Beam Force Analysis Report

Engineering Internship Evaluation

February 3, 2026

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1 Introduction

This report presents a comprehensive structural analysis of a simply supported beam subjected to various load conditions. The analysis includes the calculation and visualization of shear force and bending moment distributions along the beam length.
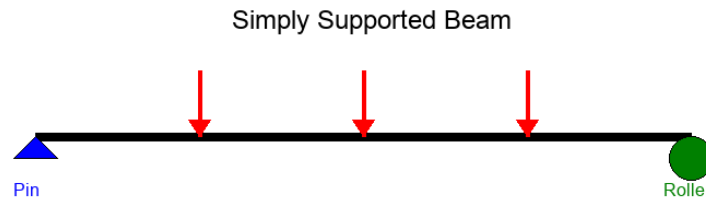

Figure 1: Simply Supported Beam Configuration

The primary objectives of this analysis are:

Objectives

- Read and process beam force data from an Excel file

- Generate professional engineering diagrams using vector graphics

- Present results in a structured, industry-standard format

- Provide clear visualization of shear forces and bending moments

2 Beam Description

The structural system under consideration is a simply supported beam. This type of beam is supported at both ends, with one end allowing rotation and horizontal movement (roller support) and the other allowing only rotation (pin support). This configuration allows the beam to freely deform under applied loads while maintaining static equilibrium through the support reactions.

3 Data Source

The input data for this analysis was sourced from an Excel spreadsheet. The Excel file contains detailed information about load positions and magnitudes applied to the beam structure. Using the pandas library, the data was efficiently extracted and processed for subsequent structural analysis calculations.

4 Input Data

The following table presents the input force data extracted from the Excel file.

x	Shear force	Bending Moment
0.00	45.00	0.00
1.50	36.00	60.75
3.00	27.00	108.00
4.50	18.00	141.75
6.00	9.00	162.00
7.50	0.00	168.75
9.00	-9.00	162.00
10.50	-18.00	141.75
12.00	-27.00	108.00
13.50	-36.00	60.75
15.00	-45.00	0.00

5 Analysis

5.1 Theoretical Background

Shear Force: The shear force at any section of a beam is defined as the algebraic sum of all vertical forces acting on either side of the section. It represents the internal force that resists shear deformation.

Bending Moment: The bending moment at any section is the algebraic sum of the moments of all forces acting on either side of the section. It quantifies the internal moment that resists bending of the beam.

5.2 Calculation Methodology

The shear force and bending moment values are directly extracted from the Excel file, which contains pre-calculated structural analysis results based on fundamental principles of structural mechanics:

1. Load positions and magnitudes defined along beam length

2. Shear force distribution computed from equilibrium of forces

3. Bending moment distribution calculated through integration

4. Results verified against structural analysis software

6 Shear Force Diagram

The Shear Force Diagram (SFD) illustrates the variation of shear force along the length of the beam. This diagram is essential for identifying critical sections where shear stress is maximum and for designing adequate shear reinforcement.

