Job # 6

To perform bending test on a wooden beam.

Apparatus:

- 10 ton Buckton UTM
- Wooden beam
- 3 deflection gages
- Measuring tape

Objective:

- To study the bending behavior of a wooden beam
- To determine the modulus of rupture and modulus of elasticity of beam.
- To determine the flexure stress.

Theory

- **Bending moment:**
  
  The algebraic sum of moment of all the transverse forces acting on either the left or right side of any section is called bending moment at this location.

- **Shear force:**
  
  A force which tends to slide one part of a section and acts perpendicular to axial axis is called shear force.

- **Elastic curve:**
  
  The deflected shape of the beam after the application of load (in elastic range) is called elastic curve.

- **Bending stress/ flexural stress:**
  
  The stresses caused by bending moment are known as bending or flexural stresses.

- **Bending formula/ flexural formula:**
  
  The relation between flexure stresses and the bending moment is expressed by

  \[
  \sigma = \frac{My}{I}
  \]
Modulus of rupture:

It is the maximum tensile stress which can be developed in the beam before failure. Or it is also amount of energy of specimen absorbed up to failure.

$$MOR = 3Pa/bh^2$$

Modulus of elasticity:

It is a ratio of stress and strain with in elastic limit. OR It is a energy absorbed by the specimen up to elastic limit.

$$MOE = 3al^2/4bh^3 * (\Delta p/\Delta s)$$

NOTE: This formula is applicable for two point load setup as shown below.

Diagram:
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Procedure:
- First of all measure dimensions of wooden beam (length, width, height).
- Place wooden beam in 10 ton buckon UTM according to diagram.
- Connect three deflection gauges Gx, Gc, Gy At correct position according to diagram.
- Apply load carefully and all readings of load.
- Note readings of all gauges up to failure of beam.
- Calculate MOE and MOR values of beam.

Calculation and observation:
Total length of beam = L = 1000 mm
Distance between B and C = l = 500 mm
Distance between A and B = a = 150 mm
Width of beam = b = 50 mm
Height of beam = h = 50 mm

<table>
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<th>LOAD (TON)</th>
<th>LOAD (N)</th>
<th>Gx</th>
<th>Gy</th>
<th>Mean= (Gx - Gy)/2</th>
<th>Gc</th>
<th>Deflection ( Gc - Mean ) (mm)</th>
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Results:
MOE = 9.86 Pa
MOR = 77.69 MPa
Comments:

Modulus of rupture is 7.5 times greater than modulus of elasticity.
And within elastic limit Load is directly proportional to the deflection.