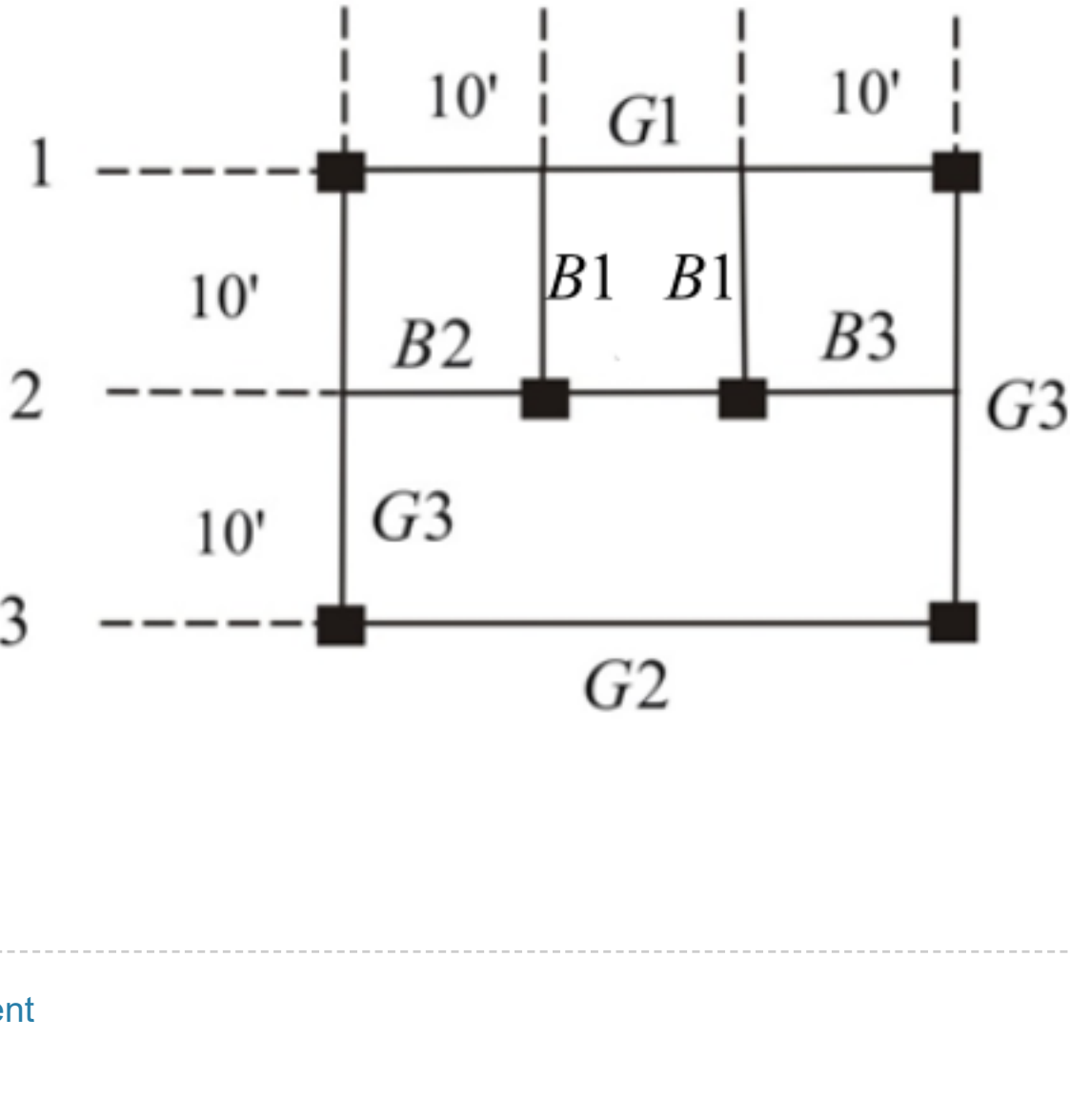


Statics and Strength of Materials for Architecture and Building Construction | (3rd Edition)

