

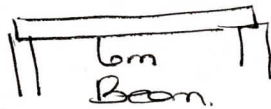
Concrete Example

Information Usually given

①

Double Garage - Reinforced Concrete beam. to form sunroof. 6m long beams

About the Beam



Beam span $L = 6\text{m}$ - (Taken from question)

Beam Width $b = 150\text{mm}$

Beam depth $h = 300\text{mm}$ (Using same beam as example)

Loads, forces + moments

Uniformly distributed load - 0.3 kN/m^2

Point load (placed in centre of beam) - 1.2 kN

(Use big assignment help document to find the figures you should use here)

From Design Standards

use these figures

Calculations

characteristic concrete strength $f_{ck} = 40\text{ N/mm}^2$

Concrete material (safety) factor $\gamma_{Mc} = 1.5$

Therefore design concrete strength $f_{cd} = \frac{f_{ck}}{\gamma_{Mc}} = \frac{40}{1.5}$

Reinforcement yield strength $f_{yk} = 500\text{ N/mm}^2$

Steel material (safety) factor $\gamma_{Ms} = 1.15$

Therefore design steel strength $f_{yd} = \frac{f_{yk}}{\gamma_{Ms}} = \frac{500}{1.15} = 434.78\text{ N/mm}^2$

Above taken from sheet, design + Eurocodes

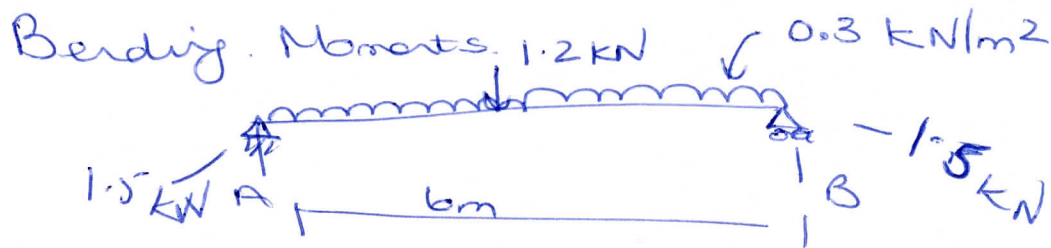
Uniform distributed load of 0.3 kN/m^2

(2)

Point load of 1.2 kN

(from assignment help)

Beam span $L = 6 \text{ m}$ (from question/drawing)



$$\text{UDL Force} = 0.3 \times 6 = 1.8 \text{ kN}$$

$$\text{Point load} = 1.2$$

$$\text{Total force (downwards)} = 1.8 + 1.2 = 3 \text{ kN}$$

Symmetrical. $\therefore$

$$\text{Upwards force} = 3$$

$$\therefore A = 3 \div 2 = 1.5 \text{ kN}$$

$$B = 3 \div 2 = 1.5 \text{ kN}$$

Maximum bending moment for UDL

$$M = \frac{WL^2}{8} = \frac{0.3 \times 6^2}{8} = \frac{10.8}{8} = 1.35 \text{ kNm}$$
$$= 13500000 \text{ Nmm}$$

Maximum bending moment for point load

$$M = 1.5 \times 3 = 4.5 \text{ kNm}$$
$$= 45000000 \text{ Nmm}$$

$$\text{Add together } 45000000 + 13500000$$
$$= 58.500000 \text{ Nmm}$$

Referring to Figure 3 $d = h$ - nominal for -

$$\text{Link diameter} = \frac{300}{\text{mm}} - \frac{40}{\text{mm}} - \frac{10}{\text{mm}} = \frac{250}{\text{mm}}$$

(Use same beam as on sheet)

$$k' = 0.168 \text{ (Eurocodes)}$$

You need to calculate

Flow chart

(3)

1. Start

2. Moment Calculated (5850000 Nmm)

3. Concrete class $\leq C_{F0}/C_{60}$ = Yes C40 to be used.

$$4. k = \frac{M}{bd^2 f_{ck}} = \frac{5850000}{150 \times 250^2 \times 40}$$
$$= \frac{5850000}{375000000}$$
$$= 0.0156$$

5. $k \leq k'$? = Yes $0.0156 \leq 0.168$

6. No Compression reinforcement required.

$$7. z = \frac{d}{2} \left[1 + \sqrt{1 - 3.53k} \right]$$
$$= \frac{250}{2} \left[1 + \sqrt{1 - 3.53 \times 0.0156} \right]$$
$$= 125 (1 + \sqrt{0.944932})$$
$$= 125 (1 + 0.9720761287)$$
$$125 \times 1.9720761287$$
$$= \underline{246.509 \text{ mm}}$$

$$8. A_s = \frac{M}{f_{yd} \times z} = \frac{5850000}{434.78 \times 246.509}$$
$$= \frac{5850000}{107177.4074} = 54.58239886$$
$$= \underline{54.58 \text{ mm}^2}$$

9. Use of

$$1 \times 10 \text{ mm bar} = 1 \times 78.5 = 78.5 \text{ mm}^2$$
$$2 \times 8 \text{ mm bar} = 2 \times 50.3 = 100.6 \text{ mm}^2$$
$$\text{or } 2 \times 6 \text{ mm bar} = 2 \times 28.3 = 56.6 \text{ mm}^2$$