Beam: **Beam 1** **Span: 9.1 m.**

		Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U	D	o.w.	2.4	0		L	10.92	10.92
U	D	Roof	8.52	0		L	38.77	38.77
						Total load: 99.37 kN	**49.69**	**49.69**
						Dead:	*49.69*	*49.69*
						Live:	*0.00*	*0.00*

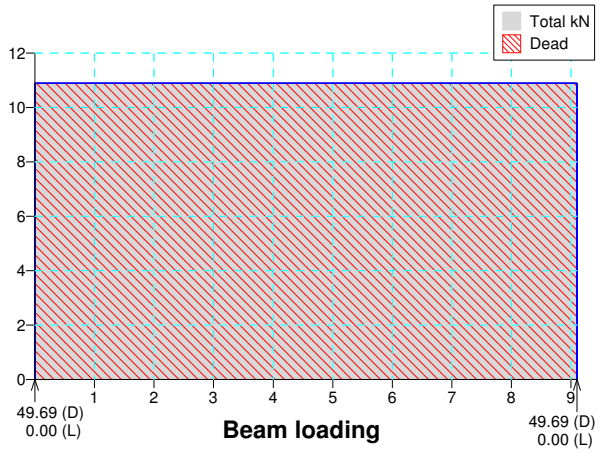
Load types: U: UDL D: Dead; L: Live (positions in m. from R1)

Maximum B.M. = 113 kNm at 4.55 m. from R1

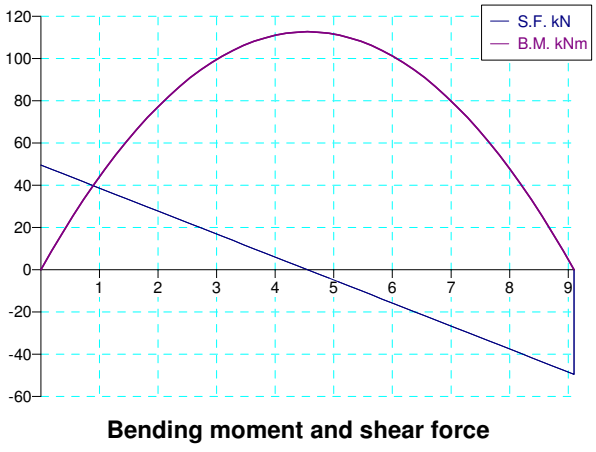
Maximum S.F. = -49.7 kN at R2

Live load deflection = 0.00 x 10^8/EI at R2 *(E in N/mm^2, I in cm^4)*

Total deflection = 975 x 10^8/EI at 4.55 m. from R1



Beam loading



Bending moment and shear force

Beam: **Beam 1** **Span: 9.1 m.**

		Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U	D	o.w.	2.4	0		L	10.92	10.92
U	D	Roof	8.52	0		L	38.77	38.77
						Total load: 99.37 kN	**49.69**	**49.69**
						Dead:	*49.69*	*49.69*
						Live:	*0.00*	*0.00*

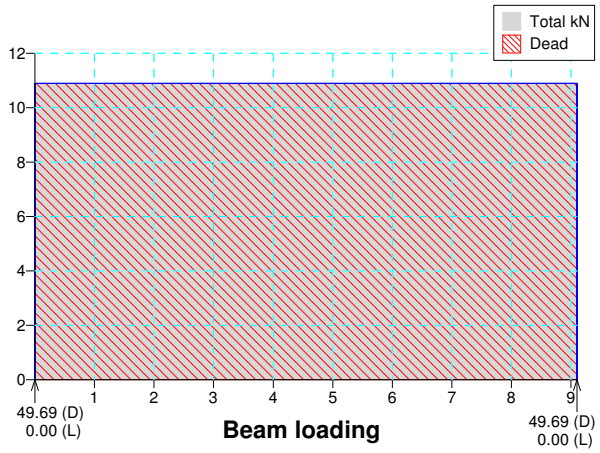
Load types: U: UDL D: Dead; L: Live (positions in m. from R1)

