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Site: Land Adjacent to Park House, Glenfield

Job: New Maintenance Building

Job number: 7406

SuperBeam 7.03a 440365

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Beam: Beam 2

Span: 8.4 m.

|                      | Load name | Loading w1 | Start x1 | Loading w2 | End x2 | R1comp       | R2comp       |
|----------------------|-----------|------------|----------|------------|--------|--------------|--------------|
| U D                  | o.w.      | 1.95       | 0        |            | L      | 8.19         | 8.19         |
| U L                  | Roof      | 8.52       | 0        |            | L      | 35.78        | 35.78        |
| Total load: 87.95 kN |           |            |          |            |        | <b>43.97</b> | <b>43.97</b> |
| Dead:                |           |            |          |            |        | 8.19         | 8.19         |
| Live:                |           |            |          |            |        | 35.78        | 35.78        |

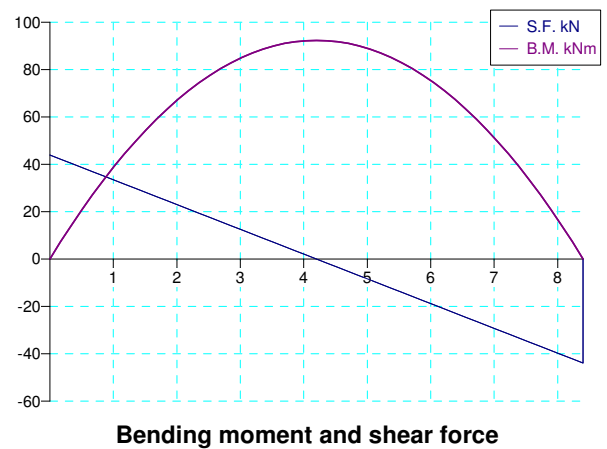
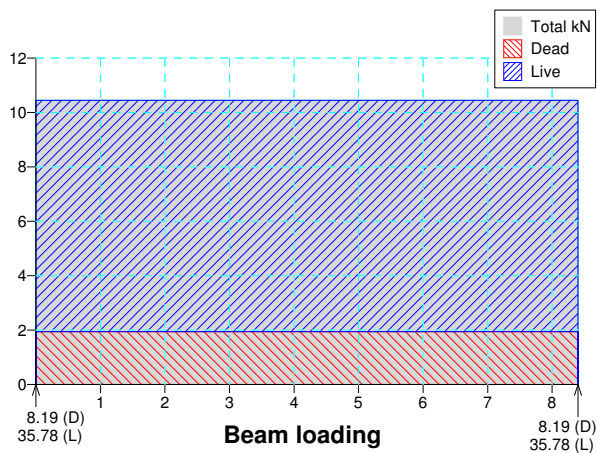
Load types: U: UDL D: Dead; L: Live (positions in m. from R1)

Maximum B.M. = 92.3 kNm at 4.20 m. from R1

Maximum S.F. = -44.0 kN at R2

Live load deflection =  $552 \times 10^8 / EI$  at 4.20 m. from R1 ( $E$  in  $N/mm^2$ ,  $I$  in  $cm^4$ )

Total deflection =  $679 \times 10^8 / EI$  at 4.20 m. from R1



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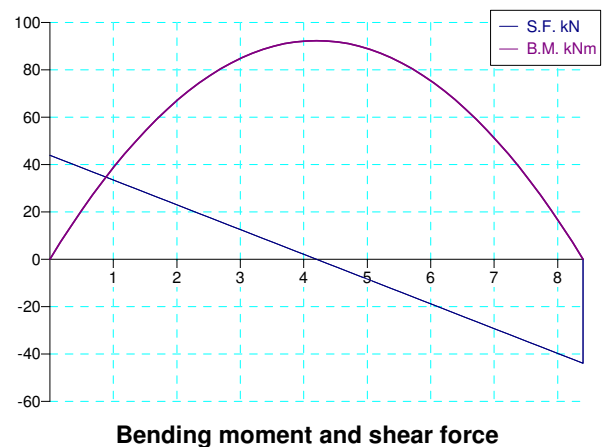
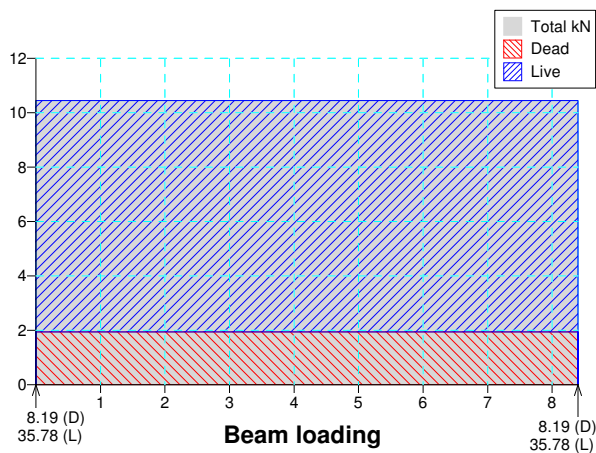
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Steel beam calculation to BS449 Part 2 using S355 steel

**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  $I_x=50,900$  cm<sup>4</sup>  $r_y=8.04$  cm  $Z_x=3,000$  cm<sup>3</sup>

Bending:  $L_E/r_y = 8.40 \times 100/8.04 = 104$   $D/T = 10.8$

Permissible bending stress,  $p_{bc} = 193.7$  N/mm<sup>2</sup> (Table 3b)

