	OK
$P_{cy} = A_{area} \cdot p_{cy}$	$64.9 \times 241.54 / 10 =$	1567.600 kN	Table 24 b

Equivalent Uniform Moment Factors mLT, mx, my and myx

$m_{LT} = 0.2 + (.15M_2 + .5M_3 + .15M_4)/M_{max}$	$0.2 + (.15 \times 48 + .5 \times 88 + .15 \times 120) / 144 = 0.44$	0.678	Table 18
$m_y = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$	$0.2 + (.1 \times 0 + .6 \times 0 + .1 \times 0) / 0 = .8 \times 0 / 0$	1	Table 26
$m_x = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$	$0.2 + (.1 \times 129 + .6 \times 172 + .1 \times 129) / 172 = .8 \times 172 / 172$	0.95	Table 26
$m_{yx} = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$	$0.2 + (.1 \times 0 + .6 \times 0 + .1 \times 0) / 0 = .8 \times 0 / 0$	1	Table 26

Lateral Buckling Check Mb

$L_e = 1.00 L$	$1 \times 1.8 =$	1.8 m	
$\lambda = L_e/r_{yy}$	$1.8 / 3.87$	46.51	OK
$v = F_n(x, L_e, r_{yy}, \lambda)$	32.073, 1.8, 3.87, 46.51	0.975	Table 19
$\lambda_{LT} = u \cdot v \cdot \lambda \cdot \sqrt{\beta_w}$	$0.882 \times 0.975 \times 46.51 \sqrt{1}$	40	
$p_b = F_n(p_y, \lambda_{LT})$	275, 40	261.85 N/mm ²	Table 16
$M_b = S_{xx} \cdot p_b \leq M_c$	$896 \times 261.85 \leq 246.4 =$	234.616 kN.m	

Combined Axial Compression and Bending to Annex I

$r_b = m_{LT} \cdot M_{LT} / M_b$	$0.678 \times 144.4 / 234.6$	0.417	
$r_c = F_c / P_{cy}$	$13.6 / 1567.6$	0.009	
$\lambda_r = (r_b \lambda_{LT} + r_c \lambda_y) / (r_b + r_c)$	$(0.417 \cdot 40 + 0.009 \cdot 46.5) / (0.417 + 0.009)$	40.132	
$\lambda_{ro} = 17.15 \varepsilon (2r_b + r_c) / (r_b + r_c)$	$17.15 \cdot 1 (2 \cdot 0.417 + 0.009) / (0.417 + 0.009)$	33.951	
$M_{ob} = M_b (1 - F_c / P_{cy})$	$234.616 (1 - 13.6 / 1567.6)$	232.580	
$M_{xy} = M_{cx} (1 - F_c / P_{cy})^{1/2}$	$246.400 (1 - 13.6 / 1567.6)^{1/2}$	245.329	
$M_{ox} = M_{cx} (1 - F_c / P_{cy}) / (1 + 0.5 F_c / P_{cx})$	$246.400 (1 - 13.6 / 1567.6) / (1 + 0.5 \cdot 13.6 / 1567.6)$	243.428	
$M_{oy} = M_{cy} (1 - F_c / P_{cy}) / (1 + k_y (F_c / P_{cy}))$	$37.376 (1 - 13.6 / 1567.6) / (1 + 1.0 (13.6 / 1567.6))$	36.733	
$M_{ab} = \min(\lambda_r, \lambda_{ro}, \varepsilon, M_{xy}, M_{ob})$	40.132, 33.951, 1.000, 245.329, 232.580	244.732	
$M_{ax} = \min(\lambda_x, \varepsilon, M_{rx}, M_{ox})$	40.650, 1.000, 246.377, 243.428	245.368	
$M_{ay} = \min(\lambda_y, \varepsilon, M_{ry}, M_{oy})$	46.512, 1.000, 37.376, 36.733	37.101	
$m_x \cdot M_x / M_{ax}$	$0.95 \times 171.9 / 245.4$	0.666	OK
$m_{LT} \cdot M_{LT} / M_{ab}$	$0.678 \times 144.4 / 244.7$	0.400	OK
$m_x \cdot M_x / M_{ax}$	$0.95 \times 171.9 / 245.4$	0.559	OK
Compare with Simplified to 4.8.3.3	0.754, 0.426, 0.426	0.754	
Compare with MoreExact to 4.8.3.3	0.674, 0.426, 0.402	0.674	

Deflection Check - Load Case 2

In-span $\delta \leq \text{Span} / 360$	$14.84 \leq 6000 / 360$	14.84 mm	OK
---	-------------------------	----------	----

📁 P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ BAK2.MP

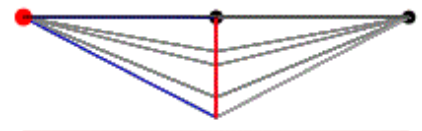
AXIAL WITH MOMENTS (MEMBER)

Members 58 & 66 (1-2\H-J)

Between 0.000 and 3.000 m, in Load Case 5

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.4 D2 + 1.6 L0 + 1.6 L1





R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 28 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Member Forces in Load Case 5 and Maximum Deflection from Load Case 2

Mem ber No.	Node End1 End2	Axial Force (kN)	Torque Moment (kN.m)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)		Maximum Deflection (mm @ m)
				x-x	y-y	x-x	y-y	x-x	y-y	
	114	2.91T	0.00	97.39	0.53	0.00	0.00	288.02	1.58	14.52
	124	2.91T	0.00	-97.39	-0.53	0.00	0.00	@ 3.000	@ 3.000	@ 3.000

Classification and Properties (BS 5950: 2000)

Section (67.1 kg/m) 356x171 UB 67 [S 275]
Class = $F_n(b/T, d/t, p_y, F, M_x, M_y)$ 5.52, 34.24, 275, 0, 288.03, 1.58 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1 & 5-41

Local Capacity Check

F_{vx}/P_{vx} 94.625 / 545.645 = 0.173 Low Shear
 $M_{cx} = p_y.S_{xx} \leq 1.2 p_y.Z_{xx}$ 275 x 1210.9 $\leq$ 1.2 x 275 x 1071.31 = 332.998 kN.m
 F_{vy}/P_{vy} 0.527 / 807.614 = 0.001 Low Shear
 $M_{cy} = p_y.S_{yy} \leq 1.2 p_y.Z_{yy}$ 275 x 243 $\leq$ 1.2 x 275 x 157.62 = 52.015 kN.m
 $A_e = F_n(A_g, A_{net}, p_y, U_s)$ 85.48, 85.48, 275, 410 85.48 cm²
 $P_z = A_e.p_y$ 85.48 x 275 2350.7 kN
 $n = F/P_z$ -2.905 / 2350.7 = 0.001 OK
 $S_{rx} = F_n(S_{xx}, n)$ 1210.9, 0.001 1210.9 cm³
 $M_{rx} = S_{rx}.p_y$ 1210.9 x 275 332.997 kN.m
 $S_{ry} = F_n(S_{yy}, n)$ 243, 0.001 243 cm³
 $M_{ry} = S_{ry}.p_y$ 243 x 275 52.015 kN.m
 $(M_x/M_{rx})^{2.1} + (M_y/M_{ry})^{2.2}$ $(288.033/332.997)^{2.1} + (1.583/52.015)^{2.2} = 0.779$ OK

Equivalent Uniform Moment Factors m_{LT} , m_x , m_y and m_{yx}

$m_{LT} = 0.2 + (.15M_2 + .5M_3 + .15M_4)/M_{max}$ $0.2 + (.15 \times 73 + .5 \times 145 + .15 \times 217)/288 = 0.44$ 0.603 Table 18
 $m_y = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1 \times 0 + .6 \times 1 + .1 \times 1)/2 = .8 \times 1/2$ 0.6 Table 26
 $m_x = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1 \times 145 + .6 \times 288 + .1 \times 145)/288 = .8 \times 288/288$ 0.901 Table 26
 $m_{yx} = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1 \times 1 + .6 \times 2 + .1 \times 1)/2 = .8 \times 2/2$ 0.899 Table 26

Lateral Buckling Check M_b

$L_e = 1.00 L$ 1 x 3 = 3 m
 $\lambda = L_e/r_{yy}$ 3 / 4 75 OK
 $v = F_n(x, L_e, r_{yy}, \lambda)$ 24.422, 3, 4, 75 0.908 Table 19
 $\lambda_{LT} = u.v.\lambda.\sqrt{\beta_w}$ 0.887 x 0.908 x 75 $\sqrt{1}$ 60.42
 $p_b = F_n(p_y, \lambda_{LT})$ 275, 60.42 212.16 N/mm² Table 16
 $M_b = S_{xx}.p_b \leq M_c$ 1210.9 x 212.16 $\leq$ 332.998 = 256.911 kN.m

Simplified Approach

$p_y.Z_x$ 275 x 1071.31 294.61 kN.m
 $p_y.Z_y$ 275 x 157.62 43.346 kN.m
 $F/P_c + m_x.M_x/p_y.Z_x + m_y.M_y/p_y.Z_y$ $0 + 0.901 \times 288/294.6 + 0.6 \times 1.6/43.3$ 0.903 OK
 $F/P_{cy} + m_{LT}.M_{LT}/M_b + m_y.M_y/p_y.Z_y$ $0 + 0.603 \times 288/256.9 + 0.6 \times 1.6/43.3$ 0.698 OK

More Exact Approach

$M_{ax} = M_{cx}/(1 + .5F/P_{cx})$ 333/(1 + .5 x 0/2224.5) 332.998 kN.m
 $M_{ay} = M_{cy}/(1 + F/P_{cy})$ 52/(1 + 0/1639.5) 52.015 kN.m
 $F/P_{cx} + m_x.M_x/M_{ax} + .5m_{yx}.M_y/M_{cy}$ $0/2224.5 + 0.901 \times 288/333 + .5 \times 0.899 \times 1.6/52$ 0.793 OK
 $F/P_{cy} + m_{LT}.M_{LT}/M_b + m_y.M_y/M_{ay}$ $0/1639.5 + 0.603 \times 288/256.9 + 0.6 \times 1.6/52$ 0.694 OK
 $M_{ax} = M_{cx}(1 - F/P_{cx})/(1 + .5F/P_{cx})$ $333(1 - 0/2224.5)/(1 + .5 \times 0/2224.5)$ 332.998 kN.m
 $M_{ay} = M_{cy}(1 - F/P_{cy})/(1 + F/P_{cy})$ $52(1 - 0/1639.5)/(1 + 0/1639.5)$ 52.015 kN.m
 $m.M_x/M_{ax} + m_y.M_y/M_{ay}$ $0.901 \times 288.033/332.998 + 0.6 \times 1.583/52.015$ 0.540 OK

Deflection Check - Load Case 2

In-span $\delta \leq \text{Span}/360$ 14.52 $\leq$ 6000 / 360 14.52 mm OK

P:\JOBS\7000S\7200\7275\CALCULATIONS\MEZ FRAME.\$5

AXIAL WITH MOMENTS (MEMBER) Member SBL1Id 1 @ Level 1 in Load Case 1



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

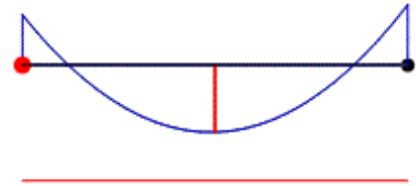
Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 29 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.6 L1

D1 UDLY -025.000 (kN/m)
L1 UDLY -025.000 (kN/m)



Member Forces in Load Case 1 and Maximum Deflection from Load Case 2							
Mem ber No.	Node End1 End2	Axial Force (kN)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)	
1	2	147.361C	379.004	-397.875	529.681	12.962	
	4	147.361C	-395.309	-479.399	@ 4.900	@ 4.800	

Classification and Properties (BS 5950: 2000)

Section (177.0 kg/m) 356x368 UC 177 [S 275]
Class = $F_n(b/T, d/t, p_y, F, M_x, M_y)$ 7.83, 20.15, 265, 147.36, 529.66, 0 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1

Local Capacity Check

F_{vx}/P_{vx} 8.161 / 843.031 = 0.01 Low Shear
 $M_{cx} = p_y.S_{xx} \leq 1.2 p_y.Z_{xx}$ 265 x 3455.2 $\leq$ 1.2 x 265 x 3103.33 = 915.628 kN.m
 $P_z = A_g.p_y$ 225.5 x 265 = 5975.75 kN
 $n = F/P_z$ 147.361 / 5975.75 = 0.025 OK
 $S_{rx} = F_n(S_{xx}, n)$ 3455.2, 0.025 3449.83 cm³
 $M_{rx} = S_{rx}.p_y$ 3449.83 x 265 914.205 kN.m
 $(M_x/M_{rx})^{2.1} + (M_y/M_{ry})^{2.2}$ (529.25/914.205)^{2.1} + (0)^{2.2} = 0.335 OK

Compression Resistance P_c

$\lambda_x = L_{ex}/r_{xx}$ 100x1x10/15.92 = 62.8 OK
 $P_{cx} = A_{pcx}$ 225.5x209.013/10 = 4713.234 kN Table 24 b
 $\lambda_y = L_{ey}/r_{yy}$ 100x1x10/9.54 = 104.8 OK
 $P_{cy} = A_{pcy}$ 225.5x115.65/10 = 2607.797 kN Table 24 c

Equivalent Uniform Moment Factors m_{LT} , m_x , m_y and m_{yx}

$m_{LT} = 0.2 + (.15M_2 + .5M_3 + .15M_4)/M_{max}$ 0.2 + (.15x308 + .5x529 + .15x267)/530 = 0.44 0.862 Table 18
 $m_y = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ 0.2 + (.1x0 + .6x0 + .1x0)/0 = .8x0/0 1 Table 26
 $m_x = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ 0.2 + (.1x308 + .6x529 + .1x267)/530 = .8x530/530 0.908 Table 26
 $m_{yx} = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ 0.2 + (.1x0 + .6x0 + .1x0)/0 = .8x0/0 1 Table 26

Lateral Buckling Check M_b

$L_e = 1.0L + 2D$ 1 x 10 + 2 x 0.368 = 10.736 m
 $\lambda = L_e/r_{yy}$ 10.736 / 9.54 112.54 OK
 $v = F_n(x, L_e, r_{yy}, \lambda)$ 15.024, 10.736, 9.54, 112.54 0.716 Table 19
 $\lambda_{LT} = u.v.\lambda.\sqrt{\beta_w}$ 0.844 x 0.716 x 112.54 $\sqrt{1}$ 68.01
 $p_b = F_n(p_y, \lambda_{LT})$ 265, 68.01 188.4 N/mm² Table 16
 $M_b = S_{xx}.p_b \leq M_c$ 3455.2 x 188.4 $\leq$ 915.628 = 650.962 kN.m

Combined Axial Compression and Bending to Annex I

$r_b = m_{LT}.M_{LT}/M_b$ 0.862x529.3/651 0.701
 $r_c = F_c/P_{cy}$ 147.4/2607.8 0.057
 $\lambda_r = (r_b\lambda_{LT} + r_c\lambda_y)/(r_b + r_c)$ (0.701x68 + 0.057x104.8)/(0.701 + 0.057) 70.760
 $\lambda_{ro} = 17.15 \epsilon (2r_b + r_c)/(r_b + r_c)$ 17.15x1.019(2x0.701 + 0.057)/(0.701 + 0.057) 33.638
 $M_{ob} = M_b(1 - F_c/P_{cy})$ 650.962(1 - 147.4/2607.8) 614.177
 $M_{xy} = M_{ox}(1 - F_c/P_{cy})^{1/2}$ 915.628(1 - 147.4/2607.8)^{1/2} 889.382
 $M_{ox} = M_{cx}(1 - F_c/P_{cx})/(1 + 0.5F_c/P_{cx})$ 915.628(1 - 147.4/4713.2)/(1 + 0.5x147.4/4713.2) 873.348
 $M_{oy} = M_{cy}(1 - F_c/P_{cy})/(1 + k_y(F_c/P_{cy}))$ 350.662(1 - 147.4/2607.8)/(1 + 1.0(147.4/2607.8)) 313.151
 $M_{ab} = f_n(\lambda_r, \lambda_{ro}, \epsilon_r, M_{xy}, M_{ob})$ 70.760, 33.638, 1.019, 889.382, 614.177 707.056
 $M_{ax} = f_n(\lambda_x, \epsilon_r, M_{rx}, M_{ox})$ 62.814, 1.019, 914.205, 873.348 887.714
 $M_{ay} = f_n(\lambda_y, \epsilon_r, M_{ry}, M_{oy})$ 104.822, 1.019, 350.662, 313.151 313.151
 $m_x.M_x/M_{ax}$ 0.908x529.7/887.7 0.542 OK
 $m_{LT}.M_{LT}/M_{ab}$ 0.862x529.3/707.1 0.645 OK
 $m_x.M_x/M_{ax}$ 0.908x529.7/887.7 0.541 OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 30 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Compare with Simplified to 4.8.3.3 0.641, 0.758, 0.758 0.758
Compare with MoreExact to 4.8.3.3 0.565, 0.758, 0.523 0.758

Deflection Check - Load Case 2

In-span $\delta \leq \text{Span}/360$ $12.96 \leq 10000 / 360$ 12.96 mm OK

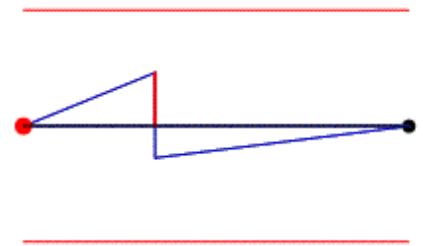
P:\JOBS\7000S\7200\7275\CALCULATIONS\MEZ FRAME.\$5

AXIAL WITH MOMENTS (MEMBER) Member SCL1Id 3 @ Level 1 in Load Case 1

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.6 L1

D1 PX -050.000 2.700 (kN,m)



Member Forces in Load Case 1 and Maximum Deflection from Load Case 2						
Mem ber No.	Node End1 End2	Axial Force (kN)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
	3	406.924C	-111.605	0.000	-301.321	1.284
	5	0.000C	-34.244	0.000	@ 2.700	@ 1.890

Classification and Properties (BS 5950: 2000)

Section (129.0 kg/m) 356x368 UC 129 [S 275]
Class = $F_n(b/T, d/t, p_y, F, M_x, M_y)$ 10.53, 27.9, 265, 406.92, 301.33, 0 (Axial: Non-Slender) SemiComp
Effective Properties Area=164.33 cm², $S_{xx}=2458.2(2479.3)$ cm³, $S_{yy}=1159.4(1199.2)$ cm³
Auto Design Load Cases 1

Local Capacity Check

F_{vx}/P_{vx} 111.604 / 588.02 = 0.19 Low Shear
 $M_{cx} = p_y.S_{xx} \leq 1.2 p_y.Z_{xx}$ 265 x 2458.2 $\leq$ 1.2 x 265 x 2264.33 = 651.424 kN.m
 $P_z = A_g.p_y$ 164.33 x 265 = 4354.745 kN
 $n = F/P_z$ 406.924 / 4354.745 = 0.093 OK
 $F/A_g.p_y + M_x/M_{cx} + M_y/M_{cy}$ 406.924 / 4354.745 + 301.333 / 651.424 + 0 = 0.556 OK

Compression Resistance P_c

$\lambda_x = L_{ex}/r_{xx}$ 100x1x7.9/15.65 = 50.5 OK
 $P_{cx} = \text{Area}.p_{cx}$ 164.33x228.044/10 = 3747.450 kN Table 24 b
 $\lambda_y = L_{ey}/r_{yy}$ 100x1x7.9/9.43 = 83.8 OK
 $P_{cy} = \text{Area}.p_{cy}$ 164.33x150.38/10 = 2471.122 kN Table 24 c

Equivalent Uniform Moment Factors m_{LT} , m_x , m_y and m_{yx}

$m_{LT} = 0.2 + (.15M_2 + .5M_3 + .15M_4)/M_{max}$ $0.2 + (.15x220 + .5x135 + .15x68)/301 = 0.44$ 0.568 Table 18
 $m_y = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1x0 + .6x0 + .1x0)/0 = .8x0/0$ 1 Table 26
 $m_x = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1x-220 + .6x135 + .1x68)/301 = .8x301/301$ 0.8 Table 26
 $m_{yx} = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1x0 + .6x0 + .1x0)/0 = .8x0/0$ 1 Table 26

