The second set of data to be examined consists of the strain gages located on the underside of the top flange at various locations along the length of the beam. These strain gages will be used to calculate the internal bending moment along the axis of the beam.
Theoretical Moment

- Here is the theoretical moment diagram

This is the theoretical moment diagram. It assumes zero moments at the ends. Your theoretical moment diagram will be slightly different than this one because the actual measured distances shown as distance "a" may not be exactly the same for your beam. This means that the reactions may not be the same.
Actual Moment

• Here is the actual moment diagram

End moments resist the rotation

Extrapolate the regression line to the beam end (bolt line) to get the end moment

Theoretical moment diagram, M=0 at the ends

Inflection Point

M_L

M_R

P

2

P

2

V

P

2

Pa

2

Pa

2

3 regression lines

Inflection Point

M=0

M=0

Calculate the stresses from the measures strains for each Flange gage.

Use the bending stress equation to back calculate the internal bending moment knowing the stress, y distance to the gages, and I. Plot these moments on a graph like the one shown above. Separate these points into three segments: from the left end out to the applied load; between the two applied loads; and from the right end out to the applied load. Draw three regression lines through the points in each segment as shown. This is your experimental moment diagram. Evaluate each end moment and show the numerical values on the graph. Discuss!
Experimental Bending Moment

Here is the bending stress equation:

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

Solve for M:

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

$$M = \frac{E\varepsilon I}{y}$$

- $\varepsilon$ is the experimental measured strain at the gages
- From the experimental measured strain, the experimental bending can be calculated

Here are the equations to use to calculate the bending moment along the length of the beam.
Calculate the stresses from the measures strains for each Flange gage. Use the bending stress equation to back calculate the internal bending moment knowing the stress, \( y \) distance to the gages, and \( I \). Plot these moments on a graph like the one shown above. Separate these points into three segments: from the left end out to the applied load; between the two applied loads; and from the right end out to the applied load. Draw three regression lines through the points in each segment as shown. This is your experimental moment diagram. Evaluate each end moment and show the numerical values on the graph. Discuss!