Detailed Engineering Report: Simply Supported Beam Analysis

Osdag Internship Project - Advanced Module

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1 Executive Summary

This comprehensive report details the structural response of a simply supported beam. The analysis evaluates reactions at supports and internal force distributions (Shear and Moment) based on the specified loading conditions. The beam has a total span of 15.00 meters and is subjected to 1 distinct loading elements.

Key findings include:

- Total applied downward force: 90.00 kN

- Maximum Shear Force: 45.00 kN at x = 0.00 m

- Maximum Bending Moment: 168.75 kNm at x = 7.48 m

2 Methodology

The analysis is performed using the principles of static equilibrium. The beam is discretized into 500 segments to ensure high resolution in the resulting diagrams.

2.1 Global Equilibrium

The support reactions R_A and R_B are calculated by taking moments about support A:

$$\sum M_A = 0 R_B \cdot L = \sum (P_i \cdot x_i) + \sum (w_j \cdot L_j \cdot x_{centroid,j})$$

Once R_B is determined, R_A is found using vertical force balance:

$$\sum F_y = 0 R_A = \sum Load_{Total} - R_B$$

2.2 Internal Forces

At any section x, the shear force $V(x)$ and bending moment $M(x)$ are derived as:

$$V(x) = R_A - \int_0^x w(x)\,dx - \sum P_i|_{x_i<x}$$

$$M(x) = R_A \cdot x - \int_0^x w(x)(x-\xi)\,d\xi - \sum P_i(x-x_i)|_{x_i<x}$$

3 Input Data

The loading data extracted from the Excel file is shown below.

3.1 Load Table

Load Type	Magnitude (kN)	Position (m)	Start Position (m)	End Position (m)
UDL	6	NaN	0	15

Table 1: Load Configuration

4 Analysis & Visualizations

The structural analysis yielded the following support reactions:

R_A **(Left Support):** 45.00 kN

R_B **(Right Support):** 45.00 kN

4.1 Shear Force Diagram (SFD)

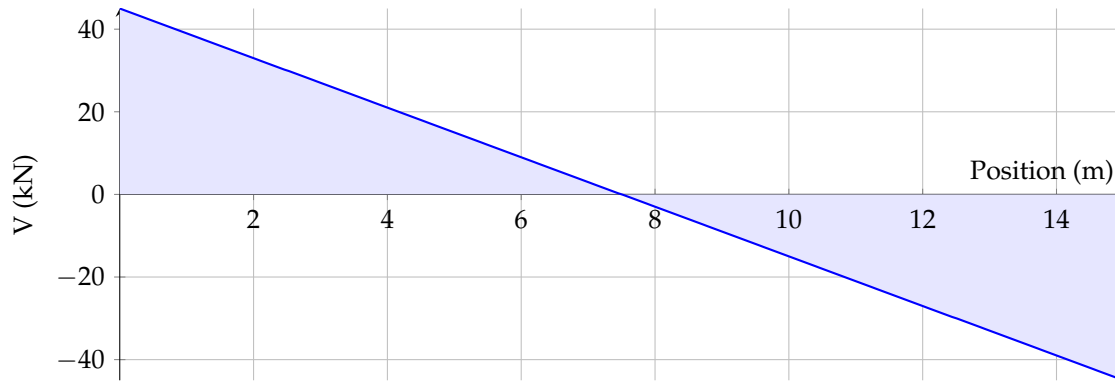The maximum absolute shear force is 45.00 kN, occurring at 0.00 m.

Figure 1: Shear Force Diagram (SFD)

4.2 Bending Moment Diagram (BMD)

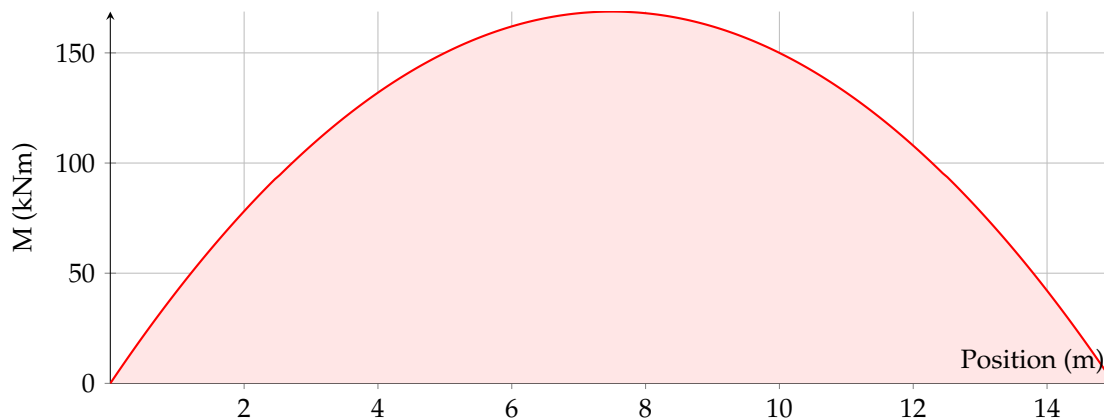The maximum absolute bending moment (critical section) is 168.75 kNm, occurring at 7.48 m.

Figure 2: Bending Moment Diagram (BMD)

5 Conclusion

The analysis of the simply supported beam has been successfully completed. The resulting SFD and BMD provide the necessary internal force distributions for further structural design, such as reinforcement calculation or section selection. Special attention should be given to the section at x = 7.48 m, where the bending moment is maximized.

End of Engineering Report