Lateral Buckling Check M_b

$L_e = 1.0L + 2D$ 1 x 7.9 + 2 x 0.356 = 8.611 m
 $\lambda = L_e/r_{yy}$ 8.611 / 9.43 91.32 OK
 $v = F_n(x, L_e, r_{yy}, \lambda)$ 19.95, 8.611, 9.43, 91.32 0.836 Table 19
 $\lambda_{LT} = u.v.\lambda.\sqrt{\beta_w}$ 0.844 x 0.836 x 91.32 $\sqrt{0.991}$ 64.17
 $p_b = F_n(p_y, \lambda_{LT})$ 265, 64.17 197.48 N/mm² Table 16
 $M_b = S_{xx}.p_b \leq M_c$ 2458.2 x 197.48 $\leq$ 651.424 = 485.441 kN.m

Simplified Approach

$p_y.Z_x$ 265x2264.33 600.048 kN.m
 $F/P_c + m_x.M_x/p_y.Z_x$ 406.924/2471.122 + 0.8x301.3/600 0.566 OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 31 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

F/Pcy+m_{LT}.M_{LT}/Mb 406.924/2471.122+0.568x-301.3/485.4 0.517 OK

More Exact Approach

Max=Mcx/(1+.5F/Pcx) 651.4/(1+.5x406.9/3747.5) 617.877 kN.m
F/Pcx+mx.Mx/Max 406.9/3747.5+0.8x301.3/617.9 0.499 OK
F/Pcy+m_{LT}.M_{LT}/Mb 406.9/2471.1+0.568x-301.3/485.4 0.517 OK

Deflection Check - Load Case 2

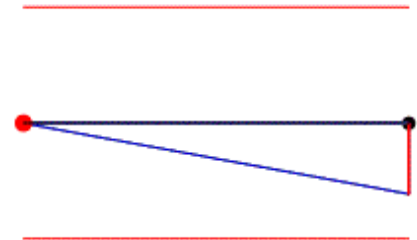
In-span $\delta \leq \text{Span}/360$ 1.28 $\leq$ 7900 / 360 1.28 mm OK

P:\JOBS\7000S\7200\7275\CALCULATIONS\MEZ FRAME.\$5

AXIAL WITH MOMENTS (MEMBER) Member SCL1Id 2 @ Level 1 in Load Case 1

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.6 L1



Member Forces in Load Case 1 and Maximum Deflection from Load Case 2						
Mem ber No.	Node End1 End2	Axial Force (kN)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
2	1	382.974C	147.361	0.000		0.601
	2	379.004C	147.361	397.875		@ 1.566

Classification and Properties (BS 5950: 2000)

Section (129.0 kg/m) 356x368 UC 129 [S 275]
Class = Fn(b/T,d/t,py,F,Mx,My) 10.53, 27.9, 265, 382.97, 397.88, 0 (Axial: Non-Slender) SemiComp
Effective Properties Area=164.33 cm², Sxx=2458.2(2479.3) cm³, Syy=1159.4(1199.2) cm³
Auto Design Load Cases 1

Local Capacity Check

Fvx/Pvx 147.361 / 588.02 = 0.251 Low Shear
Mcx = py.Sxx $\leq$ 1.2 py.Zxx 265 x 2458.2 $\leq$ 1.2 x 265 x 2264.33 = 651.424 kN.m
Pz = Ag.py 164.33 x 265 = 4354.745 kN
n = F/Pz 382.974 / 4354.745 = 0.088 OK
F/Ag.py+Mx/Mcx+My/Mcy 382.974 / 4354.745 + 397.875 / 651.424 + 0 = 0.699 OK

Compression Resistance Pc

$\lambda_x = L_{ex}/r_{xx}$ 100x1x2.7/15.65 = 17.3 OK
Pcx = Area.pcx 164.33x265/10 = 4354.745 kN Table 24 b
 $\lambda_y = L_{ey}/r_{yy}$ 100x1x2.7/9.43 = 28.6 OK
Pcy = Area.pcy 164.33x248.08/10 = 4076.649 kN Table 24 c

Equivalent Uniform Moment Factors m_{LT}, m_x, m_y and m_{yx}

m_{LT}=0.2+(.15M₂+.5M₃+.15M₄)/M_{max} 0.2+(.15x99+.5x199+.15x298)/398 = 0.44 0.6 Table 18
m_y=0.2+(.1M₂+.6M₃+.1M₄)/M_{max} 0.2+(.1x0+.6x0+.1x0)/0 = .8x0/0 1 Table 26
m_x=0.2+(.1M₂+.6M₃+.1M₄)/M_{max} 0.2+(.1x99+.6x199+.1x298)/398 = .8x298/398 0.6 Table 26
m_{yx}=0.2+(.1M₂+.6M₃+.1M₄)/M_{max} 0.2+(.1x0+.6x0+.1x0)/0 = .8x0/0 1 Table 26

Lateral Buckling Check Mb

Le = 1.0L+2D 1 x 2.7 + 2 x 0.356 = 3.411 m
 $\lambda = L_e/r_{yy}$ 3.411 / 9.43 36.17 OK
v = Fn(x_y,Le,ryy, λ) 19.95, 3.411, 9.43, 36.17 0.963 Table 19
 $\lambda_{LT} = u.v.\lambda.\sqrt{\beta_w}$ 0.844 x 0.963 x 36.17 $\sqrt{0.991}$ 29.27



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 32 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

$p_b = F_n(p_y, \lambda_{LT})$	265, 29.27	265 N/mm ²	Table 16
$M_b = S_{xx}.p_b \leq M_c$	$2458.2 \times 265 \leq 651.424 =$	651.424 kN.m	
Simplified Approach			
$p_y.Z_x$	265x2264.33	600.048 kN.m	
$F/P_c + m_x.M_x/p_y.Z_x$	$382.974/4076.649 + 0.6 \times 397.9/600$	0.492	OK
$F/P_{cy} + m_{LT}.M_{LT}/M_b$	$382.974/4076.649 + 0.6 \times 397.9/651.4$	0.461	OK
More Exact Approach			
$M_{ax} = M_{cx}/(1 + .5F/P_{cx})$	$651.4/(1 + .5 \times 383/4354.7)$	623.986 kN.m	
$F/P_{cx} + m_x.M_x/M_{ax}$	$383/4354.7 + 0.6 \times 397.9/624$	0.471	OK
$F/P_{cy} + m_{LT}.M_{LT}/M_b$	$383/4076.6 + 0.6 \times 397.9/651.4$	0.461	OK
Deflection Check - Load Case 2			
In-span $\delta \leq \text{Span}/360$	$0.6 \leq 2700 / 360$	0.6 mm	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 33 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

CANOPY

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ FINAL.MP

AXIAL WITH MOMENTS (MEMBER)

Lean-To Beam 1 : Member 689 (N.150-A4)

Between 0.000 and 1.800 m, in Load Case 6

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.4 D2 + 1.6 L0 + 1.6 L1

UT Spacing 05.000 [Multiply AllLoads]
D1 UDLY -000.150 [kN/m]
D2 UDLY -000.000 [kN/m]
L0 UDLY -000.600 [kN/m]



Member Forces in Load Case 6 and Maximum Deflection from Load Case 2										
Mem ber No.	Node End1 End2	Axial Force (kN)	Torque Moment (kN.m)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)		Maximum Deflection (mm @ m)
				x-x	y-y	x-x	y-y	x-x	y-y	
689	150	0.26C	0.00	37.90	0.00	0.00	0.00	108.96	0.00	29.63
	216	0.26C	0.00	-37.90	0.00	0.00	0.00	@ 5.750	@ 0.000	@ 5.750

Classification and Properties (BS 5950: 2000)

Section (56.95 kg/m) 356x171 UB 57 [S 275]
Class = $F_n(b/T, d/t, p_y, F, M_x, M_y)$ 6.62, 38.47, 275, 0.26, 108.96, 0 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1 & 5-41

Local Capacity Check

F_{vx}/P_{vx} 26.035 / 478.467 = 0.054 Low Shear
 $M_{cx} = p_y.S_{xx} \leq 1.2 p_y.Z_{xx}$ 275 x 1010.1 ≤ 1.2 x 275 x 896.16 = 277.778 kN.m
 $P_z = A_g.p_y$ 72.55 x 275 = 1995.125 kN
 $n = F/P_z$ 0.261 / 1995.125 = 0.000 OK
 $S_{rx} = F_n(S_{xx}, n)$ 1010.1, 0 1010.1 cm³
 $M_{rx} = S_{rx}.p_y$ 1010.1 x 275 277.778 kN.m
 $(M_x/M_{rx})^{2.1} + (M_y/M_{ry})^{2.2}$ $(57.539/277.778)^{2.1} + (0)^{2.2} = 0.043$ OK

Compression Resistance P_c

$\lambda_x = L_{ex}/r_{xx}$ 100x1x11.5/14.87 = 77.3 OK
 $P_{cx} = A_{area}.p_{cx}$ 72.55x209.097/10 = 1516.996 kN Table 24 a
 $\lambda_y = L_{ey}/r_{yy}$ 100x1x1.8/3.91 = 46 OK
 $P_{cy} = A_{area}.p_{cy}$ 72.55x242.2/10 = 1757.133 kN Table 24 b

Equivalent Uniform Moment Factors m_{LT} , m_x , m_y and m_{yx}

$m_{LT} = 0.2 + (.15M_2 + .5M_3 + .15M_4)/M_{max}$ $0.2 + (.15x16 + .5x31 + .15x45)/58 = 0.44$ 0.634 Table 18
 $m_y = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1x0 + .6x0 + .1x0)/0 = .8x0/0$ 1 Table 26
 $m_x = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1x82 + .6x109 + .1x82)/109 = .8x109/109$ 0.95 Table 26
 $m_{yx} = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$ $0.2 + (.1x0 + .6x0 + .1x0)/0 = .8x0/0$ 1 Table 26

Lateral Buckling Check M_b

$L_e = 1.00 L$ 1 x 1.8 = 1.8 m
 $\lambda = L_e/r_{yy}$ 1.8 / 3.91 46.04 OK
 $v = F_n(x, L_e, r_{yy}, \lambda)$ 28.79, 1.8, 3.91, 46.04 0.97 Table 19
 $\lambda_{LT} = u.v.\lambda.\sqrt{\beta_w}$ 0.883 x 0.97 x 46.04 $\sqrt{1}$ 39.46
 $p_b = F_n(p_y, \lambda_{LT})$ 275, 39.46 263.1 N/mm² Table 16
 $M_b = S_{xx}.p_b \leq M_c$ 1010.1 x 263.1 ≤ 277.778 = 265.760 kN.m

Simplified Approach

$p_y.Z_x$ 275x896.16 246.444 kN.m
 $F/P_c + m_x.M_x/p_y.Z_x$ $0.261/1516.996 + 0.95x109/246.4$ 0.420 OK
 $F/P_{cy} + m_{LT}.M_{LT}/M_b$ $0.261/1757.133 + 0.634x57.5/265.8$ 0.137 OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 34 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

More Exact Approach

Max=Mcx/(1+.5F/Pcx)	277.8/(1+.5x0.3/1517)	277.754 kN.m	
F/Pcx+mx.Mx/Max	0.3/1517+0.95x109/277.8	0.373	OK
F/Pcy+m _{LT} .M _{LT} /Mb	0.3/1757.1+0.634x57.5/265.8	0.137	OK

Deflection Check - Load Case 2

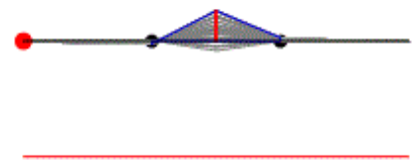
In-span $\delta \leq \text{Span}/360$	$29.63 \leq 11500 / 360$	29.63 mm	OK
---------------------------------------	--------------------------	----------	----

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ FINAL.MP

AXIAL WITH MOMENTS (MEMBER) Members 36-39 (N.149-N.153) Between 5.000 and 10.000 m, in Load Case 39

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.4 D2 + 1.6 L1 + 1.05 L5



Member Forces in Load Case 39 and Maximum Deflection from Load Case 2										
Member No.	Node End1 End2	Axial Force (kN)	Torque Moment (kN.m)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)		Maximum Deflection (mm @ m)
				x-x	y-y	x-x	y-y	x-x	y-y	
	149	0.58T	0.01	4.63	-0.04	-2.71	0.21	-113.15	-0.30	8.10
	153	0.25C	-0.04	0.34	-0.03	0.00	0.00	@ 7.500	@ 7.500	@ 7.625

Classification and Properties (BS 5950: 2000)

Section (65.7 kg/m) 533x165 UB 66 [S 275]
Class = Fn(b/T,d/t,py,F,Mx,My) 7.24, 53.54, 275, 0.25, 113.15, 0.3 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1 & 5-41

Local Capacity Check

Fvx/Pvx	50.058 / 770.522 =	0.065	Low Shear
Mcx = py.Sxx ≤ 1.2 py.Zxx	275 x 1560.9 ≤ 1.2 x 275 x 1335.18 =	429.248 kN.m	
Fvy/Pvy	0.221 / 558.996 =	0	Low Shear
Mcy = py.Syy ≤ 1.2 py.Zyy	275 x 166.3 ≤ 1.2 x 275 x 104.03 =	34.33 kN.m	
Ae = Fn(Ag,A.net,py,Us)	83.69,83.69,275,410	83.69 cm ²	
Pz = Ae.py	83.69x275	2301.475 kN	
n = F/Pz	-0.679 / 2301.475 =	0.000	OK
Srx = Fn(Sxx, n)	1560.9, 0	1560.9 cm ³	
Mrx = Srx.py	1560.9 x 275	429.248 kN.m	
Sry = Fn(Syy, n)	166.3, 0	166.3 cm ³	
Mry = Sry.py	166.3 x 275	34.33 kN.m	
(Mx/Mrx) ^{2.1} + (My/Mry) ^{2.2}	(113.151/429.248) ² + (0.3/34.33) ¹ =	0.078	OK

Compression Resistance Pc

λx = Lex/rxx	100x1x15/20.46 =	73.3	OK
Pcx = Area.pcx	83.69x217.278/10 =	1818.402 kN	Table 24 a
λy = Ley/ryy	100x1x5/3.2 =	156.3	OK
Pcy = Area.pcy	83.69x69.28/10 =	579.844 kN	Table 24 b

Equivalent Uniform Moment Factors m_{LT}, m_x, m_y and m_{yx}

m _{LT} = 0.2 + (.15M ₂ + .5M ₃ + .15M ₄)/M _{max}	0.2 + (.15x51 + .5x113 + .15x63)/113 = 0.44	0.851	Table 18
m _y = 0.2 + (.1M ₂ + .6M ₃ + .1M ₄)/M _{max}	0.2 + (.1x0 + .6x0 + .1x0)/0 = .8x0/0	0.858	Table 26
m _x = 0.2 + (.1M ₂ + .6M ₃ + .1M ₄)/M _{max}	0.2 + (.1x8 + .6x-113 + .1x-8)/113 = .8x113/113	0.8	Table 26



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 35 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

$m_{yx} = 0.2 + (.1M_2 + .6M_3 + .1M_4) / M_{max}$ $0.2 + (.1 \times 0 + .6 \times 0 + .1 \times 0) / 0 = .8 \times 0 / 0$ 0.8 Table 26

Lateral Buckling Check Mb

Le = 1.00 L $1 \times 5 =$ 5 m
 $\lambda = L_e / r_{yy}$ $5 / 3.2$ 156.25 OK
 $v = F_n(x, L_e, r_{yy}, \lambda)$ 46.909, 5, 3.2, 156.25 0.896 Table 19
 $\lambda_{LT} = u.v.\lambda.\sqrt{\beta_w}$ $0.848 \times 0.896 \times 156.25 \sqrt{1}$ 118.68
 $p_b = F_n(p_y, \lambda_{LT})$ 275, 118.68 97.24 N/mm² Table 16
 $M_b = S_{xx}.p_b \leq M_c$ $1560.9 \times 97.24 \leq 429.248 =$ 151.789 kN.m

Simplified Approach

$p_y.Z_x$ 275×1335.18 367.175 kN.m
 $p_y.Z_y$ 275×104.03 28.608 kN.m
 $F/P_c + m_x.M_x/p_y.Z_x + m_y.M_y/p_y.Z_y$ $0.254/579.844 + 0.8 \times 113.2/367.2 + 0.858 \times 0.3/28.6$ 0.256 OK
 $F/P_{cy} + m_{LT}.M_{LT}/M_b + m_y.M_y/p_y.Z_y$ $0.254/579.844 + 0.851 \times 113.2/151.8 + 0.858 \times 0.3/28.6$ 0.644 OK

More Exact Approach

$M_{ax} = M_{cx} / (1 + .5F/P_{cx})$ $429.2 / (1 + .5 \times 0.3/1818.4)$ 429.218 kN.m
 $M_{ay} = M_{cy} / (1 + F/P_{cy})$ $34.3 / (1 + 0.3/579.8)$ 34.315 kN.m
 $F/P_{cx} + m_x.M_x/M_{ax} + .5m_{yx}.M_y/M_{cy}$ $0.3/1818.4 + 0.8 \times 113.2/429.2 + .5 \times 0.8 \times 0.3/34.3$ 0.215 OK
 $F/P_{cy} + m_{LT}.M_{LT}/M_b + m_y.M_y/M_{ay}$ $0.3/579.8 + 0.851 \times 113.2/151.8 + 0.858 \times 0.3/34.3$ 0.642 OK
 $M_{ax} = M_{cx}(1 - F/P_{cx}) / (1 + .5F/P_{cx})$ $429.2(1 - 0.3/1818.4) / (1 + .5 \times 0.3/1818.4)$ 429.158 kN.m
 $M_{ay} = M_{cy}(1 - F/P_{cy}) / (1 + F/P_{cy})$ $34.3(1 - 0.3/579.8) / (1 + 0.3/579.8)$ 34.3 kN.m
 $m.M_x/M_{ax} + m.M_y/M_{ay}$ $0.8 \times 113.151/429.158 + 0.858 \times 0.3/34.3$ 0.232 OK

Deflection Check - Load Case 2

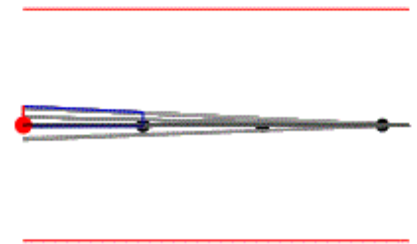
In-span $\delta \leq \text{Span}/360$ $8.1 \leq 15000 / 360$ 8.1 mm OK

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ FINAL.MP

AXIAL WITH MOMENTS (MEMBER) Member 504 (N.4-N.150) Between 0.000 and 1.800 m, in Load Case 10

Member Loading and Member Forces

Loading Combination : 1 UT + 1 D1 + 1.4 W2



Member Forces in Load Case 10 and Maximum Deflection from Load Case 2										
Mem ber No.	Node End1 End2	Axial Force (kN)	Torque Moment (kN.m)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)		Maximum Deflection (mm @ m)
				x-x	y-y	x-x	y-y	x-x	y-y	
504	4	1.61T	0.01	6.22	-0.48	-36.05	2.80			0.49
	150	3.90T	-0.01	6.22	-0.48	0.00	0.00			@ 2.436

Classification and Properties (BS 5950: 2000)

Section (40.28 kg/m) 305x165 UB 40 [S 355]
 Class = $F_n(b/T, d/t, p_y, F, M_x, M_y)$ 8.09, 44.2, 355, 0, 36.05, 2.8 (Axial: Non-Slender) Compact
 Auto Design Load Cases 1 & 5-41

Local Capacity Check

F_{vx}/P_{vx} $6.216 / 387.745 =$ 0.016 Low Shear
 $M_{cx} = p_y.S_{xx} \leq 1.2 p_y.Z_{xx}$ $355 \times 623.1 \leq 1.2 \times 355 \times 560.6 =$ 221.201 kN.m
 F_{vy}/P_{vy} $0.483 / 645.262 =$ 0.001 Low Shear
 $M_{cy} = p_y.S_{yy} \leq 1.2 p_y.Z_{yy}$ $355 \times 141.7 \leq 1.2 \times 355 \times 92.85 =$ 39.554 kN.m



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 36 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

