

Engineering Applications

Mechanics

TIM BARNETT

SE32403

00361755

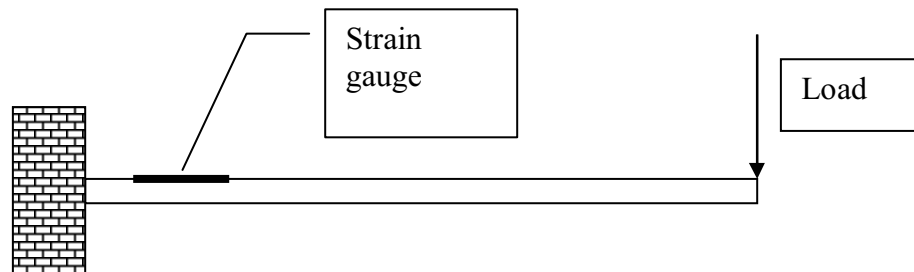
Log entry 1

Experiment 1

The experiment is to calculate the stress in a beam and compare these results with actual results found.

The equipment used: -

- Strain gauge
- Metal bar
- Weights in 1kg increments
- G-clamp
- Weighted hook
- Vichy Strain Bridge



The metal bar, complete with the weighted hook is clamped to the table, and then the strain gauge is connected to the strain bridge and zeroed. So as not to get any false readings.

Weights are added in 1kg increments and readings are taken off the strain bridge. This tells us how much strain the bar is under as we load it up.

Results are as follows

Weight loaded	Strain
1 kg	51 *10 ⁻⁶
2 kg	102 *10 ⁻⁶
3 kg	153 *10 ⁻⁶
4 kg	202 *10 ⁻⁶
5 kg	253 *10 ⁻⁶

As you can see the results go up uniform ally.

Theory

The following equations are used to calculate the final stress on the bar.

$$M = P * L$$

$$\sigma = \frac{M * y}{I}$$

$$\sigma = E * \varepsilon$$

$$I = \frac{bd^3}{12}$$

Length of the bar 0.25M

Width of the bar 0.04M

Depth of the bar 0.006M

Force = weight * gravity

$$\begin{aligned} 1\text{kg} * 9.81 &= 9.81 \\ 2\text{kg} * 9.81 &= 19.62 \\ 3\text{kg} * 9.81 &= 29.43 \\ 4\text{kg} * 9.81 &= 39.24 \\ 5\text{kg} * 9.81 &= 49.05 \end{aligned}$$

Mass = P * L

$$\begin{aligned} 9.81 * 0.25 &= 2.45 \\ 19.62 * 0.25 &= 4.90 \\ 29.43 * 0.25 &= 7.35 \\ 39.24 * 0.25 &= 9.80 \\ 49.05 * 0.25 &= 12.26 \end{aligned}$$

$$I = \frac{bd^3}{12}$$

$$\begin{aligned} &0.04 * 0.006^3 / 12 \\ &= 7.2 * 10^{-10} \end{aligned}$$

E for steel is $= 200 * 10^9$

$$\sigma = \frac{My}{I}$$

$$12.26 * 0.003 / 7.2 * 10^{-10}$$

$$= 51.19 \text{ N/m}^2$$

Strain

$$E = \frac{\sigma}{\epsilon}$$

$$51.19 / 200 * 10^9$$

$$= \underline{255 * 10^{-6}}$$

As you can see the actual result of $253 * 10^{-6}$ is very close to the theoretical figure of $255 * 10^{-6}$, so the actual test was correct.