SM Design & Consulting Ltd
Consulting Structural and Design Engineers

28/11/22

Your Ref:
Our Ref: 22-251

Contact: Simon Maddox
Email: simon@smdesignconsult.co.uk

CALCULATIONS FOR: **LITTLE PAXTON VILLAGE HALL**

PROPOSAL: These calculations have been prepared for new office building.

CODES USED:
BS 648, 1964: Weights of Building Materials
BS 6399 Part 1, 1996: Loads for Buildings; Dead & Imposed Loads
BS 6399 Part 2, 1997: Loads for Buildings; Wind Loads
BS 5950 Part 1, 2000: Structural Use of Steelwork in Building
BS 8110 Part 1, 1997: Structural Use of Concrete
BS 5268 Part 2, 2002: Structural Use of Timber
BS 5628 Part 1, 2005: Structural Use of Masonry

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33 Juniper Walk
Kempston
Bedford MK42 7SX
Tel : 07939 595055

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Loads for Roofs		**kg/m² Dead**		**Live**
Tiled Roof –				
Tiles (standard clay)		75		
Felt and battens		6		
Rafters		6		
	Plan Load Total	**87**		
	Pitch 45		**1.23**	**0.60**
Tiled Roof (with lining) –				
Tiles (standard clay)		75		
Felt and battens		6		
Rafters		6		
Battens & insulation		4		
Plasterboard & skim		15		
	Plan Load Total	**106**		
	Pitch 45		**1.65**	**0.60**
Built up felt roof (flat roof) -				
Felt & chippings		40		
Board & insulation		15		
Joists & firings		10		
Plasterboard & skim		15		
	Total	**80**	**0.80**	**0.75**
(with access)				**1.50**
Ceilings –				
Joists		8		
Insulation		2		
Plasterboard & skim		15		
	Total	**25**	**0.25**	**0.25**
Timber Floors –				
Boarding		20		
Joists		8		
Insulation		2		
Plasterboard & skim		15		
	Total	**45**	**0.45**	**1.50**

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Loads for Walls		**kg/m²**	**Dead**	**Live**
New cavity walls -				
102 brick		210		
100 block		80		
12mm plaster		24		
	Total	**314**	**3.14**	**-**
New party walls -				
100 block		160		
100 block		160		
2 x 12mm plaster		48		
	Total	**368**	**3.68**	**-**
Internal block walls -				
100 block		160		
2 x 12mm plaster		48		
	Total	**208**	**2.08**	**-**
Stud Partition walls –				
2 x 9.5mm Plasterboard		20		
2 x skim coat plaster		10		
Studs 75 x 50 @ 400c/c		10		
	Total	**40**	**0.40**	**-**

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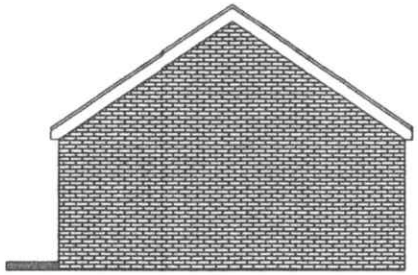
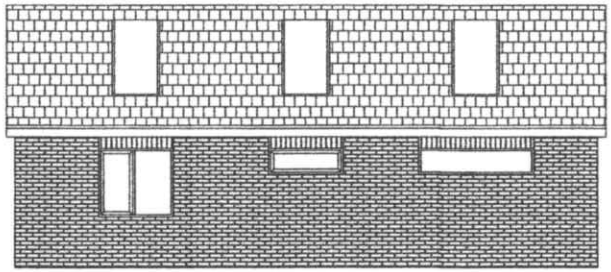
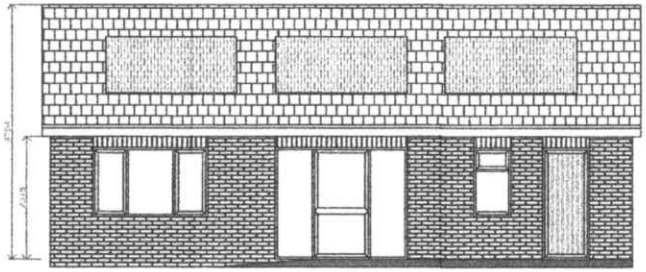