$A_e = F_n(A_g, A_{net}, p_y, U_s)$	51.31, 51.31, 355, 470	51.31 cm ²	
$P_z = A_e \cdot p_y$	51.31 x 355	1821.505 kN	
$n = F/P_z$	-3.901 / 1821.505 =	0.002	OK
$S_{rx} = F_n(S_{xx}, n)$	623.1, 0.002	623.1 cm ³	
$M_{rx} = S_{rx} \cdot p_y$	623.1 x 355	221.199 kN.m	
$S_{ry} = F_n(S_{yy}, n)$	141.7, 0.002	141.7 cm ³	
$M_{ry} = S_{ry} \cdot p_y$	141.7 x 355	39.554 kN.m	
$(M_x/M_{rx})^{2.1} + (M_y/M_{ry})^{2.2}$	$(36.052/221.199)^2 + (2.804/39.554)^2 =$	0.097	OK

Equivalent Uniform Moment Factors m_{LT} , m_x , m_y and m_{yx}

$m_{LT} = 0.2 + (.15M_2 + .5M_3 + .15M_4)/M_{max}$	$0.2 + (.15 \times 33 + .5 \times 30 + .15 \times 28)/36 = 0.44$	0.876	Table 18
$m_y = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$	$0.2 + (.1 \times 3 + .6 \times 2 + .1 \times 2)/3 = .8 \times 3/3$	0.876	Table 26
$m_x = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$	$0.2 + (.1 \times 27 + .6 \times 18 + .1 \times 9)/36 = .8 \times 27/36$	0.6	Table 26
$m_{yx} = 0.2 + (.1M_2 + .6M_3 + .1M_4)/M_{max}$	$0.2 + (.1 \times 2 + .6 \times 1 + .1 \times 1)/3 = .8 \times 2/3$	0.6	Table 26

Lateral Buckling Check M_b

$L_e = 1.00 L$	$1 \times 1.8 =$	1.8 m	
$\lambda = L_e/r_{yy}$	$1.8 / 3.86$	46.63	OK
$v = F_n(x, L_e, r_{yy}, \lambda)$	31.091, 1.8, 3.86, 46.63	0.974	Table 19
$\lambda_{LT} = u.v.\lambda.\sqrt{\beta_w}$	$0.89 \times 0.974 \times 46.63 \sqrt{1}$	40.39	
$p_b = F_n(p_y, \lambda_{LT})$	355, 40.39	323.73 N/mm ²	Table 16
$M_b = S_{xx} \cdot p_b \leq M_c$	$623.1 \times 323.73 \leq 221.201 =$	201.718 kN.m	

Combined Axial Compression and Bending to Annex I

$r_b = m_{LT} \cdot M_{LT}/M_b$	$0.876 \times -36.1/201.7$	0.157	
$r_c = F_c/P_{cy}$	$0/1564.6$	0.000	
$\lambda_r = (r_b \lambda_{LT} + r_c \lambda_y)/(r_b + r_c)$	$(0.157 \times 40.4 + 0 \times 46.6)/(0.157 + 0)$	40.393	
$\lambda_{ro} = 17.15 \varepsilon (2r_b + r_c)/(r_b + r_c)$	$17.15 \times 0.88(2 \times 0.157 + 0)/(0.157 + 0)$	30.189	
$M_{ob} = M_b(1 - F_c/P_{cy})$	$201.718(1 - 0/1564.6)$	201.718	
$M_{xy} = M_{ox}(1 - F_c/P_{cy})^{1/2}$	$221.201(1 - 0/1564.6)^{1/2}$	221.201	
$M_{ox} = M_{cx}(1 - F_c/P_{cx})/(1 + 0.5F_c/P_{cx})$	$221.201(1 - 0/1672.5)/(1 + 0.5 \times 0/1672.5)$	221.201	
$M_{oy} = M_{cy}(1 - F_c/P_{cy})/(1 + K_y(F_c/P_{cy}))$	$39.554(1 - 0/1564.6)/(1 + 1.0(0/1564.6))$	39.554	
$M_{ab} = f_n(\lambda_r, \lambda_{ro}, \varepsilon_r, M_{xy}, M_{ob})$	40.393, 30.189, 0.880, 221.201, 201.718	216.815	
$M_{ax} = f_n(\lambda_x, \varepsilon_r, M_{rx}, M_{ox})$	45.066, 0.880, 221.199, 221.201	221.201	
$M_{ay} = f_n(\lambda_y, \varepsilon_r, M_{ry}, M_{oy})$	46.632, 0.880, 39.554, 39.554	39.554	
$m_x \cdot M_x/M_{ax} + .5m_{yx} \cdot M_y/M_{cy}(1 - F_c/P_{cx})$	$0.6 \times 36.1/221.2 + .5 \times 0.6 \times 2.8/(39.6(1 - 0/1672.5))$	0.119	OK
$m_{LT} \cdot M_{LT}/M_{ab} + m_y \cdot M_y/M_{ay}$	$0.876 \times -36.1/216.8 + 0.876 \times 2.8/39.6$	0.208	OK
$m_x \cdot M_x/M_{ax} + m_y \cdot M_y/M_{ay}$	$0.6 \times 36.1/221.2 + 0.876 \times 2.8/39.6$	0.160	OK
Compare with Simplified to 4.8.3.3	0.183, 0.231, 0.231	0.231	
Compare with MoreExact to 4.8.3.3	0.119, 0.219, 0.205	0.219	

Deflection Check - Load Case 2

In-span $\delta \leq \text{Span}/360$	$0.49 \leq 5800 / 360$	0.49 mm	OK
---------------------------------------	------------------------	---------	----



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

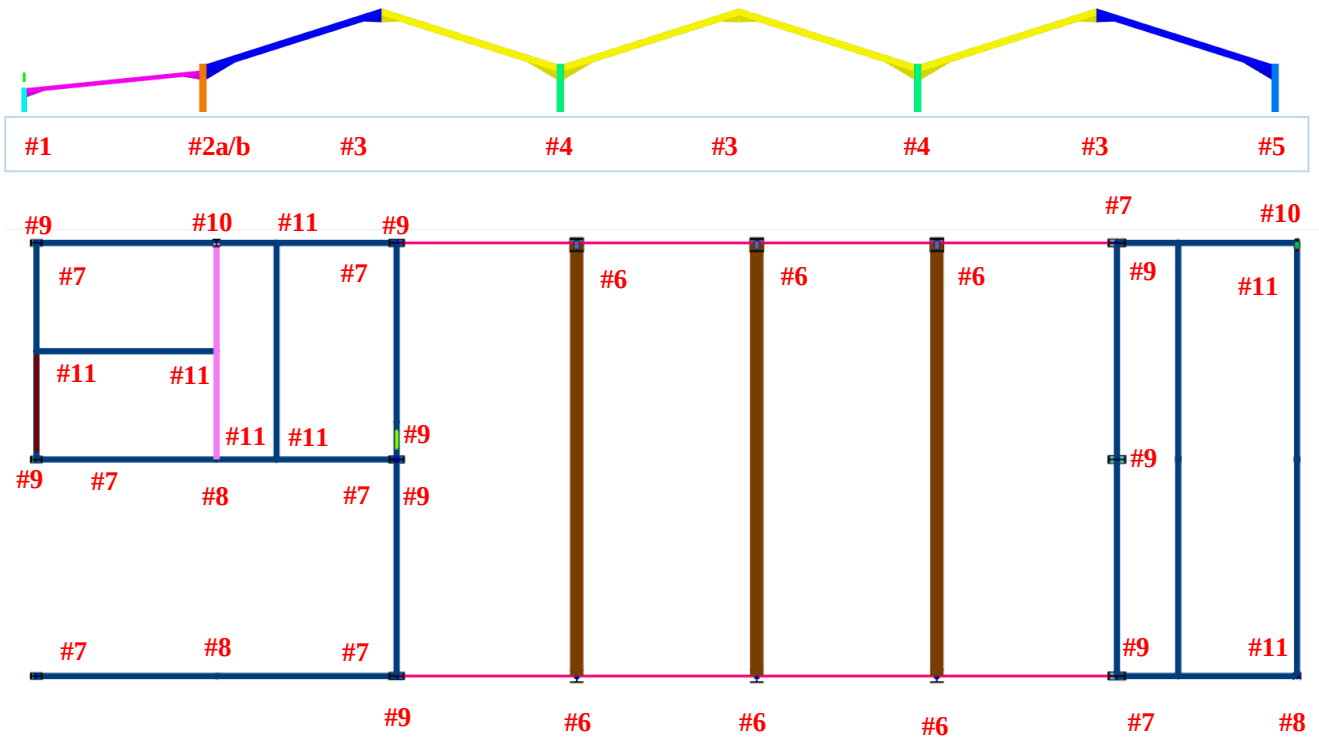
Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 37 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

CONNECTIONS

Section through roof structure



Mezzanine Level



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

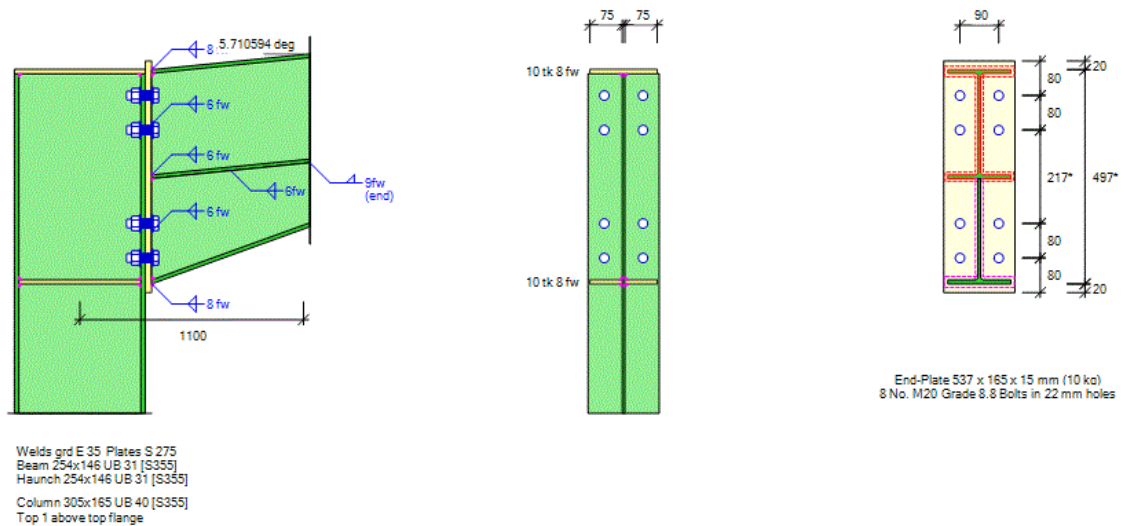
Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 38 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

#1

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275.MP

EAVES JOINT AT : C1 - LEVEL 1 : LEAN-TO BEAM 1 : MEMBER 98 (C\1-2)



Beam to Column Flange End-Plated Connection to BS 5950

LOADING CASE 001 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW

Basic Data

Integrated Applied Forces at Column/Right Rafter Interface

Right Rafter Forces M, Fvr, Fr 87.0 kNm, 48.7 kN, 21.4 kN
Resultant Forces M, Fv, F 87.0 kNm, 50.6 kN, 16.5 kN
Load directions Top of Joint in Tension, Rafter moving Down and in Compression.
Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95

Rafter Capacities Mc, Fvc, Fc 344.3 kN.m, 634.8 kN, 1930.8 kN Mc = 344.3 kN.m OK

Summary of Results (Unity Ratios)

Moment Capacity 130.6 kNm (for 3 rows of bolts) (Modified Applied Moment Mm=81.0 kNm)	0.62	OK
Moment Capacity 83.5 kNm (for the 1 rows of bolts required in the tension zone)	0.97	OK
Shear Capacity	0.08	OK
Column Tension Stiffener at row 0	0.00, 0.21, 0.02, 0.09, 0.46	OK
Flange Welds	0.47	OK
Web Welds	0.38, 0.08	OK
Haunch Welds	0.03, 0.19, 0.11	OK
Column Compression stiff Web Weld	0.16	OK
End of Haunch Compression Zone	0.06, 0.07	OK


R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

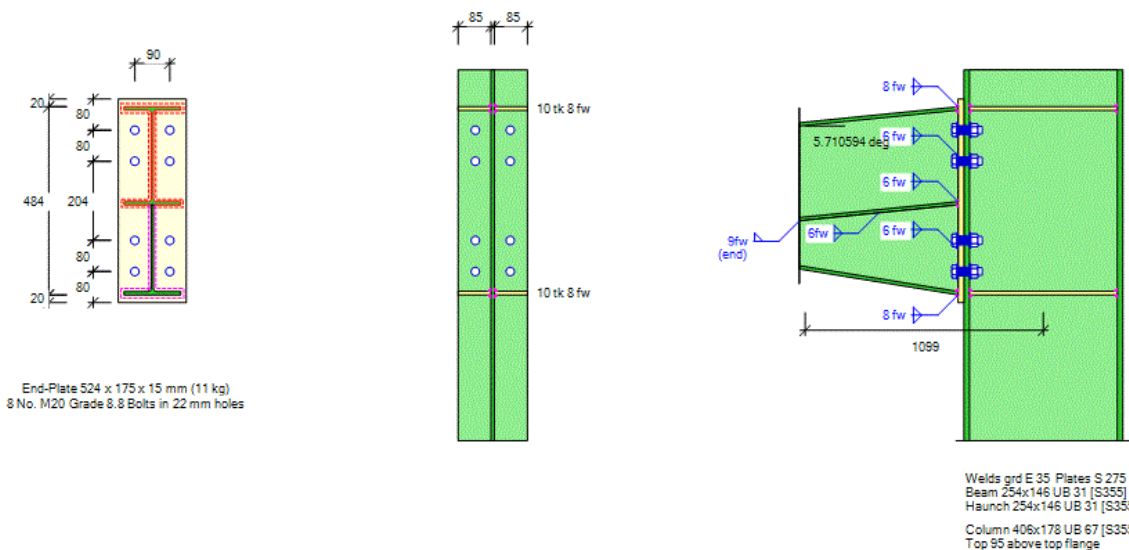
Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 39 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

#2a

BEAM TO COLUMN FLANGE JOINT AT : C2 - LEVEL 2 : LEAN-TO BEAM 1 : MEMBER 98 (C\1-2)



Beam to Column Flange End-Plated Connection to BS 5950

LOADING CASE 001 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW Basic Data

Integrated Applied Forces at Column/Left Rafter Interface

Left Rafter Forces M, Fvr, Fr 79.6 kNm, 47.1 kN, 11.5 kN
Resultant Forces M, Fv, F 79.6 kNm, 45.8 kN, 16.1 kN
Load directions Top of Joint in Tension, Rafter moving Down and in Compression.
Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95

Rafter Capacities Mc, Fvc, Fc 332.1 kN.m, 618.5 kN, 1903.9 kN Mc = 332.1 kN.m

OK

Summary of Results (Unity Ratios)

Moment Capacity 186.4 kNm (for 3 rows of bolts) (Modified Applied Moment Mm=73.9 kNm)	0.40	OK
Moment Capacity 95.4 kNm (for the 1 rows of bolts required in the tension zone)	0.78	OK
Shear Capacity	0.07	OK
Column Tension Stiffener at row 0	0.00, 0.23, 0.01, 0.08, 0.26	OK
Flange Welds	0.44	OK
Web Welds	0.44, 0.08	OK
Haunch Welds	0.03, 0.17, 0.10	OK
Column Compression stiff Web Weld	0.11	OK
End of Haunch Compression Zone	0.06, 0.06	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

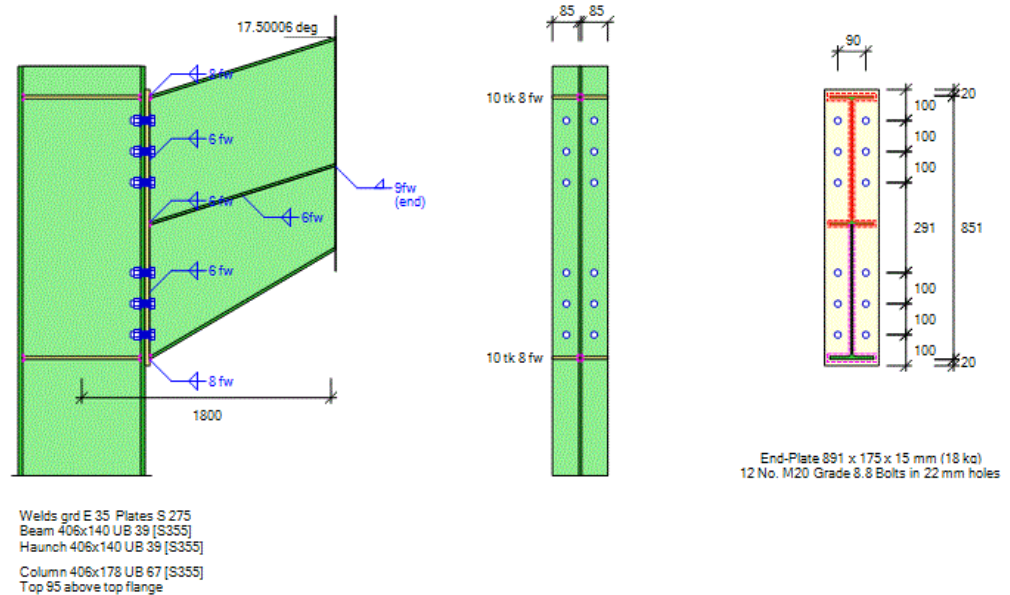
Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref	: 7275
Sheet	: Sheet Ref / 40 -
Made By	: PF
Date	: 23 Jul 2019/ Version 2015.04
Checked	:
Approved	:

#2b

EAVES JOINT AT : C2 - LEVEL 3 : RAFTER 1 OF BAY 1 : MEMBERS 70-72 (C\2-4)



Beam to Column Flange End-Plated Connection to BS 5950

LOADING CASE 001 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW
Basic Data

Integrated Applied Forces at Column/Right Rafter Interface

Right Rafter Forces M, Fvr, Fr	272.2 kNm, 82.0 kN, 73.1 kN
Resultant Forces M, Fv, F	272.2 kNm, 100.2 kN, 45.1 kN
Load directions	Top of Joint in Tension, Rafter moving Down and in Compression.
Design to	

Rafter Capacities M_c , F_{vc} , F_c	BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95 758.0 kN.m, 1160.0 kN, 2791.7 kN	$M_c = 758.0 \text{ kN.m}$
--	--	----------------------------

OK

Summary of Results (Unity Ratios)

Moment Capacity 447.3 kNm (for 5 rows of bolts) (Modified Applied Moment Mm=243.6 kNm)	0.54	OK	
Moment Capacity 296.3 kNm (for the 2 rows of bolts required in the tension zone)	0.82	OK	
Shear Capacity	0.11	OK	
Column Tension Stiffener at row 0	0.00, 0.18, 0.01, 0.06, 0.21	0.21	OK
Flange Welds	0.87	0.87	OK
Web Welds	0.60, 0.09	0.60	OK
Haunch Welds	0.03, 0.41, 0.13	0.41	OK
Column Compression stiff Web Weld	0.22	0.22	OK
End of Haunch Compression Zone	0.10, 0.14	0.14	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