Step-by-step solution

Step 1 of 25

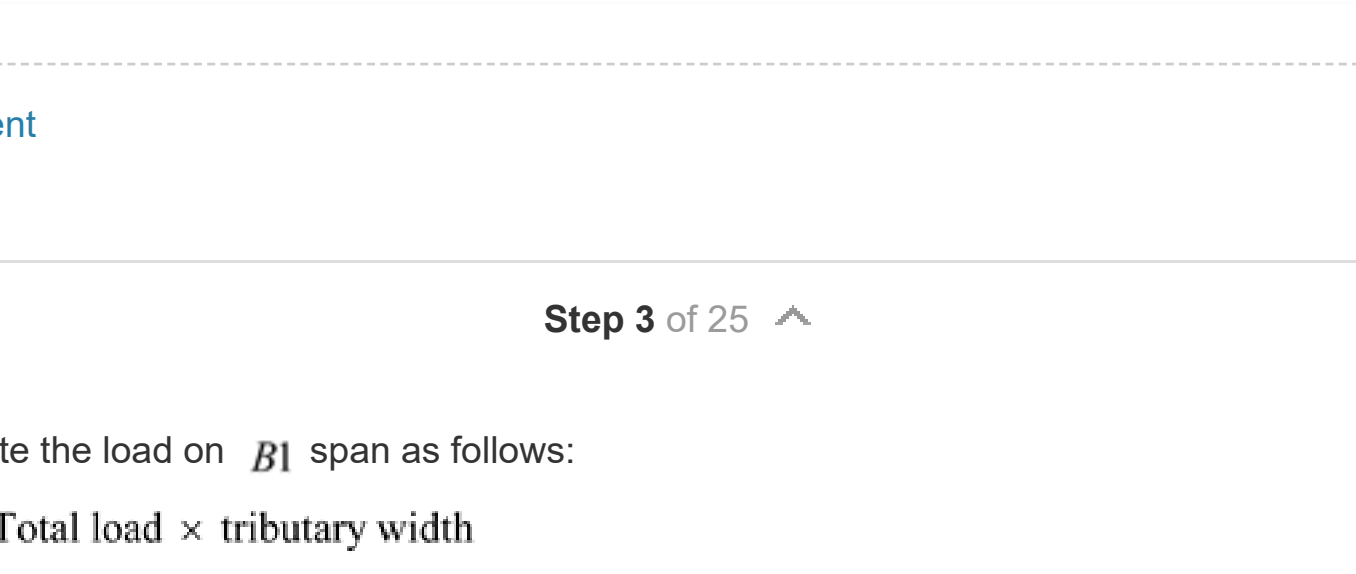
Represent the floor frame as shown below:



Comment

Step 2 of 25

Draw the free body diagram of the beam B_1 as shown below:



Comment

Step 3 of 25

Calculate the load on B_1 span as follows:

$$w_{B1} = \text{Total load} \times \text{tributary width}$$

Substitute 50 psf for Total load and $\frac{10}{2}$ ft for tributary width.

$$\begin{aligned} w_{B1} &= 50 \times \frac{10}{2} \\ &= 250 \text{ lb/ft} \end{aligned}$$

Comments (1)

Step 4 of 25

Calculate the support reaction for span B_1 as follows:

$$R = \frac{w_{B1} l_{B1}}{2}$$

Here, l_{B1} is the length of the beam B_1 .

Substitute 250 lb/ft for w_{B1} and 10 ft for l_{B1} .

$$\begin{aligned} R &= \frac{250 \times 10}{2} \\ &= 1250 \text{ lb} \end{aligned}$$

Therefore, the reaction on span B_1 is **1250 lb**.

Comments (1)

Step 5 of 25

Draw the free body diagram of the beam B_2 as shown below:



Comment

Step 6 of 25

Calculate the load on B_2 span as follows:

$$w_{B2} = \text{Total load} \times \text{tributary width}$$

Substitute 50 psf for Total load and $\frac{10}{2}$ ft for tributary width.

$$\begin{aligned} w_{B2} &= 50 \times \frac{10}{2} \\ &= 250 \text{ lb/ft} \end{aligned}$$

Comment

Step 7 of 25

Calculate the support reaction for span B_2 as follows:

$$R = \frac{w_{B2} l_{B2}}{2}$$

Substitute 250 lb/ft for w_{B2} and 10 ft for l_{B2} .