PROPOSED SIDE ELEVATION



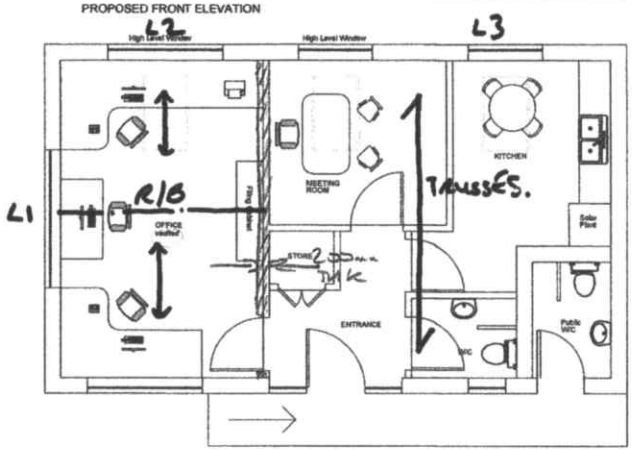
PROPOSED REAR ELEVATION



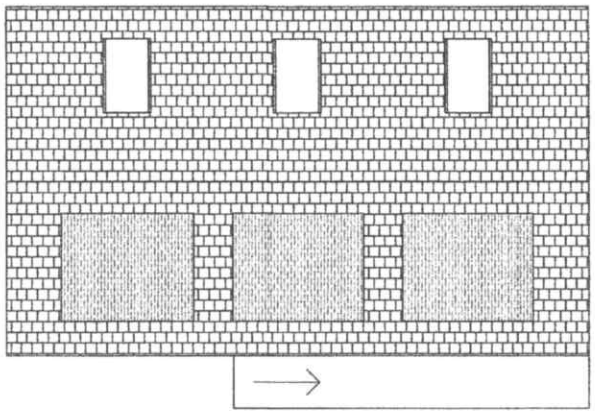
PROPOSED FRONT ELEVATION

PROPOSED SIDE ELEVATION

Internal Floor Area
63 sq. m



PROPOSED GROUND FLOOR PLAN



PROPOSED ROOF PLAN

NOTES -

Drainage subject to a visit by the builder and assessment of existing drains.

Party wall act may be required and is the responsibility of the homeowner, we can advise if required.

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www.binneyandsimsdesign.co.uk

Site plans and Location plans purchased from streetwise.net and are subject to their terms and conditions.

Drawings are for planning purposes only.

Prior to commencement of works the contractor is responsible for checking the plans to the site conditions. If any anomolies are found they are reported for rectification. Failure to do so at this stage will result in the contractor being liable for resulting costs incurred.

Drawings are subject to structural engineering and building control.

Client:

Little Paxton Parish Council

Site Address:

Village Hall Car Park
Little Paxton
St Neots
PE19

Scale :1/100

Drawn By: *PS*

Date : 9th November 2022

Drawing No:730/3 PRO

Z:\Support Files\B&S Logo.gif

03

PROJECT Village Hall Car Park, Little Paxton, St Neots

STRUCTURAL DESIGN

LINTELS

(i) L1 SPAN = 2.5m

Roof $2 \times 6/2 \times 4/2 / 3$ = 4.0 kN/m
Wall = 4.0 kN/m
8.0 kN/m

$8 \times 2.5 = 20$ kN

1G L1/H0 (35)

(ii) L2 SPAN = 2.3m

Roof $2 \times 3/2$ 3.00
Wall 1.00
4.00

$4 \times 2.3 = 9.20$ 1G L1/S (22)