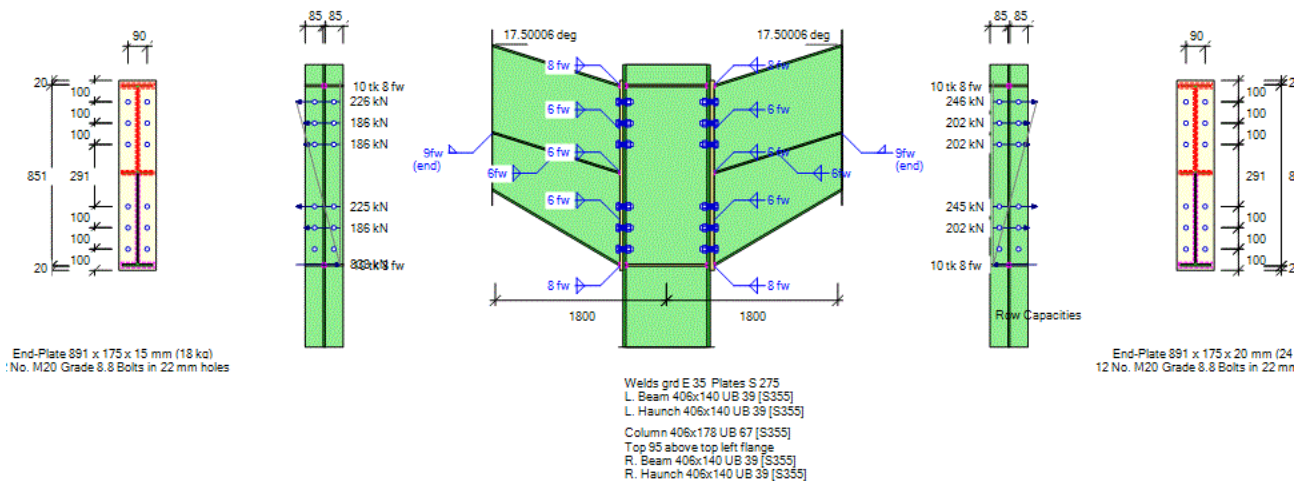
Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 41 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

#3

EAVES JOINT AT : C6 - LEVEL 3 : RAFTER 2 OF BAY 1 : MEMBERS 73-75 (C\6-4)



Double Beam to Column Flange End-Plated Connection to BS 5950

LEFT SIDE - LOADING CASE 001 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW Basic Data

Integrated Applied Forces at Column/Left Rafter Interface

Left Rafter Forces M, F_v, F_r 257.7 kNm, 80.6 kN, 72.7 kN
Resultant Forces M, F_v, F 257.7 kNm, 98.7 kN, 45.1 kN
Load directions Top of Joint in Tension, Rafter moving Down and in Compression.
Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95
Rafter Capacities M_c, F_{vc}, F_c 758.0 kN.m, 1160.0 kN, 2791.7 kN M_c = 758.0 kN.m OK

Summary of Results (Unity Ratios)

Moment Capacity 452.9 kNm (for 5 rows of bolts) (Modified Applied Moment M _m =229.1 kNm)	0.51	OK
Moment Capacity 296.2 kNm (for the 2 rows of bolts required in the tension zone)	0.77	OK
Shear Capacity	0.11	OK
Column Tension Stiffener at row 0	0.00, 0.18, 0.01, 0.06, 0.21	0.21 OK
Flange Welds	0.82	0.82 OK
Web Welds	0.60, 0.09	0.60 OK
Haunch Welds	0.03, 0.37, 0.12	0.37 OK
Column Compression stiff Web Weld	0.20	0.20 OK
End of Haunch Compression Zone	0.09, 0.12	0.12 OK

RIGHT SIDE - LOADING CASE 001 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW Basic Data

Integrated Applied Forces at Column/Right Rafter Interface

Right Rafter Forces M, F_v, F_r 265.3 kNm, 80.3 kN, 73.7 kN
Resultant Forces M, F_v, F 265.3 kNm, 98.8 kN, 46.2 kN
Load directions Top of Joint in Tension, Rafter moving Down and in Compression.
Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95
Rafter Capacities M_c, F_{vc}, F_c 758.0 kN.m, 1160.0 kN, 2791.7 kN M_c = 758.0 kN.m OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 42 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Summary of Results (Unity Ratios)

Moment Capacity 476.7 kNm (for 5 rows of bolts) (Modified Applied Moment $M_m=236.0$ kNm)	0.50	OK
Moment Capacity 322.0 kNm (for the 2 rows of bolts required in the tension zone)	0.73	OK
Shear Capacity	0.11	OK
Column Tension Stiffener at row 0	0.00, 0.20, 0.01, 0.07, 0.22	OK
Flange Welds	0.85	OK
Web Welds	0.65, 0.09	OK
Haunch Welds	0.03, 0.40, 0.12	OK
Column Compression stiff Web Weld	0.21	OK
End of Haunch Compression Zone	0.09, 0.13	OK
Column web shear	0.01	OK

Combined (Resultant) Column Web Shear

SOP 0.0 mm is	Ultimate Forces		Developed Forces		Resultant	
Top of Left Flange	LHS	RHS	LHS	RHS	Shear	
Net Shear at -80.0 mm	+226.4	-245.8	+175.1	-180.1	-5.0 kN	
Net Shear at -180.0 mm	+185.6	-202.2	+143.6	-148.2	-9.6 kN	
Net Shear at -846.1 mm	-833.3	+845.4	-363.8	+374.5	1.1 kN	
Net Axial Shear $F_{a\text{left}}-F_{a\text{right}}$	45.1	-46.2			-1.1 kN	
Column Web Capacity	3602.7•213				767.4 kN	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

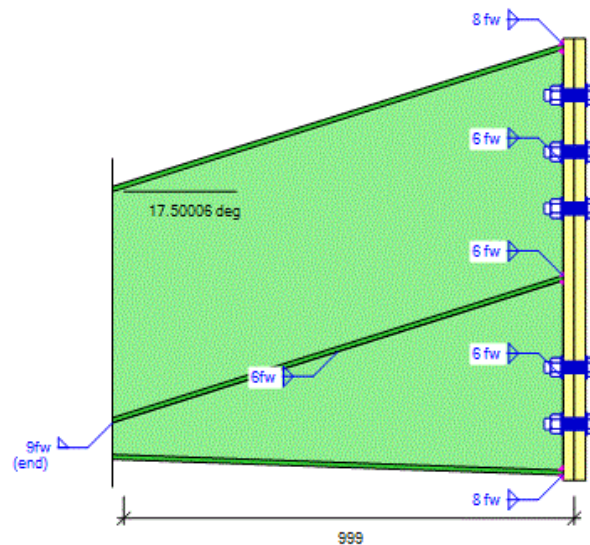
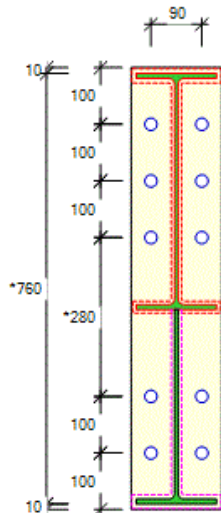
Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 43 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

#4

APEX JOINT AT : C4 - LEVEL 6 : RAFTER 1 OF BAY 1 : MEMBERS 70-72 (C\2-4)



Beam to Beam End-Plated Connection to BS 5950

LOADING CASE 001 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW Basic Data

Integrated Applied Forces at End-plate Interface

Left Rafter Forces M, Fvr, Fr -83.3 kNm, 12.7 kN, 42.6 kN
Resultant Forces M, Fv, F -83.3 kNm, -0.7 kN, 44.5 kN
Load directions Bottom of Joint in Tension, Rafter moving Up and in Compression.
Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95
Rafter Capacities Mc, Fvc, Fc 644.9 kN.m, 1036.4 kN, 2585.5 kN Mc = 644.9 kN.m

OK

Summary of Results (Unity Ratios)

Moment Capacity 347.4 kNm (for 4 rows of bolts) (Modified Applied Moment Mm=74.3 kNm)	0.21	OK
Moment Capacity 182.3 kNm (for the 1 rows of bolts required in the tension zone)	0.41	OK
Shear Capacity	0.00	OK
Flange Welds	0.29	OK
Web Welds	0.53, 0.00	OK
Haunch Welds	0.03, 0.24, 0.12	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

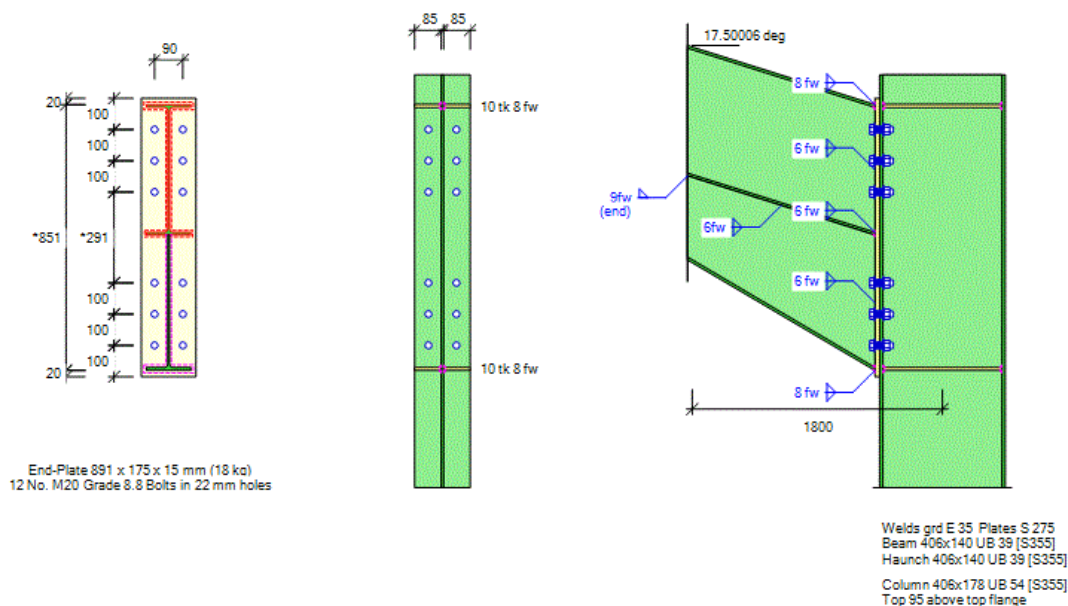
Tel: (01590) 683 176

Job ref	: 7275
Sheet	: Sheet Ref / 44 -
Made By	: PF
Date	: 23 Jul 2019/ Version 2015.04
Checked	:
Approved	:

Fax: (01590) 683 533

#5

EAVES JOINT AT : C14 - LEVEL 3 : RAFTER 2 OF BAY 3 : MEMBERS 85-87 (C\14-12)



Beam to Column Flange End-Plated Connection to BS 5950

LOADING CASE 001 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW
Basic Data

Integrated Applied Forces at Column/Left Rafter Interface

Left Rafter Forces M, Fvr, Fr	266.6 kNm, 82.6 kN, 69.2 kN
Resultant Forces M, Fv, F	266.6 kNm, 99.6 kN, 41.2 kN
Load directions	Top of Joint in Tension, Rafter moving Down and in Compression.
Design to	

Rafter Capacities M_c, F_{vc}, F_c	BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95 757.5 kN.m, 1159.4 kN, 2790.7 kN	$M_c = 757.5 \text{ kN.m}$
--------------------------------------	--	----------------------------

OK

Summary of Results (Unity Ratios)

Moment Capacity 383.3 kNm (for 5 rows of bolts) (Modified Applied Moment $M_m=240.4$ kNm)	0.63	OK	
Moment Capacity 266.7 kNm (for the 2 rows of bolts required in the tension zone)	0.90	OK	
Shear Capacity	0.11	OK	
Column Tension Stiffener at row 0	0.00, 0.17, 0.01, 0.06, 0.19	0.19	OK
Flange Welds	0.86	0.86	OK
Web Welds	0.53, 0.09	0.53	OK
Haunch Welds	0.03, 0.39, 0.12	0.39	OK
Column Compression stiff Web Weld	0.21	0.21	OK
End of Haunch Compression Zone	0.09, 0.13	0.13	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

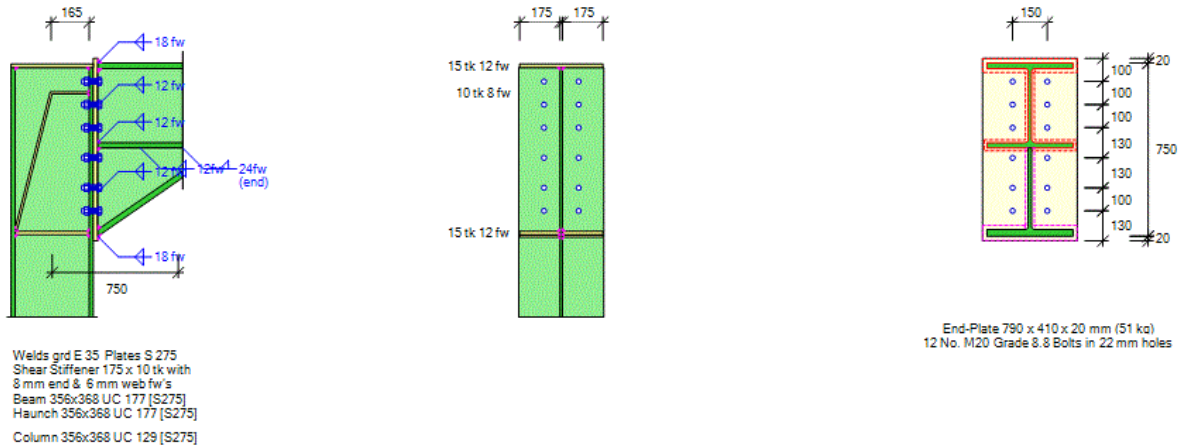
Job ref	: 7275
Sheet	: Sheet Ref / 45 -
Made By	: PF
Date	: 23 Jul 2019/ Version 2015.04
Checked	:
Approved	:

Fax: (01590) 683 533

#6

 P:\JOBS\7000S\7200\7275\CALCULATIONS\MEZ FRAME.\$5

EAVES JOINT AT : END 1 OF MEMBER SBL1Id 1 - LEVEL 1



Beam to Column Flange End-Plated Connection to BS 5950

LOADING CASE 001 : DEAD PLUS LIVE (ULTIMATE)

Basic Data

Integrated Applied Forces at Column/Right Rafter Interface

Resultant Forces M_r , F_v , F_h	415.5 kNm, 363.2 kN, 178.2 kN
Load directions	Top of Joint in Tension, Rafter moving Down and in Compression.
Design to	

Rafter Capacities M_c , F_{vc} , F_c	BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95 2195.5 kN.m, 1717.2 kN, 7432.7 kN	$F_{vc} = 1717.2$ kN	OK
--	---	----------------------	----

Summary of Results (Unity Ratios)

Moment Capacity 418.3 kNm (for 5 rows of bolts) (Modified Applied Moment $M_m=316.7$ kNm)	0.76	OK	
Moment Capacity 397.0 kNm (for the 3 rows of bolts required in the tension zone)	0.80	OK	
Shear Capacity	0.47	OK	
Column Tension Stiffener at row 0	0.00, 0.10, 0.04, 0.09, 0.22	0.22	OK
Column Tension Stiffener at row 1	0.09, 0.34, 0.44, 0.61, 0.88	0.88	OK
Beam Tension Stiffener at row 3	0.00, 0.12, 0.20	0.20	OK
Flange Welds	0.22	0.22	OK
Web Welds	0.26, 0.33	0.33	OK
Haunch Welds	0.99	0.99	OK
Column Compression stiff Web Weld	0.34	0.34	OK
Shear stiff End Welds	0.88	0.88	OK
End of Haunch Compression Zone	0.59, 0.43	0.59	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

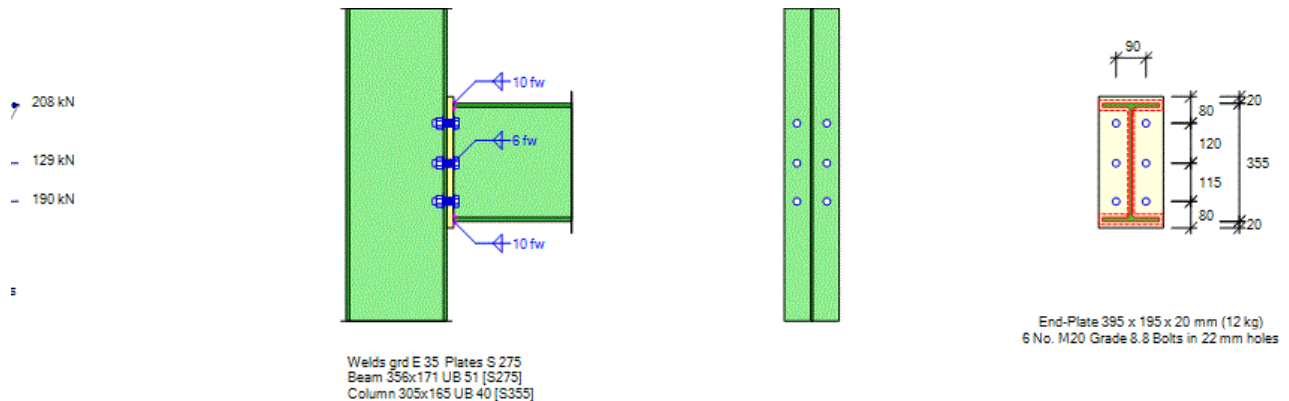
Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 46 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

#7 — Same detail for adjoining 406x178 UB 67

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ BAK2.MP

BEAM TO COLUMN FLANGE JOINT AT : F1 - LEVEL 1 : MEMBER 13 (F\1)



Beam to Column Flange End-Plated Connection to BS 5950

LOADING CASE 001 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW

Basic Data

Integrated Applied Forces at Column/Right Rafter Interface

Resultant Forces M, Fv, F -27.8 kNm, 177.8 kN, -12.0 kN
Load directions Bottom of Joint in Tension, Rafter moving Down and in Tension.
Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95
Rafter Capacities Mc, Fvc, Fc 246.4 kN.m, 433.5 kN, 1784.8 kN Fvc = 433.5 kN OK

Summary of Results (Unity Ratios)

Tensile Capacity		0.04	OK
Moment Capacity 60.2 kNm (for 2 rows of bolts) (Modified Applied Moment Mm=29.9 kNm)		0.50	OK
Moment Capacity 54.9 kNm (for the 1 rows of bolts required in the tension zone)		0.54	OK
Shear Capacity		0.40	OK
Shear Capacity (Fv & T)		0.32	OK
Flange Welds	0.18	0.18	OK
Web Welds	0.37, 0.49	0.49	OK


R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

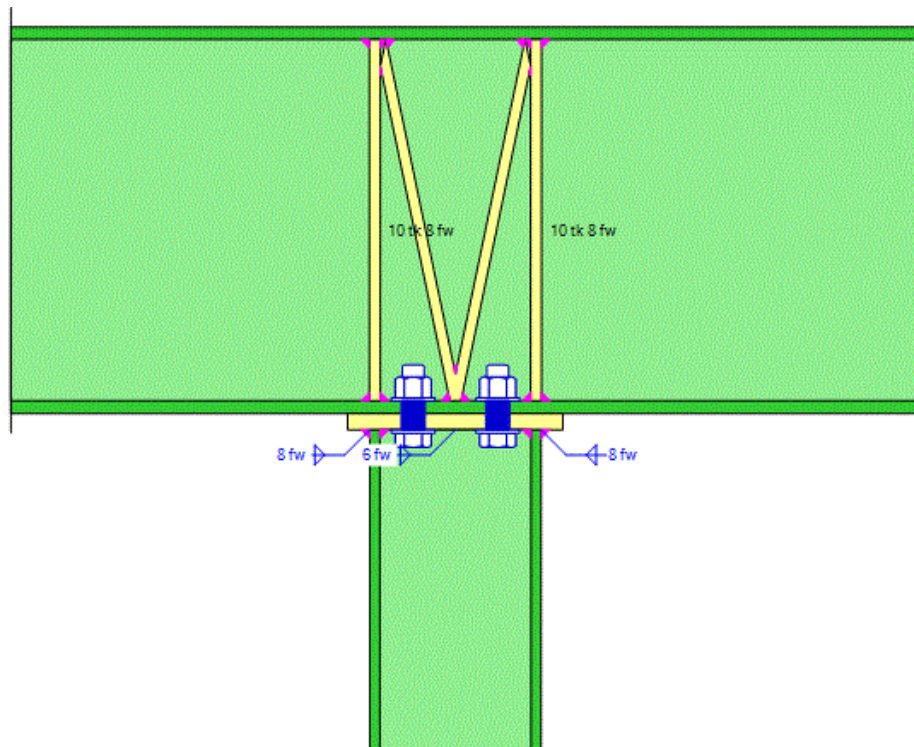
Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 47 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

#8

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ BAK2.MP

COLUMN TO BEAM FLANGE JOINT AT : N.114 - LEVEL 1 : MEMBER 527 (H\2-1)



Welds grd E 35 Plates S 275
Shear Stiffener 80 x 10 tk with
8 mm end & 6 mm web fw's
Column 152x152 UC 30 [S355]
Beam 356x171 UB 51 [S275]

Column to Cap Beam Flange End-Plated Connection to BS 5950

LOADING CASE 001 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW

Basic Data

Integrated Applied Forces at Beam/Bottom Column Interface

Resultant Forces M, F_v, F 0.0 kNm, 0.0 kN, 570.7 kN
Load directions , Column in Compression.
Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95

Summary of Results (Unity Ratios)

Compression Checks Right	0.40, 0.32, 0.40	0.40	OK
Web Welds	0.00	0.00	OK
Beam Compression stiff Web Weld	0.19	0.19	OK
Shear stiff End Welds	0.88	0.88	OK
Compression Checks Left	0.40, 0.32, 0.40	0.40	OK
Beam Compression stiff Web Weld	0.19	0.19	OK
Shear Capacity		0.00	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

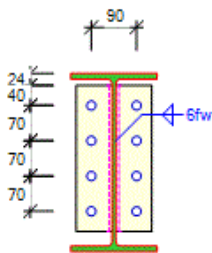
Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 48 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

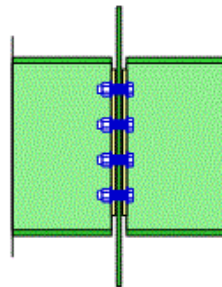
#9

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ BAK2.MP

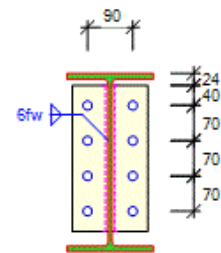
BEAM TO COLUMN: FLEXIBLE END-PLATE CONNECTION AT H2 - LEVEL 1



Beam 1: 356x171 UB 51 [S275]
Plate: 8 x 150 x 290 mm dp. (3 kg)
With 8 No. 18 mm holes
For 16 mm Ø Grade 8.8 Bolts.