Maximum B.M. = 113 kNm at 4.55 m. from R1

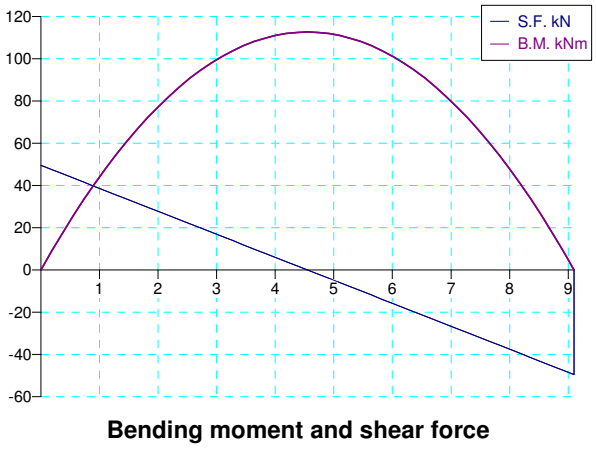
Maximum S.F. = -49.7 kN at R2

Live load deflection = 0.00 x 10^8/EI at R2 *(E in N/mm², I in cm⁴)*

Total deflection = 975 x 10^8/EI at 4.55 m. from R1



Beam loading



Bending moment and shear force

Steel beam calculation to BS449 Part 2 using S355 steel

SECTION SIZE : **305 x 305 x 198 UC** S355

D=339.9 mm B=314.5 mm t=19.1 mm T=31.4 mm I_x=50,900 cm⁴ r_y=8.04 cm Z_x=3,000 cm³

Bending: L_E/r_y = 9.10 x 100/8.04 = 113 D/T = 10.8
Permissible bending stress, p_{bc} = 187.3 N/mm² (Table 3b)
Actual bending stress, f_{bc} = 113.0 x 1000/3000.0 = 37.7 N/mm² OK

Shear: Maximum shear in web, f_s = 49.7 x 1000/(19.1 x 339.9) = 7.7 N/mm² OK

Beam web: Check unstiffened web capacity with load of 49.69 kN
Bearing: p_b = 260N/mm² (Table 9); C1 = 401 kN; C2 = 4.97 kN/mm
Buckling: p_c = 204N/mm² (Table 17b); C1 = 661 kN; C2 = 3.89 kN/mm
Minimum required stiff bearing length, L_b = 0mm
Bearing capacity, P_w = C1 + L_b.C2 = 401kN <<<
Buckling capacity, P_x = C1 + L_b.C2 = 661kN

Deflection: Live load deflection = 0.00 x 1e8/(205,000 x 50,900) = 0.0 mm OK
Total deflection = 975 x 1e8/(205,000 x 50,900) = 9.3 mm (L/974)

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2$ = 0.040 at 4.55 m. (<=1.25 OK)

Bearings

305 x 305 x 198 UC stiff bearing length, $b_1 = t + 1.6r + 2T = 106.2$ mm

Masonry: 100mm 3.6N/mm^2 solid block (SF>2.0), class (iii) mortar, normal const/normal mfr
Local design strength (factored) = 3.5/3.5 = 1.00N/mm^2 (BS5628-1:2005 Table 2d/2e)

R1: 700 x 100 mm padstone

Factored reaction = 49.69 x 1.4 + 0.00 x 1.6 = 69.56 kN

Factored stress under padstone = 69.56 x 1000/700 x 100 = 0.99 N/mm^2

R2 as R1

Beam: Beam 1

9.1 m. span

Section : **305 x 305 x 198 UC** S355

Zxx = 3,000 cm^3 Shear area = 6,492 mm^2

Analysis ***(all loads applied)***

From	*B.M.*	f_{bc}	*S.F.*	f_s	*Deflection mm.*		
R1 m.	*kNm*	N/mm^2	*kN*	N/mm^2	*Dead*	*Live*	*Total*
0.000	0.0	0.00	49.69	7.653	0.00	0.00	0.00
0.455	21.5	7.16	44.72	6.888	1.49	0.00	1.49
0.910	40.7	13.56	39.75	6.123	2.93	0.00	2.93
1.365	57.6	19.22	34.78	5.357	4.30	0.00	4.30
1.820	72.3	24.11	29.81	4.592	5.55	0.00	5.55
2.275	84.8	28.26	24.84	3.827	6.66	0.00	6.66
2.730	94.9	31.65	19.87	3.061	7.60	0.00	7.60
3.185	102.9	34.29	14.91	2.296	8.35	0.00	8.35
3.640	108.5	36.17	9.94	1.531	8.90	0.00	8.90
4.095	111.9	37.30	4.97	0.765	9.23	0.00	9.23
4.550	113.0	37.68	0.00	0.000	9.34	0.00	9.34
5.005	111.9	37.30	-4.97	-0.765	9.23	0.00	9.23
5.460	108.5	36.17	-9.94	-1.531	8.90	0.00	8.90
5.915	102.9	34.29	-14.91	-2.296	8.35	0.00	8.35
6.370	94.9	31.65	-19.87	-3.061	7.60	0.00	7.60
6.825	84.8	28.26	-24.84	-3.827	6.66	0.00	6.66
7.280	72.3	24.11	-29.81	-4.592	5.55	0.00	5.55
7.735	57.6	19.22	-34.78	-5.357	4.30	0.00	4.30
8.190	40.7	13.56	-39.75	-6.123	2.93	0.00	2.93
8.645	21.5	7.16	-44.72	-6.888	1.49	0.00	1.49
9.100	0.0	0.00	-49.69	-7.653	0.00	0.00	0.00