(iii) L3

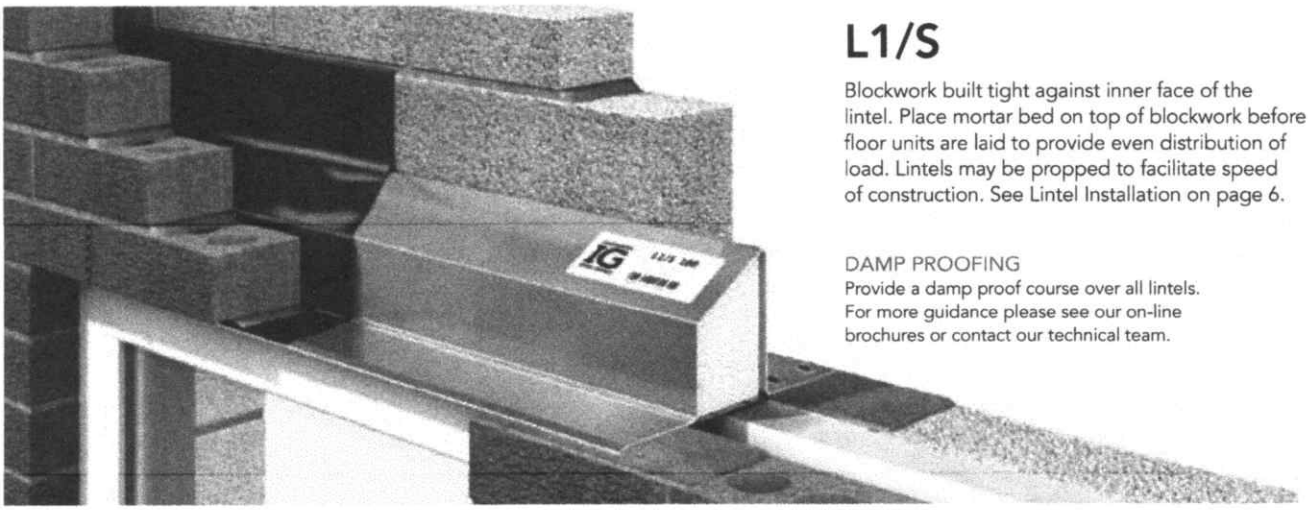
Roof $2 \times 6/2$ 6.0
Wall 1.0
7.0

$7.0 \times 2.5 = 17.5$ kN 1G L1/S (22)

Cavity Wall

Available for cavity widths from **50mm to 165mm**

OUTER LEAF	INNER LEAF
102mm	100mm



L1/S

Blockwork built tight against inner face of the lintel. Place mortar bed on top of blockwork before floor units are laid to provide even distribution of load. Lintels may be propped to facilitate speed of construction. See Lintel Installation on page 6.

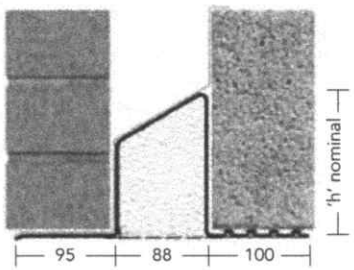
DAMP PROOFING
Provide a damp proof course over all lintels. For more guidance please see our on-line brochures or contact our technical team.

Standard Load

L1/S 100 — For cavity widths 90-105mm

Manufactured length 150mm increments	600-1200	1350-1500	1650-1800	1950-2100	2250-2400	2550-2700	2850-3000	3150-3600	3750-4050	4200-4800
Height 'h'	88	88	107	125	150	162	171	200	200	200
Thickness	1.6	2.0	2.0	2.0	2.0	2.6	2.6	3.2	3.2	3.4
Total UDL kN 3:1	12	16	19	21	23	27	27	27	26	27
Total UDL kN 19:1	10	13	16	17	18	22	20	20	19	22

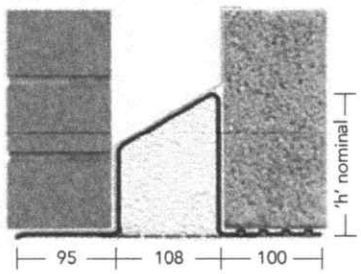
90-105mm cavity



L1/S 110 — For cavity widths 110-125mm

Manufactured length 150mm increments	600-1500	1650-1800	1950-2100	2250-3000	3150-4050	4200-4800
Height 'h'	95	121	145	195	195	195
Thickness	2.0	2.0	2.6	2.9	3.2	3.4
Total UDL kN 3:1	16	22	24	27	26	25
Total UDL kN 19:1	13	18	18	22	19	20

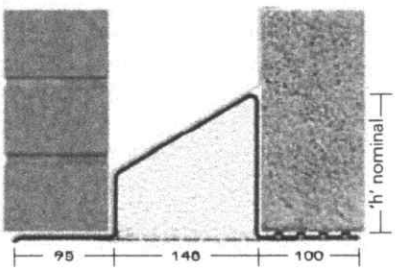
110-125mm cavity



L1/S 150 — For cavity widths 150-165mm

Manufactured length 150mm increments	600-1500	1650-1800	1950-2100	2250-3000	3150-4050	4200-4800
Height 'h'	100	125	180	180	180	180
Thickness	2.0	2.0	2.6	2.9	3.2	3.4
Total UDL kN 3:1	16	22	24	27	26	25
Total UDL kN 19:1	13	18	18	22	19	20