Column: 406x178 UB 67 [S275]
Welds E 35 Plates S 275



Beam 2: 356x171 UB 51 [S275]
Plate: 8 x 150 x 290 mm dp. (3 kg)
With 8 No. 18 mm holes
For 16 mm Ø Grade 8.8 Bolts.

Beam to Column Flexible End-plate Connection to BS 5950 Basic Data

Integrated Applied Forces at Interface

Shear Forces Flange 1 = 0.0 kN, Web 1 = 114.6 kN
Flange 2 = 143.4 kN, Web 2 = 47.7 kN
Tie Forces Flanges = 0.0 kN, Webs = 75.0 k
But not less than 100% of the Shear Load. (SCI P341 T5.1)
Design to BS 5950: Pt 1: 2000 and the SCI Green Book: SCI-P212: 2002

Basic Dimensions

Web 1-356x171UB51 [S 275] D=355.0, B=171.5, T=11.5, t=7.4, r=10.2, py=275
Web 2-356x171UB51 [S 275] D=355.0, B=171.5, T=11.5, t=7.4, r=10.2, py=275
Column -406x178UB67 [S 275] D=409.4, B=178.8, T=14.3, t=8.8, r=10.2, py=275
Bolts 16 mm Ø in 18 mm holes Grade 8.8 Bolts
Plates S 275, Welds E 35

Summary of Results (Unity Ratios)

Checks for Web Beams 1 & 2

Bolt Shear & Bearing	0.24, 0.10	0.24	OK
Plate Bearing		0.24	OK
Plate Shear	0.17, 0.16, 0.16	0.17	OK
Web Shear & Weld	0.36, 0.22	0.36	OK
Column Web Bolt Bearing		0.14	OK
Column Web Bearing & Shear	0.31, 0.17, 0.15	0.31	OK
Tie force Plate, Web, Weld, Bolts	0.54, 0.19, 0.18, 0.22	0.54	OK
Column Web Tie Force		0.56	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

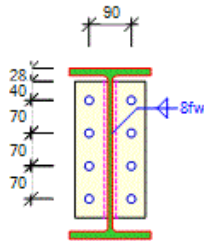
Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 49 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

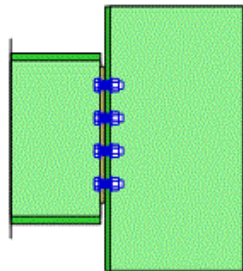
#10

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ BAK2.MP

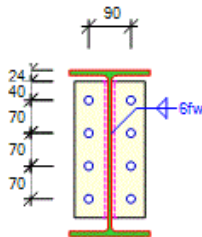
BEAM TO COLUMN: FLEXIBLE END-PLATE CONNECTION AT N.124 - LEVEL 1



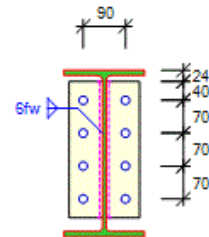
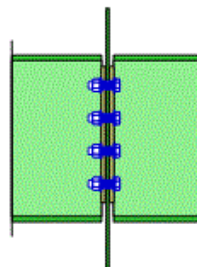
Beam 1: 356x171 UB 67 [S275]
Plate: 8 x 150 x 290 mm dp. (3 kg)
With 8 No. 18 mm holes
For 16 mm Ø Grade 8.8 Bolts.



Column: 305x165 UB 40 [S 355]
Welds E 35 End-Plates S 275



Beam 1: 356x171 UB 51 [S275]
Plate: 8 x 150 x 290 mm dp. (3 kg)
With 8 No. 18 mm holes
For 16 mm Ø Grade 8.8 Bolts.



Beam 2: 356x171 UB 51 [S275]
Plate: 8 x 150 x 290 mm dp. (3 kg)
With 8 No. 18 mm holes
For 16 mm Ø Grade 8.8 Bolts.

Beam to Column Flexible End-plate Connection to BS 5950 Basic Data

Integrated Applied Forces at Interface

Shear Forces Flange 1 = 97.4 kN, Web 1 = 189.2 kN
Flange 2 = 0.0 kN, Web 2 = 190.7 kN
Tie Forces Flanges = 75.0 kN, Webs = 75.0 k
But not less than 100% of the Shear Load. (SCI P341 T5.1)
Design to BS 5950: Pt 1: 2000 and the SCI Green Book: SCI-P212: 2002

Basic Dimensions

Flange 1-356x171UB67 [S 275] D=363.4, B=173.2, T=15.7, t=9.1, r=10.2, py=275
Web 1-356x171UB51 [S 275] D=355.0, B=171.5, T=11.5, t=7.4, r=10.2, py=275
Web 2-356x171UB51 [S 275] D=355.0, B=171.5, T=11.5, t=7.4, r=10.2, py=275
Column -305x165UB40 [S 355] D=303.4, B=165.0, T=10.2, t=6.0, r=8.9, py=355
Bolts 16 mm Ø in 18 mm holes Grade 8.8 Bolts
Plates S 275, Welds E 35

Summary of Results (Unity Ratios)

Checks for Flange Beam on Side 1

Check	Value	Limit	Result
Bolt Shear & Bearing	0.21, 0.10	0.21	OK
Plate Bearing		0.21	OK
Plate Shear	0.14, 0.14, 0.13	0.14	OK
Web Shear & Weld	0.25, 0.14	0.25	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
 Lymington, Hampshire SO41 6EB
 E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
 Sheet : Sheet Ref / 50 -
 Made By : PF
 Date : 23 Jul 2019/ Version 2015.04
 Checked :
 Approved :

Column Flange Bolt Bearing		0.07	OK
Column Flange Bearing & Shear	0.14, 0.07, 0.07	0.14	OK
Tie force Plt, Flg, Web, Weld, Bolts	0.41, 0.23, 0.13, 0.12, 0.18	0.41	OK

Checks for Web Beams 1 & 2

Bolt Shear & Bearing	0.40, 0.25	0.40	OK
Plate Bearing		0.40	OK
Plate Shear	0.28, 0.27, 0.26	0.28	OK
Web Shear & Weld	0.60, 0.37	0.60	OK
Column Web Bolt Bearing		0.49	OK
Column Web Bearing & Shear	0.90, 0.44, 0.44	0.90	OK
Tie force Plate, Web, Weld, Bolts	0.90, 0.32, 0.30, 0.37	0.90	OK
Column Web Tie Force		0.02	OK


R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

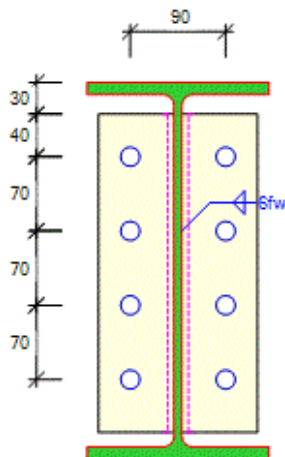
Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 51 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

#11

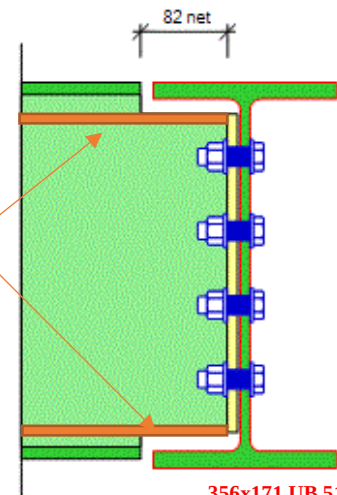
P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ BAK2.MP

BEAM TO BEAM: FLEXIBLE END-PLATE CONNECTION AT N.122 - LEVEL 1



Left Beam: 356x171 UB 51 [S275]
Top Notch: 30 x 84 mm lg. net
Bot Notch: 30 x 84 mm lg. net
Plate: 10 x 150 x 300 mm dp. (4 kg)
With 8 No. 18 mm holes
For 16 mm Ø Grade 8.8 Bolts.

10mm stiffeners welded to
beam web both sides



356x171 UB 51 OR
Beam: 356x171 UB 67 [S275]
Welds E35 End-Plates S 275

Beam to Beam Flexible End-plate Connection to BS 5950 Basic Data

Integrated Applied Forces at Interface

Shear Forces Left = 189.3 kN
Tie Force 75.0 k
But not less than 100% of the Shear Load. (SCI P341 T5.1)
Design to BS 5950: Pt 1: 2000 and the SCI Green Book: SCI-P212: 2002

Basic Dimensions

Left-356x171UB51 [S 275] D=355.0, B=171.5, T=11.5, t=7.4, r=10.2, py=275
Supporting-356x171UB67 [S 275] D=363.4, B=173.2, T=15.7, t=9.1, r=10.2, py=275
Bolts 16 mm Ø in 18 mm holes Grade 8.8 Bolts
Plates S 275, Welds E 35

Summary of Results (Unity Ratios)

Left Hand Beam

Bolt Shear & Bearing	0.40, 0.15	0.40	OK
Plate Bearing		0.32	OK
Plate Shear	0.21, 0.21, 0.21	0.21	OK
Web Shear & Weld	0.58, 0.36	0.58	OK
Web Bending		0.60	OK
Tie force Plate, Web, Weld, Bolts	0.57, 0.32, 0.29, 0.35	0.57	OK

Supporting Beam

Bolt Bearing		0.16	OK
Plate Bearing		0.35	OK
Web Bearing & Shear	0.35, 0.19, 0.18	0.35	OK
Web Tie Force		0.79	OK
Web Tie Force		0.18	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

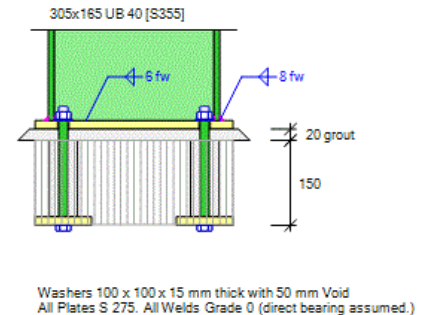
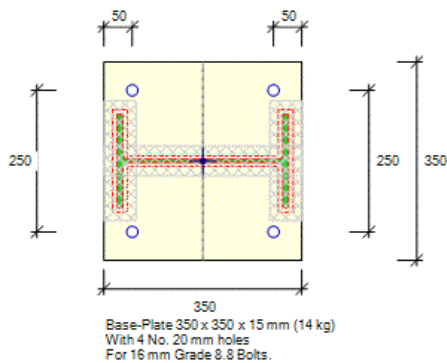
Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 52 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Base Plates

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ BAK2.MP

BASE PLATE AT : H1 - LEVEL 0



Base-Plate Connection to BS 5950

LOADING CASE 005 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW + NOTIONAL --> Basic Data

Integrated Applied Forces at Interface

Resultant Forces M, Fv, F

Moment +0.0 kNm, Shear +5.0 kN, Axial +271.6 kN
Forces taken from Support Reaction
(Axial Compression)

Basic Dimensions

Column: 305x165UB40 [36]
Bolts 16 mm Ø in 20 mm holes
Plates S 275, Welds E 35
Grout Fcu, Conc Fcu, vc, py, slope

D=303.4, B=165.0, T=10.2, t=6.0, r=8.9, py=355
Grade 8.8 Bolts
30 N/mm², 30 N/mm², 0.35 N/mm², 275 N/mm², 30 deg to vertical
Special control over placement of high strength grout is required

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95
221.2 kN.m, 387.7 kN, 1821.5 kN

Column Capacities Mc, Fvc, Fc

Fc = 1821.5 kN OK

Summary of Results (Unity Ratios)

Concrete Pressure		0.62	OK
Base-Plate thickness in Compression		0.44	OK
Flange & Web Welds	0.01	0.01	OK

Base-Plate Connection to BS 5950

LOADING CASE 039 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW DRIFT L5 + NOTIONAL <- Basic Data

Integrated Applied Forces at Interface

Resultant Forces M, Fv, F

Moment +0.0 kNm, Shear -5.0 kN, Axial +276.9 kN
Forces taken from Support Reaction
(Axial Compression)

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95
221.2 kN.m, 387.7 kN, 1821.5 kN

Column Capacities Mc, Fvc, Fc

Fc = 1821.5 kN OK

**R Elliott Associates Ltd**

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 53 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Summary of Results (Unity Ratios)

Concrete Pressure		0.63	OK
Base-Plate thickness in Compression		0.45	OK
Flange & Web Welds	0.01	0.01	OK



R Elliott Associates Ltd

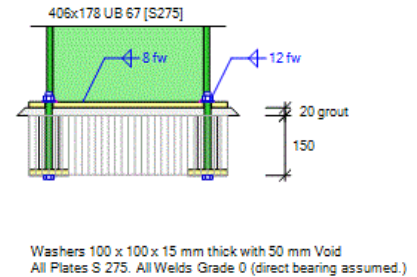
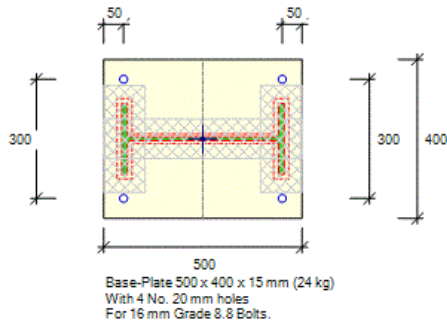
Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 54 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

BASE PLATE AT : H2 - LEVEL 0



Base-Plate Connection to BS 5950

LOADING CASE 005 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW + NOTIONAL --> Basic Data

Integrated Applied Forces at Interface

Resultant Forces M, Fv, F

Moment +0.0 kNm, Shear -33.5 kN, Axial +612.2 kN
Forces taken from Support Reaction
(Axial Compression)

Basic Dimensions

Column: 406x178UB67 [28]
Bolts 16 mm Ø in 20 mm holes
Plates S 275, Welds E 35
Grout Fcu, Conc Fcu, vc, py, slope

D=409.4, B=178.8, T=14.3, t=8.8, r=10.2, py=275
Grade 8.8 Bolts

30 N/mm², 30 N/mm², 0.35 N/mm², 275 N/mm², 30 deg to vertical
Special control over placement of high strength grout is required

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95

Column Capacities Mc, Fvc, Fc

370.2 kN.m, 594.4 kN, 2352.4 kN

Fc = 2352.4 kN

OK

Summary of Results (Unity Ratios)

Concrete Pressure		0.60	OK
Base-Plate thickness in Compression		0.84	OK
Flange & Web Welds	0.04	0.04	OK

Base-Plate Connection to BS 5950

LOADING CASE 007 : 1.0 DEAD + 1.4 SIDE WIND W1

Basic Data

Integrated Applied Forces at Interface

Resultant Forces M, Fv, F

Moment +0.0 kNm, Shear +14.3 kN, Axial +173.6 kN
Forces taken from Support Reaction
(Axial Compression)

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95

Column Capacities Mc, Fvc, Fc

370.2 kN.m, 594.4 kN, 2352.4 kN

Fc = 2352.4 kN

OK

Summary of Results (Unity Ratios)

Concrete Pressure		0.17	OK
Base-Plate thickness in Compression		0.45	OK
Flange & Web Welds	0.02	0.02	OK



R Elliott Associates Ltd

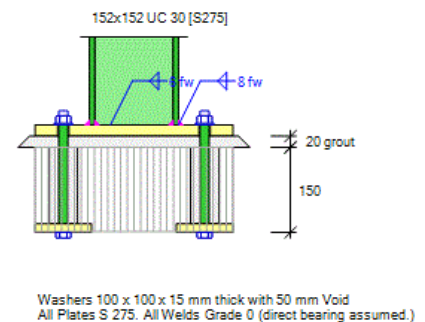
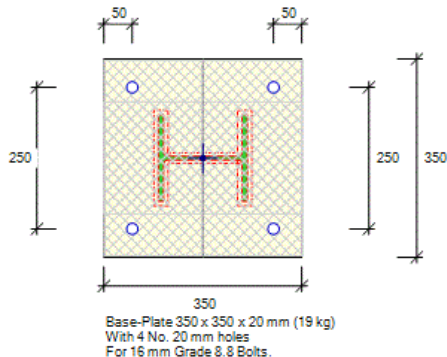
Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 55 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

BASE PLATE AT : N.44 - LEVEL 0



Base-Plate Connection to BS 5950

LOADING CASE 005 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW + NOTIONAL --> Basic Data

Integrated Applied Forces at Interface

Resultant Forces M , F_v , F

Moment +0.0 kNm, Shear +0.0 kN, Axial +384.0 kN
Forces taken from Support Reaction
(Axial Compression)

Basic Dimensions

Column: 152x152UC30 [28]
Bolts 16 mm $\varnothing$ in 20 mm holes
Plates S 275, Welds E 35
Grout f_{cu} , Conc f_{cu} , v_c , p_y , slope

$D=157.6$, $B=152.9$, $T=9.4$, $t=6.5$, $r=7.6$, $p_y=275$
Grade 8.8 Bolts

30 N/mm², 30 N/mm², 0.35 N/mm², 265 N/mm², 30 deg to vertical
Special control over placement of high strength grout is required

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95

Column Capacities M_c , F_{vc} , F_c

68.1 kN.m, 169.0 kN, 1052.2 kN

$F_c = 1052.2$ kN

OK

Summary of Results (Unity Ratios)

Concrete Pressure
Base-Plate thickness in Compression

0.26
0.91

OK
OK

Base-Plate Connection to BS 5950

LOADING CASE 007 : 1.0 DEAD + 1.4 SIDE WIND W1 Basic Data

Integrated Applied Forces at Interface

Resultant Forces M , F_v , F

Moment +0.0 kNm, Shear +0.0 kN, Axial +108.1 kN
Forces taken from Support Reaction
(Axial Compression)

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95

Column Capacities M_c , F_{vc} , F_c

68.1 kN.m, 169.0 kN, 1052.2 kN

$F_c = 1052.2$ kN

OK

Summary of Results (Unity Ratios)

Concrete Pressure
Base-Plate thickness in Compression

0.07
0.48

OK
OK



R Elliott Associates Ltd

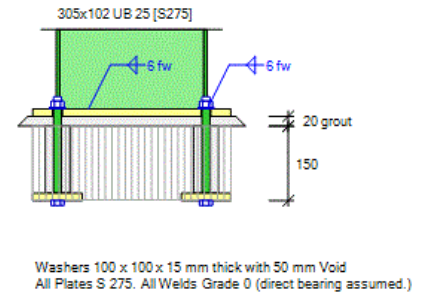
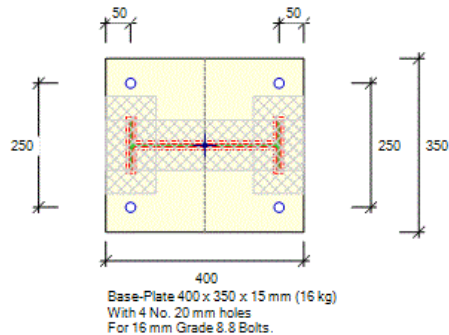
Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 56 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