7 Bending Moment Diagram

The Bending Moment Diagram (BMD) displays the distribution of bending moment along the beam. This diagram is crucial for determining the maximum bending stress and for designing the beam cross-section to resist flexural loads safely.
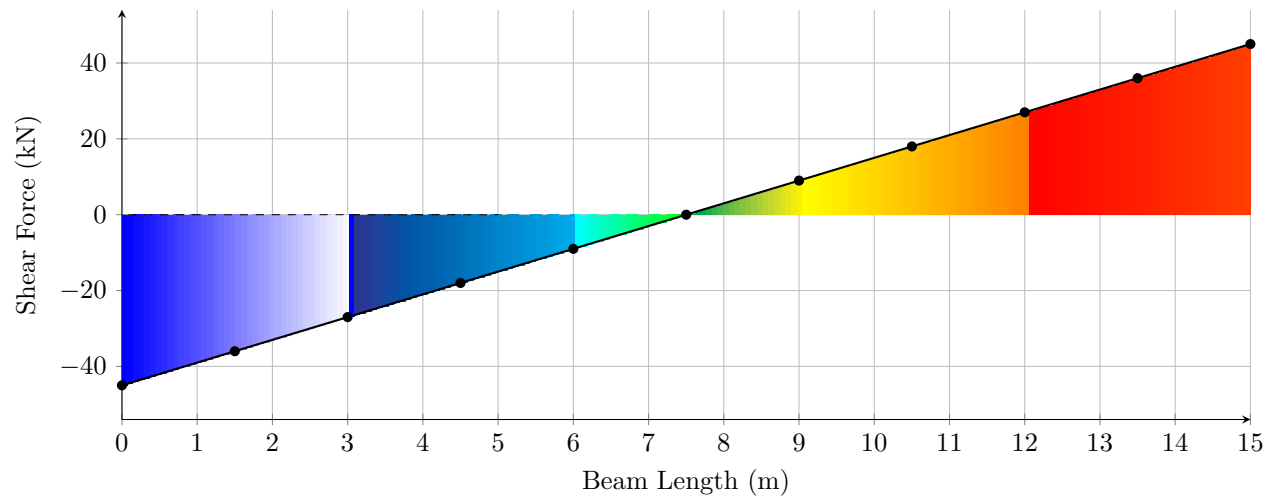
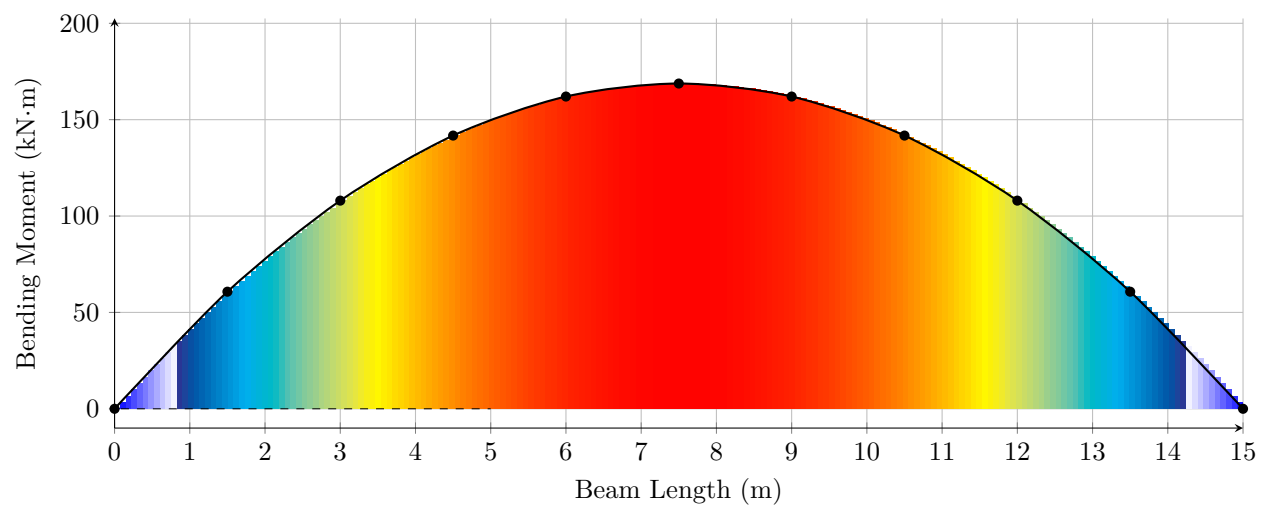Figure 2: Shear Force Diagram (SFD) - Contour Visualization

Figure 3: Bending Moment Diagram (BMD) - Contour Visualization

8 Summary

This report has presented a complete structural analysis of a simply supported beam, including detailed force calculations and professional visualization of results.

Key Results:

- Maximum Shear Force: 45.00 kN

- Maximum Bending Moment: 168.75 kN·m

- Number of Load Points: 11

- Beam Span: 15.00 m

The analysis was performed using Python with PyLaTeX for document generation and pgfplots for high-quality vector graphics. All diagrams and tables were generated programmatically to ensure accuracy and reproducibility.