150-165mm cavity

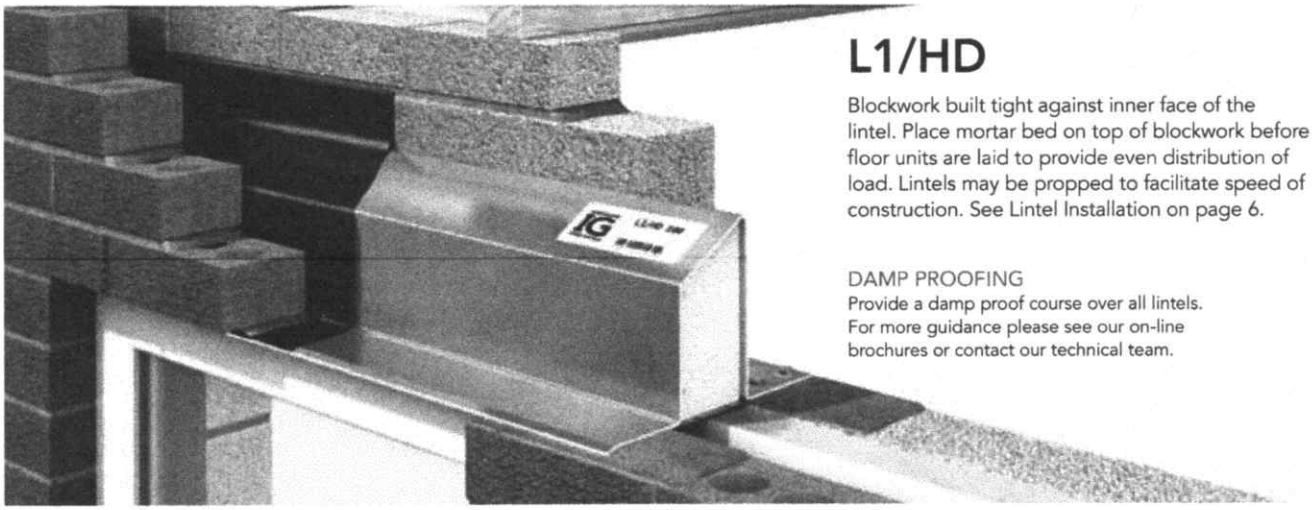


Please note other cavity widths and loading conditions are available.

Cavity Wall

Available for cavity widths from **50mm to 165mm**

OUTER LEAF	INNER LEAF
102mm	100mm



L1/HD

Blockwork built tight against inner face of the lintel. Place mortar bed on top of blockwork before floor units are laid to provide even distribution of load. Lintels may be propped to facilitate speed of construction. See Lintel Installation on page 6.

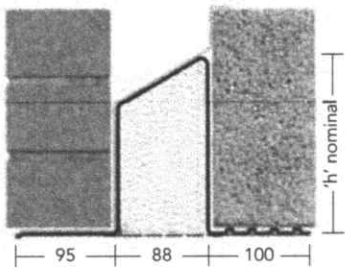
DAMP PROOFING

Provide a damp proof course over all lintels. For more guidance please see our on-line brochures or contact our technical team.

Heavy Duty Load

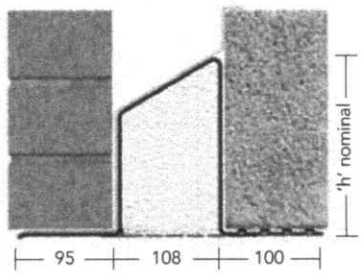
L1/HD 100	For cavity widths 90-105mm						
Manufactured length 150mm increments	600-1200	1350-1500	1650-2100	2250-2550	2700-3000	3150-3600	3750-4200
Height 'h'	110	135	163	203	203	203	203
Thickness	2.9	2.9	2.9	2.9	3.2	3.2	3.2
Total UDL kN 3:1	30	30	40	40	40	35	33
Total UDL kN 19:1	22	22	35	35	35	32	28

90-105mm cavity



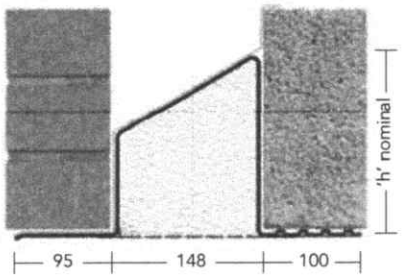
L1/HD 110	For cavity widths 110-125mm				
Manufactured length 150mm increments	600-1500	1650-2100	2250-3000	3150-3600	3750-4050
Height 'h'	125	145	195	195	195
Thickness	2.9	2.9	2.9	3.2	3.2
Total UDL kN 3:1	30	30	35	32	30
Total UDL kN 19:1	20	22	30	28	26