BASE PLATE AT : N.3 - LEVEL 0



Base-Plate Connection to BS 5950

LOADING CASE 005 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW + NOTIONAL -->

Basic Data

Integrated Applied Forces at Interface

Resultant Forces M, Fv, F Moment +0.0 kNm, Shear +0.0 kN, Axial +47.9 kN
Forces taken from Support Reaction
(Axial Compression)

Basic Dimensions

Column: 305x102UB25 [28] D=305.1, B=101.6, T=7.0, t=5.8, r=7.6, py=275
Bolts 16 mm Ø in 20 mm holes Grade 8.8 Bolts
Plates S 275, Welds E 35
Grout Fcu, Conc Fcu, vc, py, slope 30 N/mm², 30 N/mm², 0.35 N/mm², 275 N/mm², 30 deg to vertical
Special control over placement of high strength grout is required

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95

Column Capacities Mc, Fvc, Fc 94.1 kN.m, 292.0 kN, 869.0 kN Fc = 869.0 kN OK

Summary of Results (Unity Ratios)

Concrete Pressure	0.07	OK
Base-Plate thickness in Compression	0.30	OK

Base-Plate Connection to BS 5950

LOADING CASE 007 : 1.0 DEAD + 1.4 SIDE WIND W1

Basic Data

Integrated Applied Forces at Interface

Resultant Forces M, Fv, F Moment +0.0 kNm, Shear +12.1 kN, Axial -3.7 kN
Forces taken from Support Reaction
(Axial Up-Lift)

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95

Column Capacities Mc, Fvc, Fc 94.1 kN.m, 292.0 kN, 869.0 kN Fvc = 292.0 kN OK

Summary of Results (Unity Ratios)

Bolt Tension	0.01	OK
Plate Tension Bending	0.22	OK
Concrete Embedment	0.02	OK
Washer size	0.85	OK
Pullout Cones	0.04	OK
Flange & Web Welds	0.02	OK



R Elliott Associates Ltd

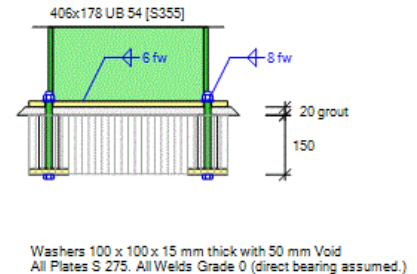
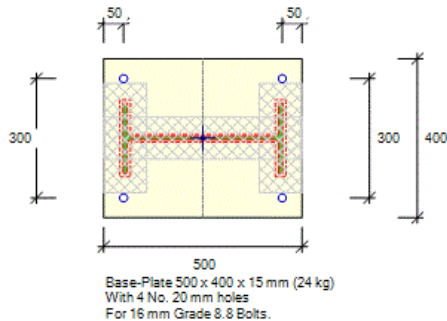
Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 57 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

BASE PLATE AT : G14 - LEVEL 0



Base-Plate Connection to BS 5950

LOADING CASE 005 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW + NOTIONAL --> Basic Data

Integrated Applied Forces at Interface

Resultant Forces M, Fv, F Moment +0.0 kNm, Shear -42.0 kN, Axial +109.3 kN
Forces taken from Support Reaction
(Axial Compression)

Basic Dimensions

Column: 406x178UB54 [36] D=402.6, B=177.7, T=10.9, t=7.7, r=10.2, py=355
Bolts 16 mm Ø in 20 mm holes Grade 8.8 Bolts
Plates S 275, Welds E 35
Grout Fcu, Conc Fcu, vc, py, slope 30 N/mm², 30 N/mm², 0.35 N/mm², 275 N/mm², 30 deg to vertical
Special control over placement of high strength grout is required

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95

Column Capacities Mc, Fvc, Fc 374.4 kN.m, 660.3 kN, 2447.7 kN Fvc = 660.3 kN OK

Summary of Results (Unity Ratios)

Concrete Pressure		0.10	OK
Base-Plate thickness in Compression		0.38	OK
Flange & Web Welds	0.06	0.06	OK

Base-Plate Connection to BS 5950

LOADING CASE 006 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW + NOTIONAL <- Basic Data

Integrated Applied Forces at Interface

Resultant Forces M, Fv, F Moment +0.0 kNm, Shear -39.6 kN, Axial +107.4 kN
Forces taken from Support Reaction
(Axial Compression)

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95

Column Capacities Mc, Fvc, Fc 374.4 kN.m, 660.3 kN, 2447.7 kN Fvc = 660.3 kN OK

Summary of Results (Unity Ratios)

Concrete Pressure		0.10	OK
Base-Plate thickness in Compression		0.37	OK
Flange & Web Welds	0.06	0.06	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

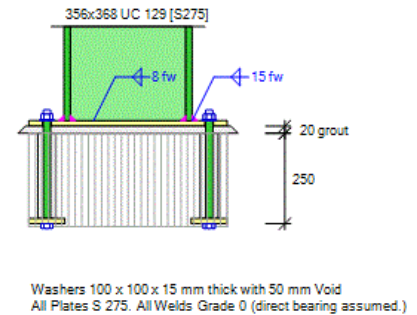
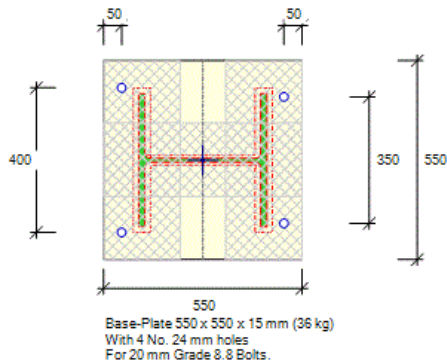
Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 58 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

P:\JOBS\7000S\7200\7275\CALCULATIONS\MEZ FRAME.\$5

BASE PLATE AT : END 1 OF MEMBER SCL1Id 3 - LEVEL 0



Base-Plate Connection to BS 5950

LOADING CASE 001 : DEAD PLUS LIVE (ULTIMATE)

Basic Data

Integrated Applied Forces at Interface

Resultant Forces M, Fv, F Moment +0.0 kNm, Shear -145.0 kN, Axial +411.3 kN
Forces taken from Support Reaction
(Axial Compression)

Basic Dimensions

Column: 356x368UC129 [28] D=355.6, B=368.6, T=17.5, t=10.4, r=15.2, py=265
Bolts 20 mm Ø in 24 mm holes Grade 8.8 Bolts
Plates S 275, Welds E 35
Grout Fcu, Conc Fcu, vc, py, slope 30 N/mm², 30 N/mm², 0.35 N/mm², 275 N/mm², 30 deg to vertical
Special control over placement of high strength grout is required

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95
Column Capacities Mc, Fvc, Fc 657.0 kN.m, 588.0 kN, 4354.7 kN

Fvc = 588.0 kN OK

Summary of Results (Unity Ratios)

Concrete Pressure		0.13	OK
Base-Plate thickness in Compression		0.85	OK
Flange & Web Welds	0.20	0.20	OK


R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

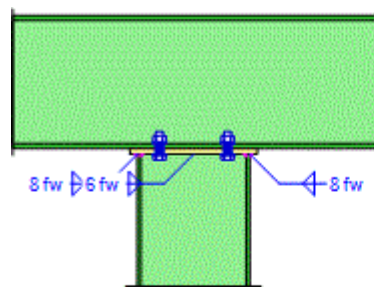
Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 59 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

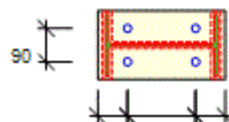
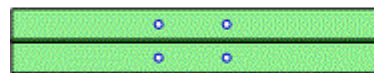
Canopy Conenctions — End plate detials to be repeated for connenctons into columns not specified below

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ FINAL.MP

COLUMN TO BEAM FLANGE JOINT AT : N.150 - LEVEL 2 : MEMBER 500 (N.4-N.150)



Welds grd E 35 Plates S 275
Column 305x165 UB 40 [S355]
Beam 356x171 UB 57 [S275]



End-Plate 343 x 185 x 15 mm (7 kg)
4 No. M20 Grade 8.8 Bolts in 22 mm holes

Column to Cap Beam Flange End-Plated Connection to BS 5950

LOADING CASE 001 : 1.4 (DEAD+SERVICES) + 1.6 LIVE/SNOW Basic Data

Integrated Applied Forces at Beam/Bottom Column Interface

Resultant Forces M, Fv, F	0.1 kNm, 0.3 kN, -10.2 kN
Load directions	Column moving Down, Column in Tension.
Design to	BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

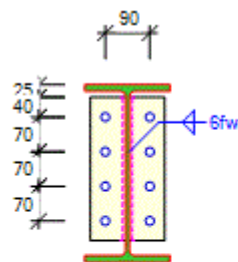
Job ref : 7275
Sheet : Sheet Ref / 60 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Summary of Results (Unity Ratios)

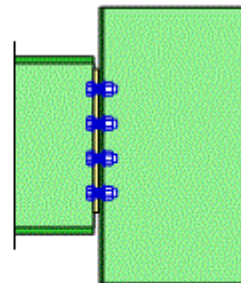
Tensile Capacity		0.02	OK
Column Tension Stiffener at row 2	0.00, 0.27, 0.30	0.30	OK
Flange Welds	0.01, 0.01, 0.01	0.01	OK
Web Welds	0.01, 0.18	0.18	OK
Shear Capacity		0.00	OK
Shear Capacity (Fv & T)		0.00	OK

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ FINAL.MP

BEAM TO COLUMN: FLEXIBLE END-PLATE CONNECTION AT A4 - LEVEL 2



Beam 1: 356x171 UB 57 [S275]
Plate: 10 x 150 x 290 mm dp. (3 kg)
With 8 No. 18 mm holes
For 16 mm Ø Grade 8.8 Bolts.



Column: 305x102 UB 25 [S 275]
Welds E 35 End-Plates S 275

Beam to Column Flexible End-plate Connection to BS 5950 Basic Data

Integrated Applied Forces at Interface

Shear Forces Flange 1 = 38.1 kN, Flange 2 = 0.0 kN
Tie Forces 75.0 kN But not less than 100% of the Shear Load. (SCI P341 T5.1)
Design to

BS 5950: Pt 1: 2000 and the SCI Green Book: SCI-P212: 2002

Basic Dimensions

Flange 1-356x171UB57 [S 275] D=358.0, B=172.2, T=13.0, t=8.1, r=10.2, py=275
Column -305x102UB25 [S 275] D=305.1, B=101.6, T=7.0, t=5.8, r=7.6, py=275
Bolts 16 mm Ø in 18 mm holes Grade 8.8 Bolts
Plates S 275, Welds E 35

Summary of Results (Unity Ratios)

Checks for Flange Beam on Side 1

Bolt Shear & Bearing	0.08, 0.04	0.08	OK
Plate Bearing		0.06	OK
Plate Shear	0.04, 0.04, 0.04	0.04	OK
Web Shear & Weld	0.11, 0.07	0.11	OK
Column Flange Bolt Bearing		0.04	OK
Column Flange Bearing & Shear	0.09, 0.05, 0.04	0.09	OK
Tie force Plt, Flg, Web, Weld, Bolts	0.22, 0.45, 0.12, 0.12, 0.14	0.45	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

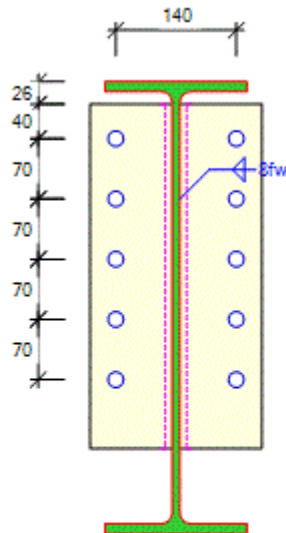
Tel: (01590) 683 176

Fax: (01590) 683 533

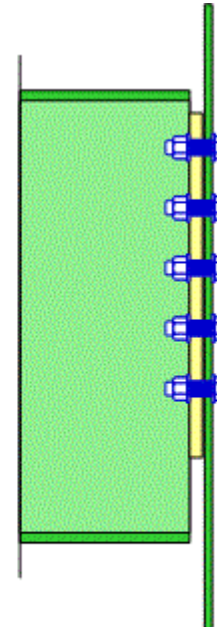
Job ref : 7275
Sheet : Sheet Ref / 61 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ FINAL.MP

BEAM TO COLUMN: FLEXIBLE END-PLATE CONNECTION AT A6 - LEVEL 2



Beam 1: 533x165 UB 66 [S275]
Plate: 15 x 200 x 400 mm dp. (9 kg)
With 10 No. 18 mm holes
For 16 mm Ø Grade 8.8 Bolts.



Column: 406x178 UB 67 [S275]
Welds E 35 Plates S 275

Beam to Column Flexible End-plate Connection to BS 5950 Basic Data

Integrated Applied Forces at Interface

Shear Forces Web 1 = -12.5 kN, Web 2 = 0.0 kN
Tie Forces 75.0 kN But not less than 100% of the Shear Load. (SCI P341 T5.1)
Design to

BS 5950: Pt 1: 2000 and the SCI Green Book: SCI-P212: 2002

Basic Dimensions

Web 1-533x165UB66 [S 275] D=524.7, B=165.1, T=11.4, t=8.9, r=12.7, py=275
Column -406x178UB67 [S 275] D=409.4, B=178.8, T=14.3, t=8.8, r=10.2, py=275
Bolts 16 mm Ø in 18 mm holes Grade 8.8 Bolts
Plates S 275, Welds E 35

Summary of Results (Unity Ratios)

Checks for Web Beam on Side 1

Bolt Shear & Bearing	0.02, 0.01	0.02	OK
Plate Bearing		0.01	OK
Plate Shear	0.01, 0.01, 0.01	0.01	OK
Web Shear & Weld	0.02, 0.01	0.02	OK
Column Web Bolt Bearing		0.01	OK
Column Web Bearing & Shear	0.02, 0.01, 0.01	0.02	OK
Tie force Plate, Web, Weld, Bolts	0.15, 0.09, 0.07, 0.12	0.15	OK
Column Web Tie Force		0.50	OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

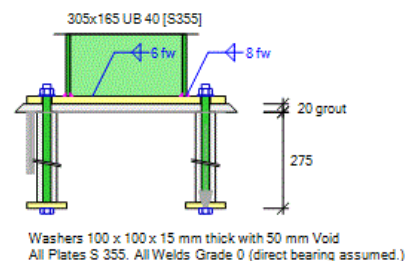
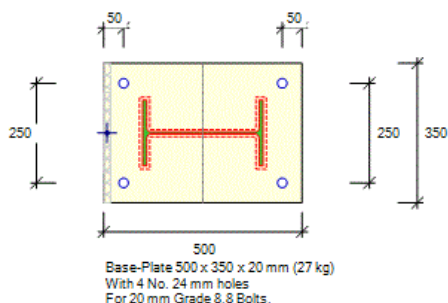
Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 62 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

P:\JOBS\7000S\7200\7275\CALCULATIONS\7275 MEZ FINAL.MP

BASE PLATE AT : N.3 - LEVEL 0



Base-Plate Connection to BS 5950

LOADING CASE 008 : 1.4(DEAD + SERV + SIDE WIND W1)

Basic Data

Integrated Applied Forces at Interface

Resultant Forces M, Fv, F Moment -32.6 kNm, Shear +5.6 kN, Axial -6.6 kN
Forces taken from Support Reaction
(Right side in tension, Axial Up-Lift)

Basic Dimensions

Column: 305x165UB40 [36] D=303.4, B=165.0, T=10.2, t=6.0, r=8.9, py=355
Bolts 20 mm Ø in 24 mm holes Grade 8.8 Bolts
Plates S 355, Welds E 50
Grout Fcu, Conc Fcu, vc, py, slope 30 N/mm², 30 N/mm², 0.35 N/mm², 345 N/mm², 30 deg to vertical
Special control over placement of high strength grout is required
Tk limited by Axial only elastic stress 4.13.2.3

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95
Column Capacities Mc, Fvc, Fc 221.2 kN.m, 387.7 kN, 1821.5 kN Mc = 221.2 kN.m OK

Summary of Results (Unity Ratios)

Bolt Tension		0.02	OK
Bolt Tension		0.35	OK
Base-Plate thickness in Compression		0.89	OK
Plate Tension Bending	0.56	0.56	OK
Concrete Embedment		0.51	OK
Washer size	1.00, 1.00	1.00	OK
Pullout Cones	0.44, 0.55	0.55	OK
Flange & Web Welds	0.22, 0.01, 0.00, 0.00	0.22	OK

Base-Plate Connection to BS 5950

LOADING CASE 016 : 1.0 DEAD + 1.4 SIDE WIND W4

Basic Data

Integrated Applied Forces at Interface

Resultant Forces M, Fv, F Moment -13.4 kNm, Shear +2.3 kN, Axial +6.8 kN
Forces taken from Support Reaction
(Right side in tension, Axial Compression)

Design to

BS 5950-1: 2000 and the SCI Green Book: SCI-P-207/95
Column Capacities Mc, Fvc, Fc 221.2 kN.m, 387.7 kN, 1821.5 kN Mc = 221.2 kN.m OK



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
 Lymington, Hampshire SO41 6EB
 E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
 Sheet : Sheet Ref / 63 -
 Made By : PF
 Date : 23 Jul 2019/ Version 2015.04
 Checked :
 Approved :

Summary of Results (Unity Ratios)

Concrete Pressure (under Axial only)		0.00	OK
Base-Plate thickness in Compression (under Axial only)		0.09	OK
Bolt Tension		0.12	OK
Base-Plate thickness in Compression		0.62	OK
Plate Tension Bending	0.32	0.32	OK
Concrete Embedment		0.20	OK
Washer size	1.00, 1.00	1.00	OK
Pullout Cones	0.15, 0.19	0.19	OK
Flange & Web Welds	0.09, 0.00	0.09	OK


R Elliott Associates Ltd

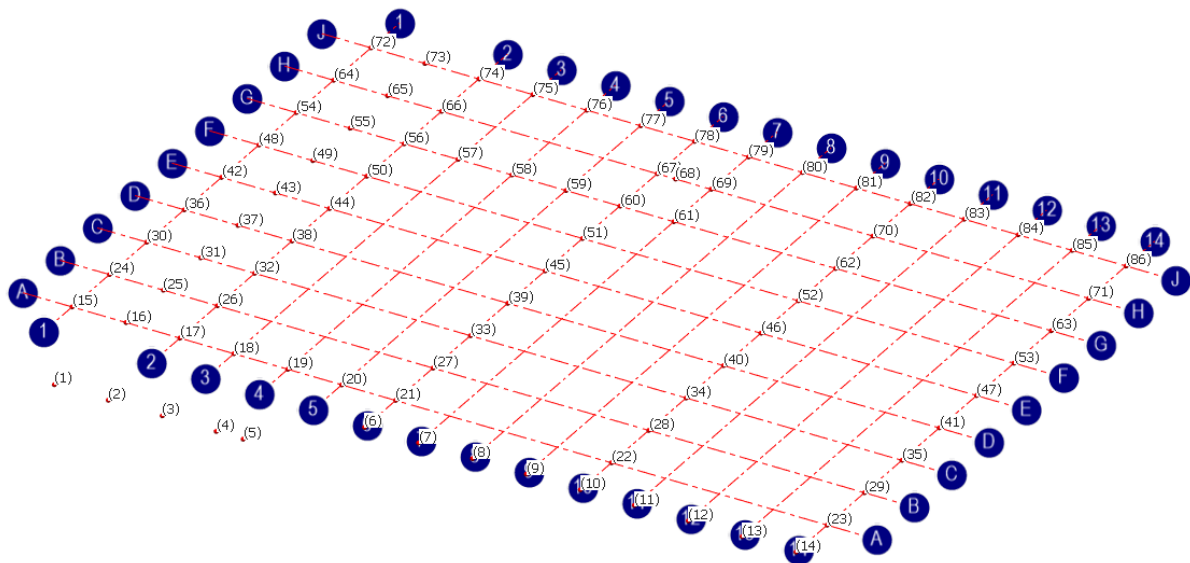
Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 64 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

FOUNDATIONS – Nodal loading of columns below, Refer to 7275/ST/01 for pile cap. Pile cap to have two piles, therefore loadings below to be halved for pile design.