Actual bending stress,  $f_{bc} = 92.3 \times 1000/3000.0 = 30.8$  N/mm<sup>2</sup> OK

Shear: Maximum shear in web,  $f_s = 44.0 \times 1000/(19.1 \times 339.9) = 6.8$  N/mm<sup>2</sup> OK

Beam web: Check unstiffened web capacity with load of 43.97 kN

Bearing:  $p_b = 260$  N/mm<sup>2</sup> (Table 9);  $C1 = 401$  kN;  $C2 = 4.97$  kN/mm

Buckling:  $p_c = 204$  N/mm<sup>2</sup> (Table 17b);  $C1 = 661$  kN;  $C2 = 3.89$  kN/mm

Minimum required stiff bearing length,  $L_b = 0$  mm

Bearing capacity,  $P_w = C1 + L_b \cdot C2 = 401$  kN <<<

Buckling capacity,  $P_x = C1 + L_b \cdot C2 = 661$  kN

Deflection: Live load deflection =  $552 \times 1e8/(205,000 \times 50,900) = 5.3$  mm (L/1587) OK

Total deflection =  $679 \times 1e8/(205,000 \times 50,900) = 6.5$  mm (L/1292)

Combined bending and shear check (14.c):  $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.025$  at 4.20 m. ( $\leq 1.25$  OK)

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## **Bearings**

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

Local design strength of masonry (factored) =  $1.00$  N/mm<sup>2</sup> (User-entered value)

### **R1: 700 x 100 mm padstone**

Factored reaction =  $8.19 \times 1.4 + 35.78 \times 1.6 = 68.72$  kN

Factored stress under padstone =  $68.72 \times 1000 / 700 \times 100 = 0.98$  N/mm<sup>2</sup>

**R2 as R1**

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Beam: Beam 2

8.4 m. span

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

Zxx = 3,000 cm<sup>3</sup> Shear area = 6,492 mm<sup>2</sup>

**Analysis (all loads applied)**

| <i>From</i>  | <i>B.M.</i> | <i>f<sub>bc</sub></i>   | <i>S.F.</i> | <i>f<sub>s</sub></i>    | <i>Deflection mm.</i> |             |              |
|--------------|-------------|-------------------------|-------------|-------------------------|-----------------------|-------------|--------------|
| <i>R1 m.</i> | <i>kNm</i>  | <i>N/mm<sup>2</sup></i> | <i>kN</i>   | <i>N/mm<sup>2</sup></i> | <i>Dead</i>           | <i>Live</i> | <i>Total</i> |
| 0.000        | 0.00        | 0.00                    | 43.97       | 6.773                   | 0.00                  | 0.00        | 0.00         |
| 0.420        | 17.55       | 5.85                    | 39.58       | 6.096                   | 0.19                  | 0.84        | 1.04         |
| 0.840        | 33.24       | 11.08                   | 35.18       | 5.419                   | 0.38                  | 1.66        | 2.04         |
| 1.260        | 47.10       | 15.70                   | 30.78       | 4.741                   | 0.56                  | 2.43        | 2.99         |
| 1.680        | 59.10       | 19.70                   | 26.38       | 4.064                   | 0.72                  | 3.14        | 3.86         |
| 2.100        | 69.26       | 23.09                   | 21.99       | 3.387                   | 0.86                  | 3.77        | 4.63         |
| 2.520        | 77.57       | 25.86                   | 17.59       | 2.709                   | 0.99                  | 4.30        | 5.29         |
| 2.940        | 84.03       | 28.01                   | 13.19       | 2.032                   | 1.08                  | 4.73        | 5.81         |
| 3.360        | 88.65       | 29.55                   | 8.79        | 1.355                   | 1.15                  | 5.04        | 6.19         |
| 3.780        | 91.42       | 30.47                   | 4.40        | 0.677                   | 1.20                  | 5.23        | 6.43         |
| 4.200        | 92.35       | 30.78                   | 0.00        | 0.000                   | 1.21                  | 5.29        | 6.50         |
| 4.620        | 91.42       | 30.47                   | -4.40       | -0.677                  | 1.20                  | 5.23        | 6.43         |
| 5.040        | 88.65       | 29.55                   | -8.79       | -1.355                  | 1.15                  | 5.04        | 6.19         |
| 5.460        | 84.03       | 28.01                   | -13.19      | -2.032                  | 1.08                  | 4.73        | 5.81         |
| 5.880        | 77.57       | 25.86                   | -17.59      | -2.709                  | 0.99                  | 4.30        | 5.29         |
| 6.300        | 69.26       | 23.09                   | -21.99      | -3.387                  | 0.86                  | 3.77        | 4.63         |
| 6.720        | 59.10       | 19.70                   | -26.38      | -4.064                  | 0.72                  | 3.14        | 3.86         |
| 7.140        | 47.10       | 15.70                   | -30.78      | -4.741                  | 0.56                  | 2.44        | 2.99         |
| 7.560        | 33.24       | 11.08                   | -35.18      | -5.419                  | 0.38                  | 1.66        | 2.04         |
| 7.980        | 17.55       | 5.85                    | -39.58      | -6.096                  | 0.19                  | 0.84        | 1.04         |
| 8.400        | 0.00        | 0.00                    | -43.97      | -6.773                  | 0.00                  | 0.00        | 0.00         |