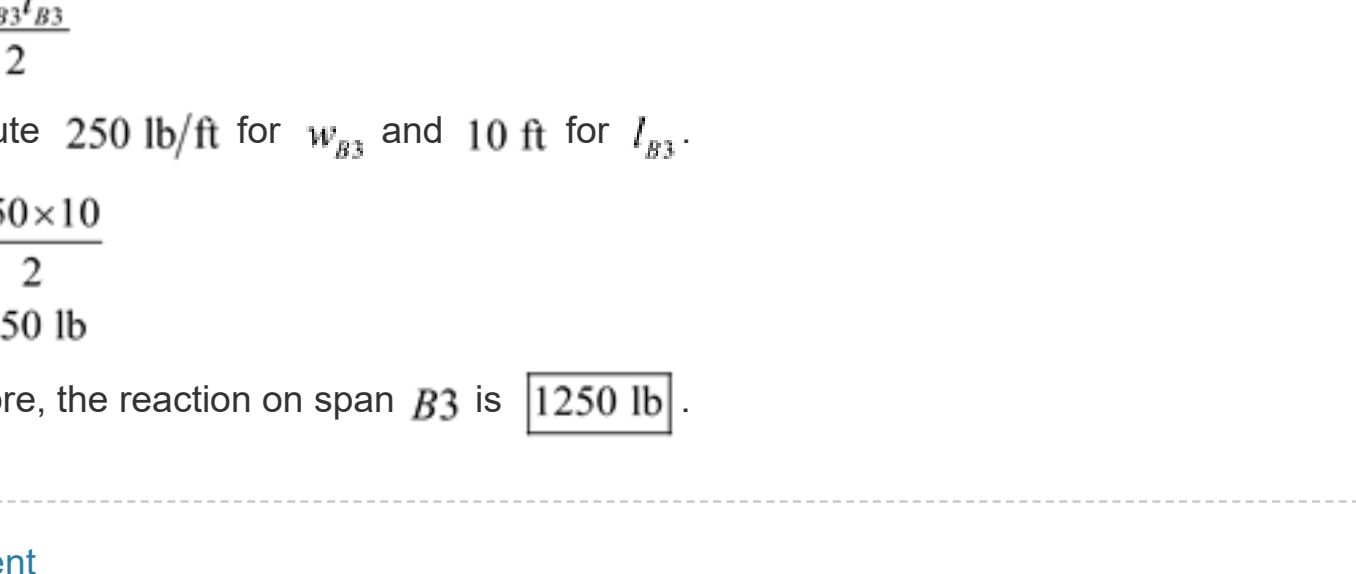
$$\begin{aligned} R &= \frac{250 \times 10}{2} \\ &= 1250 \text{ lb} \end{aligned}$$

Therefore, the reaction on span B_2 is **1250 lb**.

Comment

Step 8 of 25

Draw the free body diagram of the beam B_3 as shown below:



Comment

Step 9 of 25

Calculate the load on B_3 span as follows:

$$w_{B3} = \text{Total load} \times \text{tributary width}$$

Substitute 50 psf for Total load and $\frac{10}{2}$ ft for tributary width.

$$\begin{aligned} w_{B3} &= 50 \times \frac{10}{2} \\ &= 250 \text{ lb/ft} \end{aligned}$$

Comment

Step 10 of 25

Calculate the support reaction for span B_3 as follows:

$$R = \frac{w_{B3} l_{B3}}{2}$$

Substitute 250 lb/ft for w_{B3} and 10 ft for l_{B3} .

$$\begin{aligned} R &= \frac{250 \times 10}{2} \\ &= 1250 \text{ lb} \end{aligned}$$

Therefore, the reaction on span B_3 is **1250 lb**.

Comment

Step 11 of 25

Calculate the load on G_1 girder as follows:

$$w_{G1} = \text{Total load} \times \text{tributary width}$$

Substitute 50 psf for Total load and $\frac{10}{2}$ ft for tributary width.

$$\begin{aligned} w_{G1} &= 50 \times \frac{10}{2} \\ &= 250 \text{ lb/ft} \end{aligned}$$

Comment

Step 12 of 25

Calculate the support reaction for span G_1 as follows:

$$R = \frac{w_{G1} l_{G1}}{2}$$

Substitute 250 lb/ft for w_{G1} and 10 ft for l_{G1} .

$$\begin{aligned} R &= \frac{250 \times 10}{2} \\ &= 1250 \text{ lb} \end{aligned}$$

Therefore, the reaction on span G_1 is **1250 lb**.

Comment

Step 13 of 25

Calculate the load on G_2 girder as follows:

$$w_{G2} = \text{Total load} \times \text{tributary width}$$

Substitute 50 psf for Total load and $\frac{10}{2}$ ft for tributary width.

$$\begin{aligned} w_{G2} &= 50 \times \frac{10}{2} \\ &= 250 \text{ lb/ft} \end{aligned}$$

Comment

Step 14 of 25

Calculate the support reaction for span G_2 as follows:

$$R = \frac{w_{G2} l_{G2}}{2}$$

Substitute 250 lb/ft for w_{G2} and 30 ft for l_{G2} .

$$\begin{aligned} R &= \frac{250 \times 30}{2} \\ &= 3750 \text{ lb} \end{aligned}$$

Therefore, the reaction on span G_2 is **3750 lb**.