Support Reactions (Maximum Values)						
Node	Directional Reactions (kN)			Moment Reactions (kN.m)		
	Rx→(kN)	Ry↑(kN)	Rz↗(kN)	Mx→(kN.m)	My↑(kN.m)	Mz↗(kN.m)
1	-0.481	28.524	4.724	27.401	0.000	2.790
2	-0.481	49.249	4.271	24.771	0.000	2.792
3	-0.482	48.776	5.629	32.649	0.000	2.793
4	-0.482	-12.015	6.315	36.625	0.000	2.795
5	-0.482	98.176	-3.668	-21.274	0.000	2.796
6	-18.231	169.867	-120.002	-2.803	0.105	73.739
7	0.000	23.453	0.000	0.000	0.000	0.000
8	0.000	50.734	-12.821	0.000	0.000	0.000
9	0.000	7.760	-10.830	0.000	0.000	0.000
10	-9.898	-55.192	-0.843	-5.903	0.000	69.284
11	-0.019	8.760	-10.823	0.000	0.000	0.000
12	0.000	65.979	-12.821	0.000	0.000	0.000
13	-0.026	16.393	-10.807	0.000	0.000	0.000
14	-18.754	49.375	-32.974	-0.306	0.046	71.367
15	5.349	231.715	30.257	0.000	0.104	-3.886
16	-0.102	425.061	-0.591	0.000	0.000	0.000
17	9.675	262.368	17.369	-0.370	0.000	-12.671
18	0.069	65.715	14.890	0.000	0.000	0.000
19	0.090	141.546	11.203	0.000	0.000	0.000
20	0.071	64.233	-8.427	0.000	0.000	0.000
21	7.723	151.736	-3.455	0.244	0.000	-10.841
22	-3.925	137.031	-9.242	0.105	0.000	0.834
23	-11.045	40.300	2.039	0.044	0.000	0.836
24	7.924	185.599	0.413	0.020	0.000	-5.055
25	0.000	474.506	0.000	0.000	0.000	0.000
26	18.494	280.886	1.187	-0.100	0.000	-17.520



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 65 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Support Reactions (Maximum Values)						
Node	Directional Reactions (kN)			Moment Reactions (kN.m)		
	Rx→(kN)	Ry↑(kN)	Rz↗(kN)	Mx→(kN.m)	My↑(kN.m)	Mz↗(kN.m)
27	13.385	181.481	0.081	0.100	0.000	-8.272
28	-8.191	213.223	-0.108	0.045	0.000	13.476
29	-42.008	109.387	0.000	0.014	0.000	62.545
30	12.273	249.496	0.000	0.000	0.000	-20.464
31	0.000	375.822	0.000	0.000	0.000	0.000
32	38.571	355.109	0.399	-0.011	0.000	-59.681
33	-12.603	210.032	0.063	0.091	0.000	-2.602
34	9.358	211.712	-0.106	0.048	0.000	11.896
35	-41.168	108.702	0.000	0.000	0.000	42.870
36	16.490	200.684	0.000	0.000	0.000	-24.099
37	0.000	472.727	0.000	0.000	0.000	0.000
38	29.688	300.404	-0.159	0.000	0.000	-41.017
39	-16.519	211.506	0.049	0.084	0.000	-2.471
40	-13.476	211.601	-0.103	0.050	0.000	11.620
41	-41.070	108.620	0.000	0.000	0.000	42.710
42	9.605	202.439	0.000	0.000	0.000	-17.714
43	0.000	472.622	0.000	0.000	0.000	0.000
44	40.462	301.437	-0.225	-0.014	0.000	-53.818
45	-16.176	209.952	0.037	0.077	0.000	1.593
46	-13.363	211.722	-0.101	0.053	0.000	13.926
47	-41.752	109.198	0.000	0.000	0.000	44.186
48	10.069	249.496	0.000	0.000	0.000	-20.465
49	0.000	375.824	0.000	0.000	0.000	0.000
50	38.573	355.107	-0.550	-0.110	0.000	-59.684
51	-12.477	210.033	0.023	0.071	0.000	-2.601
52	9.223	211.711	-0.100	0.055	0.000	11.897
53	-41.169	108.702	0.000	-0.015	0.000	42.871
54	-8.753	207.368	0.000	0.000	0.000	-8.459
55	0.000	472.757	0.000	0.000	0.000	0.000
56	-23.067	412.367	-4.093	0.747	0.000	-28.410
57	0.084	455.988	233.042	0.000	-0.080	0.000
58	0.082	453.440	228.805	0.000	-0.078	0.000
59	0.080	455.788	232.705	0.000	-0.074	0.000
60	54.894	387.157	-2.168	0.138	0.000	-30.513
61	0.000	103.802	0.000	0.000	0.000	0.000
62	-13.713	213.791	-0.098	0.057	0.000	13.462
63	-41.967	109.343	0.000	-0.021	0.000	43.474
64	5.237	277.546	4.978	2.650	0.000	-3.512
65	0.000	571.814	0.000	0.000	0.000	0.000
66	18.301	646.078	31.462	6.961	-0.087	-12.643
67	-9.388	426.271	-2.172	0.143	0.000	3.281
68	0.927	185.395	0.000	0.000	0.000	0.000
69	0.000	231.063	0.000	0.000	0.000	0.000
70	8.646	229.108	-0.100	0.059	0.000	-2.669
71	-20.530	-58.264	-0.036	-0.063	0.000	21.001
72	-2.169	333.768	-40.549	2.656	-0.210	1.490
73	-0.257	504.253	0.620	0.000	0.000	0.000
74	-4.897	426.729	-21.725	-2.769	0.024	4.341
75	-10.306	524.292	-254.133	0.000	-0.076	0.000
76	-12.664	597.007	-249.475	0.000	-0.071	0.000
77	-12.152	524.009	-253.811	0.000	-0.071	0.000
78	6.164	182.713	-4.419	0.127	0.000	4.219
79	-0.461	137.398	-10.225	0.000	0.000	0.000
80	0.000	115.044	-11.471	0.000	0.000	0.000
81	0.000	30.909	-10.224	0.000	0.000	0.000
82	-10.399	-66.726	-8.814	0.069	0.000	1.979
83	0.000	32.410	-10.224	0.000	0.000	0.000
84	0.000	97.352	-11.471	0.000	0.000	0.000
85	0.000	33.417	-10.644	0.000	0.000	0.000



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 66 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Support Reactions (Maximum Values)						
Node	Directional Reactions (kN)			Moment Reactions (kN.m)		
	Rx→(kN)	Ry↑(kN)	Rz↗(kN)	Mx→(kN.m)	My↑(kN.m)	Mz↗(kN.m)
86	-11.201	80.262	-60.873	-0.025	-0.124	2.882
Total	-536.106	18618.680	-515.812	143.124	-0.480	228.562

Highlighted forces above represent the mez beams spanning 11.5m un supported with haunched connection at either end.

To resolve the shear force present, 5 No H20 bars need to be welded to the columns in one length, or in lapped (50xdia) and welded pieces. To be incorporated in the concrete slab.

$$\text{yield stress} = 275,000 \text{ kN/m}^2$$

$$20\text{mm bar } A_s = \pi \times \frac{0.020^2 m}{4} = 3.14159 \times 10^{-4}$$

$$\begin{aligned} \text{Allowable Force} &= 275,000 \text{ kN/m}^2 \times 3.14159 \times 10^{-4} \\ &= 86 \text{ kN} \Rightarrow \frac{86 \text{ kN}}{1.5} (\text{FOS}) = 57.5 \text{ kN} \end{aligned}$$

$$\text{Number of Bars Required} = \frac{255 \text{ kN}}{57.5 \text{ kN}} = 4.45 = 5 \text{ number H20 Bars}$$



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

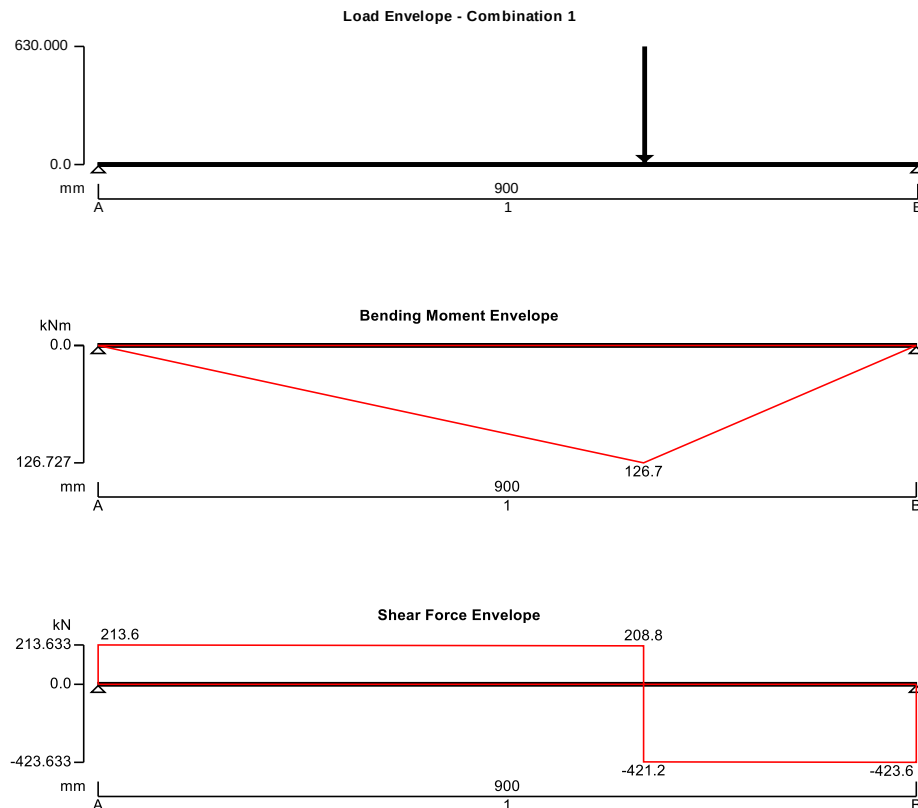
Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 67 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

RC BEAM ANALYSIS & DESIGN BS8110

TEDDS calculation version 2.1.12



Support conditions

Support A

Vertically restrained

Rotationally free

Support B

Vertically restrained

Rotationally free

Applied loading

Dead point load 450 kN at 600 mm

Dead full UDL 0 kN/m

Dead self weight of beam $\times 1$

Load combinations

Load combination 1

Support A

Dead $\times 1.40$

Imposed $\times 1.60$

Span 1

Dead $\times 1.40$

Imposed $\times 1.60$

Support B

Dead $\times 1.40$

Imposed $\times 1.60$

Analysis results

Maximum moment support A;

$M_{A_max} = 0 \text{ kNm};$

$M_{A_red} = 0 \text{ kNm};$

Maximum moment span 1 at 600 mm;

$M_{s1_max} = 127 \text{ kNm};$

$M_{s1_red} = 127 \text{ kNm};$

Maximum moment support B;

$M_{B_max} = 0 \text{ kNm};$

$M_{B_red} = 0 \text{ kNm};$



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

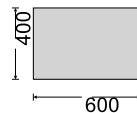
Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 68 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Maximum shear support A;	$V_{A_max} = 214 \text{ kN};$	$V_{A_red} = 214 \text{ kN}$
Maximum shear support A span 1 at 350 mm;	$V_{A_s1_max} = 211 \text{ kN};$	$V_{A_s1_red} = 211 \text{ kN}$
Maximum shear support B;	$V_{B_max} = -424 \text{ kN};$	$V_{B_red} = -424 \text{ kN}$
Maximum shear support B span 1 at 550 mm;	$V_{B_s1_max} = 209 \text{ kN};$	$V_{B_s1_red} = 209 \text{ kN}$
Maximum reaction at support A;	$R_A = 214 \text{ kN}$	
Unfactored dead load reaction at support A;	$R_{A_Dead} = 153 \text{ kN}$	
Maximum reaction at support B;	$R_B = 424 \text{ kN}$	
Unfactored dead load reaction at support B;	$R_{B_Dead} = 303 \text{ kN}$	

Rectangular section details

Section width;	$b = 600 \text{ mm}$
Section depth;	$h = 400 \text{ mm}$



Concrete details

Concrete strength class;	C40/50
Characteristic compressive cube strength;	$f_{cu} = 50 \text{ N/mm}^2$
Modulus of elasticity of concrete;	$E_c = 20 \text{ kN/mm}^2 + 200 \times f_{cu} = 30000 \text{ N/mm}^2$
Maximum aggregate size;	$h_{agg} = 20 \text{ mm}$

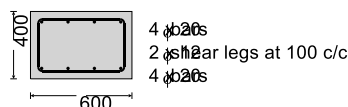
Reinforcement details

Characteristic yield strength of reinforcement;	$f_y = 500 \text{ N/mm}^2$
Characteristic yield strength of shear reinforcement;	$f_{yv} = 500 \text{ N/mm}^2$

Nominal cover to reinforcement

Nominal cover to top reinforcement;	$C_{nom_t} = 40 \text{ mm}$
Nominal cover to bottom reinforcement;	$C_{nom_b} = 40 \text{ mm}$
Nominal cover to side reinforcement;	$C_{nom_s} = 40 \text{ mm}$

Mid span 1





R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 69 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Design moment resistance of rectangular section (cl. 3.4.4) - Positive moment

Design bending moment; $M = \text{abs}(M_{s1_red}) = 127 \text{ kNm}$
Depth to tension reinforcement; $d = h - c_{nom_b} - \phi_v - \phi_{bot} / 2 = 338 \text{ mm}$
Redistribution ratio; $\beta_b = \min(1 - m_{rs1}, 1) = 1.000$
 $K = M / (b \times d^2 \times f_{cu}) = 0.037$
 $K' = 0.156$

K' > K - No compression reinforcement is required

Lever arm; $z = \min(d \times (0.5 + (0.25 - K / 0.9)^{0.5}), 0.95 \times d) = 321 \text{ mm}$
Depth of neutral axis; $x = (d - z) / 0.45 = 38 \text{ mm}$
Area of tension reinforcement required; $A_{s,req} = M / (0.87 \times f_y \times z) = 907 \text{ mm}^2$
Tension reinforcement provided; $4 \times 20\phi \text{ bars}$
Area of tension reinforcement provided; $A_{s,prov} = 1257 \text{ mm}^2$
Minimum area of reinforcement; $A_{s,min} = 0.0013 \times b \times h = 312 \text{ mm}^2$
Maximum area of reinforcement; $A_{s,max} = 0.04 \times b \times h = 9600 \text{ mm}^2$

PASS - Area of reinforcement provided is greater than area of reinforcement required

Rectangular section in shear

Design shear force Span 1 - 270 mm to 630 mm; $V = \max(V_{s1_mid}, 0 \text{ kN}) = 421 \text{ kN}$
Design shear stress; $v = V / (b \times d) = 2.078 \text{ N/mm}^2$
Design concrete shear stress; $v_c = 0.79 \times \min(3, [100 \times A_{s,prov} / (b \times d)]^{1/3}) \times \max(1, (400 / d)^{1/4}) \times$
 $(\min(f_{cu}, 40) / 25)^{1/3} / \gamma_m$
 $v_c = 0.657 \text{ N/mm}^2$

Allowable design shear stress; $v_{max} = \min(0.8 \text{ N/mm}^2 \times (f_{cu} / 1 \text{ N/mm}^2)^{0.5}, 5 \text{ N/mm}^2) = 5.000 \text{ N/mm}^2$

PASS - Design shear stress is less than maximum allowable

Value of v from Table 3.7; $(v_c + 0.4 \text{ N/mm}^2) < v < v_{max}$
Design shear resistance required; $v_s = \max(v - v_c, 0.4 \text{ N/mm}^2) = 1.421 \text{ N/mm}^2$
Area of shear reinforcement required; $A_{sv,req} = v_s \times b / (0.87 \times f_{yv}) = 1960 \text{ mm}^2/\text{m}$
Shear reinforcement provided; $2 \times 12\phi \text{ legs at } 100 \text{ c/c}$
Area of shear reinforcement provided; $A_{sv,prov} = 2262 \text{ mm}^2/\text{m}$

PASS - Area of shear reinforcement provided exceeds minimum required

Maximum longitudinal spacing; $s_{vl,max} = 0.75 \times d = 254 \text{ mm}$

PASS - Longitudinal spacing of shear reinforcement provided is less than maximum

Spacing of reinforcement (cl 3.12.11)

Actual distance between bars in tension; $s = (b - 2 \times (c_{nom_s} + \phi_v + \phi_{bot}/2)) / (N_{bot} - 1) - \phi_{bot} = 139 \text{ mm}$

Minimum distance between bars in tension (cl 3.12.11.1)

Minimum distance between bars in tension; $s_{min} = h_{agg} + 5 \text{ mm} = 25 \text{ mm}$

PASS - Satisfies the minimum spacing criteria

Maximum distance between bars in tension (cl 3.12.11.2)

Design service stress; $f_s = (2 \times f_y \times A_{s,req}) / (3 \times A_{s,prov} \times \beta_b) = 240.7 \text{ N/mm}^2$
Maximum distance between bars in tension; $s_{max} = \min(47000 \text{ N/mm} / f_s, 300 \text{ mm}) = 195 \text{ mm}$

PASS - Satisfies the maximum spacing criteria

Span to depth ratio (cl. 3.4.6)

Basic span to depth ratio (Table 3.9); $\text{span_to_depth}_{basic} = 20.0$
Design service stress in tension reinforcement; $f_s = (2 \times f_y \times A_{s,req}) / (3 \times A_{s,prov} \times \beta_b) = 240.7 \text{ N/mm}^2$
Modification for tension reinforcement

$$f_{tens} = \min(2.0, 0.55 + (477 \text{ N/mm}^2 - f_s) / (120 \times (0.9 \text{ N/mm}^2 + (M / (b \times d^2)))) = 1.266$$



R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 70 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Modification for compression reinforcement

$$f_{comp} = \min(1.5, 1 + (100 \times A_{s2,prov} / (b \times d)) / (3 + (100 \times A_{s2,prov} / (b \times d)))) = \mathbf{1.171}$$

Modification for span length;

$$f_{long} = 1.000$$

Allowable span to depth ratio;

$$\text{span_to_depth}_{allow} = \text{span_to_depth}_{basic} \times f_{tens} \times f_{comp} = \mathbf{29.7}$$

Actual span to depth ratio;

$$\text{span_to_depth}_{actual} = L_{s1} / d = \mathbf{2.7}$$

PASS - Actual span to depth ratio is within the allowable limit

;

**R Elliott Associates Ltd**

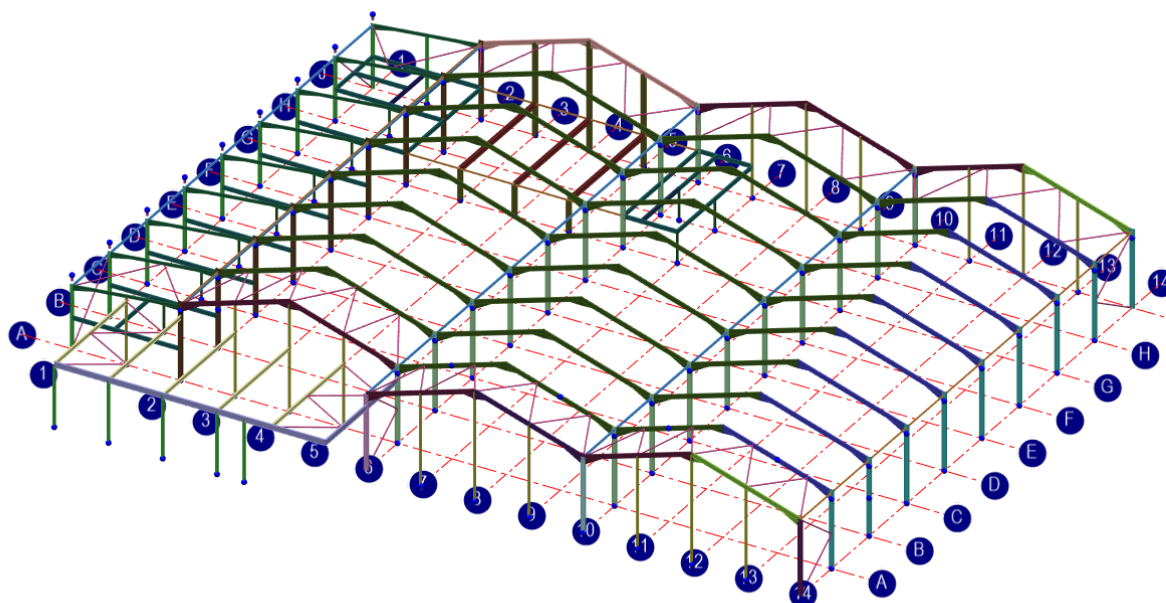
Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 71 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