110-125mm cavity



L1/HD 150	For cavity widths 150-165mm				
Manufactured length 150mm increments	600-1500	1650-2100	2250-3000	3150-3600	3750-4050
Height 'h'	125	160	180	180	200
Thickness	2.9	2.9	3.2	3.2	3.2
Total UDL kN 3:1	30	30	35	30	30
Total UDL kN 19:1	20	22	30	25	26

150-165mm cavity



Please note other cavity widths and loading conditions are available.

PROJECT Village Hall Car Park, Little Paxton, St Neots

(iv) RAFTERS

SPAN = 3.5m

TRADA T6-18

50 x 175 C24
@ 400 c/cs

(0.2m)

(v) RIDGE BEAM

SPAN = 4.0m

(Kn/m)

OW		0.30	
ROOF	1.2 x 6/2	3.60	
	0.75 x 6/2		2.25
		3.90	2.25

FOUNDATIONS

BGS MAP INDICATES RIVER TERRACE DEPOSITS OVER OXFORD CLAY. FOOTINGS 600mm WIDE & MIN 1000mm DP SUBJECT TO LA INSPECTION & APPROVAL ON SITE.

Table 6.17 Permissible clear spans for common or jack rafters

Slope of roof 30.0° or more but less than 45.0° Imposed load F_i = 0.75 kN/m² Single span

Strength Class C16 Service Class 1 or 2

		Dead loads F_d (kN/m²)								
		F_d not more than 0.5			F_d more than 0.5 but not more than 0.75			F_d more than 0.75 but not more than 1.00		
Size of rafter		Spacing of rafters (mm)								
Breadth (mm)	Depth (mm)	400	450	600	400	450	600	400	450	600
		Maximum clear span (m)								
38	100	2.30	2.24	2.11	2.11	2.06	1.91	1.97	1.91	1.77
38	125	3.09	2.97	2.70	2.89	2.78	2.52	2.67	2.58	2.36
38	150	3.70	3.56	3.23	3.46	3.33	3.03	3.28	3.15	2.86
38	195	4.78	4.60	4.19	4.49	4.32	3.92	4.25	4.09	3.68
44	100	2.57	2.50	2.27	2.35	2.29	2.12	2.19	2.12	1.95
44	125	3.24	3.12	2.83	3.04	2.92	2.65	2.88	2.76	2.51
44	150	3.88	3.73	3.39	3.64	3.50	3.18	3.44	3.31	3.01
44	195	5.01	4.83	4.40	4.71	4.53	4.12	4.46	4.29	3.90
47	100	2.66	2.55	2.32	2.47	2.39	2.17	2.29	2.22	2.04
47	125	3.31	3.18	2.90	3.10	2.98	2.71	2.94	2.83	2.67
47	150	3.96	3.81	3.47	3.71	3.57	3.25	3.52	3.39	3.08
47	195	5.12	4.93	4.49	4.81	4.63	4.21	4.56	4.39	3.99
ALS/CLS										
38	89	1.92	1.88	1.78	1.78	1.74	1.63	1.67	1.63	1.51
38	140	3.45	3.32	3.02	3.24	3.11	2.83	3.06	2.95	2.67
38	184	4.52	4.35	3.96	4.24	4.08	3.70	4.01	3.86	3.48

Table 6.18 Permissible clear spans for common or jack rafters

Slope of roof 30.0° or more but less than 45.0° Imposed load F_i = 0.75 kN/m² Single span