Comment

Step 15 of 25

Calculate the load on G_3 girder of 20 ft as follows:

$$w_{G3} = \text{Total load} \times \text{tributary width}$$

Substitute 50 psf for Total load and $\frac{10}{2}$ ft for tributary width.

$$\begin{aligned} w_{G3} &= 50 \times \frac{10}{2} \\ &= 250 \text{ lb/ft} \end{aligned}$$

Comment

Step 16 of 25

Calculate the support reaction for span G_3 girder of 20 ft as follows:

$$R = \frac{w_{G3} l_{G3}}{2}$$

Substitute 250 lb/ft for w_{G3} and 20 ft for l_{G3} .

$$\begin{aligned} R &= \frac{250 \times 20}{2} \\ &= 2500 \text{ lb} \end{aligned}$$

Therefore, the reaction on span G_3 girder of 20 ft is **3750 lb**.

Comment

Step 17 of 25

Calculate the load on G_3 girder of 10 ft as follows:

$$w_{G3} = \text{Total load} \times \text{tributary width}$$

Substitute 50 psf for Total load and $\frac{10}{2}$ ft for tributary width.

$$\begin{aligned} w_{G3} &= 50 \times \frac{10}{2} \\ &= 250 \text{ lb/ft} \end{aligned}$$

Comment

Step 18 of 25

Calculate the support reaction for span G_3 girder of 10 ft as follows:

$$R = \frac{w_{G3} l_{G3}}{2}$$

Substitute 250 lb/ft for w_{G3} and 10 ft for l_{G3} .

$$\begin{aligned} R &= \frac{250 \times 10}{2} \\ &= 1250 \text{ lb} \end{aligned}$$

Therefore, the reaction on span G_3 girder of 10 ft is **1250 lb**.

Comment

Step 19 of 25

Calculate the load on column A_1 as follows:

$$C_{A1} = G_1 + G_3$$

Substitute 1250 lb for G_1 and 2500 lb for G_3 .

$$\begin{aligned} C_{A1} &= 1250 + 2500 \\ &= 3750 \text{ lb} \end{aligned}$$

Therefore, load on column A_1 is **3750 lb**.

Comment

Step 20 of 25

Calculate the load on column A_3 as follows:

$$C_{A3} = G_3 + G_2$$

Substitute 1250 lb for G_3 and 3750 lb for G_2 .

$$\begin{aligned} C_{A3} &= 1250 + 3750 \\ &= 5000 \text{ lb} \end{aligned}$$

Therefore, load on column A_3 is **5000 lb**.

Comment

Step 21 of 25

Calculate the load on column B_2 as follows:

$$C_{B2} = B_1 + B_2 + 1250 \text{ (load from beam parallel to } G_1)$$

Substitute 1250 lb for B_1 and 1250 lb for B_2 .

$$\begin{aligned} C_{B2} &= 1250 + 1250 + 1250 \\ &= 3750 \text{ lb} \end{aligned}$$

Therefore, load on column B_2 is **3750 lb**.

Comment

Step 22 of 25

Calculate the load on column C_2 as follows:

$$C_{C2} = B_1 + B_3 + 1250 \text{ (load from beam parallel to } G_1)$$

Substitute 1250 lb for B_1 and 1250 lb for B_3 .

$$\begin{aligned} C_{C2} &= 1250 + 1250 + 1250 \\ &= 3750 \text{ lb} \end{aligned}$$

Therefore, load on column C_2 is **3750 lb**.

Comment

Step 23 of 25

Calculate the load on column D_1 as follows:

$$C_{D1} = G_1 + G_3$$

Substitute 1250 lb for G_1 and 2500 lb for G_3 .

$$\begin{aligned} C_{D1} &= 1250 + 2500 \\ &= 3750 \text{ lb} \end{aligned}$$

Therefore, load on column D_1 is **3750 lb**.

Comment

Step 24 of 25

Calculate the load on column D_3 as follows:

$$C_{D3} = G_3 + G_2$$

Substitute 3750 lb for G_2 and 1250 lb for G_3 .

$$\begin{aligned} C_{D3} &= 1250 + 3750 \\ &= 5000 \text{ lb} \end{aligned}$$

Therefore, load on column D_3 is **5000 lb**.

Comment

Tabulate the calculated loads on beams, columns, and girders as shown below:

Span:	
B_1	1,250 lb
B_2	1,250 lb
B_3	1,250 lb
Girders:	
G_1	1,250 lb
G_2	3,750 lb
G_3	1,250 lb/2,500 lb
Columns:	
A_1	3,750 lb
A_3	5,000 lb
B_2	3,750 lb
C_2	3,750 lb
D_1	3,750 lb
D_3	5,000 lb

Comment

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