Frame Views with Grid Reference



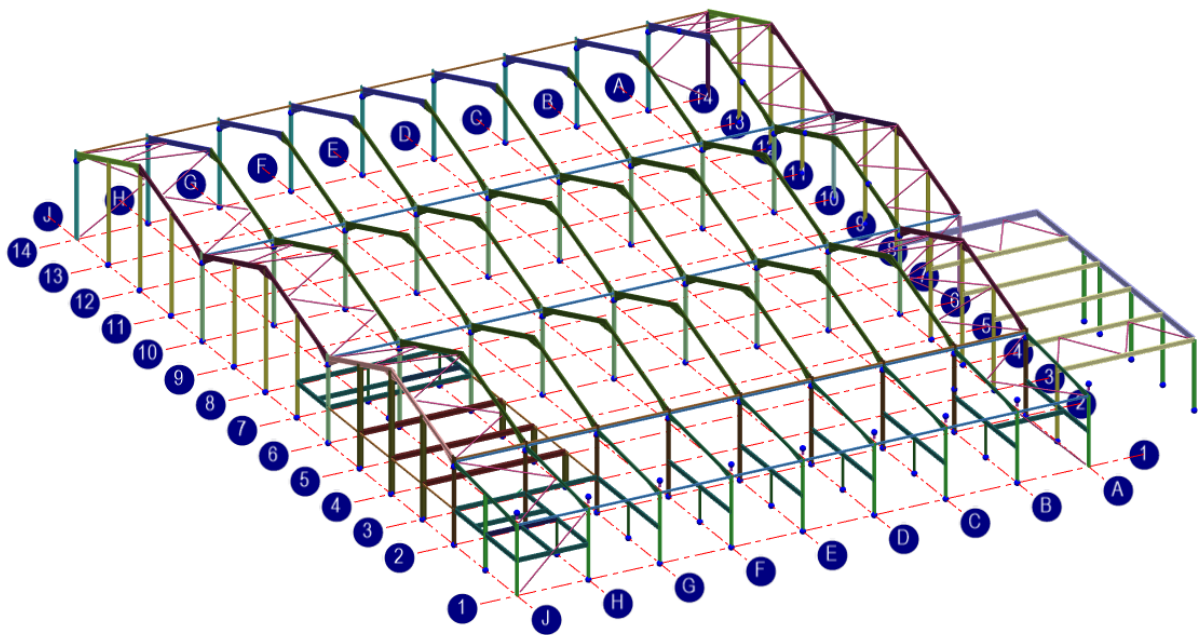
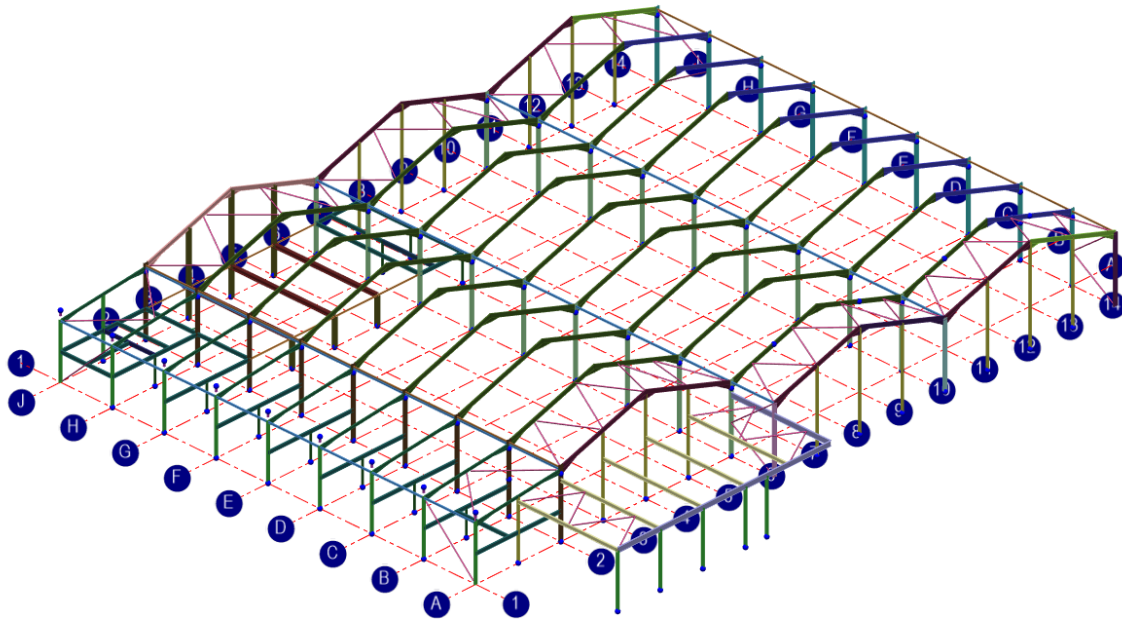
**R Elliott Associates Ltd**

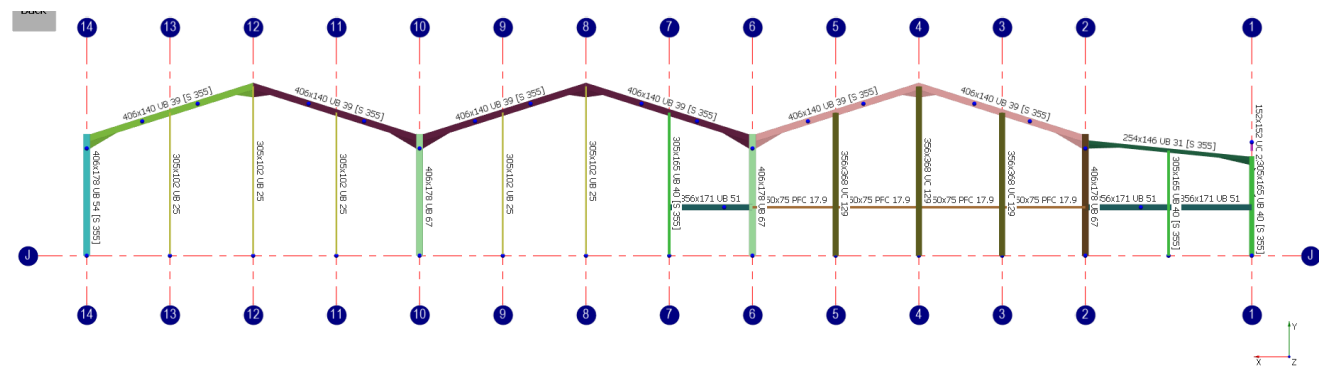
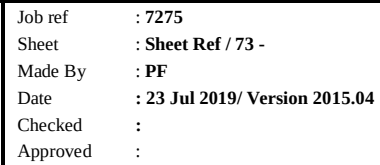
Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 72 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :







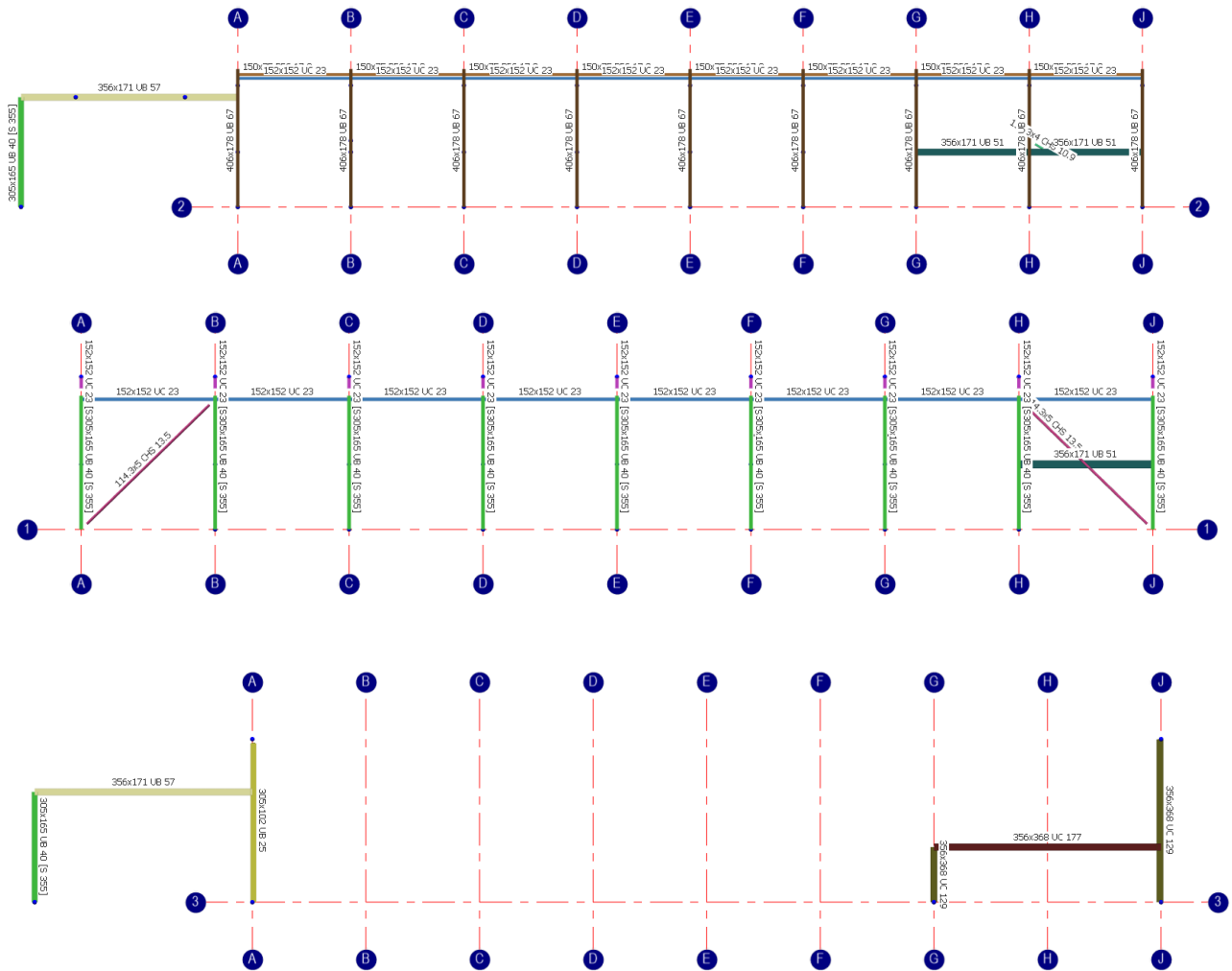
R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 74 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :





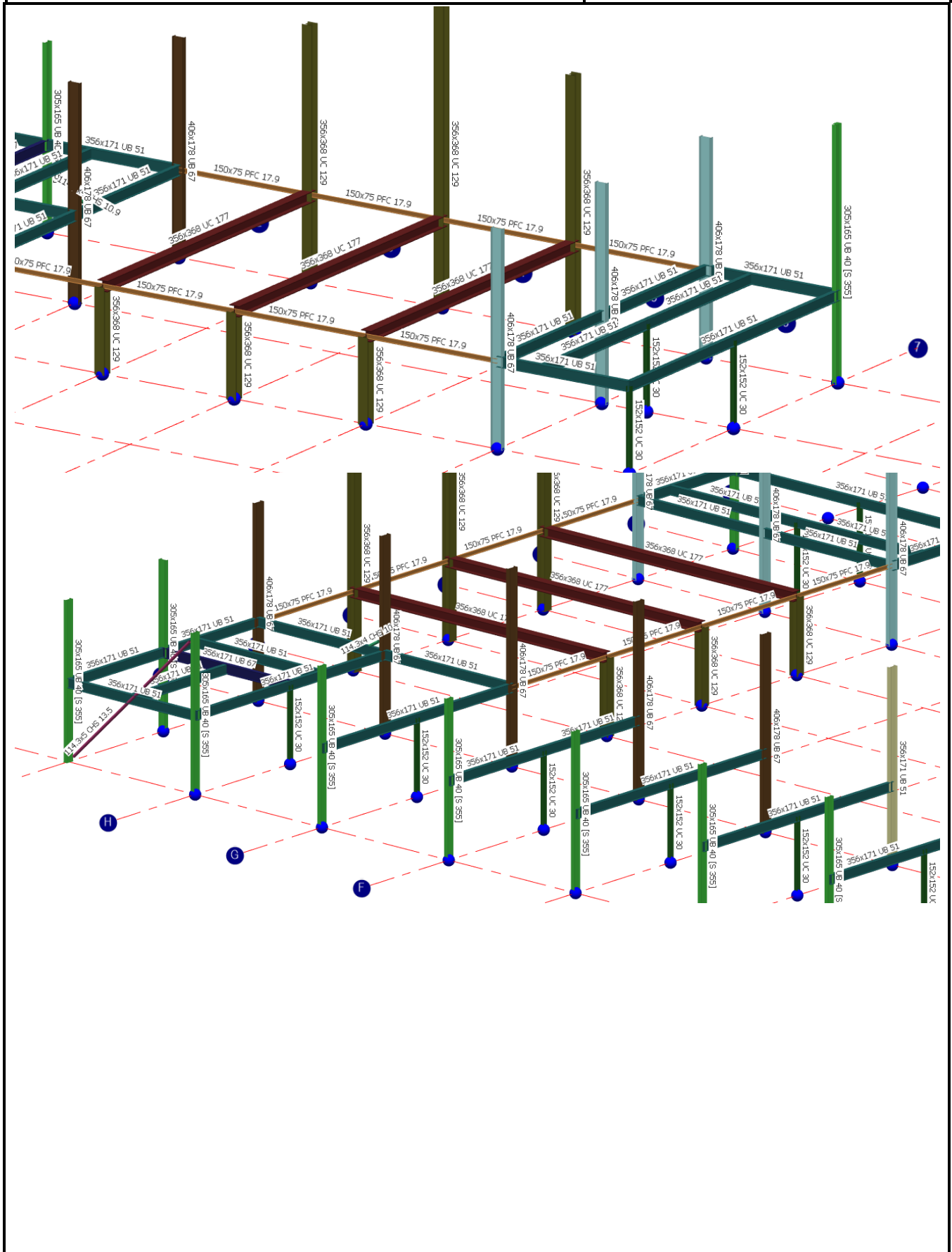
R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 75 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :





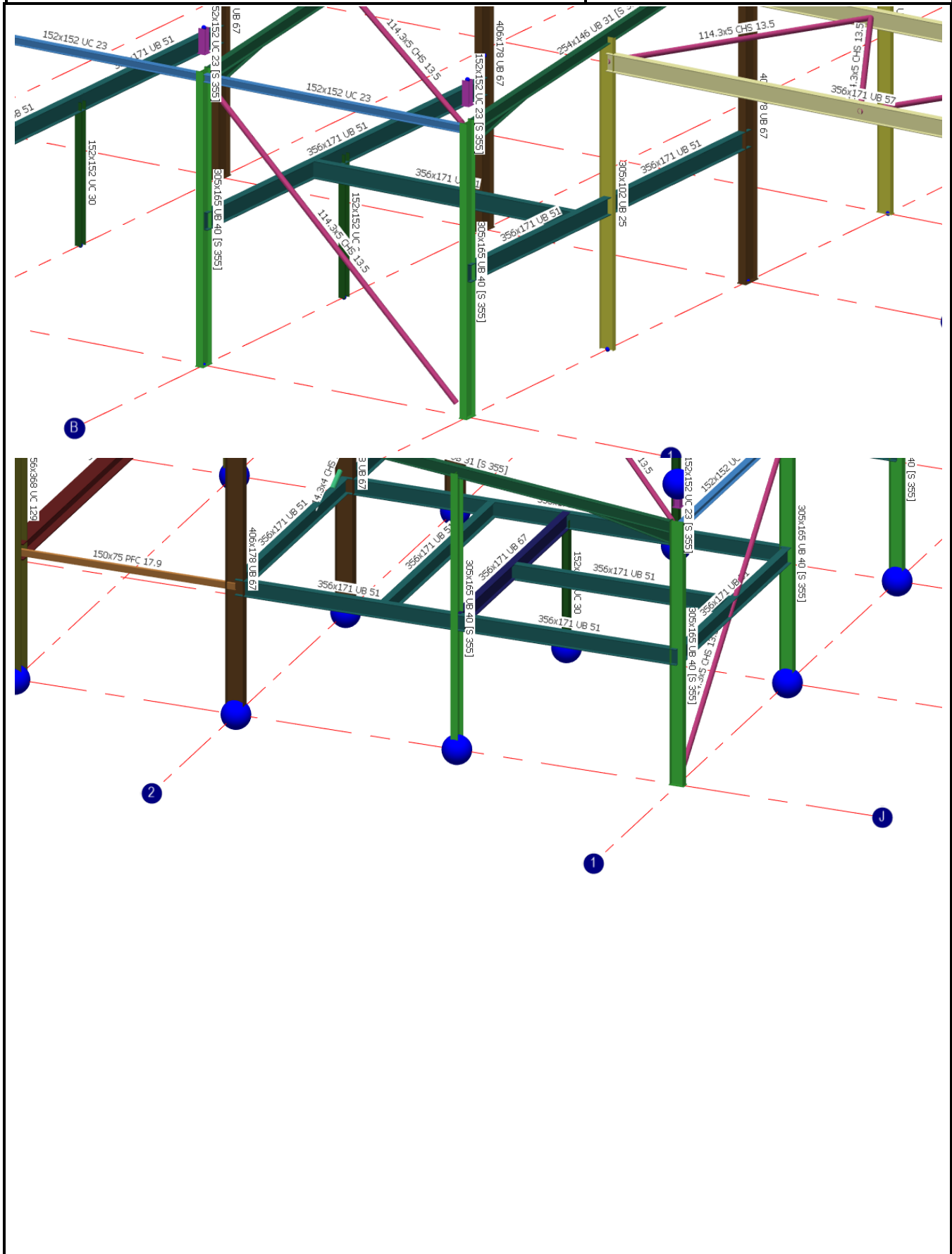
R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 76 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :




R Elliott Associates Ltd

Dennett House, Brighton Road, Sway
Lymington, Hampshire SO41 6EB
E-mail: info@rea-ltd.co.uk

Tel: (01590) 683 176

Fax: (01590) 683 533

Job ref : 7275
Sheet : Sheet Ref / 78 -
Made By : PF
Date : 23 Jul 2019/ Version 2015.04
Checked :
Approved :

SUMMARY

Section Sizes –

*** Refer to frame images above for exact sizes & location of structural elements.**

Member	Section	Grade
Main Rafter	406x140 UB 39	355
Main Column	406x178 UB 67 & 406x178 UB 54	355
Gable Columns	305x102 UB 25, 305x146 UB 40	S355
Eaves	150x75 PFC & 152x152 UC 23	235/275/355
Mez Columns	356x368 UC 129, 152x152 UC 30	S355
Mez Beams	356x368 UC 177, 356x171 UB 51, 356x171 UB 67	S355
Lean too Column	305x165 UB 40	S355
Lean too rafter	254x146 UB 31	S355
Canopy Beam	356x171 UB 57	S355
Canopy Support Beam	533x165 UB 66	S355
Canopy Column	305x165 UB 40	S355
Bracing	114x5.0 CHS	235

Stays

Member	Stays
Rafter	At #1,#2,#3 & #5 Number referes to purlin from eaves – purlins at 1.8m c/c
Column	At eaves and rail below eaves

Foundations – by others, refer to column loadings