Strength Class C24 Service Class 1 or 2

		Dead loads F_d (kN/m²)								
		F_d not more than 0.5			F_d more than 0.5 but not more than 0.75			F_d more than 0.75 but not more than 1.00		
Size of rafter		Spacing of rafters (mm)								
Breadth (mm)	Depth (mm)	400	450	600	400	450	600	400	450	600
		Maximum clear span (m)								
38	100	2.65	2.55	2.32	2.48	2.39	2.17	2.35	2.26	2.05
38	125	3.30	3.18	2.89	3.10	2.98	2.71	2.93	2.82	2.56
38	150	3.95	3.81	3.46	3.71	3.57	3.24	3.51	3.38	3.07
38	195	5.11	4.92	4.49	4.80	4.62	4.20	4.55	4.38	3.98
44	100	2.78	2.68	2.43	2.61	2.51	2.28	2.47	2.37	2.16
44	125	3.47	3.34	3.03	3.25	3.13	2.84	3.08	2.96	2.69
44	150	4.14	3.99	3.63	3.89	3.74	3.40	3.69	3.55	3.22
44	195	5.36	5.16	4.71	5.03	4.85	4.41	4.77	4.59	4.18
47	100	2.84	2.73	2.49	2.66	2.56	2.33	2.52	2.43	2.20
47	125	3.54	3.41	3.10	3.32	3.20	2.91	3.15	3.03	2.75
47	150	4.23	4.08	3.71	3.97	3.82	3.48	3.77	3.62	3.29
47	195	5.47	5.27	4.81	5.14	4.95	4.51	4.88	4.69	4.27
ALS/CLS										
38	89	2.36	2.27	2.06	2.21	2.13	1.93	2.09	2.01	1.83
38	140	3.69	3.56	3.23	3.46	3.33	3.03	3.28	3.16	2.86
38	184	4.83	4.65	4.24	4.53	4.36	3.97	4.30	4.13	3.76

Beam: Ridge Beam **Span: 4.0 m.**

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U D	dl	4	0		L	8.00	8.00
U L	ll	2.25	0		L	4.50	4.50
				Unfactored reactions (kN)	**Total:**	**12.50**	**12.50**
					Dead:	*8.00*	*8.00*
					Live:	*4.50*	*4.50*
Total load: 25.00/36.80 kN *Unfactored/Factored*					**Factored reactions:**	**18.40**	**18.40**

Load types: U: UDL D: Dead; L: Live (positions in m. from R1)

Maximum B.M. (factored) = 18.40 kNm at 2.00 m. from R1

Maximum S.F. (factored) = 18.40 kN at 0.00 m. from R1

Live load deflection = 7.50 x 10^8/EI at 2.00 m. from R1 *(E in N/mm², I in cm⁴)*

Total deflection = 20.8 x 10^8/EI at 2.00 m. from R1

Beam calculation to BS5950-1:2000 using S275 steel

SECTION SIZE : **203 x 133 x 30 UB** S275 (compact)

D=206.8 mm B=133.9 mm t=6.4 mm T=9.6 mm I_x=2,900 cm⁴ r_y=3.17 cm S_x=314 cm³ x=21.5

Shear

Shear capacity = 0.6 p_y.t.D = 0.6 x 275 x 6.4 x 206.8/1000 = 218 kN (>=18.4) OK

Bending

Maximum moment = 18.40 kNm at 2.00 m. from R1

Moment capacity, $M_c = p_y.S_x$ = 275 x 314/1000 = 86.35 kNm OK

Lateral-torsional buckling

Beam is laterally restrained at supports only
Restraint condition at R1 and R2: Compression flange laterally unrestrained; both flanges free to rotate on plan.
Partial torsional restraint by dead bearing of bottom flange to support (1.2L+2D) [BS5950 Table 13]
Effective length = 1.2L+2D

Bending strength, p_b = 120.0 N/mm²

Maximum moment within segment, M_x = 18.40 kNm

Equivalent uniform moment factor, m_{LT} = 0.925 (M_2=13.8, M_3=18.4, M_4=13.8)

Equivalent uniform moment = 0.925 x 18.40 = 17.02 kNm

Buckling resistance moment, $M_b = p_b.S_x$ = 120.0 x 314/1000 = 37.67 kNm OK

Web capacity

Check unstiffened web capacity with load of 18.40 kN
C1 = 60.5 kN; C2 = 1.76 kN/mm; C4 = 261; K = min{0.5+(a_e/1.4d),1.0}; p_{vw} = 275N/mm²
(for derivation of C factors see Steelwork Design Guide to BS5950-1:2000 6th ed.)

Minimum required stiff bearing length, b_1 = 0mm: a_e = 0mm; K = 0.500
Bearing capacity, $P_w = C1 + b_1.C2$ = 60.5 kN <<<
Buckling capacity, $P_x = K\sqrt{(C4.P_w)}$ = 0.500√(261 x 60.5) = 62.9 kN

Deflection

LL deflection = 7.50 x 1e8/205,000 x 2,900 = 1.3 mm (L/3171) OK
TL deflection = 20.8 x 1e8/205,000 x 2,900 = 3.5 mm (L/1142)