Experiment No. 1 – Beam Reactions

Objective:

The objective of this lab is to determine the reactions at the supports of a simply-supported beam for various conditions of loading.

Protective laboratory practices and personal equipment:

- Undergraduate students and teaching assistants are required to wear *substantial footwear* (footwear made of a solid material which completely encloses the foot.) Open toe or open heel sandals or shoes are not acceptable.
- No food or drinks are allowed in the lab.
- Students are required to remain within the designated area confined to the "Mechanics of Materials" lab (CBY E07).

Equipment:

- An aluminium beam of 1,220-mm length;
- Two supporting frames;
- Weights to apply external load; and,
- Two spring balances located at the supports.

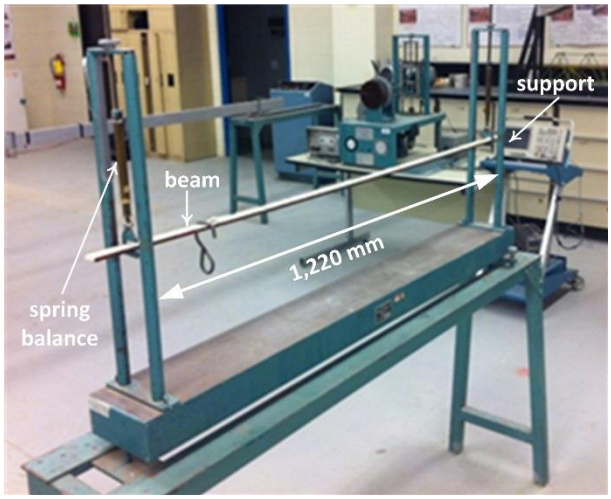

Figure 1: Beam reaction apparatus

Figure 2: Measuring spring balance

Procedure:

1. To investigate the reactions of a simply supported beam subjected to concentrated loads, the apparatus is assembled as shown in Fig. 1. The beam can be set level by adjusting the screws provided. Make sure to take the initial readings of each spring balance (Fig. 2).

2. Apply a single concentrated load P = 5.35 lb at various distances "a" from the left support A and read both reactions R_A and R_B (case 1 in Fig. 3). Record readings in Table 1.

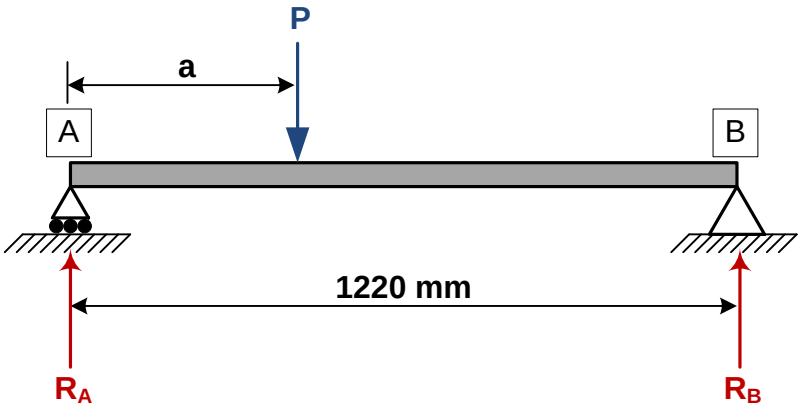

Figure 3: Load condition case 1

3. Repeat the measurements with two simultaneous loads P_1 = 2.35 lb and P_2 = 5.35 lb at various distances "a" from each support A and B (case 2 in Fig. 4). Record readings in Table 2.

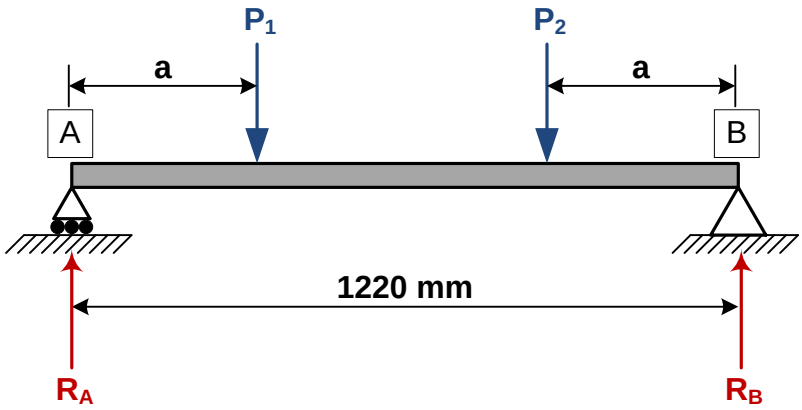

Figure 4: Load condition case 2

4. Try the case in which the beam has an overhang outside one support, and on which a load P = 2.35 lb is applied at a distance a = 6 in, as shown in Fig. 5. Record readings in Table 3.

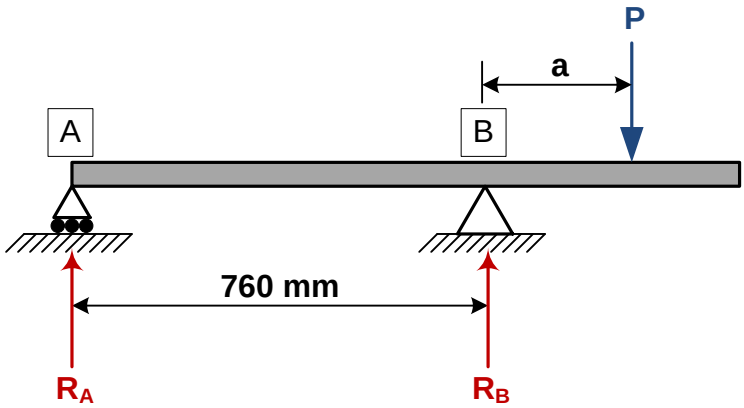

Figure 5: Load condition case 3

Observations:

Table 1: Readings from load condition case 1 (Fig. 3)

		R_A (lb)	R_B (lb)
Initial reading			
Distance a (in)	**(mm)**	**R_A (lb)**	**R_B (lb)**
6	152		
12	305		
18	457		
24	610		
30	762		
36	914		
42	1,067		

Table 2: Readings from load condition case 2 (Fig. 4)

		R_A (lb)	R_B (lb)
Initial reading			
Distance a (in)	**(mm)**	**R_A (lb)**	**R_B (lb)**
6	152		
12	305		
18	457		

Table 3: Readings from load condition case 3 (Fig. 5)

		R_A (lb)	R_B (lb)
Initial reading			
Distance a (in)	**(mm)**	**R_A (lb)**	**R_B (lb)**
6	152		

Report:

The report should include the following:

1. The measured support reactions for each of the loading cases (1-3). Note that the initial readings have to be subtracted from the measured values.
2. The calculated support reactions for each of the loading cases (1-3).
3. A comparison between measured and calculated support reactions for each of the loading cases (1-3). Report the % error.

Follow the organization and formatting provided in the "Guide for writing laboratory reports." All values in the report should be reported in SI units. Note: 1 in = 25.4 mm, 1 lb = 4.45 N.

You are required to submit a pdf file through Blackboard Learn. The deadline for submission is two weeks after your group has performed the experiment.